



Outpatient • Office Based • Non-Operating Room

2023 Annual Meeting

May 18 – 20, 2023

Phoenix, Arizona

Arizona Biltmore, A Waldorf Astoria Resort

Jointly Provided by the American Society of Anesthesiologists
(ASA) and the Society for Ambulatory Anesthesia (SAMBA).



SYLLABUS

6737 West Washington Street, Suite 4210 • Milwaukee, WI 53214
Phone: (414) 488-3915 • www.SAMBAhq.org

PROGRAM INFORMATION

Target Audience

This meeting is designed for anesthesiologists, anesthesia providers, practitioners, nurses and administrators who work and specialize in ambulatory, office-based or non-operating room anesthesia.

About This Meeting

The purpose of this meeting is to educate and share information that will enable anesthesiology practitioners to provide the highest level of ambulatory anesthesia services and improve patient outcomes. Topics for this meeting were selected by various methods. Suggestions for topics were derived from evaluations of the 2022 and other previous Annual Meetings. In addition, the Annual Meeting Committee and Board members review the published literature with the highest impact on the specialty and solicit suggestions from members of SAMBA active in the clinical practice of ambulatory anesthesia. These suggestions were discussed with educators who attended previous SAMBA meetings.

Registration

Registration for the 2023 Annual Meeting includes all sessions and the program syllabus. Note that all fees are quoted in U.S. currency. Registration for the meeting can be made either by using the registration form in this brochure or through SAMBA's website at www.SAMBAhq.org.

Registration Deadline

The registration deadline for the meeting is May 17, 2023.

ACCME Accreditation and Designation Statements

This activity has been planned and implemented in accordance with the accreditation requirements and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint providership of American Society of Anesthesiologists and the Society for Ambulatory Anesthesia. The American Society of Anesthesiologists is accredited by the ACCME to provide continuing medical education for physicians.

Accreditation Information

The American Society of Anesthesiologists designates this live activity for a maximum of 21.50 *AMA PRA Category 1 Credits*[™]. Physicians should only claim credit commensurate with the extent of their participation in the activity.

Maintenance of Certification in Anesthesiology® program and MOCA® are registered trademarks of The American Board of Anesthesiology®. MOCA 2.0® is a trademark of the American Board of Anesthesiology®.

This activity offers up to 21.50 CME credits, of which 5.00 credits contribute to the patient safety CME component of the American Board of Anesthesiology's redesigned Maintenance of Certification in Anesthesiology® (MOCA®) program, known as MOCA 2.0®. Please consult the ABA website, www.theABA.org, for a list of all MOCA 2.0 requirements.

Disclaimer

The information provided at this activity is for continuing medical education purposes only and is not meant to substitute for the independent medical judgment of a healthcare provider relative to diagnostic and treatment options of a specific patient's medical condition.

Disclosure Statement

The American Society of Anesthesiologists remains strongly committed to providing the best available evidence-based clinical information to participants of this educational activity and requires an open disclosure of any potential conflict of interest identified by our faculty members. It is not the intent of the American Society of Anesthesiologists to eliminate all situations of potential conflict of interest, but rather to enable those who are working with the American Society of Anesthesiologists to recognize situations that may be subject to question by others. All disclosed conflicts of interest are reviewed by the educational activity course director/chair to ensure that such situations are properly evaluated and, if necessary, resolved. The American Society of Anesthesiologists educational standards pertaining to conflict of interest are intended to maintain the professional autonomy of the clinical experts inherent in promoting a balanced presentation of science. Through our review process, all American Society of Anesthesiologists education activities are ensured of independent, objective, scientifically balanced presentations of information. Disclosure of any or no relationships will be made available for all educational activities.

Disclosure information will be provided to participants before the start of the activity.

Statement of Need

The SAMBA Annual Meeting provides a forum devoted to ambulatory and office-based anesthesia offering clinically relevant lectures, panels and workshops; highlights of innovative ambulatory and office-based practices; networking opportunities with peers and experts in the field; and exposure to relevant products/services of interest to our attendees in the exhibits area.

Special Needs

The Society for Ambulatory Anesthesia fully complies with the legal requirements of the Americans with Disabilities Act and the rules and regulations thereof. If any attendee in this educational activity is in need of accommodations, please contact SAMBA at (414) 488-3915.

Cancellation Policy

Cancellations received through May 1, 2023, will receive a full refund. Cancellations received from May 1, 2023 through May 10, 2023 will receive a refund less a \$200 administrative fee. Refunds will not be given after May 10, 2023. Cancellation of a meeting registration must be submitted in writing. Refunds will be determined by date written cancellation is received at the SAMBA office in Milwaukee, WI.

Overall Learning Objectives

At the conclusion of this activity, participants should be able to:

- Enlist the updates to the ASA NPO Guidelines
- Justify the management plan of perioperative hyperglycemia
- Discuss anesthesia for Cataract surgery
- Apply prevention and management strategies for complications of regional anesthesia
- Discuss different aspects of patient selection and triaging for ambulatory surgery and Office based anesthesia

PROGRAM SCHEDULE

THURSDAY, MAY 18, 2023

Time	Event
6:30am – 7:30am	Welcome Breakfast
7:30am – 7:45am	Welcome & Introductions Steven Butz, MD, SAMBA-F
7:45am – 9:00am	Panel: NORA Snap Talks <i>Moderator: Basem Abdelmalak, MD, FASA, SAMBA-F</i> <ul style="list-style-type: none"> • Remimazolam Use in NORA Sedation Kara M. Barnett, MD, FASA • Ergonomics in NORA Mary Ann Vann, MD, FASA • Anesthetic Management for Novel Interventional Oncology Procedures Kevin Min, MD • NORA Checklists and Timeouts Michael O'Rourke, MD, FASA • Crisis Simulation in MRI Settings Hedwig Schroeck, MD, FAAP • Aspiration and Propofol for Colonoscopy Russell Woda, MD
9:00am – 10:15am	Panel: When Blocks Become Botched: Complications of Regional Anesthesia <i>Moderator: Ashley M. Shilling, MD</i> <ul style="list-style-type: none"> • Nerve Injury After Peripheral Nerve Blocks; Bleeding Complications Ashley M. Shilling, MD • Catheter Complications (Dislodged, Failure); Infection (in Context Mostly of Catheters); Failed Spinals for Total Joint Arthroplasty (Including Short Versus Long-Acting Agents) Sakura Kinjo, MD • Inefficiencies in Practice, Block Delays; Wrong-Sided Nerve Blocks Marco Lotano, MD, MS • Block-Specific Complications (Including Pneumothorax with PVB, Diaphragmatic Paresis with ISB); LAST Hanae K. Tokita, MD, FASA
10:15am – 10:30am	Break
10:30am – 11:45am	DEA Issues: <ul style="list-style-type: none"> • Diversion Meghan C. Valach, MD • Cannabinoids/Recreational Substances Srinivas Pyati, MBBS, MD, FCARCSI • Impaired Provider Sher-Lu Pai, MD, SAMBA-F, FASA
11:45am – 12:15pm	Pro/Con: You Should Always Cancel a Case for New A-Fib <i>Moderator: Michael Walsh, MD, FASA, SAMBA-F</i> Michael V. Presta, DO (Pro); BobbieJean Sweitzer, MD, FACP, SAMBA-F, FASA (Con)
12:15pm – 1:15pm	Sponsored Lunch Symposium: Eagle Pharmaceutical (Non-CME)
12:15pm – 1:15pm	Lunch Break

Program Schedule continued on next page

PROGRAM SCHEDULE *continued*

THURSDAY, MAY 18, 2023 <i>continued</i>	
Time	Event
1:30pm – 2:45pm	Coming Soon to an ASC Near You <i>Moderator: Catherine Tobin, MD</i> <ul style="list-style-type: none"> • Cardiac Cases in an ASC Andrew Kaplan, MD, FACC • Interventional Radiology Procedures in an ASC Kara M. Barnett, MD, FASA • Outpatient Thyroid Surgery Catherine Tobin, MD
2:45pm – 3:15pm	Lecture: Hypoglossal Nerve Stimulators for OSA Michael V. Presta, DO
3:15pm – 4:30pm	Former President's Rapid Fire <i>Moderator: Dawn J. Schell, MD</i> <ul style="list-style-type: none"> • Methadone in Ambulatory Surgery Michael Walsh, MD, FASA, SAMBA-F • Preventing Airway Fires at the ASC and NORA Basem B. Abdelmalak, MD, FASA, SAMBA-F • Timing of Dialysis Before Surgery BobbieJean Sweitzer, MD, FACP, SAMBA-F, FASA • Timing of Elective Surgery After Stroke Girish P. Joshi, MBBS, MD, FACP, SAMBA-F • MH at an ASC Kumar Belani, MBBS, MS, FACA, FAAP, SAMBA-F
4:30pm – 5:00pm	ASA 2023 Guidelines for Reversing Neuromuscular Blockade Victor Davila, MD
5:00pm – 7:00pm	Moderated Poster Session Kara M. Barnett, MD, FASA; David Beebe, MD; Kathryn H. Bridges, MD, FASA; Kenneth Cummings, MD, MS, FASA; Chhaya Patel, MD, SAMBA-F; Catherine D. Tobin, MD
5:00pm – 7:00pm	Cocktails with Exhibitors

FRIDAY, MAY 19, 2023	
Time	Event
6:30am – 7:30am	Sponsored Breakfast Symposium: Mindray North America (Non-CME)
7:00am – 7:30am	Breakfast with Exhibitors
7:30am – 7:40am	Welcome Steven Butz, MD, SAMBA-F
7:40am – 9:00am	The New SAMBA Diabetes Guidelines <i>Moderator: Steven Butz, MD, SAMBA-F</i> Niraja Rajan, MD, SAMBA-F; Mary Ann Vann, MD, FASA; Girish P. Joshi, MBBS, MD, FACP, SAMBA-F; Basem B. Abdelmalak, MD, FASA, SAMBA-F

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PROGRAM SCHEDULE *continued*

FRIDAY, MAY 19, 2023 <i>continued</i>	
Time	Event
9:00am – 10:00am	Medical Director Topics <i>Moderator: Steven Butz, MD, SAMBA-F</i> <ul style="list-style-type: none"> • Conflict Resolution Jarrett A. Heard, MD, MBA • OR Efficiency Steven Butz, MD, SAMBA-F
10:00am – 10:45am	Break with Exhibitors
10:45am – 11:30am	Lecture: 2023 ASA NPO Guideline Modular Update Basem B. Abdelmalak, MD, FASA, SAMBA-F
11:30am – 12:00pm	Pro/Con: You Should NEVER Do a Case with an SGA for More than 2 Hours <i>Moderator: Michael Walsh, MD, FASA, SAMBA-F</i> Kenneth Cummings, MD, MS, FASA (Pro); Dawn J. Schell, MD (Con)
12:00pm – 1:00pm	Sponsored Lunch Symposium: Fisher & Paykel Healthcare (Non-CME)
12:00pm – 1:00pm	Exhibits Open / Lunch Break
1:00pm – 2:00pm	Ambulatory Anesthesia Literature Year in Review Girish P. Joshi, MBBS, MD, FAcI, SAMBA-F
2:00pm – 2:45pm	Break with Exhibitors
2:45pm – 4:30pm	PBLD Set 1 <ul style="list-style-type: none"> • Conflict Resolution: Case Request/Block Time Jarrett A. Heard, MD, MBA • Ambulatory Anesthetic Management of Gender Affirmation Surgery Patients: Who, What, Where, Why? Kelly Lebak, MD, FASA • Dexmedetomidine in the Office: Route, Timing, and Patient Selection Grace Lee Dorsch, MD • The Anemic Patient in Your ASC Kenneth Cummings, MD, MS, FASA • Pediatric Dental Patient with PMH of Asthma, Obesity, and Prematurity - What Do I Need to Know??? Audra Webber, MD, FASA
6:00pm – 10:00pm	SAMBA Member Social

SATURDAY, MAY 20, 2023

Time	Event
6:30am – 7:30am	Sponsored Breakfast Symposium: GE HealthCare (Non-CME)
7:00am – 7:30am	Breakfast with Exhibitors
7:30am – 7:40am	Welcome Steven Butz, MD, SAMBA-F
7:40am – 8:45am	Research Award Nominee Presentations
8:45am – 10:00am	Cases from the Real World <i>Moderator: Michael Walsh, MD, FASA, SAMBA-F</i> Kara M. Barnett, MD, FASA; Gustavo A. Lozada, MD, MSEd ; Carey Brewbaker, MD

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PROGRAM SCHEDULE *continued*

SATURDAY, MAY 20, 2023 <i>continued</i>	
Time	Event
10:00am – 10:45am	Networking Break & Exhibitors
10:45am – 11:30am	<p>Panel: Pediatric Ambulatory Recovery Issues and Difficult Airway Management <i>Moderator: Simon Lee, MD</i></p> <ul style="list-style-type: none"> • Avoiding Pitfalls of Delayed Recovery and Discharge in the Pediatric Ambulatory Patient Marjorie P. Brennan, MD, MPH • Pediatric Difficult Airway – Updates to the New (2022) Guidelines Audra Webber, MD, FASA
11:30am – 12:00pm	<p>Pro/Con: You Should ALWAYS Manage a Patient with SQ Insulin in an ASC <i>Moderator: Michael Walsh, MD, FASA, SAMBA-F</i></p> Leopoldo V. Rodriguez, MD, MBA, FAAP, FASA, SAMBA-F (Pro); Niraja Rajan, MD, SAMBA-F (Con)
12:00pm – 1:00pm	<p>SAMBA Annual Updates and Awards Luncheon Dawn J. Schell, MD</p>
1:00pm – 2:00pm	<p>ASA Update Ronald L. Harter, MD, FASA</p>
2:00pm – 3:15pm	<p>Panel: Dental Ambulatory Anesthesia <i>Moderator: Fred E. Shapiro, DO, FASA</i></p> <ul style="list-style-type: none"> • M&M Case Presentation Steve Yun, MD • Challenges in Starting a Mobile Dental Anesthesia Practice Anastasios Sakellariou, MD, DMD • Building a Scalable Model for Mobile Dental Anesthesia Shawn Nason • Pros/Cons of Using an LMA for Longer Dental Procedures Steve Yun, MD & Anastasios Sakellariou, MD, DMD
3:15pm – 3:30pm	Networking Break
3:30pm – 5:00pm	<p>PBLD Set 2 (Breakout Option 1)</p> <ul style="list-style-type: none"> • Conflict Resolution: Case Request/Block Time Jarrett A. Heard, MD, MBA • Ambulatory Anesthetic Management of Gender Affirmation Surgery Patients: Who, What, Where, Why? Kelly Lebak, MD, FASA • The Anemic Patient in Your ASC Kenneth Cummings, MD, MS, FASA • Dexmedetomidine in the Office: Route, Timing, and Patient Selection Grace Lee Dorsch, MD • Pediatric Dental Patient with PMH of Asthma, Obesity, and Prematurity - What Do I Need to Know??? Audra Webber, MD, FASA

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PROGRAM SCHEDULE *continued*

SATURDAY, MAY 20, 2023 <i>continued</i>	
Time	Event
3:30pm – 5:15pm	<p>OBA Sub-Section (Breakout Option 2) <i>Moderators: Fred E. Shapiro, DO, FASA & Meghan C. Valach, MD</i></p> <ul style="list-style-type: none"> • Pros & Cons of Transitioning to Office-Based Anesthesia Grace Lee Dorsch, MD • How to Break into the Market Stephen R. Smith, MD • Marketing Your Practice Philip Yen, DDS • Safety in Office-Based Anesthesia Fred E. Shapiro, DO, FASA • Patient Selection and Outcomes for ASA 3-4 Patients Penelope Duke, MD • Importance of Benchmarking Richard D. Urman, MD, MBA • Compiled Data Outcomes for Dental Office Cases Mark A. Saxen, DDS, PhD • Case Types on the Horizon Meghan C. Valach, MD
3:30pm – 5:00pm	<p>Resident Panel (Breakout Option 3)</p> <ul style="list-style-type: none"> • Private Practice vs. Academics Dawn J. Schell, MD • Anesthesia Billing 101 Jamey E. Eklund, MD • Non-Clinical Anesthesia Careers and Locums Work Simon Lee, MD

PROGRAM PLANNING COMMITTEE

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HANDOUTS



Welcome & Introductions

Steven Butz, MD, SAMBA-F

05/18/2023

7:30am - 7:45am MST

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HANDOUTS



Panel: NORA Snap Talks - Remimazolam Use in NORA Sedation

Kara M. Barnett, MD, FASA

05/18/2023

7:45am - 9:00am MST

Remimazolam Use in NORA Sedation
Does it Make Sense For You?

Kara M. Barnett, MD, FASA
Memorial Sloan Kettering Cancer Center
barnettk@mskcc.org

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Disclosures

I have no disclosures

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Objectives

- Summarize the strengths and weakness of remimazolam use in NORA sedation
- Determine if remimazolam has a place in YOUR practice

Remimazolam = remimazolam besylate = remimazolam tosylate

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Pro: Fast On and Fast Off

Benzodiazepines

Midazolam, Remimazolam, Inactive Metabolite, CNS705A

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Side by Side Comparison

Sedative	Midazolam	Remimazolam	Propofol
Distribution Half-Life	6-15 minutes	0.5-2 minutes	2-3 minutes
Onset	3-5 minutes	1-1.5 minutes	9-51 seconds
Recovery	2 hours	11-14 minutes	10 minutes
Metabolism	Hepatic	Tissue esterases	Hepatic/extrahepatic
Active Metabolite	Yes	No	No
Elimination Half-Life	2-6 hours	0.6-0.9 hours	0.7 hours
Volume of Distribution at Steady State	1.1-1.7 L/kg	0.76-0.98 L/kg	2-10 L/kg

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Con: Sometimes Too Fast!

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Con: Reconstitution!

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Con: Cost

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Con: Cost

Intraoperative IV medications	Patient 1		Patient 2		Patient 3		Patient 4		Patient 5		Patient 6	
	Case 1	Case 2										
Fentanyl (mcg)	50	25	-	50	100	100	100	100	50	50	-	-
Midazolam (mg)	-	-	-	3	-	2	-	2	-	2	-	-
Propofol (mg)	97.4	-	116.7	-	323.6	-	158.8	-	102.8	-	182.9	-
Remimazolam (mg)	-	6	-	20	-	24	-	13	-	17	-	18
Cost	\$15.27	\$48.07	\$21.00	\$48.07	\$53.07	\$94.87	\$31.67	\$48.07	\$24.67	\$48.07	\$28.00	\$46.50

Thank you Bridget Macorkowi and Joanna Serafin

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Con: Reconstitution & Administration

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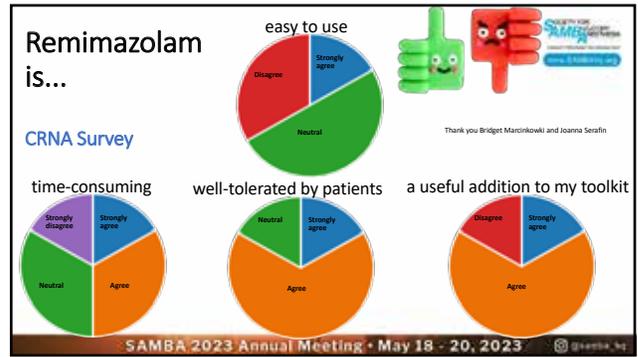
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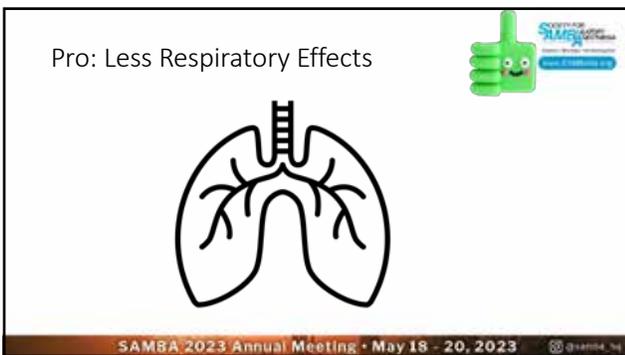
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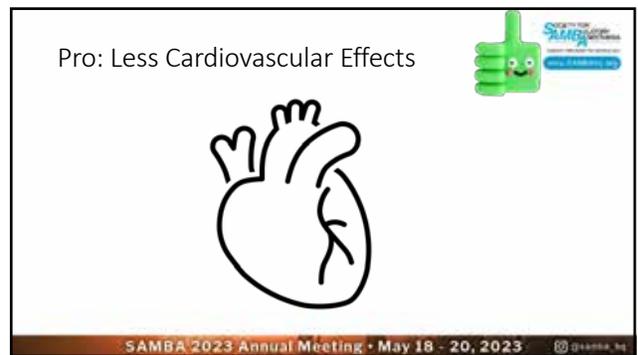
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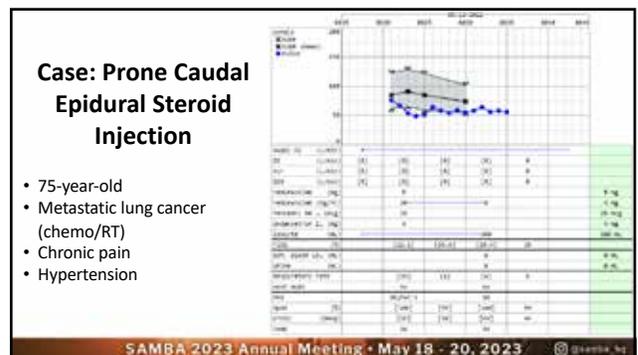
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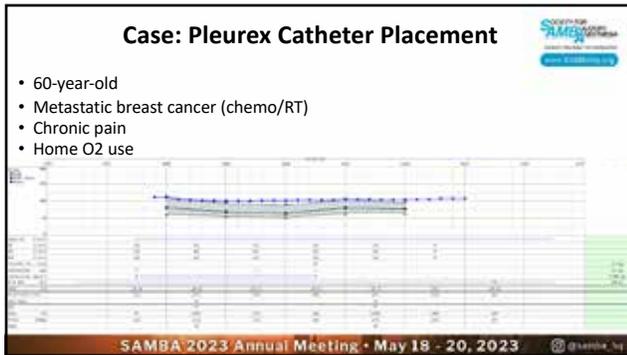
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- Pro: Ideal For....**
- ✓ Prone
 - ✓ Obese
 - ✓ Respiratory fragility
 - ✓ CV fragility
 - ✓ ASA physical status 3-4
- AVOID:**
- ✗ Heavy alcohol use
 - ✗ High benzo use
 - ✗ Chronic phenytoin use
 - ✗ Severe hepatic impairment
- Not approved:**
- ✗ Pregnant patients
 - ✗ Pediatric patients
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Summary

PRO: Procedures ≤30 mins **CON**

- Fast on and off
- Less respiratory depression
- Less cardiovascular depression
- Ideal for sicker patients and prone positioning

- Can be too fast
- Reconstitution required
- Cost
- Administration/learning curve

Beware of remifentanyl

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HANDOUTS



Panel: NORA Snap Talks - Ergonomics in NORA

Mary Ann Vann, MD, FASA

05/18/2023

7:45am - 9:00am MST

Ergonomics of NORA

Mary Ann Vann MD, FASA
Harvard Medical School
Beth Israel Deaconess Medical Center
Boston, MA

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Bad Ergonomics- You know it when you see it

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Why do we care?

- Situation – Anesthesiologists have perceived increase in physical workload, hazardous conditions and disability
- 1999: “In recent years in the United States the number of anaesthetists who have sought disability status has risen precipitously. All these factors can impact adversely on the national manpower supply.” Jackson

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What is ergonomics?

The study of how to improve the fit between the physical demands of the workplace and the employees who perform the work. That means considering the variability in human capabilities when selecting, designing, or modifying equipment, tools, work tasks, and the work environment. OSHA

Goal: Avoid pain or discomfort at work and it's consequences

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Ergonomic challenges: Stressors

- OSHA: Awkward postures, overhead work, carrying loads, wrist deviations, contact stress, poor shoulder/wrist posture, prolonged standing or sitting, cramped spaces
- Awkward postures: reaching, bending, twisting, stretching, flexion or extension of neck and back

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Ergonomic Challenges - Consequences

- Chronic WMSDs (Work related Musculoskeletal disorders)
 - Muscle strains, Low Back Pain, Tendonitis
 - Shoulder, Elbow and Hand Pain
 - Anesthesia providers: hand, arm, shoulder, neck most common (neck and back)
- Injuries
 - Disability – Impact on workplace

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Personal Impact of Work Injury

- Limited or missed work
- Loss of income
- Stress, Burnout
- Loss of sleep
- Deterioration of personal relationships
- Early retirement

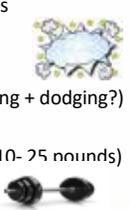
J Vasc Surg. 2019

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Location Specifics – NORA

- Cramped spaces
 - Limited access to patient, supply cart, drugs
- Poor lighting
- Obstacles
 - Ceiling mounted equipment (are you ducking + dodging?)
 - Floor: wires, bases of equipment
- Wearing of heavy protective lead shielding (10- 25 pounds)



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Ergonomic Challenges: NORA

Maintaining Good Posture

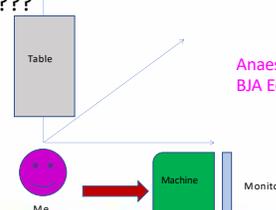
- The machine, patient and anaesthetist should be in the triangle, with each of them **within 45° from the sagittal plane within the arc of movement.**
- The anaesthetist should have a **direct line of sight** of the patient, the monitor (VS) and the video monitor(U/S) if appropriate

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Ergonomic Challenges: NORA

- 45 degrees???



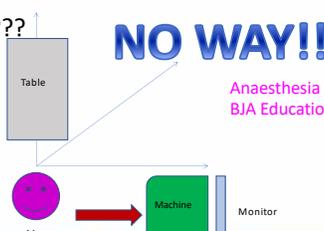
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Ergonomic Challenges: NORA

- 45 degrees???

NO WAY!!



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Ergonomic Challenges: Equipment

Anesthesia Machine

- Ease of **access** – **Weight**:
 - May be as much as 365 lbs without monitors
 - “Lite” machine = >220 lbs (often in NORA!) 
- East of Access – **Height**
 - Elbow at 90 degrees, neck not flexed or extended
- Ease of Access – Attachments, suction, O2

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Ergonomic Challenges: Beds/Stretchers

Patient beds:

- Med/Surg bed: 450-500 lbs (+ pt)
- ICU bed: 800 lbs (+ pt)

Stretchers: (+ pt up to 700 lbs)

- Weight
 - Usual Transport: 264 lbs
- Width
 - Standard: 30 inches – 33 inches with side rails up
 - Wide: 34 inches – 38 inches with side rails up

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Rules of Manual Handling – Anaesthesia 2021

Do not lift or handle unnecessarily

Co-ordinate a lift If the patient's weight is a concern, take further action such as having additional handlers or hoists on stand-by

If the load, is on a height-adjustable surface, **raise it upwards** before the movement in order that all handlers remain upright during the move. **Avoid placing anything at low levels that might encourage bending.**

Stand as close to the object being moved as possible as this will limit any reaching. Handling the load at arm's length results in five times the amount of stress than is the case if the load remains very close to the trunk when it is handled.

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Rules of Manual Handling – Anaesthesia 2021

Stand with feet apart and with one foot in front of the other when moving a load. This stance will offer stability to the handler. The floor should be kept clear of cables, hoses or other pieces of equipment.

Use the feet to move with the load

Lower the upper body by flexing the knees which results in the weight of the upper body being added to the overall lift.

Raise the head before lifting commences. This will assist in reducing any forward bending.

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Good Principles (Anaesthesia 2021)

- Sufficient space
- Access to the patient should be unobstructed and there should be no objects impeding access to the patient
- The level of the patient relative to the anaesthetist should be adjusted in order that the neck of the anaesthetist is NOT flexed > 60°
- The equipment should be placed on the operator's dominant side in order to minimize torsion of the torso or overreaching for equipment
- Monitoring should be clearly visible
- Whether sitting or standing, the height of the table or monitors should be adjusted to minimize flexion of the anaesthetist's neck, lower back and knees

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Solutions – Environment

GI Room 1

GI Room 2

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NORA

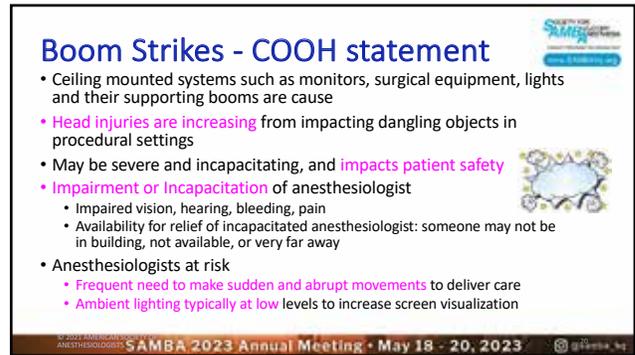
WHATS WRONG WITH THIS PHOTO?

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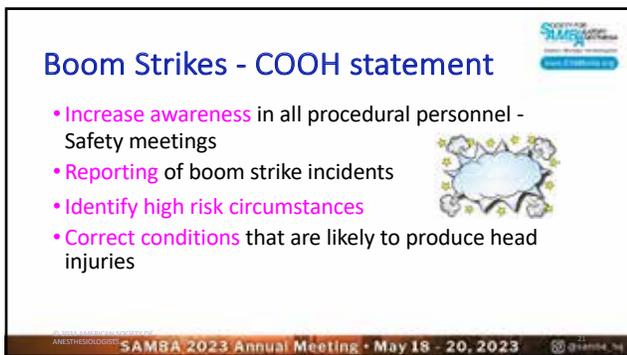
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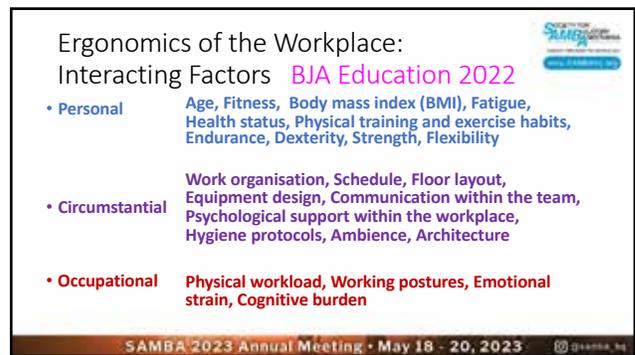
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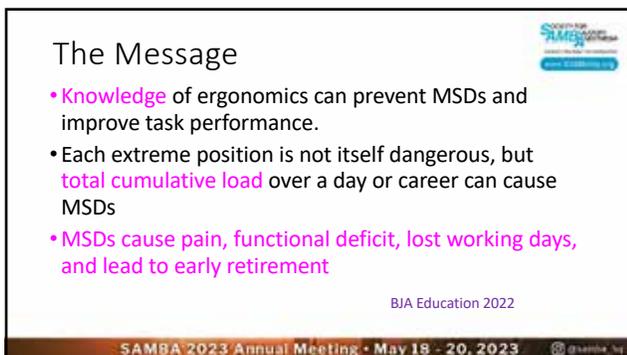
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HANDOUTS



Panel: NORA Snap Talks - Anesthetic Management for Novel Interventional Oncology Procedures

Kevin Min, MD

05/18/2023

7:45am – 9:00am MST



Anesthetic Management for Novel Interventional Oncology Procedures

Kevin J Min
Assistant Professor
Dept. of Anesthesiology
Jefferson Health

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1

**Interventional Oncology:
Minimally Invasive Treatments
for Cancer**

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**Irreversible
Electroporation**

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What is Irreversible Electroporation?

- Uses high voltage **electrical pulses**
 - Delivered through needles
 - Creates **nanopores** in the cell membrane
 - Causes **controlled apoptosis**
- **Preserves the surrounding structures**
 - Vasculature, ducts, bowel
- **Non-thermal = No heat sink**
 - Ablation less effective 2/2 cooling from nearby vasculature
 - Addresses weaknesses of thermal ablation
 - Radiofrequency ablation (RFA)
 - Microwave ablation (MWA)

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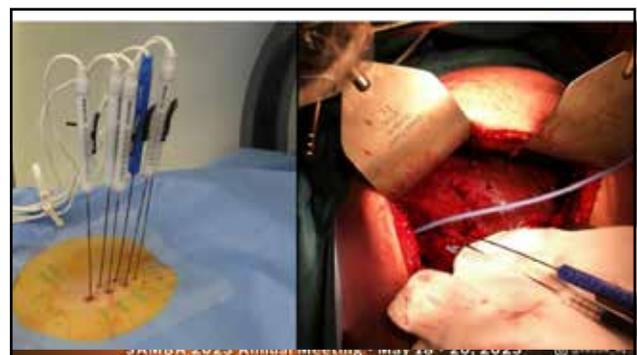
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What is Irreversible Electroporation?

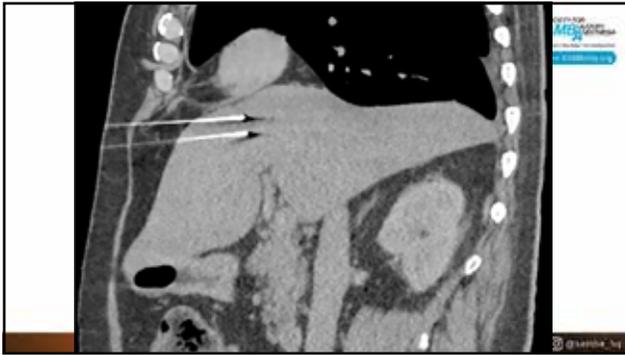
- Used mainly in **pancreatic** and **liver** cancers/metastases
 - Sometimes **lung, kidney, prostate**, and other **unresectable tumors**
- Usually percutaneous under CT-guidance in Interventional Radiology (IR)
 - Can be done open or laparoscopic as well 2/2 tumor location (OR)
- Many unique considerations
 - Major Complication rate: ~2-17%
 - Communication with proceduralist key

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Unique Considerations: Arrhythmias

- Electrical pulses = **R on T phenomenon**
- Before cardiac synchronization: **22% ventricular tachycardia**
 - Pooled analysis
 - **After cardiac synchronization: 1.2%**
 - Location irrelevant
 - Except prostate
- Leads of the EKG connect to the IRE machine
 - Clear QRS
- Defibrillator pads often placed prophylactically
- **Doesn't trigger seizures 2/2 GA**
- Hx: Arrhythmias
 - Pacemaker to asynchronous
 - ICD disabled

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Unique Considerations: Muscle Contractions

- Electrical pulses = **severe muscle contractions**
 - May move the IRE needle
 - May affect accuracy
 - Complications: PTX, intraperitoneal hemorrhage, hematomas reported
- Requires **deep neuromuscular blockade**
 - TOF ≤ 0
 - Post-Tetanic Count ≤ 3
 - Mild local contractions still can occur
 - Esp. if needle passes through large musculature

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Unique Considerations: Hypertension

- **Severe and rapid hypertension with IRE stimulation**
 - Even with **sevo at 8%**
 - Median systolic: **190** (185-215)
 - Median diastolic: **98** (91-115)
 - 38 patient cohort
 - ~1/2 the patients received antihypertensives
 - "Poor response"
- **Responds well to opioids**
 - Median dose of fentanyl: 500 mcg
 - Delayed extubation
 - Low postop pain
 - **Remifentanyl is the preferred agent**
 - Sevo 2%, 13% anti-HTN meds
- Hx: Limited cardiopulmonary reserve
 - CAD

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Immuno-embolization

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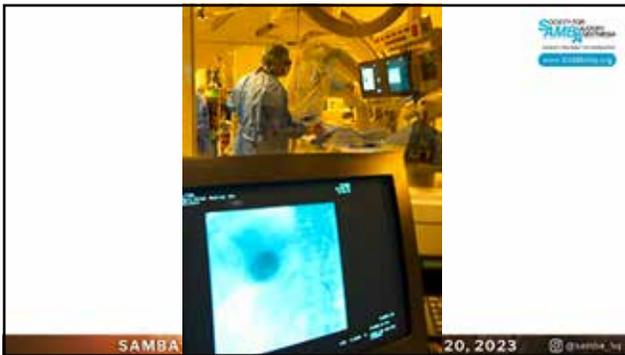
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What is Immuno-Embolization?

- Similar to chemo-embolization
 - Endovascular
 - Disrupts the tumor blood supply
 - Usually in the liver
- Instead of "chemo"
 - Glycoproteins: GM-CSF
 - Monoclonal Antibodies
 - Oncolytic Viruses
- **Large proteins**
 - **Marked bradycardia**
 - Hypotension
 - Other arrhythmias
 - HTN/tachycardia
- Consider ppx glycopyrrolate

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TLDR

- Irreversible Electroporation (IRE)
 - GA 2/2 Deep paralysis
 - Remifentanyl during IRE stimulation 2/2 HTN
 - Risk of arrhythmia high = Consider ppx defib pads
- Immuno-embolization
 - Risk of bradyarrhythmia's 2/2 large molecules
 - Consider ppx glycopyrrolate

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HANDOUTS



Panel: NORA Snap Talks – NORA Checklists and Timeouts

Michael O'Rourke, MD, FASA

05/18/2023

7:45am – 9:00am MST



NORA Checklists and Timeouts

Michael O'Rourke, MD, FASA
 Professor, Loyola University Chicago
 Anesthesiologist, Edward Hines, Jr VA Hospital
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Disclosures

- I have no actual or potential conflict of interest in relation to this presentation.
- My words are my own and do not represent the official views of the Veteran Health Administration or the United States government

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Learning Objectives

- Describe challenges associated with providing safe anesthesia care for NORA
- Discuss challenges with implementation of NORA timeout checklists
- Formulate a plan for implementing a timeout checklist at a NORA practice site

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3



Figure 2. Characteristics of nonoperating room anesthesia settings that may contribute to adverse events

Tobin C, Bridges K. Curr Opin Anesthesiol 2022, 35:502-507

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“Same Standard of Care as the Main Operating Room”

- Closed Claims analysis from 2006 to 2009
- NACOR database from 2010 to 2013

Metzner J, et al. Curr Opin Anaesthesiol. 2009 Aug;22(4):502-8. PMID: 19506473
 Woodward, et al. Anesthesiol Clin. 2017 Dec;35(4):569-581. PMID: 29101947.
 Chang B, et al. J Patient Saf. 2018 Mar;14(1):9-16. PMID: 30461406.
 Herman AD, et al. Br J Anaesth. 2021 Nov;127(5):729-744. PMID: 34452733.

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“Same Standard of Care as the Main Operating Room”

- Timeout checklists are inconsistently implemented in NORA
- Recent publications in GI, IR, EP, MRI



Herman AD, et al. Br J Anaesth. 2021 Nov;127(5):729-744. PMID: 34452733.

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Panel: NORA Snap Talks – Crisis Simulation in MRI Settings

Hedwig Schroeck, MD, FAAP

05/18/2023

7:45am – 9:00am MST

Crisis Simulation in MRI Settings

Hedi Schroeck, MD FAAP
@SchroeckHedi hedwig.schroeck@dartmouth.edu

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Disclosures

I have no conflicts of interest.

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Outline

- Crisis Simulation in MRI - Why?
- How we did it at Dartmouth-Hitchcock Medical Center
- Lessons Learned and Outcomes

3

MRI settings

- diagnostic MRI
- intra-operative MRI (MRI-OR hybrid suite)
- cardiac MRI hybrid rooms
- ? future applications

4

Diagnostic MRI - case scenario

- 3 year old for MRI spine
- mask induction, PIV, propofol
- transport to scanner
 - coughing/patient movement
 - vomiting
 - desaturation

5

Simulation in MRI settings

Our prerogatives:

- **in situ**
site-specific features, MRI safety
- **interprofessional**
single anesthesia clinician, MRI techs (RNs)
- focus on **initial steps**, not ACLS per se
 - communication
 - call for help
 - decision making
 - task delegation

6

MRI-OR crisis simulation

7

1st round:
(low budget, in the MRI-OR)

ad-hoc, after cases finished



8

Barriers to crisis management:



- Distance to patient/airway
- Availability and organization of equipment
- Call for help system

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MRI-safe Airway Grab Bag

Single-person airway rescue
(temporizing measure)

- Self-inflating bag
- Adjuncts
- Adult/Pedi version

(Implemented for all NORA sites)

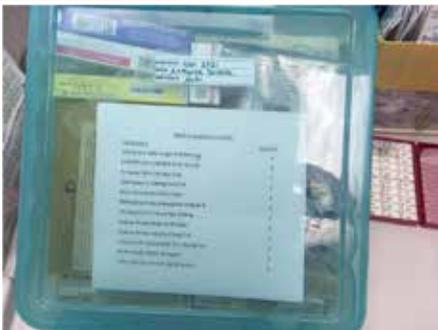


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Code Cart Meds

- MRI-safe
- sealed tray

(MRI-OR only)



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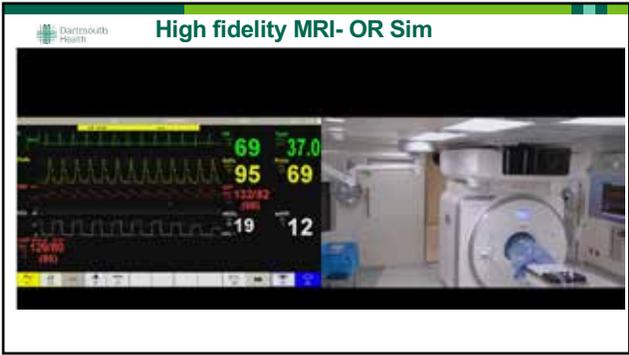
Standardized Call for Help

- different sites have unique issues
- day-time vs. after-hours
- hospital system still reliant on radio paging

(Implemented for all NORA sites)



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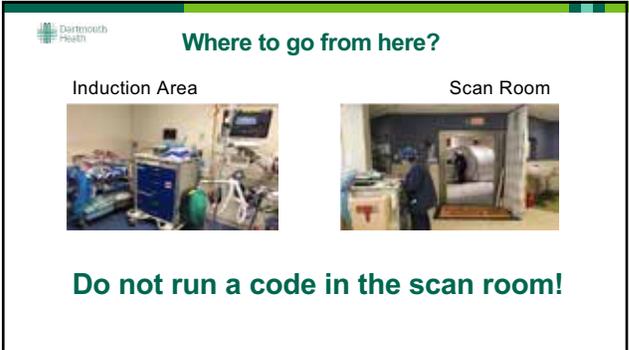
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Post-course Survey Results:

N >90-100 participants (MRI-OR and diagnostic MRI)
 ~ 50% Anesthesia participants

- **Relevance:** 96% of 75 respondents
- Learned something new: 89%
- Should be offered again: 88%

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CRM for interprofessional teams:

- Systematic review with 12 included studies
- 10 studies with **improved CRM skills**
- 1 study with **improved team behaviours**
- 2 studies with sustained **reductions in adverse patient outcomes after a single simulation-based CRM team intervention.**

“[...] promise for the use of simulation-based CRM team training to enhance [...] communication and coordination abilities for crises management.”

Fung L, Boet S, Bould MD, et al. Impact of crisis resource management simulation-based training for interprofessional and interdisciplinary teams: A systematic review. *Journal of Interprofessional Care*. 2015;29(5):433-444.

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Take home points 1/2:

Basic tenets of crisis management are hard in NORA/MRI
 - so consider a standard approach to:

- 1) Call for help process
- 2) MRI-safe Airway Equipment




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Take home points 2/2:

Interprofessional ad-hoc teams have to function well for optimal outcomes.

- **Crisis training can improve teamwork and facilitate solutions.**



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Questions & Comments

Hedi Schroeck, MD FAAP
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Panel: NORA Snap Talks - Aspiration and Propofol for Colonoscopy

Russell Woda, MD

05/18/2023

7:45am - 9:00am MST



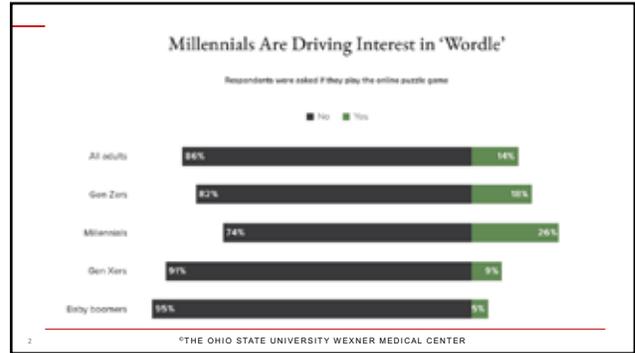


Aspiration and Propofol for Colonoscopy

Russell P. Woda, DO, MA, FCCP
Associate Professor of Anesthesiology, Clinical Director, Anesthesia Endoscopy Services
The Ohio State University Wexner Medical Center
Columbus, Ohio

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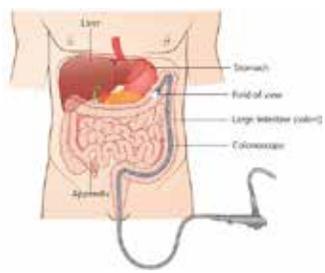
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Colonoscopy and Colon Cancer Screening

An exam using a tube-like instrument to look inside the rectum and colon for polyps, abnormal areas or cancer. Tissue samples can be collected (biopsy) and abnormal growths can be removed.



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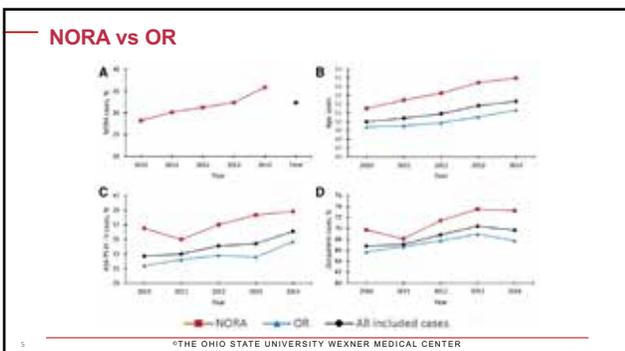
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Frequency Rank	Location	2016		2013		2010		2007		Total
		%	%	%	%	%	%	#	%	
1	Colonoscopy	43.3	42.7	45.0	47.3	50.8	1,301,087	22.8		
2	Esophagogastroduodenoscopy	35.3	36.1	36.6	36.4	37.6	1,186,443	19.7		
3	Endobronchial Ultrasound	12.0	12.1	15.2	8.8	6.4	266,105	4.3		
4	Endoscopic retrograde cholangiopancreatography	5.8	5.8	5.4	4.6	3.2	145,013	2.4		
5	Esophageal endoscopy	2.7	3.4	2.8	2.6	2.0	77,130	1.3		
Total number		284,585	350,736	541,853	713,013	936,443	2,868,530			

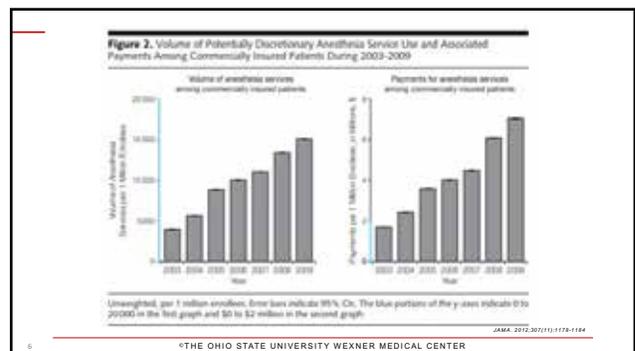
Percent of all nonemergency non-sedation cases included in this study.

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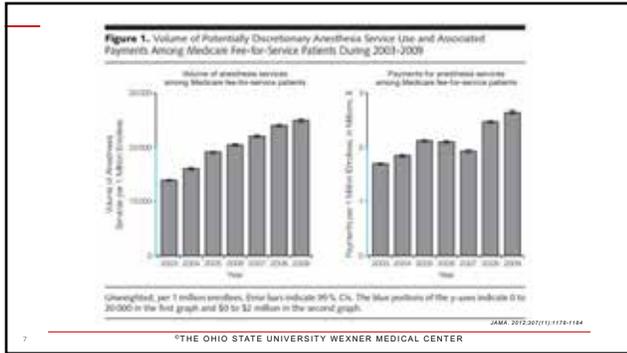
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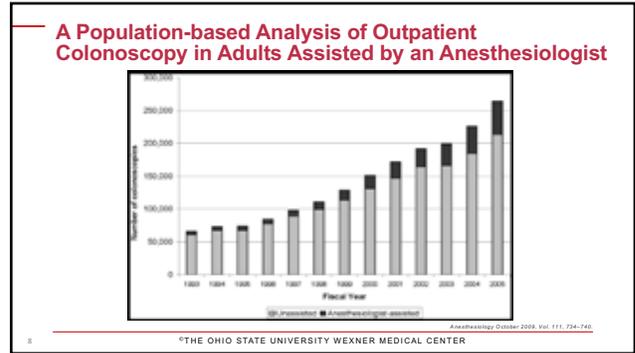
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Incidence of Colonoscopy-Related Bowel Perforation, Splenic Injury and Aspiration Pneumonia by Receipt of AA Following Outpatient Colonoscopy in Ontario Adults, 2005-2012 (n = 3,059,045) (AA, anesthesia assistance)

Outcome	Unassisted colonoscopy N = 2,196,228		Anesthesia-assisted colonoscopy N = 862,817		P value
	Events	Rate	Events	Rate	
Perforation	977	1 in 2248	419	1 in 2059	.133
Splenic injury	102	1 in 21,532	36	1 in 23,967	.58
Aspiration	112	1 in 19,609	74	1 in 11,660	<.001

<http://dx.doi.org/10.1053/j.gastro.2017.08.012>

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Results of 4 Logistic Regression Models Examining the Effect of AA on Colonoscopy-Related Bowel Perforation, Aspiration Pneumonia, and Splenic Injury in a Propensity-Matched Cohort of AA for Outpatient Colonoscopy in Ontario, January 1, 2005 to December 31, 2012 (n = 1,586,146) (AA, anesthesia assistance; CI, confidence interval; OR, odds ratio)

Model	Outcome	Independent variable(s)	OR (95% CI)	P value
1	Perforation	Anesthesia	0.99 (0.84-1.16)	.885
		No anesthesia	Ref	
1a	Perforation	Anesthesia	0.99 (0.85-1.16)	.919
		No anesthesia	Ref	
		Therapy		
		Large polypectomy	7.60 (4.83-11.96)	<.001
		Dilation or stent placement	16.80 (8.80-32.06)	<.001
		Standard polypectomy	1.78 (1.52-2.10)	<.001
2	Aspiration pneumonia	Anesthesia	1.14 (0.88-1.46)	.326
		No therapy	Ref	
		Anesthesia	1.63 (1.11-2.37)	.012
		No anesthesia	Ref	
3	Splenic injury	Anesthesia	1.09 (0.62-1.90)	.771
		No anesthesia	ref	

<http://dx.doi.org/10.1053/j.gastro.2017.08.012>

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ABSTRACT

In clinical research, study results, which are statistically significant are often interpreted as being clinically important. While statistical significance indicates the reliability of the study results, clinical significance reflects its impact on clinical practice. The third article in this series exploring pitfalls in statistical analysis clarifies the importance of differentiating between statistical significance and clinical significance.

[Perspect Clin Res, 2015 Jul-Sep; 6\(3\): 169-170.](http://dx.doi.org/10.1053/j.gastro.2017.08.012)

Discussion

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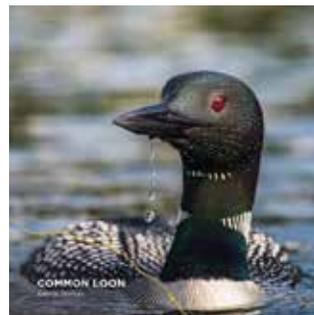
Questions

1. Does anything we discussed cause you to want to change your practice?
2. How does this information effect your thoughts on NPO guidelines (2, 4, 6, 8, hours for bowel prep)?
3. Do you believe you see much aspiration during colonoscopy at your institution?
4. How does the Canadian reimbursement system impact the cost distribution/burden compared to the US system?

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COMMON LOON

14

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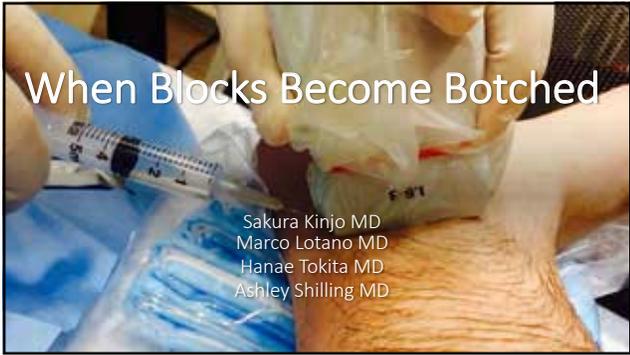


Panel: When Blocks Become Botched: Complications of Regional Anesthesia – Nerve Injury After Peripheral Nerve Blocks; Bleeding Complications

Ashley Shilling, MD

05/18/2023

9:00am – 10:15am MST



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6

Safety Checklists in Regional Anesthesia
Goals and Objectives:

- Is there error? Is there a need?
- The Safety Checklists in Regional Anesthesia
- Do Safety Checklists work?



7

Just another (busy) day in the OR

- 60 year-old male for TKA
- Plan for continuous adductor catheter
- New attending covering three rooms
- After inducing one patient, I run to regional block room to perform pre-operative block
- Patient is prepped and draped by resident for continuous catheter
- Hypotension noted on monitor, distracted
- Block and catheter are placed ...



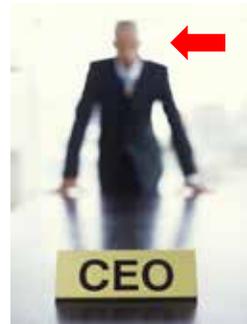
8



ON THE WRONG SIDE

9

It could be worse....



10

Is there Error when performing regional blocks?

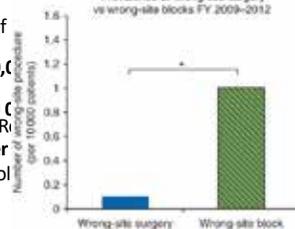
YES!!!!!!

- Complications in block technique
- Anti-coagulation concerns and failures
- Drug error
- Local anesthetic maximum dose
- Local Anesthetic Systemic Toxicity (LAST)
- Wrong Site Nerve Block (WSNB)

11

Regional, Acute Pain, Chronic pain: Wrong Site

- Incidence of procedures
- **3.63 per 10,000** (New Zealand)
- **2.59 per 10,000** (Registry of R)
- **2.66 per per**
- **WSNB 10-f**



Henshaw 2013, Cohen 2010, Sites 2014, Henshaw 2019, Barrington 2015

12

Actual patient harm related to WSNB

- **"Bilateral phrenic nerve palsies** resulted in the patient undergoing artificial ventilation until they "wore off".
- Consequence of peribulbar block in wrong (left) eye: **...dense vitreous hemorrhage** that precluded visualization of the fundus. The patient was then transferred to a quaternary referral center for further management.... She was discharged home 8 days later with normal visual acuity (10/10) in the right eye, but only light discrimination in the left eye (preoperative value of 8/10)" [21].
- "Following a left (correct) infragluteal sciatic nerve block, a right (incorrect) femoral block was performed. Following disclosure and apology, the patient and family decided to proceed with the operation and the patient received an uneventful general anesthesia with endotracheal tube placement. In the post-anesthesia care unit, the patient elected for a left femoral rescue block for pain control. ...**A reduced dose of local anesthetic** was chosen owing to the concerns for cumulative toxicity".
- [After a left (incorrect) interscalene block], "it was decided to proceed with surgery and use morphine intra-operatively and a morphine PCA for post-operative pain relief. An interscalene **block on the right side was contraindicated** due to the significant risk of bilateral phrenic nerve palsy".
- "...in two (15%) cases the physician **refused to perform the second procedure** out of concern for administering too much corticosteroid".
- "The **error in laterality was discovered** shortly after completion of the block and the anesthetic was **converted to general anesthesia**".

Deutsch 2018, Fox 1993, Edmonds 2005, O'Neill 2010, Cohen 2010, Nixon 2011, Simmons 2011

13

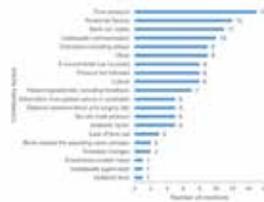
Risk Factors for Error



14

Risk Factors for Error

- Perceived time pressure
- Physician distraction
- Site marking not visible
- Poor communication
- Patient position change
- Scheduling changes
- Inadequate documentation
- Lack of surgical consent
- Inadequate supervision
- Fatigue, cognitive overload
- **No time-out being performed**



15

Wrong Site Nerve Block



https://link.springer.com/chapter/10.1007/978-3-030-28267-7_9

16

What is a Checklist?

- Type of job aid used to reduce failure by compensating for potential limits of human memory or attention
- Consistency and completeness



Hales 2008; Wikipedia

17

Checklists



18

Safety Checklists



1999 - US Building a culture of safety: Extensive use of checklists in surgical procedures garnered attention. 2008 - World Surgical Safety Checklist—improving patient safety by improving communication in the operating room

Err is Human: The Checklist Manifesto

A Surgical Safety Checklist

19

The Checklist

- The Checklist is only successful when the teams using it are committed to the teamwork, discipline, and humility that it requires.

-Atul Gawande



20

ASRA

- 2014 guidelines on pre-procedural checklist



Mulroy 2014

21

Regional, Acute Pain, Chronic pain

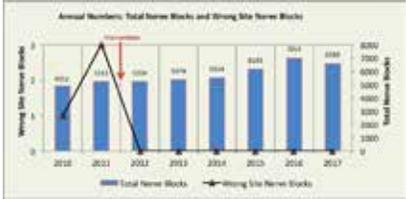
- Retrospective review 2 years before to 6 years after implementation of pre-procedural checklist for regional anesthesia (2010-2017)
- 3.95/10,000 WSNB procedures before checklist
- 0/35,890 after checklist



Henshaw 2019

22

Pre-intervention and post-intervention annual numbers of peripheral nerve blocks and the number of wrong-side nerve blocks occurring annually



Henshaw 2019

23

Risk Factors for Error

- Incidence of wrong-site blocks in large multi-hospital health-care system and review their associated risk factors
- 1.28 per 10 000 patients receiving unilateral blocks
- Highest with femoral nerve block
- All occurrences of wrong-site block after the implementation of the timeout policy involved **policy violations**

Hudson 2015

24

Anesthesia Checklists

- Systematic review of all anesthesia checklists
- 874 identified articles, 25 were included in review (up to 2019)
- Positive impact of the use of checklists was found in 23 (92%) of the 25 studies included in this review

Saxena 2020

25

Anesthesia Checklists

- Anesthesia-specific checklists have the ability to:
 - Decrease human error
 - Improve team communication
 - Increase quality of care
- Anesthesia-specific checklists useful in:
 - Provider handoffs
 - Emergencies
 - Routine procedures

Saxena 2020

26

Checklists only work if you Comply....

A reminder to anesthesiologists and anesthetic assistants:

- Verify the site with patient and consent form.
- Mark the block site.
- Stop and confirm with assistant if immediately before marking block ready.

27

Just another day in the OR

- 60 year-old male for TKA
- Plan for continuous adductor catheter
- I am new attending covering three rooms

Regional Block Preprocedural Checklist

- 1) Patient is identified, 2 correct
- 2) Allergies and contraindications are reviewed
- 3) Surgical procedure/consent is confirmed
- 4) Block plan is confirmed, site is marked
- 5) Necessary equipment is present, drugs/volumes are labeled
- 6) Resuscitative equipment is immediately available, airway devices, suction, resuscitative drugs, fluid available
- 7) Appropriate ASB's monitors are applied, intravenous access, suction, and supplemental oxygen are provided, if indicated.
- 8) Aseptic technique is used, hand cleaning is performed, mask and sterile gloves are used.
- 9) "Time out" is performed before needle insertion for each new block site if the position is changed or repeated in time or performed by another team.

28

Just another day in the OR

- 79 year-old
- Hx of CHF, E
- Pre-operative
- Pre-operative
- Patient take
- On incision,
- Lidocaine 60
- Surgeon inje

aine
racaine
on started

29

Lc

- P
- Ir
- b
- P
- L

= A LOT OF LOCAL ANESTHETICS

30

Time Out

- Will Local Anesthetic be used during this case?
- Has Local Anesthetic already been used?
- Calculate (maximum) dose and write on white board.



31

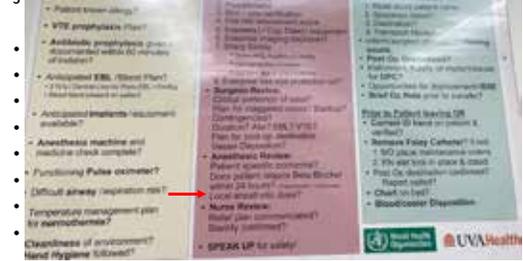


32



33

Just another day in the OR



34

Safety Checklists in Regional Anesthesia

USE THEM...

- Error reduction
- Improved patient safety
- Decreases Botched Blocks



35

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HANDOUTS

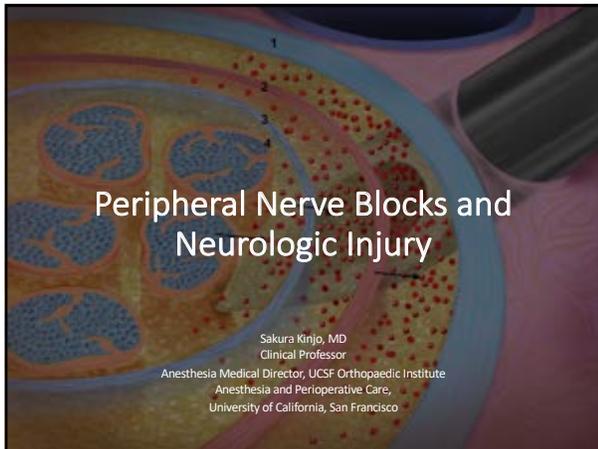


Panel: When Blocks Become Botched: Complications of Regional Anesthesia – Catheter Complications (Dislodged, Failure); Infection (in Context Mostly of Catheters); Failed Spinals for Total Joint Arthroplasty (Including Short Versus Long-Acting Agents)

Sakura Kinjo, MD

05/18/2023

9:00am – 10:15am MST



1



2

Objectives

- Describe the typical causes of peripheral nerve injury (PNI)
- Describe the risk factors and preventative measures of PNI
- Describe how to assess and manage PNI

3

A surgeon's email says...

"I have a patient that has developed what seems to be a nerve injury related to a nerve block. Can you please take a look and let me know what you would recommend?"

4

A 40-year-old woman presented for a left ACL reconstruction

PMHx: Asthma, depression/anxiety

PSHx: Endometriosis s/p hysterectomy, chronic back pain with left L5/S1 radiculopathy s/p microdiscectomy (2020), s/p breast surgery complicated with MRSA infection, implant removal (2021), developed chronic pain in her chest.

Anesthesia & surgery: GA and femoral and sciatic blocks. **No tourniquet.**

POD3: Severe pain, numbness, tingling, and increased swelling of her left leg.

PE: Decreased sensation below the knee. Motor intact.

5

Neurologic complications after PNB are NOT necessarily from a PNB

Postoperative Neurologic Symptoms (PONS)

Short Term Neurologic Symptoms...Common

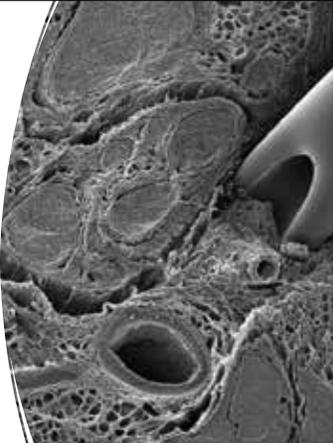
Incidence of PNI after nerve block is **RARE (1.5-4/10,000)**

6

Mechanisms of Nerve Injury

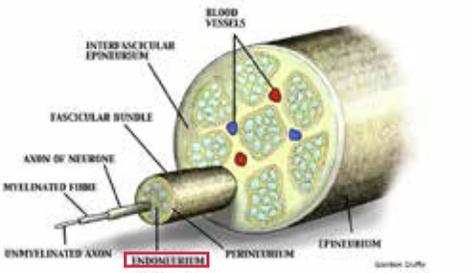
- Mechanical
- Stretch
- Pressure
- Chemical
- Vascular

→ Most injuries involve multiple mechanisms



Reina MA, Atlas of Functional Anatomy for Regional Anesthesia and Pain Medicine

7



Epineurium: external connective tissue that binds fascicular bundles
 Perineurium: Binds each fascicle
 Endoneurium: connective tissue surrounds individual axons

8

SEDDON'S CLASSIFICATION OF NERVE INJURIES

Neuropraxia		No loss of axon Days to weeks to recover
Axonotmesis		Axon is damaged Weeks to months
Neurotmesis		Complete transection (by Avulsion, massive trauma) Severe deficits

For nerve regeneration, endoneurium needs to be intact.

9

Perioperative Neurologic Injury is Multifactorial

Pre-operatively—nerve block, pre-existing pathology

Intra-operatively—surgical injury, positioning, tourniquet injury

Post-operatively—bandage/cast too tight, hematoma

10

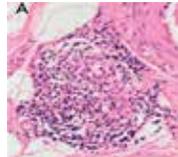
Risk Factors: Patient Characteristics

- Pre-existing neuropathies
- Peripheral vascular disease
- Smoking
- Hypertension
- Obesity

11

Postsurgical Inflammatory Neuropathy

- Immune mediated response to surgery.
- Symptoms outside of the expected surgery, intense pain, weakness.
- Within 30 days of surgery.
- Dx: Nerve biopsy.
- Tx: Steroids, IVIG.



Staff NP et al. Brain 2010.133;2866-2880

12

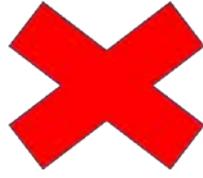
Prevention:
Does Regional Anesthesia Technique Matter?



No Difference Non-Specific

13

Prevention: Do NOT do this...



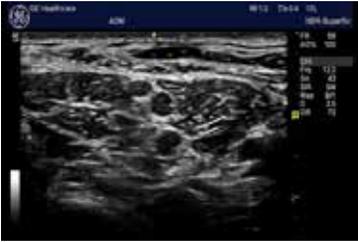
- Intraneural injection
Needle should not go inside of endoneurium or perineurium, or even epineurium.
- Do not use long bevel needle
- Do not inject if you encounter high pressure



14

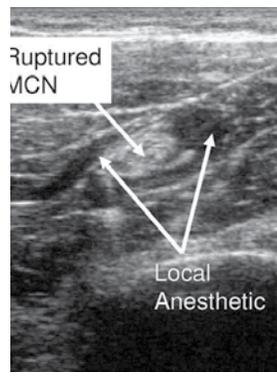
Prevention - Do NOT do this...

- Interscalene block:** avoid intraplexus injection, do not pierce long thoracic nerve, dorsal scapular, and phrenic nerve. Always confirm the location of vessels with color doppler.



15

Assessment/Diagnosis



- Electrophysiological studies:** electromyography (EMG) and nerve conduction studies (NCS) can help determine the **site, severity,** and chronicity of the injury and monitor for nerve recovery.
- MR neurogram:** can indicate the **site and severity** of the injury (lower sensitivity for milder forms of nerve injury (neuropraxia).
- Ultrasound:** looks for hypoechoic, nerve swelling, neural interruptions and compressions.

16

Timing of Electrophysiology Studies

- <2 weeks:** NCS may be useful if there is a question about whether early surgical nerve repair is necessary
- >3 weeks:** Waiting at least 3 weeks will allow the site of the pathophysiology to be localized according to the pattern of EMG denervation.

17

Management

Assess urgency

New onset of neurologic deficits, block lasting longer than anticipated. Severe pain, motor function affected, symptoms progressively worse

↓

Consultation

- Peripheral nerve expert: surgeon (e.g., neuro, ortho, plastic) and neurologist.
- Chronic pain physician

18

Case continuation Postoperative Course

- **3 weeks later:** persistent pain and paresthesia. Developed absent L ankle reflex and EHL weakness.
- Meds (gabapentin, ibuprofen, hydrocodone/acetaminophen, nortriptyline, tramadol) and PT/OT
- **EMG/NCS:** subacute, axonometric left sciatic mononeuropathy.
- **MR neurogram:** increased T2 signal involving the sciatic nerve at the mid to distal thigh and extending to the tibial and common peroneal nerves. Irregular caliber of the tibial nerve was noted at the mid-calf, accompanied by **subcutaneous and intramuscular edema**. These findings were concerning for perioperative compressive nerve injury.



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CRPS Type 2

6 weeks: Decompression Surgery
EHL signal to electrical stimulation that recovered during surgery

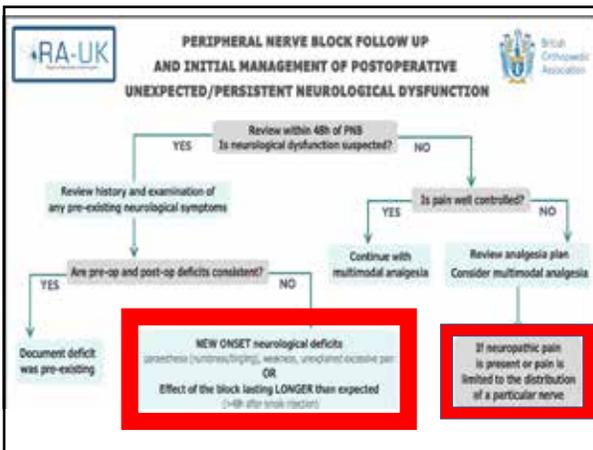
4 months: PO steroid, lumbar sympathetic block (not effective).

6 months: temporal peripheral nerve stimulator (80% effective for pain, improvement in ankle strength)

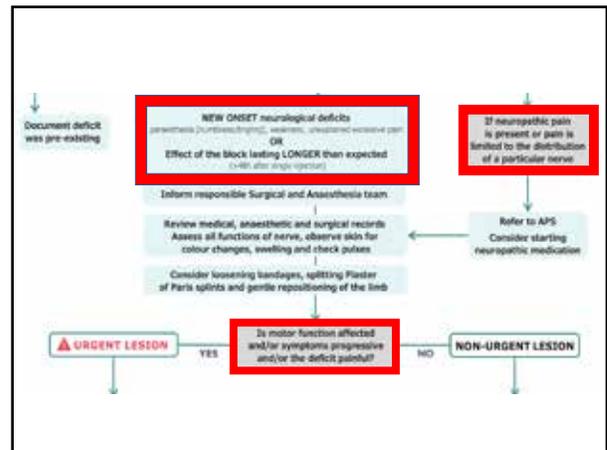
Meds)
gabapentin, nortriptyline, lidocaine cream, vitamin C and fish oil.

PT/OT, cognitive behavior therapy, TENS unit.

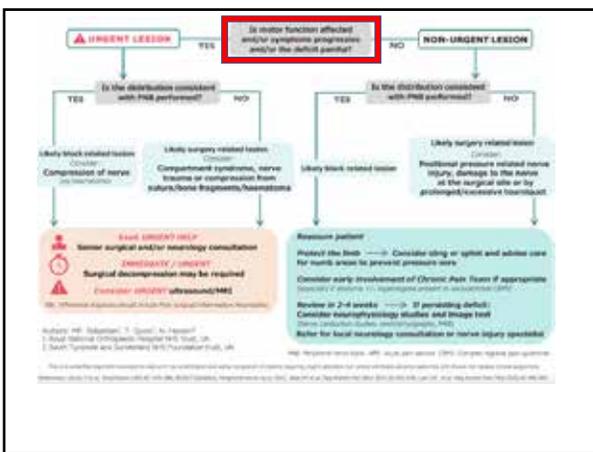
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If neuropathic pain occurs...

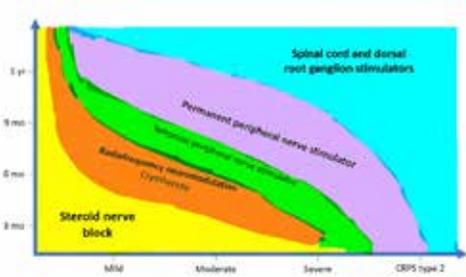
First line: conservative treatment

- Medications:
 - Anticonvulsants (gabapentin/pregabalin), SNRIs (duloxetine and venlafaxine), Tricyclic antidepressants (nortriptyline and amitriptyline).
- Ketogenic diet (anti-inflammation)
- Supplements (vitamins, fish oil)

Terkawi, A and et al. Anesthesiology Clin (2023) <https://doi.org/10.1016/j.anclin.2023.04.009>

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Interventional “Non-surgical” pain management



Terkawi, A and et al. Anesthesiology Clin (2023) <https://doi.org/10.1016/j.anclin.2023.04.009>

25

Summary

- **Etiology:** Though nerve injury is a potential complication of peripheral nerve blockade, the majority of PNIs are due to other causes.
Actual discrimination between surgical, anesthetic and patient factors is often difficult.
- **Prevention:** Avoid intraneural injection, use short bevel needle. Be vigilant about patient positioning and tourniquet time, check cast.
- **Assessment:** Monitoring of symptoms, patient counselling, MR neurogram and EMG/NCS.
- **Management:** In severe cases, early consultation to peripheral nerve specialists is important.

26

Thank you.

Sakura.Kinjo@ucsf.edu



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HANDOUTS



Panel: When Blocks Become Botched: Complications of Regional Anesthesia - Inefficiencies in Practice, Block Delays; Wrong-Sided Nerve Blocks

Marco Lotano, MD, MS

05/18/2023

9:00am – 10:15am MST

Marco Lotano MD
Complications with Continuous
Catheter Nerve Blocks

1

Nondisclosure

I have no conflicts of interest in relation to this presentation.



2

Regional Anesthesia in OPSC

- Regional anesthesia is beneficial for outpatient surgery
 - Improved postoperative analgesia, minimizing opioid use
 - Decreased complications / adverse side-effects (e.g. respiratory depression, PONV)
 - Shorter average recovery room times / improved quality of recovery
 - Lower hospital readmission rates
 - Relatively few contraindications
- Use of continuous peripheral nerve block (PNB) techniques and extended release local anesthetic delivery systems have extended these benefits beyond the limited duration of single-injection PNBs.

3

Prolonged Peripheral Nerve Blocks

LA adjuncts

- Vasoconstrictors (Epi 1:200k – 1:400k)
- Dexamethasone
- Alpha 2 Agonists

Liposomal Bupivacaine LPB (Exparel)



4

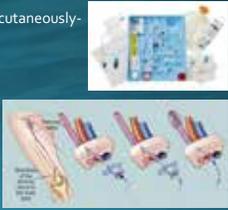
Continuous Nerve Catheter

Continuous infusion of LA (local anesthetic) through percutaneously-placed catheter adjacent to peripheral nerve

Prolonged duration of anesthesia/analgesia

Planning and patience

- Patient selection/education
- Prolonged time to place catheter - sterile technique
- Increased costs and follow-up
- Associated complications



5

Complications with ssPNBs

- Bleeding/hematoma
- Infection
- Allergic reaction
- Nerve injury
- Local Anesthetic Systemic Toxicity (LAST)

Secondary injury: motor block related falls
tissue injury in blocked extremity

Major complications resulting in permanent (~6 mo) nerve damage **0.015-0.09%**

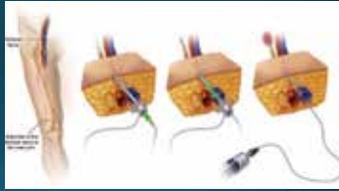


Shen EP, Trimmer AH, Hwang MD, et al. Incidence of local anesthetic systemic toxicity and neurotoxicity/neurologic symptoms associated with 12,668 peripheral nerve blocks: an analysis from a prospective, single-center study. *Anesth Analg* 2019;129:732

6

Risks of Continuous Nerve Catheters

- Failure of Catheter
 - Primary (placement)
 - Secondary
- Removal
- Needle-induced injuries
 - Bleeding / hematoma
 - Nerve Injury
- Infection
- Local anesthetic induced complications
 - Local Anesthetic Systemic Toxicity/LAST



7

Continuous Nerve Catheter Failure

- Primary
 - Improper placement
 - Technically challenging
 - Additional training
- Secondary
 - Catheter displacement
 - Catheter migration
 - Disconnection
 - Leakage of local anesthetic
 - Pump failure



8

Primary Catheter Failure: Improper Insertion

- Published failure rates range from **0.5 to 26%**
- Studies support **ultrasound-guidance improves continuous catheter success**



Hfield BM. Continuous Peripheral Nerve Blocks: An Update of the Published Evidence and Comparison With Novel, Alternative Analgesic Modalities. *Anesth Analg*. 2017 Jan;124(1):308-335.

9

Primary Catheter Failure: Improper Insertion

- Case Report:
- Patient demise after nerve catheter placed under GA
- Catheter inserted 7 cm beyond the needle tip
- Bolus administered post-operatively without prolonged observation of patient
- "Interscalene" catheter was actually *intrathecal*
- **Imperative to: Confirm catheter placement**
- **Monitor patient after bolus**



Yanovski B, Gattini L, Volodarski N, Ben-David N. Catastrophic complication of an interscalene catheter for continuous peripheral nerve block analgesia. *Anaesthesia* 2012, 67, 1166-1169

10

Secondary Catheter Failure

- Leakage at site
- Dislodgement
- Catheter obstruction
- Difficulty removing
 - Catheter retention during withdrawal
 - Loop, knot, kink (case reports)
 - Shearing
- *Stimulating catheters* more commonly retained



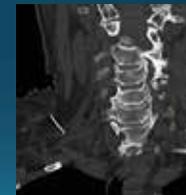
Hfield BM. Continuous Peripheral Nerve Blocks: An Update of the Published Evidence and Comparison With Novel, Alternative Analgesic Modalities. *Anesth Analg*. 2017 Jan;124(1):308-335. doi: 10.1213/ANE.0000000000002581. PMID: 27793354.

Hfield B, Essener D, Moroy T, Enneking K. Ambulatory perineural infusions: the patients' perspective. *Reg Pain Med* 2003;3:841B-23.

11

Secondary Catheter Failure

Stimulating catheters more commonly retained



Yanovski B, Gattini L, Volodarski D, Ben-David B. Catastrophic complication of an interscalene catheter for continuous peripheral nerve block analgesia. *Anesthesiology*. 2012. 67:1166-1169

12

Secondary Catheter Failure

- 1458 patients with Interscalene catheter
- Tubing obstruction
- Pump/catheter disconnection
- Persistent alarming from the electronic pump



- Pump-related issues were higher for the electronic device compared with the elastomeric pump

- 12% patients seeking medical advice, usually by telephone

Probsthaus M, Leighton P, Wang A, Chadduck M, Akersheera A, Foxglove C. An analysis of 1458 consecutive patients receiving continuous interscalene analgesia at home: a multicenter prospective safety study. *Anaesthesia*. 2016; 71(11):1212-9. doi: 10.1111/anae.13285. Epub 2016 Feb 3. PMID: 26842272.

13

Secondary Catheter Failure: Variability between types of block




King R, Mariano ER, Yavnik M, Kou A, Kim TE, Hunter OO, Howard SK, Mudumbai SC. Outcomes of Ambulatory Upper Extremity Surgery Patients Discharged Home with Perineural Catheters from a Veterans Health Administration Medical Center. *Pain Med*. 2019 Nov 1;20(11):2256-2262. doi: 10.1093/pm/pnz033. PMID: 3089266

14

Secondary Catheter Failure: Leakage

- 1644 patients, 748 without and 896 with Dermabond[®]
- 2-Octyl Cyanoacrylate glue
 - Decreased leakage problem by a factor of 10
 - Decreased dislodged catheters
- Peri-catheter leakage at 24 h was 0% (Dermabond[®]) versus 93% (sterile strips)
- Displacement at 24 hours: 6.7% versus 93.3%



Gurramy N, Narain R, Patel K, et al. Dermabond[®] decreases pericatheter local anesthetic leakage after continuous peripheral infusions. *Anesth Analg*. 2013;117:1066-1070. doi: 10.1093/anaesth/117.4.1066. Epub 2013 Aug 1. PMID: 23881111.

15

Mitigating Catheter Migration or Dislodgement

- Insertion technique
 - ? tunnel catheter
- Securing carefully
 - Dermabond[®], Tegaderm
- Patient education: postop care
 - positioning / activity



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Bleeding and / or Hematoma

- Considerations for diagnosing bleeding complications at home
 - Patient education
 - Post-operative communication
- Anti-coagulation pre-operatively and/or post-operatively
- Sight of injection - deep blocks higher risk
 - Psoas catheter causing retroperitoneal hematoma



Warner NS, Duncan CM, Kopp SL. Acute retroperitoneal hematoma after psoas catheter placement in a patient with myeloproliferative thrombocytosis and aspirin therapy. *A A Case Rep*. 2016;6:e830.

17

Postoperative Neurologic Symptoms (PONS) Peripheral Nerve Injury (PNI)

- Potential catheter-associated risks:
 - ? Increased concentration of local anesthetics
 - ? Prolonged exposure



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Risk of Nerve Injury after ssPNB

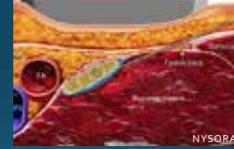
1-2 / 5,000
0.02-0.04%
> 6 months

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Postoperative Neurologic Symptoms (PONS) Peripheral Nerve Injury (PNI)

- Prospective study 1010 ssPNBs

- 8.2% day 10
- 3.7% at 1 month
- 0.6% at 6 months



Fredrickson MJ, Kiffolye DH. Neurological complication analysis of 1000 ultrasound guided peripheral nerve blocks for elective orthopaedic surgery: a prospective study. *Anaesthesia*. 2009 Aug;64(8):896-44. doi: 10.1111/j.1365-2044.2009.05938.x. PMID: 19604186.

20

Postoperative Neurologic Symptoms (PONS) Peripheral Nerve Injury (PNI)

- Prospective study 1505 interscalene catheters

- 7.3% patients reported tingling, weakness or pain >1 month
- 3.2% > 3 months
- 1.8% > 6 months
- 0.7% > 12 months



Fredrickson MJ, Leighton P, Wong A, Chaddock M, Abeyotera A, Phipps C. A randomised, prospective study of patient-reported postoperative neurologic symptoms after interscalene block: a multicentre prospective safety study. *Anaesthesia*. 2016;71:3120-5.

21

Infection

- Site of catheter
- Duration of catheter
- Patient risks factors



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Infection

- Rates of inflammation (3%–4%) and catheter colonization (6%–57%)
- Clinically relevant infection rare (0%–3%)



Dott D, Canlas C, Sobey C, Obrensky W, Thomson AB. Necrotizing Fasciitis as a Complication of a Continuous Sciatic Nerve Catheter Using the Lateral Popliteal Approach. *Reg Anesth Pain Med*. 2016 Nov/Dec;41(6):728-730. doi: 10.1097/AAP.0000000000000482. PMID: 27662664.

23

Infection



Capdevila X, Jaber S, Pesonen P, et al. Acute bacterial and mold infections complicating a continuous interscalene block. *Anesth Analg* 2008;107:1219-1221.

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Time and Expense

- Extensive time commitment for placement, confirmation, securing catheter compared to ss PNB
- Requires more technical skill / training for catheter
- Management of catheter requires support service/acute pain team to educate, manage, trouble-shoot catheter

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Patient Satisfaction/Support

Category	08/28/2019	08/29/2019	08/30/2019
Chlorbutol	10 (20.4%)	2 (2.4%)	2007
Alprazolam	10 (20.4%)	2 (2.4%)	4007
Valium	9 (18.7%)	1 (1.2%)	3007
Morphine	7 (14.3%)	1 (1.2%)	4007
Midazolam	2 (4.1%)	0	0
Propofol	2 (4.1%)	0	0
Hydrocodone	1 (2.0%)	1 (1.2%)	0
Codeine	1 (2.0%)	0	0
Sumatriptan	1 (2.0%)	0	0
Hydroxyzine	1 (2.0%)	0	0
Meperidine	1 (2.0%)	0	0
Other	1 (2.0%)	0	0
Total	49 (100.0%)	4 (100.0%)	4007

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- Available in multiple languages
- Available in multiple time zones

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How to avoid complications?

Provider Education

- Ultrasound-guidance training
- PNB selection / Technique
- Patient Selection
- LA selection
- Monitoring

Patient education



Acknowledgements: Ashley Shilling MD, Hanae Tokita MD, Sakura Kinjo MD

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HANDOUTS



Panel: When Blocks Become Botched: Complications of Regional Anesthesia - Block-Specific Complications (Including Pneumothorax with PVB, Diaphragmatic Paresis with ISB); LAST

Hanae K. Tokita, MD, FASA

05/18/2023

9:00am - 10:15am MST



When blocks become botched: Local anesthetic systemic toxicity and block-specific complications

Hanae K. Tokita MD, FASA
 Director of Anesthesia, Josie Robertson Surgery Center
 Associate Attending, Department of Anesthesiology & Critical Care
 Memorial Sloan Kettering Cancer Center
 New York, NY

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Disclosures

I have no relevant financial interests or conflicts to disclose.

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Objectives

- Recognize the spectrum of clinical presentations of LAST
- Gain awareness of the changing clinical setting of LAST in recent years
- Understand how the management of cardiac arrest from LAST differs from the standard ACLS algorithm
- Consider complications of interscalene and paravertebral block

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Case report



- 58yo, 82kg male presented for arthroscopic rotator cuff surgery
- PMH: CABG at 43yo; h/o angina on exertion and occasionally at rest; deemed stable on medical therapy by cardiologist
- Meds: NTG PRN, lisinopril, atenolol, clopidogrel, and aspirin

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Case report



- Standard monitors placed in preop area, oxygen by NC, and 2mg midazolam and 50mcg fentanyl administered
- **Interscalene block** was performed and 40mL of local anesthetic was administered (20mL of 0.5% bupivacaine + 20mL of 1.5% mepivacaine) slowly in 5mL increments after gentle negative aspiration
- Pt **awake** and conversant during block, blood was not aspirated at any time

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Case report



- **30 seconds** after block was placed, pt became incoherent and then developed a **tonic-clonic seizure**
- Oxygen was delivered by face mask and 50mg of propofol was injected, seizure stopped but occurred again 90 seconds later

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Case report

- EKG showed **asystole** and no pulse was detectable
- ACLS was initiated, trachea intubated, and pt received epi, atropine, amiodarone, vasopressin
- Shocks were administered when warranted
- Plan to initiate emergency cardiopulmonary bypass



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Case report

- 20 mins after initiation of code, 100mL of 20% **intralipid** was administered
- Compressions continued and a shock was administered
- Within seconds, a single beat appeared on the EKG and within 15 seconds, cardiac rhythm returned to sinus at 90 bpm and BP and pulse returned
- Intralipid infusion** was continued for 2 hours, pt was weaned from vent, awake, responsive with no neurologic sequelae

Rosenblatt MA et al. Anesthesiology 2006

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Local Anesthetic Systemic Toxicity (LAST)

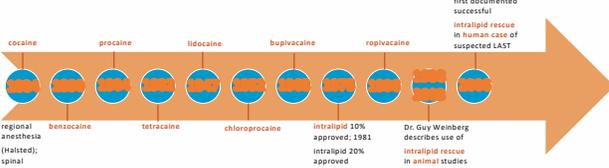
Potentially **life-threatening CV collapse** from unintentional **intravascular injection** or **slow absorption** of high dose of local anesthetic



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Historical perspective



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Intralipid

- Prop...
- 8 ye...
- Parti...
- lono...
- Post...



Side courtesy of Dr. Ashley Shilling

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Frequency of LAST

Author	Year	Study	n	LAST cases	%	Regional Anesthesia	Setting	Incidence
Wattson et al. 2007	2007	Prospective	1,000	1	0.1%	Spinal	Operating Room	1 per 1,000
Macfarlane et al. 2007	2007	Retrospective	1,000	1	0.1%	Spinal	Operating Room	1 per 1,000
Gitman et al. 2018	2018	Retrospective	1,000	1.8	0.18%	Spinal	Operating Room	1.8 per 1,000

Incidence: 1.8 per 1000 nerve blocks

Macfarlane AJR et al. Anaesthesia 2021
Gitman M et al. RAPM 2018.

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Clinical Setting of LAST is Changing

- Shifting away from anesthesia providers in an OR setting to non-anesthesia providers including in remote locations
- Between Dec 2017 and May 2020, 36 cases of LAST published
 - 61% hospital
 - 17% outpatient surgery centers
 - 14% outpatient clinics (e.g., dental, pain, urology)
 - Personnel administering the local anesthetic: 50% anesthesiologists; 39% surgeons/proceduralists; 5.5% dentists, and 5.5% self-administered

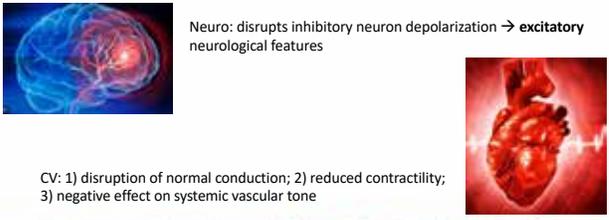
Macfarlane AJR et al. Anaesthesia 2021

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Mechanism of Action, LAST

Local anesthetic systemic toxicity causes sodium channel blockade



Neuro: disrupts inhibitory neuron depolarization → excitatory neurological features

CV: 1) disruption of normal conduction; 2) reduced contractility; 3) negative effect on systemic vascular tone

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Clinical Manifestation of LAST



- Early signs: dizziness, drowsiness, tinnitus
- Sedation or general anesthesia may mask initial signs/increase seizure threshold so first sign may be CV collapse
- Neuro: seizure → coma
- Cardiac: excitatory → myocardial depressant

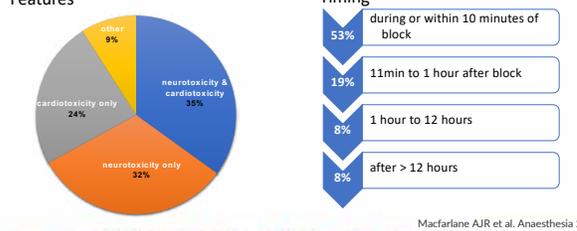
FIGURE 3. Bar graph showing the frequency of cardiovascular symptoms and signs. Arrhythmias (includes tachycardia, ventricular tachycardia or bradycardia), conduction disturbances (includes widened electrocardiogram or other changes (eg, ST segment changes)), cardiac arrest (includes pulseless electrical activity, asystole, as determined by authors of the case reports).

Gitman M et al. RAPM 2018

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LAST may have variable presentation and speed of onset



Features

- neurotoxicity & cardiotoxicity 36%
- neurotoxicity only 32%
- cardiotoxicity only 24%
- other 9%

Timing

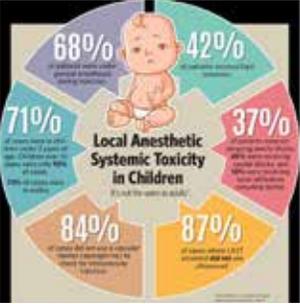
- during or within 10 minutes of block 53%
- 11min to 1 hour after block 19%
- 1 hour to 12 hours 8%
- after > 12 hours 8%

Macfarlane AJR et al. Anaesthesia 2021

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Local Anesthetic Systemic Toxicity in Children



- 68% of cases have an associated airway obstruction
- 42% of cases have a seizure
- 71% of cases have a seizure
- 37% of cases have a seizure
- 84% of cases have a seizure
- 87% of cases have a seizure

Review of 31 case reports in peds LAST 2014-2019

Events occurred despite staying within maximum local anesthetic dosing guidelines

- 42% used less than
- 35% used equal to
- 23% used greater than

anesthetics/highly sedated administered before recommended maximum

not given or/only reducedly administered the maximum

diagnostic and primary care physicians were not fully aware of the recommended maximum

Singaravelu RA, Boretzky K. RAPM 2021
Gupta RK, Schwenk ES. RAPM 2021

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Block type and risk of LAST

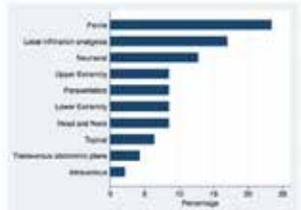


FIGURE 1. Bar graph showing the block types that caused LAST. Psoas, penile block, upper extremity, includes variation of brachial plexus blockade; lower extremity, includes variations of sciatic and femoral nerve blocks.

Gitman M et al. RAPM 2018

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Current areas of interest in LAST research

- Fascial plane blocks
- Liposomal bupivacaine
- Catheters
- Local infiltration analgesia in total joint arthroplasty
- Tumescent anesthesia

El-Boghdady K et al. Local Reg Anesth 2018

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Key Points for the Ambulatory Setting

- Despite low incidence of LAST in current practice, even a single episode of LAST can lead to **serious harm/death** if not treated promptly and appropriately
- Clinical setting of LAST is **changing**, reports of LAST in ASCs and non-anesthesiologists administering local anesthesia
- **Constant** vigilance, preventive safety steps, raising awareness and educating (including our non-anesthesia colleagues) are necessary
- **Stock intralipid** if local anesthesia is used in nerve blocks or surgeon infiltration
 - It's cheap and has a long shelf life
- **Simulation** with multidisciplinary team
- <http://lipidrescue.org/> is a great **online resource**

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Block specific complications: Interscalene block and phrenic nerve palsy

Phrenic nerve palsy

- **Transient:** 100% with 20mL local anesthesia
- **Persistent:** 1/2000 or 1/100; may be multifactorial (cervical spinal stenosis + nerve trauma + local anesthetic)

El-Boghdady K et al. Anesthesiology 2017

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Block specific complications: Interscalene block and phrenic nerve palsy

Strategies to reduce phrenic nerve palsy

- Reduce dose (volume/concentration)
 - 10mL ↓ incidence of palsy to 60%
- Modify injection site: superior trunk block

El-Boghdady K et al. Anesthesiology 2017
Kim DH et al. Anesthesiology 2019

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Block-specific complications: paravertebral block and pneumothorax

- Lonnqvist 1995: 367 pts; **PTX 0.5%**
- Naja 2001: 642pts; **PTX 0.5%**
- Pace 2016: 856 pts; **PTX 0%**
- Kelly 2018: 1152 pts; **PTX 0.26%**
- Our experience: 2251 pts; **PTX 0.04%**

Lonnqvist PA et al. Anesthesiology 1995
Naja Z and Lonnqvist PA. Anesthesiology 2001
Pace MM et al. Anesth Analg. 2016
Kelly M, et al. Breast J. 2018

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Ann Surg Oncol (2023) 29:4772–4786
<https://doi.org/10.1245/s12453-023-41724-9>

Annals of
SURGICAL ONCOLOGY
 www.annals-of-surgical-oncology.com

REVIEW ARTICLE – BREAST ONCOLOGY

The Use of Pectoralis Blocks in Breast Surgery: A Practice Advisory and Narrative Review from the Society for Ambulatory Anesthesia (SAMBA)

Alberto E. Ardau, MD, MPH¹, John E. George III, MD², Kapil Gupta, MD³, Michael J. O'Rourke, MD⁴, Melinda S. Seering, MD⁵, Hanne K. Tokita, MD⁶, Sylvia H. Wilson, MD⁷, Tracy-Ann Mao, MD⁸, Ingrid Llaneras, MBBS⁹, Sarah McLaughlin, MD⁹, and Roy A. Greenbaum, MD⁹

 For patients undergoing a mastectomy, a PECS block may provide an opioid-sparing effect similar to that achieved with PVB; SAMBA recommends the use of a PECS block if a patient is unable to receive a PVB (Strength of Recommendation A).

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Thank you

tokitah@mskcc.org
 @drhanae_tokita



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HANDOUTS



DEA Issues: Diversion

Meghan C. Valach, MD

05/18/2023

10:30am - 11:45am MST

DEA Issues Diversion Rules: Transporting, Storing and Obtaining Controlled Substances



Meghan C Valach MD
Mobile Anesthesiologists

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Learning Objectives

- At the end of this presentation the participants will be able to
 - Explain why the Drug Enforcement Agency (DEA) and Department of Justice (DOJ) have implemented strict diversion processes for Controlled Substances
 - Analyze current diversion rules and the impact they have for out of hospital administration of controlled substances and improvements that can be made
 - Summarize the recent DEA Medical Assisted Treatment (MAT) training and resources to meet the requirement
- I have the following financial interests or conflicts to disclose:
 - Chief Medical Officer for Mobile Anesthesiologists

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Background

- Controlled Substances Act (CSA)
 - Title II of the Comprehensive Drug Abuse Prevention and Control Act of 1970
- Drug Enforcement Agency (DEA) Diversion Control Division
 - Controlled Pharmaceuticals
 - Listed Chemicals

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Why diversion matters

Scope of the Problem

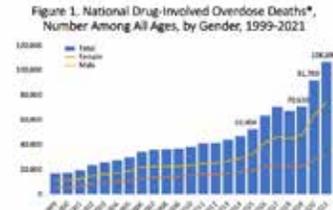


Figure from National Institute on Drug Abuse (NIDA)

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Why diversion matters

Scope of the problem

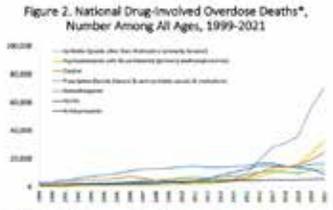


Figure from NIDA

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Why diversion matters

Scope of the problem

“In 2020, the ballpark cost of the opioid epidemic is now more than \$1.3 trillion and rising, according to a *Forbes* estimate using the same approach as the CDC.”

-Kate Jennings, Forbes

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DEA Diversion rules

- Current State
 - Scheduled narcotics including fentanyl, morphine, hydromorphone (II), ketamine (III) and midazolam (IV) must be delivered by a licensed distributor directly to the site of administration
 - A DEA registration must be held for each physical address
 - Opiates (schedule 2) must be ordered using a 222 form unique to that address
 - “Black bag exception”

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DEA Diversion rules

- Current State Shortcomings
 - Patient access to standard of care therapies
 - Wasting of limited resources
 - Increased diversion potential

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DEA Diversion Rules

- Ideal state for office-based anesthesiologists
 - DEA license held for address where narcotics are delivered by a distributor
 - Medications securely maintained
 - Licensed physicians or employees acting on their order can transport the narcotics securely to site of patient care
 - Any unused, unopened vials can be returned

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DEA Diversion Rules

- Ideal state improvements
 - Improved patient access
 - Preservation of limited resources by reduced wastage
 - Contains costs
 - Reduced opportunities for diversion

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SPORTS Act of 2023

- Saving Practices on Registered Transportation of Substances (SPORTS) Act of 2023
- Bill proposed to allow physicians to apply for a separate registration to transport controlled substances across state lines
- Allows provider to travel with narcotics (out of state) for up to 96 hours away from primary practice location
- Also confers ability to move medications in state to places other than principal place of business
- Built to mirror Veterinary Mobility Act of 2014

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SPORTS Act of 2023

- Limitations include:
 - Physician must transport personally
 - Focuses on out of state transport
 - 96 hour limit
 - Still uses wording of “not a principal place of business or professional practice”

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DEA MATE Act of 2023

Section 1263 of the 'Consolidated Appropriations Act of 2023' otherwise known as the Medication Access and Training Expansion (MATE) Act

- Requires at least 8 hours of training on opioid or other substance use disorders
- Grants authority to the Assistant Secretary for Mental Health and Substance Use and the Department of Health & Human Services Substance Abuse and Mental Health Services Administration (SAMHSA) to determine what curriculum satisfies this requirement

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DEA MAT requirement

What is required of all DEA registrants?

One of the following

- 8 hours of training on opioid and other substance use disorders
- Board certification in addiction medicine or addiction psychiatry
- Graduation within 5 years and in good standing from a medical school in the United States

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8 hour training

- Doesn't need to be all in one course
- Can include prior learning
- Multiple formats qualify
- All accredited continuing education sources

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SUD training

Ideal curriculum expected content should be related to:

- Prevention of substance abuse
- Recognition of SUD
- Treatment of people with substance use disorders
 - concurrent pain
 - psychiatric and medical co-morbidities

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Links for Online training

From SAMHSA :

<https://education.sudtraining.org/>

<https://smokingcessationleadership.ucsf.edu/resources/curricula>

From ASA – free to members:

<https://www.asahq.org/shop-asa/e023r00w00>

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• **“Given the urgency of the nation’s overdose crisis, the importance of practitioners receiving training in substance use disorders (SUD) cannot be overstated. Incorporating training on SUD into routine healthcare will enable practitioners to screen more widely for substance use disorders, treat pain appropriately, prevent substance misuse, and engage people in life-saving interventions.” – SAHMSA**

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References

1. <https://deaddiversion.usdoj.gov/pubs/docs/index.html>
2. <https://nida.nih.gov/research-topics/trends-statistics/overdose-death-rates>
3. Editorial *The Lancet*. Published Online February 2, 2022 [https://doi.org/10.1016/S0140-6736\(22\)00200-8](https://doi.org/10.1016/S0140-6736(22)00200-8)
4. Kate Jennings. Forbes Published online Feb 4, 2022, 06:30am EST <https://www.forbes.com/sites/katejennings/2022/02/04/economic-toll-of-opioid-epidemic-13-trillion-a-year/#1e4793689292>
5. <https://www.samhsa.gov/medications-substance-use-disorders/provider-support-services/recommendations-curricular-elements-substance-use-disorders-training>

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HANDOUTS



DEA Issues: Cannabinoids / Recreational Substances

Srinivas Pyati, MBBS, MD, FCARCSI

05/18/2023

10:30am – 11:45am MST

"To certain people, cannabis is a drug with evil consequences, a gateway to even worse drugs, to be condemned with full force of the law. To others, cannabis offers benign escape from reality that is less harmful"

Dr Mather, Univ of Sydney 2001

"Most people, medical, legal or lay, it seems, have a viewpoint"

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Cannabis refers to products of the plant Cannabis sativa

Endocannabinoids Phytocannabinoids Syntheticcannabinoids

Widespread neuronal activity affecting many biological functions throughout the body
Ex: learning, eating and emotional processing

THC

CBD

**Delta-9 Marinol (schedule 3)
Delta-8**

CBD products (except Epidiolex) are not FDA approved so there are no standards on content, purity or strength. May contain contaminants such as THC during manufacturing.

Antiepileptic
Anti-inflammatory
Analgesic
Use in Neurological disorders

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State Regulated Cannabis Programs

37 states regulate cannabis use for medical use by qualified individuals
10 states allow the use low THC and high CBD products
NCSL: National Conference of State Legislatures

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Schedule I - Federal classification: Criminal penalty for production, distribution and possession.

RESEARCH GAP

- All cause mortality**
 - There is **insufficient evidence** to support or refute a statistical association between self-reported cannabis use and all-cause mortality.
- Occupational injury**
 - There is **insufficient evidence** to support or refute a statistical association between general, nonmedical cannabis use and occupational accidents or injuries.
- MVA**
 - There is **substantial evidence** of a statistical association between cannabis use and increased risk of motor vehicle crashes.
- Overdose injuries and death**
 - There is **insufficient evidence** to support or refute a statistical association between cannabis use and death due to cannabis overdose.
 - There is **moderate evidence** of a statistical association between cannabis use and increased risk of overdose injuries among **pediatric populations** in U.S. states where cannabis is legal.

The Health Effects of Cannabis and Cannabinoids: The Current State of Evidence and Recommendations for Research. National Academies Press 2017

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**Cannabis Use:
Should we stop asking patients?**

•As of March 2021, at least 40 pharmaceutical companies are engaged in manufacturing of cannabis related products
"Enrollment in medical cannabis programs is on the rise approx. 4.5 fold (2016-2020)
*In January 2023, FDA issued a statement that a new regulatory pathway will be developed for CBD and stated that they will watch marketplace and will take action "within our authorities" if needed

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Perioperative risks of Cannabis use

- Negative effects of cannabis:** chronic bronchitis, minor cognitive effects, psychosis
- Studies have shown that cannabis users have **higher incidence of PONV (~20%)** and in acutely intoxicated patients drug interactions can occur
- Some evidence suggests that h/o drug use is associated with poorer outcomes (increased pain, longer stays, more post operative complications and 5-fold increase in mortality).

Best MJ et al. J Arthroplasty 2015;30:1137-41
Volkow ND et al. W Engl J Med Overseas Ed 2014; 370:2219-27
Webb CW et al. Hawaii J Med Public Health 2014;73:109-11
National Academies of Sciences, 2017

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Cannabis as medicine

- Body wasting condition (**appetite stimulant**), glaucoma, chemotherapy induced **nausea**, multiple sclerosis, **epilepsy** and **intractable pain**, especially when conventional treatment have failed.
- Chronic pain is the most common reason for medical cannabis certification nationwide (>65%)

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Cannabis and Chronic Pain

- Approximately 3 million patients are already using medical cannabis for chronic pain
- Over 1700 chronic pain patients surveyed (36 states, medical marijuana program)
- **31% reported using cannabis (24% in the last 30 days)**
- More than 50% of them were using concurrent prescription drugs (opioids etc)
- Less than 1% reported that cannabis use increased their use of prescription drugs
- Other reported positive effects:
 - 39% said that they use less PT to manage pain
 - **26% decreased use of CBT**

"pain patients do not have many options to manage their pain, so they seek unregulated products-one should know what effects are produced at different doses and concentrations"
-Romero-Sandoval

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Perioperative cannabis use: a longitudinal study of associated clinical characteristics and surgical outcomes

Jenna McAfee,¹ Kevin F Boehrlke,¹ Stephanie M Mose,¹ Chad M Brummett,¹ Jennifer F Wales,² Erin E Bonar^{1,4}

- Prospectively looked at **1335 adults** undergoing elective surgery
- **6% reported cannabis use** (20% recreational and 25% medical and recreational)
- Chronic pain was most common (91%) reason for cannabis use
- Cannabis users reported: Preoperatively worst pain, more centralized pain, worse functional impairment, higher fatigue, sleep disturbance anxiety and depression
- **27% were on opioids and 19% benzos**

- At 3 and 6 months post: cannabis users continued to report worse clinical symptoms but beyond that both groups did not differ on outcomes, implying **cannabis did not affect long-term recovery**

Reg Anesth Pain Med 2021; 46:137-144

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(Anesth Analg 2022;00:00-00)

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ASRA Pain Medicine consensus guidelines on the management of the perioperative patient on cannabis and cannabinoids

Shalini Shah,¹ Eric S Schwert,² Rakesh V Sondkeppam,³ Harce Clarke,⁴ Mark Zakowski,⁵ Rachel S Riisa-Lynn,⁶ Brent Young,⁷ Kate Nicholson,⁸ Gary Schwartz,^{9,10} W Michael Hooten,¹¹ Mark Wallace,¹² Eugene R Vicusi,¹³ Samer Narouze¹⁴

Shah S, et al. Reg Anesth Pain Med 2023;0:1-21. doi:10.1136/rapm-2022-104013

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- **Should we screen preoperatively:**
 - 28 studies (>65 k patients) did not show any benefits/harms of screening
 - Screening-ask if use is recreational or medicinal purpose, type, dose, frequency
 - Preoperative **drug testing is not currently recommended** unless clinically indicated
- **To stop or continue cannabis preoperatively and / or postpone surgery**
 - As cannabis regulation continues to change, a local guideline may be necessary because of the effects that it may impair cognition and ability to give consent. **Cognition is impaired in both recent and chronic heavy users.** Evidence suggests that most executive functions return by 5-6 hours after inhalation of THC-9
 - Given the risk of MI, conservative recommendation is to **avoid smoking cannabis 72 hr prior to surgery**
 - **Driving ability returns by 5-7 hours after inhaling cannabis**
 - **Postpone surgery if acutely intoxicated.**
- **Cannabis withdrawal postoperatively and its management**
 - High index of suspicion if patient smokes >1.5 G or 20 mg THC per day
 - Can present as disrupted sleep, increased pain, changes in opioid use and agitation
 - Consider gabapentin(1200 mg) and/ or dronabinol and nabilone

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- **Concomitant use of cannabis and opioids (pre and postoperative considerations)**
 - THC use has a biphasic response-low dose can decrease pain and opioid consumption while high/chronic use can increase perioperative pain levels-Evidence: MODERATE
 - **Recommendations: High users should be counseled about negative effects of cannabis while low dose, medicinal use likely has a lower risk profile**
- **Do cannabis users require special consideration during intraoperative management**
 - Regular cannabis users require **higher doses of propofol** (RCT:Flisberg et al Eur J of Anaesth 2009) **109 mgs vs 69 mgs**
 - Consideration should be given to dose of anesthetic agents depending on the timing and concentration of cannabis use.
- **Do patients taking preoperative cannabinoids require any special postoperative considerations?**
 - Increased vigilance but no special monitoring
 - Use multimodal analgesic approach due to increased risk of higher opioid requirement

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Bottom line is....

If patient appears intoxicated, do a drug screening test and reschedule surgery as appropriate. Explain the reasons behind canceling surgery to the patient and family.

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Future

Clinical Practice Guidelines for Cannabis and Cannabinoid-Based Medicines in the Management of Chronic Pain and Co-Occurring Conditions

Alan D. Bell,¹ Caroline MacCallum,² Shari Margolis,³ Zach Walsh,⁴ Patrick Wright,⁵ Paul J. Dwanick,^{6,7} Enrico Mandarino,¹⁰ Gary Lacasse,¹⁴ Jaggaal Karar Dool,¹ Lauren de Freitas,¹⁰ Michelle St. Pierre,⁸ Lynne Bellefleur,⁹ Mariou Gagnon,¹¹ Sian Bevan,¹² Tatiana Sanchez,⁸ Stephanie Ait,¹³ Max Morahan-Ellison,¹¹ James O'Hara,¹⁴ Michael Boivin,¹⁵ and Cecilia Costinuk¹⁰⁻¹⁸, and External Review Panel¹

Recommend the use of CBM as monotherapy, replacement or adjunct treatment for management of chronic pain

2023

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Summary

- Understand pharmacology of cannabis and potential risks in the perioperative period because increasing number of your patients are taking and will continue to take
- Providers lack robust evidence to make informed decisions about potential effect of cannabis on perioperative risks and postoperative outcomes
- Self reported outcomes are great, but trials haven't shown that, so we need longitudinal well controlled studies to establish evidence, but some states are ahead of the science.
- Listen and be ready to have difficult conversations with patients- "the kind of talk medical school did not prepare you to do"

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Thank you

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- Sold under several names "K2" "spice" "crazy monkey" "chill out" "spice diamond"
- **Delta 8:** Typically manufactured from CBD and produces psychoactive effects. It is structurally different from Delta-9 THC
- **Toxicity:** Hallucinations, delirium, agitation and acute psychosis are common with Synthetics than Cannabis
- Rapid UDS will not DETECT synthetic metabolites



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HANDOUTS



DEA Issues: Impaired Provider

Sher-Lu Pai, MD, SAMBA-F, FASA

05/18/2023

10:30am – 11:45am MST

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Impaired Provider

- ~10-15% of anesthesia providers develop a substance abuse problem at some point during their career
- Anesthesiology, Emergency Medicine, Psychiatry
- Significant higher risk of mortality
 - Access to potent and highly addictive anesthetic agents

Bryson EO. The opioid epidemic and the current prevalence of substance use disorder in anesthesiologists. *Current Opinion* 2018; 31: 388-92
 Berge KH, et al. Chemical dependency and the physician. *Mayo Clin Proc* 2009; 84: 625-31
 Bailderson MB. Impaired healthcare professional. *Crit Care Med* 2007; 35: 3150-16
 Samuelson ST, Bryson EO. The impaired anesthesiologist. *Can J Anesth* 2017; 64: 219-35

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Impaired Provider

Substance Abuse Disorder

- Alcohol and chemical dependencies are illnesses in which a provider consumes alcoholic beverages or uses chemicals which interfere with his/her job performance.
- Job performance may be one of the last aspects of life to be affected in the chemically impaired provider.

Mayo Clinic. Substance Abuse Disorder Policy.
 https://intranet.mayo.edu/charlie/anesthesiology-perioperative-medicine-rs/residents/resident-policies/substance-abuse-disorder-policy/

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Impaired Provider

- Often does not recognize that the substance use represents a significant problem
 - Treatment is seldom spontaneously sought
 - Denial

Samuelson ST, Bryson EO. The impaired anesthesiologist. *Can J Anesth* 2017; 64: 219-35
 Rosen A, et al. Psychiatrically impaired medical practitioners. *Australian Psychiatry* 2009; 17: 11-8
 Kneve JP. Physicians at risk. *J Occup Med* 1984; 26: 503-8
 Dunn LB, et al. Delaying care, avoiding stigma. *Acad Med* 2009; 84: 242-50
 Moulter C, et al. When residents need health care. *Acad Psychiatry* 2016; 33: 431-41
 Berge KH, et al. Chemical dependency and the physician. *Mayo Clin Proc* 2009; 84: 625-31

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Impaired Provider

- Delay in diagnosis and intervention
- Reasons for not seeking help
 - Fear of career setback, loss of medical license, social stigma, and other consequences

Samuelson ST, Bryson EO. The impaired anesthesiologist. *Can J Anesth* 2017; 64: 219-35
 Rosen A, et al. Psychiatrically impaired medical practitioners. *Australian Psychiatry* 2009; 17: 11-8
 Kneve JP. Physicians at risk. *J Occup Med* 1984; 26: 503-8
 Dunn LB, et al. Delaying care, avoiding stigma. *Acad Med* 2009; 84: 242-50
 Moulter C, et al. When residents need health care. *Acad Psychiatry* 2016; 33: 431-41
 Berge KH, et al. Chemical dependency and the physician. *Mayo Clin Proc* 2009; 84: 625-31

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Impaired Provider

- Reasons for not reporting suspected addiction in a peer
 - Fear of retaliatory litigation
 - Risk of sanctions if a physician becomes aware of an addictive disease in a colleague and fails to intervene or notify the board or the state's physician health program

Samuelson ST, Bryson EO. The impaired anesthesiologist. *Can J Anesth* 2017; 64: 219-35
 Rosen A, et al. Psychiatrically impaired medical practitioners. *Australian Psychiatry* 2009; 17: 11-8
 Kneve JP. Physicians at risk. *J Occup Med* 1984; 26: 503-8
 Dunn LB, et al. Delaying care, avoiding stigma. *Acad Med* 2009; 84: 242-50
 Moulter C, et al. When residents need health care. *Acad Psychiatry* 2016; 33: 431-41
 Berge KH, et al. Chemical dependency and the physician. *Mayo Clin Proc* 2009; 84: 625-31

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Impaired Provider

- Alcohol and chemical dependency should be regarded as an illness which can be medically treated

Mayo Clinic. Substance Abuse Disorder Policy.
 https://intranet.mayo.edu/charlie/anesthesiology-perioperative-medicine-rs/residents/resident-policies/substance-abuse-disorder-policy/

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2 Indication

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Indicators of Potential Impairment

- Unable to practice medicine skillfully and safely because of physical or mental illness

Johns Hopkins Medicine. Impaired Practitioners. https://www.hopkinsmedicine.org/suburban_hospital_for_physicians/docs/impaired_practitioner.pdf
 Diskin D, et al. Infect Control Hosp Epidemiol. 2019;43(9):963-7
 Feely MA, et al. Am Fam Physician. 2013;87(6):644-8

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Impaired Provider
Risk Factors

- Male sex
- Comorbid psychiatric illness
- Family history of substance abuse
- Prior history of substance abuse

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35

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Impaired Provider
Indications

- May appear functional and “normal”
 - Remain attentive and physically present at work until very late in the course of the disease
 - Rely on the job as the source of the drugs

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
 Johns Hopkins Medicine. Impaired Practitioners. https://www.hopkinsmedicine.org/suburban_hospital_for_physicians/docs/impaired_practitioner.pdf
 Bergs KJ, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Impaired Provider
Signs and Symptoms in the Workplace
Signs suggestive of alcohol dependence

- Alcohol on breath
- Slurred speech
- Ataxia
- Erratic performance or decrement in performance
- Tremulousness
- “Out-of-control” behavior at social events
- Problems with law enforcement (e.g., domestic abuse, driving while intoxicated)
- Hidden bottles
- Poor personal hygiene
- Failure to remember events, conversations, or commitments (“blackouts”)
- Tardiness
- Frequent hangovers
- Poor early morning performance
- Unexplained absences
- Unusual traumatic injuries
- Mood swings
- Irritability
- Sweating
- Domestic/marital problems
- Isolation/withdrawal from social activities
- Leaving the workplace early on a regular basis

Bergs KJ, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31
 Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35

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Impaired Provider
Signs and Symptoms in the Workplace
Signs suggestive of opioid dependence

- Periods of agitation (withdrawal) alternating with calm (drug just taken)
- Dilated pupils (withdrawal)
- Pinpoint pupils (opioid side effect)
- Excessive sweating
- Addition of long sleeves (hide needle tracks)
- Frequent bathroom breaks (take another dose)
- Frequent unexplained absences during workday
- Spending more hours at work than necessary (access source of drug)
- Volunteering for extra call
- Volunteering to provide extra breaks or refusing breaks
- Volunteering to clean operating rooms
- Volunteering to return waste drugs to pharmacy
- Rummaging through sharps containers
- Sloppy record keeping or discrepancies between charted dose and actual doses
- Excessive opioid use charged for patients
- Assay of waste drug returned showing evidence of dilution
- Never returning any waste at the end of a case
- Patients arriving in postsurgical recovery room with pain out of proportion to charted opioid dosage

Bergs KJ, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31
 Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35

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Impaired Provider

Indications

- Periods of irritability, anger, euphoria, and depression
- Mood swings, with periods of depression alternating with periods of euphoria
- Withdrawal from family, friends, and leisure activities

Berge KH, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31
Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35

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Impaired Provider

Indications

- Spending more time at the hospital, even when off duty
- Volunteering for extra call
- Refusing relief for lunch or break
- Signing out increasing amounts of narcotics or quantities inappropriate for the given case

Berge KH, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31
Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35

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Impaired Provider

Indications

- Chronic tardiness
- Disorientation
- Mental or physical deterioration
- Pale skin
- Paranoia
- Red eyes
- Slurred speech
- Smell of alcohol on breath
- Unsteady gait
- Weight loss

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
Johns Hopkins Medicine. Impaired Practitioners. https://www.hopkinsmedicine.org/suburban_hospital_for_physicians/docs/impaird_practitioner.pdf

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3 Intervention

MAYO CLINIC

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Work Restrictions

- Intended to be therapeutic and speed recovery from an illness or injury, as well as to facilitate a safe and productive return to employment
- Functional limitations caused by an employee's medical condition

AskMayoExpert. Work Restrictions. 2008-2023 Mayo Foundation for Medical Education and Research. <https://askmayoexpert.mayoclinic.org/hopkins/clinical-answers/gm/201513693/acc-20156845>

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Intervention

Initial Confrontation

- One of the MOST stressful events for both the suspected addict and those intervening



Berge KH, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Intervention

- An intervention does NOT consist of accusing the individual of a crime
- Do NOT delay until evidence of provider addiction or diversion of drugs is secured "beyond a reasonable doubt"

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
 Berge KI, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Intervention

Initial Confrontation

- NEVER simply approach the suspected addict one-on-one
 - The threat to the provider's reputation, autonomy, security, and financial stability may drive him or her to an act of desperation
 - Suicide
 - Critical level of stress → Lethal overdose
 - Quitting the job on the spot

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
 Myers MF, Gabard GO. The Physician as Patient. Washington, DC: American Psychiatric Publishing; 2008
 Berge KI, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Institutional Policy

- Impaired Provider Policy
- Impaired Practitioners Policy
- Substance Abuse Disorder Policy

Johns Hopkins Medicine. Impaired Practitioners. https://www.hopkinsmedicine.org/suburban_hospital_for_physicians/docs/impaired_practitioner.pdf
 Dickson DM, et al. Infect Control Hosp Epidemiol. 2019;40(9):963-7
 Feely MA, et al. Am Fam Physician. 2013;87(6):414-6

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Institutional Policy

- Immediate concern about the patient safety
 - Suspend the provider's clinical privileges
 - Chair of Department/Division
 - Director of Training Program
 - Medical Executive Committee
 - President of Medical Affairs
 - Hospital President

Johns Hopkins Medicine. Impaired Practitioners. https://www.hopkinsmedicine.org/suburban_hospital_for_physicians/docs/impaired_practitioner.pdf
 Dickson DM, et al. Infect Control Hosp Epidemiol. 2019;40(9):963-7
 Feely MA, et al. Am Fam Physician. 2013;87(6):414-6

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Reporting Process

Supervisor's Observations and Report Form for Reasonable Suspicion Determination

Mayo Foundation for Medical Education and Research, 2021. MC0061-15rev0121.

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Intervention Process

- Assistance from experienced and trained professionals
- Coordinated intervention
- Impaired provider should remain supervised and in a safe place

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
 Berge KI, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Available Resources

- Employee Health
- Employee Assistance Program
- Health Professionals Service Program
- Chemical Awareness Committee
- Wellness Committee

Johns Hopkins Medicine. Impaired Practitioners. https://www.hopkinsmedicine.org/suburban_hospital_for_physicians/docs/impaired_practitioner.pdf
 Onkoya DM, et al. Infect Control Hosp Epidemiol. 2019;60(9):963-7
 Feely MA, et al. Am Fam Physician. 2013;87(6):414-8

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Chemical Awareness Committee

- Oversee the policy on chemical dependency.
- Oversee a monitored rehabilitation program for impaired providers.
- Maintain an educational program on substance abuse disorder.
- Monitor narcotic handling and disposal practices in the operating room and other procedural areas.

Mayo Clinic. Substance Abuse Disorder Policy. <https://intranet.mayo.edu/charlie/anesthesiology/peroperative-medicine-residents/resident-policies/substance-abuse-disorder-policy/>

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Treatment

- Facility with expertise in dealing with healthcare providers
 - Medically supervised detoxification
 - Monitored abstinence
 - Education on substance use disorder
 - Self-help group
 - Individual psychotherapy

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
 Berge KH, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Intervention



Berge KH, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Prevention

- Substance use disorder is an occupational hazard within the practice of medicine

Aach RD, et al. Alcohol and other substance abuse and impairment among physicians in residency training. Ann Intern Med 1995; 116: 245-54
 Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
 Berge KH, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Prevention

- Anesthesia information management systems, audits, automated dispenser transactions
 - High use of opioids
 - High wastage
 - Transactions occurring on cancelled cases, after case completion, or in a different location

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
 Berge KH, et al. Chemical dependency and the physician. Mayo Clin Proc 2009; 84: 625-31

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Prevention

- Syringe content verification
 - Special equipment
- Video surveillance at locations with controlled substances
- Serious “cautious attitude” toward drugs and alcohol
- Safe for providers suffering from early-stage chemical dependency to ask for help

Samuelson ST, Bryson EO. The impaired anesthesiologist. Can J Anesth 2017; 64: 219-35
Bergs KJ, et al. Chemical dependency and the physician. Mayo Clin Proc 2008; 84: 655-31

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Conclusions

1. Substance use disorder is an illness that can be medically treated after diagnosis.
2. While signs and symptoms of addictive illness range from very subtle to extremely overt, there are indicators that allow us to provide the necessary rapid confirmation and intervention.
3. It is important to know the local reporting process and intervention resources in order to protect the safety of our patients and the impaired providers.

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Questions & Answers

Sher-Lu Pai, MD, SAMBA-F, FASA
 pai.sherlu@mayo.edu
 @sher_pai

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HANDOUTS



Pro/Con: You Should Always Cancel a Case for New A-Fib

Michael V. Presta, DO (Pro)

BobbieJean Sweitzer, MD, FACP, SAMBA-F, FASA (Con)

05/18/2023

11:45am - 12:15pm MST



Pro/Con: You Should Always Cancel a Case for New Atrial Fibrillation.

Michael Presta, DO
Associate Professor
GI Lab Director Anesthesia Services
Director NORA Rotation
Department of Anesthesiology and Perioperative Medicine

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1

Disclosure

- I have no actual or potential conflict of interest in relation to this program/presentation.

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Learning Objectives

- Understand the current atrial fibrillation (AF) prevalence and associated risk factors.
- Recognize that AF carries significant morbidity, particularly the risk of thromboembolic events.
- Appreciate that preoperative AF is a significant risk factor for perioperative mortality and morbidity.
- Realize newly discovered AF should be treated as a potentially unstable condition that should preclude elective noncardiac surgery.

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GLOBAL PREVALENCE OF AF



Centers for Disease Control and Prevention (CDC)

- 2% percent of people younger than 65 years old
- 10% of people ages 65 and older
- 12.1M people in the United States will have AF in 2030.

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WHAT DO WE DO?

Cancellations and Transfers Related to New-Onset Atrial Fibrillation: An Analysis of Survey and Patient Safety Reporting Data From Ambulatory Surgical Facilities



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WHAT DO WE DO?

- Canceling surgery for additional workup is common
- Often unclear if the arrhythmia is new or preexisting (asymptomatic)



- New-onset arrhythmias in the preoperative setting should prompt investigation into underlying causes, including cardiopulmonary disease, ongoing myocardial ischemia or myocardial infarction, drug toxicity, and endocrine or metabolic derangements. If time and resources permit, cardiology consultation may help identify high-risk patients.

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6

Atrial Fibrillation- Pro

BobbieJean Sweitzer, MD, FACP, F-SAMBA, FASA
 Immediate Past-President, SAMBA
 Systems Director, Perioperative Medicine
 Inova Health
 Professor, Medical Education
 University of Virginia
Bobbiejean.sweitzer@inova.org
 @BobbieJeanSwei1

You know that feeling when you meet someone and your heart skips a beat?
 Yeah, that's arrhythmia. You can die from that.



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Atrial fibrillation in patients having noncardiac surgery

- ✓Lack of data on AF discovered immediately before noncardiac surgery
- ✓AF more common in older individuals
- ✓AF more common with systemic illnesses (hypertension and diabetes)
- ✓Non-cardiac surgery common in older individuals
- ✓Only a matter of time until we encounter a patient with “**newly discovered AF**” in the preoperative setting



UpToDate®



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2

Newly discovered preop atrial fibrillation

- ✓Paucity of studies limits evidence-based recommendations
- ✓Investigate underlying causes
- ✓If time and resources permit, consult cardiology
- ✓Decision to cancel or postpone is case-by-case
- ✓Rate control most important
- ✓Rhythm control has no or few short term advantages
- ✓Restoring sinus rhythm is associated with post-conversion LA dysfunction
- ✓Risk of stroke is highest in month following cardioversion
- ✓Anticoagulation required for 30 days post-cardioversion



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Acute AF = detected first time during acute illness such as hospitalization for another condition

- ✓Acute AF previously thought to be transient and isolated
- ✓Accumulating evidence suggests that acute AF associated with a high risk of long-term AF recurrence
- ✓The 3As of acute management:
 - ✓ Acute triggers
 - ✓ AF rate/rhythm management
 - ✓ Anticoagulation
- ✓Early referral for evaluation (usually outpatient)

AMA SCIENTIFIC STATEMENT
 Atrial Fibrillation Occurring During Acute Hospitalization: A Scientific Statement From the American Heart Association

Circulation 2023;147:00–. DOI: 10.1161/CR.0000000000001133



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Approach to Preoperative AF

- ✓ AF History
 - ✓ Prior history of AF
 - ✓ Is the AF paroxysmal or persistent?
- ✓ Functional capacity
 - ✓ Angina, dyspnea, edema, other signs of HF
- ✓ Examination
 - ✓ BP, HR
 - ✓ Cardiovascular exam: JVD, murmur, edema
- ✓ Prior testing
 - ✓ Stress test, echocardiography, TFTs, CBC, electrolytes

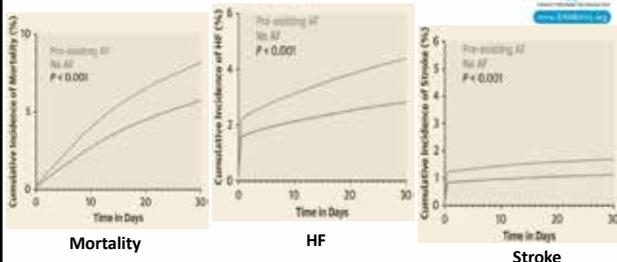
AF rarely a result of acute ischemia




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Lower postop risk of MI in those with hx of AF



30-day higher risk of bleeding and VTE

J Am Coll Cardiol 2022;79:2471



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Newly Discovered Preoperative AF

Preoperative atrial fibrillation — AF diagnosed preoperatively may arise in the setting of a risk factor such as hypertension or from an underlying systemic disorder such as severe hyperthyroidism. Both the AF and the underlying disorder may be a source of perioperative risk unless recognized and managed. For these reasons, we suggest that newly discovered AF be treated as a potentially unstable condition that should preclude elective noncardiac surgery. Diagnosis and management of newly discovered AF are discussed elsewhere. (See “[Newly onset atrial fibrillation](#).”)



7

Day of Surgery Newly Discovered AF Proceed vs. Postpone

Proceed

- ✓ Rate controlled
- ✓ Known history of AF
- ✓ No symptoms
- ✓ Surgery urgent or time sensitive
- ✓ Low risk surgery with sedation
- ✓ Condition or surgery precludes anticoagulation

Postpone

- ✓ Rapid ventricular rate
- ✓ Hypotension
- ✓ New cardiac symptoms
- ✓ Known or suspected structural HD



8

SUMMARY

- ✓ Controversy over how to proceed with newly discovered DOS AF
- ✓ Associated comorbidities and symptoms important in assessing risk
- ✓ Rate control more important than rhythm control
- ✓ Risk of VTE low
- ✓ New onset postoperative AF carries risk, especially of stroke
- ✓ **Likely safe to proceed with low risk surgeries and MAC**

BobbieJean.sweitzer@inova.org

@BobbieJeanSwei1



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HANDOUTS



Coming Soon to an ASC Near You: Cardiac Cases in an ASC

Andrew Kaplan, MD, FACC

05/18/2023

1:30pm – 2:45pm MST

Coming soon to an ASC near you:
Cardiac Cases

Andrew Kaplan, MD, FACC, FHRS
Director of Electrophysiology
Phoenix Heart, PLLC

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Disclosures

- Nothing relevant to this topic

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2

Current Financial Pressures
Is private practice going to survive?

ASC Tumorounds: Ideas to Improve Performance

Physician cuts will create 'immediate financial instability': 4 thoughts on physician pay

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Ancillary Imaging/Interventional Services:
A New Source of Revenue

- Office-based Laboratory (OBL)
- Ambulatory Surgery Center (ASC)

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Office Based Laboratory

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Case Mix for the OBL

- Peripheral vascular assessment and intervention
- Venous ablation
- Implantable cardiac rhythm monitors
- Electrical cardioversion
- Transesophageal echocardiography

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Venous Interventions

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Procedural and 3-Year Outcomes of Peripheral Vascular Interventions Performed in Office-Based Labs: LIBERTY 360 Sub-Analysis

Procedure	Mean Age (SD)	Mean BMI (SD)	Mean CAC (SD)
Carotid artery stenting	70.2 (10.1)	28.1 (4.5)	100 (150)
Carotid artery endarterectomy	70.1 (10.2)	28.2 (4.6)	101 (151)
Carotid artery bypass	70.3 (10.3)	28.3 (4.7)	102 (152)
Carotid artery stenting with embolic protection	70.4 (10.4)	28.4 (4.8)	103 (153)
Carotid artery stenting without embolic protection	70.5 (10.5)	28.5 (4.9)	104 (154)
Carotid artery stenting with distal embolic protection	70.6 (10.6)	28.6 (5.0)	105 (155)
Carotid artery stenting with proximal embolic protection	70.7 (10.7)	28.7 (5.1)	106 (156)
Carotid artery stenting with distal and proximal embolic protection	70.8 (10.8)	28.8 (5.2)	107 (157)
Carotid artery stenting with embolic protection and stenting	70.9 (10.9)	28.9 (5.3)	108 (158)
Carotid artery stenting with embolic protection and stenting and stenting	71.0 (11.0)	29.0 (5.4)	109 (159)
Carotid artery stenting with embolic protection and stenting and stenting and stenting	71.1 (11.1)	29.1 (5.5)	110 (160)
Carotid artery stenting with embolic protection and stenting and stenting and stenting and stenting	71.2 (11.2)	29.2 (5.6)	111 (161)
Carotid artery stenting with embolic protection and stenting and stenting and stenting and stenting and stenting	71.3 (11.3)	29.3 (5.7)	112 (162)
Carotid artery stenting with embolic protection and stenting and stenting and stenting and stenting and stenting and stenting	71.4 (11.4)	29.4 (5.8)	113 (163)
Carotid artery stenting with embolic protection and stenting	71.5 (11.5)	29.5 (5.9)	114 (164)
Carotid artery stenting with embolic protection and stenting	71.6 (11.6)	29.6 (6.0)	115 (165)
Carotid artery stenting with embolic protection and stenting	71.7 (11.7)	29.7 (6.1)	116 (166)
Carotid artery stenting with embolic protection and stenting	71.8 (11.8)	29.8 (6.2)	117 (167)
Carotid artery stenting with embolic protection and stenting	71.9 (11.9)	29.9 (6.3)	118 (168)
Carotid artery stenting with embolic protection and stenting	72.0 (12.0)	30.0 (6.4)	119 (169)

Giannopoulos, et. Al, Journal of Invasive Cardiology, May 2021

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Role of the Anesthesiologist in the OBL

- Propofol administration for TEE and Cardioversions
- Moderate to deep sedation for venous ablation
- Moderate to deep sedation for peripheral vascular interventions
 - Cardiac vs. vascular surgical ASC
- Capnography

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Ambulatory Surgery Center

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Case Mix for the ASC

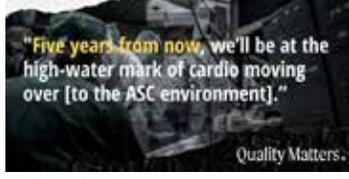
- Cardiac rhythm device implantation: pacemakers, ICDs, CRT
- Heart failure device implantation: Optimizer, CardioMems
- Coronary artery assessment and intervention
- Peripheral vascular assessment and intervention
- Implantable cardiac rhythm monitors
- Central sleep apnea implantable devices

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Anticipated ASC Growth

- Beckers (9/22/2022) Newitt: "Cardiology procedures received the highest estimated Medicare payment increases in 2021, making it the **fastest growing** ASC specialty, according to Avanza's "2022 Key ASC Benchmarks and Industry Figures" report.
- Additionally, a 2020 Bain & Co. report projected that by the mid-2020s, 33 percent of cardiology procedures will be performed in ASCs, a 23 percent increase from 2018.
- ASC leaders are seeing this play out on the policy side, with CMS adding cardiac procedures to the ASC-covered list."



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Hybrid Model

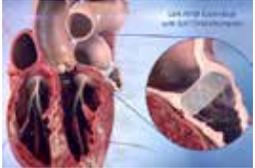
- Alternative OBL vs. ASC days in a single space designed to ASC standards
- Maximize utilization of a single space
- May be limited in utility as cases migrate from OBL to ASC



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Potential New Procedures in 2024-2025


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Anesthesia Considerations in the ASC



- Conscious sedation vs. general anesthesia
- ETCO2 monitoring
- Anticoagulation management
- Cardiac drugs: isoproterenol
- TEE assistance (vs. ICE)
- Esophageal protection
- Cardiac perforation and other catastrophes
- Postoperative management



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Advantages of Self-Owned Imaging

- **Autonomy, flexibility, and control**
 - Maximize time efficiency
 - Personnel, equipment, operational decisionmaking
- **Lower costs for patients and payers**
 - Outpatient cases
 - Price transparency
- **Higher quality care**
 - Ease of access, avoid hospitals
 - Outcomes metrics
 - Patient satisfaction questionnaire
 - Latest technology






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Challenges of Self-Owned Imaging

- Facility: new or adapted
- Construction costs, supplies
- Imaging equipment availability
- Recruiting and retention of staff
- Policies and procedures
- Certification, accreditation, contracting
- Management: internal vs. external
- Supply chain strategy
- Cost containment

Step 1
 Startup funding Construction

↓

Step 2
 Personnel Supplies

↓

Step 3
 Certification Contracting

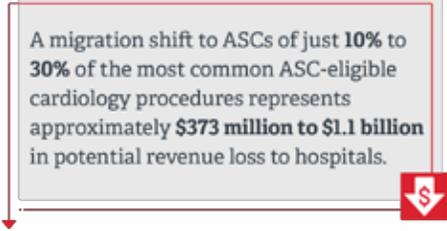


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Opposition from local health systems

A migration shift to ASCs of just **10%** to **30%** of the most common ASC-eligible cardiology procedures represents approximately **\$373 million** to **\$1.1 billion** in potential revenue loss to hospitals.



Becker's ASC Review 7/2022



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Does an ASC or Imaging Center Make Sense

A qualified yes!

- Offset declining physician work payments, capture technical revenue currently going to the hospital
- Opportunity to harvest case volume growth
- Attract patients in a "shopping era"
- Suitable for transition to value-based care

Perfect environment:

- Engaged team of physicians invested in the success of the center
 - ❖ Personal pride
 - ❖ Similar supply utilization and efficiency
 - ❖ Come to quality meetings
 - ❖ Offer suggestions to improve processes



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Questions?

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602-228-0600



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HANDOUTS



Coming Soon to an ASC Near You: Interventional Radiology Procedures in an ASC

Kara M. Barnett, MD, FASA

05/18/2023

1:30pm – 2:45pm MST

Interventional Radiology Coming to the ASC
Moving Care Closer to Home

Kara M. Barnett, MD, FASA
Memorial Sloan Kettering Cancer Center
barnettk@mskcc.org

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Disclosures

I have no disclosures

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3

Objectives

- Discuss why interventional radiology can safely be integrated into the ASC.
- Identify appropriate procedures and patients for interventional radiology in the ASC.
- Determine if you can integrate interventional radiology into your ASC.

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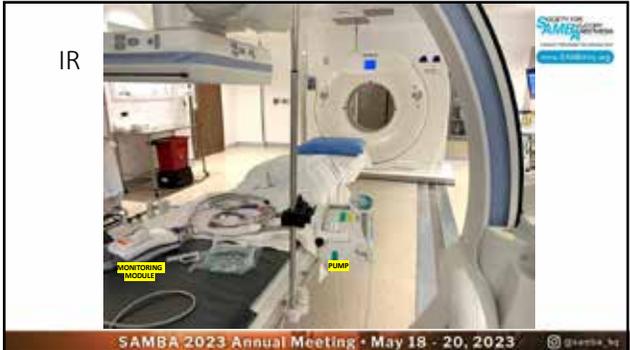
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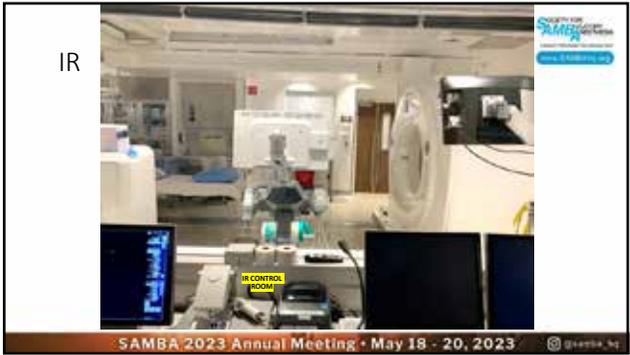
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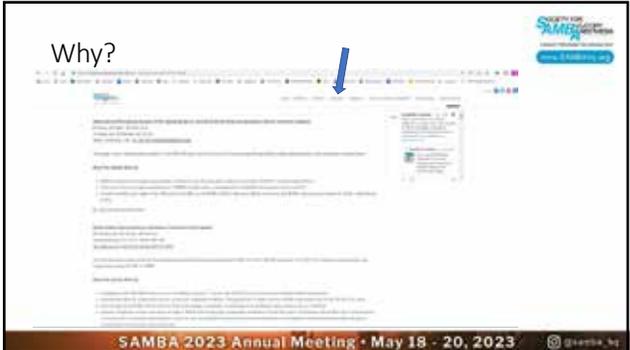
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Why?



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Demographic Data

- Age 63-64
- BMI 27



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Demographic Data

Characteristic	IR (N=3635; 45%)	Non-IR (4457)
Male	1504 (41%)	1416 (31%)
ASA PS Score		
1-2	503 (14%)	1935 (43%)
3	2939 (81%)	2471 (56%)
4	193 (5.3%)	51 (0.1%)

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Demographic Data

Characteristic	IR (N=3635; 45%)	Non-IR (4457)
Male	1504 (41%)	1416 (31%)
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4	193 (5.3%)	51 (0.1%)

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Why?

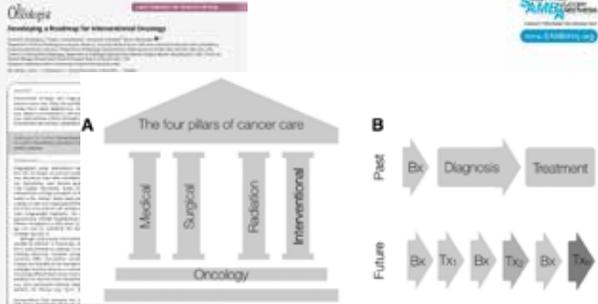


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Oncologic

Developing a Roadmap for Interventional Oncology



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Type	Established current procedures
Diagnostic	Biopsies for pathology Needle aspirates for cytology/histology, ID Needle/wire placement (breast surgery) Angiography for surgical planning
Therapeutic	Radiofrequency ablation Microwave ablation for local tumor control Chemembolization of stage A and B HCC Selective internal radiation therapy Intraarterial injection of therapeutics
Palliative/Other	Ports, venous access Paracenteses, long term drain placements (Pleures) Thoracentesis, chest tube placement Gastrostomy, jejunostomy Access drainage Celiac block, nerve block Kyphoplasty Biliary drainage Nephrostomy Supercath catheter placements Embolization Fibrotic placements

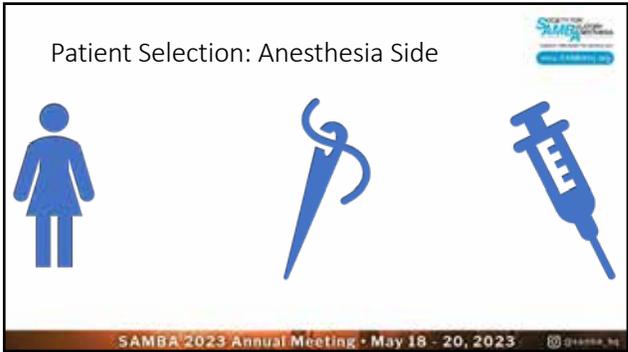
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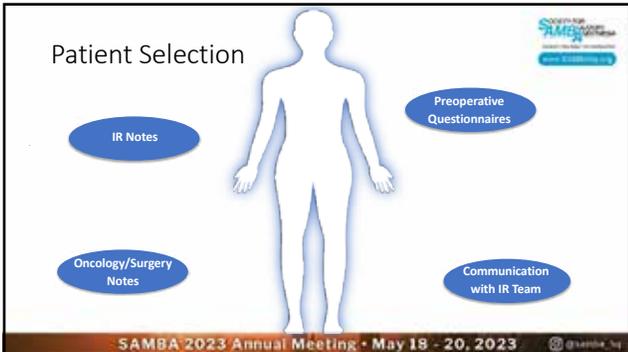
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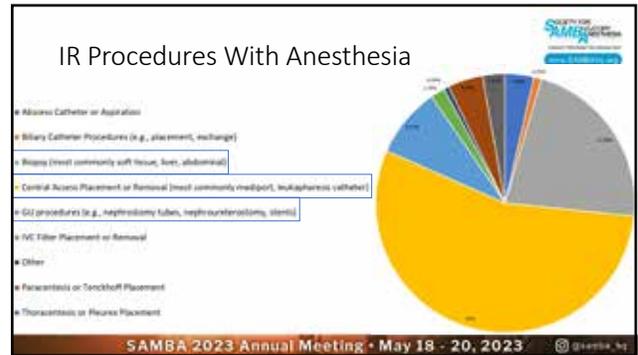
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Intra-Operative

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Procedure Data

Thank you Natalie Simon and Ioanna Sorafin

Characteristic	IR (N=5656)
Procedure Duration (minutes)	17 (13, 23)
Anesthesia Duration (minutes)	41 (35, 50)

* = minutes

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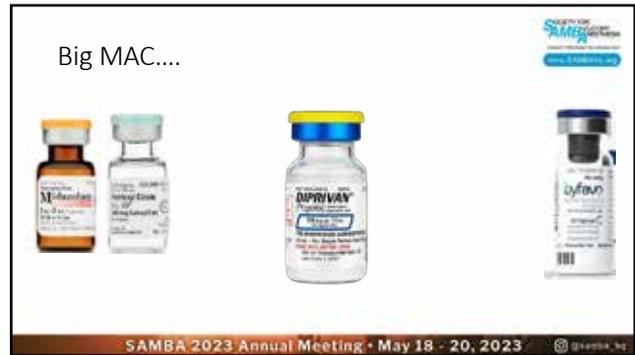
Procedure Data

Thank you Natalie Simon and Joanna Sorfin

Characteristic	IR (N=5656; 45%)	Non-IR (N=6782)
MAC Anesthesia	5611 (99%)	3857 (57%)
Anesthesia Conversion	22 (0.4%)	116 (1.7%)

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Post-Operative

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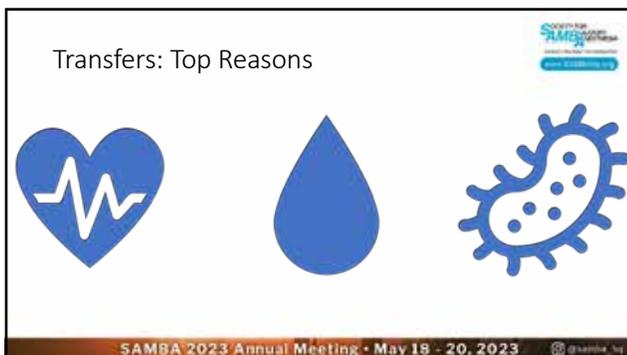
PACU Data

Thank you Natalie Simon and Joanna Sorfin

Characteristic	IR (N=5656; 45%)
PACU LOS (minutes)	75 (59, 100)

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Adverse Outcomes

Thank you Natalie Simon and Joanna Sorfin

Adverse Outcome	IR (N=5656; 45%)	Non-IR (N=6782)
In-room Cancellation	10 (0.2%)	8 (0.1%)
Immediate Transfer to OSH from PACU	35 (0.6%)	22 (0.3%)
Death within 3d	5 (0.04%)	0 (0%)

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Reasons for Adverse Outcomes

Thank you Natalie Simon and Joanna Scrofin

Reason	IR (N=5656; 45%)	Non-IR (N=6782)
Anesthesia	21 (0.4%)	37 (0.5%)

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Summary

- Growth
- Demand
- Feasible
- Collaboration
- Design

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HANDOUTS



Coming Soon to an ASC Near You: Outpatient Thyroid Surgery

Catherine Tobin, MD

05/18/2023

1:30pm - 2:45pm MST

Coming Soon to an ASC Near You

Outpatient Thyroid Surgery

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Disclosures..

- I have no financial interests or conflicts to disclose related to this topic.

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Objectives:

- Review Thyroid Surgery as an "Outpatient".
- Describe who is a "good candidate".
- Compare complication rates between outpatient and inpatient: hematoma, recurrent laryngeal nerve injury, hypocalcemia, admission to hospital.

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Thyroid: Same day discharge or admit.....

- Who is the surgeon?
- How long is surgery?
- First case of day versus last case of the day?
- What is surgery?
 - Partial or hemithyroidectomy
 - Total Thyroidectomy
 - Completion thyroidectomy (other side after a previous partial)
- ASA Physical Status
- ESRD
- Age
- BMI
- What is the AHI if OSA?
- How far away do they live?

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"Outpatient"

- Go home same day
- Watch in PACU 3 hours versus 8 hours
- 23 hour admit
- For my talk.. Outpatient will be going home same day and sleeping in their own bed that night....

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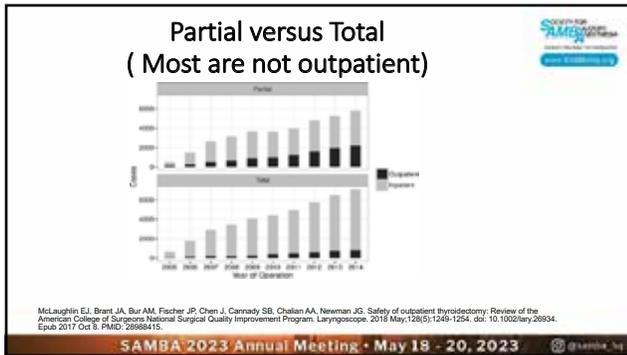
Trend of Thyroidectomies

Percent of Cases Performed as Outpatient

Year of Operation	Outpatient Cases (%)
2005	13
2006	11
2007	12
2008	12
2009	14
2010	17
2011	19
2012	21
2013	23
2014	24

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American Thyroid Association (2013 Statement)

Outpatient advantages: patient comfort, conservation of resources, patient safety (less nosocomial infections or patient harm related to medical errors)

- **Outpatient disadvantages:** bleeding, low calcium, PONV
- **Anesthesia Technique:**
 - local/regional cervical plexus blocks
 - Laryngeal nerve monitor with dual channel electromyographic ETT
- Dressing and drains-pressure dressings and routine drains if uncomplicated surgery do not prevent hematomas
- Deep extubation- when possible is useful
- Parathyroid-inspect resected tissue for inadvertently removed parathyroid, autotransplant does not preclude outpatient status.

Tennis DJ, Snyder S, Carneiro-Pita D, Inabnet WB 3rd, Kandil E, Orloff L, Shindo M, Tufano RP, Tuttle RM, Urken M, Yeh MW. American Thyroid Association Surgical Affairs Committee Writing Task Force. American Thyroid Association statement on outpatient thyroidectomy. Thyroid. 2013 Oct;23(10):1193-202. doi: 10.1089/thy.2013.0049. Epub 2013 Sep 14. PMID: 23742254.

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American Thyroid Association (2013 Statement)

PACU:

- recovery head up 45 degrees
- PONV
- Calcium-routine oral calcium after surgery
- Check vocal cord function-look for dystonia, dyspnea, aspiration while drinking
- On studies patients **keep at least 2 hours** (range 2-6 hours)
- Bleeding (risk 1%, **most occur within first 6 hours**) Increased bleeding (age, male, extent of resection, surgeon experience, recurrent disease, bilateral procedures)

Tennis DJ, Snyder S, Carneiro-Pita D, Inabnet WB 3rd, Kandil E, Orloff L, Shindo M, Tufano RP, Tuttle RM, Urken M, Yeh MW. American Thyroid Association Surgical Affairs Committee Writing Task Force. American Thyroid Association statement on outpatient thyroidectomy. Thyroid. 2013 Oct;23(10):1193-202. doi: 10.1089/thy.2013.0049. Epub 2013 Sep 14. PMID: 23742254.

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Requirement for Discharge Following Ambulatory Thyroidectomy (from 2013 statement):

- Ability to take liquids and postoperative medications
- Adequate pain control on oral medications
- Ability to void satisfactorily
- Ability to ambulate as preoperatively and preform essential activities of daily living
- Satisfactory postoperative assessment with attention to surgical wound, neck swelling/hematoma, dysphonia, dyspnea, and dysphagia
- Adequate social support and understanding of instructions
- Adequate oxygenation, vital signs and blood pressure control.

Tennis DJ, Snyder S, Carneiro-Pita D, Inabnet WB 3rd, Kandil E, Orloff L, Shindo M, Tufano RP, Tuttle RM, Urken M, Yeh MW. American Thyroid Association Surgical Affairs Committee Writing Task Force. American Thyroid Association statement on outpatient thyroidectomy. Thyroid. 2013 Oct;23(10):1193-202. doi: 10.1089/thy.2013.0049. Epub 2013 Sep 14. PMID: 23742254.

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Safety of Outpatient Thyroidectomy: Review of the American College of Surgeons National Surgical Quality Improvement Program (NSQIP)

- NSQIP data (2005 to 2014)
- 76,604 cases, 35,264 between 2012-2014
- 14,187 done as outpatient (18.5%)
- 1,473 (1.9%) patients who underwent reoperation and 477 unplanned 30-day readmissions (1.4%)
- 78% by general surgeons, 22 by ENT surgeons
- Trend to increasing outpatient partial and total thyroidectomy
- Yet Totals still most likely to be treated as inpatient.
- Outpatient surgery was not an independent risk factor for readmission or re-operation.

McLaughlin EJ, Brant JA, Bur AM, Fischer JP, Chen J, Cannady SB, Chaitan AA, Newman JG. Safety of outpatient thyroidectomy: Review of the American College of Surgeons National Surgical Quality Improvement Program. Laryngoscope. 2018 May;128(5):1249-1254. doi: 10.1002/lary.26934. Epub 2017 Oct 8. PMID: 28988415.

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Safety of Outpatient Thyroidectomy: Review of the American College of Surgeons - (NSQIP)

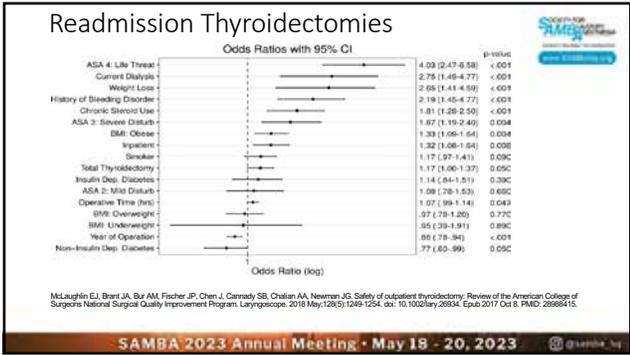
Risk factors for unplanned readmission and reoperation:

- Dialysis
- Chronic steroid use
- Unintentional weight loss
- ASA 3 and 4
- History of bleeding disorder

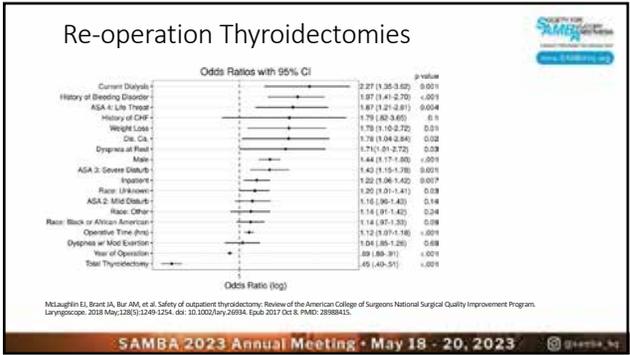
McLaughlin EJ, Brant JA, Bur AM, Fischer JP, Chen J, Cannady SB, Chaitan AA, Newman JG. Safety of outpatient thyroidectomy: Review of the American College of Surgeons National Surgical Quality Improvement Program. Laryngoscope. 2018 May;128(5):1249-1254. doi: 10.1002/lary.26934. Epub 2017 Oct 8. PMID: 28988415.

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Outpatient versus Inpatient Thyroidectomy: a systematic review and meta-analysis

- Outpatient (home the same day, not overnight or 23 observation)
- Age: 18 and above
- 10 studies were included, 1665 records
- **Outcome measures:** 30-day mortality, readmission, hematoma, hypocalcemia, recurrently laryngeal nerve paresis

Lee DI, Chen CJ, Hong CJ, Peters S, Witterick H. Outpatient versus inpatient thyroidectomy: A systematic review and meta-analysis. Head Neck. 2018 Jan;40(1):193-202. doi: 10.1002/hed.24934. Epub 2017 Nov 9. PMID: 29120517

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Outpatient versus Inpatient Thyroidectomy: a systematic review and meta-analysis

- **Hypocalcemia**-more common in inpatients , rates: Outpatient 4% vs. Inpatient 8%
- The outpatients are sent home on oral calcium and vitamin D prophylactically; routine labs caught it?
- **Hematoma**-7/1802 cases in outpatient, 8/1136 inpatient, not statistically different

Lee DI, Chen CJ, Hong CJ, Peters S, Witterick H. Outpatient versus inpatient thyroidectomy: A systematic review and meta-analysis. Head Neck. 2018 Jan;40(1):193-202. doi: 10.1002/hed.24934. Epub 2017 Nov 9. PMID: 29120517

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Outpatient versus Inpatient Thyroidectomy: a systematic review and meta-analysis

- **Recurrent laryngeal nerve injury**-no statically significant difference
- **Overall-**
- Two deaths- 1 outpatient due to toxic thyroid crisis from undetected goiter and 1 due to myocardial ischemia as inpatient
- Overall few complication rates as outpatients
- No difference in readmission rates
- They do note high risk of bias, could not adjust for confounders.

Lee DI, Chen CJ, Hong CJ, Peters S, Witterick H. Outpatient versus inpatient thyroidectomy: A systematic review and meta-analysis. Head Neck. 2018 Jan;40(1):193-202. doi: 10.1002/hed.24934. Epub 2017 Nov 9. PMID: 29120517

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Outpatient versus inpatient thyroidectomy: A systematic review and meta-analysis

Overall Complication Rates:

Complication	Outpatient (n/N)	Inpatient (n/N)	OR (95% CI)	p-value
30-day mortality	0/1665	0/1665	0.00	0.99
Readmission	1/1665	1/1665	1.00	0.99
Hypocalcemia	7/1665	8/1136	0.40 (0.15-1.05)	0.06
Hematoma	7/1802	8/1136	0.60 (0.25-1.45)	0.32
Recurrent laryngeal nerve injury	0/1665	0/1665	0.00	0.99
Weight loss	1/1665	1/1665	1.00	0.99
Current dialysis	0/1665	0/1665	0.00	0.99
ASA 4: Life Threat	0/1665	0/1665	0.00	0.99
History of Bleeding Disorder	0/1665	0/1665	0.00	0.99
Chronic Steroid Use	0/1665	0/1665	0.00	0.99
ASA 3: Severe Disturb	0/1665	0/1665	0.00	0.99
BMI: Obese	0/1665	0/1665	0.00	0.99
Insulin Dep. Diabetes	0/1665	0/1665	0.00	0.99
Smoker	0/1665	0/1665	0.00	0.99
Total Thyroidectomy	0/1665	0/1665	0.00	0.99
ASA 2: Mid Disturb	0/1665	0/1665	0.00	0.99
Operative Time (hrs)	0/1665	0/1665	0.00	0.99
BMI: Overweight	0/1665	0/1665	0.00	0.99
BMI: Underweight	0/1665	0/1665	0.00	0.99
Year of Operation	0/1665	0/1665	0.00	0.99
Non-Insulin Dep. Diabetes	0/1665	0/1665	0.00	0.99
Year of Operation	0/1665	0/1665	0.00	0.99

Head & Neck, Volume 40, Issue 1, Pages 190-202, First published 09 November 2017, DOI: 10.1002/hed.24934

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“Ambulatory thyroidectomy: an anesthesiologist's perspective”

- Published in 2017, reviewed literature from 2000 and onward.
- Traditional inpatient due to fear of cervical hematoma, bilateral recurrent laryngeal nerve injury and hypocalcemia.

Vocal cord paralysis permanent (rate 0.02%) found right after extubation. 7 out of 30,259. Most cases are transient. Concern is for bilateral. You would know right away. Many use intraoperative monitoring via NIMS or special tube.

Murray B, Tandon S, Dempsey G. Ambulatory thyroidectomy: an anesthesiologist's perspective. Local Reg Anesth. 2017 Apr 5;10:31-39. doi: 10.2147/LRA.S111554. PMID: 28435323; PMCID: PMC5388280.

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Ambulatory thyroidectomy: an anesthesiologist's perspective”

Hypocalcemia: (common reason for admit)

- More common in total versus partial thyroidectomy
- Temporary -2.9%
- Permanent- 1.39 %
- Old rates were closer to 40%
- Surgical techniques, implanting parathyroid, measuring PTH levels and using protocols (rapid within 6 hours) , or prophylactically treated post of with calcium and +/- Vit D.
- 1 hour post op test can be used to predict who stays and who goes
- Argument- we can predict and treat it so why is that reason for admission....

Murray B, Tandon S, Dempsey G. Ambulatory thyroidectomy: an anesthesiologist's perspective. Local Reg Anesth. 2017 Apr 5;10:31-39. doi: 10.2147/LRA.S111554. PMID: 28435323; PMCID: PMC5388280.

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Ambulatory thyroidectomy: an anesthesiologist's perspective”

Hematoma:

- Notes, the most serious, resistance to same day discharge...
- Incidence 0.48%
- 40-50% are in first 6 hours (Burkey 2001 and Leyre 2008)
- 40% between 7 and 24 hours
- 10-20% beyond 24 hours.
- So if watched 24 hours, you catch 80-90% of cervical hematomas.
- 11/14 case reports were after 24 hours (so day 2-9)

Murray B, Tandon S, Dempsey G. Ambulatory thyroidectomy: an anesthesiologist's perspective. Local Reg Anesth. 2017 Apr 5;10:31-39. doi: 10.2147/LRA.S111554. PMID: 28435323; PMCID: PMC5388280.

Marino M, Spencer A, Robinson S, Robinson D, Sosa JC et. Costs of outpatient thyroid surgery from the University HealthSystem Consortium (UHC) database. Otolaryngol Head Neck Surg. 2014 May;150(5):762-8. doi: 10.1177/0008719213504848. Epub 2014 Feb 6. PMID: 24496762.

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Ambulatory thyroidectomy: an anesthesiologist's perspective”

Cost Outpatient Thyroidectomy:

- On average saving \$1301.
- One study said academic medical center charges inpatient \$20, 510 vs. \$14, 796. (Marino)

Murray B, Tandon S, Dempsey G. Ambulatory thyroidectomy: an anesthesiologist's perspective. Local Reg Anesth. 2017 Apr 5;10:31-39. doi: 10.2147/LRA.S111554. PMID: 28435323; PMCID: PMC5388280.

Marino M, Spencer A, Robinson S, Robinson D, Sosa JC et. Costs of outpatient thyroid surgery from the University HealthSystem Consortium (UHC) database. Otolaryngol Head Neck Surg. 2014 May;150(5):762-8. doi: 10.1177/0008719213504848. Epub 2014 Feb 6. PMID: 24496762.

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Feasibility and Safety of Outpatient Thyroidectomy: A Narrative Scoping Review

Phileas J, Baran E, Noel CW, et al.

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Feasibility and Safety of Outpatient Thyroidectomy: A Narrative Scoping Review

Phileas J, Baran E, Noel CW, et al.

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The diagram illustrates the interconnected nature of Clinical, Social, and Procedural factors in thyroid surgery. Clinical factors include patient history, physical exam, and lab work. Social factors include patient expectations, support system, and insurance. Procedural factors include surgical approach, anesthesia, and post-operative care. Arrows indicate how these factors influence each other.

• Philteos J, Baran E, Noel CW, Pasternak JD, Higgins KM, Freeman JL, Chiodo A, Eskander A. Feasibility and Safety of Outpatient Thyroidectomy: A Narrative Scoping Review. *Front Endocrinol (Lausanne)*. 2021 Jul 28;12:717427. doi: 10.3389/fendo.2021.717427. PMID: 34894006; PMCID: PMC8355596.

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Signs and Symptoms of Post-Op Complications

Bleeding	Airway	Hypocalcemia	Other
Neck swelling	Dyspnea	Paresthesias	Fever
Bleeding	Dysphonia	Extremity cramping	Nausea/vomiting
Drainage	Stridor		
Dysphagia	Hoarseness		
Pressure	Aspiration/choking		

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Patient Satisfaction- so favors outpatient but still some dissatisfaction

Patient satisfaction	Yes	No
Did my family agree with my undergoing surgery in the outpatient setting?	16 (69.5%)	7 (30.4%)
Would I recommend outpatient thyroid surgery to others?	15 (65.2%)	8 (34.8%)
If I were to undergo this operation again, would I do it in day hospital?	15 (65.2%)	8 (34.8%)

Patients were monitored for 6 hours in PACU

Cozzaglio L, Montzari R, Zaccarelli A, Canana F, Scoti F, Ruggi L, Quaghiolo V. Quality of life and patient satisfaction in outpatient thyroid surgery. *Updates Surg*. 2022 Feb;74(1):317-323. doi: 10.1007/s13304-021-01390-5. Epub 2021 Oct 22. PMID: 34627709.

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Drain or No Drain....

Fig. 3: thyroidectomy with insertion of drain

Elrahim, Ayman Helmy. "Assessment of Routine Drainage in Elective Thyroid Surgery: A Prospective Randomized Study." *The Egyptian Journal of Hospital Medicine* 74 (2019): 147-155.

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Use of Drains after thyroid or parathyroid surgery

- Does not change risk of hematoma/reoperation
- More discomfort for patient
- Increased LOS if in hospital
- Excluding neck dissections, retrosternal goiters- may need drains
- Negative pressure versus natural wound drainage

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Ideas if you are doing Outpatient Thyroid Surgery

- Brochure about complications for patient
- POD 1 visit for drain removal and check in
- Another visit post op 7-10 days
- Drain was reason for discomfort (Drains decrease risk of airway compromise but not risk of bleeding)

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Outpatient Thyroidectomy

Pros:

- Low complication rates
- Less cost (maybe \$2,500 less)
- Less nosocomial infections
- Less iatrogenic injury
- You can monitor laryngeal nerve during and after resection to help make decision.

Cons:

- Less satisfaction?
- Could miss a hematoma
- Risk stratification is not standardized

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American Academy of Otolaryngology and Head and Neck Surgery (April 2021)

Position Statement on exclusion for Ambulatory Surgery Center (ASC) :

- Extensive blood loss
- Emergency cases
- Directly involve major blood vessels
- Require systemic thrombolytic therapy

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HANDOUTS



Lecture: Hypoglossal Nerve Stimulators for OSA

Michael V. Presta, DO

05/18/2023

2:45pm - 3:15pm MST

Hypoglossal Nerve Stimulators For Obstructive Sleep Apnea

Michael Presta, DO
Associate Professor
GI Lab Director Anesthesia Services
Director NORA Rotation
Department of Anesthesiology and Perioperative Medicine

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Disclosure

- I have no actual or potential conflict of interest in relation to this program/presentation.

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2

Learning Objectives

- Understand obstructive sleep apnea (OSA) and its prevalence
- Discuss previous treatment options for OSA
- Knowledge of location and mechanics of upper airway stimulation (UAS) devices
- Review UAS data, patient care and therapy options
- Anesthesia considerations

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The Basics.....

- Obstructive sleep apnea (OSA) is characterized by repetitive upper airway collapse during sleep which leads to oxygen desaturation and hypercarbia.
- These intermittent desaturations lead to nighttime awakening; manifesting into chronic sleep deprivation and subsequent daytime somnolence.

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The Numbers....

- OSA is extremely common. Prevalence = diabetes or asthma worldwide.
- 25 million in the USA. Over 1 billion people worldwide.
- Only 25% are currently being treated.
- Gold standard is Continuous Positive Airway Pressure (CPAP)

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Global Sleep Disorder Market Share, by Disorder Type, 2022 (%)

Disorder Type	Market Share (%)
Sleep Apnea	48%
Insomnia	30%
Restless Legs Syndrome (RLS)	18.5%
Narcolepsy	2.5%
Others	2%

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Why Do We Need An Alternative To CPAP?

- ≥10 million patients own CPAP machines in North America.
- Studies have shown that almost half do not comply with CPAP (Weaver et al. 2008)

1. Mask discomfort
2. Claustrophobia
3. Pressure intolerance
4. Dry or irritated nasal membranes
5. Eye irritation from air leakage around the mask (Pawowski & Shelgikar, 2017).




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Untreated OSA

- If left untreated, OSA can result in
 - Hypertension
 - Diabetes mellitus
 - Coronary artery disease
 - Stroke
 - Congestive heart failure
 - Atrial fibrillation
 - Death
- Increased cancer incidence, increased mortality, and increased neurodegeneration (Lim & Pack, 2017)



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Alternatives To CPAP For Treating Sleep Apnea

1. Weight Loss and Exercise
2. Sleep Position
3. Avoiding Alcohol
4. Mandibular Advancement Devices
5. Tongue Retaining Devices
6. Myofunctional Therapy
7. Surgery (variable success 35-75%)
 - a) Maxillomandibular advancement
 - b) Uvulopalatopharyngoplasty (UPPP)
 - c) Adenotonsillectomy



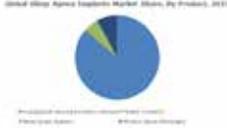


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Introduction Of The Hypoglossal Nerve Stimulator (HGNS)

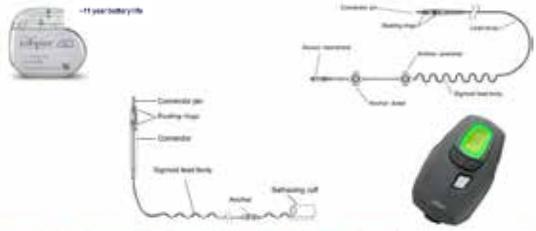
- Initial patents filed in the 1990s with Inspire founded in 2007 and FDA approval in 2014 for the treatment of OSA.

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Components Of The Inspire System



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How It Works

- The stimulation electrode is placed on the hypoglossal nerve to recruit tongue-protrusion function
- The sensing lead is placed between the internal and external intercostal muscles to detect ventilatory effort
- The neurostimulator is implanted in the right ipsilateral mid-intraclavicular region.



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The Hypoglossal Nerve Innervation

All the intrinsic muscles and all but one of the extrinsic muscles (genioglossus, styloglossus, and hyoglossus) of the tongue.

Mild Stimulation to Select Distal Branches during inspiration

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Hypoglossal Nerve Stimulation Effect An Increase In Cross Sectional Size Of Airway

No Stimulation

Base of Tongue Palate

Mild Stimulation

Base of Tongue Palate

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Requirements for HGNS Consideration

- Non-Pregnant Adult >18yo
- Intolerant of CPAP
- Moderate-Severe OSA
AHI ≥15/h and <45/h
- No more than 20% of central or mixed events
- BMI <35 kg/m²
- Absence of complete concentric palatal collapse at DISE (Drug induced sleep endoscopy)

50% reduction in AHI to a value of <20

HOW SEVERE IS YOUR SLEEP APNEA?

AHI is the number of apneas or hypopneas recorded during the study per hour of sleep

<5 per hour	Normal
5-15 per hour	Mild
15-30 per hour	Moderate
>30 per hour	Severe

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Pre-op Anatomical Assessment Drug Induced Sleep Endoscopy (DISE)

- Used to determine eligibility for device implantation.
 - patients are excluded if DISE reveals complete concentric collapse
 - tongue's protrusion will not resolve this pattern of airway obstruction. (Gupta et al., 2018).
- Propofol (midazolam and dexmedetomidine) are the drugs of choice for DISE.
- The degree of sedation is important (BIS score in the mid 60's); a light sedation that most closely mimics sleep is ideal for accurate assessment of the upper airway.
- Collaborate with surgery PRIOR to the procedure.

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Pre-op Anatomical Assessment Drug Induced Sleep Endoscopy (DISE)

Good Candidate

Posterior wall Lateral walls

AP collapse at palate

Assess lateral wall collapse at genu of the soft palate

Not a Good Candidate

Complete concentric collapse at palate

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Inspire STAR Trial (The Stimulation Therapy for Apnea Reduction Trial) Multicenter trial

Table 1. Characteristics of the Study Population at Baseline.*

Characteristic	Participants (N=126)	Number	%	Mean	Range	P Value
Age — yr	34.3 (±2.2)	126	100	34.3	18-61	<.001
Male sex — no. (%)	120 (95)	120	95			<.001
White race — no. (%)	122 (97)	122	97			<.001
Body mass index†	28.4 (±2.8)	126	100	28.4	18-57	<.001
Neck size — cm	41.2 (±3.2)	126	100	41.2	33-54	<.001
Blood pressure — mm Hg						
Systolic	128.7 (±16.1)	126	100	128.7	78-174	<.001
Diastolic	81.5 (±9.7)	126	100	81.5	45-119	<.001
Hyperlipidemia — no. (%)	48 (38)	48	38			<.001
Diabetes — no. (%)	11 (9)	11	9			<.001
Stroke — no. (%)	5 (4)	5	4			<.001
Congestive heart failure — no. (%)	3 (2)	3	2			<.001
Cardiopulmonary bypass — no. (%)	22 (17)	22	17			<.001

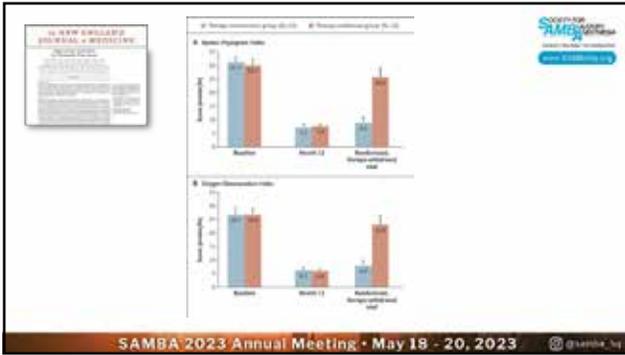
*Data are presented as mean (SD) or number (%).

Table 2. Primary and Secondary Endpoints at Baseline*

Endpoint	Number	%	Mean	Range	P Value
AHI	126	100	28.4	1-100	<.001
Mean	28.4	100	28.4	1-100	<.001
SD	12.2	100	12.2	0-45	<.001
Range	1-100	100	1-100	1-100	<.001
95th Percentile	45	100	45	1-100	<.001
90th Percentile	35	100	35	1-100	<.001
85th Percentile	25	100	25	1-100	<.001
80th Percentile	15	100	15	1-100	<.001
75th Percentile	10	100	10	1-100	<.001
70th Percentile	5	100	5	1-100	<.001
65th Percentile	2	100	2	1-100	<.001
60th Percentile	1	100	1	1-100	<.001
55th Percentile	0	100	0	1-100	<.001
50th Percentile	0	100	0	1-100	<.001
45th Percentile	0	100	0	1-100	<.001
40th Percentile	0	100	0	1-100	<.001
35th Percentile	0	100	0	1-100	<.001
30th Percentile	0	100	0	1-100	<.001
25th Percentile	0	100	0	1-100	<.001
20th Percentile	0	100	0	1-100	<.001
15th Percentile	0	100	0	1-100	<.001
10th Percentile	0	100	0	1-100	<.001
5th Percentile	0	100	0	1-100	<.001
1st Percentile	0	100	0	1-100	<.001

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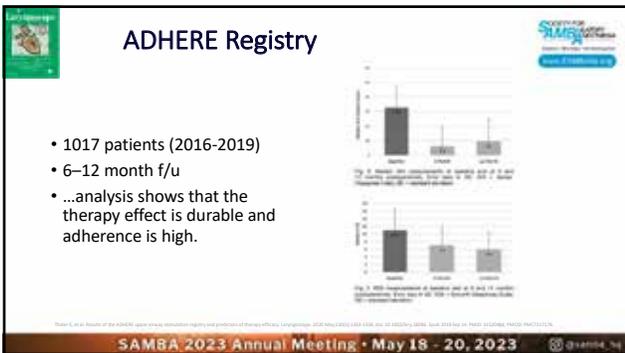


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ADHERE Registry - Enrollment goal of 5,000
Goal: Collect real-world outcomes data

Site	Enrollment	Follow-up	Readmission	Mortality
Site 1	1,000	1,000	1,000	1,000
Site 2	1,000	1,000	1,000	1,000
Site 3	1,000	1,000	1,000	1,000
Site 4	1,000	1,000	1,000	1,000
Site 5	1,000	1,000	1,000	1,000
Total	5,000	5,000	5,000	5,000

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Post-operative Complication Rate Comparison Between Airway Surgery and Upper Airway Stimulation Using NSQIP and ADHERE

....the study concluded that hypoglossal nerve stimulator patients had...

- shorter hospital stays
- lower 30-day return to the operating room (0.1% of HNS vs. 4.8%)
- lower surgical site infections (0.13% HNS vs. 0.9%)
- All despite an older HNS cohort and subsequent higher prevalence of comorbidities.

1623 UAS procedures in ADHERE
310 in NSQIP (National Surgical Quality Improvement Program NSQIP).

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- Sleep and Breathing**
International Journal of the Science and Practice of Sleep Medicine
- Neruntarat et al. (2021) performed the most recent meta-analysis
 - 990 patients participating in randomized trials or observational studies.
 - Inspire HNS implant vs traditional OSA surgeries (UPPP, Transoral robotic surgery and various palatal procedures).
 - Hypoglossal nerve stimulation >> traditional OSA surgeries.
 - AHI reduction (23.9 vs. 15.8, P < 0.001)
 - They also had shorter hospital stays, lower readmission rates, and a lower incidence of adverse events.

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Anesthetic Management Concerns

Technical Guidance

For questions contact Patient Therapy Support at 1-800-444-7447 or 800-444-7447 ext. 2

Respiratory Support

• Preoperative assessment and optimization

• Intraoperative monitoring and management

• Postoperative care and follow-up

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Anesthetic Management concerns

- Similar to a patient with a cardiac pacemaker
- Preoperative radiologic films



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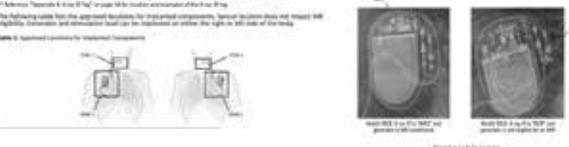
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Anesthetic Management concerns

Table 1. Assessment and Planning

Model	Risk of MRI	Serial Number Prefix	Diagnostic Details
SDS	MR Safe	488000000	MR Conditional at 1.5T
SDS	MR Safe	488000000	MR Safe for MRI

Appendix B: X-ray ID Tag



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Anesthetic Management concerns

MRI Conditional Guidelines



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Anesthetic Management concerns

- To avoid the risk of infection and damage to the implanted components, a 15cm (6 inches) separation between the components and the surgical procedure site is recommended by the manufacturer.
- If less call manufacturer for device interrogation
- Bipolar cautery preferred. If mono used → placement of pad important
- Postoperatively, electrolyte disturbances can affect lead sensing, and as such, checking a basic metabolic panel after surgery may be indicated. (Preston et al. Am J Cardiology)
- Check the device function post op prior to discharge!!!

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Anesthetic Management concerns

ANESTHESIOLOGY

Evaluation of Diaphragmatic Function after Interscalene Block with Liposomal Bupivacaine: A Randomized Controlled Trial

Hemi-diaphragmatic Transient Phrenic Nerve Palsy.

Paralysis resulting from local anesthetic traveling over the anterior scalene muscle to the phrenic nerve.

Decrease in diaphragm function of 0 to 25% normal
Decrease of 25 to 75% is partial paralysis
Decrease of 75% or greater defines complete paralysis.

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Anesthetic Management concerns

- Leuzinger K et al. (2021)
 - Hypoglossal nerve palsies, both isolated and in conjunction with other nerves, have been linked to numerous anesthesia-related iatrogenic etiologies including laryngeal manipulation during intubation or with ENT suspension cases, prolonged placement of the endotracheal tube, use of laryngeal mask airways, bronchoscopy, and shoulder surgery with utilization of chin straps.
- Bharati S et al. (2014) Ipsilateral paralysis of hypoglossal nerve following interscalene brachial plexus block.
- Fritz et al. (2014) ...compression of the lateral tongue base during prolonged surgery or intubation.

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HANDOUTS



Former President's Rapid Fire: Methadone in Ambulatory Surgery

Michael Walsh, MD, FASA, SAMBA-F

05/18/2023

3:15pm – 4:30pm MST

Methadone in Ambulatory Surgery

Michael T Walsh, MD
Assistant Professor Anesthesiology
Mayo Clinic Rochester

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Disclosures

- None

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Outline

- Focus on using methadone as a primary strategy to treat pain in ambulatory surgical patients
- Why?
- Advantages
- Inpatient Studies
- Outpatient **Study**
- Where do we go from here

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Outline

- Focus on using methadone as a primary strategy to treat pain in ambulatory surgical patients
- **Why?**
- Advantages
- Inpatient Studies
- Outpatient **Study**
- Where do we go from here

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Too many people with postop pain

- >50% - even in minor/medium level procedures

Journal of Clinical Anesthesia 16:200–206, 2004 Ann Surg 2019;269:856–865

Jnl of Pain 2016;17(2):131-157 Ann Surg 2017;266:516–524

- Acute post op pain is biggest risk factor for chronic postsurgical pain

Pain Reports 2022;7(6):e1048
JPRAS Open 2022;31:32–49

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Too Few Healthcare Workers

A Public Health Crisis: Staffing Shortages in Health Care

Keck School of Medicine of USC

Staff Shortages Choking U.S. Health Care System

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Worldwide Problem



10 million more health workers are needed by 2030, primarily in low and lower middle income countries

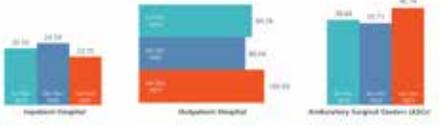
A 2022 McKinsey report projects a shortage of 200,000 to 450,000 RNs and 50,000 to 80,000 physicians by 2025

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INSIGHTS

2019-21 SURGERY LOCATIONS (SLURS) PER 1,000



7.3% DECREASE IN INPATIENT SURGERY
3.1% DECREASE IN OUTPATIENT SURGERY
10.3% INCREASE IN ASC SURGERY

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Methadone Advantages

- Strong μ -opioid receptor agonist
 - Incomplete cross tolerance with other opioids
- NMDA antagonist
- Inhibits reuptake serotonin and norepinephrine in CNS
- IV – “rapid” onset: $t_{1/2}$ ke0 = 8 minutes
- Long half life (1-2 days) = long duration

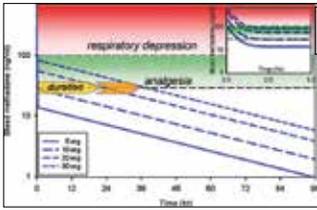
Opioid	$t_{1/2}$ (min)	Elimination $t_{1/2}$ (hr)
Remifentanyl	1 minute	0.5 hour
Alfentanil	1 minute	1 hour
Sufentanil	0.5 minutes	8 hours
Fentanyl	2 minutes	3-10 hours
Morphine	2-4 hours	2-3 hours
Methadone	8 minutes	20-40 hours

Anesth and Analg 2011;112:13-16

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Figure 2



Study: “Intraoperative Methadone Improves Postoperative Pain Control in Patients Undergoing Complex Spine Surgery” Anesth Analg 2011;112(1):218-23

Figure 2. Relationship between methadone dose and duration of effect. Simulated methadone blood concentrations versus time are based on the pharmacokinetic parameters of Gourlay et al. [28]. $t_{1/2}$ is the terminal effective analgesic methadone concentration (approximately 30 ng/mL), and the threshold for significant (5 to 6 breaths/min) respiratory depression (approximately 200 ng/mL). 30 data are shown for 10-hour methadone doses of 5, 10, and 30 mg. Estimated duration of analgesia for these doses is approximately 6, 12, 24, and 36 hours. Duration of analgesia is governed by redistribution (and the redistribution half-life of approximately 6 minutes) for the 5- and 10-mg doses, but the elimination (and the elimination half-life of approximately 30 hours) for the larger doses. The first three show concentrations for the first hour after dosing. <https://doi.org/10.1093/anae/112.1.218>

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Methadone Studies

- “Intraoperative Methadone for the Prevention of Postoperative Pain: A Randomized, Double-blinded Clinical Trial in Cardiac Surgical Patients” 156 patients
Anesthesiology 2015;122:1112-22
- “Clinical Effectiveness and Safety of Intraoperative Methadone in Patients Undergoing Posterior Spinal Fusion Surgery: A Randomized, Double-blinded, Controlled Trial” 115 patients
Anesthesiology 2017;126:822-33
- “Perioperative Methadone and Ketamine for Postoperative Pain Control in Spinal Surgical Patients: A Randomized, Double-blind, Placebo-controlled Trial” 130 patients
Anesthesiology 2021;134:697-708

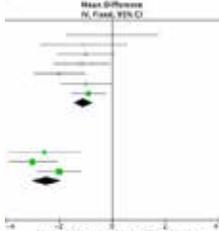
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Systematic Review and Meta-analysis

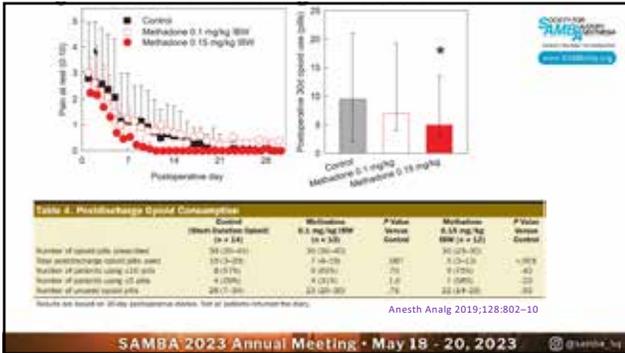
Anesth Analg 2019;129:1723-32

- 13 studies; 929 patients
- variety of mostly inpatient surgery
- Lower postoperative opioid consumption in morphine equivalent dosage and better pain scores in methadone group



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Summary of Outpatient Study

- Better pain relief in PACU and post discharge
- Less opioid use
- Better patient satisfaction
- No difference in side effect

Number of patients studied is very small!

20

A guide to perioperative methadone use

- IV bolus in OR as before induction
 - Inpatient (>1 night): **20 mg** (15 mg if >60 yr "physiologically")
 - Outpatient (23 hr overnight): **15 mg**
 - Outpatient (same-day discharge): **10 mg**
- "See it & forget it" (i.e. nonminimal additional intraop opioids unless the pt "proves" they need it - e.g. big reconstructive spines)
- End case:
 - ETCO₂ to 40% low 50% for spontaneous ventilation (same for typical PACU pt comfortable with opioids)
 - Titrate additional methadone 2 mg to RR ~12 before emergence
- PACU: 2 mg IV methadone q5-10 min, max 6 mg then call (needing more is rare)
- Minimize CNS depressants (gabapentinoids, amNzaminers, sedating antiemetics, postop benzodiazepines, etc). This is very important!

Figure courtesy of Evan Hershon, MD PhD

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Conclusions

- High confidence that pain control and patient satisfaction superior with methadone for acute postop pain
 - Lower opioid needs at home May be helpful in opioid epidemic?
 - Better pain control at 30 days May decrease chronic pain?
- No difference in adverse effects (low confidence)
 - Numbers too small to remark on safety
- Personal practice: still inpatient only - but looking into a protocol

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HANDOUTS



Former President's Rapid Fire: Preventing Airway Fires at the ASC and NORA

Basem Abdelmalak, MD, FASA, SAMBA-F

05/18/2023

3:15pm - 4:30pm MST



Preventing Airway Fire at the ASC and NORA

Basem Abdelmalak, MD, FASA, SAMBA-F
 Professor of Anesthesiology
 Director, Anesthesia for Bronchoscopic Surgery
 Director, Center for Procedural Sedation
 Anesthesiology Institute, Cleveland Clinic

Past President, Society For Ambulatory Anesthesia
 Past president, Society For Head and Neck Anesthesia

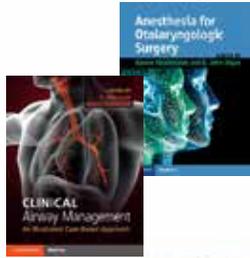
©B Abdelmalak 2023
 @basemcc

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Conflict Of Interest Disclosure

- Co-editor:
 - Anesthesia for Otolaryngology
 - Clinical Airway Management: an Illustrated Case Based Approach
- Speaker: Mindray



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Objectives

- Precautions for preventing airway fires
- Tips in management of airway fires

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The Fire Triangle



Oxidizer:
Oxygen
Nitrous oxide

Igniting Energy:
LASER, Cautery
Thermoplasty catheter
Heat-generating light source/drill

Fuel:
ETT, Drapes
[Fire triangle - Fire triangle - Wikipedia](#)

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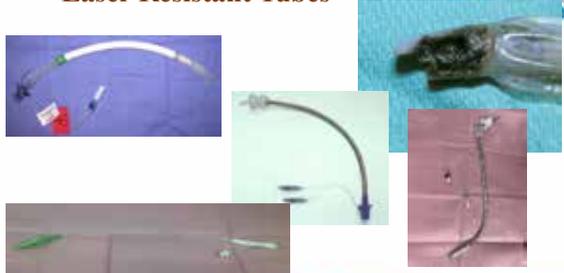
Safety Measures: Limitation of Oxidizers

- The FiO₂ should be limited to the lowest concentration necessary to maintain acceptable O₂ sat.
- The balance of the FG should be nitrogen (air) and/or helium
- Inhalation agents may be added as clinically indicated
- Nitrous oxide should not be used
- Communication

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Laser Resistant Tubes



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Safety Measures: Saline-filled Cuffs

- Filling ETT cuffs with saline
- Methylene blue or other biocompatible and highly visible dye should be added to the saline
- The addition of fluid to the cuff system may prolong the process of cuff deflation.
- Have an extra endotracheal tube available for re-intubation in case a fire occurs.

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Facial and H & N Procedures

- Use minimal to no sedation
- Avoid using oxygen if feasible
- Separate O₂ from energy source
- Avoid oxygen tenting



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Thermoplasty



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9

Utility of Transnasal Humidified Rapid Insufflation Ventilatory Exchange for Microlaryngeal Surgery

Michael S. Benninger, MD, Emily S. Zhang, BS, Botao Chen, BS, William S. Tierney, MD, MS, MSc, Bassem Abdelmalak, MD, Paul C. Reynor, MD



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Intra-oral ignition of monopolar diathermy during transnasal humidified rapid-insufflation ventilatory exchange (THRIVE)

D. Umrocht, K. El Baghdadi, E. Oakley and I. Akouf

- Palate Surgery in a 65 Y/O using HFNO
- Noticed an arc arising from the diathermy tip
- The Fire Triad:
 - Oxidizer
 - Fuel
 - Energy source



Anesthesia 2017, 72, 761-763

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Safety and Utility of Transnasal Humidified Rapid-Insufflation Ventilatory Exchange (THRIVE) for Laser Laryngeal Surgery

- 172 cases, mostly subglottic stenosis
- No tube
- Laser safety protocol
- No airway fire

Khan NC, Vukkadala N, Saxena A, Damrose EJ, Nekhendzy V, Sung CK. Otolaryngol Head Neck Surg. 2023 Apr 6. doi: 10.1002/ohn.324. Online ahead of print

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What To Do For An Airway Fire

- Stop lasering, stop ventilation.
- Disconnect the circuit.
- Pull the burning material out.
- Douse fire with water
- When needed use CO₂ fire extinguisher



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What To Do After An Airway Fire

- Resume ventilation by mask.
- Re-intubation and respiratory support.
- Perform bronchoscopy
- Admit & monitor the patient in the ICU.
- Administer steroids?
- Administer antibiotics?



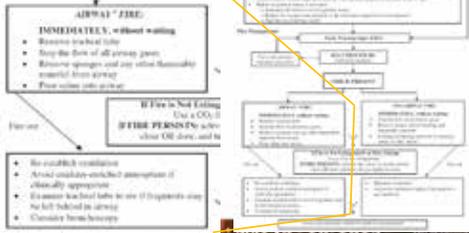
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Practice Advisory for the Prevention and Management of Operating Room Fires

Anesthesiology 2014; 118:900-911

An Updated Report by the American Society of Anesthesiologists Task Force on Operating Room Fires



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Summary

- The anesthesiologist should keep the administered oxygen levels to the minimum needed when a potential for an airway fire is present.
- Nitrous oxide should not be used during airway surgery
- A simple means to extinguish airway fires (e.g., 50 ml syringe filled with saline) should be immediately on hand. In addition, a CO₂ fire extinguisher is good to have nearby
- Preventive measures do not guarantee that fires will not occur; always be prepared
- **Communication**

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Thank you!
 Basem Abdelmalak, MD, FASA, SAMBA-F
abdalmh@cccf.org
[@basemcc](https://twitter.com/basemcc)

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HANDOUTS



Former President's Rapid Fire: Timing of Dialysis Before Surgery

BobbieJean Sweitzer, MD, FACP, SAMBA-F, FASA

05/18/2023

3:15pm - 4:30pm MST

Dialysis and Timing of Surgery and Anesthesia

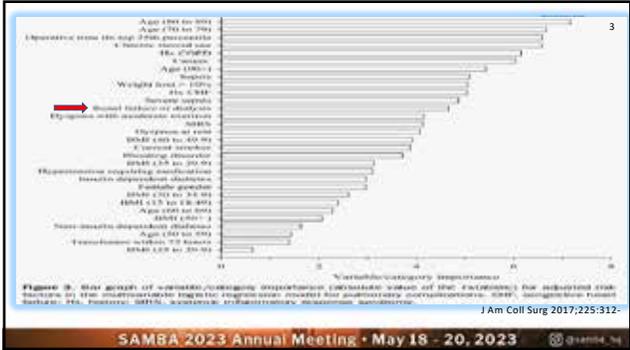
BobbieJean Sweitzer, MD, FACP, F-SAMBA, FASA
 Immediate Past-President, SAMBA
 Systems Director, Perioperative Medicine
 Inova Health
 Professor, Medical Education
 University of Virginia
Bobbiejean.sweitzer@inova.org
 @BobbieJeanSwei1

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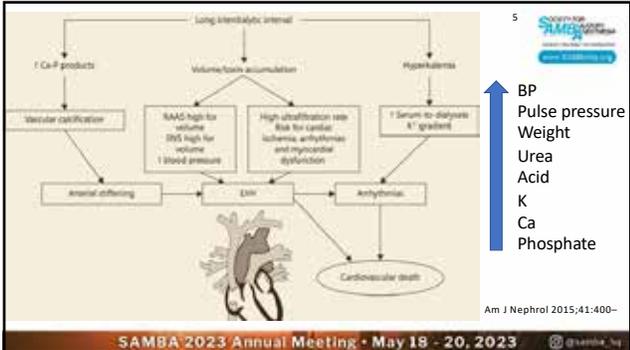
3

Adverse Effects of Conventional Thrice-Weekly Hemodialysis: Is It Time to Avoid 3-Day Interdialytic Intervals?

- ✓ Maintenance hemodialysis is typically scheduled 3x/week due to simple logistic reasons (availability and cost)
- ✓ Morbid and mortal events occur more frequently during the last day of the long interdialytic interval

Am J Nephrol 2015;41:400-
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Dialysis outcomes and analysis of practice patterns suggests the dialysis schedule affects day-of-week mortality

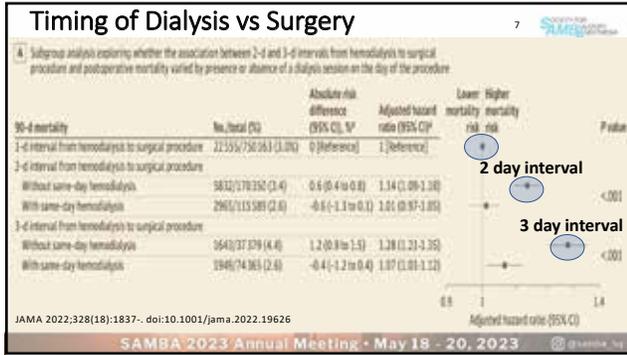
The risk of death for hemodialysis patients is highest on the days following the longest interval without dialysis (usually Mondays and Tuesdays)

Comparison	Schedule	RR, male	RR, female	P-value (difference)
Monday vs. Avg	MWF	1.32	1.47	0.152
Tuesday vs. Avg	TTS	1.45	1.20	0.028

Abbreviations: Avg, average; MWF, Monday-Wednesday-Friday; RR, relative risk; TTS, Tuesday-Thursday-Saturday.

Kidney International 2012;81:1108-; Kidney Int 1999; 55: 1553-
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7

SUMMARY

- ✓ Highest risk of death on Monday if on M, W, F schedule
- ✓ Those on T, Th, F schedule have highest risk of death on Tuesday
- ✓ Nondialysis days have lower risks for mortality compared with dialysis days
- ✓ **Patients should be dialyzed the day before procedures and anesthesia**
- ✓ Adjust days to have extra dialysis the day before if needed
 - ✓ M, W, F schedule is done M, W, Th, Sa to allow for Friday surgery
- ✓ Only day surgery cannot occur is Monday
- ✓ NO dialysis available on Sunday

Bobbiejean.sweitzer@inova.org @BobbieJeanSwei1

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8

HANDOUTS



Former President's Rapid Fire: Timing of Elective Surgery After Stroke

Girish P. Joshi, MBBS, MD, FCAI, SAMBA-F

05/18/2023

3:15pm – 4:30pm MST

THE UNIVERSITY OF TEXAS
SOUTHWESTERN MEDICAL CENTER
AT DALLAS



Timing of Elective Surgery After Stroke

Girish P. Joshi, MB, BS, MD, FFRCSI
Professor of Anesthesiology and Pain Management

DISCLOSURE: Consultant Baxter International Inc.

1

Previous Stroke and Elective Surgery

- Previous stroke increases postoperative neurological and cardiac complications with significant increase in mortality
- Optimal timing of elective surgery after neurological event remains controversial
- Historically, it was recommended delaying elective surgery for at least 3 months after neurological event (TIA/stroke)

2

Previous Stroke and Risk of Major Adverse Cardiovascular Events and Mortality

- Danish nationwide cohort study of adult patients (n=481,183) undergoing elective non-cardiac surgeries (2005-2011)
- Risk of postoperative adverse outcomes (ischemic stroke, acute MI, and cardiovascular mortality and all-cause mortality) was highest within the first 3 months of previous stroke
- Low- and intermediate-risk surgeries posed the same relative risk of MACE compared with high-risk surgery
- Associated risk leveled off after 9 months
- Authors recommend delaying surgery for 9 months

Jorgensen ME, et al. JAMA 2014; 312: 269-77

3

Previous Stroke and Elective Surgery

AHA and ESC recommends waiting at least 6 months

Perioperative Neurological Evaluation and Management to Lower the Risk of Acute Stroke in Patients Undergoing Noncardiac, Nonneurological Surgery
A Scientific Statement From the American Heart Association/American Stroke Association
The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists.
The American Association of Neurological Surgeons/Congress of Neurological Surgeons Cardiovascular Section affirms the educational benefit of this document.

Benesch C, et al. Circulation. 2021;143:e923-e946

2022 ESC Guidelines on cardiovascular assessment and management of patients undergoing non-cardiac surgery
Developed by the task force for cardiovascular assessment and management of patients undergoing non-cardiac surgery of the European Society of Cardiology (ESC).
Endorsed by the European Society of Anaesthesiology and Intensive Care (ESAIC)

Eur Heart J 2022; 43: 3826-924

4

Preoperative Stroke and Postoperative Ischemic Stroke After Elective Surgery

- Medicare patients (n=5,841,539, mean age 74 years) undergoing elective non-neurologic, non-cardiac surgeries (2011-2018), of these 0.9% had previous stroke
- Surgery performed within 30 days of stroke (vs. no stroke) was associated with higher odds of peri-operative stroke and 30-day all-cause mortality
- Odds of stroke were similar at 61-90 days (vs. 181-360 days)
- Authors recommend delaying surgery for at least 3 months

Glance LG, et al. JAMA Surg 2022; 157: e222236

5

Peri-operative Considerations

- Optimize risk factors: Hypertension, DM, ESRD
- Manage anticoagulant/antiplatelet therapy
- Anesthetic technique
 - No difference between regional and general anesthesia
 - No difference between inhalation anesthesia and TIVA
- Lung protective ventilation
 - Maintain normocapnia (ETCO₂ ~40 mmHg)
- Blood pressure management
 - Specific thresholds remains controversial
 - Most recommend maintaining MAP >70 mmHg

Eur Heart J 2022; 43: 3826-3924

6

**Carbon Dioxide,
Blood Pressure, and
Perioperative Stroke:
A Retrospective
Case-Control Study**

Philip F. Hoadley, M.D., Graduate Fellow, Ph.D.,
Alexis M. Linn, M.D.,
Stephen Caporaso, M.D., Ph.D., M.D., M.P.H.,
Joseph M. Scriver, M.D., Steven J. Cook, M.D., M.S.C.C.R.,
Lauren A. Dyer, M.D., Ph.D., William F. Kozlowski, M.D.,
Karin M. Lagerstedt, M.D., David Christensen, M.D.,
Nathan L. Frank, M.D., M.D., Jeffrey Hertz, M.D.,
Katherine Cummings, M.D., Jack Casavola, M.D.,
Armenak M. Marmar, M.D., Sachin Khatri, M.D.,
Lance E. Olson, M.D., George A. Mathias, M.D., Ph.D.
Anesthesiology 2022; 137:434-46

- Multicenter, retrospective case-control study: (n=1,244,881), 1702 positive for stroke
- Patients with confirmed stroke (n=126) matched with corresponding controls (n=500)
- Hypocarbica, hypercarbica, and hypotension were each independently associated with postoperative stroke
- No synergistic interaction between hypotension and either hypo- or hypercarbica
- MAP<55 mmHg and ETCO₂ >45 mmHg associated with increased odds of stroke

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HANDOUTS



Former President's Rapid Fire: MH at an ASC

Kumar Belani, MBBS, MS, FACA, FAAP, SAMBA-F

05/18/2023

3:15pm - 4:30pm MST

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HANDOUTS



ASA 2023 Guidelines for Reversing Neuromuscular Blockade

Victor Davila, MD, SAMBA-F

05/18/2023

4:30pm – 5:00pm MST


www.SAMBA.org

ASA 2023 Guidelines for Reversing Neuromuscular Blockade

Victor R. Davila, MD FASA
 Associate Professor
 Ohio State University
 May 18, 2023

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No Disclosures

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2023 ASA NMB Guidelines can be grouped into 2 categories

Categories of 2023 NMB Recommendations

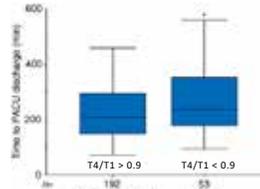
- How to assess depth of neuromuscular blockade
- What to do with the information obtained from the assessment.

Stephen R. Tishler, Wade A. Weigel, Michael M. Todd, Richard P. Dutton, Cynthia A. Lim, Stuart A. Grant, Joseph W. Szokol, Luc L. Eriksson, Myron Yaster, Mark D. Grant, Mathiella Agarwal, Anna M. Muehle, John F. Bland, Adam B. Cronin. 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antidote of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade. *Anesthesiology* 2023; 138:33-41. doi: [10.1097/ALN.0000000000004278](https://doi.org/10.1097/ALN.0000000000004278)

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Residual Neuromuscular Blockade is associated with delayed PACU discharge



It takes longer for patients with residual NMB to leave the PACU

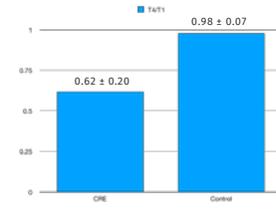
- Observational Study (n= 246)
- PACU discharge readiness longer (224 min vs 149 min)
- Incidence of residual NMB= 22%.

Battersby A, Kibben LA, George J, Sainberg WS, Ehrenmann M, Schmidt D. Postoperative residual curarization from short-acting neuromuscular blocking agents delays recovery room discharge. *J Anaesth* 2010; 20(5):204-9. doi: [10.1097/PAF.0b013e3181974622](https://doi.org/10.1097/PAF.0b013e3181974622)

4


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Critical Respiratory Events in the PACU are associated with residual NMB



73.8% of cases had TOF ratios < 0.7

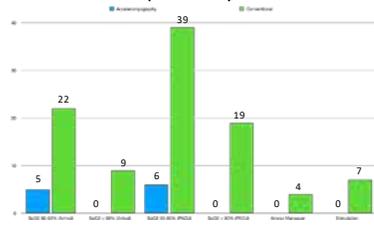
- Case Control Study
 - 42 Matched Cases (7459 total)
 - Severe Hypoxemia 52% (22/42)
 - Airway Obstruction 38% (15/42)

Murphy GS, Giddell JM, Maymone JM, Greenberg SE, Arora M, Yaster M. Residual neuromuscular blockade and critical respiratory events in the postanesthetic care unit. *Anesth Analg* 2008; 106(1):130-7. doi: [10.1213/01.ane.0b013e3181641268](https://doi.org/10.1213/01.ane.0b013e3181641268). PMID: 18434734

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Quantitative Monitoring reduces risk of adverse respiratory events in the PACU



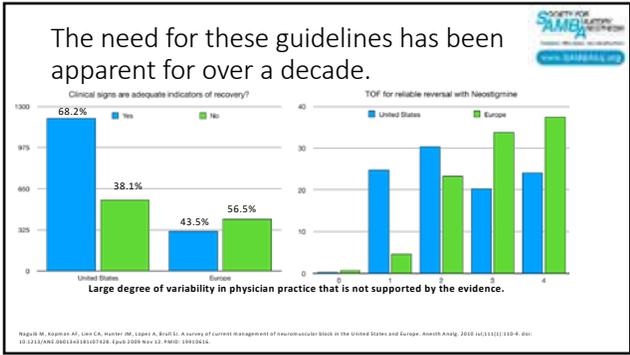
Incidence of significant respiratory events was virtually non-existent in prospective randomized trial of 185 patients.

Higher incidence of:

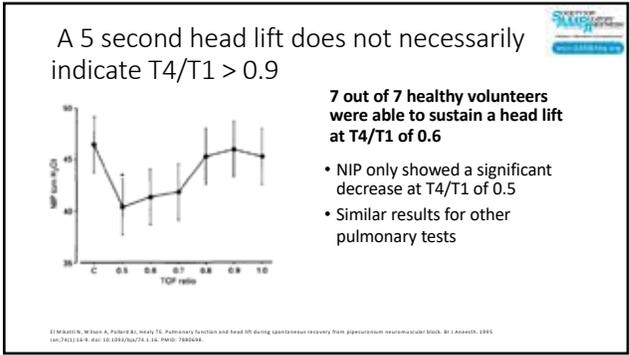
- SpO2 < 90% (PACU and Arrival)
- Airway Maneuvers
- Stimulation

Murphy GS, Giddell JM, Maymone JM, Greenberg SE, Arora M, Yaster M, Naranjo M. Intraoperative acoustomyographic monitoring reduces the risk of residual neuromuscular blockade and adverse respiratory events in the postanesthetic care unit. *Anesthesiology* 2008; 109(1):108-16. doi: [10.1097/ALN.0b013e3181641268](https://doi.org/10.1097/ALN.0b013e3181641268). PMID: 18174436

6



7



8

2023 ASA NMB Guidelines

Recommendations:

- Do not use clinical assessment alone to avoid residual neuromuscular blockade.**

9

2023 ASA NMB Guidelines

Recommendations:

- Do not use clinical assessment alone to avoid residual neuromuscular blockade.**
- Quantitative Monitoring is recommended over qualitative monitoring to avoid residual neuromuscular blockade.**

10

Baseline T4/T1 measurements in Acceleromyography can commonly exceed 1.0 and should be normalized.

Baseline values should be obtained in Acceleromyographic assessments.

- Example: $0.95/1.15 = 0.83$
- Baseline > 1.01 may be present in more than half of patients.
- The goal should be a normalized T4/T1 > 0.9

11

2023 ASA NMB Guidelines

Recommendations:

- Do not use clinical assessment alone to avoid residual neuromuscular blockade.**
- Quantitative Monitoring is recommended over qualitative monitoring to avoid residual neuromuscular blockade.**
- When using quantitative monitoring, confirm a T4/T1 ratio > 0.9 prior to extubation**

12

“Direct evidence from randomized trials that compare confirming or not confirming TOF ratios before extubation are lacking.”

Supplemental Table 11. Strength of evidence for use of the adductor pollicis muscle as a condition.

Outcome	Quality	Effect Size	95% CI	Interpretation
SpO2 < 90% (PACU and Arrival)	Low	OR 0.01	0.00 to 0.02	Very low risk of respiratory events
Airway Maneuvers	Low	OR 0.01	0.00 to 0.02	Very low risk of respiratory events
Stimulation	Low	OR 0.01	0.00 to 0.02	Very low risk of respiratory events

- Effects are substantive and clinically meaningful for both neostigmine and sugammadex.

Stephan R. Thelen, Wade A. Weigel, Michael M. Todd, Richard P. Dutton, Cynthia A. Lin, Stuart A. Grant, Joseph W. Szokol, Leri I. Eriksson, Myron Yaster, Mark D. Grant, Mathubala Agarwal, Anne M. Marikawa, James F. Black, Karen B. Dunbar. 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade. *Anesthesiology* 2023; 138:13-41 doi: <https://doi.org/10.1097/ALN.0000000000003478>

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Quantitative Monitoring reduces risk of adverse respiratory events in the PACU

Event Type	Adductor pollicis	Orbicularis
SpO2 < 90%	5	22
Airway Maneuvers	0	9
Stimulation	6	39
SpO2 < 90% (PACU and Arrival)	0	19
Airway Maneuvers	0	4
Stimulation	0	7

Incidence of significant respiratory events was virtually non-existent in prospective randomized trial of 185 patients.

Higher incidence of:

- SpO2 < 90% (PACU and Arrival)
- Airway Maneuvers
- Stimulation

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2023 ASA NMB Guidelines

Recommendations:

2. Quantitative Monitoring is recommended over qualitative monitoring to avoid residual neuromuscular blockade.
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“Disagreement exists between the degree of paralysis measured at the OO and the AP muscles.”

16 patients with vecuronium induced and neostigmine antagonized NMB

- Orbicularis Oculi had a faster recovery than the Adductor Pollicis

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16

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7. Neostigmine is a reasonable alternative to sugammadex at minimal depth of neuromuscular blockade.

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17

Residual NMB is lower and recovery is faster with sugammadex compared to neostigmine

Depth of Blockade	Peripheral Nerve Stimulator and Qualitative Assessment	Quantitative Monitor
Complete	Posttetanic count = 0	Posttetanic count = 0
Deep	Posttetanic count = 1, Train-of-four ratio = 0	Posttetanic count = 1, Train-of-four ratio = 0
Moderate	Train-of-four count = 1-3	Train-of-four ratio = 0.5
Shallow	Train-of-four count = 4	Train-of-four ratio = 0.8
Minimal	Train-of-four fade present	Train-of-four ratio = 0.8-0.9
Acceptable	Train-of-four fade absent	Train-of-four ratio = 0.9-1.0
Recovery	Control by relaxation	Train-of-four ratio = 1.0

With a peripheral nerve stimulator it is recommended that sugammadex be used if you can detect fade on TOF

- This corresponds to T4/T1 < 0.4
- If TOF has no fade or T4/T1 > 0.4 it is reasonable to use neostigmine.

Stephan R. Thelen, Wade A. Weigel, Michael M. Todd, Richard P. Dutton, Cynthia A. Lin, Stuart A. Grant, Joseph W. Szokol, Leri I. Eriksson, Myron Yaster, Mark D. Grant, Mathubala Agarwal, Anne M. Marikawa, James F. Black, Karen B. Dunbar. 2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade. *Anesthesiology* 2023; 138:13-41 doi: <https://doi.org/10.1097/ALN.0000000000003478>

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This table summarizes the data that supports recommending sugammadex over neostigmine

Outcome	Randomized Controlled Trials	Patients	Strength of Evidence	Effect (95% CI)
Less residual neuromuscular blockade	8	1,421	Weak	Risk ratio 0.13 (0.07 to 0.23)
Time-of-four ratio > 0.9	8	1,421	Weak	Risk difference -21.8% (-33.8 to -8.4%)
Shorter time to time-of-four ratio > 0.9 than	4	305	Weak	Mean difference, min -23.4 (-38.3 to -7.6)
Deep block	17	3,114	Weak	-10.4 (-12.7 to -7.2)
Moderate block	5	152	Weak	-3.9 (-4.7 to -3.0)
Shallow block	9	17	Very low	-1.4 (-2.8 to 0.0)

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The recommendations are linked to the strength of the data supporting them.

Outcome	Randomized Controlled Trials	Patients	Strength of Evidence	Effect (95% CI)
Less residual neuromuscular blockade	8	1,421	Weak	Risk ratio 0.13 (0.07 to 0.23)
Time-of-four ratio > 0.9	8	1,421	Weak	Risk difference -21.8% (-33.8 to -8.4%)
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Where the data is more robust the use of sugammadex is supported.

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For minimal depth of block there is no evidence to support the use of either sugammadex or neostigmine.

Outcome	Randomized Controlled Trials	Patients	Strength of Evidence	Effect (95% CI)
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2023 ASA NMB Guidelines

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- For Atracurium and Cisatracurium:
 - Quantitative monitoring: reverse with neostigmine at T4/T1 > 0.4 and confirm recovery to T4/T1 > 0.9 prior to extubation.
 - Qualitative monitoring: Reverse with no detectable fade and then WAIT AT LEAST 10 minutes prior to extubation.

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24

The dose of neostigmine when used for minimal depth of NMB should not exceed 40 mcg/kg

Quantitative Assessment

- Give lower doses at T4/T1 > 0.6
 - (15-30 mcg/kg)
- Confirm that adequate reversal was achieved.

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25

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If adequate reversal is not achieved within 10 minutes of neostigmine administration, it is probably because insufficient time was given for spontaneous recovery.

Options:

- Wait for spontaneous recovery
- Give sugammadex
- Give additional neostigmine up to total dose of 50 mcg/kg



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27

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- Give lower doses at T4/T1 > 0.6
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Qualitative Assessment

- Wait for 10 minutes and hope for the best.



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The benefits of complete recovery include increased patient satisfaction, decreased length of PACU stay, decreased postoperative pulmonary complications, and decreased mortality.

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Thank you.



Contact: office@sambahq.org

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HANDOUTS



Welcome

Steven Butz, MD, SAMBA-F

05/19/2023

7:30am - 7:40am MST

HANDOUTS



The New SAMBA Diabetes Guidelines

Niraja Rajan, MD, SAMBA-F

Mary Ann Vann, MD, FASA

Girish P. Joshi, MBBS, MD, FACI, SAMBA-F

Basem B. Abdelmalak, MD, FASA, SAMBA-F

05/19/2023

7:40am – 9:00am MST

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HANDOUTS



Medical Director Topics: Conflict Resolution

Jarrett A. Heard, MD, MBA

05/19/2023

9:00am – 10:00am MST

Conflict Resolution

Jarrett A. Heard, MD, MBA
Associate Professor - Clinical
Medical Director of Ambulatory Perioperative Services
Director Executive Leadership and Business in Anesthesiology Fellowship
The Ohio State University Wexner Medical Center

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Disclosures

- I have no disclosures to report

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2

Objectives

- Define Conflict and Resolution
- Review Different Approaches to Conflict Resolution
 - Awareness of Conflict
 - Use different tools assess conflict resolution
 - Identify ways to handle difficult conversations during conflict resolution
- Relate Real Examples in Ambulatory Surgery

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3

Conflict Resolution

- Several definitions
- Understanding the conflict¹
 - Involves two or more parties
 - Requires commitment and communication of conflicting ideologies
 - Often involves collective negotiation or diplomacy
 - May be peaceful or forceful
- Several theories/strategies of conflict resolution

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4

Conflict Resolution Theories

- Conflict Resolution Curve²
 - Two domains: Competing vs. Accommodating
- Dual Concern Model³
 - Concern for self vs. concern for others
- Often necessitates strategy

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5

Awareness

- Self-awareness
 - Strengths and weaknesses
 - Wants vs. needs
 - How do you view others?
- Situational awareness
 - Strengths and weaknesses
 - Wants vs. needs of others
 - Intensity and time
 - How do others view you?

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6

Thomas-Kilmann Instrument⁴

Assertive	High	Competing (forcing) I'm not prepared to change my position. My view is clearly the right one. I know best, do as you're told.	Collaborating (problem solving) Let's work together on this. Let's find some common ground. My position is... what's yours? How can we solve this?
	Low	Compromising (sharing) Let's find a quick solution. Split the difference. Meet half way. I'm prepared to, if you will.	Accommodating (smoothing) I concede that point. I agree with you there. I'm prepared to accept that. What's your preferred outcome.
		Low	High

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Thomas-Kilmann Conflict Styles⁴

- Competing – assertive and cooperative
- Accommodating – unassertive and cooperative
- Avoiding – unassertive and uncooperative
- Collaboration – assertive and cooperative
- Compromising – intermediate assertive/cooperative

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Conflict Resolution Skills

- Assertiveness
- Mediation
- Empathy
- Facilitation
- Interviewing/Active Listening
- Accountability

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9

Difficult Conversations⁵

- Make it a safe conversation
- Avoid escalation – Master your story
- Explore other's paths
- State your path
- Seek Mutual Purpose

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Examples?

- OSU Case Migration Across Pavilions
 - Labor Resource Shortage
 - Equipment/Instrumentation
 - Staff familiarity/training
 - Cost and Logistics
 - Perioperative Staff: Nursing, Techs, Anesthesia providers, Surgeons

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What did we cover?

- Define Conflict and Resolution
- Review Different Approaches to Conflict Resolution
 - Awareness of Conflict
 - Use different tools assess conflict resolution
 - Identify ways to handle difficult conversations during conflict resolution
- Relate Real Examples in Ambulatory Surgery

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Questions/Comments?



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13

References



- 1.) American Management Association. www.amanet.org.
- 2.) Das, Tuhin K. "Regret Analysis Towards Conflict Resolution". 2018. SSRN. Doi10.2139/ssrn.3173490.
- 3.) Goldfien, J, Robbenolt, J. "What if the lawyers have their way? An empirical assessment of conflict strategies and attitudes toward mediation styles". Ohio State Journal on Dispute Resolution. 22(2):277-320.
- 4.) Kilmann Diagnostics. Thomas-Kilmann Conflict Mode Instrument. www.kilmanniagnostics.com.
- 5.) Crucial Conversations for Mastering Dialogue: The Standard in Effective Communication. www.cruciallearning.com.

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HANDOUTS



Medical Director Topics: OR Efficiency

Steven Butz, MD, SAMBA-F

05/19/2023

9:00am – 10:00am MST





OR Efficiency

Steven Butz, MD
Professor Anesthesiology, MCW
Associate Chief Medical Officer, Children's Wisconsin

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1



Conflicts of interest

- None for this lecture
- Board of directors for AAAHC
- President-Elect SAMBA

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2

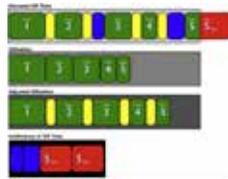


Objectives

- Be able to assess a facility's efficiency
- Be able to identify components that go into efficiency
- Demonstrate alternatives to current work flows

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3

Definitions

Pash, et al. Anesthesiology Clin 32 (2014) 517-527

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4



OR Efficiency Scoring

Metric	Points		
	0	1	2
Excess staffing costs	Greater than 10%	0-10%	Less than 5%
Start time tardiness (mean tardiness of start times for elective cases per OR per day)	Greater than 60 min	45-60 min	Less than 45 min
Case cancellation rate	Greater than 15%	5-10%	Less than 5%
Facility admission delays (% of workdays with at least one delay in PACU admission)	Greater than 20%	10-20%	Less than 10%
Contribution margin (mean) per OR hour	Less than \$1,000/h	\$1,000-2,000/h	More than \$2,000/h
Turnover times (mean setup and cleanup) turnover times for all cases)	Greater than 40 min	20-40 min	Less than 20 min
Prediction bias (bias in case duration estimates per 8 h of OR time)	Greater than 15 min	5-15 min	Less than 5 min
Prolonged turnovers (% of turnovers that are more than 60 min)	Greater than 25%	10-25%	Less than 10%

Marcario. Anesthesiology 2006; 105:237-40

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5



Percent of time idle or over

- 0 points for > 10%
- 1 point for 5-10%
- 2 points for < 5%

Efficiency Score: Staffing Costs

- Match to workers to do the work:
 - Circulator
 - Scrub
 - Anesthesiologist
 - Surgeon
- Avoid over- or under-use

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Mean tardiness of start times for elective cases per OR per day (8 hr):

- 0 points > 60 min
- 1 point 45-60 min
- 2 points < 45 min

Efficiency Score:
Start Time Tardiness

- Keeps patients from waiting
- Balance between arrival time and time to prepare vs. predicted case time
- No credit given for cases that start early

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Rates of:

- 0 points > 10%
- 1 point 5-10%
- 2 points < 5%

Efficiency Score:
Cancellation Rate

- Rates vary 4.6% to 13% depending on case type and location
 - Facility-based
 - Weather-based
 - Process-based
 - Patient-based (biggest)

8

% of OR days with 1 case delay

- 0 points > 20%
- 1 point 10—20%
- 2 points < 20%

Efficiency Score:
PACU Admission Delays

- This metric involves staffing resources to avoid delays in care in the PACU

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Margin per hour

- 0 points < \$1000
- 1 point \$1000-\$2000
- 2 points > \$2000

Efficiency Score:
Contribution to Margin

- Margin per hour of OR time is income minus all costs (labor, supplies)
- All cases > \$0 should be done
- Variability of contracts make is more difficult in US care model

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Minutes

- 0 points > 40
- 1 point 25-40
- 2 points < 25

Efficiency Score:
Turnover Times

- Only time for clean-up and set-up, not delays
- Only is beneficial if staff and allocations are likewise reduced
- OR managers use it because it is comparable and surgeon satisfier

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End time at 8 hour shift

- 0 points >15 min
- 1 point 5-15 min
- 2 points < 5 min

Efficiency Score:
Prediction Bias

- Judges your accuracy of case time
- Surgeons "underestimate"
- Historical data present 37%
- Facility may have 6000 DPCs

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**Efficiency Score:
Prolonged Turnover**

- % of turnovers > 60 min*
 - 0 points >25%
 - 1 point 10-25%
 - 2 points < 10%

- Includes all reasons
- Process assessment
- Scheduling assessment

*Hospital-based

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Definitions

- Important to have a common goal and idea of what time:
 - Start time
 - Turnover time
 - Patient arrival



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Definitions

- **Surgical Responsibilities:**
 - History and Physicals
 - Immediate pre-op assessment
 - Site marking
 - Consent
 - OR/Anesthesia set-up
 - Presence at case start



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Definitions: Efficiency

- **Time Used/Time Available**
 - Assumes fully staffed for day
 - Ability to place more cases
 - Assumes all case pay equally
 - Cancellation rate
 - Overhead is basically fixed
 - "Lean" processing
 - Easier to compare as benchmark
- **Expense/Time**
 - Variable staffing
 - Ability to place more cases
 - Variable expense rate
 - Cancellation rate
 - Cases treated individually
 - Better for setting costs



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Efficiency Benchmarks

Block Utilization:

- 70% is industry standard
- 65-80% is a good goal
- >85% is time to build/expand
- Variables is time available
 - 7am-3pm?
 - 7:30am-5:00 pm?
 - Most use 8-hour day



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Pre-op

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Pre-op Evaluation and Testing

- Pre-Eval clinics reduce case cancellation (A1 level of recommendation!!!)
- Need to have consistent algorithms
- Options:
 - Phone vs Video vs In Person
 - RN vs PA/APN vs MD/DO
 - Electronic interface
- Testing only when indicated



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Pre-op: Scheduling of Cases

- Who schedules/verifies?
- Case length*
 - Average vs Surgeon request
 - "Optimism"
- Case order
 - Long vs short
 - Patient age
 - Case type
- When does assessment happen?



* Reeves, et al. A&A. December 2021 • Volume 133 • Number 6

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Pre-op: Arrival Time

- How long does it take to admit?
 - Average
 - Interpreter
 - Special needs
 - Ortho/crutch training
 - ASA score
 - COVID testing issues
- Transportation issues
- Anticipation of schedule performance



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Pre-op: Order Set

- Should standardize patient admission
- May include:
 - Pre-medication
 - DVT prophylaxis
 - Pregnancy testing
 - Glucose testing
 - Admission
- Surgical sets for X-ray, Antibiotics



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Intra-Op: "Start Time"

- For staff
- For "wheels at the door"
- Staggered
- First case vs consecutive cases
 - Not associated with delayed end
 - Under-utilized time at end of day has greater impact on efficiency than anything else.*



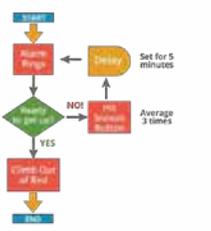
* Reeves, et al. A&A. December 2021 • Volume 133 • Number 6

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Intra-Op: Turnover Time

- Need a definition
- Idealize parallel processing
 - Mapping of duties is useful
 - May differ by case type
- Induction rooms
 - Satisfaction
 - Effectiveness*
- Block room reduced times and increased cases/day**
- Anesthesia Contribution



* Varughese, et al. Pediatric Anesthesia 22 (2012) 327-334
 **Brown, et al. Int J Health Care Qual Assur 2014;27(8):697-706.

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Intra-Op: Turnover Time

- Limited by staffing—Lunch time
- Music Choice*
- Surgeon's role
 - Availability**
 - Routine of "paperwork"
 - Motivations**

*Mosaed, et al. J Perioper Pract 2020 May;30(5):141-144.
**Gottschalk, et al. HAND 2016, Vol. 11(4) 489-494

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Intra-Op: ASC VS HOPD vs Hospital

- Staffing in hospital had 6x and 2.5x greater changes in ST and RN than ASC*
- ASCs more likely than HOPD**
 - Have consistent team
 - Slightly lower ASA score
 - Physician ownership
 - Less distractions
 - Better metrics for case time, TOT, out of room, recovery



*Patrick, et al. Orthopedics. 2017; 40(5):297-302.
**Imran, et al. The American Journal of Surgery 218 (2019) 809e812.

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Intra-Op: Miscellaneous



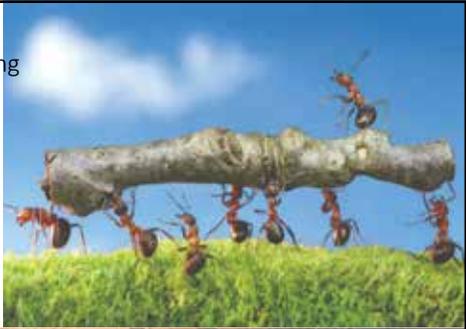
- Cancellation rate:
 - By cause
 - Great topic for QI study
- EMR vs Paper
- Residents/Trainees*
 - Longer induction and emergence
 - Faster turnover
 - Best model for ambulatory is supervised CAA/CRNA

*Urman, et al. The Observer Journal 11(2)5-20, 2012

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Post-Op: Staffing



- Flexibility between areas
- Full-time vs part-time
- Call vs Second Shift

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Post-Op: Anesthesia



- Fast tracking
- Anesthesia contribution
 - Multi-modal pain control
 - PONV score and therapy
 - Spinal vs General vs Sedation
 - Other anesthesia medications

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Post-Op: Delays



- Pain
 - "Golden hour"
- PONV
- Emergence Delirium
- Rides/Escorts
- Should all be tracked

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Summary of Issues

- Over- and Under-Utilized times were most important to efficiency
 - Staff can be adjusted
 - Cases may be added or limited
 - Raw utilization is important, but accuracy is most important
- Promotes accuracy of end time as most important efficiency indicator



Reeves, et al. A&A. December 2021 • Volume 133 • Number 6

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So What Really Matters.....?

- Operative time?
- Anesthesia efficiency?
- Team skill?
- Patient preparation?
- Facility lay out?
- Process development?

- All of it, but....
 - Late starts are relatively few
 - Prolonged turn-over times are few
 - The biggest contribution is

PREDICTABILITY!

- Only thing that prevent overrun and under-utilization.

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THANK YOU!

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HANDOUTS



Lecture: 2023 ASA NPO Guidelines Modular Update

Basem B. Abdelmalak, MD, FASA, SAMBA-F

05/19/2023

10:45am - 11:30am MST

**The 2023 ASA NPO Guidelines
A Modular Update of the 2017
Guidelines**

Basem Abdelmalak, MD, FASA, SAMBA-F
Professor of Anesthesiology
Director, Anesthesia for Bronchoscopic Surgery
Director, Center for Procedural Sedation
Anesthesiology Institute, Cleveland Clinic

Past President, Society For Ambulatory Anesthesia
Past president, Society For Head and Neck Anesthesia

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Objectives

1. Enumerate the 2023 updates to the ASA NPO guidelines
2. Justify the NPO guidelines recommendations
3. Discuss patient characteristics that may impact NPO duration
4. Recommend strategies to prevent pulmonary aspiration

3

Disclosures

- No relevant financial COI to disclose
- Co-Chair the ASA taskforce for the 2023 modular update to the NPO Guidelines

2

ANESTHESIOLOGY
Pulmonary Aspiration of Gastric Contents: A Closed Claims Analysis

Mark A. Warner, M.D., Karen L. Meyerhoff, M.D., M.P.H., Mary E. Warner, M.D., Karen L. Pines, Ph.D., Linda Stephens, Ph.D., Karen B. Thindal, M.D., M.P.H.
Anesthesiology 2021; 133:264-81

What This Article Tells Us That Is New

- In a closed claims analysis of 115 cases of pulmonary aspiration, death occurred in 52% of the claims and severe permanent injury in another 14%.
- Sixty-one percent of the patients in the claims had either gastrointestinal obstruction or another intrabdominal process.
- Anesthetic practice was judged to be substandard in 59% of the 115 claims.

4

NAP4

- **Aspiration** was the single most common primary cause of mortality (rather than cerebral hypoxia per se)
- Aspiration accounted for 8 anesthesia deaths and two cases of brain damage

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2022 ASA Guidelines: Part 1

DIFFICULT AIRWAY ALGORITHM: ADULT PATIENTS

Any one factor alone (assessed difficulty with intubation or ventilation, or aspiration or desaturation risk) may be clinically important enough to warrant an awake intubation.

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2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway*

Jeffrey L. Apfelbaum, M.D., Cassi A. Hagberg, M.D., Robert T. Combs, Ph.D., Basem B. Abdelmalak, M.D., Madhulika Agarwal, M.D., Richard F. Dutton, M.D., John L. Fleisher, M.D., Robert Grubb, M.D., P. Alan Rankin, Jr., M.D., David W. Warshaw, M.D., Steven H. Meyers, M.D., Steve P. O'Rourke, M.D., William H. Henderson, M.D., Neelam K. Ghoshal, M.D., Avery Yang, M.D.

ANESTHESIOLOGY 2022; 134:21-81†

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PRACTICE PARAMETERS

Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures

An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration*

Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures. An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. Anesthesiology, 2017, 126(3): p. 276-300.

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Detailed NPO Table

Ingested Material	Minimum Fasting Period*
Clear liquids†	2h
Breast milk	4h
Infant formula	4h
Non-human milk‡	4h
Light meal	6h
Regular meal	8h

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Is There a Downside to Fasting?

- Prolonged fasting influences patient-related outcomes:
 - Thirst
 - Hunger
 - Anxiety
 - Nausea and vomiting
 - Pain, and reduced feeling of well-being
- Clinical outcomes:
 - Dehydration
 - Electrolyte imbalance
 - Hypotension at induction of general anesthesia

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NPO Foot Notes

- Healthy Individuals of all ages
- Factors that delays gastric emptying:
 - Esophageal disorders such as significant uncontrolled GERD, HH, Zenker's diverticulum, achalasia, stricture
 - Previous gastric surgery such as gastric bypass
 - Gastroparesis; diabetes mellitus;
 - Opioid use
 - Gastrointestinal obstruction or acute intra-abdominal processes;
 - Pregnancy; obesity; and emergency procedures

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2023 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting: Carbohydrate-containing Clear Liquids with or without Protein, Chewing Gum, and Pediatric Fasting Duration—A Modular Update of the 2017 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting*

Dirish F. Joshi, MBBCh, MD, (Co-Chair),
 Bassem B. Abdelmalak, MD, (Co-Chair),
 Wade A. Biegel, MD, Monica W. Harbell, MD,
 Catherine I. Katz, MD, Saptarshi S. Sanyal, MD,
 Paul A. Stecken, MD,
 Terezie Tipton, BSN, RN, CNOB,
 Mark D. Grant, MD, PhD, Anne M. Marbella, MS,
 Madhulika Aggarwal, MPA, James F. Black, M.D., MPA,
 Karen S. Conroy, M.D., MPA
 Anesthesiology 2023; 139:132-57

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Recommendation #1

Healthy adults drink carbohydrate-containing clear liquids until 2 h before elective procedures
 The carbohydrates may be simple or complex

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Who Do These Recommendations Apply To?

- Patients undergoing elective
 - General anesthesia
 - Regional anesthesia
 - Procedural sedation

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Recommendation #1 Evidence

- Participants drinking carbohydrate-containing clear liquids had lower patient-rated hunger
- differences were not detected in thirst, preoperative nausea, or patient satisfaction
- Mixed treatment comparisons did not support the superiority of complex carbohydrates over simple carbohydrates with respect to residual gastric volume or hunger

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How Much Clear Liquid??

- A. Up to 100 mL
- B. Up to 200 mL
- C. Up to 300 mL
- D. Up to 400 mL
- E. Up to 500 mL
- F. Up to 1000 mL

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Carbohydrates in Patients with Diabetes

- Caution with carbohydrate-containing liquids in patients with diabetes, especially patients who skip or reduce their usual hypoglycemics prior to surgery.
- Home glucometer readings may help guide the patient's choice of a carbohydrate or a non-caloric clear liquid.

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How Much Clear Liquid?? Evidence

- Up to 400 mL of clear liquids is considered an appropriate volume.
- Trial participants ingested a median of 400 mL of carbohydrate-containing clear liquids (interquartile range: 300 to 400 mL) up to 2 hours prior to anesthesia administration.

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Recommendation #2 (No Recommendation)

There is insufficient evidence to recommend protein-containing clear liquids preferentially over other clear liquids

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Recommendation #2 Evidence

- All protein-containing clear liquids in the trials included carbohydrates precluding assessment of liquids containing only protein.
- There was inconclusive evidence concerning residual gastric volume in nonsurgical studies that included comparisons of protein-containing clear liquids compared with carbohydrate-containing clear liquids alone

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Recommendation #3 Evidence

- Patients chewing gum had a minimally increased residual gastric volume at anesthesia induction compared with fasting
- There was no difference in gastric pH between the groups

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Recommendation #3 (Suggestion)

Not delaying elective procedures in healthy adults who are chewing gum

Chewing gum should be removed before any sedative/anesthetic is administered

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Recommendation #4 (No Recommendation)

There is insufficient evidence concerning benefits and harms to recommend pediatric patients drink clear liquids until 1 h versus 2 h before Procedures

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Recommendation #4 Evidence

- There was no difference in patient-reported hunger or thirst, incidence of aspiration or regurgitation, and gastric pH among pediatric patients fasting for 1 hour compared with 2 hours
- Inconsistent results were reported for residual gastric volume

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Recommendation #5 (Best Practice Statement)

To avoid prolonged fasting in children, efforts should be made to allow clear liquids as close to 2 hours prior to procedures as possible. In children with shorter clear liquid fasting duration, exercise clinical judgment.

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Ultrasound Assessment of Gastric Fluid Volume in Children Scheduled for Elective Surgery After Clear Fluid Fasting for 1 Versus 2 Hours: A Randomized Controlled Trial

Khaled Abdelfattah Selman, MD, DESA, Hossam Hasaneen, MSc, Ahmed Hasanin, MD, DESA,

CONCLUSIONS: In healthy children scheduled for elective surgery receiving 3 mL kg⁻¹ clear fluid, the median GFV after 1-hour fasting was double the volume after conventional 2-hour fasting. These findings should be considered whether weighting the risk/benefit of a liberal approach to preoperative fasting versus the risk of pulmonary aspiration. (*Anesth Analg* 2023;136:711-8)

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Recommendation #5 Evidence

- Fasting duration is often substantially longer than recommended irrespective of a 1- or 2-hour clear liquid fasting policy

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Enteral Tube Feeding and NPO

- Exercise clinical judgment in minimizing feeding interruptions in critically ill patients
- Caveat:
 - Airway is protected with an endotracheal or tracheostomy tube with properly inflated cuff
 - Procedures that does not include reintubation or airway manipulations

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Summary

- Every effort should be made to minimize the risk of Aspiration
- Please Consider the 2017 ASA NPO Guidelines recommendations
- The 2023 Update
- Recommend Carbs containing clear liquids
- Does not recommend protein containing clear liquids
- Remove the chewing gum, and proceed
- Does not recommend 1 hour fasting for children
- Decrease the prolongation of fasting period for children keeping it close to 2 hours as possible.

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Education and Implementation

- Robust local efforts at each facility disseminating and discussing information
- Provide necessary education to all patient care teams
- Update related policies, printed literature, and wall posters/charts

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Every life deserves world class care.

Thank you!
 Basem Abdelmalak, MD, FASA, SAMBA-F
abdemb@ccf.org
 @basemcc

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PRACTICE PARAMETER

2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway*

Jeffrey L. Apfelbaum, M.D., Carin A. Hagberg, M.D., Richard T. Connis, Ph.D., Basem B. Abdelmalak, M.D., Madhulika Agarkar, M.P.H., Richard P. Dutton, M.D., John E. Fiadjo, M.D., Robert Greif, M.D., P. Allan Klock, Jr., M.D., David Mercier, M.D., Sheila N. Myatra, M.D., Ellen P. O'Sullivan, M.D., William H. Rosenblatt, M.D., Massimiliano Sorbello, M.D., Avery Tung, M.D.

ANESTHESIOLOGY 2022; 136:31–81

Practice guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be adopted, modified, or rejected according to clinical needs and constraints and are not intended to replace local institutional policies. In addition, practice guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Practice guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. They provide basic recommendations that are supported by a synthesis and analysis of the current literature, expert and practitioner opinion, open forum commentary, and clinical feasibility data.

This document is a revision of the “Practice guidelines for management of the difficult airway: A report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway,” adopted by the ASA in 2012 and published in 2013.¹

ABSTRACT

The American Society of Anesthesiologists; All India Difficult Airway Association; European Airway Management Society; European Society of Anaesthesiology and Intensive Care; Italian Society of Anesthesiology, Analgesia, Resuscitation and Intensive Care; Learning, Teaching and Investigation Difficult Airway Group; Society for Airway Management; Society for Ambulatory Anesthesia; Society for Head and Neck Anesthesia; Society for Pediatric Anesthesia; Society of Critical Care Anesthesiologists; and the Trauma Anesthesiology Society present an updated report of the Practice Guidelines for Management of the Difficult Airway.

(Anesthesiology 2022; 136:31–81)

HIGHLIGHTS BOX

These updated guidelines:

- Replace the “Practice Guidelines for Management of the Difficult Airway: A Report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway,” adopted by the American Society of Anesthesiologists in 2012 and published in 2013.¹
- Specifically address difficult airway management. The guidelines do not address education, training, or certification requirements for practitioners who provide anesthesia and airway management.
- Differ from previous guidelines in that they were developed by an international task force of anesthesiologists representing several anesthesiology, airway, and other medical organizations.
- Provide new evidence obtained from recent scientific literature along with findings from new surveys of expert consultants, American Society of Anesthesiologists members, and 10 participating organizations.
- Provide consideration for the development of a difficult airway management strategy including considerations for awake airway management.
- Update equipment for standard and advanced difficult airway management.
- Recommend supplemental oxygen administration before initiating and throughout difficult airway management, including the extubation process.
- Offer noninvasive and invasive alternatives for difficult airway management.
- Emphasize awareness of the passage of time and limiting the number of attempts of different devices and techniques during difficult airway management.
- Provide more robust recommendations for extubation of the difficult airway.
- Provide new algorithms and infographics for adult and pediatric difficult airway management.

Supplemental Digital Content is available for this article. Direct URL citations appear in the printed text and are available in both the HTML and PDF versions of this article. Links to the digital files are provided in the HTML text of this article on the Journal's Web site (www.anesthesiology.org).

Received from the American Society of Anesthesiologists, Schaumburg, Illinois. Submitted for publication February 22, 2021. Accepted for publication April 27, 2021. Published online first on November 11, 2021. Supported by the American Society of Anesthesiologists and developed under the direction of the Committee on Standards and Practice Parameters, Jeffrey L. Apfelbaum, M.D. (Chair). Approved by the ASA House of Delegates on October 13, 2021. These guidelines have been endorsed by the Difficult Airway Society.

*Updated by the American Society of Anesthesiologists; All India Difficult Airway Association; European Airway Management Society; European Society of Anaesthesiology and Intensive Care; Italian Society of Anesthesiology, Analgesia, Resuscitation and Intensive Care, Learning, Teaching and Investigation Difficult Airway Group; Society for Airway Management; Society for Ambulatory Anesthesia; Society for Head and Neck Anesthesia; Society for Pediatric Anesthesia; Society of Critical Care Anesthesiologists; and the Trauma Anesthesiology Society; Jeffrey L. Apfelbaum, M.D., Chicago, Illinois (Co-Chair); Carin A. Hagberg, M.D., Houston, Texas (Co-Chair); Richard T. Connis, Ph.D., Woodinville, Washington (Chief Methodologist); Basem B. Abdelmalak, M.D., Cleveland, Ohio; Madhulika Agarkar, M.P.H., Schaumburg, Illinois (Methodologist); Richard P. Dutton, M.D., Dallas, Texas; John E. Fiadjo, M.D., Philadelphia, Pennsylvania; Robert Greif, M.D., Bern, Switzerland; P. Allan Klock, Jr., M.D., Chicago, Illinois; David Mercier, M.D., Dallas, Texas; Sheila N. Myatra, M.D., Mumbai, India; Ellen P. O'Sullivan, M.D., Dublin, Ireland; William H. Rosenblatt, M.D., New Haven, Connecticut; Massimiliano Sorbello, M.D., Catania, Italy; Avery Tung, M.D., Chicago, Illinois; in collaboration with the Society for Pediatric Anesthesia, Pediatric Difficult Intubation Collaborative (pediatric algorithm and infographic). Copyright © 2021, the American Society of Anesthesiologists. All Rights Reserved. Anesthesiology 2022; 136:31–81. DOI: 10.1097/ALN.0000000000004002

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PRACTICE PARAMETER

Methodology**Definition of Difficult Airway**

For these practice guidelines, a difficult airway includes the clinical situation in which anticipated or unanticipated difficulty or failure is experienced by a physician trained in anesthesia care, including but not limited to one or more of the following: face-mask ventilation, laryngoscopy, ventilation using a supraglottic airway, tracheal intubation, extubation, or invasive airway. These clinical situations are further defined as follows.

Difficult Facemask Ventilation. It is not possible to provide adequate ventilation (*e.g.*, confirmed by end-tidal carbon dioxide detection), because of one or more of the following problems: inadequate mask seal, excessive gas leak, or excessive resistance to the ingress or egress of gas.

Difficult Laryngoscopy. It is not possible to visualize any portion of the vocal cords after multiple attempts at laryngoscopy.

Difficult Supraglottic Airway Ventilation. It is not possible to provide adequate ventilation because of one or more of the following problems: difficult supraglottic airway placement, supraglottic airway placement requiring multiple attempts, inadequate supraglottic airway seal, excessive gas leak, or excessive resistance to the ingress or egress of gas.

Difficult or Failed Tracheal Intubation. Tracheal intubation requires multiple attempts or tracheal intubation fails after multiple attempts.

Difficult or Failed Tracheal Extubation. The loss of airway patency and adequate ventilation after removal of a tracheal tube or supraglottic airway from a patient with a known or suspected difficult airway (*i.e.*, an “at risk” extubation).

Difficult or Failed Invasive Airway. Anatomic features or abnormalities reducing or preventing the likelihood of successfully placing an airway into the trachea through the front of the neck.

Inadequate Ventilation. Indicators of inadequate ventilation include absent or inadequate exhaled carbon dioxide, absent or inadequate chest movement, absent or inadequate breath sounds, auscultatory signs of severe obstruction, cyanosis, gastric air entry or dilatation, decreasing or inadequate oxygen saturation, absent or inadequate exhaled gas flow as measured by spirometry, anatomic lung abnormalities as detected by lung ultrasound, and hemodynamic changes associated with hypoxemia or hypercarbia (*e.g.*, hypertension, tachycardia, bradycardia, arrhythmia). Additional clinical symptoms may include changed mental status or somnolence.

Purposes of the Guidelines

The purposes of these guidelines are to guide the management of patients with difficult airways, optimize first attempt success of airway management, improve patient safety during airway management, and minimize/avoid adverse events. The principal adverse outcomes associated with the difficult airway include (but are not limited to) death, brain injury, cardiopulmonary arrest, airway trauma, and damage to the teeth. The appropriate choice of medications and

techniques for anesthesia care and airway management is dependent upon the experience, training, and preference of the individual practitioner, requirements or constraints imposed by associated medical issues of the patient, type of procedure, and environment in which airway management takes place. The choice of agents, techniques, and devices may be limited by federal, state, or municipal regulations or statutes.

Focus

These guidelines focus specifically on the management of the difficult airway encountered with mask ventilation, tracheal intubation, or supraglottic airway placement during procedures requiring general anesthesia, deep sedation, moderate sedation, or regional anesthesia or elective airway management without a procedure. Procedures include diagnostic, elective, and emergency procedures and invasive airway access. Airway management during cardiopulmonary resuscitation is not addressed by these guidelines. The guidelines are intended for adult and pediatric patients with either anticipated or unanticipated difficult airways, obstetric patients, intensive care (ICU) patients, and critically ill patients. The guidelines do not address patients at risk of aspiration without anatomically difficult airways, patients where difficult airways are not encountered, or physiologically difficult airways that are not anatomically difficult.‡

These guidelines do not address education, training, or certification requirements for practitioners who provide anesthesia and airway management. Some aspects of the guidelines may be relevant in other clinical contexts. The guidelines do not represent an exhaustive consideration of all manifestations of the difficult airway or all possible approaches to airway management.

Application

These guidelines are intended for use by anesthesiologists and all other individuals who perform anesthesia care or airway management. The guidelines are intended to apply to all airway management and anesthetic care delivered in inpatient (*e.g.*, perioperative, nonoperating room, emergency department, and critical care settings) and ambulatory settings (*e.g.*, ambulatory surgery centers and office-based surgery and procedure centers performing invasive airway procedures). Excluded are prehospital settings and individuals who do not deliver anesthetic care or perform airway management. These guidelines are also intended to serve as a resource for other physicians and patient care personnel who are involved in the care of difficult airway patients, including those involved in local policy development.

‡These include, but are not limited to, patients at increased risk for cardiorespiratory deterioration with airway management due to underlying conditions such as hypoxemia, hypotension, severe metabolic acidosis, or right ventricular failure.

Practice Guidelines for Difficult Airway Management

Task Force Members

In 2019, the ASA Committee on Standards and Practice Parameters requested that these guidelines be updated. This update is a revision developed by an ASA-appointed task force of 15 members, including physician anesthesiologists in both private and academic practices from the United States, India, Ireland, Italy, and Switzerland; an independent consulting methodologist; and an ASA staff methodologist. Conflict-of-interest documentation regarding current or potential financial and other interests pertinent to the practice guideline were disclosed by all task force members and managed. §

Process and Evaluation of Evidence

These updated guidelines were developed by means of a six-step process. First, consensus was reached on the criteria for evidence. Second, a comprehensive literature search was conducted by an independent librarian to identify citations relevant to the evidence criteria. Third, original published articles from peer-reviewed journals relevant to difficult airway management were evaluated and added to literature included in the previous update. Fourth, consultants who had expertise or interest in difficult airway management and who practiced or worked in various settings (*e.g.*, private and academic practice) were asked to participate in opinion surveys addressing the appropriateness, completeness, and feasibility of implementation of the draft recommendations and to review and comment on a draft of the guidelines. Fifth, additional opinions were solicited from random samples of active members of the ASA and participating organizations. Sixth, all available information was used to build consensus to finalize the Guidelines. A summary of recommendations is provided in appendix 1. Preparation of these updated guidelines followed a rigorous methodologic process, described in more detail in appendix 2 and other related publications.²⁻⁵

Criteria for literature acceptance included randomized controlled trials, prospective nonrandomized comparative studies (*e.g.*, quasiexperimental, cohort), retrospective comparative studies (*e.g.*, case control), observational studies (*e.g.*, correlational or descriptive statistics), and case reports or case series from peer-reviewed journals. Literature exclusion criteria included: (1) patients or practitioners described in the study who were specifically excluded or not identified by evidence criteria in the evidence model; (2) interventions not identified or specifically excluded in the evidence model; (3) studies with insufficient or no outcome data or reported outcomes not relevant to the evidence model; (4) articles with no original data, including review articles, descriptive letters, or editorials; (5) systematic reviews,

secondary data, meta-analysis, || or other articles with no original data; (6) abstracts, letters, or articles not published in a peer-reviewed journal; (7) studies outside of designated search dates; (8) duplicate data presented in a different reviewed article; or (9) retracted publications.

Within the text of these guidelines, literature classifications are reported for each intervention as follows: Category A, level 1, meta-analysis of randomized controlled trials; Category A, level 2, multiple randomized controlled trials; Category A, level 3, a single randomized controlled trial; Category B, level 1, nonrandomized studies with group comparisons; Category B, level 2, nonrandomized studies with associative findings; Category B, level 3, nonrandomized studies with descriptive findings; and Category B, level 4, case series or case reports. Statistically significant outcomes ($P < 0.01$) are designated as either beneficial (B) or harmful (H) to the patient; statistically nonsignificant findings are designated as equivocal (E). # When available, Category A evidence is given precedence over Category B evidence for any particular outcome. The lack of sufficient scientific evidence in the literature is reported in the text of the guidelines as “insufficient evidence.”*** Opinions regarding the scientific quality of the studies or opinion ratings of the strength of recommendations are not reported in this document.

Survey findings from task force-appointed expert consultants and samples of the memberships of ASA and participating organizations †† are reported in appendix 2. Survey responses for each recommendation are reported using a five-point scale based on median values from strongly agree to strongly disagree.

Guidelines

Evaluation of the Airway

Airway evaluation topics include (1) risk assessment to predict a difficult airway or risk of aspiration, and (2) airway examination (bedside and advanced). Risk assessment includes evaluation of information obtained from a patient's history or medical records, including demographic information, clinical conditions, diagnostic tests, and patient/family interviews or questionnaires. An airway examination is intended to identify the presence of upper airway pathologies or anatomical anomalies. Issues addressed in these guidelines include: (1) measurement of facial and jaw features, (2) anatomical measurements and landmarks, (3) imaging with ultrasound or virtual laryngoscopy/bronchoscopy, (4) three-dimensional printing, and (5) bedside endoscopy. **Literature Findings.** Patient demographic and personal characteristics evaluated for difficult airway risk prediction included age, sex, body mass index, weight, and height. Clinical characteristics assessed included a history of difficult

§Additional conflict of interest information is located after appendix 2 in this document.

||All meta-analyses are conducted by the ASA methodology group. Meta-analyses from other sources are reviewed but not included as evidence in this document. A minimum of five independent randomized controlled trials (*i.e.*, sufficient for fitting a random-effects model) is required for meta-analysis.

#The complete bibliography used to develop this updated advisory, arranged alphabetically by author, is available as Supplemental Digital Content 1, <http://links.lww.com/ALN/C694>.

***A more detailed description of the definition of insufficient evidence is described in appendix 2.

††See appendix 2 for tables reporting survey findings.

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intubation, distorted airway anatomy, snoring, obstructive sleep apnea, diabetes mellitus, or findings from diagnostic tests (e.g., radiography, computed tomography), patient interviews, and questionnaires. Measurement of facial and jaw features included mouth opening, the ability to prognath, head and neck mobility, prominent upper incisors, presence of a beard, and an upper lip bite test. Anatomical measures included Mallampati and modified Mallampati scores, thyromental distance, sternomental distance, interincisor distance, neck circumference, ratio of neck circumference to thyromental distance, ratio of height to thyromental distance, hyomental distance, and hyomental distance ratio. Measurements obtained from ultrasound included skin-to-hyoid distance, tongue volume, and distance from skin to epiglottis.

Observational studies reported comparative demographic findings for difficult *versus* nondifficult airway patients, as well as sensitivity, specificity, positive predictive, negative predictive, and accuracy values for difficult laryngoscopy, supraglottic airway use, and tracheal intubation. Findings for the above patient characteristics were shown to have very high predictive and comparative variability, with sensitivity, specificity, and significance values ranging from low to very high across all patient demographic measures (Category B2-E evidence).⁶⁻⁷⁰ No single characteristic was identified as consistently being more predictive than another, and multivariate measures intended to predict difficult airways were too few and diverse among the studies to determine a common set of predictors.

Case reports identified difficult laryngoscopy or difficult intubation occurring among patients with a variety of acquired or congenital disease states (e.g., ankylosing spondylitis, degenerative osteoarthritis, Treacher-Collins, Klippel-Feil, Down syndrome, mucopolysaccharidosis, and airway masses) (Category B4-H evidence).⁷¹⁻¹²²

Observational studies reported comparative findings for facial and jaw features and anatomical measurement for difficult *versus* nondifficult airway patients as well as sensitivity, specificity, positive predictive, negative predictive, and accuracy values for difficult laryngoscopy and intubation. Findings for facial and jaw features,^{7-11,13,14,18,27,33,38-40,42,43,45-47,49,51-54,57,58,64,68,123-159} anatomical measurements,^{7-11,13-15,18,22,23,27-30,33,35,37-40,45-47,49,51-54,57,58,60,64,65,68,70,123-132,134-154,156,158-203} and ultrasound anatomical measurements^{69,139,162,170,194,196,203-213} were shown to have very high predictive and comparative variability, with sensitivity, specificity, and significance values ranging from low to very high across all patient measures (Category B2-E evidence). No single characteristic was identified as consistently being more predictive than another, and multivariate measures intended to predict difficult airways were too few and diverse among the studies to determine a common set of predictors.

A prospective cohort study reported improved laryngeal views (during tongue protrusion) when transnasal endoscopy was added to the preoperative bedside evaluation (Category B2-B evidence),²¹⁴ and an observational study

utilizing preoperative endoscopic examination as an added airway assessment tool reported that airway management plans were revised in 26% of patients based on the results of this examination (Category B3-B evidence).²¹⁵ Observational studies and case reports indicated that radiography and computed tomography scans identified anatomical characteristics such as laryngeal deviations, cervical abnormalities, fractures, and abscesses that may suggest a potential difficult airway (Category B3-B and B4-B evidence).^{90,216-219}

Observational studies indicated that patient questionnaires may identify patients at risk of difficult ventilation and intubation (Category B3-B evidence).^{163,220,221} The literature was insufficient to evaluate the predictive value of virtual laryngoscopy/bronchoscopy or three-dimensional printing.

Survey Findings. The consultants and members of participating organizations strongly agree with recommendations to ensure that an airway risk assessment is performed by the person(s) responsible for airway management whenever feasible before the initiation of anesthetic care or airway management and with the recommendation to conduct an airway physical examination before the initiation of anesthetic care or airway management.

Recommendations for Evaluation of the Airway

- Before the initiation of anesthetic care or airway management, ensure that an airway risk assessment is performed by the person(s) responsible for airway management whenever feasible to identify patient, medical, surgical, environmental, and anesthetic factors (e.g., risk of aspiration) that may indicate the potential for a difficult airway.
 - When available in the patient's medical records, evaluate demographic information, clinical conditions, diagnostic test findings, patient/family interviews, and questionnaire responses.
 - Assess multiple demographic and clinical characteristics to determine a patient's potential for a difficult airway or aspiration.
- Before the initiation of anesthetic care or airway management, conduct an airway physical examination to further identify physical characteristics that may indicate the potential for a difficult airway.
 - The physical examination may include assessment of facial features‡‡ and assessment of anatomical measurements and landmarks.§§
 - Additional evaluation to characterize the likelihood or nature of the anticipated airway difficulty may include

‡‡Examples of facial features include mouth opening, the ability to prognath, head and neck mobility, prominent upper incisors, presence of a beard, and the upper lip bite test.

§§Examples of anatomical measures include Mallampati and modified Mallampati scores, thyromental distance, sternomental distance, interincisor distance, neck circumference, ratio of neck circumference to thyromental distance, ratio of height to thyromental distance, hyomental distance, and hyomental distance ratio. Measurements obtained from ultrasound included skin-to-hyoid distance, tongue volume, and distance from skin to epiglottis.

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bedside endoscopy, virtual laryngoscopy/bronchoscopy, or three-dimensional printing.||||

- Assess multiple airway features to determine a patient's potential for a difficult airway or aspiration.

Preparation for Difficult Airway Management

Topics related to interventions intended to prepare for difficult airway management include (1) the availability of equipment for airway management (*e.g.*, items for anesthetizing locations, portable storage unit, cart, or trolley for difficult airway management); (2) informing the patient with a known or suspected difficult airway; (3) preoxygenation; (4) patient positioning; (5) sedative administration; (6) local anesthesia; (7) supplemental oxygen during difficult airway management; (8) patient monitoring; and (9) human factors.## **Literature Findings.** Although the need for immediate access to difficult airway management equipment is a well accepted practice, the literature is insufficient to directly evaluate outcomes associated with the availability of such equipment. In addition, the literature is insufficient to evaluate the outcomes associated with informing the patient of a known or suspected difficult airway, preoxygenation, administration of sedatives or local anesthesia, or patient monitoring. One randomized controlled trial comparing the ramped with sniffing positions reported equivocal findings ($P > 0.01$) for laryngoscopic view and intubation success (*Category A3-E evidence*).²²² A nonrandomized study comparing the sniffing position with head and neck raised beyond the sniffing position reported improved laryngeal views with the raised position (*Category B-2 B evidence*).²²³

Survey Findings. The consultants and members of participating organizations strongly agree with recommendations to ensure that a skilled individual is present or immediately available to assist with airway management if a difficult airway is known or suspected; inform the patient or responsible person of the special risks and procedures pertaining to management of the difficult airway; and administer oxygen before initiating management of the difficult airway and to deliver supplemental oxygen throughout the process of difficult airway management, including extubation.

Recommendations for Preparation for Difficult Airway Management

- Ensure that airway management equipment is available in the room.***

||||In addition to airway evaluation, three-dimensional printing may be a useful means of testing methods for device insertion or for practitioner training.

##Human factors are generally considered part of airway preparation as well as management and postevent airway care (see table 3 for additional human factor information).

***See table 1 for examples of appropriate airway equipment.

- Ensure that a portable storage unit that contains specialized equipment for difficult airway management is immediately available.†††
- If a difficult airway is known or suspected:
 - Ensure that a skilled individual is present or immediately available to assist with airway management when feasible.
 - Inform the patient or responsible person of the special risks and procedures pertaining to management of the difficult airway.
 - Properly position the patient, administer supplemental oxygen before initiating management of the difficult airway,‡‡‡ and continue to deliver supplemental oxygen whenever feasible throughout the process of difficult airway management, including extubation.§§§
- Ensure that, at a minimum, monitoring according to the ASA Standards for Basic Anesthesia Monitoring are followed immediately before, during, and after airway management of all patients.||||

Anticipated Difficult Airway Management

Airway management of an anticipated difficult airway consists of interventions addressing awake tracheal intubation, anesthetized tracheal intubation, or both awake and anesthetized intubation.

Literature Findings for Awake Tracheal Intubation. Studies with observational findings reported successful awake intubation in 88 to 100% of anticipated difficult airway patients (*Category B3-B evidence*).^{224–227} Case reports for awake intubation (*e.g.*, blind tracheal intubation, intubation through supraglottic devices, optically guided intubation) also observed success with anticipated difficult airway patients (*Category B4-B evidence*).^{228–230}

Literature Findings for Anesthetized Tracheal Intubation. The literature is insufficient to evaluate the benefit or harm of the following interventions: use of cricoid pressure (*i.e.*, Sellick maneuver), pressure-limited mask ventilation *versus* ablation of spontaneous ventilation, maintenance of spontaneous ventilation *versus* ablation of spontaneous ventilation, administration of neuromuscular blockade to improve mask ventilation, or rocuronium with sugammadex *versus* suxamethonium or succinylcholine for airway management of anticipated difficult airway patients.

Literature Findings for Both Awake and Anesthetized Intubation. Interventions addressed for anticipated difficult airway patients receiving either awake or anesthetized

†††See table 2 for examples of specialized equipment for a portable storage unit.

‡‡‡The uncooperative or pediatric patient may impede opportunities for oxygen administration.

§§§Opportunities for supplemental oxygen administration include (but are not limited to) oxygen delivery by nasal cannulae, facemask, or supraglottic insufflation.

||||This recommendation does not preclude local or institutional policies that require more stringent monitoring.

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airway management include (1) airway maneuvers, (2) non-invasive airway management devices, (3) combination techniques, (4) invasive airway management interventions, and (5) extracorporeal membrane oxygenation (ECMO).

Airway Maneuvers. Two case reports indicated that use of a backward-upward-rightward pressure of the larynx maneuver resulted in successful intubation of difficult airway patients (*Category B4-B evidence*).^{231,232} One case report observed successful intubation using external cricoid manipulation after failed direct intubation (*Category B4-B evidence*).²³³

Noninvasive Devices. Noninvasive devices for airway management of patients with anticipated difficult airways include rigid laryngoscopic blades of alternative design and size; adjuncts (e.g., introducers, bougies, stylets, and alternative tracheal tubes); videolaryngoscopes; flexible intubation scopes; supraglottic airway devices; lighted or optical stylets; and rigid bronchoscopes. The literature is insufficient to evaluate which devices are most effective when attempted first after failed intubation, nor is the literature sufficient to evaluate the most effective order of devices to be used for attempted intubation of an anticipated difficult airway.

Rigid laryngoscopic blades of alternative design and size. A randomized controlled trial comparing levering laryngoscopes to standard laryngoscopes reported no differences in laryngoscopic view, but shorter times to intubation and fewer intubation maneuvers were needed for successful intubation with the levering laryngoscope (*Category A3-B evidence*).²³⁴ Case reports observed intubation success with levering laryngoscopic blades (*Category B4-B evidence*).^{235,236} Case reports of mechanical failure and arytenoid dislocation have been noted with levering blades (*Category B4-H evidence*).^{237–239}

Adjuncts (e.g., introducers, bougies, stylets, alternative tracheal tubes, intubating stylets, or tube changers). Observational studies reported intubation success ranging from 87 to 100% of patients (*Category B3-B evidence*),^{240–242} and case reports observed intubation success with bougies and stylets (*Category B4-B evidence*).^{243–248}

Videolaryngoscopes. Meta-analyses of randomized controlled trials comparing video-assisted laryngoscopy with direct laryngoscopy in patients with predicted difficult airways reported improved laryngeal views, a higher frequency of successful intubations, a higher frequency of first attempt intubations, and fewer intubation maneuvers with video-assisted laryngoscopy (*Category A1-B evidence*);^{249–259} findings for time to intubation were equivocal (*Category A1-E evidence*).^{250,253–255,258–261###} Randomized controlled trials comparing video-assisted laryngoscopy with awake laryngoscopy with a flexible intubation scope reported equivocal findings for laryngeal view, visualization time, first attempt intubation success, and time to intubation (*Category A2-E evidence*).^{262–265} Randomized controlled trials comparing channel-guided videolaryngoscopes with

non-channel-guided videolaryngoscopes reported equivocal findings for laryngeal view, intubation success, first attempt intubation, time to intubation, and needed intubation maneuvers (*Category A3-E evidence*).^{256,266} Randomized controlled trials reported equivocal findings for laryngoscopic view, intubation success, first attempt intubation success, and time to intubation when hyperangulated videolaryngoscopes were compared with nonangulated videolaryngoscopes for anticipated difficult airways (*Category A2-E evidence*).^{257,259}

Observational studies indicated intubation success rates for videolaryngoscopes ranging from 85 to 100% of patients^{267–275} and first attempt successful intubation rates ranging from 51 to 100%^{267,269,271–275} (*Category B3-B evidence*). Case reports observed videolaryngoscope intubation successes with a wide range of difficult airway conditions (*Category B4-B evidence*).^{160,276–297} Adverse outcomes that may occur include sore throat, laryngospasm, lip, dental, or mucosal injuries (*Category B4-H evidence*).^{278,298}

Flexible intubation scopes. A nonrandomized comparative study comparing intubation with a flexible bronchoscope versus direct laryngoscopy reported equivocal findings for complicated intubations (*Category B2-E evidence*).²⁹⁹ Studies with observational findings for flexible intubation scopes indicated success rates ranging from 78 to 100% (*Category B3-B evidence*).^{224–227,300–303} Case reports also observed successful intubation with flexible intubation scopes (*Category B4-B evidence*).^{304–356}

Supraglottic airway devices. Observational studies indicated successful supraglottic airway insertion and intubation ranging from 65 to 100% of anticipated difficult airway patients (*Category B3-B evidence*).^{357–367} Three observational studies reported oxygen desaturation occurring in 1.8 to 3.3% of patients after supraglottic airway placement (*Category B3-H evidence*).^{362,363,368} Case reports observed successful ventilation and intubation with various supraglottic airways (*Category B4-B evidence*).^{369–413}

Randomized controlled trials comparing flexible intubation through supraglottic airways versus flexible intubation scopes alone reported a higher frequency of first attempt intubation success with the supraglottic airway (*Category A2-B evidence*)^{414–417}; findings were equivocal for overall successful intubation and time to intubation (*Category A2-E evidence*).^{415–417} A randomized controlled trial comparing second generation supraglottic airways with first generation supraglottic airways reported faster times to intubation with second generation supraglottic airways (*Category A2-B evidence*).⁴¹⁸ Randomized controlled trials reported equivocal findings for overall successful intubation (*Category A2-E evidence*).^{418,419}

Lighted or optical stylets. A randomized controlled trial comparing intubation with a lightwand versus blind intubation for patients with anticipated difficult airways reported a significantly higher frequency of successful intubations and shorter

###See appendix 2 for meta-analysis details.

intubation times for the lightwand (*Category A3-B evidence*).⁴²⁰ Two randomized controlled trials reported shorter intubation times when lighted stylets were compared with direct laryngoscopy (*Category A2-B evidence*); findings were equivocal for successful intubation and first attempt success (*Category A2-E evidence*).^{255,421} Randomized controlled trials comparing lighted stylets with flexible bronchoscopes reported shorter intubation times with lighted stylets (*Category A3-B evidence*).^{422,423}

Observational studies reported successful intubation ranging from 84.9 to 100% of anticipated difficult airway patients when lighted stylets were used (*Category B3-B evidence*).^{424–428} Case reports observed successful intubations with lighted and optical stylets (*Category B4-B evidence*).^{429–437}

Rigid bronchoscopes. The literature is insufficient to evaluate the benefit or harm of the rigid bronchoscope for patients with anticipated difficult airways.

Combination techniques. Examples of combination techniques include: (1) direct or video laryngoscopy combined with either optical/video stylet, flexible intubation scope, airway exchange catheter, retrograde-placed guide wire, or supraglottic airway placement and (2) supraglottic airway combined with either optical/video stylet or flexible intubation scope (with or without hollow guide catheter). A randomized controlled trial comparing a lightwand combined with direct laryngoscopy *versus* a lightwand alone for intubation reported equivocal findings for successful intubation, first attempt success, time to intubation, and number of intubation attempts (*Category A3-E evidence*).⁴³⁸ A randomized controlled trial comparing a videolaryngoscope combined with a flexible bronchoscope reported a greater first attempt success rate with the combination technique than with a videolaryngoscope alone (*Category A3-B evidence*).⁴³⁹

Observational studies indicated successful intubation with combination techniques ranging from 80 to 90%^{440–445} and first attempt success rates ranging from 50 to 100% of anticipated difficult airway patients^{440–442,446} (*Category B3-B evidence*). Case reports also observed successful intubation occurring with various combinations of techniques (*Category B4-B evidence*).^{447–468}

Invasive Interventions. Invasive airway management interventions for anticipated difficult airway management include retrograde wire-guided intubation, front-of-neck percutaneous or surgical cricothyrotomy/tracheostomy, awake cricothyrotomy/tracheostomy, and ECMO. Case reports observed successful intubations when retrograde wire-guided intubation was performed for patients with anticipated difficult airways (*Category B4-B evidence*).^{469–473} A case report observes successful percutaneous tracheostomy for an anticipated difficult airway patient as an alternative after unsuccessful surgical tracheostomy (*Category B3-B evidence*).⁴⁷⁴ The literature is insufficient to evaluate awake cricothyrotomy/tracheostomy and ECMO for anticipated difficult airway patients.

Survey Findings for Anticipated Difficult Airway Management. The consultants and members of participating organizations strongly agree with the recommendation to identify a strategy

for (1) awake intubation, (2) the patient who can be adequately ventilated but is difficult to intubate, (3) the patient who cannot be ventilated or intubated, and (4) alternative approaches to airway management failure. The consultants strongly agree and members of participating organizations agree or strongly agree with recommendations to perform awake intubation, when appropriate, if the patient is suspected to be a difficult intubation and difficult ventilation (face mask/supraglottic airway) is anticipated; perform awake intubation, when appropriate, if the patient is suspected to be a difficult intubation and increased risk of aspiration is anticipated; and perform awake intubation, when appropriate, if the patient is suspected to be a difficult intubation and the patient is likely incapable of tolerating a brief apneic episode. The consultants and members of participating organizations strongly agree with the recommendation to perform awake intubation, when appropriate, if the patient is suspected to be a difficult intubation and difficulty with emergency invasive airway rescue is anticipated.

The consultants and members of participating organizations strongly agree with the recommendation to identify a preferred sequence of noninvasive devices to use for airway management if a noninvasive approach is selected. The consultants strongly agree and members of participating organizations agree or strongly agree that if difficulty is encountered with individual techniques, combination techniques may be performed. The consultants and members of participating organizations strongly agree with the recommendation to be aware of the passage of time the number of attempts and oxygen saturation. The consultants strongly agree and members of participating organizations agree or strongly agree with the recommendation to provide and test mask ventilation between attempts. The consultants and members of participating organizations strongly agree with recommendations to limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications; identify a preferred intervention if an elective invasive approach to the airway is selected; ensure that an invasive airway is performed by an individual trained in invasive airway techniques whenever possible; and identify an alternative invasive intervention if the selected invasive approach fails or is not feasible.

Recommendations for Anticipated Difficult Airway Management

- Have a preformulated strategy for management of the anticipated difficult airway.
 - This strategy will depend, in part, on the anticipated surgery, the condition of the patient, patient cooperation/consent, the age of the patient, and the skills and preferences of the anesthesiologist.
 - Identify a strategy for: (1) awake intubation, (2) the patient who can be adequately ventilated but is difficult to intubate, (3) the patient who cannot be ventilated or intubated, and (4) difficulty with emergency invasive airway rescue.

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- When appropriate, perform awake intubation if the patient is suspected to be a difficult intubation and one or more of the following apply: (1) difficult ventilation (face mask/supraglottic airway), (2) increased risk of aspiration, (3) the patient is likely incapable of tolerating a brief apneic episode, or (4) there is expected difficulty with emergency invasive airway rescue.***
- The uncooperative or pediatric patient may restrict the options for difficult airway management, particularly options that involve awake intubation. Airway management in the uncooperative or pediatric patient may require an approach (e.g., intubation attempts after induction of general anesthesia) that might not be regarded as a primary approach in a cooperative patient.
- Proceed with airway management after induction of general anesthesia when the benefits are judged to outweigh the risks.
- For either awake or anesthetized intubation, airway maneuver(s) may be attempted to facilitate intubation.
- Before attempting intubation of the anticipated difficult airway, determine the benefit of a noninvasive versus invasive approach to airway management.
 - If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.††††
 - If difficulty is encountered with individual techniques, combination techniques may be performed.‡‡‡‡
 - Be aware of the passage of time, the number of attempts, and oxygen saturation.
 - Provide and test mask ventilation after each attempt, when feasible.
 - Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.
 - If an elective invasive approach to the airway is selected, identify a preferred intervention.§§§§
 - Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.
 - If the selected approach fails or is not feasible, identify an alternative invasive intervention.
 - Initiate ECMO when/if appropriate and available.

***Any one factor alone (i.e., assessed difficulty with intubation or ventilation, increased risk of aspiration or desaturation) may be of sufficient clinical importance to warrant an awake intubation.

††††Noninvasive devices include rigid laryngoscopic blades of alternative designs and sizes (with adequate face mask ventilation after induction), adjuncts (e.g., introducers, bougies, stylets, alternative tracheal tubes, and supraglottic airways), video/video-assisted laryngoscopy, flexible intubation scopes, supraglottic airway devices, lighted or optical stylets, alternative optical laryngoscopes, and rigid bronchoscopes.

‡‡‡‡Combination techniques may include but are not limited to (1) direct or video laryngoscopy combined with either optical/video stylet, flexible scope intubation, airway exchange catheter, retrograde-placed guide wire or supraglottic airway placement and (2) supraglottic airway combined with either optical/video stylet, flexible scope intubation (with or without hollow guide catheter), or retrograde-placed guide wire.

Unanticipated and Emergency Difficult Airway Management

Airway management of an unanticipated or emergency difficult airway consists of interventions addressing (1) calling for help, (2) optimization of oxygenation, (3) use of a cognitive aid, (4) noninvasive airway management devices, (5) combination techniques, (6) invasive airway management interventions, and (7) ECMO.

Literature Findings. The literature is insufficient to evaluate patient outcomes associated with the immediate access to airway management support equipment or calling for help, although the necessity of these interventions is obvious. The literature is also insufficient to evaluate difficult airway patient outcomes associated with the use of a visual aid, cognitive aid, or algorithm for unanticipated or emergency difficult airways.

Case reports have observed successful emergency ventilation *via* tube exchangers using expiratory ventilation assistance after multiple failed intubation attempts (*Category B4-B evidence*).^{475,476} Devices for noninvasive airway management of patients with unanticipated or emergency difficult airways include rigid laryngoscopic blades of alternative designs and sizes; adjuncts (e.g., introducers, bougies, stylets, and alternative tracheal tubes), videolaryngoscopes; flexible intubation scopes; supraglottic airway devices (supraglottic airways); lighted or optical stylets; and rigid bronchoscopes.

The literature is insufficient to evaluate patient outcomes associated with rigid laryngoscopic blades of alternative designs and sizes for patients with unanticipated or emergency difficult airways. Observational findings from a randomized trial reported a first attempt intubation success rate for difficult airways of 96% with bougies and 82% with stylets and tracheal tubes in an emergency department (*Category B3-B evidence*).⁴⁷⁷ Case reports observed intubation successes with bougies, introducers, and stylets for patients with unanticipated or emergency difficult airways (*Category B4-B evidence*).^{114,478–485}

Nonrandomized studies comparing videolaryngoscopes with direct laryngoscopy reported equivocal findings for intubation success with difficult airways in emergency departments (*Category B1-E evidence*).^{6,486,487} Observational studies indicated successful videolaryngoscope-guided intubation rates after failed intubation ranging from 92 to 100% for unanticipated and emergency difficult airways (*Category B4-B evidence*).^{488–491} Case reports also observed successful intubation with videolaryngoscopes in unanticipated and emergency difficult airways (*Category B4-B evidence*).^{160,492–496} A retrospective observational study reported a flexible bronchoscopy success rate of 78% for intubation rescue after failed direct laryngoscopy (*Category B3-B evidence*).⁴⁸⁸ Case reports of flexible bronchoscopy or fiberoptic

§§§§Invasive interventions may include, but are not limited to, one of the following techniques: surgical cricothyrotomy (e.g., scalpel-bougie-tube), needle cricothyrotomy with a pressure-regulated device, large-bore cannula cricothyrotomy or surgical tracheostomy, retrograde wire-guided intubation, and percutaneous tracheostomy.

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nasotracheal intubation observed successful rescue intubations for unanticipated and emergency difficult airways (*Category B4-B evidence*).^{497–503}

A retrospective observational study reported a 78% successful rescue intubation rate, and another observational study reported 94.1% successful rescue ventilation with supraglottic airway placement (*Category B3-B evidence*).^{488,504} Case reports also observed successful rescue ventilation and intubation using supraglottic airways for unanticipated and emergency difficult airways (*Category B4-B evidence*).^{505–521}

A retrospective observational study reported a success rate with a lighted stylet of 77% for intubation rescue after failed direct laryngoscopy (*Category B3-B evidence*).⁴⁸⁸ Case reports observed successful intubations with lighted stylets after failed direct laryngoscopies for emergency airways (*Category B4-B evidence*).^{522,523} A case report observed successful intubation with a rigid bronchoscope in an emergency airway obstruction case (*Category B4-B evidence*).⁵²⁴

An observational study reported successful intubation in 97.7%, first attempt success in 86.4%, and successful ventilation in 100% of unanticipated difficult airway patients using a combination of a supraglottic airway and lighted stylet (*Category B3-B evidence*).⁵²⁵ Case reports also observed intubation success for unanticipated and emergency airway patients when combination techniques were used (*Category B4-B evidence*).^{526–536} The literature is insufficient to evaluate which of the above devices are most effective when attempted first after failed intubation, nor is the literature sufficient to evaluate the most effective order of devices to be used for attempted intubation of an unanticipated or emergency difficult airway.

Invasive airway management interventions for unanticipated and emergency difficult airway management include retrograde wire-guided intubation, front-of-neck percutaneous or surgical cricothyrotomy/tracheostomy, awake cricothyrotomy/tracheostomy, jet ventilation, and ECMO. A case series of two patients reported successful intubation using retrograde wire-guided intubation after failed intubation through a supraglottic airway (*Category B4-B evidence*).⁵³⁷ Observational findings from a randomized controlled trial comparing percutaneous dilatational tracheotomy with percutaneous cricothyrotomy reported successful procedure rates of 97.6 and 95.3% (*Category B3-B evidence*).⁵³⁸ and case reports also observed success with percutaneous procedures (*Category B4-B evidence*).^{539–544}

A retrospective observational study reported restoration of oxygen saturation levels to above 90% when rescue trans-tracheal jet ventilation was used (*Category B3-B evidence*).⁵⁴⁵ and case reports observed improvements in oxygen saturation levels with supraglottic jet oxygenation in “cannot intubate, cannot ventilate” situations (*Category B4-B evidence*).^{546,547} Case reports observed oxygen saturations of 72 to 100% with the use of ECMO for difficult airways before

intubation attempts for emergency procedures (*Category B4-B evidence*).^{548–550}

Survey Findings for Unanticipated and Emergency Difficult Airway Management. The consultants and members of participating organizations strongly agree with recommendations to determine the benefit of waking and/or restoring spontaneous breathing upon encountering an unanticipated difficult airway; determine the benefit of a noninvasive *versus* invasive approach to airway management; and identify a preferred sequence of noninvasive devices to use for airway management if a noninvasive approach is selected.

The consultants strongly agree and members of participating organizations agree or strongly agree that if difficulty is encountered with individual techniques, combination techniques may be performed. The consultants and members of participating organizations strongly agree with recommendations to be aware of the passage of time, the number of attempts, and oxygen saturation; provide and test mask ventilation between attempts; limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications; identify a preferred intervention if an invasive approach to the airway is necessary (*i.e.*, cannot intubate, cannot ventilate); ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible; ensure that an invasive airway is performed as rapidly as possible; and identify an alternative invasive intervention if the selected invasive approach fails or is not feasible.

Recommendations for Unanticipated and Emergency Difficult Airway Management

- Call for help.
- Optimize oxygenation.|||||
- When appropriate, refer to an algorithm##### and/or cognitive aid.
- Upon encountering an unanticipated difficult airway:
 - Determine the benefit of waking and/or restoring spontaneous breathing.
 - Determine the benefit of a noninvasive *versus* invasive approach to airway management.
 - If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.*****
 - If difficulty is encountered with individual techniques, combination techniques may be performed.
 - Be aware of the passage of time, the number of attempts, and oxygen saturation.
 - Provide and test mask ventilation after each attempt, when feasible.

|||||Examples include low- or high-flow nasal oxygen during efforts securing a tube.

#####See figs. 1 to 4 for examples of algorithms or cognitive aids.

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- Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.
- If an invasive approach to the airway is necessary (*i.e.*, cannot intubate, cannot ventilate), identify a preferred intervention.†††††
 - Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.
 - Ensure that an invasive airway is performed as rapidly as possible.
 - If the selected invasive approach fails or is not feasible, identify an alternative invasive intervention.
 - Initiate ECMO when/if appropriate and available.

Confirmation of Tracheal Intubation

Literature Findings. Studies with observational findings indicate that capnography or end-tidal carbon dioxide monitoring confirms tracheal intubation in 88.5 to 100% of difficult airway patients (*Category B3-B evidence*).^{551,552} Case reports also observed intubation confirmation with capnography (*Category B4-B evidence*).^{354,553} The literature is insufficient to evaluate whether visualization (any technique), flexible bronchoscopy, ultrasonography, or radiography can be effective in confirming appropriate tracheal intubation.

Survey Findings. The consultants and members of participating organizations strongly agree with the recommendation to confirm tracheal intubation using capnography or end-tidal carbon dioxide monitoring. The consultants strongly agree and members of participating organizations agree or strongly agree with the recommendation that when uncertain about the location of the tracheal tube, determine whether to either remove it and attempt ventilation or use additional techniques to confirm positioning of the tube.

Recommendations for Confirmation of Tracheal Intubation

- Confirm tracheal intubation using capnography or end-tidal carbon dioxide monitoring.
- When uncertain about the location of the tracheal tube, determine whether to either remove it and attempt ventilation or use additional techniques to confirm positioning of the tracheal tube.‡‡‡‡‡

****Noninvasive devices include rigid laryngoscopic blades of alternative design and size (with adequate face mask ventilation after induction), adjuncts (*e.g.*, introducers, bougies, stylets, alternative tracheal tubes, and supraglottic airways), video/video-assisted laryngoscopy, flexible intubation scopes, supraglottic airway devices, lighted optical stylets, alternative optical laryngoscopes, and rigid bronchoscopes.

†††††Invasive interventions may include surgical cricothyrotomy (*e.g.*, scalpel-bougie technique), surgical tracheostomy, needle cricothyrotomy with pressure-regulated ventilation (*e.g.*, transtracheal jet ventilation or other pressure-regulated techniques), and large-bore cannula cricothyrotomy (including Seldinger guided techniques).

Extubation of the Difficult Airway

An extubation strategy includes interventions that may be used to facilitate airway management associated with extubation of a difficult airway. Extubation intervention topics addressed by these guidelines include: (1) assessment of patient readiness for extubation, (2) the presence of a skilled individual to assist with extubation, (3) selection of an appropriate time and location for extubation, (4) planning for possible reintubation, (5) elective tracheostomy, (6) awake extubation or supraglottic airway removal, (7) supplemental oxygen throughout the extubation process, and (8) extubation with an airway exchange catheter or supraglottic airway. The task force regards the concept of an extubation strategy as a logical extension of the intubation strategy.

Literature Findings. A retrospective observational study comparing successfully extubated patients with patients who failed extubation observed differences in duration of intubation; conditions associated with failed extubation included airway granulations and subglottic stenosis (*Category B1-H evidence*).⁵⁵⁴ An observational study reported that staged extubation and reintubation with a Cook airway exchange catheter was successful in 92% of known or presumed difficult extubation patients (*Category B3-B evidence*).⁵⁵⁵ Another observational study reported single occurrences of a wire in the esophagus, a nontolerable cough, and gagging or salivation with a Cook airway exchange catheter (*Category B3-H evidence*).⁵⁵⁶ A case report observed successful extubation with an airway exchange catheter (*Category B3-B evidence*).⁵⁵⁷ Another case report observed an esophageal misplacement of an airway exchange catheter during extubation of a difficult airway patient (*Category B3-H evidence*).⁵⁵⁸ The literature is insufficient to evaluate the benefits of the presence of a skilled individual to assist with extubation, selection of an appropriate time and location for extubation, awake extubation or supraglottic airway removal, supplemental oxygen, planning for possible reintubation, and elective tracheostomy for difficult airway patients.

Survey Findings. The consultants and members of participating organizations strongly agree with recommendations to have a preformulated strategy for extubation and subsequent airway management, ensure that a skilled individual is present to assist with extubation, and select an appropriate time and location for extubation when possible. The consultants strongly agree and members of participating organizations agree or strongly agree with recommendations to assess the relative clinical merits and feasibility of the short-term use of an airway exchange catheter and/or supraglottic airway that can serve as a guide for expedited reintubation and evaluate the risks and benefits of elective surgical tracheostomy before attempting extubation. The

‡‡‡‡‡Additional techniques include, but are not limited to, visualization (any technique), flexible bronchoscopy, ultrasonography, or radiography.

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consultants and members of participating organizations strongly agree with recommendations to evaluate the risks and benefits of awake extubation *versus* extubation before the return to consciousness and assess the clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.

Recommendations for Extubation of the Difficult Airway

- Have a preformulated strategy for extubation and subsequent airway management.
 - This strategy will depend, in part, on the surgery/procedure, other perioperative circumstances, the condition of the patient, and the skills and preferences of the clinician.
- Assess patient readiness for extubation.
- Ensure that a skilled individual is present to assist with extubation when feasible.
- Select an appropriate time and location for extubation when possible.
- Assess the relative clinical merits and feasibility of the short-term use of an airway exchange catheter and/or supraglottic airway that can serve as a guide for expedited reintubation. §§§§§
 - Minimize the use of an airway exchange catheter with pediatric patients.
- Before attempting extubation, evaluate the risks and benefits of elective surgical tracheostomy.
- Evaluate the risks and benefits of awake extubation *versus* extubation before the return to consciousness.
- When feasible, use supplemental oxygen throughout the extubation process.
- Assess the clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.

Follow-up Care

Follow-up care includes the topics of: (1) postextubation care (*i.e.*, steroids, racemic epinephrine), (2) postextubation counseling (*i.e.*, informing and advising the patient

or responsible individual of the occurrence and potential complications associated with a difficult airway), (3) documentation of difficult airway and management in the medical record and to the patient, and (4) registration with a difficult airway notification service.

Literature Findings. The literature is insufficient to evaluate the benefits of postextubation steroids or epinephrine, counseling, documentation in the medical record, or registration with a difficult airway notification service. A case report of a difficult airway patient who was awakened after failed intubation indicated that records of previous difficult intubations were unavailable (*Category B4-H evidence*).⁵⁵⁹

Survey Findings. The consultants and members of participating organizations strongly agree with the recommendation to inform the patient (or responsible person) of the airway difficulty that was encountered to provide the patient (or responsible person) with information to guide and facilitate the delivery of future care and to document the presence and nature of the airway difficulty in the medical record to guide and facilitate the delivery of future care.

Recommendations for Follow-up Care. • Use postextubation steroids and/or racemic epinephrine when appropriate.

- Inform the patient or a responsible person of the airway difficulty that was encountered to provide the patient (or responsible person) with a role in guiding and facilitating the delivery of future care.
 - The information conveyed may include (but is not limited to) the presence of a difficult airway, the apparent reasons for difficulty, how the intubation was accomplished, and the implications for future care.
- Document the presence and nature of the airway difficulty in the medical record to guide and facilitate the delivery of future care. |||||
- Instruct the patient to register with an emergency notification service when appropriate and feasible.

|||||Aspects of documentation include, but are not limited to, (1) a description of the airway difficulties that were encountered, distinguishing between difficulties encountered in facemask or supraglottic airway ventilation and difficulties encountered in tracheal intubation and (2) a description of the various airway management techniques that were used, indicating the extent to which each of the techniques served either a beneficial or detrimental role in management of the difficult airway.

§§§§§These interventions are considered advanced techniques.

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Appendix 1: Summary of Recommendations**Recommendations for Evaluation of the Airway**

- Before the initiation of anesthetic care or airway management, ensure that an airway risk assessment is performed by the person(s) responsible for airway management whenever feasible to identify patient, medical, surgical, environmental, and anesthetic factors (*e.g.*, risk of aspiration) that may indicate the potential for a difficult airway.
 - When available in the patient's medical records, evaluate demographic information, clinical conditions, diagnostic test findings, patient/family interviews, and questionnaire responses.
 - Assess multiple demographic and clinical characteristics to determine a patient's potential for a difficult airway or aspiration.
- Before the initiation of anesthetic care or airway management, conduct an airway physical examination to further identify physical characteristics that may indicate the potential for a difficult airway.
 - The physical examination may include assessment of facial features##### and assessment of anatomical measurements and landmarks.*****
 - Additional evaluation to characterize the likelihood or nature of the anticipated airway difficulty may include bedside endoscopy, virtual laryngoscopy/bronchoscopy, or three-dimensional printing.†††††
- Assess multiple airway features to determine a patient's potential for a difficult airway or aspiration.

Recommendations for Preparation for Difficult Airway Management

- Ensure that airway management equipment is available in the room.†††††
- Ensure that a portable storage unit that contains specialized equipment for difficult airway management is immediately available.§§§§§
- If a difficult airway is known or suspected:

#####Examples of facial features include mouth opening, the ability to prognath, head and neck mobility, prominent upper incisors, presence of a beard, and the upper lip bite test.

*****Examples of anatomical measures include Mallampati and modified Mallampati scores, thyromental distance, sternomental distance, interincisor distance, neck circumference, ratio of neck circumference to thyromental distance, ratio of height to thyromental distance, hyomental distance, and hyomental distance ratio. Measurements obtained from ultrasound included skin-to-hyoid distance, tongue volume, and distance from skin to epiglottis.

†††††In addition to airway evaluation, three-dimensional printing may be a useful means of testing methods for device insertion or for practitioner training.

†††††See table 1 for examples of appropriate airway equipment.

§§§§§See table 2 for examples of specialized equipment for a portable storage unit.

- Ensure that a skilled individual is present or immediately available to assist with airway management when feasible.
 - Inform the patient or responsible person of the special risks and procedures pertaining to management of the difficult airway.
 - Properly position the patient, administer supplemental oxygen before initiating management of the difficult airway,||||| and continue to deliver supplemental oxygen whenever feasible throughout the process of difficult airway management, including extubation.#####
- Ensure that, at a minimum, monitoring according to the ASA Standards for Basic Anesthesia Monitoring is performed immediately before, during, and after airway management of all patients.*****

Recommendations for Anticipated Difficult Airway Management

- Have a preformulated strategy for management of the anticipated difficult airway.
 - This strategy will depend, in part, on the anticipated surgery, the condition of the patient, patient cooperation/consent, the age of the patient, and the skills and preferences of the anesthesiologist.
 - Identify a strategy for: (1) awake intubation, (2) the patient who can be adequately ventilated but is difficult to intubate, (3) the patient who cannot be ventilated or intubated, and (4) difficulty with emergency invasive airway rescue.
 - When appropriate, perform awake intubation if the patient is suspected to be a difficult intubation and one or more of the following apply: (1) difficult ventilation (face mask/supraglottic airway), (2) increased risk of aspiration, (3) the patient is likely incapable of tolerating a brief apneic episode, or (4) there is expected difficulty with emergency invasive airway rescue.†††††
 - The uncooperative or pediatric patient may restrict the options for difficult airway management, particularly options that involve awake intubation. Airway management in the uncooperative or pediatric patient may require an approach (*e.g.*, intubation attempts after induction of general anesthesia) that might not be regarded as a primary approach in a cooperative patient.

|||||The uncooperative or pediatric patient may impede opportunities for oxygen administration.

#####Opportunities for supplemental oxygen administration include (but are not limited to) oxygen delivery by nasal cannulae, facemask, or supraglottic insufflation.

*****This recommendation does not preclude local or institutional policies that require more stringent monitoring.

†††††Any one factor alone (*i.e.*, assessed difficulty with intubation or ventilation, increased risk of aspiration or desaturation) may be of sufficient clinical importance to warrant an awake intubation.

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- Proceed with airway management after induction of general anesthesia when the benefits are judged to outweigh the risks.
 - For either awake or anesthetized intubation, airway maneuver(s) may be attempted to facilitate intubation.
 - Before attempting intubation of the anticipated difficult airway, determine the benefit of a noninvasive *versus* invasive approach to airway management.
 - If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.
 - If difficulty is encountered with individual techniques, combination techniques may be performed.
 - Be aware of the passage of time, the number of attempts, and oxygen saturation.
 - Provide and test mask ventilation after each attempt, when feasible.
 - Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.
 - If an elective invasive approach to the airway is selected, identify a preferred intervention.
 - Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.
 - If the selected approach fails or is not feasible, identify an alternative invasive intervention.
 - Initiate ECMO when/if appropriate and available.
- Upon encountering an unanticipated difficult airway:
 - Determine the benefit of waking and/or restoring spontaneous breathing.
 - Determine the benefit of a noninvasive *versus* invasive approach to airway management.
 - If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.
 - If difficulty is encountered with individual techniques, combination techniques may be performed.
 - Be aware of the passage of time, the number of attempts, and oxygen saturation.
 - Provide and test mask ventilation after each attempt, when feasible.
 - Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.
 - If an invasive approach to the airway is necessary (*i.e.*, cannot intubate, cannot ventilate), identify a preferred intervention.
 - Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.
 - Ensure that an invasive airway is performed as rapidly as possible.
 - If the selected invasive approach fails or is not feasible, identify an alternative invasive intervention.
 - Initiate ECMO when/if appropriate and available.

Recommendations for Unanticipated and Emergency Difficult Airway Management

- Call for help.
- Optimize oxygenation.
- When appropriate, refer to an algorithm and/or cognitive aid.

Noninvasive devices include rigid laryngoscopic blades of alternative designs and sizes (with adequate face mask ventilation after induction), adjuncts (*e.g.*, introducers, bougies, stylets, alternative tracheal tubes, and supraglottic airways), video/video-assisted laryngoscopy, flexible intubation scopes, supraglottic airway devices, lighted or optical stylets, alternative optical laryngoscopes, and rigid bronchoscopes.

Combination techniques may include, but are not limited to, (1) direct or video laryngoscopy combined with either optical/video stylet, flexible scope intubation, airway exchange catheter, retrograde-placed guide wire, or supraglottic airway placement and (2) supraglottic airway combined with either optical/video stylet, flexible scope intubation (with or without hollow guide catheter), or retrograde-placed guide wire.

Invasive interventions may include, but are not limited to, one of the following techniques: surgical cricothyrotomy (*e.g.*, scalpel-bougie-tube), needle cricothyrotomy with a pressure-regulated device, large-bore cannula cricothyrotomy or surgical tracheostomy, retrograde wire-guided intubation, and percutaneous tracheostomy.

Examples include low- or high-flow nasal oxygen during efforts securing a tube.

See figs. 1 to 4 for examples of algorithms or cognitive aids.

Recommendations for Confirmation of Tracheal Intubation

- Confirm tracheal intubation using capnography or end-tidal carbon dioxide monitoring.
- When uncertain about the location of the tracheal tube, determine whether to either remove it and attempt ventilation or use additional techniques to confirm positioning of the tracheal tube.

Noninvasive devices include rigid laryngoscopic blades of alternative design and size (with adequate face mask ventilation after induction), adjuncts (*e.g.*, introducers, bougies, stylets, alternative tracheal tubes, and supraglottic airways), video/video-assisted laryngoscopy, flexible intubation scopes, supraglottic airway devices, lighted optical stylets, alternative optical laryngoscopes, and rigid bronchoscopes.

Invasive interventions may include surgical cricothyrotomy (*e.g.*, scalpel-bougie technique), surgical tracheostomy, needle cricothyrotomy with pressure-regulated ventilation (*e.g.*, transtracheal jet ventilation or other pressure-regulated techniques), and large-bore cannula cricothyrotomy (including Seldinger guided techniques).

Additional techniques include but are not limited to visualization (any technique), flexible bronchoscopy, ultrasonography, or radiography.

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Recommendations for Extubation of the Difficult Airway

- Have a preformulated strategy for extubation and subsequent airway management.
 - This strategy will depend, in part, on the surgery/procedure, other perioperative circumstances, the condition of the patient, and the skills and preferences of the clinician.
- Assess patient readiness for extubation.
- Ensure that a skilled individual is present to assist with extubation when feasible.
- Select an appropriate time and location for extubation when possible.
- Assess the relative clinical merits and feasibility of the short-term use of an airway exchange catheter and/or supraglottic airway that can serve as a guide for expedited reintubation. |||||
- Minimize the use of an airway exchange catheter with pediatric patients.
- Before attempting extubation, evaluate the risks and benefits of elective surgical tracheostomy.
- Evaluate the risks and benefits of awake extubation *versus* extubation before the return to consciousness.
- When feasible, use supplemental oxygen throughout the extubation process.
- Assess the clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.

Recommendations for Follow up Care

- Use postextubation steroids and/or racemic epinephrine when appropriate.
- Inform the patient or a responsible person of the airway difficulty that was encountered to provide the patient (or responsible person) with a role in guiding and facilitating the delivery of future care.
 - The information conveyed may include (but is not limited to) the presence of a difficult airway, the apparent reasons for difficulty, how the intubation was accomplished, and the implications for future care.
- Document the presence and nature of the airway difficulty in the medical record to guide and facilitate the delivery of future care. #####
- Instruct the patient to register with an emergency notification service when appropriate and feasible.

|||||These interventions are considered advanced techniques.

#####Aspects of documentation include, but are not limited to, (1) a description of the airway difficulties that were encountered, distinguishing between difficulties encountered in facemask or supraglottic airway ventilation, and difficulties encountered in tracheal intubation and (2) a description of the various airway management techniques that were used, indicating the extent to which each of the techniques served either a beneficial or detrimental role in management of the difficult airway.

Appendix 2: Methods and Analyses

For these updated guidelines, a systematic search and review of peer-reviewed published literature was conducted, with scientific findings summarized and reported below and in the document. Assessment of conceptual issues, practicality, and feasibility of the guideline recommendations were also evaluated, with opinion data collected from surveys and other sources. The systematic literature review is based on evidence linkages or statements regarding potential relationships between interventions and outcomes associated with difficult airway management. The evidence model below guided the search, providing inclusion and exclusion information regarding patients, procedures, practice settings, providers, clinical interventions, and outcomes. The opinion data were obtained from surveys based on proposed recommendations derived from the literature findings (see “Consensus-based evidence” below).

After review of all evidentiary information, the task force placed each recommendation into one of three categories: (1) provide the intervention or treatment, (2) provide the patient with the intervention or treatment based on circumstances of the case and the practitioner’s clinical judgment, or (3) do not provide the intervention or treatment. The policy of the ASA Committee on Standards and Practice Parameters is to update practice guidelines every 5 yr. The ASA Committee on Standards and Practice Parameters reviews all practice guidelines at the ASA annual meeting and determines update and revision timelines.

Evidence Model

Patients

- Inclusion criteria:
 - Patients with or at risk of difficult mask ventilation
 - Patients with or at risk of difficult laryngoscopy (direct or indirect)*****
 - Patients with or at risk of difficult ventilation using a supraglottic airway
 - Patients with or at risk of difficult/failed tracheal intubation
 - Patients with or at risk of difficult/failed extubation
 - Anticipated difficult airway patients
 - Unanticipated difficult airway patients
 - Adult patients
 - Pediatric patients including infants and neonates
 - Obstetric patients
 - ICU/critically ill patients
- Exclusion criteria
 - Patients where difficult airways are not encountered

*****Patients “at risk” refers to difficult laryngoscopy where it is not possible to visualize any portion of the vocal cords after multiple attempts.

+++++These include, but are not limited to hypoxemia, hypotension, severe metabolic acidosis, and right ventricular failure.

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- Physiologically difficult airways that are not anatomically difficult††††††††††

Procedures

- Inclusion criteria:
 - Procedures requiring general anesthesia
 - Procedures requiring sedation or regional anesthesia
 - Elective/emergency airway management without a procedure
 - Diagnostic procedures
 - Elective procedures
 - Emergency procedures
 - Invasive airway access
- Exclusion criteria:
 - Airway management during cardiopulmonary resuscitation

Practice Settings

- Inclusion criteria:
 - In-hospital
 - Perioperative care settings
 - Nonoperating room anesthetic setting
 - Emergency department setting
 - ICU/critical care setting
 - Ambulatory surgery centers
 - Office-based procedure/anesthesia locations
 - Out-of-hospital or prehospital (*i.e.*, field) settings, included only if emergency invasive airway is performed
- Exclusion criteria:
 - Out-of-hospital or prehospital (*i.e.*, field) settings, excluded except for emergency invasive airway

Providers

- Inclusion criteria:
 - Anesthesia care providers
- Exclusion criteria:
 - Individuals who do not deliver anesthetic care and airway management

Interventions

- Evaluation of the airway
 - Risk prediction (for difficult airway or aspiration) obtained from history/medical records
 - Demographic conditions (*e.g.*, age, sex)
 - Clinical conditions (*e.g.*, body mass index, previous difficult airway, diabetes, obesity)
 - Diagnostic test findings (*e.g.*, radiography, computed tomography, magnetic resonance imaging, bedside endoscopy, bedside ultrasound)
 - Patient interview/questionnaires (*e.g.*, MACOCHA, STOP-Bang)
 - Airway assessment/exam (bedside and advanced) when a difficult airway is known or suspected

- Assessment of facial features (*e.g.*, mouth opening, nose slope, neck slope, ratio of brow to nose to chin, full beard)
- Upper lip bite test
- Anatomical measurements and landmarks (*e.g.*, Mallampati/modified Mallampati, neck circumference, neck mobility (neck radiation changes), prognathism, ruler or finger measurements of thyromental, sternomental, or temporomandibular distance)
- Individual measures contained in airway scoring systems (*e.g.*, Wilson risk sum scores, simplified airway risk index scores, El-Ganzouri scores)
- Imaging
 - Ultrasound
 - Virtual laryngoscopy/bronchoscopy (magnetic resonance imaging/computed tomography reconstruction)
 - 3D printing
 - Bedside endoscopy
 - Direct laryngoscopy (*e.g.*, Cormac–Lehane grades)
 - Bronchoscopy
 - Nasopharyngoscopy
- Preparation for difficult airway management
 - Availability of equipment for airway management (*i.e.*, items for anesthetizing locations, portable storage unit, cart, or trolley for difficult airway management)
 - Availability of an assigned individual to provide assistance when a difficult airway is encountered (from previous evidence model)
 - Informing the patient with a known or suspected difficult airway
 - Preoxygenation††††††††††
 - Preoxygenation *versus* room air
 - 3 to 5 min of O₂ (3 to 5 min at tidal volume, F_{IO₂} = 1) *versus* 1 min (1 min at tidal volume, F_{IO₂} = 1)
 - 3 to 5 min of O₂ (3 to 5 min at tidal volume, F_{IO₂} = 1) *versus* 4 to 12 deep breaths at forced vital capacity in 1 min or the shortest time lag (F_{IO₂} = 1)
 - 3 min of preoxygenation to reach an end-tidal oxygen concentration of 0.90 or higher (EtO₂ ≥ 0.9)
 - Preoxygenation using noninvasive ventilation (pressure support with positive end expiratory pressure)
 - Patient positioning (*e.g.*, sniffing, sitting, head/neck extension, head-elevated laryngoscopy, ramped)
 - Sedative *versus* hypnotic administration
 - Local anesthesia *versus* no local anesthesia

††††††††††Methods to deliver preoxygenation include oxygen delivery with nasal cannulae, facemask (including humidified nasal cannula and continuous positive airway pressure), or supraglottic airway insufflation. §§§§§§§§§§Methods to deliver supplemental oxygen include oxygen delivery with nasal cannulae, facemask (including humidified nasal cannula and continuous positive airway pressure), or supraglottic airway insufflation.

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- Supplemental oxygen during airway management
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- Patient monitoring (according to ASA standards)
- Anticipated difficult airway management.
 - Awake tracheal intubation (any device)
 - Awake/sedated intubation *versus* intubation after induction
 - Awake/sedated *versus* anesthetized intubation in patients with full stomach
 - Anesthetized tracheal intubation
 - Rapid sequence induction/intubation
- With *versus* without cricoid pressure (Sellick maneuver)
- Pressure-limited mask ventilation *versus* abolition of spontaneous ventilation
 - Maintenance of spontaneous ventilation *versus* abolition of spontaneous ventilation
 - Administration of neuromuscular blockade to improve mask ventilation
 - Rocuronium with sugammadex *versus* suxamethonium or succinylcholine
- Both awake and anesthetized intubation
 - Airway maneuvers (e.g., jaw thrust chin lift, external laryngeal manipulation, backwards/upwards/rightwards pressure)
- Airway management devices
 - Rigid laryngoscopic blades of alternative design and size: with adequate face mask ventilation after induction (alternatives to standard blades such as Macintosh, Miller)
 - Adjuncts – introducers, bougies, stylets, alternative tracheal tubes
 - Video/video-assisted laryngoscopy
- Video/video-assisted laryngoscopy *versus* direct laryngoscopy
- Video/video-assisted laryngoscopy *versus* fiberoptic laryngoscopy
- Channel-guided *versus* non-channel-guided videolaryngoscopes|||||||
- Hyperangulated *versus* nonangulated devices
 - Flexible intubation scopes
- Flexible intubation scopes *versus* blind tracheal or nasotracheal intubation
- Flexible intubation scopes *versus* rigid laryngoscopic intubation
 - Supraglottic airway
- Supraglottic airway *versus* face mask for ventilation
- Intubation with *versus* without a supraglottic airway
- Intubating techniques with a supraglottic airway
 - Laryngoscopic intubation with a supraglottic airway *versus* blind intubation with a supraglottic airway
 - Flexible scope intubation with a supraglottic airway *versus* standard laryngoscopic intubation with a supraglottic airway
 - Optically/image-guided intubation with a supraglottic airway *versus* standard laryngoscopic intubation with a supraglottic airway
- Second *versus* first generation supraglottic airway
 - Lighted stylet, light wand, optical stylet
- Lighted stylet, light wand, or optical stylet *versus* blind intubation
- Lighted stylet, light wand, or optical stylet *versus* laryngoscopic intubation
 - Rigid bronchoscope
- Intubation with *versus* without a supraglottic airway
- Intubating techniques with a supraglottic airway
- Laryngoscopic intubation with a supraglottic airway *versus* blind intubation with a supraglottic airway
- Flexible scope intubation with a supraglottic airway *versus* standard laryngoscopic intubation with a supraglottic airway
 - Additional airway management interventions (with anticipated failure of airway management devices)
 - Retrograde wire-guided intubation
 - Invasive airway
- Cricothyrotomy (percutaneous)
- Cricothyrotomy (surgical)
- Tracheostomy/tracheotomy
- Scalpel bougie technique or scalpel bougie tube technique *versus* needle cannula technique
- Awake/sedated cricothyrotomy/tracheostomy for invasive airway
 - Combination techniques#####
- Unanticipated and emergency (*i.e.*, cannot oxygenate or ventilate) difficult airway management.
 - Call for help
 - Maximize oxygenation
 - Nasal oxygen during efforts securing a tube
 - Expiratory ventilation assistance
 - High-flow nasal cannula oxygen/transnasal humidified rapid insufflation ventilatory exchange
 - Use of a cognitive aid
 - Airway management devices
 - Rigid bronchoscope

#####Channel-guided devices include Airtraq, Kingvision, and Pentax videolaryngoscopes. Non-channel-guided devices include Glidescope, C-MAC, and McGrath videolaryngoscopes.

#####Combination techniques include (1) direct laryngoscopy with supraglottic airway, bougie, optical stylet, flexible intubation scope, airway exchange catheter, or retrograde intubation; (2) videolaryngoscopes with supraglottic airway, bougie, optical stylet, flexible scope/fiberoptic scope, airway exchange catheter, or retrograde intubation; (3) flexible intubation scope with supraglottic airway, airway exchange catheter, retrograde intubation, or cricothyrotomy; (4) optical stylet with supraglottic airway, bougie, flexible scope intubation scope, or retrograde intubation; and (5) airway exchange catheter with supraglottic airway, retrograde intubation, or cricothyrotomy.

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- Rigid laryngoscopic blades of alternative design and size: with adequate face mask ventilation after induction (alternatives to standard blades such as Macintosh, Miller)
- Lighted stylet, light wand, optical stylet
- Lighted stylet, light wand, or optical stylet *versus* blind intubation
- Lighted stylet, light wand, or optical stylet *versus* laryngoscopic intubation
 - Flexible intubation scopes)
- Flexible scope intubation *versus* blind tracheal or nasotracheal intubation
- Flexible scope intubation *versus* rigid laryngoscopic intubation
 - Video/video-assisted laryngoscopy
- Video/video-assisted laryngoscopy *versus* direct laryngoscopy
- Video/video-assisted laryngoscopy *versus* flexible scope intubation
- Hyperangulated *versus* nonangulated devices
- Channel-guided *versus* non-channel-guided videolaryngoscopes
- Alternative optical laryngoscopes
 - Adjuncts – introducers, bougies, stylets, alternative tracheal tubes
 - Supraglottic airway
- Supraglottic airway *versus* face mask for ventilation
- Intubation with *versus* without a supraglottic airway
- Intubating techniques with a supraglottic airway
 - Laryngoscopic intubation with a supraglottic airway *versus* blind intubation with a supraglottic airway
 - Flexible scope intubation with a supraglottic airway *versus* standard laryngoscopic intubation with a supraglottic airway
 - Optically/image-guided intubation with a supraglottic airway *versus* standard laryngoscopic intubation with a supraglottic airway
- Second- *versus* first-generation supraglottic airway
 - Additional airway management interventions (with anticipated failure of airway management devices)
 - Retrograde wire-guided intubation
 - Emergency invasive airway
- Cricothyrotomy (percutaneous)
- Cricothyrotomy (surgical)
- Tracheostomy/tracheotomy
- Scalpel bougie technique or scalpel bougie tube technique *versus* needle cannula technique
- Awake/sedated cricothyrotomy/tracheostomy for emergency invasive airway
 - ECMO
- Jet ventilation
- Combination techniques
- Confirmation of successful intubation
 - Pulse oximetry (for oxygen saturation levels/desaturation/hypoxemia/hypoxia)
 - Capnography for carbon dioxide levels/hypercarbia/hypercapnia
 - Capnography *versus* capnometry
 - Capnography *versus* colorimetry
 - Visualization (any technique)
 - Flexible bronchoscopy
 - Ultrasound
 - Radiography
- Extubation
 - Assess readiness for extubation
 - Presence of a skilled individual to assist
 - Selection of ideal time and location
 - Plan for possible reintubation
 - Elective tracheostomy
 - Awake extubation or supraglottic airway removal
 - Awake tracheal tube extubation *versus* asleep (anesthetized) extubation
 - Awake supraglottic airway removal *versus* anesthetized supraglottic airway removal
 - Apnea *versus* spontaneous ventilation during extubation
 - Supplemental oxygen throughout extubation (*e.g.*, by mask, blow-by, nasal cannula, continuous positive airway pressure, bilevel positive airway pressure, or high-flow nasal cannula)
 - Supplemental oxygen after extubation
 - Staged extubation
- Airway exchange catheter
- Supraglottic airway exchange catheter (Bailey maneuver)
- Follow-up care
 - Postextubation steroids
 - Postextubation epinephrine
 - Postextubation counseling (*i.e.*, informing and advising the patient or responsible patient of the occurrence and potential complications associated with a difficult airway)
 - Documentation of difficult airway and management in the medical record and to the patient
 - Registration with an emergency notification service
- Human factors

Excluded Interventions

- Interventions not addressing any aspect of airway and anesthetic management
- Lung separation
 - Double lumen tube

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- Bronchial blocker
- Physiologically difficult airway
- Details of awake intubation techniques
- Submental intubation
- Cardiopulmonary bypass
- Effects of anesthetics/sedatives on ease of intubation/supraglottic airway insertion (*e.g.*, propofol)
- Details of ECMO

Outcomes

- Inclusion criteria:
 - Identification of patient characteristics at risk of difficult intubation
 - Identification of patient characteristics leading to awake intubation
 - Intubation/ventilation success/failure:
 - Face/bag mask ventilation (success/failure, easy/difficult)
 - supraglottic airway placement (success/failure, number of attempts)
 - Laryngoscopy (success/failure, number of attempts)
 - Tracheal intubation (success/failure, number of attempts)
 - Invasive airway
- Percutaneous cricothyrotomy (success/failure)
- Surgical cricothyrotomy (success/failure)
- Tracheostomy (success/failure)
- Scalpel bougie technique or scalpel bougie tube technique *versus* needle catheter technique (success/failure)
 - Restoration of failed oxygenation (success/failure)
 - Esophageal intubation
 - Barotrauma (pneumothorax, pneumomediastinum)
 - Subcutaneous emphysema
 - Gastric rupture
 - Tracheal rupture
 - Delayed tracheal stenosis
- Physiologic outcomes (measurement of physiologic functioning)
 - Oxygenation/desaturation
 - Carbon dioxide levels
 - Hemodynamic levels (*e.g.*, mean arterial pressure, central venous pressure)
- Clinical outcomes
 - Hypoxemia/hypoxia
 - Hypercapnia/hypercarbia
 - Hemodynamic instability
 - Aspiration
 - Airway injury/trauma
 - Soft tissue injuries/blind spot injuries
 - Sore throat
 - Palatal injury
 - Oral/dental damage
 - Cardiac events (*e.g.*, cardiac arrest)
- Neurologic injury
 - Unplanned tracheotomy/surgical airway
 - Neurologic deficit of less than 72 h
- Permanent (long-term) outcomes
 - Death
 - Respiratory system damage
- Airway trauma
- Pneumothorax
- Aspiration
 - Nerve/brain damage
- Nerve damage
- Neurologic/memory deficit
- Permanent brain damage
- Brain injury (anoxic encephalopathy)
 - Cardiovascular damage
- Cardiopulmonary arrest
 - Fetal/newborn damage
 - Functional deficit
- Awareness/fright
- Loss of employment
 - Nonclinical outcomes
 - Unplanned ICU admission
 - Unplanned hospital admission
 - Surgery postponed/cancelled
 - Length of hospital stay
 - Patient satisfaction
- Exclusion criteria:
 - No exclusion criteria

Evidence Collection

- Literature inclusion criteria:
 - Randomized controlled trials
 - Prospective nonrandomized comparative studies (*e.g.*, quasiexperimental, cohort)
 - Retrospective comparative studies (*e.g.*, case control)
 - Observational studies (*e.g.*, correlational or descriptive statistics)
 - Case reports, case series
- Literature exclusion criteria (except to obtain new citations):
 - Editorials
 - Literature reviews
 - Meta-analyses conducted by others
 - Unpublished studies
 - Studies in non-peer-reviewed journals
 - Newspaper articles
- Survey evidence:
 - Expert consultant survey
 - ASA membership survey
 - Membership surveys of other participating organizations
 - Reliability survey
 - Feasibility survey

State of the Literature

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For the systematic review, potentially relevant clinical studies were identified *via* electronic and manual searches. Bibliographic database searches included PubMed and EMBASE. The searches covered a 9.25-yr period from January 1, 2012, through March 31, 2021. Citation searching (backward and forward) of relevant meta-analyses and other systematic reviews was also performed. No search for gray literature was conducted. Publications identified by task force members were also considered. Accepted studies from the previous guidelines were re-reviewed, covering the period of January 1, 2002, through June 31, 2012. Only studies containing original findings from peer-reviewed journals were acceptable. Editorials, letters, and other articles without data were excluded. A literature search strategy and PRISMA* flow diagram are available as Supplemental Digital Content 2, <http://links.lww.com/ALN/C695>. In total, 12,544 unique new citations were identified, with 1,026 full articles assessed for eligibility. After review, 619 were excluded, with 407 new studies meeting inclusion criteria. These studies were combined with 190 pre-2012 articles from the previous guidelines, resulting in a total of 597 articles accepted as evidence for these guidelines. In this document, 559 are referenced, with a complete bibliography of articles used to develop these guidelines, organized by section, available as Supplemental Digital Content 3, <http://links.lww.com/ALN/C696>.

Each pertinent outcome reported in a study was classified by evidence category and level and designated as beneficial, harmful, or equivocal. Findings were then summarized for each evidence linkage and reported in the text of the updated guidelines.

Evidence categories refer specifically to the strength and quality of the research design of the studies. Category A evidence represents results obtained from randomized controlled trials, and category B evidence represents observational results obtained from nonrandomized study designs or randomized trials without pertinent comparison groups. When available, category A evidence is given precedence over category B evidence for any particular outcome. These evidence categories are further divided into evidence levels. Evidence levels refer specifically to the strength and quality of the summarized study findings (*i.e.*, statistical findings, type of data, and the number of studies reporting/replicating the findings). In this document, the highest level of evidence is included in the summary report for each intervention–outcome pair, including a designation of benefit, harm, or equivocality.

Category A

Randomized controlled trials report comparative findings between clinical interventions for specified outcomes.

Statistically significant ($P < 0.01$) outcomes are designated as either beneficial (B) or harmful (H) for the patient; statistically nonsignificant findings are designated as equivocal (E).

Level 1

The literature contains a sufficient number of randomized controlled trials to conduct meta-analysis,^{*****} and meta-analytic findings from these aggregated studies are reported as evidence.

Level 2

The literature contains multiple randomized controlled trials, but the number of randomized controlled trials is not sufficient to conduct a viable meta-analysis for the purpose of these guidelines. Findings from these randomized controlled trials are reported separately as evidence.

Level 3

The literature contains a single randomized controlled trial, and findings from this study are reported as evidence.

Category B

Observational studies or randomized controlled trials without pertinent comparison groups may permit inference of beneficial or harmful relationships among clinical interventions and clinical outcomes. Inferred findings are given a directional designation of beneficial (B), harmful (H), or equivocal (E). For studies that report statistical findings, the threshold for significance is $P < 0.01$.

Level 1

The literature contains nonrandomized comparisons (*e.g.*, quasiexperimental, cohort [prospective or retrospective], or case-control research designs) with comparative statistics between clinical interventions for a specified clinical outcome.

Level 2

The literature contains noncomparative observational studies with associative statistics (*e.g.*, correlation, sensitivity, and specificity).

Level 3

The literature contains noncomparative observational studies with descriptive statistics (*e.g.*, frequencies, percentages).

Level 4

The literature contains case reports.

***** A minimum of five independent randomized controlled trials (*i.e.*, sufficient for fitting a random-effects model) is required for meta-analysis.⁵⁶⁰

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Insufficient Literature

The lack of sufficient scientific evidence in the literature may occur when the evidence is either unavailable (*i.e.*, no pertinent studies found) or inadequate. Inadequate literature cannot be used to assess relationships among clinical interventions and outcomes, either, because a clear interpretation of findings is not obtained due to methodologic concerns (*e.g.*, confounding of study design or implementation) or the study does not meet the criteria for content as defined in the “focus” of the guidelines.

Literature addressing risk prediction reported sensitivity, specificity, positive and negative predictive, and other common values for age, sex, body mass index, weight, height, and history of snoring. Values for airway assessment were reported for facial and jaw features, anatomical landmarks, and measurements.

Literature relating to videolaryngoscopes contained enough studies with well defined experimental designs and statistical information to conduct formal meta-analyses (table 4). Outcomes assessed were (1) laryngoscopic view, (2) intubation success, (3) first attempt intubation success, (4) assist maneuvers used for intubation, and (5) time to intubation. For meta-analyses of studies reporting frequency of events, event rates and odds ratios were pooled. Time to intubation was pooled using mean differences (continuous outcomes) for clinical relevance. Fixed-effects models were fitted using Mantel-Haenszel or inverse variance weighting as appropriate. Random-effects models were fitted with inverse variance weighting using the DerSimonian and Laird estimate of between-study variance. Sensitivity to effect measure was also examined. Heterogeneity was quantified with I^2 and a significance level of $P < 0.01$ was applied for analyses. Statistics for individual studies and forest plots are available as Supplemental Digital Content 4, <http://links.lww.com/ALN/C697>.

Interobserver agreement among task force members and two methodologists was assessed for this update, with agreement levels using a κ statistic for two-rater agreement pairs as follows: (1) research design, $\kappa = 0.55$ to 0.61 ; (2) type of analysis, $\kappa = 0.55$ to 0.83 ; (3) evidence linkage assignment, $\kappa = 0.67$ to 0.79 ; and (4) literature inclusion for database, $\kappa = 0.08$ to 0.79 . Three-rater κ values between two methodologists and task force reviewers were (1) research design, $\kappa = 0.61$; (2) type of analysis, $\kappa = 0.65$; (3) linkage assignment, $\kappa = 0.67$; and (4) literature database inclusion, $\kappa = 0.15$. These values represented low to moderate levels of agreement.

Consensus-based Evidence

Validation of the concepts addressed by these guidelines and subsequent recommendations proposed was obtained by consensus from multiple sources, including (1) survey

opinion from expert consultants who were selected based on their knowledge or expertise in difficult airway management; (2) survey opinions from randomly selected samples of active members of the ASA and participating organizations; and (3) internet commentary. All opinion-based evidence relevant to each topic was considered in the development of these guidelines. However, only findings obtained from formal surveys are reported in the document. Opinion surveys were developed by the task force to address each clinical intervention identified in the document. Identical surveys were distributed to expert consultants, a random sample of ASA members, and members of the participating organizations.

Survey responses were recorded using a five-point scale and summarized based on median values††††††††††:

Strongly agree: Median score of 5 (at least 50% of the responses are 5)

Agree: Median score of 4 (at least 50% of the responses are 4 or 4 and 5)

Equivocal: Median score of 3 (at least 50% of the responses are 3, or no other response category or combination of similar categories contains at least 50% of the responses)

Disagree: Median score of 2 (at least 50% of responses are 2 or 1 and 2)

Strongly disagree: Median score of 1 (at least 50% of responses are 1)

For consultant respondents, the rate of return for the survey addressing guideline recommendations was 82% ($n = 174$ of 212), and the results are presented in table 5. For membership respondents, the survey totals were as follows: American Society of Anesthesiologists (ASA) = 220; All India Difficult Airway Association (AIDAA) = 74; European Airway Management Society (EAMS) = 79; Italian Society of Anesthesiology, Analgesia, Resuscitation and Intensive Care (SIAARTI) = 177; Learning, Teaching and Investigation Difficult Airway Group (FIDIVA) = 24; Society for Ambulatory Anesthesia (SAMBA) = 47; Society for Airway Management (SAM) = 70; Society for Head and Neck Anesthesia (SHANA) = 27; Society for Pediatric Anesthesia (SPA) = 268; Society of Critical Care Anesthesiologists (SOCCA) = 85; and Trauma Anesthesiology Society (TAS) = 21. Survey results for each organization are presented as Supplemental Digital Content 5, <http://links.lww.com/ALN/C698>.

An additional survey was sent to the consultants accompanied by a draft of the guidelines asking them

††††††††††When an equal number of categorically distinct responses are obtained, the median value is determined by calculating the arithmetic mean of the two middle values. Ties are calculated by a predetermined formula.

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to indicate which, if any, of the recommendations would change their clinical practices if the guidelines were instituted. The rate of return was 31% (n = 68 of 218). The percentage of responding consultants expecting *no change* associated with each linkage were as follows: (1) evaluation of the airway = 82%, (2) availability of airway management equipment = 79%, (3) the presence of a skilled individual to assist = 82%, (4) supplemental oxygen delivery = 76%, strategy for management of an anticipated difficult airway = 88%, awake intubation strategy = 81%, selection of an elective invasive airway = 84%, preferred sequence of devices for attempting intubation = 93%, strategy for management of an unanticipated difficult airway = 88%, strategy for management of an emergency difficult airway = 87%, use of an algorithm, cognitive aid, or infographic = 65%, use of capnography for confirmation of intubation = 90%, strategy for invasive management of a difficult airway = 82%, supplemental oxygen delivery for extubation = 87%, and documentation of the encountered difficult airway = 81%. Of all the respondents, 91% indicated that the guidelines would have *no effect* on the amount of time spent on a typical case, 7% indicated that there would be an increase of the amount of time spent on a typical case, and 1% indicated a decrease in time with the implementation of these guidelines; 72% indicated that new equipment, supplies, or training would *not* be needed to implement the guidelines; and 86% indicated that implementation of the guidelines would *not* require changes in practice that would affect costs.

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Competing Interests

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of directors member of the ASA; received consultant fees from the Acacia Pharma (Indianapolis, Indiana) advisory board and from Medtronic (Minneapolis, Minnesota); and received royalties from Cambridge University Press (London, United Kingdom). Dr. Dutton holds equity in U.S. Anesthesia Partners (Dallas, Texas) and serves on the ex-officio board of directors of the Trauma Anesthesiology Society (Houston, Texas). Dr. Fiadjo received a grant from the Anesthesia Patient Safety Foundation (Rochester, Minnesota); serves on the board of directors of the Society for Pediatric Anesthesia (Richmond, Virginia) and as the director of the American Board of Anesthesiology (Raleigh, North Carolina); provides expert witness testimony for the University of Michigan (Ann Arbor, Michigan); and received honoraria from Penn State Health (Hershey, Pennsylvania), Atrium Health (Charlotte, North Carolina), the Missouri Society of Anesthesiologists (Jefferson City, Missouri), the American Board of Anesthesiologists, and Stanford University (Palo Alto, California). Dr. Greif received a 2018 Karl Storz Research Grant (Tuttlingen, Germany); is a past president of the European Airway Management Society (Bern, Switzerland); and serves as the board director of education and training for the European Resuscitation Council (Niel, Belgium). Dr. Mercier received material support from Teleflex (Athlone, Ireland) and Karl Storz Endoscopy (Tuttlingen, Germany); serves on the ASA House of Delegates and Committee on Standards and Practice Parameters; and is the chairman of the Committee on Long Range Planning and a former president of the Texas Society of Anesthesiologists. Dr. Myatra is president of the All India Difficult Airway Association (Karnataka, India). Dr. O'Sullivan is a council member and trustee of the Royal College of Anaesthetists (London, United Kingdom). Dr. Rosenblatt received honoraria from Medtronics (Dublin, Ireland) and is owner of Airway On Demand Limited Liability Corporation (Hamden, Connecticut), and is a consultant for Ambu (Copenhagen, Denmark). Dr. Sorbello is a paid consultant for Teleflex Medical (Athlone, Ireland), Deas Italia (Castelbolognese, Italy), and Merck Sharp and Dohme (Rome, Italy). Dr. Tung is employed as a section editor for *Anesthesia & Analgesia* (International Anesthesia Research Society, San Francisco, California). The other authors declare no competing interests.

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Table 1. Airway Management Items for Anesthetizing Locations

- Self-inflating resuscitation bag
- Suction tubing, Yankauers, suction catheters, and appropriate connectors
- Various sizes of face masks
- Various sizes of oral and nasal airways
- Various sizes and types of laryngoscope blades and handles
- Various sizes and types of tracheal tubes
- Tracheal tube introducer (bougie) for adult patients
- Tracheal tube stylets (malleable and rigid)
- Equipment for emergency invasive airway management
- Various sizes of supraglottic airways
- Water-soluble medical lubricant
- Nasal cannula and oxygen face masks
- Video laryngoscope with appropriate stylets
- Standard ASA monitors
- Anesthetic induction, maintenance, and rescue medications

The examples listed in this table represent basic minimum contents for an anesthetizing location cart or trolley. The cart may be customized to meet the specific needs, preferences, and skills of the practitioner and healthcare facility.
 ASA, American Society of Anesthesiologists.

Table 2. Portable Storage Unit Items for Difficult Airway Management

Category*	Item†‡
Alternative/rescue ventilation equipment	Oral and nasal airways of assorted sizes Supraglottic airways of assorted sizes/cuffed pharyngeal sealer Nasal cannula
Alternative intubation equipment	Tracheal tubes of assorted sizes (including microlaryngeal tubes) Rigid blades of alternate design and size for intubation Tracheal tube guides. Examples include (but are not limited to) semirigid stylets, lighted stylets, forceps designed to manipulate the distal portion of the tracheal tube Intubating supraglottic airway Videolaryngoscope with appropriate stylet Optical laryngoscope Intubating video stylet Flexible intubating bronchoscope along with topical anesthetic and equipment, and airway/bite block Aintree catheter
Emergency airway equipment	Equipment for emergency invasive airway management Jet ventilation equipment
Miscellaneous	Airway exchange catheters of assorted sizes Multiple exhaled carbon dioxide detectors A laminated version of a local accepted difficult airway algorithm/cognitive aid/checklist Defogger

The examples listed in this table represent airway management equipment beyond what may be available in the anesthetizing location (see Table 1). In areas where these items are not available at the anesthetizing location, add them to this portable storage unit.

*Equipment and supplies sizes should match the intended population to be served (e.g., neonates, pediatrics, adults). †The items listed in this table represent suggestions. The contents of the portable storage unit should be customized to meet the specific needs, preferences, and skills of the practitioner and healthcare facility. ‡Choice of some items (e.g., videolaryngoscope, jet ventilation equipment) may depend on practitioner familiarity and experience with the device.

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Table 3. Human Factors Relevant to Difficult Airway Management

Practitioner factors	
Before	Practitioner knowledge and training Possible alternate outcomes (plan B) Preoperative assessment Complacency
During	Internal and external stressors (fatigue, illness, production pressure) Decision-making (perseveration, judgment, situational awareness, interpretation of data) Team dynamics (leadership, role assignment, empowerment, sterile cockpit) Calling for assistance
After	Strategic debriefing
External factors	
Patient factors	Anatomical/physiological airway difficulty risk, aspiration risk, infection risk, exposure risk, urgency, comorbidities
Environment factors	
	Airway equipment Monitoring Personal protective equipment
Institutional factors	
	Culture, staffing, shift duration Protocols, reporting Supervision/support, training

This table lists aspects of airway management that address how the practitioner may interact with patients, other clinicians, assistants, equipment, or the environment during the process of airway management. Practitioners may consider these factors before, during, and/or after the course of airway management. Factors are classified as related directly to or external to the practitioner.

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Table 4. Meta-analysis Summary: Videolaryngoscopy *versus* Direct Laryngoscopy*

	Studies†	Patients	Effect			Heterogeneity		
			Fixed	P	Random	P	I ²	P
Odds Ratio‡ (99% CI)								
Laryngoscopic view	8	1,100	0.123 (0.078, 0.194)	< 0.001	0.124 (0.056, 0.275)	< 0.001	53%	0.036
Successful intubation	10	1,213	0.181 (0.097, 0.339)	< 0.001	0.225 (0.063, 0.803)	0.003	52%	0.026
First attempt success	9	624	0.327 (0.161, 0.666)	< 0.001	0.357 (0.170, 0.749)	< 0.001	0%	0.719
Additional maneuvers	6	738	0.379 (0.250, 0.574)	< 0.001	0.311 (0.149, 0.650)	< 0.001	57%	0.041
Mean Difference (99% CI)								
Intubation time	10	793	-0.158 (-0.347, 0.030)	0.031	-0.036 (-0.652, 0.580)	0.880	90.12%	< 0.001

*Statistics for individual studies and forest plots are available as Supplemental Digital Content 4, <http://links.lww.com/ALN/C697>. †Number of studies included in the meta-analysis. ‡Continuity correction of 0.5 for zero cell frequencies.

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Table 5. Expert Consultant Survey Results (Response Rate = 82%)

Recommendations	N	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Evaluation of the airway						
1a. Before the initiation of anesthetic care or airway management, ensure that an airway risk assessment is performed by the person(s) responsible for airway management whenever feasible to identify patient, medical, surgical, environmental, and anesthetic factors (<i>e.g.</i> , risk of aspiration) that may indicate the potential for a difficult airway.	174	92*	6	1	0	1
1b. Before the initiation of anesthetic care or airway management, conduct an airway physical examination.	174	84*	13	1	0	1
Preparation for Difficult Airway Management						
2a. If a difficult airway is known or suspected, ensure that a skilled individual is present or immediately available to assist with airway management.	174	94*	5	0	0	1
2b. If a difficult airway is known or suspected, inform the patient or responsible person of the special risks and procedures pertaining to management of the difficult airway.	174	74*	21	3	1	1
2c. If a difficult airway is known or suspected, administer oxygen before initiating management of the difficult airway and deliver supplemental oxygen throughout the process of difficult airway management, including extubation.	173	83*	10	6	1	1
Anticipated Difficult Airway Management						
3. Identify a strategy for (1) awake intubation, (2) the patient who can be adequately ventilated but is difficult to intubate, (3) the patient who cannot be ventilated or intubated, and (4) alternative approaches to airway management failure.	164	84*	12	3	1	1
4a. When appropriate, perform awake intubation if the patient is suspected to be a difficult intubation and difficult ventilation (face mask/supraglottic airway) is anticipated.	165	68*	22	7	2	1
4b. When appropriate, perform awake intubation if the patient is suspected to be a difficult intubation and increased risk of aspiration is anticipated.	165	42	30*	15	11	2
4c. When appropriate, perform awake intubation if the patient is suspected to be a difficult intubation and anticipated to be incapable of tolerating a brief apneic episode.	166	44	34*	14	6	2
4d. When appropriate, perform awake intubation if the patient is suspected to be a difficult intubation and difficulty with emergency invasive airway rescue is anticipated.	166	58*	25	11	4	1
5. If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.	166	63*	29	7	0	1
5a. If difficulty is encountered with individual techniques, combination techniques may be performed.	167	66*	28	5	1	1
5b. Be aware of the passage of time, the number of attempts, and oxygen saturation.	166	91*	6	2	0	1
5c. Provide and test mask ventilation between attempts.	167	58*	23	13	6	1
5d. Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.	167	77*	19	2	1	1
6. If an elective invasive approach to the airway (<i>e.g.</i> , surgical cricothyrotomy, tracheostomy, or large-bore cannula cricothyrotomy) is selected, identify a preferred intervention.	165	72*	21	6	1	1
6a. Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.	166	83*	15	2	0	1
6b. If the selected invasive approach fails or is not feasible, identify an alternative invasive intervention.	166	72*	22	5	1	1
Unanticipated and Emergency Difficult Airway Management						
7a. Upon encountering an unanticipated difficult airway, determine the benefit of waking and/or restoring spontaneous breathing.	164	64*	23	10	2	1
7b. Upon encountering an unanticipated difficult airway, determine the benefit of a noninvasive versus invasive approach to airway management.	161	62*	30	5	2	1
8. If a noninvasive approach is selected, identify a preferred sequence of noninvasive devices to use for airway management.	164	73*	24	1	1	1
8a. If difficulty is encountered with individual techniques, combination techniques may be performed.	163	66*	26	6	1	1
8b. Be aware of the passage of time, the number of attempts, and oxygen saturation.	162	88*	9	2	0	1
8c. Provide and test mask ventilation between attempts.	159	59*	25	9	7	1
8d. Limit the number of attempts at tracheal intubation or supraglottic airway placement to avoid potential injury and complications.	163	83*	12	4	1	1
9. If an invasive approach to the airway (<i>e.g.</i> , surgical cricothyrotomy, tracheostomy, or large-bore cannula cricothyrotomy) is necessary (<i>i.e.</i> , cannot intubate, cannot ventilate), identify a preferred intervention.	161	76*	20	2	1	1
9a. Ensure that an invasive airway is performed by an individual trained in invasive airway techniques, whenever possible.	163	83*	14	2	1	1
9b. Ensure that an invasive airway is performed as rapidly as possible.	163	67*	23	7	2	1
9c. If the selected invasive approach fails or is not feasible, identify an alternative invasive intervention.	163	74*	20	4	1	1

(Continued)

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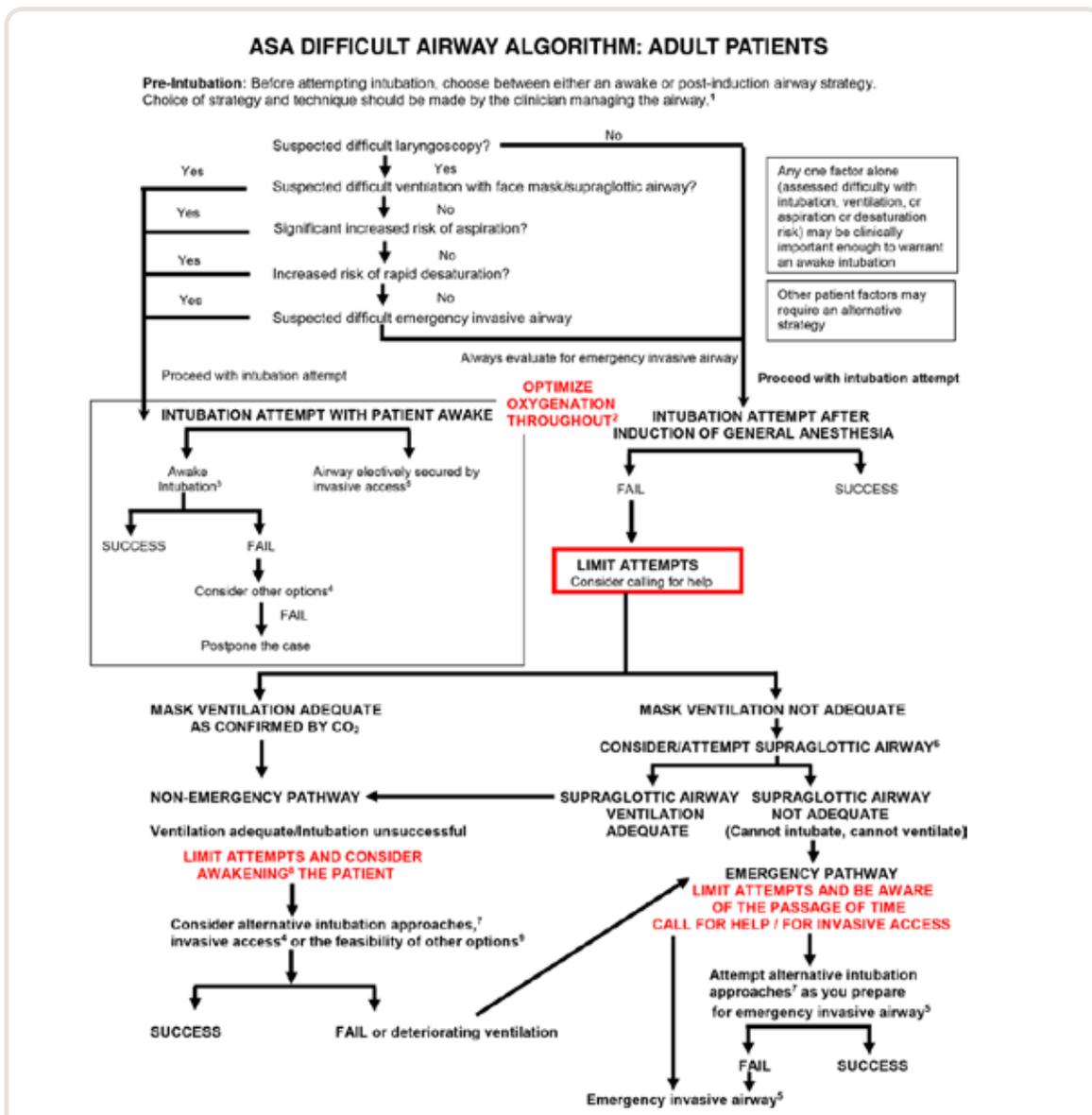
Practice Guidelines for Difficult Airway Management

Table 5. (Continued)

Recommendations	N	Strongly Agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly Disagree (%)
Confirmation of tracheal intubation						
10. Confirm tracheal intubation using capnography or end-tidal carbon dioxide monitoring.	164	91*	7	0	1	1
11. When uncertain about the location of the tracheal tube, determine whether to either remove it and attempt ventilation or use additional techniques to confirm positioning of tracheal tube.	163	60*	28	7	4	1
Extubation of the difficult airway						
12. Have a preformulated strategy for extubation and subsequent airway management.	163	91*	8	1	0	1
13. Ensure that a skilled individual is present to assist with extubation.	162	72*	23	3	1	1
14. Select an appropriate time and location for extubation when possible.	163	77*	20	2	1	1
15. Assess the relative clinical merits and feasibility of the short-term use of an airway exchange catheter and/or supraglottic airway that can serve as a guide for expedited reintubation.	163	64*	29	5	1	1
16. Before attempting extubation, evaluate the risks and benefits of elective surgical tracheostomy.	163	47	33*	18	2	1
17. Evaluate the risks and benefits of awake extubation <i>versus</i> extubation before the return to consciousness.	163	57*	23	9	6	6
18. Assess the clinical factors that may produce an adverse impact on ventilation after the patient has been extubated.	162	75*	23	1	0	1
Follow-up care						
19. Inform the patient (or responsible person) of the airway difficulty that was encountered to provide the patient (or responsible person) with a role in guiding and facilitating the delivery of future care.	162	88*	11	1	0	1
20. Document the presence and nature of the airway difficulty in the medical record to guide and facilitate the delivery of future care.	163	94*	5	1	0	1

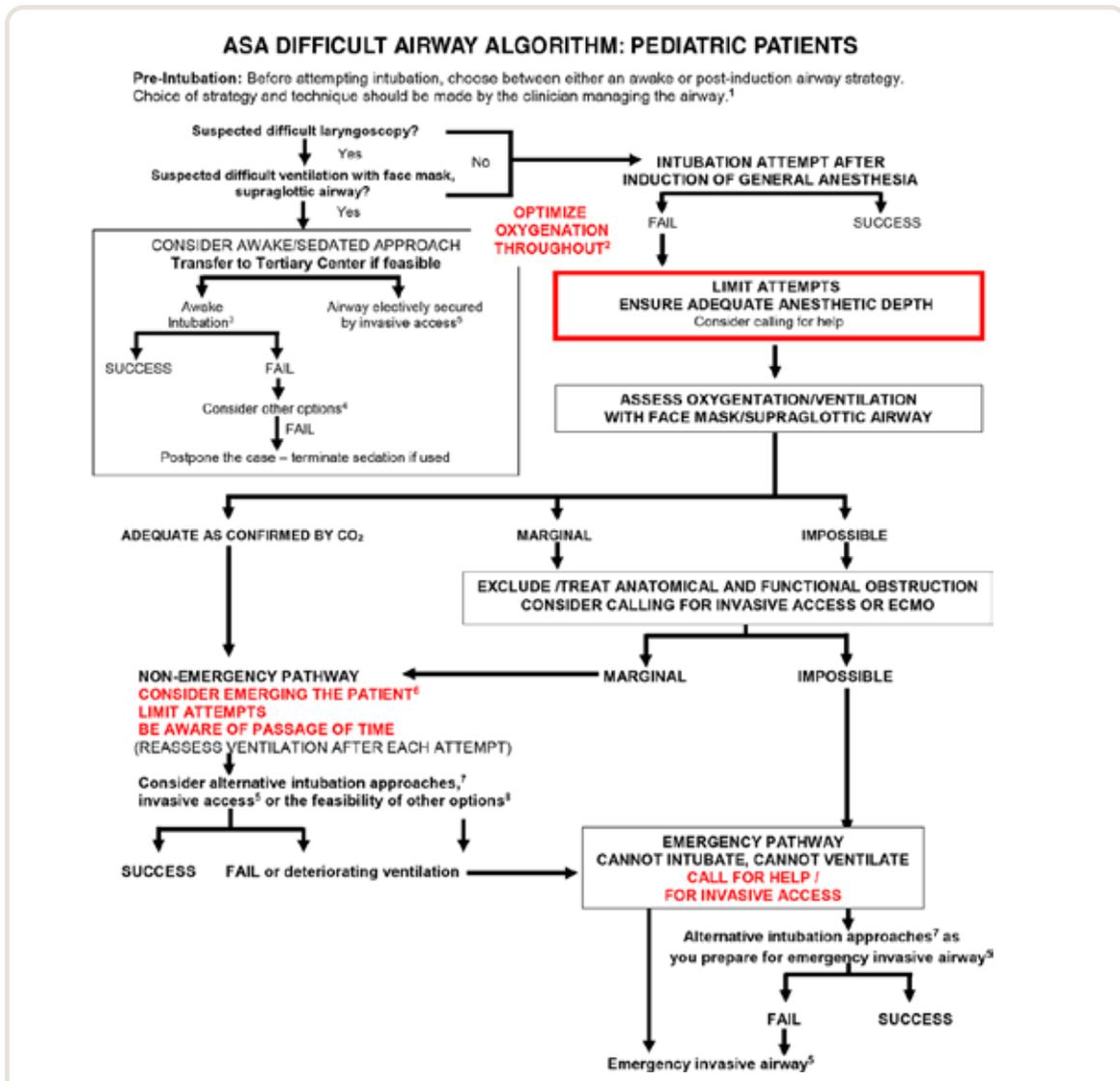
*An asterisk beside a percentage score indicates the median.

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Fig. 1. Difficult airway algorithm: Adult patients. ¹The airway manager's choice of airway strategy and techniques should be based on their previous experience; available resources, including equipment, availability and competency of help; and the context in which airway management will occur. ²Low- or high-flow nasal cannula, head elevated position throughout procedure. Noninvasive ventilation during preoxygenation. ³Awake intubation techniques include flexible bronchoscope, videolaryngoscopy, direct laryngoscopy, combined techniques, and retrograde wire-aided intubation. ⁴Other options include, but are not limited to, alternative awake technique, awake elective invasive airway, alternative anesthetic techniques, induction of anesthesia (if unstable or cannot be postponed) with preparations for emergency invasive airway, and postponing the case without attempting the above options. ⁵Invasive airway techniques include surgical cricothyrotomy, needle cricothyrotomy with a pressure-regulated device, large-bore cannula cricothyrotomy, or surgical tracheostomy. Elective invasive airway techniques include the above and retrograde wire-guided intubation and percutaneous tracheostomy. Also consider rigid bronchoscopy and ECMO. ⁶Consideration of size, design, positioning, and first *versus* second generation supraglottic airways may improve the ability to ventilate. ⁷Alternative difficult intubation approaches include but are not limited to video-assisted laryngoscopy, alternative laryngoscope blades, combined techniques, intubating supraglottic airway (with or without flexible bronchoscopic guidance), flexible bronchoscopy, introducer, and lighted stylet or lightwand. Adjuncts that may be employed during intubation attempts include tracheal tube introducers, rigid stylets, intubating stylets, or tube changers and external laryngeal manipulation. ⁸Includes postponing the case or postponing the intubation and returning with appropriate resources (e.g., personnel, equipment, patient preparation, awake intubation). ⁹Other options include, but are not limited to, proceeding with procedure utilizing face mask or supraglottic airway ventilation. Pursuit of these options usually implies that ventilation will not be problematic.



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Fig. 2. Difficult airway algorithm: Pediatric patients. ¹The airway manager’s assessment and choice of techniques should be based on their previous experience; available resources, including equipment, availability, and competency of help; and the context in which airway management will occur. ²Low- or high-flow nasal cannula, head elevated position throughout procedure. Noninvasive ventilation during preoxygenation. ³Awake intubation techniques include flexible bronchoscope, videolaryngoscopy, direct laryngoscopy, combined techniques, and retrograde wire-aided intubation. ⁴Other options include, but are not limited to, alternative awake technique, awake elective invasive airway, alternative anesthetic techniques, induction of anesthesia (if unstable or cannot be postponed) with preparations for emergency invasive airway, or postponing the case without attempting the above options. ⁵Invasive airway techniques include surgical cricothyroidotomy, needle cricothyroidotomy if age-appropriate with a pressure-regulated device, large-bore cannula cricothyroidotomy, or surgical tracheostomy. Elective invasive airway techniques include the above and retrograde wire-guided intubation and percutaneous tracheostomy. Also consider rigid bronchoscopy and ECMO. ⁶Includes postponing the case or postponing the intubation and returning with appropriate resources (e.g., personnel, equipment, patient preparation, awake intubation). ⁷Alternative difficult intubation approaches include, but are not limited to, video-assisted laryngoscopy, alternative laryngoscope blades, combined techniques, intubating supraglottic airway (with or without flexible bronchoscopic guidance), flexible bronchoscopy, introducer, and lighted stylet. Adjuncts that may be employed during intubation attempts include tracheal tube introducers, rigid stylets, intubating stylets, or tube changers and external laryngeal manipulation. ⁸Other options include, but are not limited to, proceeding with procedure utilizing face mask or supraglottic airway ventilation. Pursuit of these options usually implies that ventilation will not be problematic.

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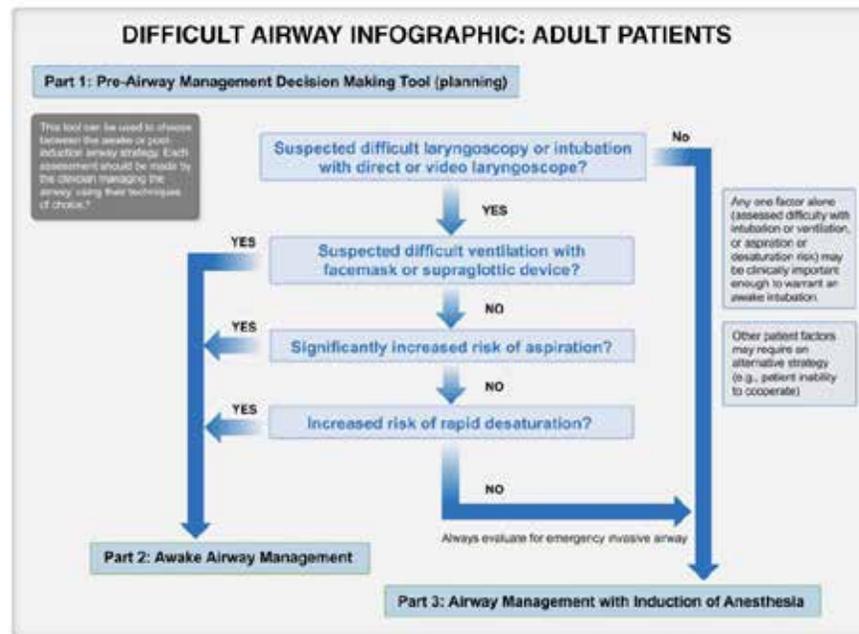


Fig. 3. Difficult airway infographic: Adult patient example. This figure provides three tools to aid in airway management for the patient with a planned, anticipated difficult, or unanticipated difficult airway. *Part 1* is a decision tool that incorporates relevant elements of evaluation and is intended to assist in the decision to enter the awake airway management pathway or the airway management with the induction of anesthesia pathway of the ASA difficult airway algorithm. *Part 2* is an awake intubation algorithm. *Part 3* is a strategy for managing patients with induction of anesthesia when an unanticipated difficulty with ventilation (as determined by capnography) with a planned airway technique is encountered.^aThe airway manager's assessment and choice of techniques should be based on their previous experience; available resources, including equipment, availability, and competency of help; and the context in which airway management will occur. **Review airway strategy:** Consider anatomical/physiologic airway difficulty risk, aspiration risk, infection risk, other exposure risk, equipment and monitoring check, role assignment, and backup and rescue plans. Awake techniques include flexible intubation scope, videolaryngoscopy, direct laryngoscopy, supraglottic airway, combined devices, and retrograde wire-aided. **Adequate ventilation** by any means (e.g., face mask, supraglottic airway, tracheal intubation) should be confirmed by capnography, when possible. **Follow-up care** includes postextubation care (i.e., steroids, racemic epinephrine), counseling, documentation, team debriefing, and encouraging patient difficult airway registry. **Postpone the case/intubation** and return with appropriate resources (e.g., personnel, equipment, patient preparation, awake intubation). **Invasive airways** include surgical cricothyroidotomy, needle cricothyroidotomy with a pressure-regulated device, large-bore cannula cricothyroidotomy, or surgical tracheostomy. Elective invasive airways include the above, retrograde wire-guided intubation, and percutaneous tracheostomy. Other options include rigid bronchoscopy and ECMO. **Invasive airway** is performed by an individual trained in invasive airway techniques, whenever possible. ^bIn an unstable situation or when airway management is mandatory after a failed awake intubation, a switch to the airway management with the induction of anesthesia pathway may be entered with preparations for an emergency invasive airway. ^cLow- or high-flow nasal cannula, head elevated position throughout procedure. Noninvasive ventilation during preoxygenation. ^dThe intent of limiting attempts at tracheal intubation and supraglottic airway insertion is to reduce the risk of bleeding, edema, and other types of trauma that may increase the difficulty of mask ventilation and/or subsequent attempts to secure a definitive airway. Persistent attempts at any airway intervention, including ineffective mask ventilation, may delay obtaining an emergency invasive airway. A reasonable approach may be to limit attempts with any technique class (i.e., face mask, supraglottic airway, tracheal tube) to three, with one additional attempt by a clinician with higher skills. **Optimize:** suction, relaxants, repositioning. **Face mask:** oral/nasal airway, two-hand mask grip. **Supraglottic airway:** size, design, repositioning, first versus second generation. **Tracheal tube:** introducer, rigid stylet, hyperangulated videolaryngoscopy, blade size, external laryngeal manipulation. Consider other causes of inadequate ventilation (including but not limited to laryngospasm and bronchospasm). ^eFirst versus second generation supraglottic airway with intubation capability for initial or rescue supraglottic airway. ^fVideolaryngoscopy as an option for initial or rescue tracheal intubation. (Continued)

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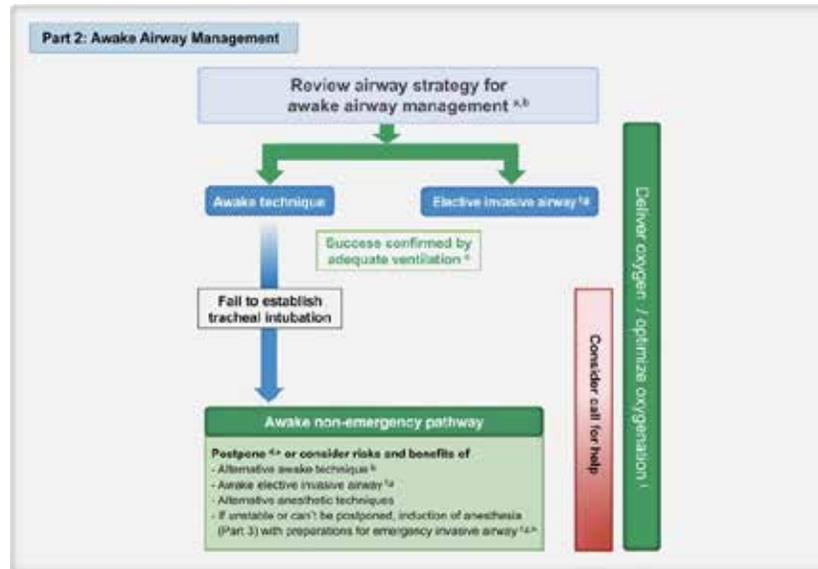


Fig. 3 (Continued)

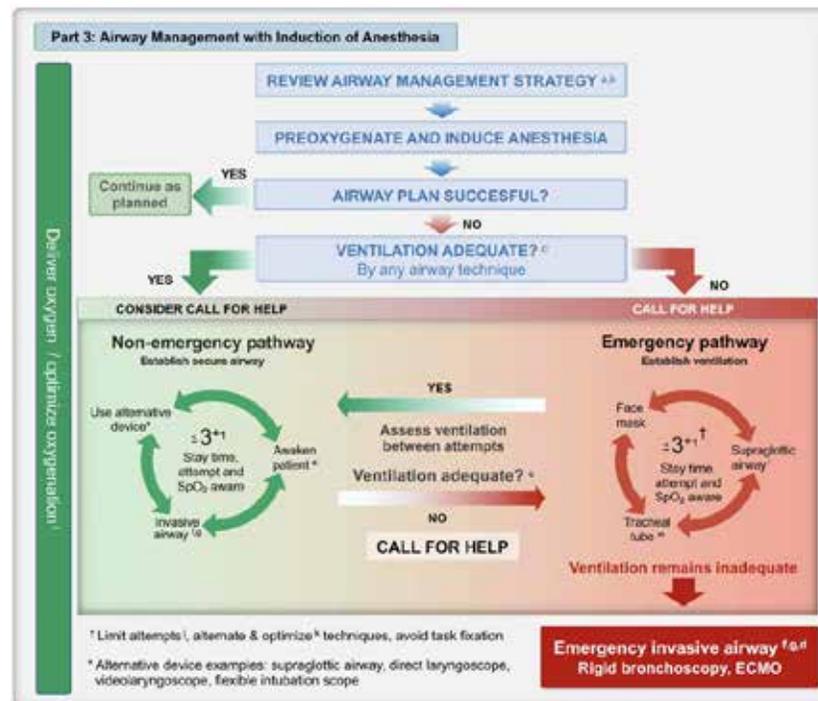
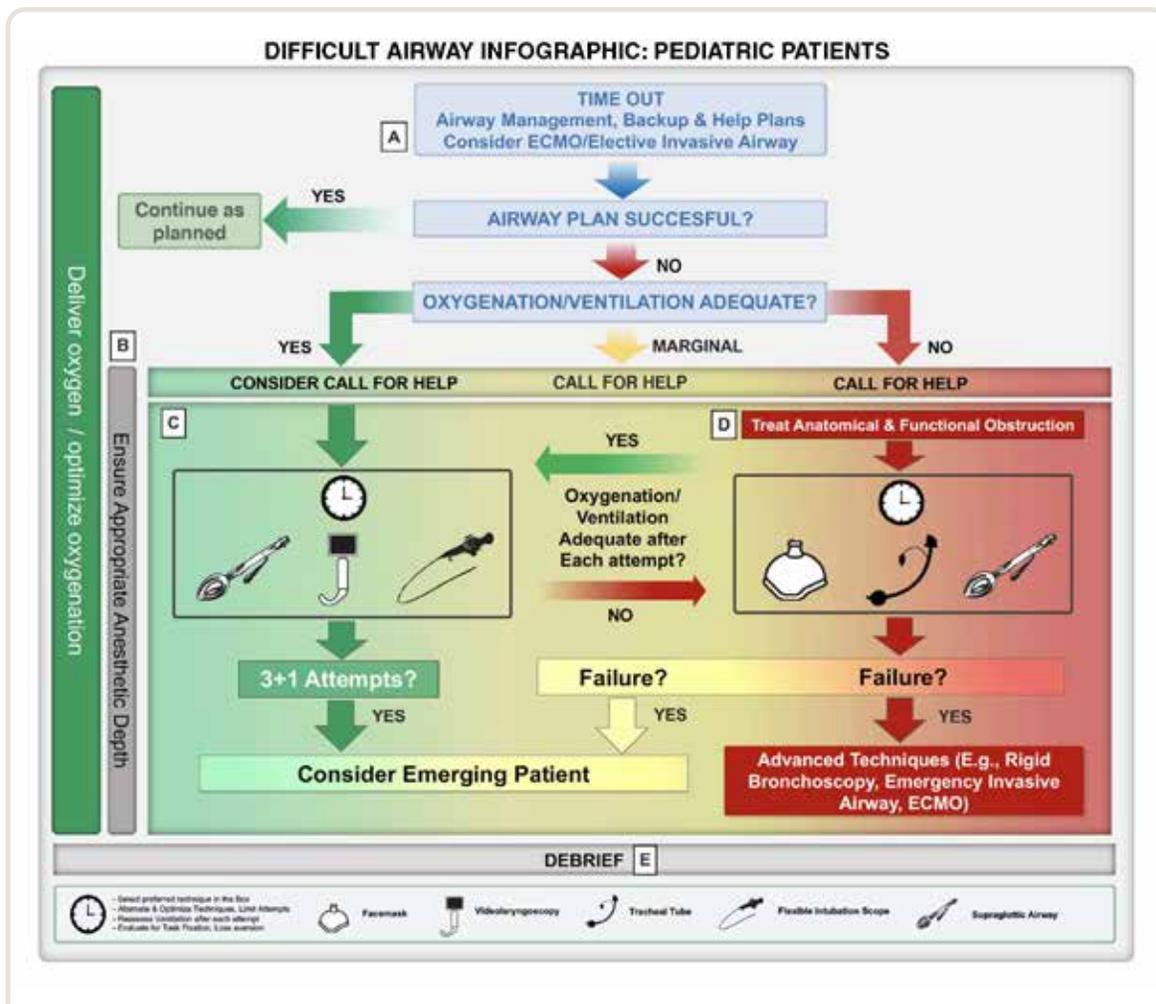


Fig. 3 (Continued)

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Fig. 4. Difficult airway infographic: Pediatric patient example. **A**Time Out for identification of the airway management plan. A team-based approach with identification of the following is preferred: the primary airway manager and backup manager and role assignment, the primary equipment and the backup equipment, and the person(s) available to help. Contact an ECMO team/otolaryngologic surgeon if noninvasive airway management is likely to fail (e.g., congenital high airway obstruction, airway tumor, etc.). **B**Color scheme. The colors represent the ability to oxygenate/ventilate: green, easy oxygenation/ventilation; yellow, difficult or marginal oxygenation/ventilation; and red, impossible oxygenation/ventilation. Reassess oxygenation/ventilation after each attempt and move to the appropriate box based on the results of the oxygenation/ventilation check. **C**Nonemergency pathway (oxygenation/ventilation adequate for an intubation known or anticipated to be challenging): deliver oxygen throughout airway management; attempt airway management with the technique/device most familiar to the primary airway manager; select from the following devices: supraglottic airway, videolaryngoscopy, flexible bronchoscopy, or a combination of these devices (e.g., flexible bronchoscopic intubation through the supraglottic airway); other techniques (e.g., lighted stylets or rigid stylets may be used at the discretion of the clinician); optimize and alternate devices as needed; reassess ventilation after each attempt; limit direct laryngoscopy attempts (e.g., one attempt) with consideration of standard blade videolaryngoscopy in lieu of direct laryngoscopy; limit total attempts (insertion of the intubating device until its removal) by the primary airway manager (e.g., three attempts) and one additional attempt by the secondary airway manager; after four attempts, consider emerging the patient and reversing anesthetic drugs if feasible. Clinicians may make further attempts if the risks and benefits to the patient favor continued attempts. **D**Marginal/emergency pathway (poor or no oxygenation/ventilation for an intubation known or anticipated to be challenging): treat functional (e.g., airway reflexes with drugs) and anatomical (mechanical) obstruction; attempt to improve ventilation with facemask, tracheal intubation, and supraglottic airway as appropriate; and if all options fail, consider emerging the patient or using advanced invasive techniques. **E**Consider a team debrief after all difficult airway encounters: identify processes that worked well and opportunities for system improvement and provide emotional support to members of the team, particularly when there is patient morbidity or mortality.

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PRACTICE PARAMETER

2023 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting: Carbohydrate-containing Clear Liquids with or without Protein, Chewing Gum, and Pediatric Fasting Duration—A Modular Update of the 2017 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting*

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Practice guidelines are systematically developed recommendations that assist the practitioner and patient in making decisions about health care. These recommendations may be

ABSTRACT

These practice guidelines are a modular update of the “Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: Application to healthy patients undergoing elective procedures.” The guidance focuses on topics not addressed in the previous guideline: ingestion of carbohydrate-containing clear liquids with or without protein, chewing gum, and pediatric fasting duration.

(*ANESTHESIOLOGY* 2023; 138:132–51)

HIGHLIGHTS BOX

- The task force reaffirms the previous recommendations for clear liquids until 2 h preoperatively. Simple or complex carbohydrate-containing clear liquids appear to reduce hunger compared with noncaloric clear liquids. The addition of protein to preoperative carbohydrate-containing clear liquids did not seem to either benefit or harm healthy patients. We further suggest not to delay surgery in healthy adults after confirming the removal of chewing gum.
- Fasting duration is often substantially longer than recommended and prolonged fasting has well described adverse consequences. Therefore, to avoid prolonged fasting in children, efforts should be made to allow clear liquids in healthy children as close to 2 h before procedures as possible.
- The task force recommends a robust local effort at each facility disseminating and discussing information shared in this document, providing necessary education to all patient care teams, including but not limited to all members of the anesthesiology and surgical teams, preoperative clinic personnel, preoperative nurses, and hospital floor nurses. Furthermore, it would be necessary to update related policies, printed literature, and wall posters/charts to ensure that patients are receiving consistent messages and instructions from all medical personnel.

adopted, modified, or rejected according to clinical needs and constraints and are not intended to replace local institutional policies. In addition, practice guidelines developed by the American Society of Anesthesiologists (ASA) are not intended as standards or absolute requirements, and their use cannot guarantee any specific outcome. Practice guidelines are subject to revision as warranted by the evolution of medical knowledge, technology, and practice. They provide basic recommendations for anesthesia care that are supported by synthesis and analysis of the current literature, expert and practitioner opinion, public comment, and clinical feasibility data. Practice guidelines aim to improve patient care and patient outcomes by providing up-to-date information for patient care.

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Practice Guidelines for Preoperative Fasting

The intended population for this update is the same as for the 2017 ASA guideline, limited to healthy patients undergoing elective procedures.¹ Healthy patients are those without coexisting diseases or conditions that may increase the risk for aspiration, including esophageal disorders such as significant uncontrolled reflux disease, hiatal hernia, Zenker's diverticulum, achalasia, stricture; previous gastric surgery (for example, gastric bypass); gastroparesis; diabetes mellitus; opioid use; gastrointestinal obstruction or acute intraabdominal processes; pregnancy; obesity; and emergency procedures.²⁻⁴ Anesthesiologists should recognize that these conditions can increase the likelihood of regurgitation and pulmonary aspiration and should modify these guidelines based upon clinical judgment.

Recommendations

Recommendation	Strength of Recommendation	Strength of Evidence
1. We recommend healthy adults* drink carbohydrate-containing clear liquids† until 2 h before elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation. The carbohydrates may be simple or complex.	Strong	Moderate
2. There is insufficient evidence to recommend protein-containing clear liquids preferentially over other clear liquids before elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation (no recommendation).	Not applicable	Very low
3. We suggest not delaying elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation in healthy adults* who are chewing gum.‡	Conditional	Very low
4. There is insufficient evidence concerning benefits and harms to recommend pediatric patients drink clear liquids until 1 h versus 2 h before procedures with general anesthesia, regional anesthesia, or procedural sedation (no recommendation).	Not applicable	Very low
5. To avoid prolonged fasting in children, efforts should be made to allow clear liquids in children at low risk of aspiration as close to 2 h before procedures as possible. In children with shorter clear liquid fasting duration, exercise clinical judgment.	Best practice statement	Not applicable

*Individuals without coexisting diseases or conditions that may increase the risk for aspiration, including esophageal disorders such as significant uncontrolled reflux disease, hiatal hernia, Zenker's diverticulum, achalasia, stricture, previous gastric surgery (for example, gastric bypass), gastroparesis, diabetes mellitus, opioid use, gastrointestinal obstruction or acute intraabdominal processes, pregnancy, obesity, and emergency procedures. Exercise clinical judgment with this patient population. †Up to 400 mL of clear liquids is considered an appropriate volume. Trial participants ingested a median of 400 mL of carbohydrate-containing clear liquids (interquartile range, 300 to 400 mL) up to 2 h before anesthesia administration. ‡Chewing gum should be removed before any sedative/anesthetic is administered.

Purpose

This is a modular update of the "Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: Application to healthy patients undergoing elective procedures. An updated report by the ASA task force on preoperative fasting and use of pharmacologic agents to reduce the risk of pulmonary aspiration," which was adopted by the ASA in 2016 and published in 2017.¹ The 2017 guideline did not address whether one type of clear liquid, such as water or carbohydrate-containing clear liquids (with and without protein), is more beneficial. The 2017 guideline also did not address chewing gum or whether a shorter duration of fasting from clear liquids would be more beneficial than the current recommendation of 2 h of fasting for pediatric patients. The purpose of this modular update is to evaluate the current evidence on preoperative fasting, focusing on these interventions. All other recommendations from the 2017 guideline still apply. The outcomes of interest for this update include the adverse consequences of fasting (hunger, thirst, and preoperative nausea and vomiting) and pulmonary aspiration.

Background

Pulmonary aspiration of gastric contents is a rare but potentially life-threatening complication. Although aspiration is uncommon in healthy ASA Physical Status I or II patients (estimated 1.1/10,000 adults and 1.3/10,000 children),²⁻⁴ it may lead to pneumonitis, pneumonia, and airway obstruction.^{5,6} Of the aspiration events described in the 2021 ASA Closed Claims analysis of aspiration of gastric contents events, 57% of aspiration incidents resulted in death, and another 15% resulted in permanent severe injury.⁴ The rationale for preoperative fasting is to minimize gastric content, thereby lowering the risk of regurgitation and subsequent pulmonary aspiration.

Although the relationship between gastric volume and gastric emptying time with aspiration risk has not been demonstrated in adequately powered studies,⁷ most published studies have used these measures as intermediate outcomes. Assuming a 1.1/10,000 baseline incidence of aspiration, to detect a 2-fold increase would require 214,000 participants per arm in a two-arm study (power, 80%; α , 0.05).

Previous ASA guidelines recommend that clear liquids such as water, black coffee, black tea, and juice without pulp are safe to drink until 2 h before general anesthesia, regional anesthesia, or procedural sedation for elective procedures.¹

For patients undergoing elective procedures, this update addresses:

- Carbohydrate-containing clear liquids (simple or complex)
- Protein-containing clear liquids

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- Chewing gum
- Clear liquid fasting duration (1 h *vs.* 2 h) for children

Methodology

The guideline task force included anesthesiologists, epidemiology-trained methodologists, and a patient representative, who was chosen from contacts of the task force and who had experience as a patient. The members disclosed relevant relationships (industry and other entities) that might pose a conflict of interest. The task force was responsible for developing key questions; the relevant patient populations, interventions, comparators, and outcomes; and the study inclusion/exclusion criteria to guide the systematic review (see Systematic Review Protocol in the Supplemental Digital Content, <http://links.lww.com/ALN/C930>).

- Population: patients undergoing general anesthesia, regional anesthesia, or procedural sedation for elective procedures
- Interventions: drinking carbohydrate-containing clear liquids (simple or complex) until 2 h before general anesthesia, regional anesthesia, or procedural sedation for elective procedures; drinking protein-containing clear liquids (all studied included carbohydrates) until 2 h before general anesthesia, regional anesthesia, or procedural sedation for elective procedures; gum chewing before surgery/procedure; and a shortened duration for clear liquid fasting in children of 1 h
- Comparators: fasting or drinking noncaloric clear liquids (*e.g.*, water, placebo, broth, black tea, black coffee); no gum chewing; and clear liquid fasting duration of 2 h in pediatric patients
- Outcomes: adverse effects of fasting (preoperative hunger, thirst, and nausea) and pulmonary aspiration. Due to the rarity of aspiration, regurgitation, gastric volume, and gastric pH were included as intermediate outcomes.

The anesthesiologist and patient representative task force members rated the importance of each outcome for decision-making on a scale of 1 to 9 (1 to 3, of limited importance; 4 to 6, important; 7 to 9, critical).⁸ The evidence synthesis focused on the outcomes rated important or critical.

Literature Search

Comprehensive bibliographic database searches were conducted by a medical librarian using PubMed, EMBASE, and SCOPUS in July 2020 and updated in December 2021. Studies examining carbohydrate- and protein-containing clear liquids published in January 2000 or later were eligible for inclusion. Because gum chewing and 1-h fasting in pediatric patients were new in this guideline, studies published beginning in January 1990 were eligible. In addition, the Cochrane Central Register of Controlled Trials was queried; task force members provided potentially relevant studies; references from systematic reviews and meta-analyses

were hand-searched; and trial registries were searched. The PRISMA flow diagram (<http://links.lww.com/ALN/C931>) and Literature Search Strategy (<http://links.lww.com/ALN/C932>) are available as Supplemental Digital Content.

Study Screening and Selection

Titles with abstracts and full-text screening were performed using systematic review software (DistillerSR,⁹ Evidence Partners, Ottawa, Canada). Screening was performed independently by two methodologists. Conflicts were discussed and, when necessary, included a third methodologist to achieve consensus. All discrepancies were resolved. Potential inclusion-exclusion discrepancies were also examined with an artificial intelligence tool, a component of the systematic review software. Eligible studies included randomized and nonrandomized trials, quasiexperimental, cohort (prospective and retrospective), and case-control designs. Case reports and case series, conference abstracts, letters not considered research reports, non-English publications, and animal studies were excluded. Excluded studies with reasoning are shown in the Supplemental Digital Content (<http://links.lww.com/ALN/C933>). Studies with multi-component interventions (for example, enhanced recovery after surgery protocols) were excluded if the effect of fasting on outcomes could not be independently ascertained. Clear liquids with carbohydrates were categorized as simple or complex. Simple carbohydrates included clear fruit juices or water with glucose or fructose added. The complex carbohydrate used in the carbohydrate-loading interventions was maltodextrin. Clear liquids containing less than 10 gm/ml carbohydrate were not considered carbohydrate-containing. Oral rehydration solutions were classified as simple carbohydrates. All protein-containing clear liquids also contained carbohydrates. Trial comparator liquids such as water, placebo, broth, black tea, and black coffee are referred to as “noncaloric clear liquids.”

Data Extraction and Management

The study results were extracted into DistillerSR by a single methodologist and reviewed by a second methodologist for quality control. Conflicts were resolved by consensus. When the relevant data were not reported in the published work, attempts were made to contact the authors. The figures were digitized as necessary to obtain quantitative results for synthesis.

Evidence Synthesis

The body of evidence was first described according to study characteristics and treatment arms. The results were then summarized in tabular form by outcome. When relevant, decision-informative, and practicable, pairwise and network random-effects meta-analyses of randomized controlled trials were conducted.^{10,11} Nonrandomized studies were considered in the assessment of harms when there was infrequent reporting of harms in randomized controlled trials. Small study

Table 1. GRADE Strength of Evidence Definitions

GRADE	Interpretation
High	We are very confident that the true effect lies close to the estimate of the effect.
Moderate	We are moderately confident in the effect estimate. The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.
Low	Our confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect.
Very low	We have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of effect.

GRADE, Grading of Recommendations, Assessment, Development, and Evaluation framework.

effects and the potential for publication bias were evaluated using funnel plots and regression-based tests.¹² Analyses were conducted in R (R Foundation for Statistical Computing, Vienna, Austria).^{13–15} (See the methods supplement for further details, <http://links.lww.com/ALN/C962>.)

Risk of Bias Assessment

The risk of bias for individual studies was evaluated using tools according to study design: for randomized controlled trials, the Cochrane risk of bias tool,¹⁶ and for nonrandomized studies, the Risk Of Bias In Non-Randomised Studies of Interventions tool.¹⁷ The risk of bias appraisals for only randomized controlled trials were used to support all strength-of-evidence ratings (supplemental figs. 1 through 14, <http://links.lww.com/ALN/C935>).

Strength of Evidence

The strength of evidence was rated by outcome using the Grading of Recommendations, Assessment, Development, and Evaluation framework (table 1). In this framework, randomized control trials start as high strength of evidence, and nonrandomized studies start as low. The strength may be downgraded based on summary study-level risk of bias, inconsistency, indirectness, imprecision, and publication bias. The strength may be upgraded if the effect is large, if a dose-response is present, or if unaccounted residual confounding would likely have increased the effect.¹⁸ For the comparisons of simple and complex carbohydrate-containing clear liquids (residual gastric volume and hunger, and thirst), the strength of evidence was assessed with the Confidence in Network Meta-Analysis tool.¹⁹ This tool includes considerations specific to network meta-analyses.

Strength of Recommendations

For each key question, the evidence synthesis and summary tables of benefits and harms were presented to the task force. The methodologists also reviewed the strength

of the evidence for each outcome by key question with the task force.

The categories of recommendations in the Grading of Recommendations, Assessment, Development, and Evaluation approach include strong in favor, conditional in favor, conditional against, and strong against an intervention. Strong recommendations reflect the task force believing all or almost all clinicians would choose the specific action or approach. Conditional recommendations are those where most, but not all, would choose the action or approach.^{20,21} When the task force judged the body of evidence inappropriate to rate the strength of evidence but judged a recommendation important, a best practice statement was considered.²²

Carbohydrate-containing Clear Liquids

Key Question

For adults undergoing elective procedures with general anesthesia, regional anesthesia, or procedural sedation, what are the benefits and harms of carbohydrate-containing clear liquids ingested until 2 h before the procedure compared with fasting and noncaloric clear liquids?

Recommendation

We recommend healthy adults drink carbohydrate-containing clear liquids until 2 h before elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation. The carbohydrates may be simple or complex.

- Strength of recommendation: Strong
- Strength of evidence: Moderate

Up to 400 ml of clear liquids is considered an appropriate volume. Trial participants ingested a median of 400 ml of carbohydrate-containing clear liquids (interquartile range, 300 to 400 ml) up to 2 h before anesthesia administration.

Summary of Evidence

Most patients in the studies were ASA Physical Status I or II with mean or median body mass index of 25 kg/m² (range, 21 to 33 kg/m²; see Appendix). Patients drinking carbohydrate-containing clear liquids until 2 h before their procedures experienced less hunger and thirst compared to fasting (table 2) and less hunger compared to drinking noncaloric clear liquids (table 3). There was no incidence of aspiration or regurgitation in any groups. Tables 2 and 3 summarize the evidence for clinically important outcomes. Supplemental tables 1 to 4 (<http://links.lww.com/ALN/C934>) detail the strength-of-evidence ratings.

Carbohydrate-containing Clear Liquids *versus* Fasting

Patient-reported Outcomes. Participants drinking carbohydrate-containing clear liquids had lower patient-rated hunger

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Table 2. Benefits, Harms, and Strength of Evidence for Carbohydrate-containing Clear Liquids *versus* Fasting

Nonrandomized Studies	Randomized Controlled Trials	Patients	Outcomes	Strength of Evidence GRADE	Effect	Estimate (95% CI)
	5	496	Less hunger*	Moderate	Risk ratio	0.55 (0.43 to 0.71)
	19	1,439	Lower patient-rated hunger	Moderate	Standardized mean difference	-0.62 (-0.84 to -0.40)
	6	673	Less thirst*	Moderate	Mean difference†	-16.7 (-22.6 to -10.9)
	19	1,437	Lower patient-rated thirst	Moderate	Risk ratio	0.43 (0.24 to 0.74)
					Standardized mean difference	-1.0 (-1.4 to -0.63)
					Mean difference†	-24.0 (-33.0 to -15.0)
	5	290	Less nausea*	Low	Risk ratio	0.76 (0.40 to 1.44)
	8	659	Lower patient-rated nausea	Low	Standardized mean difference	-0.03 (-0.48 to 0.43)
					Mean difference†	-0.2 (-4.0 to 3.5)
3	2	108	More satisfaction	Low		Discordant trial results
	31	2,688	Aspiration	Not rated		No aspiration reported
	5	402	Regurgitation	Very low		Differences not detected in any trial
	5	518	Vomiting	Low		Differences not detected in any trial
	14	1,103	Residual gastric volume	Moderate	Mean difference	-2.1 mL (-5.5 to 1.3)
	5	564	Gastric pH	Moderate	Mean difference	0.17‡ (-0.40 to 0.74)

*Incidence proportion. †Reexpressed from standardized mean difference based on mean weighted standard deviation from studies reporting results on a 0 to 100 visual analogue scale. ‡Mean pH in fasted arms 3.1 (95% CI, 1.4 to 4.7). Patients with long-term use of histamine 2 receptor antagonists were excluded from the studies, although one study administered histamine 2 receptor antagonists to the patients in both arms of the study the night before surgery. GRADE, Grading of Recommendations, Assessment, Development, and Evaluation framework.

Table 3. Benefits, Harms, and Strength of Evidence for Carbohydrate-containing Clear Liquids *versus* Noncaloric Clear Liquids

Nonrandomized Studies	Randomized Controlled Trials	Patients	Outcomes	Strength of Evidence GRADE	Effect	Estimate (95% CI)
	9	939	Lower patient-rated hunger	Moderate	Standardized mean difference	-0.52 (-0.83 to -0.21)
					Mean difference†	-12.8 (-20.9 to -5.2)
	1	40	Less thirst*	Very low	Risk ratio	0.14 (0.01 to 2.6)
	10	850	Lower patient-rated thirst	Low	Standardized mean difference	-0.3 (-0.73 to 0.13)
					Mean difference†	-5.6 (-13.4 to 2.3)
	4	823	Less nausea*	Very low		Discordant trial results
	4	338	Lower patient-rated nausea	Low		Differences not detected in any trial
	2	132	More satisfaction	Low		Higher with carbohydrate liquids
	17	1,823	Aspiration	Not Rated		No aspiration reported
	3	115	Regurgitation	Not Rated		No regurgitation reported
	4	823	Vomiting	Very low		Differences not detected in any trial
1	6	955	Residual gastric volume	Low	Mean difference	0.1 mL (-3.8 to 4.0)
	1	105	Gastric pH	Very low		Differences not detected in any trial

*Incidence proportion. †Reexpressed from standardized mean difference based on mean weighted standard deviation from studies reporting results on a 0 to 100 visual analogue scale. GRADE, Grading of Recommendations, Assessment, Development, and Evaluation framework.

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(supplemental figs. 15 to 16, <http://links.lww.com/ALN/C935>) and thirst²³⁻⁴² compared with fasting patients (moderate strength of evidence). Differences were not detected in rates of nausea^{36,39,43-45} (low strength of evidence) or patient-rated nausea (low strength of evidence). Patient satisfaction^{31,46} was reported in only two trials, and a difference could not be assessed (low strength of evidence).

Clinical Outcomes. No aspiration was reported after either the fasting or carbohydrate-containing clear liquids groups in 31 randomized controlled trials,^{23-26,29,30,32,33,36,37,39,42-44,47-64} 2 non-randomized trials,^{65,66} and 1 case-control study⁶⁷ (strength of evidence not rated due to lack of events). Differences were not detected in regurgitation^{43,49,55,66,68,69} (very low strength of evidence) or preoperative vomiting^{39,50-52,62} (low strength of evidence). Meaningful differences were not apparent for either residual gastric volume^{34,38,41,44,46,48-51,62,68-71} (supplemental fig. 17, <http://links.lww.com/ALN/C935>) or gastric pH^{46,50,51,69,71} after fasting or drinking carbohydrate-containing clear liquids (moderate strength of evidence).

Carbohydrate-containing Clear Liquids versus Noncaloric Clear Liquids

Patient-reported Outcomes. Drinking carbohydrate-containing clear liquids resulted in lower hunger ratings than did noncaloric clear liquids (moderate strength of evidence).^{23,24,26,39,41,72-75} Differences were not evident for patient ratings of thirst^{23,24,26,39,41,72,73,75-77} (low strength of evidence) and nausea^{23,24,26,73} (low strength of evidence) or in rates of preoperative thirst⁷⁸ and nausea^{23,24,26,39,73,79} (both very low strength of evidence). Patient satisfaction^{46,80} was reported in two trials, with higher satisfaction in patients drinking carbohydrate-containing clear liquids (low strength of evidence). **Clinical Outcomes.** No aspiration after carbohydrate-containing clear or noncaloric clear liquids was reported in 17 randomized controlled trials.^{23,24,26,39,55,57,59,63,74,75,77,78,80-84} (strength of evidence not rated due to lack of events). Regurgitation^{49,55,77} or preoperative vomiting^{39,75,82,85} did not differ in randomized controlled trials (very low strength of evidence). Differences in either residual gastric volume^{41,46,68,77,82,86} (low strength of evidence) or gastric pH^{46,87} (very low strength of evidence) could not be determined.

Comment

Healthy adult patients should be encouraged to drink up to 400 ml of carbohydrate-containing clear liquids until 2 h before an elective procedure to minimize potential harms of prolonged fasting, including hunger and thirst. Trials provided participants with a median of 400 ml (interquartile range, 300 to 400 ml) of clear liquids 2 h before anesthesia administration without adverse consequences. Although differences were not detected in thirst, preoperative nausea, or patient satisfaction, the body of evidence is consistent with lower patient ratings of hunger with carbohydrate-containing

clear liquids over noncaloric ones. Aspiration of gastric contents was not evident in the studies.

The overall assessment of aspiration risk may not rely on ASA Physical Status alone, as many of the comorbidities that qualify patients for a higher ASA Physical Status score may be unrelated to delayed gastric emptying or aspiration risk (for example, poorly controlled hypertension). Important consideration should be given to comorbidities that may affect gastric emptying and/or aspiration risk, regardless of ASA Physical Status. Decision-making is complicated by emerging data suggesting that some of the conditions traditionally considered to have an impact on gastric emptying may have little or no effect on gastric emptying. Consistent with the 2017 ASA guideline intended population,¹ healthy individuals are defined as those without coexisting diseases or conditions that may increase the risk for aspiration, including esophageal disorders such as significant uncontrolled reflux disease, hiatal hernia, Zenker's diverticulum, achalasia, stricture; previous gastric surgery (for example, gastric bypass); gastroparesis; diabetes mellitus^{88,89}; opioid use; gastrointestinal obstruction or acute intraabdominal processes; pregnancy; obesity; and emergency procedures.²⁻⁴ Anesthesiologists should recognize that these conditions can increase the likelihood of regurgitation and pulmonary aspiration and should modify these guidelines based upon their clinical judgment.

Mixed treatment comparisons did not support the superiority of complex carbohydrates over simple carbohydrates with respect to residual gastric volume or hunger (network meta-analysis; supplemental figs. 18 to 20, <http://links.lww.com/ALN/C935>, and supplemental tables 5 and 6, <http://links.lww.com/ALN/C934>).

Carbohydrate-containing liquids may have an impact on blood glucose levels in patients with diabetes, especially patients who skip or reduce their usual hypoglycemics before surgery. Home glucometer readings may help guide the patient's choice of a carbohydrate or a noncaloric clear liquid.

In summary, the evidence showed that for patients with low risk of aspiration, carbohydrate-containing clear liquids until 2 h preoperatively was superior to absolute fasting with respect to beneficial outcomes, without evidence of increased risks. Both simple and complex carbohydrate-containing clear liquids were slightly more advantageous compared with noncaloric clear liquids in patient satisfaction.

Protein-containing Clear Liquids

Key Question

For adults undergoing elective procedures with general anesthesia, regional anesthesia, or procedural sedation, what are the benefits and harms of protein-containing clear liquids 2 h before the procedure compared with fasting and other clear liquids?

Recommendation

There is insufficient evidence to recommend protein-containing clear liquids preferentially over other clear liquids 2 h

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Table 4. Benefits, Harms, and Strength of Evidence for Protein-containing Clear Liquids *versus* Fasting

Nonrandomized Studies	Randomized Controlled Trials	Patients	Outcomes	Strength of Evidence GRADE	Effect	Estimate (95% CI)
	1	98	Less hunger*	Very low	Risk ratio	0.66 (0.46 to 0.96)
	1	113	Lower patient-rated hunger	Very low		Median 10 vs. 18†, NS
	1	98	Less thirst*	Very low	Risk ratio	0.85 (0.57 to 1.76)
	1	113	Lower patient-rated thirst	Very low		Median 22 vs. 40†, NS
	1	98	Less nausea*	Very low	Risk ratio	1.15 (0.38 to 3.53)
	1	113	Less patient-rated nausea	Very low		Median 0 vs. 0†, NS
No studies	No studies		Greater satisfaction			
1	8	629	Aspiration	Not Rated		No aspiration reported
	4	150	Regurgitation	Very low		Differences not detected
	1	22	Vomiting	Very low		No vomiting reported
	3	68	Residual gastric volume	Low	Mean difference	-2.5 mL (-8.6 to 3.7)
No studies	No studies		Gastric pH			

*Incidence proportion. †0 to 100 visual analogue scale. GRADE, Grading of Recommendations, Assessment, Development, and Evaluation framework; NS, not significant.

Table 5. Benefits, Harms, and Strength of Evidence for Protein-containing Clear Liquids *versus* Noncaloric Clear Liquids

Nonrandomized Studies	Randomized Controlled Trials	Patients	Outcomes	Strength of Evidence GRADE	Effect Estimate
	1	24	Lower patient-rated hunger	Very low	Median 13 vs. 43†, $p = 0.001$
	2	55	Lower patient-rated thirst	Low	1 randomized controlled trial median 12 vs. 2†, $p = 0.01$ 1 randomized controlled trial difference not detected
	2	86	Less nausea*	Low	Differences not detected
	1	24	Less patient-rated nausea	Very low	Difference not detected
	1	74	Greater satisfaction	Very low	Mean 8.7 vs. 6.9†, $p = 0.01$
	5	270	Aspiration	Not Rated	No aspiration reported
	2	34	Regurgitation	Very low	No regurgitation reported
	1	17	Vomiting	Very low	No vomiting reported
No studies	No studies		Residual gastric volume		
No studies	No studies		Gastric pH		

*Incidence proportion. †0 to 100 visual analogue scale. ‡0 to 10 visual analogue scale. GRADE, Grading of Recommendations, Assessment, Development, and Evaluation framework.

before elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation (no recommendation).

- Strength of evidence: Very low

Summary of Evidence

All protein-containing clear liquids also contained carbohydrates. Patients drinking protein-containing clear liquids until 2h before their procedures experienced less hunger compared to fasting (table 4) and less hunger and thirst compared to drinking other clear liquids (table 5). There was no incidence of aspiration in any group. No differences in the occurrence of regurgitation were detected. Tables 4 and 5 summarize the evidence for clinically important outcomes, and supplemental tables

7 to 10 (<http://links.lww.com/ALN/C934>) detail the strength-of-evidence ratings.

Protein-containing Clear Liquids *versus* Fasting

Patient-reported Outcomes. The evidence comparing fasting with protein-containing clear liquids in adults was limited to single trials for each patient-reported outcome (table 4). Differences were not detected in patient-rated or rates of hunger,^{32,43} thirst,^{32,43} or preoperative nausea^{32,43} (all very low strength of evidence).

Clinical Outcomes. Aspiration was not reported in any of the included studies (randomized controlled trials^{32,43,49,52–55,64} or nonrandomized designs⁹⁰). Differences in regurgitation^{43,49,55,68} or preoperative vomiting⁵² were unobserved

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Practice Guidelines for Preoperative Fasting

in randomized controlled trials (very low strength of evidence). A meta-analysis of three trials found a difference of -2.5 ml (95% CI, -8.6 to 3.7) in residual gastric volume for protein-containing clear liquids *versus* fasting.^{49,68,91}

Protein-containing Liquids *versus* Noncaloric Clear Liquids

Patient-reported Outcomes. The evidence in adults comparing noncaloric clear liquids with those containing protein was limited, with one to two studies reporting each outcome of interest (table 5). Single trials reported less hunger⁷³ and greater satisfaction⁸⁰ among patients drinking protein-containing clear liquids compared with patients drinking other clear liquids (very low strength of evidence). Evidence was inconsistent for thirst,^{73,76} and differences in nausea⁸⁵ were not observed.

Clinical Outcomes. Aspiration,^{49,53,55,57,80} regurgitation,^{55,68} and preoperative vomiting⁸⁵ were not reported in any studies comparing protein-containing clear liquids with noncaloric clear liquids.

Comment

All protein-containing clear liquids in the trials included carbohydrates, precluding assessment of liquids containing only protein. There was inconclusive evidence concerning residual gastric volume in nonsurgical studies that included comparisons of protein-containing clear liquids compared with carbohydrate-containing clear liquids alone (supplemental tables 11 and 12, <http://links.lww.com/ALN/C934>). Therefore, there is insufficient evidence to recommend protein-containing over other carbohydrate-containing or noncaloric clear liquids.

Chewing Gum

Key Question

For healthy adults undergoing elective procedures with general anesthesia, regional anesthesia, or procedural

sedation, what are the effects of chewing gum on residual gastric volume, gastric pH, and pulmonary aspiration before anesthesia induction?

Recommendation

We suggest not delaying elective procedures requiring general anesthesia, regional anesthesia, or procedural sedation in healthy adults who are chewing gum.

- Strength of evidence: Very low

Chewing gum should be removed before any sedative/anesthetic is administered.

Summary of Evidence

Patients chewing gum had a minimally increased residual gastric volume at anesthesia induction compared with fasting (table 6). A difference was not detected in gastric pH between the groups. Table 6 summarizes the evidence for clinically important outcomes. Supplemental tables 13 and 14 (<http://links.lww.com/ALN/C934>) detail the strength-of-evidence ratings.

Patient-reported Outcomes. In adults, evidence comparing fasting with chewing gum was inconsistent with respect to patient-rated hunger⁹² or thirst^{92,93} (very low strength of evidence). A study of smokers⁹² reported less thirst than those chewing gum (very low strength of evidence).

Clinical Outcomes. There is no clinically relevant increase in residual gastric volume after chewing gum^{92,94-97} (low strength of evidence, supplemental fig. 21, <http://links.lww.com/ALN/C935>, and supplemental table 15, <http://links.lww.com/ALN/C934>). A difference was not detected in gastric pH^{92,94-97} (low strength of evidence, supplemental table 16, <http://links.lww.com/ALN/C934>). Aspiration was not reported (strength of evidence not rated due to lack of events). Compared with water, residual gastric volume increased in patients chewing gum (very low strength of evidence) in one crossover study.⁹⁸

Table 6. Benefits, Harms, and Strength of Evidence for Chewing Gum *versus* Fasting

Nonrandomized Studies	Randomized Controlled Trials	Patients	Outcomes	Strength of Evidence GRADE	Effect	Estimate (95% CI)
	1	104	Less patient-rated hunger	Very low		Differences not detected in smokers or nonsmokers Inconsistent results nonsmokers Less thirst smokers
	2	162	Less patient-rated thirst	Very low		
	1	44	Less patient-rated thirst	Very low		
No studies	No studies		Less nausea			
No studies	No studies		Greater satisfaction			
No studies	No studies		Aspiration			
No studies	No studies		Regurgitation			
No studies	No studies		Vomiting			
	5	550	Residual gastric volume	Low	Mean difference	7.6 mL (3.0 to 12.2)
	5	550	Gastric pH	Low	Mean difference	-0.1 (-0.4 to 0.2)

GRADE, Grading of Recommendations, Assessment, Development, and Evaluation framework.

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Comment

Although the task force does not recommend delaying surgery in healthy adults who have chewed gum during the fasting period, we urge clinicians to confirm the gum has been removed before anesthetic administration. The evidence suggests there is not a clinically meaningful increase in gastric volume after chewing gum. Any benefits of gum chewing are inconsistent and insufficiently studied to encourage gum chewing before surgery.

In conclusion, we do not recommend chewing gum before surgery due to absence of demonstrable benefits. However, if a patient chews gum for personal comfort or preference, we recommend not delaying the scheduled elective procedure, due to inconclusive evidence of harm.

One-hour Clear Liquid Fasting in Pediatric Patients

Key Question

For pediatric patients undergoing elective procedures with general anesthesia, regional anesthesia, or procedural sedation, what are the benefits and harms of 1-h *versus* 2-h clear liquid fasting?

Recommendation

There is insufficient evidence concerning benefits and harms to recommend pediatric patients drink clear liquids until 1 h *versus* 2h before procedures with general anesthesia, regional anesthesia, or procedural sedation (no recommendation).

- Strength of evidence: Very low

Best Practice Statement

To avoid prolonged fasting in children, efforts should be made to allow clear liquids in children at low risk of

aspiration as close to 2h before procedures as possible. In children with shorter clear liquid fasting duration, exercise clinical judgment.

Summary of Evidence

Differences were not detected in patient-reported hunger or thirst, incidence of aspiration or regurgitation, and gastric pH among pediatric patients fasting for 1 h compared with 2 h (table 7). Inconsistent results were reported for residual gastric volume. Table 7 summarizes the evidence for clinically important outcomes. Supplemental tables 17 through 19 (<http://links.lww.com/ALN/C934>) detail the strength-of-evidence ratings.

Patient-reported Outcomes. Evidence concerning patient-reported outcomes comparing 1- to 2-h clear liquid fasting in children was limited to one or two studies per outcome. Differences were not detected in preoperative hunger⁹⁹ (very low strength of evidence), preoperative thirst^{99,100} (very low strength of evidence), or preoperative nausea⁹⁹ (very low strength of evidence). A single randomized controlled trial reported higher satisfaction in parents of children with a 1-h clear liquid fast compared with parents of children with a 2-h clear liquid fast⁹⁹ (very low strength of evidence).

Clinical Outcomes. Two randomized controlled trials and one large prospective cohort study reported on aspiration and regurgitation.⁹⁹⁻¹⁰¹ One trial reported no aspiration in either group.⁹⁹ The other trial included children undergoing surgery for cyanotic congenital heart disease and did not detect a difference in aspiration; however, incidence was high in this population (1.8 and 1.7% in the 1- and 2-h arms respectively).¹⁰⁰ A large prospective cohort study that included subgroups of children fasting less than 1 h (n = 1,709) and 1 to 2 h (n = 2,897) reported higher rates of aspiration and regurgitation in the less than 1-h fasting group (very low strength of evidence) but also noninferiority for regurgitation or pulmonary aspiration (not worse than 1 per 1,000) for a 1- to 2-h clear liquid fast compared with longer times.¹⁰¹

Table 7. Benefits, Harms, and Strength of Evidence for 1-h *versus* 2-h Clear Liquid Fasting in Children

Nonrandomized Studies	Randomized Controlled Trials	Patients	Outcomes	Strength of Evidence GRADE	Effect	Estimate (95% CI)
	1	131	Lower patient-rated hunger	Very low		Difference not detected
	1	131	Lower patient-rated thirst	Very low		Difference not detected
	1	344	Less thirst (incidence proportion)	Very low	Risk ratio	0.62 (0.43 to 0.89)
	1	131	Less nausea (incidence proportion)	Very low	Risk ratio	0.90 (0.03 to 2.2)
	1	131	More parental satisfaction	Very low		Better in 1 of 4 domains
1	2	475	Aspiration	Very low		Differences not detected
		4,606	Aspiration/regurgitation	Very low		Less than 1 h: 0.64% vs. 1 to 2 h: 0.24%
	2	475	Vomiting	Low		Differences not detected
6*	2	622	Residual gastric volume	Very low		Inconsistent study results
	1	131	Gastric pH	Very low		Difference not detected

*Includes single-arm results from randomized controlled trials.

GRADE, Grading of Recommendations, Assessment, Development, and Evaluation framework.

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Differences were not detected in vomiting^{99,100} or gastric pH⁹⁹ between children fasted 1 h *versus* 2 h (low and very low strength of evidence, respectively). Discordant results for residual gastric volume were reported in two trials^{99,100} randomizing patients to 1- and 2-h fasting. Six additional studies provided data on gastric volume over time.^{35,102-106} Three of the studies¹⁰²⁻¹⁰⁴ were consistent with a return to baseline gastric volume close to 2h, while three studies^{35,105,106} were consistent with a return at 1 h (very low strength of evidence; supplemental table 20, <http://links.lww.com/ALN/C934>).

Comment

Fasting duration is often substantially longer than recommended irrespective of a 1- or 2-h clear liquid fasting policy.¹⁰⁷⁻¹¹² Prolonged fasting influences patient-related outcomes (preoperative thirst, hunger, anxiety, nausea and vomiting, pain, and reduced feeling of well-being) and clinical outcomes (dehydration, electrolyte imbalance, and hypotension at induction of general anesthesia).^{113,114} Due to low-quality evidence, the task force was unable to make a recommendation for reducing the clear liquid fasting duration to 1h in the pediatric population. Several pediatric anesthesia practices in the United States now utilize the 1-h fasting duration for clear liquids. Recent European¹¹⁵ and Canadian¹¹⁶ guidelines have recommended reducing clear liquid fasting to 1h in children. However, studies in children are limited, lack significant power to detect uncommon risks, and clinical controversy exists.¹¹⁷

Research Gaps and Major Uncertainties

There is a need for well designed, adequately powered randomized trials or large prospective cohort studies in both adults and children to evaluate uncommon adverse events and patient-reported outcomes including preoperative thirst, hunger, anxiety, and patient satisfaction. Comparisons and questions of interest include

- Carbohydrate-containing clear liquids (simple and complex) compared with fasting and noncaloric clear liquids
- Simple carbohydrate-containing clear liquids compared with complex carbohydrate-containing clear liquids
- Carbohydrate-containing clear liquids (simple and complex) compared with clear protein-containing liquids alone
- Protein-containing clear liquids alone compared with fasting and other clear liquids
- Adding milk or cream to coffee or tea *versus* fasting and other clear liquids
- The impact of carbohydrate-containing clear liquids on glycemic levels in patients with diabetes
- Gum chewing compared with no gum chewing

There is a need for studies evaluating gastric volume, gastric emptying, and aspiration in patients with high risk of regurgitation. Comparators of interest include

- Carbohydrate- and protein-containing clear liquids alone and in combination
- Gum chewing

Rigorous comparisons for equivalence or superiority between 1-h *versus* 2-h fasting durations in pediatric patients are needed.

Moreover, there is a need to study gastric emptying and gastric pH in critically ill patients receiving enteral feeding to determine the shortest safe duration of fasting before surgery in that population to minimize feeding interruptions. In the meantime, the task force wishes to remind clinicians to exercise clinical judgment in minimizing feeding interruptions in critically ill patients whose airways are protected with endotracheal or tracheostomy tubes with properly inflated cuffs undergoing procedures that do not include reintubation or airway manipulations.

Finally, there is a need for education of patients, their caregivers, and healthcare providers regarding avoidance of preoperative fasting beyond the recommended durations and the detrimental effects of prolonged fasting.

Summary

The task force reaffirms the 2017 recommendations for clear liquids until 2h preoperatively.¹ Simple or complex carbohydrate-containing clear liquids appear to reduce patient hunger when compared with noncaloric clear liquids. The addition of protein to preoperative carbohydrate-containing clear liquids did not appear to either benefit or harm healthy patients. We further suggest not to delay surgery in healthy adults after confirming removal of chewed gum.

Prolonged fasting has well described adverse consequences. Actively encouraging clear liquids in healthy children as close to 2h before procedures as possible is important to avoid them.

The task force recommends a robust local effort at each facility disseminating and discussing information shared in this document, providing necessary education to all patient care teams, including but not limited to all members of the anesthesiology and surgical teams, preoperative clinic personnel, preoperative nurses, and hospital floor nurses. Furthermore, it would be necessary to update related policies, printed literature, and wall posters/charts to ensure that patients are receiving consistent messages and instructions from all medical personnel.

Appendix: Study and Patient Characteristics

Carbohydrate-containing Clear Liquids

The body of evidence included 139 studies (adult surgical: 99 randomized controlled trials,^{23-34,36-64,68-86,91,118-157} 7 non-randomized trials,^{65,66,87,152,158-160} 3 prospective cohort studies,^{90,161,162} 2 retrospective cohort studies,^{163,164} 1 case-control study,¹⁶⁵ and 2 before-after studies^{67,166}; adult nonsurgical: 1

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randomized controlled trial,¹⁶⁷ 9 crossover,^{168–176} and 2 nonrandomized trials^{177,178}; pediatric surgical: 9 randomized controlled trials,^{100,113,179–185} 1 prospective cohort¹⁸⁶; and pediatric nonsurgical: 2 randomized controlled trial,^{102,104} 1 crossover,³⁵ and 1 prospective cohort¹⁰³ comparing carbohydrate-containing clear liquids (simple, complex) with water, placebo, or fasting. In the carbohydrate arms, liquids were allowed an average of 2.25 h before surgery (80% until 2 h).

The characteristics of randomized trials supporting recommendations for adult surgical patients (aspiration was assessed across study designs, but the strength of evidence was unable to be rated) included a mean of 95 participants (range, 15 to 880). Approximately one half (53%) were conducted in low-resource countries (Human Development Index scores less than 0.8). Industry support was reported in 16 trials, and author conflict of interest was reported in 12 (10%) studies.

Almost all adult study participants had an ASA Physical Status I or II (92%). The mean age was 53.1 yr (range, 26 to 81), and 61% were women. Excluding the single trial of gastric bypass patients, the average of either mean or median body mass index was 25.1 kg/m² (range, 21 to 33). Nine (9%) trials included diabetic patients (from 2 to 100% of participants).

Protein-containing Clear Liquids

All studied protein-containing clear liquids also contained carbohydrates. The body of evidence included 22 adult surgical studies (20 randomized controlled trials,^{32,43,49,52–55,57,64,68,73,76,80,85,91,148–152} 1 nonrandomized trial,⁹⁰ and 1 retrospective cohort¹⁶⁵), 7 adult nonsurgical studies (1 randomized controlled trial¹⁶⁷ and 6 crossover studies^{170,171,173–176}), and 1 pediatric nonsurgical study¹⁰⁴ comparing the effects of drinking protein-containing clear liquids with fasting or noncaloric clear liquids.

The characteristics of randomized trials supporting recommendations for adult surgical patients included a median of 46 participants (range, 20 to 150). The mean age of participants was 47 yr, 70% were female, and the average body mass index was 23.9 kg/m². Twelve studies (53%) reported enrolling patients rated with ASA Physical Status I or II (2 studies also included ASA Physical Status III, and 9 did not report ASA Physical Status). Four (22%) trials included diabetic patients (from 9 to 31% of participants). Two studies received industry support, and 1 study noted author conflict of interest.

Chewing Gum

The body of evidence included 10 studies (7 randomized controlled trials,^{92–97,187} 1 crossover study,⁹⁸ 1 single-arm study,¹⁸⁸ and 1 case series¹⁸⁹) comparing chewing gum (sugar-free or sugared) with fasting, water, or lollipops. Chewing gum was allowed either until induction or

30 min to 1 h before surgery. Studies enrolled a median of 75 participants (range, 9 to 237). The mean age of participants was 43.2 yr, and 64% were female. Three (30%) studies enrolled patients rated with ASA Physical Status I or II, and 1 (10%) study included ASA Physical Status I to III (6 [60%] studies did not report ASA Physical Status). None of the studies received industry support, and 1 study noted author conflict of interest.

One-hour Clear Liquid Fasting in Pediatric Patients

The body of evidence included 9 studies (5 randomized controlled trials,^{99,100,102,104,106} 1 crossover study,³⁵ and 3 prospective cohort studies^{101,103,105}) providing data on 1- and 2-h fasting in pediatric patients. Only 2 of the trials randomized participants into 1- and 2-h fasting protocols; the remaining studies were not designed to compare 1- and 2-h fasting; however, they included results from pediatric patients fasted less than 2 h.

Most children were ASA Physical Status I or II, although one trial enrolling patients with cyanotic congenital heart disease were more likely of higher ASA Physical Status (ASA Physical Status not reported). One study included younger children (mean age, 3 yr), 2 included children with mean or median age of 5 yr, and the remaining studies reported median ages ranging from 7 to 11 yr. Five studies were conducted in surgical settings, and 4 were nonsurgical. No studies reported industry funding, and 1 (11%) study reported a conflict of interest.

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Competing Interests

Dr. Joshi is a consultant for Baxter Healthcare (Deerfield, Illinois) and Pacira Pharmaceuticals (Parsippany, New Jersey), Dr. Abdelmalak is a consultant and speaker for Acacia Pharma (Duxford, United Kingdom) and Medtronic USA Inc. (Minneapolis, Minnesota), and Dr. Domino has received a research grant from Edwards Life Science Corporation (Irvine, California). The other authors declare no competing interests.

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Address correspondence to American Society of Anesthesiologists: 1061 American Lane, Schaumburg, Illinois 60173. kdomino@uw.edu. This Practice Guideline, as well as all published ASA Practice Parameters, may be obtained at no cost through the Journal Web site, <https://pubs.asahq.org/anesthesiology>.

Supplemental Digital Content

Systematic Review Protocol, <http://links.lww.com/ALN/C930>

PRISMA flowchart, <http://links.lww.com/ALN/C931>

Search strategy, <http://links.lww.com/ALN/C932>

Excluded studies bibliography with reasoning, <http://links.lww.com/ALN/C933>

Supplemental tables, <http://links.lww.com/ALN/C934>

Supplemental figures, <http://links.lww.com/ALN/C935>

Methods Supplement, <http://links.lww.com/ALN/C962>

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 186. Song IK, Kim HJ, Lee JH, Kim EH, Kim JT, Kim HS: Ultrasound assessment of gastric volume in children after drinking carbohydrate-containing fluids. *Br J Anaesth* 2016; 116:513–7
 187. Schoenfelder RC, Ponnamma CM, Freyle D, Wang SM, Kain ZN: Residual gastric fluid volume and chewing gum before surgery. *Anesth Analg* 2006; 102:415–7
 188. Valencia JA, Cubillos J, Romero D, Amaya W, Moreno J, Ferrer L, Pabon S, Perlas A: Chewing gum for 1 h does not change gastric volume in healthy fasting subjects: A prospective observational study. *J Clin Anesth* 2019; 56:100–5
 189. Shanmugam S, Goulding G, Gibbs NM, Taraporewalla K, Culwick M: Chewing gum in the preoperative fasting period: An analysis of de-identified incidents reported to webairs. *Anaesth Intensive Care* 2016; 44:281–4

HANDOUTS



Pro/Con: You Should NEVER Do a Case with an SGA for More than 2 hours

Kenneth Cummings, MD, MS, FASA (Pro)

Dawn J. Schell, MD (Con)

05/19/2023

11:30am - 12:00pm MST

PRO: Never Use a Supraglottic Airway for More than 2 Hours

Kenneth Cummings, MD, MS, FASA
Anesthesiology Institute, Cleveland Clinic

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1

Overview

- A brief history of supraglottic airways (SGA)
- Some sobering information about SGA
- Recommendations

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Supraglottic Airways

- 1937 – Leech invents the “pharyngeal bulb gasway”
- 1982 – Brain patents the LMA
- Categorized into generations:
 - 1st Generation (no gastric drain): LMA, LM Aura, Cobra PLA, King-LT, etc.
 - 2nd Generation (gastric drain): LMA ProSeal/Supreme, i-Gel, LT-SD, SLIPA, etc.
- Differences in seal location:
 - Base-of-Tongue: King LT, LT-SD, COPA
 - Pharyngeal: LMA, i-Gel, SLIPA, etc.

Michalek P et al. BioMed Res Int 2015; 746560

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3

SGAs Are Awesome, Right?

- Generally easy to insert
- Less stimulating than ETT
- Allow controlled or spontaneous ventilation
- Less hassle on emergence
- Lower incidence of sore throat than ETT?
- No formal recommendations about duration

Awesome!

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What We Will Discuss

- Evidence for multiple types of injuries associated with SGA use
- Risk factors for injury
- SGAs can be awesome *when used properly*

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Open Wide...

Thiruvankatarajan, R, et al. Anaesthesia 2015;70:344-59

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Injuries from SGA Use*

Site of Injury	Type of Injury
Pharyngeal mucosa	Laceration, bruising, breakdown
Laryngeal apparatus	Arytenoid dislocation, RLN injury
Uvula	Trauma / necrosis
Epiglottis	Bruising / laceration
Tongue	Frenular injury, lingual nerve injury
Teeth	Fracture / displacement
Lips	Laceration / nerve injury

*Excluding aspiration, etc.

Michalek P et al. BioMed Res Int 2015; 746560
 Brimacombe, et al. BJA 2005; 95(3):420-23
 Stewart A and Lindsay WA. Anaesthesia 2002; 57:264-5

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Nerve Injury Reports

Age	Sex	ASA	Duration	Nerve	Recovery?
61	M	2	150 min	Lingual	15 days
73	M	3	140 min	Lingual	>6 months
62	F	3	180 min	Hypoglossal	1 week
15	M	1	180 min	Hypoglossal	4 weeks
28	M	?	210 min	Hypoglossal	4 months
71	F	3	120 min	RLN	>2 months
63	F	3	425 min	Bilateral RLN	Trach 1 month

Brimacombe, et al. BJA 2005;95:420-423

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Decreased Cerebral Perfusion?!

The laryngeal mask airway reduces blood flow in the common carotid artery bulb

	Inflated	Deflated	P
Area (cm ²)	0.58 ± 0.05	0.44 ± 0.04	< 0.005
Flow (cm ³ sec ⁻¹)	65.6 ± 5.6	73.9 ± 5.6	< 0.05
Velocity (cm sec ⁻¹)	114.6 ± 5.4	118.4 ± 5.9	NS

Mean ± SEM.

CJA 1998;45(1):23-27

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9

What Contributes to SGA Injuries?

Patient Factors	Extrinsic Factors
Diabetes	Cuff pressure
Arthritis (RA, AS)	Duration
Anatomic abnormalities	Cuff over-inflation
	Undersized SGA
	Difficult insertion
	N ₂ O use?
	Hypoperfusion?

Martins et al. Laryngoscope 2009; 110(4):645-50

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Cuff Pressure – LMA

LMA Type	10 ml	20-30 ml
LMA 3	~18 mmHg	~48 mmHg
LMA 4	~15 mmHg	~52 mmHg

O'Kelly et al. Anaesthesia 1993; 48:1075

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Cuff Pressure

- RCT of manometry guidance vs none reduces adverse events by 70%
 - ~1 hour case duration
 - Limit cuff pressure to <44 mmHg (60 cmH₂O)

	1 h		2 h		24 h	
	Pressure Limiting (n = 97)	Routine Care (n = 162)	Pressure Limiting (n = 97)	Routine Care (n = 102)	Pressure Limiting (n = 97)	Routine Care (n = 102)
Sore throat (%)	7.2	7.8	2.1*	8.7	3.1*	13.6
P value		0.883		0.036		0.008
Dysphagia (%)	1*	12.6	0*	12.6	2.1*	8.7
P value		0.001		<0.001		0.008
Dysphonia (%)	5.2*	15.5	4.1	11.7	4.1	6.8
P value		0.017		0.056		0.407

*P < 0.05.

Sweet, et al. Anesthesiology 2010; 112:652

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12

Duration

- Incidence of sore throat increases after 60 minutes
- Histologic mucosal injury at 2 hours in animal studies
- Many injury case reports include longer duration

Michalek P et al. BioMed Res Int 2015; 746560

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1st versus 2nd Generation?

- No solid evidence and unlikely to be studied
- Expert opinion
 - Easier insertion
 - Lower cuff pressures?

BJA 2015; 115:497-9

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Patients Are Not Diamonds

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Patients Are Not Diamonds

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Patients Are Not Diamonds

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Putting It All Together

- SGA Cuff pressure predisposes to complications – **do we measure it?**
- SGA size is important – **are we always right?**
- Long SGA duration predisposes to some complications
- Excess risk from ETT for longer cases is not prohibitive

Don't use an SGA for more than 2 hours, especially if you're not measuring pressure

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Thank You



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19



You Should Never Use an SGA for Longer Than 2 Hours: CON



Dawn J Schell, MD | Director of Anesthesia | Cole Eye Institute
 Clinical Professor of Anesthesiology | CCLCM of CWRU
 Anesthesiology Institute | Cleveland Clinic
 President, Society for Ambulatory Anesthesia |
Dsche1SAMBA@ccf.org

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1



Disclosures:

- Consultant for AMBU

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2



You should not use a SGA for more than two hours??



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3



No supraglottic airway manufacturer recommends limiting use to two hours in product data sheets

- LMA North America/Teleflex-no comments
- AMBU- no comments
- Solus- no comments
- Air-Q- no comments
- I-Gel-use for procedures lasting less than four hours



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Potential concerns with case duration greater than 2 hours

- Sore throat
- Cranial nerve neuropraxia
- Regurgitation and aspiration



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Sore throat affects up to 49% of patients after SGA use

Incidence affected by:

- Type of SGA +/-
- Ease of insertion/technique
- Post-insertion management
- Younger age
- History of chronic pharyngitis
- Duration of surgery



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Minimizing risk of sore throat...

- Avoid endotracheal intubation!
- No clear “winner” between various SGA devices
- Use appropriately sized SGA
- Monitor cuff pressure regularly, especially if using N2O-should not exceed 60 cm H2O



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Cranial Nerve Neuropraxias

- Documented case reports of various cranial n injuries
- 2015 Thiruvankatarajan et al. published a comprehensive review of literature case reports:
 - Lingual n=22
 - Recurrent laryngeal n=17 (arytenoid dislocation)
 - Hypoglossal n=11
 - Glossopharyngeal n=3
 - Infraorbital (branch of maxillary) n=1
 - Inferior alveolar (branch of mandibular) n=2



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Cranial nerve injuries with supraglottic airway devices: a systematic review of published case reports and series

Y. Thiruvankatarajan,^{1,2} R. M. Van Wijk^{3,4} and A. Rabhee^{1,2}

- Incidence of neuropraxia after supraglottic airway use unknown; also occurs with ETTs
- Duration of surgery did not predict development of nerve injuries
- Authors recommendations:
 - Select LMA size based on multiple factors, not just weight
 - Measure cuff pressure to ensure <60 cm H2O



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Aspiration Risk with Supraglottic Airways

- Incidence of aspiration associated with LMA
 - Meta-analysis of 547 publications, 1993
 - Incidence of 2.3:10,000 patients having elective surgery, **similar to risk with ETT** (1.7-2:10,000)
 - Another large series in unconventional use 1996 0.84:10,000 incidence aspiration
- Risk of pulmonary aspiration with LMA and ETT using PPV



The incidence of aspiration associated with the laryngeal mask airway: a meta-analysis of published literature

Survey of laryngeal mask airway usage in 1,000 patients: safety and efficacy for conventional and nonconventional usage

Risk of pulmonary aspiration with laryngeal mask airway and tracheal tube during positive pressure ventilation

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ASA Closed Claims Database

- Closed claims analysis of pulmonary aspiration
 - 5% of all claims between 2000-2014
 - 105 cases of regurgitation and aspiration, 92 of them with GA; only 14 (15%) of the 92 involved SGA
 - Majority (61%) of the patients who aspirated had either gastrointestinal obstruction or acute intra-abdominal processes
 - 60% happened at the time of induction

Pulmonary Aspiration of Gastric Contents: A Closed Claims Analysis



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Risk comparison with failed airway

- Inability to adequately manage airway is responsible for 30% of anesthetic-related deaths
- Between 2006-2011, in almost a million patient encounters the rate of difficult and failed intubation 1.6:1000 and 0.6:10,000
- Ten-fold greater risk of difficult intubation than is the risk of aspiration

Temporal Trends in Difficult and Failed Tracheal Intubation in a Regional Community Anesthetic Practice



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Second-generation SGAs

- Have separate gastric emptying port
- In cadavers, they withstand higher esophageal pressures before “leaking”
- Some experts have called for preferential use of second-generation SGAs
- No definitive studies that document improved safety, and unlikely to be performed due to high number of patients required

Time to abandon the “vintage” laryngeal mask airway and adopt second-generation supraglottic airway devices as first choice



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Benefits of Supraglottic Airways

- Lower risk of sore throat than ETT
- Equivalent risk of aspiration
- Decreased likelihood of re-intubation post-operatively
- Decreased incidence of laryngospasm and coughing
- Improved hemodynamic stability



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No evidence for arbitrary time restrictions on SGA use!



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HANDOUTS



Ambulatory Anesthesia Literature Year in Review

Girish P. Joshi, MBBS, MD, FACI, SAMBA-F

05/19/2023

1:00pm – 2:00pm MST

THE UNIVERSITY OF TEXAS
SOUTHWESTERN MEDICAL CENTER
AT DALLAS



Recent Publications Impacting Ambulatory Anesthesia Practice

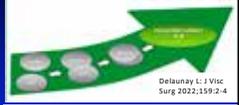
Girish P. Joshi, MB, BS, MD, FFARCSI
Professor of Anesthesiology and Pain Management

DISCLOSURE: Consultant Baxter International Inc.

1

Reengineering in Surgical Paradigm

- Ambulatory surgery facilitates patient-centered care
- Improves postoperative outcomes and reduces healthcare costs
- ASC meets triple aim of healthcare
 - Patient satisfaction, value, population health
- Hospital environment is associated with fasting, sleep disturbance, immobilization, infection, medication errors





2

Hospitalization: Patient Safety

- Despite advances in medical science, there remain important gaps in patient safety
- Retrospective cohort study assessed frequency, severity, and preventability of patient harm
 - 11 Massachusetts hospitals, n=2809
- Preventable events occurred in ~7%
 - 1% were serious—substantial intervention or prolonged recovery
- Adverse drug events were most common, followed by surgical/procedural events, and patient-care events (falls, pressure ulcers, healthcare associated infections)

Bates DW, et al: N Engl J Med 2023; 388: 2

3

Ambulatory Colectomy Surgery Perioperative Framework For Same Day Discharge

Institution has considerable experience with implementation of ERAS protocols

<p>Surgery Characteristics</p> <ul style="list-style-type: none"> • Elective surgery • Minimally invasive approach (lap or robotic) • Colonic or high rectal surgery • No requirement for stoma creation 	<p>Patient Selection</p> <ul style="list-style-type: none"> • ASA 1 or 2, BMI<30 • No anticoagulant/antiplatelet use • Good home support/ patient compliance • Proximity and access to healthcare facility
<p>Surgical Considerations</p> <ul style="list-style-type: none"> • Uncomplicated surgery • No conversion to open surgery • No requirement for drains/oral tubes • Removal or urinary catheter at end 	<p>Anesthetic Considerations</p> <ul style="list-style-type: none"> • Fast-track anesthetic (no sedatives) • Opioid-sparing analgesia • PONV prophylaxis • Minimal fluids

Immediate Postoperative Period: Resume oral intake and ambulation

Discharge Criteria: Satisfies PADSS, Tolerated major meal, able to ambulate, able to urinate, unremarkable abdominal exam and laboratory results	Do not wait for return of GI function
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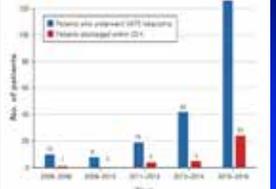
Post-Discharge: Home care nursing, surveillance platforms, follow-up at POD7 -10,
Tan JKH, et al: Surgery 2022; 172: 869-77

4

Feasibility analysis for the development of a video-assisted thoracoscopic (VATS) lobectomy 23-hour recovery pathway

Dumitra TC, et al: Can J Surg 2020; 63: E349-E358

Category	Candidate predictors
Patient characteristics	Age, sex, distance from hospital, no. of comorbidities, COPD, smoking status, smoking pack-years, DUCO, FEV ₁ , ASA classification
Tumour characteristics	Pathologic stage, clinical stage, indication for resection
Surgical factors	Surgeon, size of resected surgical specimen, chest tube duration, operative time*, length of surgery†, longer than 180 min, time of surgery and a sign, PACU duration longer than 180 min, lysis removed, additional resection



Predictors of LOS: clinical stage and surgeon

5

ERAS For Ambulatory Surgery: Multidisciplinary, Reduce variability

Preoperative	Intraoperative	Postoperative
Procedure/Patient Selection	Fast-track GA	Post-discharge Care/monitoring
Identify/Optimize comorbidities	Pain/PONV prophylaxis	Patient-related outcomes
Minimal fasting	Hemodynamic Mgmt	
Pre-habilitation	Ventilation	
Patient education	Normothermia	
Minimally Invasive	SSI prophylaxis	
	VTE prophylaxis	

Joshi GP: Curr Opin Anesthesiol 2021; 34: 667-71

6

Preoperative Considerations

7

Preoperative Optimization and Risk Reduction

- Identify and optimize comorbid conditions
- Screen for frailty in high-risk patients
 - Frailty influences postoperative outcomes, independent of age and comorbidity
- Pre-habilitation
 - Exercise, nutritional, cognitive-behavioral interventions
 - Reduces frailty, improves functionality

Telemedicine for preanesthesia evaluation: review of current literature and recommendations for future implementation
Curr Opin Anesthesiol 2021; 34: 672-7
Chenik Ahsael and Ghazi P. Jabb

- Burdensome regulations removed and payments improved since COVID-19
- Efficient, reduces costs
- Reduces anxiety, improves satisfaction
- Allows triaging for further evaluation
- Limitation: Lacks face-to-face interaction, ability to perform an actual physical exam

8

Association Between the FRAIL Scale and Postoperative Complications in Older Surgical Patients: A Systematic Review and Meta-Analysis

Gong S, et al: Anesth Analg 2023;136:251-61

FRAIL Scale: A Suitable Preoperative Frailty Screening Tool for Older Patients

Increasing morbidity associated with surgery, "frailty" or a state of age-associated vulnerability may lead to outcomes that differ from healthy patients, particularly with older surgical patients.

	Description	Grade
Fatigue	Are you fatigued?	All/most of the time = 1 Some/a little/none of the time = 0
Resistance	Do you have difficulty walking up one flight of stairs without assistance?	Yes=1; No=0
Ambulatory	Do you have difficulty walking one block without assistance?	Yes=1; No=0
Illness	Do you have more than 5 illness?	Yes=1; No=0
Loss of Weight	Have you lost more than 5% of your weight in the past year?	Yes=1; No=0

Scoring: robust (score = 0), prefrail (score = 1-2), and frail (score = 3-5)

9

Preoperative Fasting

- Minimize duration of preop fasting
- Avoidance of preop dehydration
 - Encourage water intake throughout the fasting period: provide specific advice
 - Allow water if patient complaints of thirst until 30-60 min preop
 - Consider the 6-4-0 rule
- No benefit of complex carbohydrates, simple carbohydrates may be used to improve thirst, hunger, satisfaction

Postoperative nausea and vomiting after unrestricted clear fluids before day surgery
McCracken GC, Montgomery J: Eur J Anaesthesiol 2018; 35: 337-42

6-4-0 rule reduced the rates of PONV

Network meta-analysis of the effect of preoperative carbohydrate loading on recovery after elective surgery
Amer MA, et al: Br J Surg 2017; 140: 187-97

10

2023 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting: Carbohydrate-containing Clear Liquids with or without Protein, Chewing Gum, and Pediatric Fasting Duration—A Modular Update of the 2017 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting*

Golan P, Janki M, BSB, M3, Co-Chair, Anesthesiology 2023; 138: 132-51

- Reaffirms the previous recommendations for clear liquids until 2 h preoperatively
- Simple or complex carbohydrate-containing clear liquids appear to reduce hunger compared with noncaloric clear liquids
- Addition of protein to carbohydrate-containing clear liquids did not seem to either benefit or harm healthy patients
- Do not delay surgery in healthy adults chewing gum; however, confirm the gum removal prior to induction of GA

11

Association of a Liberal Fasting Policy of Clear Fluids Before Surgery With Fasting Duration and Patient Well-being and Safety

Marsman M, et al: JAMA Surg 2023; 158: 254-63

- Prospective quality improvement study
 - Stepwise introduction of a liberal fluid fasting policy
 - Allow clear fluids (up to 1 glass of water) until arrival at the OR
- Of the 76,451 adult patients for elective surgery, 78% followed standard policy, and 22% followed liberal policy
- Implementation of liberal policy: reduced mean fasting duration by 3 h with median fasting of 1 h
- Liberal approach reduced thirst, PONV, and antiemetic use
- No significant increase in regurgitation/aspiration

12

Kratom: Peri-anesthetic Implications

- Kratom, herbal extract sold as an alternative to opioids and synthetic psychoactive substances
- Stimulant at low dose, analgesia/euphoria at higher doses
- Prone to overdose and withdrawal
 - Serotonin syndrome, prolonged QT, extrapyramidal symptoms, prolonged NMB, hemodynamic variability (hypo/hypertension) delayed emergence
- Opportunity to intervene, educate, and refer patients
 - Dangers of common additives (i.e., concentrated formulations, bacterial contaminants, heavy metals)
 - Caution against using it in combination with other substances



Gaarmon EH, Olson K: Anesth Analg 2022; 135: 1180-8

13

Patient Selection

14

Patient Selection for Adult Ambulatory Surgery: A Narrative Review
 Niraja Rajan, MD,† Eric B. Rosero, MD, MSc,‡ and Joseph P. Joshi, MD, MSc, MD, FFRCS(®)
 Anesth Analg 2021; 133: 415-30

Preoperative Care for Cataract Surgery: The Society for Ambulatory Anesthesia Position Statement
 Anesth Analg 2022; 133: 1431-6

Pro-Con Debate: Are Patients With a Cardiovascular Implantable Electronic Device Suitable to Receive Care in a Free-Standing Ambulatory Surgery Center?
 Anesth Analg 2022; 134: 919-25

Pro-Con Debate: Are Patients With Coronary Stents Suitable for Free-Standing Ambulatory Surgery Centers?
 Eric B. Rosero, MD, MSc,† Niraja Rajan, MD,‡ and Joseph P. Joshi, MD, MSc, MD, FFRCS(®)
 Rosero EB, Rajan N, Joshi GP: Anesth Analg 2023; 136: 218-26

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Pro-Con Debate: Are Patients With Coronary Stents Suitable for Free-Standing Ambulatory Surgery Centers?
 Anesth Analg 2023; 136: 218-26

Eric B. Rosero, MD, MSc,* Niraja Rajan, MD,† and Girish R. Joshi, MD, MBS, MD, FFRCS(®)

Risk factors for coronary stent thrombosis

- Invasive open surgical procedure
- Stent placed for acute coronary syndrome
- Type and number of stents
- First-generation drug-eluting stents
- Three or more stents implanted
- Long stents (>40 mm)
- Bifurcated stents or bifurcation with 2 stents implanted
- Previous stent thrombosis or inadequate antiplatelet therapy
- Patient characteristics
- Certain multivessel disease:
 - Left ventricular ejection fraction <30%
 - Diabetes mellitus requiring insulin
 - End-stage renal failure requiring dialysis
 - Malignancy

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Coronary Artery Stents Patients at ASC: Pro/Con

- DAPT has been discontinued, patient continues aspirin
 - Time elapsed since stent placement >1 month for BMS and >6 months for newer DES
- Desired procedure can be performed without discontinuation of DAPT
 - Non-invasive or minimally invasive diagnostic/therapeutic procedure
- DAPT cannot be stopped for invasive surgery (high risk of bleeding)
 - Stent-related factors that increase risk of thrombosis
 - Stent implanted for acute coronary syndrome
 - High-complexity coronary artery lesions
- Use of DAPT plus antithrombotic therapy (e.g., oral anticoagulants)
- ASC lacks transfer agreement

Rosero EB, Rajan N, Joshi GP: Anesth Analg 2023; 136: 218-26

17

Anesthetic Technique

18

General anesthetic techniques for enhanced recovery after surgery: Current controversies

Joshi GP: Best Prac Res Clin Anaesthesiol 2021; 35: 531-41

- Avoid routine use of midazolam
- Short-acting inhalation anesthesia + N₂O or TIVA
- Avoid deep anesthesia (MAC 0.8–1 and/or EEG monitoring)
- Minimize NMBD, reverse appropriately
- Opioid-sparing NOT opioid-free approach
- Multimodal pain and PONV prophylaxis
- Lung protective ventilation
- Hemodynamic management (fluid and BP management)

19

Preoperative Midazolam: Outcomes

Association of perioperative midazolam use and complications: a population-based analysis

Athanassoglou V, et al. Reg Anesth Pain Med 2022;47:228–33

The Perioperative Use of Benzodiazepines for Major Orthopedic Surgery in the United States

Cozowicz C, et al: Anesth Analg 2022; 134: 486-95

- TJA (n=2,848,847), 75% received midazolam despite concerns
- Midazolam use associated with increased in-hospital falls
- Concurrent use with gabapentin/sedatives increased pulmonary complications, naloxone use, and postoperative delirium
- Midazolam use associated with increased opioid utilization

20

Low Fresh Gas Flow: Inhalational Anesthesia

- Physiological benefits
 - Improves the flow dynamics of the inhaled air
 - Increases muco-ciliary clearance
 - Maintains temperature, as reduces heat loss
 - Reduce fluid loss
- Economical benefits: cost savings
- Ecological benefits: reduced gas emissions
- FGF must equal or exceed gas losses (e.g., O₂ consumption and gas sampling)
- Optimal FGF ~0.5 mL/min

Automated control of end-tidal inhalation anesthetic concentration using the GE Aisys Conquest™

Automated implementation of low-flow anesthesia reduces inhaled anesthetic use and save



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Low Fresh Gas Flow: Sevoflurane Anesthesia

- Sevoflurane package insert: exposure should not exceed 2 MAC hours at FGF 2 L/min and FGF <1 L/min is not recommended
 - European Union does not have minimal FGF restrictions
- This is based on animal studies reporting renal toxicity from Compound A formed by interaction of sevoflurane with strong bases (NaOH, KOH) used as CO₂ absorbents
- Modern CO₂ absorbents have a small (<2%) amount of strong bases reducing the concern of Compound A formation
- Clinical studies have found that low FGF with sevoflurane is safe
- Canadian guidelines for anesthesia practice recommends FGF <1 L/min for all volatile anesthetics
 - Dobson G, et al: Can J Anesth/J Can Anesth 2023; 70: 16-55

22

Inhaled Anesthetics Collection

An Initial Evaluation of a Novel Anesthetic Scavenging Interface

John A. Barwick, MS, CIB, Leland J. Lancaster, MD, Damon Michaels, BS, Jason E. Pope, MD, and James M. Berry, MD

Anesth Analg 2011; 113: 1064-7



New Method of Destroying Waste Anesthetic Gases Using Gas-Phase Photochemistry

Verena Rauchenwald, MSc,* Mark S. Rollins, MD, PhD,† Susan M. Ryan, MD, PhD,‡ Alex Voronov, PhD,§ John R. Felner, MD,¶ Nancy Sarkis, MSc,** and Matthew S. Johnson, PhD†

Anesth Analg 2020; 131: 288-97



2023 American Society of Anesthesiologists Practice Guidelines for Monitoring and Antagonism of Neuromuscular Blockade: A Report by the American Society of Anesthesiologists Task Force on Neuromuscular Blockade

Stephen R. Triller, M.D., M.S. (paed), et al. Anesthesiology 2023; 138: 13-47

- Minimize NMB
- Quantitative monitoring over qualitative assessment (against clinical assessment alone)
- Use adductor pollicis muscle NOT eye muscles
- For quantitative monitoring, confirm TOF ratio ≥0.9 before tracheal extubation
- Use sugammadex for roc/vec–induced NMB
 - Neostigmine is an alternative to sugammadex at minimal depth of NMB
- For atracurium or cisatracurium and qualitative assessment, neostigmine at minimal NMB depth
 - In the absence of quantitative monitoring, at least 10 min should elapse from antagonism to extubation

23

24

Association of sugammadex reversal of neuromuscular block and postoperative length of stay in the ambulatory care facility: a multicentre hospital registry study
 Azimmaraghi O, et al: Br J Anaesth 2023; 130: 296-304

- Retrospective cohort study comparing LOS after ambulatory surgery after sugammadex (n=8945) and neostigmine (n=20,371)
- Sugammadex reduced LOS (by 9.5 min) through reduced PONV (17.2% vs. 19.6%) and reduced cost of care (by \$176)
- Benefits higher in older and high-risk patients
- Limitations: Surgery performed in hospital NOT ASCs thus duration of stay not valid, definition of ambulatory surgery questionable, no info on PONV prophylaxis

25

Neuromuscular Monitoring: Qualitative Vs. Quantitative

Acceleromyography:

- Thumb must be entirely free to move
 - Precludes monitoring the hand that has been tucked
- Baseline, unparalyzed TOF ratio, should be obtained

Electromyography:

- Hand can be tucked at the patient's side
- Baseline, unparalyzed TOF ratio, is not required
- Electrical signal may be lost along with the OR noise, causing underestimation of twitches (lack of sensitivity)
 - Can lead to unrecognized residual NMB (report 1 Or 2 twitches when there are in fact no twitches) or vice versa

Bowdle A, Michaelsen K. Anesthesiology 2021; 135: 558-61



26

Mechanical Ventilation

27

Lung Protective Ventilation: Avoid Hyperventilation

- Optimal lung protective ventilatory strategy
 - Low TV (6-8 ml/kg, IBW)
 - PEEP (5-10 cm H₂O)
 - Initial respiratory rate 8/min
- Maintain ETCO₂ ~ 40 mm Hg
 - Mild hypercapnia improves tissue oxygenation

Lung-protective ventilation for the surgical patient: International expert panel-based consensus recommendations
 Young CC, et al: Br J Anaesth 2019

The Role of Carbon Dioxide in Facilitating Emergence from Inhalation Anesthesia: Then & Now
 Gray P, Jain, MD, MS, MD, PhD
 Anesth Analg 2012; 114: 933-4

28

Effects of Etc₂ on the Minimum Alveolar Concentration of Sevoflurane that Blunts the Adrenergic Response to Surgical Incision: A Prospective, Randomized, Double-Blinded Trial
 Zhiqin Wu, MD,* Junjie Yu, MD,* Yanhua Zhang, MD,* Hongying Tan, MD, PhD,* Hailing Li, MD,* Lin Xie,* Wenshan Lin, MD,* Daping Shen,* and Lanxun Ge, MD, PhD*
 Anesth Analg 2022; 135: 62-70

Influence of End-tidal CO₂ Levels on the MAC-BAR of Sevoflurane

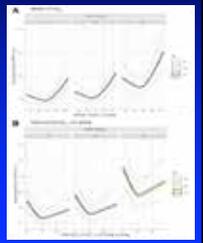


Higher ETCO₂ levels can effectively decrease the MAC-BAR of sevoflurane in patients undergoing surgery.

29

Outlying End-Tidal Carbon Dioxide During General Anesthesia Is Associated With Postoperative Pulmonary Complications: A Multicenter Retrospective Observational Study From US Hospitals Between 2010 and 2017
 Akkermans A, et al: Anesth Analg 2022; 135: 341-53

- Retrospective (1/2020-12/2017), observational, multicenter (n=11 hospitals) study in patients (n=143,769) undergoing noncardiac surgery under GA
- Overall incidence of 30-day PPC was 7.1%,
- PPC was associated with increased mortality and LOS
- Compared with median ETCO₂ 35-40 mmHg, median ETCO₂ of <30 mmHg and 40-45 mmHg was associated with increase in 30-day PPC, mortality, and LOS
- ETCO₂ associated with lowest PPC: 35-38 mmHg



30

Pain Management

31

Multimodal Pain Management

- Acetaminophen and NSAIDs or COX-2 specific inhibitor administered either preoperatively or intraoperatively
 - NSAIDs do not increase bleeding complications
 - Bongiovanni T, et al: Am Coll Surg 2021;232:765-90; Walker NJ, et al: Ann Plast Surg 2019;82:5437-45
- Dexamethasone 8-10 mg, IV
 - Reduces rebound pain [Barry GS, et al: Br J Anaesth 2021;126: 862-71]
 - Prolongs nerve blocks
 - Does not influence postoperative infection or glycemic control
 - Corcoran TB, et al: N Eng J Med 2021; 384; 18; Asehounne K, et al: BMJ 2021;373:n1162
- Procedure-specific local/regional analgesia
- Opioids as rescue
- Non-pharmacologic interventions

32

Systemic glucocorticoids as an adjunct to treatment of postoperative pain after total hip and knee arthroplasty

A systematic review with meta-analysis and trial sequential analysis

Koppen KS, et al: Eur J Anaesthesiol 2023; 40: 155-70

- RCTs investigating peri-operative systemic glucocorticoid vs. placebo or no intervention for pain management after elective THA or TKA
- Included 32 RCTs with 3521 patients, 9 RCTs had low risk of bias
- Steroids reduced 24-h cumulative morphine requirements by 5 mg
- Mean pain at rest reduced at 6 h by 7.8 mm, at 24 h by 6.3 mm
- Pain with mobilization reduced at 6 h by 9.8 mm, at 24 h by 9 mm
- GRADE rated quality of evidence was low to very low

33

High Dose Steroids and Pain After TKA

- High pain responder patients (catastrophizing score >20 or routine opioid use >30 mg OME), undergoing TKA randomized
 - Dexamethasone: 1 mg/kg (high dose) or 0.3 mg/kg (Intermediate dose)
- All patients received SA, pain management: acetaminophen, COX-2 inhibitor, LIA, and opioids for rescue
- High dose steroids reduced moderate-to-severe pain (VAS>30/100) during 5 m walk after 24 h (primary outcome): 49% vs 79%
- Pain on leg raise and QoR-15 scores were also improved with high dose dexamethasone

Nielsen NI, et al: Br J Anaesth 2022; 128: 150-8

34

High-dose dexamethasone in low pain responders undergoing total knee arthroplasty: a randomised double-blind trial

Nielsen NI, et al: Br J Anaesth 2023; 130: 322-30

- Low pain responder patients that typically have less pain and analgesic requirements after surgery randomized
 - Dexamethasone: 1 mg/kg (high dose) or 0.3 mg/kg (Intermediate dose)
- All patients received SA, pain management: acetaminophen, COX-2 inhibitor, LIA, and opioids for rescue
- Pain scores, use of rescue opioids and antiemetics, QoR-15 scores, and opioid-related symptom distress scores in the two groups were similar

35

Ketamine: Analgesic Effects

Risk-of-bias classification of 130 RCTs of IV ketamine in a Cochrane review

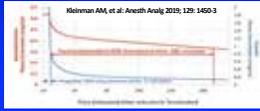
Effects of IV ketamine on postoperative pain and opioid use according to the level of pain in control

Moore A, et al: Br J Anaesth 2023; 130: 287-95

36

Dexmedetomidine: Not as Safe as You Think

- Promoted as having no resp effects
 - Can cause upper airway collapse/airway obstruction, similar as propofol
- Significant bradycardia and hypotension
 - Prolonged hemodynamics monitoring (i.e., PACU and beyond)



Upper Airway Collapsibility during Dexmedetomidine and Propofol Sedation in Healthy Volunteers
 A Randomized Placebo-Controlled Crossover Study
 Lodenius A, et al. Anesthesiology 2019; 131: 962-73

Discharge Readiness after Propofol with or without Dexmedetomidine for Colonoscopy
 A Randomized Controlled Trial
 Edokpolo LU, et al. Anesthesiology 2019; 131: 279-86

Postoperative adverse events attributed to α2-adrenoceptor agonists in patients not at risk of cardiovascular events: systematic review and meta-analysis
 Demiri M, et al. Br J Anaesth 2019; 123: 795-807

37

Postoperative Considerations

38

Reasons and Risk Factors for Failed Same-Day Discharge After Primary Total Knee Arthroplasty

Shen TS, et al. J Arthroplasty 2023; 38: 668-72

- Retrospective study of TKA patients with planned same day discharge (SDD) from 2017-2020
- Inclusion criteria: unilateral TKA, age 18-70 years, BMI <35, appropriate social and material support at home, absence of CAD, valvular heart disease, opioid dependence
- Of 274 patients, 48.9% required minimum 1-night admission
- Failed SDD: failure to ambulate (25%), late-day case (19%)
- Risks: GA, procedure start after 11am, VAS>8
- Age, ASA-PS did not influence SDD

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Ambulatory Colorectal Surgery

North American Multicentre Evaluation of a Same-Day Discharge Protocol for Minimally Invasive Colorectal Surgery using mHealth or Telephone Remote Post-Discharge Monitoring

Lee L, et al. Surg Endosc 2022

Objective: To compare outcomes after same-day discharge for minimally invasive colorectal surgery using mHealth or telephone remote post-discharge monitoring.

Methods: 100 patients recruited. 50% left on POD 0, 50% emergency call within 1 day.

Results: 75% left on POD 0, 25% emergency call within 1 day.

Conclusion: A 24-hour mHealth or telephone remote post-discharge monitoring protocol for minimally invasive colorectal surgery is safe and effective.

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Patient Safety

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Causes of Patient Harm

- Inadequate preoperative assessment and optimization of comorbid conditions
- Inadequate patient monitoring
- Lack of communication among providers

<https://www.thedoctors.com/the-doctors-advocate/fourth-quarter-2019/making-further-advancements-in-anesthesia-care-safety/>

42

Communication failures contributing to patient injury in anaesthesia malpractice claims☆

Douglas RN, et al: Br J Anaesth 2021; 127: 470-8

- Study assessed role of communication failures in patient injury using the Anesthesia Closed Claims Project database
- Claims associated with surgical/procedural and obstetric anesthesia and pain management for adverse events from 2004
- Communication: transfer of information between 2 or more parties
- Failure: incomplete, inaccurate, absent, or untimely communication
- Communication failure contributed to patient injury in 43% claims
- Most common root cause of communication failure was insufficient or inaccurate information
- Failures were more common in outpatient settings

43

Association Between Familiarity of the Surgeon-Anesthesiologist Dyad and Postoperative Patient Outcomes for Complex Gastrointestinal Cancer Surgery

Hallet J, et al: JAMA Surg. doi:10.1001/jamasurg.2022.8228

- Higher surgeon volume is associated with decreased morbidity and mortality and improved long-term outcomes
- Higher anesthesiology volume for complex cases is also associated with reduced major morbidity [Hallet J, et al: JAMA Surg 2021; 156: 479-87]
- Population-based study (n=7893), surgeon-anesthesiologist dyad was associated with 5% reduction in odds of 90-day major morbidity
- Surgeon-anesthesiologist relationship and teamwork improve patient outcomes

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A bibliometric analysis of obstructive sleep apnea and anesthesia

Özlem Onur, MD, PhD**✉, Mustafa Çenk Ecivit, MD*, Ali Necati Gökmen, MD, PhD*

Abstract

To conduct a bibliometric analysis of obstructive sleep apnea (OSA) which has reached epidemic proportions and is a frequent, unknown, and important cause of perioperative morbidity and mortality, by examining the internationally most cited articles. For OSA, the most cited articles in the field of anesthesiology and reanimation, appropriate access terms were compiled and combined, and related publications were searched using the Thompson Reuters Web of Science Citation Indexing search engine. A total of 79 journal publications were found on OSA and anesthesia, with an average of 14.86 citations per article. The most cited publication was the "Society for Ambulatory Anesthesia Consensus Statement on Preoperative Selection of Adult Patients with Obstructive Sleep Apnea Scheduled for Ambulatory Surgery", published in the journal Anesthesia and Analgesia and edited by Jorani et al. It was found that 36 of the 79 studies reached as a result of the search were articles, and the average number of citations was 21.13. The Hirsch index of these articles, which were cited 809 times in total, was 15. A total of 31 articles (39.24%) were cited at least once, while the remaining 48 articles (60.76%) were not cited at all. The majority of the articles obtained are from the research fields of anesthesiology (n = 20; 25.32%), followed by otorhinolaryngology (n = 5; 6.33%), pediatrics (n = 5; 6.33%), respiratory system (n = 5; 6.33%), internal medicine (n = 4; 5.06%), and the rest were in various fields. Publications on "Obstructive Sleep Apnea" and "Anesthesia" have increased rapidly in the last decade. Anesthesia management and airway safety, patient management, including pain control in the postoperative period, and noninvasive mechanical ventilation treatment methods, such as continuous positive airway pressure, are hot topics.

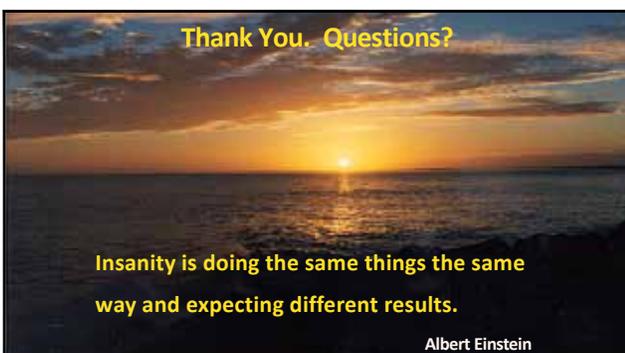
Abbreviations: AHI = apnea hypopnea index, CPAP = continuous positive airway pressure, H-index = Hirsch index, IF = impact factor, OSA = obstructive sleep apnea, OSAS = OSA syndrome, SCI = WOS Citation Indexing, UA = upper airway, WOS = Web

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Summary

- Growth in ambulatory surgery provides opportunity for anesthesiologists to play a pivotal role in perioperative care, including post-discharge care
- Develop evidence-based procedure- and patient-specific pathways with multidisciplinary input
- Elements that influence outcomes after ambulatory surgery
 - Preoperative: patient selection, preoperative evaluation and optimization
 - Fast-track anesthetic technique, pain and PONV prophylaxis
 - Post-discharge care: patient education and monitoring for early identification of complications using modern technology

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HANDOUTS



PBLD Set 1

Conflict Resolution: Case Request/Block Time

Jarrett A. Heard, MD, MBA

05/19/2023

2:45pm - 4:30pm MST

HANDOUTS



PBLD Set 1

Ambulatory Anesthesia Management of Gender Affirmation Surgery Patients: Who, What, Where, Why?

Kelly Lebak, MD, FASA

05/19/2023

2:45pm - 4:30pm MST

Problem Based Learning Discussion: Ambulatory anesthetic management of gender affirmation surgery patients: who, what, where, why?

By Kelly Lebak, MD, FASA

Learning objectives:

- Participants will describe common gender affirmation surgeries done at ambulatory surgery centers.
- Participants will identify anesthetic concerns for patients undergoing gender affirmation surgeries.
- Participants will formulate an anesthetic plan for common ambulatory surgery center gender affirmation surgeries.

A 23 year old transgender male with a BMI of 38 presents for a bilateral mastectomy for gender change. Past medical history is significant for gender dysphoria, anxiety, depression, and THC use daily. Medications include testosterone and citalopram.

Who: What does “trans” even mean? Is the patient’s sex and gender male, female, none, both? How do you plan to address this patient, i.e., which pronouns do you use? Why does it matter?

What: What kinds of surgeries do transgender patients undergo?

Where: Which ones are generally done at ambulatory surgery centers?

Why: Why do transgender patients undergo gender affirmation surgeries?

What specific things need to be addressed in the patient history and physical?

Should pregnancy testing be done on transgender females?

What are the anesthetic considerations in transgender patients?

What is your anesthetic plan? What is your airway and induction plan? What is your postoperative pain control plan?

What are the ambulatory surgery center anesthetic considerations/pearls in transgender patients?

References

MacKoul P, Danilyants N, Baxi R, van der Does L, Haworth L. Laparoscopic Hysterectomy Outcomes: Hospital vs Ambulatory Surgery Center. JSLs. 2019 Jan-Mar;23(1):e2018.00076. doi: 10.4293/JSLs.2018.00076. PMID: 30675089; PMCID: PMC6328358.

Reece-Nguyen TL, Tollinche L, Van Rooyen C, Roque RA. Current challenges faced by transgender and gender-diverse patients and providers in anesthesiology. *Int Anesthesiol Clin*. 2023 Jan 1;61(1):26-33. doi: 10.1097/AIA.0000000000000384. Epub 2022 Nov 17. PMID: 36480647.

Tollinche LE, Rosa WE, van Rooyen CD. Perioperative Considerations for Person-Centered Gender-Affirming Surgery. *Adv Anesth*. 2021 Dec;39:77-96. doi: 10.1016/j.aan.2021.07.005. Epub 2021 Sep 29. PMID: 34715982; PMCID: PMC8562883.

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HANDOUTS



PBLD Set 1 Dexmedetomidine in the Office: Route, Timing, and Patient Selection

Grace Lee Dorsch, MD

05/19/2023

2:45pm - 4:30pm MST

OBA PBLD
 SAMBA Annual Meeting May 2023
 Friday, May 19th 2:45pm

Dexmedetomidine outside the OR: route, timing, and patient selection?
Grace Lee Dorsch, MD

Problem statement: Special needs adult patients can be challenging, especially those with violent tendencies. Compound that with medication shortages or unavailability. There are few options for safely and effectively performing office anesthesia with limited resources.

Case of a young adult male with severe autism, nonverbal, and violent tendencies. Previous anesthesia successful with IM ketamine premedication. Ketamine unavailable.

Learning Objectives:

- Describe different anesthetic options for special needs adults with violent tendencies.
- Describe challenges with dexmedetomidine in the office setting with regards to administration, dosing, and discharge readiness.
- Describe the limitations in some offices with drug shortages and DEA restrictions for OBA practitioners.

Key Questions:

1. What are options for special needs adults with violent tendencies?
2. How long does IM dexmedetomidine take to induce cooperation? Intranasal?
3. What dose optimizes timing of sedation without causing prolonged sleepiness and delayed discharge?
4. What about offices who don't have DEA and/or don't want any controlled substances in their office?
5. If anesthesia provider was able to carry controlled medication, how would that change this case? What medications would you have? How would that have changed this case?
6. When are other times dexmedetomidine can be a part of your anesthetic plan in the office setting?
7. One article cited used 3 and 4 mcg/kg intranasal for laceration repair with good results....have any of you used doses that high? Any delayed recovery?

References:

Jun, J. Kim, K., Kim, J., Song, S., The effects of intranasal dexmedetomidine premedication in children: a systematic review and meta-analysis. Canadian Journal of Anesthesia 64: 947-961, 2017.

Naveen Poonai, Vikram Sabhaney, Samina Ali, Holly Stevens, Maala Bhatt, Evelyne D. Trottier, Shaily Brahmbhatt, Kamary Coriolano, Amanda Chapman, Natalie Evans, Charlotte Mace, Christopher Creene, Sarah Meulendyks, Anna Heath, Optimal Dose of Intranasal Dexmedetomidine for Laceration Repair in Children: A Phase II Dose-Ranging Study, Annals of Emergency Medicine, 2023.

Scheinin, H., Jaakola, M., Sjövall, S., Ali-Melkkilä, T., Kaukinen, S., Turunen, J. Kanto, J. Intramuscular Demedetomidine as Premedication for general anesthesia. Anesthesiology 78:1065-1075, 1993.

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HANDOUTS



PBLD Set 1

The Anemic Patient in the ASC

Kenneth Cummings, MD, MS, FASA

05/19/2023

2:45pm - 4:30pm MST

PBLD: The Anemic Patient at Your ASC

Kenneth Cummings, MD, MS, FASA

Case:

A 44-year-old woman presents to your preoperative clinic. In two weeks, she is scheduled to undergo a dilatation and curettage with intrauterine device placement at your hospital's freestanding ASC for progressively worsening menorrhagia. She also has a long history of Crohn's disease that is reasonably well controlled medically.

Past Medical History: Crohn's disease, hypertension, chronic kidney disease, and anxiety

Past Surgical History: Left hemicolectomy, small bowel resection

Social History: Uses THC gummies and occasionally "vapes" THC for anxiety

Medications: losartan/HCTZ, azathioprine, buspirone, clonazepam PRN

Vitals: HR 104, BP 165/85
5'6", 100 kg (BMI 35.5)

Labs: Hemoglobin 8.2 g/dL, hematocrit 22, platelets 550k, WBC 8.5
MCV 78 fL (ref 80-100), reticulocyte count 0.5%
Transferrin Saturation = 20%, Ferritin = 80 mcg/L, Reticulocyte hemoglobin content = 25%
Folate / B12 studies normal
K 4.4, Creatinine 1.3 (eGFR 49)
T&S A+, no antibodies

Questions:

What are the perioperative implications of anemia?

What are possible causes of this patient's anemia? How would you determine the cause?

Is she a candidate for surgery at the ASC?

What treatment options are available for preoperative anemia? What if preoperative treatment is not an option?

What are the available intravenous iron formulations? How do they differ? What are the adverse events and potential risks associated with iron infusions?

What is the role of erythropoiesis-stimulating agents (ESAs)? Are they contraindicated in a patient with cancer? What about patients with a history of thromboembolic disease?

Your health system balks at purchasing ferric carboxymaltose because of its high acquisition cost. Are there any arguments to support its use?

Is there evidence that correcting preoperative anemia improves outcomes?

What are the elements of Patient Blood Management (PBM)?

References

1. Wu WC, Schiffner TL, Henderson WG, et al. Preoperative hematocrit levels and postoperative outcomes in older patients undergoing noncardiac surgery. *JAMA* 2007; 297(22): 2481-8.
2. Collaborative TPS. The management of peri-operative anaemia in patients undergoing major abdominal surgery in Australia and New Zealand: a prospective cohort study. *Med J Aust* 2022; 217(9): 487-93.
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HANDOUTS



PBLD Set 1 Pediatric Dental Patient with PMH of Asthma, Obesity, and Prematurity – What Do I Need to Know???

Audra Webber, MD, FASA

05/19/2023

2:45pm – 4:30pm MST

Audra Webber MD, FASA – PBLD for SAMBA 2023**Topic:***Pediatric Obesity, OSA, Prematurity, and Ambulatory Surgery***Objectives:***After reading this problem based learning case, the learner will be able to:*

1. Describe the perioperative management of obesity and obstructive sleep apnea (OSA) in patients presenting for ambulatory surgery;
2. Summarize the current literature examining pediatric obesity and OSA and how these comorbidities increase the risk for perioperative adverse events;
3. Identify which factors may make certain patients inappropriate candidates for ambulatory surgery – as applies to the patient themselves as well as the particular capabilities of your ASC;
4. Apply knowledge of the impact of pediatric obesity, prematurity and suspected or diagnosed OSA to everyday ambulatory anesthesia practice.

Background:**Patient:**

A 5 year old male is scheduled at your ambulatory surgical center for dentistry under GETA. His parents state that he snores AND “holds his breath when he sleeps” but he hasn’t had a sleep study. He also has a diagnosis of ADHD. They have Medicare and have been waiting 6 months for this procedure.

PMH: Obesity and prematurity – ex 31 weeker, intubated x 2 weeks, but no current respiratory diagnosis or symptoms.

PE: 3 feet 5 inches tall (107 cm) weighing 55 pounds (25 kg) (BMI 23: > 99th ile for age/sex)

LABS: None

Medications: Gummy vitamins, clonidine nightly for sleep.

PSH: No prior surgeries

Guiding Questions:

1. Is this patient appropriate for ambulatory surgery? What do you tell the parents about anesthetic risks?
2. Does the patient need a sleep study prior to dentistry? What data would you be looking for and how would it influence your decision making process?
3. What anesthetic challenges can you anticipate in an obese pediatric patient?
4. How does the patient’s previous prematurity impact your evaluation of perioperative risk?
5. What is your plan for perioperative pain control? Discuss how both obesity and obstructive sleep apnea affect your choice of analgesic agents, specifically opioids.
6. Should the fact that rescheduling the case will result in another 6 month wait for an open slot influence your decision?
7. How would the above issues impact your discharge policy for this patient?

Discussion:

There is no overarching list of selection criteria for ambulatory surgery for pediatric patients. Individual centers create criteria in alignment with the capacities of their staff and institution. For example, a university associated ambulatory surgery center staffed by fellowship trained pediatric anesthesiologists and with a transferring hospital 10 minutes away may have more lenient selection criteria than a rural ambulatory center staffed by general anesthesiologists who care for children infrequently and is an hour and a half away from any transferring hospital. That being said, there are certain patient characteristics and comorbidities predictive of an increased incidence of perioperative complications. One of the most common in the pediatric population is obesity.

Obese pediatric patients have an increased risk for perioperative adverse events¹⁻⁴, amongst these are increased incidence of upper airway obstruction, desaturations and bronchospasms. Most anesthesiologists who take care of children regularly are adept at managing these respiratory complications⁵, but individuals who care for children infrequently may have more difficulty. Again, the comfort level and skillset of the provider are what are most important in determining outcomes. Similarly to adults, obese children are more difficult to mask ventilate and tend to desaturate more quickly. They can be very difficult IV access, which can become an issue if there is ventilatory compromise during an inhalation induction. In addition, obese children may receive overdoses of opioids and underdoses of paralytic or reversal agents, leading to adverse sequelae⁶. They have greater rates of unplanned hospital admissions, prolonged PACU lengths of stay and an increased need for antiemetics¹⁻². All of this runs antithetical to the goals of an ambulatory surgery center which are efficiency and rapid throughput.

In pediatric patients, obesity is the major risk factor associated with obstructive sleep apnea (OSA)⁷. While not all obese children have OSA it is likely a majority of them do to some degree - estimates range from 50-60%. In addition, there is no good screening tool for OSA in children⁸. Snoring does not have a 1:1 correlation with OSA. While polysomnography is the gold standard for diagnosis of obstructive sleep apnea (OSA) in both adults and children, only a

small percentage of children with OSA will have undergone this testing. The reasons for this are multifactorial but involve expense, difficulties in scheduling, and poor patient cooperation. Regardless of definitive testing, the prevalence and severity of OSA increases with increasing BMI. Therefore the obese pediatric patient presents a twofold conundrum – do they have OSA, and if so to what degree? Most times the answer to this remains a mystery and it is safest to operate under the assumption that 1. Yes they do, and 2. Moderate – Severe. Children with OSA will demonstrate an increased sensitivity to opioid analgesics^{9,10}. This can lead to recurrent or prolonged apnea in the recovery period, especially if long acting opioids are used. While most of the literature regarding OSA examines adenotonsillectomy, dentistry under general anesthesia is generally performed with an intubated patient and arguably involves the airway. The same precautions in terms of opioid use and prescription should be applied. The dentist should be encouraged to use local anesthetic if performing extractions. Opioids can be avoided entirely or small doses of a short acting opioid given intraoperatively. Multimodal analgesia should be applied. Acetaminophen and ibuprofen or acetaminophan and ketorolac should be sufficient for the remaining discomfort.

Prematurity is a risk factor for increased respiratory complications during anesthesia and sedation well beyond infancy. Havidich et al.¹² demonstrated that patients born preterm (prior to 37 weeks PCA) are nearly twice as likely to develop sedation and or anesthesia adverse events – generally respiratory complications. In addition they found that this risk continues up to 23 years of age. This finding highlights the importance of asking about prematurity in the preoperative evaluation, especially when you are weighing risk factors.

In order to safely take care of a patient with multiple risk factors for respiratory complications one must do what is reasonable to minimize them. Along with the above mentioned minimization of opioids and utilization of multimodal analgesia the manner of anesthesia induction may have an impact. A recent study by Ramgolam et al.¹³ demonstrated that inhalation induction is associated with greater perioperative respiratory adverse events in children susceptible to respiratory complications when compared to IV induction. If a patient is at increased risk for respiratory complication performing an IV as opposed to an inhalational induction may temper those complications.

There are many factors involved in deciding how to or whether to proceed with an anesthetic for surgery. Evaluation of the child's risk factors for respiratory complications is chief amongst them. It is also reasonable to consider the time and effort put forth by the child's caregivers⁵ in terms of travel, time off work, etc. All of this should be done with an honest consideration of the skillset and comfort level of the anesthesia provider. There is no perfect answer, only the delicate interplay of what can be safely done at one particular institution, with one specific patient, and one particular provider – all of which are continually moving parts.

Be aware that the incidence of childhood obesity continues to increase¹⁴ and that obese children have a higher incidence of perioperative respiratory complications. The rise in pediatric obesity will be accompanied by a concomitant rise in the number children with OSA and its perioperative sequelae. Children presenting for surgical procedures will have comorbidities that need to be addressed and awareness of and careful planning for these patients will enable you to provide the safest anesthetic care.

The most significant thing you can do to enhance patient safety is to be aware of the likelihood of respiratory complications and be prepared to manage them.

Take Home Points:

1. Pediatric obesity and obstructive sleep apnea are closely related
2. Obese pediatric patients are at greater risk of respiratory complications during anesthesia and sedation
3. Multimodal analgesia and avoidance or minimization of opioids is recommended for obese pediatric patients
4. A history of prematurity is a significant compounding risk factor for perioperative respiratory complications
5. There is no one answer or guideline to determine the appropriateness of a patient for ambulatory anesthesia. There is a complex interplay of the skills and comfort level of the providers and the capabilities of the ASC in terms of staff, equipment, and transfer of care agreements.

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13. Kumar, S., & Kelly, A. S. Review of Childhood Obesity: From Epidemiology, Etiology, and Comorbidities to Clinical Assessment and Treatment. *Mayo Clinic Proceedings* 2017, 92(2), 251–265. <https://doi.org/10.1016/j.mayocp.2016.09.01>
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HANDOUTS



Welcome

Steven Butz, MD, SAMBA-F

05/20/2023

7:30am - 7:40am MST

HANDOUTS



Research Award Nominee Presentations: Closed Claims Analysis of Patient Injury in Ambulatory Surgery Centers

Scott Chung, MD

05/20/2023

7:40am – 8:45am MST

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Category	ASC (%)	HOR (%)
Low	28%	26%
Medium	50%	39%
High	22%	35%

4

Major Injury of Claim	ASC (%)	HOR (%)
Cardiac arrest	14%	11%
Neurological injury	10%	7%
Cardiac or respiratory arrest	8%	5%
Burns	6%	2%
Other	25%	19%

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Comorbidity	ASC (%)	HOR (%)
No Comorbidity	69%	69%
Obesity	15%	18%
Obstructive sleep apnea	7%	12%
Diabetes	6%	12%
Smoking (current/past)	6%	12%
Cardiovascular disease	11%	23%
Hypertension	6%	17%

6

Conclusions

- Higher acuity and complexity of procedures in ASCs.
- Contributing factors amendable to change:
 - Better patient optimization and selection
 - Systems for supporting technical performance
 - Proper documentation
 - Improved communication among providers and with patient/family.
- Importance for clinical directors to work on patient tirage algorithms to place patients in the appropriate setting for their procedures.

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HANDOUTS



Research Award Nominee Presentations: Airway Management during Endoscopic Surgery for Laryngotracheal Stenosis

Lauren Williams, MD

05/20/2023

7:40am – 8:45am MST

Airway Management during Endoscopic Surgery for Laryngotracheal Stenosis

Lauren C. Williams, MD (PGY-3)
 Sampiya Kafle, BS; Jaime B. Hyman, MD; Nikita Kohli, MD

Yale School of Medicine
 Department of Surgery, Division of Otolaryngology – Head and Neck Surgery
 Department of Anesthesiology

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Disclosures

No financial conflicts of interest to disclose.

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Objectives:

- Describe the airway management techniques commonly used during endoscopic surgical procedures for laryngotracheal stenosis.
- Identify patterns of airway management techniques based on patient and surgical factors.
- Compare outcomes associated with various airway management techniques.

Methods:

- Retrospective review of 128 endoscopic surgeries for treatment of laryngotracheal stenosis between 2015 and 2022
- Data of interest included:
 - patient demographics, comorbidities
 - surgical procedure information
 - airway management strategies utilized
 - intraoperative physiologic parameters
 - outcomes/complications

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Results

- 128 cases for 57 unique patients
- 62.5% female-identifying
- Median age 60.5 years (IQR 51.8, 69)
- 81.25% ASA Class III or IV
- Median BMI 31.0 (IQR 24.7, 35.2)
- Etiologies:
 - iatrogenic - 60, 53.1% (of these, 38 [52.9%] were COVID-19 related)
 - Idiopathic - 49, 38.3%
 - Radiation - 5, 3.91%
 - Granulomatosis with polyangiitis (GPA) - 5, 3.91%
 - Inhalation injury - 1, 0.78%

Surgical Procedure

Airway Management

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Trends in airway management

- Excluding patients with tracheostomies at the time of surgery, 92 patients included
- Greater use of jet ventilation and THRIVE with head and neck anesthesiologists (p=0.0002)
- Different patterns in airway management based on level of stenosis (p<0.0001)

	Endotracheal Intubation	Intermittent Apnea	Jet Ventilation	THRIVE	p
Age, years	59.0 [57.2, 61.5]	60.0 [41.8, 68.0]	60.5 [49.5, 67.0]	72.5 [65.8, 74.0]	0.086
BMI	27.9 [26.3, 35.7]	32.2 [25.2, 38.0]	23.6 [22.2, 30.4]	32.7 [24.6, 33.0]	0.006
O2 Nadir	95.0 [92.5, 97.5]	84.5 [85.0, 95.0]	92.0 [85.2, 96.0]	80.0 [74.2, 93.2]	0.019
End-Tidal CO2 Peak	48.0 [42.5, 48.0]	50.0 [46.5, 55.0]	45.5 [40.5, 55.5]	56.5 [54.2, 62.5]	0.007
Operative time, minutes	48.0 [43.5, 68.5]	31.0 [25.0, 48.5]	42.5 [34.2, 51.8]	37.5 [30.5, 33.0]	0.044
Length of Stay, days	1.0 [0.8, 1.2]	0 [0, 1.0]	1.0 [0, 1.0]	0.5 [0, 1.0]	0.047
Complications, n (%)	4 (4.3%)	3 (3.3%)	2 (2.1%)	0 (0%)	0.404
Rate of airway plan failure, n (%)	0 (0%)	1 (2.3%)	4 (15.38%)	6 (50.00%)	<0.01

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Subgroup analysis for intermittent apnea

Factors Impacting Apnea Tolerance

Median Apnea Time (minutes)

Obese: 4.3 (Yes), 2.5 (No)
 GERD: 4.4 (Yes), 2.7 (No)
 Asthma: 3.4 (Yes), 2.2 (No)
 Idiopathic Etiology: 4.3 (Yes), 2.5 (No)
 Subglottic Stenosis: 4.3 (Yes), 2.7 (No)
 Male: 4.4 (Yes), 2.6 (No)
 THRIVE during Apnea: 7.1 (Yes), 3.2 (No)

Factors NOT associated with differences in apnea tolerance:

- ASA Class (p=0.19)
- Cardiovascular disease (p=0.73)
- COPD (p=0.07)
- OSA (p=0.39)

P<0.05 for all

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Takeaways

- Level of airway stenosis, and thus planned surgical procedure, are important factors in airway management planning
- Patient factors including BMI, GERD, and asthma history also important
 - Particularly for predicting tolerance of apneic periods
- Anesthesiologists specializing in head and neck anesthesia may be more comfortable attempting advanced airway management techniques
 - However should be prepared to use backup airway plan when attempting jet or THRIVE
- Potential for the use of THRIVE to prolong apneic times

Limitations

- Sample size
 - Unable to perform subgroup analysis for jet ventilation and THRIVE patients
 - Unable to adjust for covariates
- Cannot account for anesthesiologist/surgeon preference

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Acknowledgements

- Samipya Kafle (MS)
- Dr. Jaime Hyman
- Dr. Nikita Kohli

Thank you!



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HANDOUTS

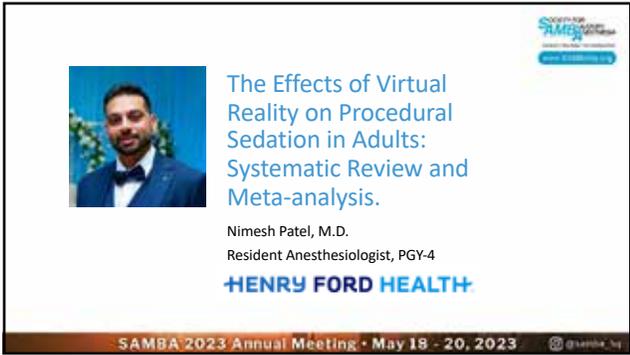


Research Award Nominee Presentations: The Effects of Virtual Reality on Procedural Sedation in Adults: Systematic Review & Meta- analysis

Nimesh Patel, MD

05/20/2023

7:40am - 8:45am MST



The Effects of Virtual Reality on Procedural Sedation in Adults: Systematic Review and Meta-analysis.

Nimesh Patel, M.D.
Resident Anesthesiologist, PGY-4
HENRY FORD HEALTH

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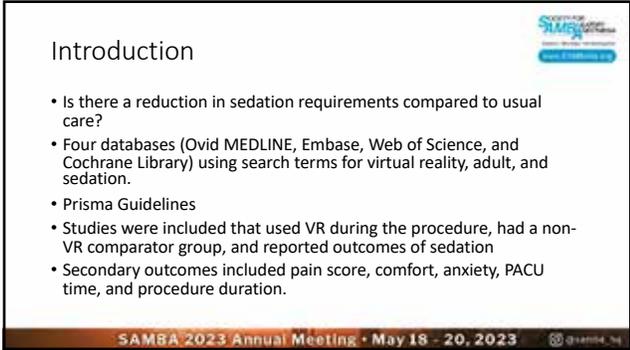


Virtual Reality in Healthcare

- Medical Training
- Treatment of Patients
- Physical Therapy
- Addiction
- Pain Management

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2

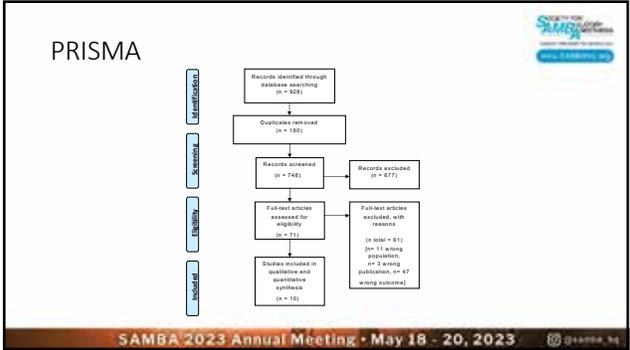


Introduction

- Is there a reduction in sedation requirements compared to usual care?
- Four databases (Ovid MEDLINE, Embase, Web of Science, and Cochrane Library) using search terms for virtual reality, adult, and sedation.
- Prisma Guidelines
- Studies were included that used VR during the procedure, had a non-VR comparator group, and reported outcomes of sedation
- Secondary outcomes included pain score, comfort, anxiety, PACU time, and procedure duration.

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PRISMA

Records identified through database searching (n = 180)

Duplicates removed (n = 180)

Records screened (n = 748)

Records excluded (n = 677)

Full-text articles assessed for eligibility (n = 71)

Full-text articles excluded, with reasons (n = 61) (not in english, duplication, not relevant)

Studies included in qualitative and quantitative synthesis (n = 10)

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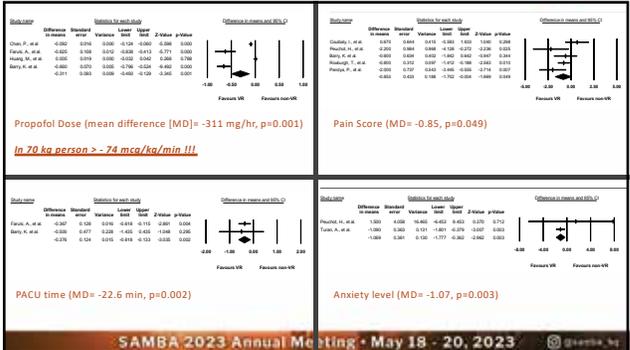
4



Author	Year	Study Design	Treatment Group (n) (VR)	Control Group (n) (Non-VR)	Type of Sedation	Type of Procedure	Primary Outcomes	Sedation	Comments
Chen, P. et al.	2021	Observational	VR (n=20), Scene panel	NR	Propofol (low and high) for regional anesthesia	Orthopedic arthroscopy	Propofol requirement, opioid effect	Propofol (mg) 1.1 vs 1.1, p=0.88	VR reduces propofol requirement and opioid consumption
Yoon, K. et al.	2021	Randomized controlled trial, non-peer reviewed	VR (n=10), Scene panel	NR	Propofol (low and high) for regional anesthesia	Orthopedic arthroscopy	Propofol requirement, opioid effect	Propofol (mg) 1.1 vs 1.1, p=0.88	VR reduces propofol requirement and opioid consumption
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Outcomes	MD	CI	P-value	N
Procedure Length	0.3 min	-4.86 to 4.32	0.91	7
Fentanyl amount	0.01 mcg	-11.1 to 11.09	0.99	6
Midazolam amount	0.3 mg	-0.47 to 1.06	0.44	3
Comfort	0.29 points	-1.71 to 2.3	0.77	3

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Conclusion

- VR can reduce anxiety, pain, and the need for sedation during and after surgery.
- Continued research and development are needed to optimize the technology and fully understand its potential benefits.
- VR has the potential to revolutionize the field of anesthesia and improve patient outcomes.

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HANDOUTS



Research Award Nominee Presentations: Postoperative outcomes after outpatient cancer procedures for super morbidly obese patients as a freestanding surgery center

Joanna Serafin, PhD

05/20/2023

7:40am – 8:45am MST



Postoperative outcomes after outpatient cancer procedures for super morbidly obese patients at a freestanding surgery center

Joanna Serafin, PhD
 Kara Barnett, MD, FASA
 Meghana Mehta, MA

Memorial Sloan Kettering Cancer Center, New York, NY

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Carefully selected higher risk patients - including morbidly obese patients – now scheduled for ambulatory procedures




Memorial Sloan Kettering (MSK) Cancer Center sites and MSK Monmouth relative to the main MSK hospital

MSK Monmouth

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- Rates of postoperative complications are comparable for:
 - nonobese and obese patients¹
 - morbidly (BMI >40 and <50 kg/m²) and super morbidly obese (BMI ≥50 kg/m²)²
- Continuous evaluation of safety outcomes is key!
- We describe the characteristics and postoperative outcomes for super morbidly obese patients who underwent procedures at the MSK Monmouth



1. Verstock EA, et al. J Clin Anesth. 2019 Dec;58:111-116.
 2. Hajmohamed S, et al. Anesth Analg. 2021 Dec 1;133(6):1366-1373.

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Methods

- Retrospective study approved by the IRB
- MSK Monmouth: mostly minor outpatient surgeries and interventional radiology procedures
- Between 1/2/2017 and 1/10/2023, 94 (0.5%) cases at MSK Monmouth included super morbidly obese patients (BMI >50 kg/m²)

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Patients and Procedures

Characteristic	MSK Monmouth Outpatient (N=51)
Age	39 (32, 64)
Female	38 (75%)
Body Mass Index (kg/m ²)	52 (51, 55)
ASA	
1	0 (0%)
2	51 (100%)
3	1 (2%)
4	0 (0%)
Obstructive Sleep Apnea*	38 (75%)
Repeat procedures**	21 (42%)

Characteristic	MSK Monmouth Outpatient (N=50)
Procedure Duration (minutes)	17 (12, 24)
Anesthesia Duration (minutes)	43 (38, 49)
Monitored Anesthesia Care	30 (60%)
Conversion to General Anesthesia	2 (4%)
Length of Stay in PACU (hours)	1.7 (1.0, 1.6)



4.2 hours max PACU stay

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Outcomes and Conclusions

Characteristic	MSK Monmouth Outpatient (N=51)
Same-Day Cancellation	0 (0%)
Urgent care visit within 30 days (2/3)*	8 (16%)
Postoperative Adverse Event	3 (6%)
Transfer	0 (0%)
Unanticipated 30-day hospital admission (2/1)**	1 (2%)

- No adverse events attributable to anesthesia
- No 30-day mortalities
- Postoperative adverse outcomes for super morbidly obese comparable to overall rates

Careful evaluation, planning and perioperative team collaboration allow super morbidly obese patients to receive outpatient cancer procedures close to home at a freestanding surgery center

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HANDOUTS



Research Award Nominee Presentations: Improving Satisfaction All Around Thru Accurate Booking

Melissa Kreso, MD, MsBA, FASA

05/20/2023

7:40am – 8:45am MST



Improving Satisfaction All Around Thru Accurate Booking in a Primarily Ophthalmology Based ASC

Melissa Kreso MD, MS, FASA
Associate Professor in Anesthesiology & Perioperative Medicine
University of Rochester Medical Center
Rochester, NY




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1

Introduction



Our Ophthalmologic Based ASC:



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Methods: 6-month period before & after



Analyzed

Frequency nursing stayed after shift & after call
split out by day of the week
Last case start hour & last case end hour
split out by day of week & individual ophthalmologist case duration accuracy



Based on results

Gathered a team to understand the scheduling process
Chose to simplify scheduling by choosing codes based on diagnosis



After implementation of the new process

Analyzed the outcome data for:
Changes relating to case accuracy
Daily end time percentages



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Results

- Cases were running after shift 58% & the call team was staying late about 41% of the time but 50+% on Mon/Thurs
- Analysis of scheduled surgical times revealed 2 surgeons as significant outliers – both high volume retina surgeons
- For retina cases, it was noted that the EMR averaging was defaulting to surgeon preferred time because of the high degree of variability in allowed scheduling options
- Implementation: Simplified booking choices based on diagnosis in clinic






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Conclusion

- Aligned CPT code selection w/ the dx associated with each surgery.
- Simplifying the coding had a **positive impact** for ophthalmology schedulers by streamlining workflow
- Case duration accuracy improved from 61% to 75% after the intervention
- Indirect effect:**
 - Scheduling started using this process for another retina surgeon which increased their accuracy from 26% to 55%





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Thank you!

None of this would have been possible without this team




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HANDOUTS



Research Award Nominee Presentations: Charting a New Course: The Impact of EHR Optimization on the Administration of PONV Prophylaxis

John Guzzi, MD

05/20/2023

7:40am - 8:45am MST

Charting a New Course: The Impact of EHR Optimization on the Administration of PONV Prophylaxis
 John Guzzi, MD and Jaime B. Hyman, MD

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Disclosures

No conflicts of interest to disclose

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2

Background

- The Apfel score is a clinically useful predictor of PONV risk

Risk Factors	Points
Female Gender	1
Non-Smoker	1
History of PONV and/or Motion Sickness	1
Postoperative Opioids	1
Sum of points	0-4

0% 20% 40% 60% 80% 100%

0 1 2 3 4

Gao, T et al. Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting. Anesthesia & Analgesia 131(2) p 411-448, August 2020.

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3

Apfel score auto-calculated from discreet demographic and preop assessment fields

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Screenshot of Intraoperative Reminder triggered for patients at moderate or high risk of PONV (Apfel score >1)

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PONV Prophylaxis Before and After BPA Introduction

Number of Prophylactic Antiemetics Administered

Pre-Intervention Post-Intervention

Low Risk (Apfel Score 0) Moderate Risk (Apfel Score 1-2) High Risk (Apfel Score 3-4)

Mean # prophylactic antiemetics administered before & after introduction of EHR reminder triggered by Apfel score. Error bars represents SEM.

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PONV Prophylaxis Before and After Introduction of Apfel-score based EHR Alert

	Pre-intervention Number of Prophylactic Antiemetics Administered (STDEV)	Post-intervention Number of Prophylactic Antiemetics Administered (STDEV)	P-value
Moderate Risk (Apfel Score 1-2)	1.79 (0.71)	1.84 (0.9)	p < 0.001
High Risk (Apfel Score 3-4)	2.1 (0.89)	2.46 (1.07)	p < 0.0001

Mean # prophylactic antiemetics administered pre-intervention and post-intervention

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Thank you!



YALE
ANESTHESIOLOGY

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HANDOUTS



Research Award Nominee Presentations: Use of Pre-procedure Questionnaire for Enhance Patient Safety & Ensure Appropriate Procedure Scheduling & Location

Alan Kotin, MD

05/20/2023

7:40am – 8:45am MS

Use of Pre-procedure Questionnaire for Oncologic Interventional Radiology for Patients to Enhance Patient Safety and Ensure Appropriate Procedure Scheduling and Location

Alan Kotin, MD; Kara Barnett, MD, FASA; Todd Liu, MD; Nina Maresca, DNP, FNP-BC
Memorial Sloan Kettering Cancer Center
New York, NY

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Introduction

- ↑ Volume
- ⊘ pre-anesthesia medical history or airway evaluation

• Have you had trouble breathing or shortness of breath while lying flat?
 • Have you had surgery or radiation therapy to your head and neck area that made it hard to open your mouth or move your neck?
 • Have you had trouble opening your mouth?
 • Have you fainted (passed out) in the past 6 months?
 • Have you had a transient ischemic attack (TIA), also known as a mini stroke in the past 6 months?
 • Have you had heart surgery, or a heart stent placed in the last 6 months?
 • Have you had a heart attack in the past 6 months?
Devices
 • Do you have an implanted permanent pacemaker or any other implanted cardiac device?
 • Do you have an implanted insulin pump?
 • Do you go for hemodialysis?

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Goals

- Improve workflow and communication with multidisciplinary approach
- Improve patient safety
- Improve scheduling and assure appropriate procedure location

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Workflow

Patient Scheduled for IR Procedure → Questionnaire Sent to Patient Portal 3-10 days Prior to Procedure → Patient Fills Out Questionnaire → Positive Responses Generate Automated Alert to Evaluation Team → Pre-Anesthesia Team Member Calls Patient → Care Team Collaboration PRN (e.g., Location Change, Medical Work-Up, etc.)

MONTHLY VOLUME AND COMPLETION

57.2% were completed
Responses: 9/2021-11/2022

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Results

Total Question Flags (Total: 756)

Category	Percentage
Stents	1%
Pacemaker	1%
Insulin Pump	2%
TIA/Stroke	5%
SBP	5%
Diabetes	5%
Stent/Cardiac Device	5%
Insulin Pump	9%
TIA/Stroke	9%
SBP	17%
Syncope	17%
Airway	22%

Patients Discussed With Team By Reason (Total: 62)

Category	Percentage
Insulin Pump	15%
TIA/Stroke	15%
SBP	15%
Diabetes	15%
Stent/Cardiac Device	15%
Insulin Pump	20%
TIA/Stroke	20%
SBP	20%
Syncope	20%
Airway	20%

Patients Moved to Main By Reason (Total: 18)

Category	Percentage
Insulin Pump	9%
TIA/Stroke	9%
SBP	9%
Diabetes	9%
Stent/Cardiac Device	9%
Insulin Pump	20%
TIA/Stroke	20%
SBP	20%
Syncope	20%
Airway	20%

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Conclusion

- ✓ Improved collaboration
- ✓ Improve safety: addressing airway concerns
- ✓ Expansion of services
- ✓ Expansion of questions
- ✓ Expansion of support

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HANDOUTS



Cases from the Real World

Moderator: Michael Walsh, MD, FASA, SAMBA-F

Kara M. Barnett, MD, FASA

Gustavo A. Lozada, MD, MSED

Carey Brewbaker, MD

05/20/2023

8:45am - 10:00m MST

Cases From the Real World



Moderator: Michael T Walsh, MD Assistant Professor Mayo Clinic Rochester, MN

Panelists:

Kara Barnett, MD, FASA Associate Attending / Director of Anesthesia Services, MSK Monmouth Department of Anesthesiology and Critical Care Medicine

Gustavo Lozada, MD, M.S.Ed. Clinical Director of Massachusetts Eye And Ear at Longwood Instructor, Harvard Medical School

Carey Brubaker, MD Assistant Professor Anesthesiology Medical University of South Carolina

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Disclosures:



- Michael T Walsh, MD - none
- Kara Barnett - none
- Gustavo A. Lozada, MD - none
- Carey Brubaker, MD - none

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1st Case



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73-year-old Male for Mediport Insertion With Sedation at a Freestanding ASC



- **PMH:**
 - Hypertension
 - High Cholesterol
 - CAD s/p CABG 2009 & 2010
 - Hyperthyroid
 - GERD
 - Anxiety
- **PSH (additional):** hernia repair, T&A, knee arthroscopy
 - 1 month earlier: tolerated EUS/bs with deep propofol sedation
- **Cancer History:**
 - Newly Diagnosed Metastatic Pancreatic Cancer; gemcitabine/ taxol the day before
 - Recurrent Prostate Cancer s/p brachytherapy 2019
 - Non-Hodgkins Lymphoma s/p pelvic resection, ChemoRT 2007
 - Basal Cell Carcinoma s/p resection

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Medications



- Aspirin 81 mg PO qd
- Bicalutamide 50 mg PO qd
- Clopidogrel 75 mg PO qd
- Esomeprazole 20 mg PO qd
- Evolocumab 140 mg/mL SQ q2 weeks
- Isosorbide mononitrate ER 60 mg PO qd
- Levothyroxine 50 mcg PO qd
- Lisinopril 10 mg PO qd
- Lorazepam 0.5 PO prn
- Metoprolol tartrate 25 mg PO BID
- Misc supplements: B12, D3, turmeric

What else do you want to know?

If asymptomatic and achieves 4 METS do you need anything else?

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Pre-Surgical



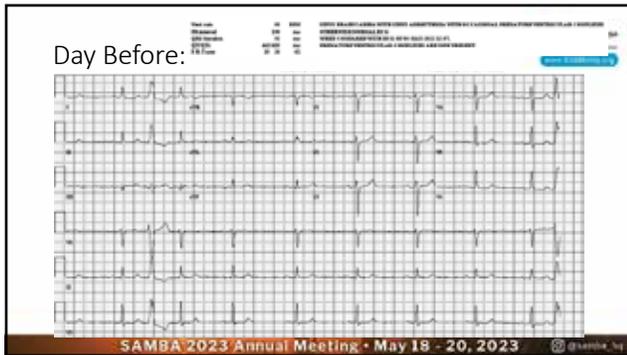
- Unremarkable echo 1 year earlier
- Labs: Hgb 11 g/dL, plt 124, electrolytes unremarkable
- BP 147/70, HR 54, O2 100%, RR 20, 98.2 degrees F
- Denied CP or SOB
- Flight of stairs without stopping

Anything else?

- Assigned ASA Class 3 for a MAC propofol sedation with lidocaine local injection

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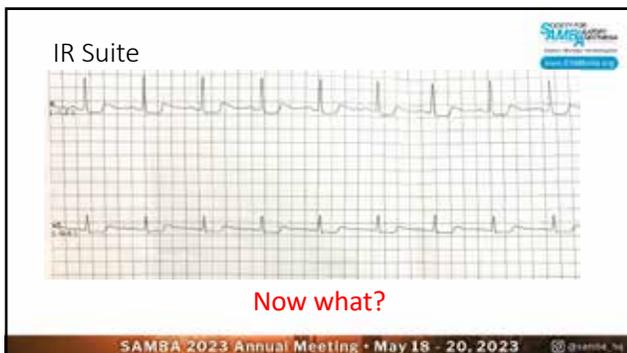
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IR Suite

- Moved self over to IR table
- Monitors placed
- 3L NC oxygen placed
- 2 mg IV midazolam
- About to start propofol BUT....

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IR Suite

- Attending talked to patient who was asking for more sedation
 - Denied CP, SOB, cardiac symptoms
 - Other vitals stable
- Found that ST depression actually present since patient placed on monitors

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What Now?

- Low risk
- Quick procedure
- Denied cardiac complaints
- Stable CAD based on history
- Needed for cancer treatment

- Higher risk patient with h/o CAD
- Ischemia? What's going on?

Anyone want to get an EKG?

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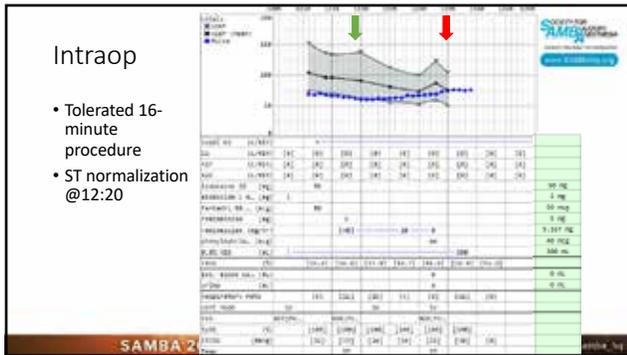
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What Now?

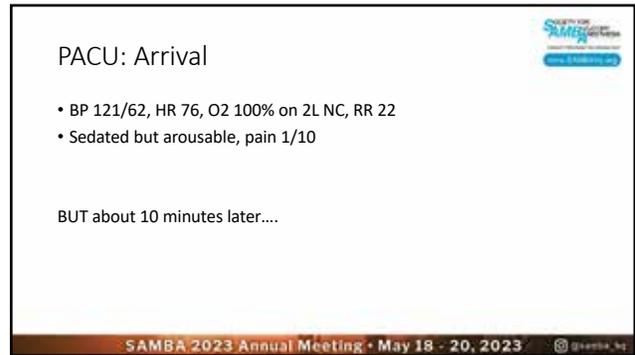
- Decision to proceed
- Changed anesthetic plan to remimazolam sedation
 - Less CV effects than propofol
 - Postop EKG

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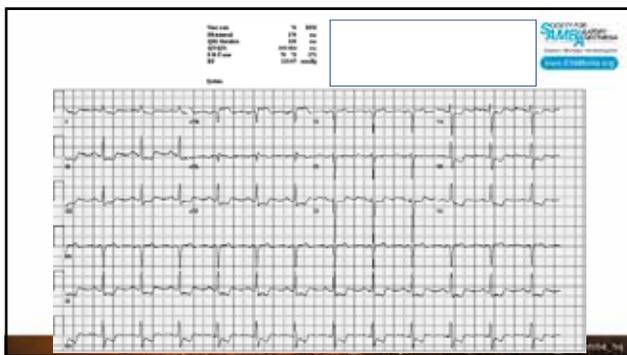
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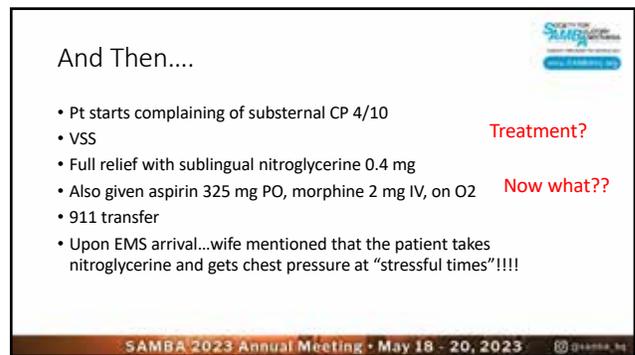
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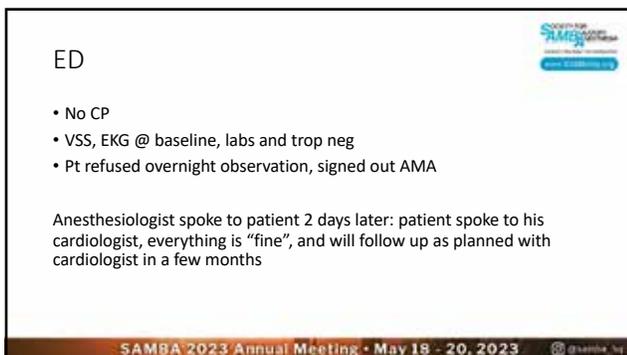
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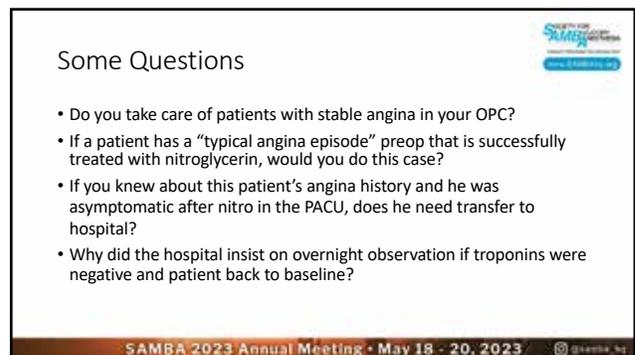
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Case # 2

- 81 yo female presented for bilateral Dacryocystorhinostomy (DCR) with tubes and bilateral nasolacrimal duct cannula insertion
- 4'11" 72.6 Kg (BMI 32.2)
- Vitals: BP 171/70 HR 68 Temp 36.6 RR 20
- Requesting general anesthesia with endotracheal intubation

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<p>PMH</p> <ul style="list-style-type: none"> • MI with PCI (RCA BMS in 2003) • HTN • Hyperlipidemia • Obesity • Asthma • A-fib • Tobacco former 20 pack year history • QA • Depression 	<p>PSH</p> <ul style="list-style-type: none"> • DCR • Knee replacement • Appendectomy • Hysterectomy • Breast lumpectomy
<p>MEDS</p> <ul style="list-style-type: none"> • Amiodarone 200 mg QD • Advair Diskus • Carvedilol 12.5 mg QD • Furosemide 20 mg QD • Irbesartan 75 mg QD • Sertraline 50 mg QD • Apixaban 5mg BID 	

What else do you want to know?

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<p>Labs</p> <ul style="list-style-type: none"> • WBC 7.54 • HGB 12.6 • HCT 39.6 • PLT 221 • PT 13.1 • Na 139 • K 4.0 • Cl 103 • BUN 25 • CRT 0.9 	<ul style="list-style-type: none"> • ECG <ul style="list-style-type: none"> • Sinus Rhythm, HR 65 • Echo (2 months ago) <ul style="list-style-type: none"> • EF 55-60% • NL LV systolic function • NL PA systolic pressure • Trivial MR and TR • Airway: MP III, Neck with FROM, NL Mouth opening, NL TM Distance
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Concerns?

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- Easy mask ventilation and intubated with a GlideScope
 - (anesthesiologist's preference)
- Uneventful surgery
- Extubated without issues
- Uneventful PACU course

• UNTIL.....

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- At time of PACU discharge, as the patient stood up to leave, profuse epistaxis developed
- The surgeon was called to assess. Pressure was applied for 10 minutes. The surgeon reassessed.
- Decided he needed to take the patient back to the OR for EUA and cautery

How would you manage induction/intubation?

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- RSI with a GlideScope. Airway secured after one attempt.
- Surgeon gets to work
- After about 45 minutes of cauterizing, surgeon still not certain about the source of bleeding
- ENT surgeon called in to assist
 - Seem to control the bleeding but was not certain if the bleeding had completely stopped or if it could continue once in PACU
- Noted that there was possible CSF in the surgical field

What do you want to do now?

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- Now the patient's BP is requiring support. The patient required multiple 40 mcg boluses of phenylephrine to keep SBP > 100
- Started in a phenylephrine gtt, ranging from 20-40 mcg/min
- EBL estimated at this time: 250 cc
- Total IV fluids administered: 1300 cc LR

What now?

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- Given the patient's history, the surgical findings, and that she was requiring BP support. The decision was made to transfer the patient to the hospital intubated
- But.....
 - The regular BLS ambulance would not take a patient intubated and on pressors. They arrived and left.
 - ACLS EMS would have required someone from anesthesia to travel with them

Now what?

Do you accompany the patient?

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Case #3

- A 21-year-old college student presents to the ambulatory surgery center for ACL reconstruction and meniscal repair
- Childhood asthma which he "grew out of" however carries an inhaler during pollen season
- Prior anesthetic history of a tonsillectomy as a child and states that he is unaware of any family history of adverse reactions to anesthesia

Anesthetic Plan?

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- **Preop:** patient received an adductor canal block preoperatively with 20cc 0.5% ropivacaine with midazolam, fentanyl, and dexmedetomidine administered for sedation. He also received 1000mg of acetaminophen
- **Induced** with propofol; LMA was placed
- **Maintained** with sevoflurane and ventilated with pressure support
 - 2g of cefazolin prior to incision

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- BP, HR, and RR began to increase which was treated with fentanyl and “deepening” the anesthetic with modest improvement
- After 200mcg of fentanyl and ↑ 2.5% sevoflurane, the pt’s HR remained in the 120s, SBP around 160, and RR was 25-30
- 1mg of IV hydromorphone for incisional and tourniquet pain
- Remained tachycardic, hypertensive, and tachypneic about 1 hour after incision and tourniquet inflation

Thoughts?

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- Patient’s EtCO₂ tracing started to show baseline elevation
 - The ventilator was still registering a RR of 30 and a minute ventilate of 15 L/min with a EtCO₂ of 55
- Fresh gas flows were increased and a new absorbent requested
- Anesthetist requested the surgeon temporarily let down the tourniquet while prepping the quadriceps graft on the back table
- After tourniquet release, the EtCO₂ rose above 60mmHg however the baseline EtCO₂ had returned to normal with new absorbent

Normal tourniquet response?

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• EtCO₂ began to approach 80mmHg

Differential diagnoses?

• Temperature of 36.2 to 38.5 degree





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• Patient remained tachycardic and hypertensive and the surgeon began to complain that there was difficulty in manipulating the knee joint as it felt “stiff.”

• Patient’s temperature now 39 degrees!





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•MH protocol initiated!



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Case # 4

- 50 year old female for robotic hysterectomy
- PMH DM2, HTN, OSA and obesity (BMI=38 kg/m²)
- History of GERD but improved after new medication

What else do you want to know?

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- Labs essentially normal
- Meds: metformin, HCTZ, pregabalin, oxycodone 5 mg PRN, and tirzepatide (Mounjaro) 12.5 mg/0.5 mL pen injector injection

How do you evaluate GERD?
Anyone pre-treating patients?

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- NPO status:
- Had dinner night before: scrambled eggs
- Of note she had carrots and homemade pizza with olives 3 days prior to surgery (2/25), chili with beans 2 days prior and chicken noodle soup with carrots for lunch day prior to surgery.
- Uneventful induction
- OG tube placed



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- Uneventful surgery
- Began vomiting upon emergence
 - ETT still in place! (thank goodness)
 - Chunks of solid material- beans, carrots, olives, other unidentified organic matter

Extubate?

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British Journal of Anaesthesia, 124 (3): 567-571 (2021)
doi: 10.1016/j.bja.2020.10.029
Advance Access Publication Date: 17 December 2020
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Preoperative considerations of new long-acting glucagon-like peptide-1 receptor agonists in diabetes mellitus

- Delayed gastric emptying has been reported
 - Effects decrease over time with ongoing treatment because of tolerance and tachyphylaxis
- Given the potential cardiovascular benefits and negligible risk for hypoglycemia, there is growing interest in continuing this class of medications without perioperative interruption

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British Journal of Anaesthesia, 124 (3): 567-571 (2021)
doi: 10.1016/j.bja.2020.10.029
Advance Access Publication Date: 17 December 2020
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Preoperative considerations of new long-acting glucagon-like peptide-1 receptor agonists in diabetes mellitus

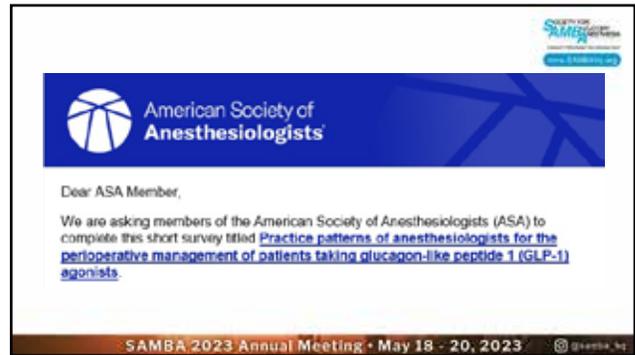
- The Society of Perioperative Assessment and Quality Improvement recommends holding GLP-1 receptor agonists on the day of surgery
 - BUT....long half-life of most medications within this class
- “.....may be prudent to re-evaluate traditional fasting guidelines in these patients”

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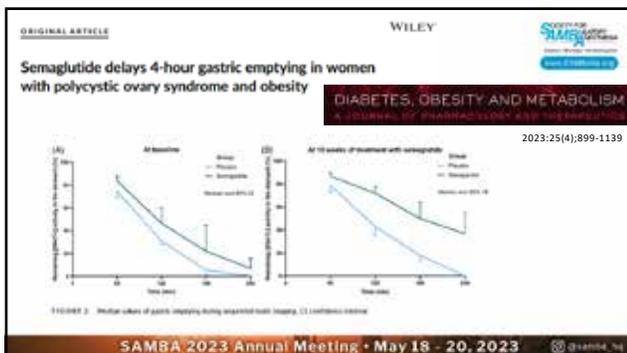
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“Semaglutide, delayed gastric emptying, and intraoperative pulmonary aspiration: a case report”

- 42-yr-old male with gastroesophageal reflux and Barrett’s esophagus
 - Hx of obesity (body mass index = 37), obstructive sleep apnea
- EGD - fifth procedure in last 2 two years (all with deep sedation)
 - Last 4 months ago
- Two months prior, he started semaglutide for weight loss (1.7 mg sq)
 - Was also on omeprazole, famotidine, paroxetine, bupropion, and buspirone
- No GI symptoms day of surgery. NPO >18 hours
- At endoscopy – stomach “full” and aspirated (liquid and solid material)

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Mayo Clinic “Guidelines”

- **Recommendations:**
 - Patients should be instructed to continuing weekly dosing as scheduled before surgery.
 - Patients should be instructed to hold daily use forms on the day of surgery. Procedures should not be delayed or cancelled if taken the day of surgery.
 - Clinicians should be aware of the increased risk for food in the stomach when following standard fasting guidelines.
 - In cases that are traditionally performed under sedation/monitored anesthesia care (MAC), general anesthesia with an endotracheal tube may be indicated. Consider early consultation with anesthesia.

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The “Did You Know” & Must Knows of Intraop ECG Filtering in Adults

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 barnettk@mskcc.org

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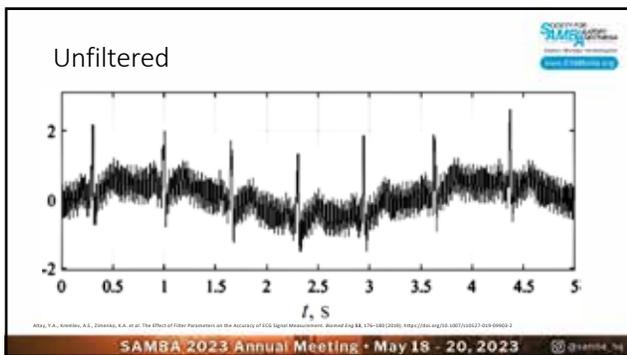
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Objectives

- Describe the need for intraoperative ECG filters.
- Differentiate between the filter types and modes of the ECG monitor and how they effect ECG morphology.

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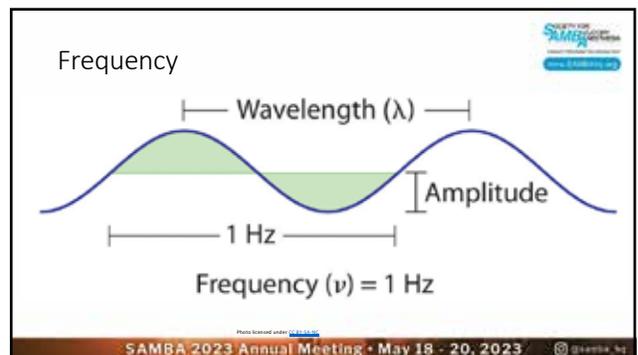
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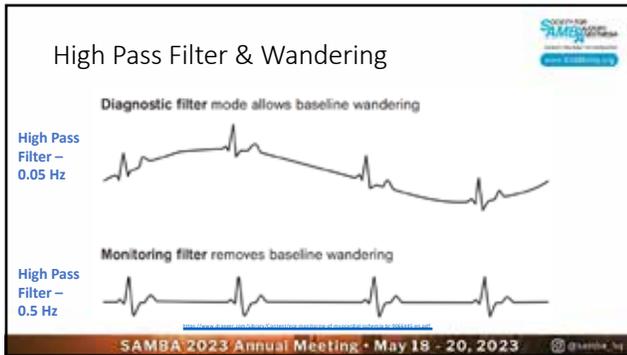
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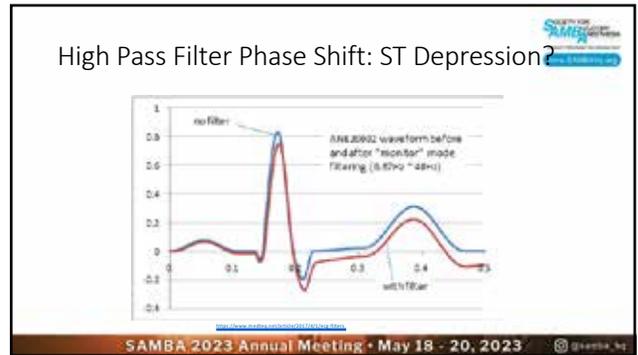
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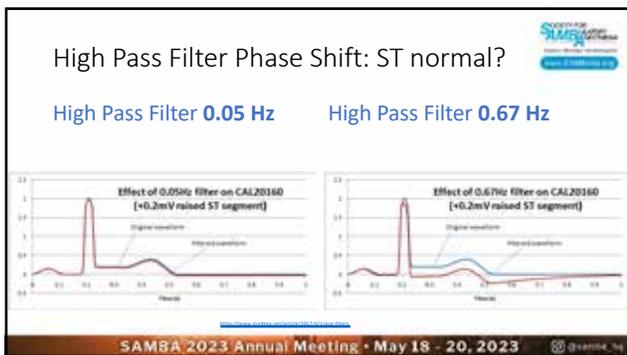
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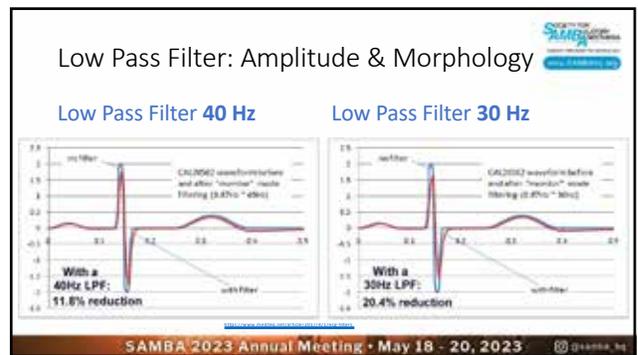
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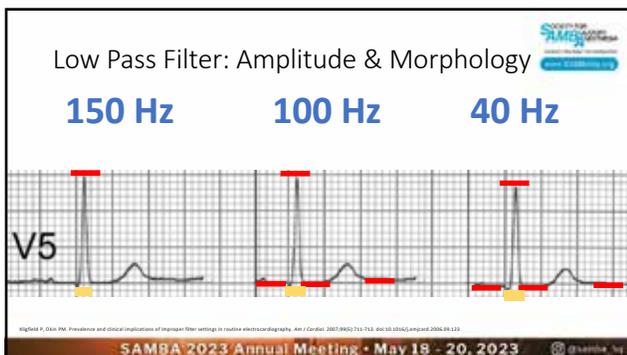
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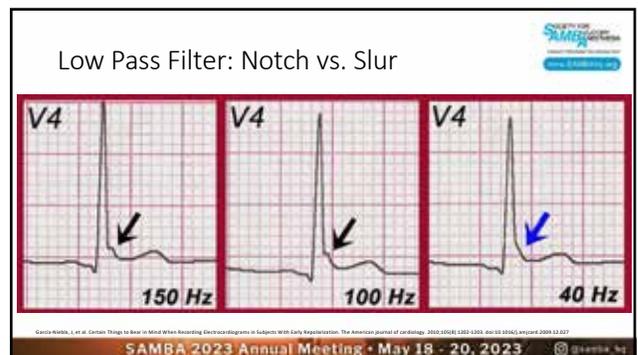
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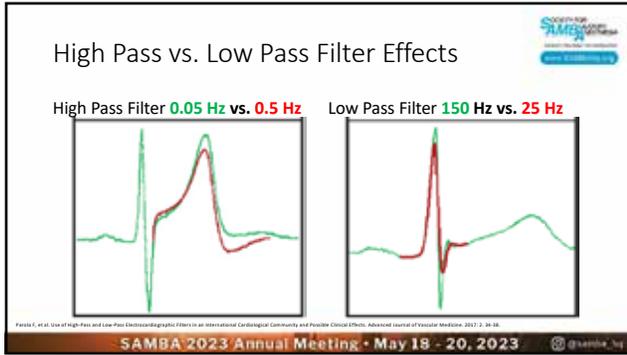
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Consequences...

Type of filter	ECG modifications with an inappropriate use	Diagnostic effects
High-pass	Alterations in ventricular repolarization (ST-T)	It mimics acute coronary syndrome [8] It mimics Brugada syndrome [9]
	Decrease in QRS width	Less diagnostic value for ventricular hypertrophy [5]
	Increase in Q waves duration	It mimics old infarction [5]
Low-pass	Decrease of pacemaker spike width	It mimics left bundle branch block or left ventricular rhythm [10]
	Attenuation, removal or modification of J waves	The pattern of early repolarization disappears or its expression changes [11]
	Attenuation or removal of Epsilon waves	Less diagnostic value of arrhythmogenic RV dysplasia [12]

Parodi F, et al. Use of High-Pass and Low-Pass Electrocardiographic Filters in an International Cardiological Community and Possible Clinical Effects. Advanced Journal of Vascular Medicine. 2017; 2: 34-38.

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12-Lead

- Post-processing

Use of the filter (in some modes):

Initial recording – filter off – recording mode at 0.57 – (1981)

Existence of cosmetic muscle interference:

Repeat recording – filter on – recording mode at 0.47 – (491)

The filter reduces interference but also distorts the ECG.

Recommended recording bandwidths for standard 12-lead ECGs:

Wide mode: 0.07 – (1982)

Narrow mode: 0.05 – (1983)

None filter: off

Official Guidelines by Consensus
Recording a Standard 12-lead Electrocardiogram
An approved method for the
Society for Cardiological Science & Technology
(SCST)

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Summary

Artifacts and Noise Exist!

Goals?

- Minimize interference
- More filtering → Monitoring or other proprietary modes

ST segment monitoring

Minimal filtering → Diagnostic

More Filtering = More Distortion

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Urgent Transfer of an Intubated Patient from an ASC: Challenges and Options



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Clinical Director of Anesthesia
Boston Eye Surgery and Laser Center
Boston, MA
May 20, 2023

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- No disclosures

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Objectives

- Compare EMS transfer options and limitations for a patient from an ASC
- Discuss legal implications associated with ambulance transfer from an ASC
- Formulate a transfer care plan for an intubated patient from an ASC

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The Dilemma

- Intubated, elderly patient necessitating transfer from an ASC operating room to main hospital



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The Options



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The Options

- BLS Ambulance
- ALS EMS
- Critical Care Transport



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BLS Ambulance

- Basic
 - Limited equipment
 - e.g. oxygen and non-invasive delivery device
 - Limited services
 - e.g. first aid



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ALS Ambulance

- ACLS
- Advanced equipment
 - Airway
 - Cardiac
- Medication administration




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Critical Care Transport

- ICU transport



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Medical Options

- Transport intubated
- Extubate and transfer



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Medicolegal Considerations

- If an anesthesiologist travels with a patient via EMS, what are the medicolegal implications?



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Medicolegal Considerations

105 CMR: DEPARTMENT OF PUBLIC HEALTH

170.109: Requirements for Additional Personnel on Ambulances

Additional personnel, beyond the minimum staffing requirements for ambulances under 105 CMR 170.305, may function on an ambulance according to the provisions listed in 105 CMR 170.310(A) and (B).

(B) A registered nurse, physician or other health care professional may render care to a patient during the transport of a patient(s) by an ambulance from a hospital or other transferring facility when designated to do so by the transferring facility.



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Outcome

- We transferred the patient intubated to BWH via MedFlight Ground Transport
- Patient scanned and taken to the OR for CSF leak repair
- Uneventful course thereafter



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- Thank you!



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Malignant Hyperthermia

- An inherited (autosomal dominant trait) disorder of skeletal muscle
 - If you have MH you would have a 50% chance of passing it to your child
- Results in:
 - Hypermetabolism
 - Skeletal muscle damage
 - Hyperthermia
 - Death if untreated
- Underlying physiologic mechanism – abnormal handling of intracellular calcium levels

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Testing for MH

- Muscle Contracture Test: Caffeine-Halothane Contracture Test (CHCT)**
- Gold Standard**
- Requires skeletal muscle biopsy from patient's thigh to assess muscle contractile properties upon exposure to ryanodine receptor agonists (eg. caffeine, halothane).
- Must be performed at the MH Muscle Biopsy Center.**
- Abnormally high levels of contractile force indicate MH susceptibility.
- Sensitivity: close to 100% (false negatives are rare)
- Specificity: ~80% (~20% false positives)
- * Genetic testing is also available, but is not as definitive.
 - Genetic testing is recommended as a confirmatory diagnostic measure for individuals known to be at high risk for an MH event, as determined by their own or a first-degree (sibling, parent, offspring) family member's clinical episode of MH or positive muscle contracture test (caffeine-halothane contracture test)

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How is MH Triggered

- Triggering Agents**
 - Potent Volatile (inhaled) Anesthetics (eg. halothane, sevoflurane, desflurane)
 - Succinylcholine
- Non-triggering Agents**
 - IV anesthetics (i.e. propofol, etomidate, ketamine)
 - Nitrous Oxide
 - Non-depolarizing muscle relaxants
 - Opioids
 - Benzodiazepines, dexmedetomidine
 - Local Anesthetics

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Clinical Presentation

- MH may occur at any time during anesthesia and in the early postoperative period.
- The principal diagnostic features:
 - Unexplained elevation of end-tidal carbon dioxide (ETCO₂) concentration, despite increased minute ventilation
 - Tachycardia
 - Muscle rigidity (masseter muscle is the classic sign, especially after succinylcholine administration)
 - Acidosis
 - Hyperthermia (often a late sign)
 - Increase in core temperature at a rate of 1-2°C every five minutes. Severe hyperthermia (core temperature greater than 44°C) may occur and lead to a marked increase in oxygen consumption, carbon dioxide production, widespread vital organ dysfunction, and disseminated intravascular coagulation
 - Hyperkalemia
- Variability in the order and time of onset of signs often makes the clinical diagnosis rather difficult.

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Clinical Presentation Progression

- Uncontrolled hypermetabolism leads to cellular hypoxia that is manifested by a progressive and worsening metabolic acidosis.
- If untreated, continuing myocyte death and rhabdomyolysis result in life-threatening hyperkalemia
- Myoglobinuria may lead to acute renal failure.
- Additional life-threatening complications include DIC, congestive heart failure, bowel ischemia, and compartment syndrome of the limbs secondary to profound muscle swelling, and renal failure from rhabdomyolysis. Indeed, when body temperature exceeds approximately 41°C, DIC is the usual cause of death.

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 <p>Dantrium</p> <ul style="list-style-type: none"> 12.5-36 vials 750-2160ml sterile water >15mins to reconstitute 1-3 staff members 20mg dantrolene per vial 	vs	 <p>Ryanodex</p> <ul style="list-style-type: none"> 1-3 vials 5-15ml sterile water Less than 1 min to reconstitute 1 staff member 250mg dantrolene per vial
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Treatment: Dantrolene

- Blocks the release of calcium from the sarcoplasmic reticulum
- Inhibits excitation-contraction coupling in the muscle fiber
- Reduces mortality from 75% to 5%
- Note the concentration difference between Dantrium and Ryanodex!
- 1 vial of RYANODEX® contains the same amount of dantrolene as 12.5 vials of other approved dantrolene sodium forms

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Crisis Management

- Discontinue inhalation agents, succinylcholine
 - Notify surgeon to halt the procedure; call for help
- Hyperventilate at high flows with 100% O₂
- Change soda lime and place charcoal filters
- Give IV dantrolene 2.5mg/kg (repeat until symptoms resolve -> i.e. EtCO₂/muscle rigidity/HR decreases)
 - Typical max dose 10mg/kg but may continue if needed
- Check blood gas and consider sodium bicarbonate 1-2 mEq/kg dose
- Treat arrhythmias/hyperkalemia
 - Calcium, bicarb, insulin/glucose, albuterol
 - Avoid additional Ca^v channel blockers as this can cause hyperkalemia
- Nursing: cool patient and place foley catheter
 - Mix dantrolene grn
- Diurese to >1 ml/kg/hr urine output

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MH Treatment Rolls in the OR

Surgeon

- Halt procedure ASAP

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Disposition

- When stable, transfer to PACU or ICU for at least 24 hours
 - ETCO₂ declining/normal
 - HR is stable/decreasing; no dysrhythmias
 - Hyperthermia resolving
 - Muscular rigidity resolved
- Give dantrolene 1 mg/kg every 4-6 hours for 24 – 48 hours
- Monitor for recrudescence – rate is 25%
- Follow electrolytes, blood gases, CK, core temperature, urine output and color, coagulation studies

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MH Like Syndromes

- Neuroleptic Malignant Syndrome (NMS)
 - CNS dopamine deficit
 - Neuroleptics like haloperidol and dopamine blocking antiemetics (metoclopramide and prochlorperazine)
 - Treatment: stop antipsychotic, treat hyperthermia, supportive care
 - Some role for dantrolene and dopamine agonists (i.e. bromocriptine/amantadine); benzos for agitation
- Parkinsonism/Hyperthermia Syndrome (PHS)
 - Parkinsonian dopaminergic withdrawal
 - Complete discontinuation of dopaminergic therapy in the perioperative period should be avoided
- Serotonin Syndrome (SS)
 - Treatment: supportive care and cyproheptadine (anti-histamine)
- Baclofen withdrawal
- Intoxication
 - Amphetamines, MDMA, cocaine, PCP, LSD

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Drug-Induced MH-like Syndromes in the Perioperative Period

Charles Watson, MD; Stanley N. Caroff, MD; Henry Rosenberg, MD

Substrate Drug	Class	Typical Dose	Pathway	Effect	Signs & Symptoms
Halothane	Halothane	0.5-1.0 MAC	Central nervous system depression	Myocardial depression, hypotension, arrhythmias, respiratory depression	Myocardial depression, hypotension, arrhythmias, respiratory depression, hyperkalemia, rhabdomyolysis, DIC
Propofol	Propofol	0.5-1.0 MAC	Central nervous system depression	Myocardial depression, hypotension, respiratory depression	Myocardial depression, hypotension, respiratory depression, hyperkalemia, rhabdomyolysis, DIC
Etomidate	Etomidate	0.1-0.3 mg/kg	Central nervous system depression	Myocardial depression, hypotension, respiratory depression	Myocardial depression, hypotension, respiratory depression, hyperkalemia, rhabdomyolysis, DIC
Propofol + Etomidate	Propofol + Etomidate	0.5-1.0 MAC + 0.1-0.3 mg/kg	Central nervous system depression	Myocardial depression, hypotension, respiratory depression	Myocardial depression, hypotension, respiratory depression, hyperkalemia, rhabdomyolysis, DIC
Propofol + Etomidate + Halothane	Propofol + Etomidate + Halothane	0.5-1.0 MAC + 0.1-0.3 mg/kg + 0.5-1.0 MAC	Central nervous system depression	Myocardial depression, hypotension, respiratory depression	Myocardial depression, hypotension, respiratory depression, hyperkalemia, rhabdomyolysis, DIC
Propofol + Etomidate + Halothane + Succinylcholine	Propofol + Etomidate + Halothane + Succinylcholine	0.5-1.0 MAC + 0.1-0.3 mg/kg + 0.5-1.0 MAC + 1-2 mg/kg	Central nervous system depression	Myocardial depression, hypotension, respiratory depression	Myocardial depression, hypotension, respiratory depression, hyperkalemia, rhabdomyolysis, DIC

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Irwin MG, Chung CKE, Ip KY, Wiles MD. Influence of propofol-based total intravenous anaesthesia on peri-operative outcome measures: a narrative review. *Anaesthesia*. 2020 Jan;75 Suppl 1:e90-e100. doi: 10.1111/anae.14905. PMID: 31903578.

TIVA

CENTRAL NERVOUS SYSTEM
The highest center of neural activity. Responsible for all voluntary and involuntary functions. TIVA causes a dose-dependent depression of neural activity.

RENAL SYSTEM
The organ of excretion. Responsible for the elimination of waste products. TIVA causes a dose-dependent depression of renal function.

CARDIOVASCULAR SYSTEM
The organ of circulation. Responsible for the transport of blood. TIVA causes a dose-dependent depression of cardiac output.

GASTRO-INTESTINAL SYSTEM
The organ of digestion. Responsible for the breakdown of food. TIVA causes a dose-dependent depression of gastrointestinal motility.

ENDOCRINE SYSTEM
The organ of hormone production. Responsible for the regulation of metabolism. TIVA causes a dose-dependent depression of endocrine function.

IMMUNE SYSTEM
The organ of defense. Responsible for the protection against infection. TIVA causes a dose-dependent depression of immune response.

HEMATOLOGICAL SYSTEM
The organ of blood formation. Responsible for the production of red and white blood cells. TIVA causes a dose-dependent depression of hematopoiesis.

REPRODUCTIVE SYSTEM
The organ of reproduction. Responsible for the production of offspring. TIVA causes a dose-dependent depression of reproductive function.

GLUCOSE METABOLISM
May be altered by TIVA, leading to hypoglycemia or hyperglycemia. The use of continuous glucose monitoring is recommended.

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TIVA

Irwin MG, Chung CKE, Ip KY, Wiles MD. Influence of propofol-based total intravenous anaesthesia on peri-operative outcome measures: a narrative review. *Anaesthesia*. 2020 Jan;75 Suppl 1:e90-e100. doi: 10.1111/anae.14905. PMID: 31903578.

- Propofol-based total intravenous anaesthesia is well known for its smooth, clear-headed recovery and antiemetic properties, but there are also many lesser known beneficial properties that can potentially influence surgical outcome.
- Modern anaesthesia is still mostly administered by the inhalational route but there is increasing concern over their potential for pollution and other adverse effects.
- Exposure to halogenated hydrocarbons may cause reduction in antioxidant activity in plasma and erythrocytes, inhibition of neutrophil apoptosis, depression of central neurorespiratory activity, increased DNA breaks, effects on cerebral blood circulation and altered renal function.
- There are other disadvantages of inhalation drugs that can be avoided or reduced with propofol such as inhibition of hypoxic vasoconstriction, increased intracranial pressure, administration practicalities (laryngoscopy, bronchoscopy, jet ventilation), malignant hyperthermia and PONV.
- Propofol has anti-inflammation and powerful anti-oxidant properties which are organ protective and may contribute to the better analgesia seen after surgery compared with inhalation anaesthesia.
- Inhalational agents do have certain advantages in that administration is relatively simple, potency in terms of MAC is familiar and end-tidal concentrations can be measured in real time.

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Our patient

- Stabilized in OR after 2 doses of ryanodex (400mg); surgeon closed knee but had not replaced ACL
- Transferred ventilated and sedated to ICU at our institution as a direct admit with lifeguard transport
 - Anesthesiologist and ICU attending closed loop communication
- Patient extubated that evening and transferred to step-down the following day. Discharged POD # 2 with no sequelae/complications
 - Returned to OR 1 week later for ACL repair with a non-triggering anesthetic
- “Even though a MH crisis may develop at first exposure to anesthesia with those agents known to trigger an MH episode, on average, patients require three anesthetics before triggering”
 - Rosenberg, H., Davis, M., James, D. et al. Malignant hyperthermia. *Orphanet J Rare Dis* 2, 21 (2007). <https://doi.org/10.1186/1750-1172-2-21>

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HANDOUTS



Panel: Pediatric Ambulatory Recovery Issues and Difficult Airway Management – Avoiding Pitfalls of Delayed Recovery and Discharge in the Pediatric Ambulatory Patient

Marjorie P. Brennan, MD, MPH

05/20/2023

10:45am – 11:30am MST



 Avoiding Pitfalls of Delayed Recovery and Discharge in the Pediatric Ambulatory Patient


 Marjorie P. Brennan, MD MPH
 Children's National Hospital
 Washington, DC



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Disclosures

- no relevant financial relationships with commercial interests

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Learning Objectives

Upon completion, participants will:

- understand common issues that prevent efficient discharge in pediatric ambulatory patients.
- be able to develop a framework to assess pediatric patients for ambulatory surgery.
- be able to develop strategies to approach common pediatric discharge barriers in the ambulatory setting.

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Why ASC's?

- In 2020 41% of all surgical procedures were performed in ambulatory surgery centers (ASCs).*
- With exceptional outcomes and exceedingly high patient satisfaction scores at substantially lower costs, ambulatory surgery centers (ASCs) are considered a great value medicine.
- This drive toward outpatient surgery can be attributed to several factors:
 - 1) Improvements in anesthetic care, including innovations such as shorter-acting anesthetic agents and improved cardiopulmonary monitoring, have allowed for fewer adverse anesthetic effects;
 - 2) Innovations in minimally invasive surgical techniques have decreased the need for inpatient hospitalization;
 - 3) Economic pressures have also influenced increased adoption of outpatient surgery.

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- The Obese Child
- Opioid-Free techniques
- Dexmedetomidine in the Ambulatory Setting
- URI symptoms
- Tonsillectomy and Adenoidectomy in the ASC without a Sleep Study

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The Obese Ambulatory Patient: A "Big" Problem



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Defining Obesity



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BMI is a poor predictor of adiposity in young overweight and obese children



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CDC Centers for Disease Control and Prevention



> 85th percentile = overweight
> 95th percentile = obese
> 99th = morbidly obese

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Incidence and Risk Factors for Perioperative Adverse Respiratory Events in Children Who Are Obese

• Perioperative respiratory adverse events (PRAE) occur more commonly in obese children

• Significant associations between obesity and PRAE for hypoxemia, upper airway obstruction and difficult bag-mask ventilation

• Obesity and BMI were significant predictors for overall PRAE, whereas difficult laryngoscopy, laryngospasm, bronchospasm, major coughing and the need for supplemental oxygen were identified but not statistically significantly associated with PRAE in this series

• Adverse respiratory events can occur even if the airway was not instrumented or manipulated.

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Children's National ASC Guidelines for Obese Children



- Young children (≤ 9 yr.) < 98 BMI %ile-for-age
- < 95 BMI %ile-for-age for airway
- Adolescents (> 8 yr.) BMI < 30 for airway surgery BMI < 35 for non-airway surgery
- No co-morbidities / OSAS
- Exceptions by consultation

Note that these are not national standards.
BMI, body mass index; OSAS, obstructive sleep apnea syndrome.

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Children's National ASC Guidelines for Obese Children

- ASA Class 2
- No co-morbidity
 - No reactive airway disease
 - No syndromes
 - No OSA



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Opioid Free Anesthesia: Trend?



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OFA: Opioid Free Anesthesia

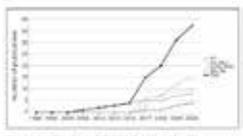


Figure 1—Number of PubMed indexed publications on OFA per year according to the type of paper: RCT, randomized clinical trial; Ob, obese; observational and retrospective studies; Eng, English; NSAID, non-steroidal anti-inflammatory drugs; NSA, sympathetic nervous; MSA, sympathetic system and metabolism.

2021 Bugada et al, Edizioni Minerva Medica



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OFA

- What is the rationale for opioid free techniques?
- Is there evidence that OFA can improve perioperative outcomes and decrease discharge time?



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Rationale for OFA

- Limits of Opioids
 - Dose-dependent side effects
 - Dose-dependent hyperalgesia
 - Opioid crisis



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OFA-defined

- The association of drugs and /or techniques that allow good quality general anesthesia with no need for opioids
 - NMDA antagonists: ketamine, lidocaine, magnesium sulfate
 - Sodium channel blockers: local anesthetics
 - Anti-inflammatory drugs (NSAID, dexamethasone)
 - Alpha-2 antagonists (dexmedetomidine, clonidine)

2019, Beloeil



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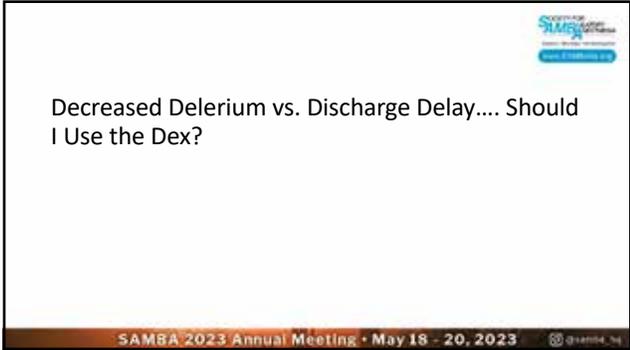
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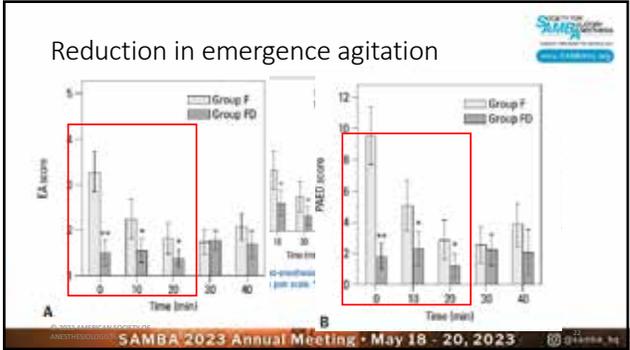
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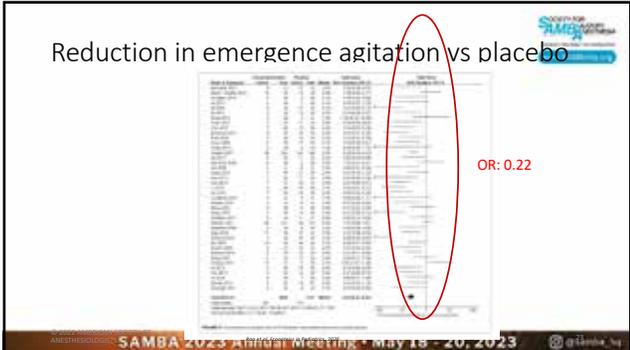
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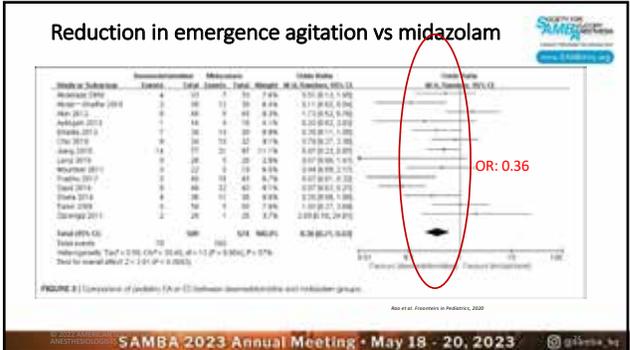
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statistical vs clinical significance

Postoperative Recovery after Intraoperative Dexmedetomidine Use in Adults

Recovery is defined by a uniform level of sedation.

Statistical vs Clinical Significance

Statistical significance is based on p-values. Clinical significance is based on patient-centered outcomes.

Through careful patient and dose selection, intraoperative dexmedetomidine use can improve postoperative recovery in adults.

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dexmedetomidine and PACU stay

dexmedetomidine and PACU stay

Median Difference (95% CI) for various procedures:

- MI: 8 (1 - 11) min
- Strabismus: 5 (3 - 15) min
- Upper GI Endoscopy: 7 (3 - 10) min
- Combined Upper/Lower GI Endoscopy: 5 (1 - 12) min

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PERIOPERATIVE MEDICINE

Inhalational versus Intravenous Induction of Anesthesia in Children with a High Risk of Perioperative Respiratory Adverse Events

A Randomized Controlled Trial

Anoop Ramgotam, Ph.D., Graham L. Hall, Ph.D., Guicheng Zhang, Ph.D., Mary Hegarty, M.D., Britta S. von Ungern-Sternberg, Ph.D.

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Table 1. Brief Definition of the Risk Factors Used as Inclusion Criteria in This Trial

Risk Factors	Brief Definition Applied in This Study
Cold < 2 weeks	Signs of runny nose, cough and/or fever (> 38°C) but deemed fit for anesthesia by independent consultant anesthesiologist
Wheezing < 12 months	More than three episodes of wheezing experienced during the past year
Wheezing at exercise	Parentally reported wheezing during exercise
Nocturnal dry cough	Parental dry night cough observed
Past/Recent asthma	Parental asthma observed in past or currently
Passive smoking	Child exposed to parents/caretakers smoking independent of location, e.g., inside or outside of house
Family history of hay fever/asthma/eczema	At least two family members (any two of parents/grandparents) with a history of either hay fever or asthma or eczema

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Table 1. Brief Definition of the Risk Factors Used as Inclusion Criteria in This Trial

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Table 2. Definition Used for Respiratory Complications Recorded

Perioperative Respiratory Adverse Events	Definition
Laryngospasm	Complete airway obstruction with associated muscle rigidity of the abdominal and chest walls
Bronchospasm	Increased respiratory effort/painfully during expiration and wheeze on auscultation
Desaturation < 95%	Less than 95%. The limit of 95% is chosen in line with institutional guidelines based on PNCU discharge criteria
Airway obstruction	Presence of airway obstruction in combination with a snoring noise and/or respiratory efforts
Severe coughing	A series of precocious, persistent severe coughs lasting more than 75s
Postoperative stridor	High-pitched sound during breathing in the postoperative period

PNCU = post-anesthesia care unit

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Perioperative Respiratory Adverse Events	N (N = 148)	Inhalation (N = 148)	IV	95% CI	P Value
Any - unadjusted	38 (26%)	54 (36.5%)	1.64	1.16-2.27	0.003
Any - adjusted			1.66	1.21-2.32	0.002
I. Bronchospasm	3 (2%)	2 (1%)	1	-	-
II. Laryngospasm	3 (2%)	15 (10%)	5.00	1.45-18.91	0.01
Severe (FA II)	3 (2%)	16 (11%)	5.33	1.50-17.92	0.007
III. Coughing	11 (7%)	26 (18%)	2.12	1.20-3.66	0.006
IV. Desaturation	26 (17%)	36 (24%)	1.68	0.94-2.98	0.084
V. Airway obstruction	7 (5%)	25 (17%)	3.57	1.39-9.50	0.007
VI. Stridor (noisy)	2 (1%)	4 (3%)	2.00	0.37-10.75	0.419
Minor (str-V)	37 (25%)	63 (42%)	1.70	1.20-2.38	0.002

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SYSTEMATIC REVIEW

Respiratory and hemodynamic perioperative adverse events in intravenous versus inhalational induction in pediatric anesthesia: A systematic review and meta-analysis

Lucy L. Porter | Sophia M. Blaauwendraad | Barbe M. Pieters

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TABLE 2. (Continued)

Study	Intervention	Control	Relative risk	95% CI
Respiratory events	Apnea	1.00	1.00	1.00
	Bradycardia	1.00	1.00	1.00
	Desaturation	1.00	1.00	1.00
	Respiratory arrest	1.00	1.00	1.00
Hemodynamic events	Bradycardia	1.00	1.00	1.00
	Hypotension	1.00	1.00	1.00
	Arrhythmia	1.00	1.00	1.00
	Cardiac arrest	1.00	1.00	1.00

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TABLE 2. (Continued)

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Hemodynamic events	Bradycardia	1.00	1.00	1.00
	Hypotension	1.00	1.00	1.00
	Arrhythmia	1.00	1.00	1.00
	Cardiac arrest	1.00	1.00	1.00

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	Arrhythmia	1.00	1.00	1.00
	Cardiac arrest	1.00	1.00	1.00

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- Patient for adenotonsillectomy without a sleep study

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Multiple attempts to measure OSA without PSG

- STBUR (Snoring, Trouble Breathing, Un-Refreshed)scale
- Pediatric Sleep Questionnaire
- STOP-Bang
- McGill Oximetry Score

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Who should have polysomnography before tonsillectomy and adenoidectomy?

- <2 years of age
- obesity,
- Down syndrome,
- craniofacial abnormalities,
- neuromuscular disorders,
- sickle cell disease
- mucopolysaccharidoses.

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- When polysomnography is not available, clinicians should obtain a thorough history from parents and consider incorporating the STBUR questions in the preoperative screening phone call.
- Ask the otolaryngologist if they have clinical information to add
- Practice conservatively including developing BMI guidelines for excluding patients.

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Culture of Safety

- Culture of safety in an organization is the way safety is perceived, prioritized, and integrated into daily activities. It reflects the real commitment by all staff to safety at all levels.

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Triple Aim

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Culture of Safety

There are many factors contributing to a culture that values safety, but at the core is a commitment to:

- 1) assess current processes
- 2) implement protocols for safety initiatives
- 3) educate staff
- 4) evaluate safety culture
- 5) foster a culture that values safety as a shared responsibility

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Limitations of a Free-standing ASC

- The lack of a diverse group of physicians to consult in the case of an urgent or emergent situation. It is not uncommon for ASCs to only have one anesthesiologist on site with multiple OR's running at the same time. This can result in serious consequences if an emergency situation arises.
- If a patient requires urgent transfer to a higher acuity healthcare facility, the only option may be to call 911.
- Unavailability of certain types of emergency medications or equipment.
- Inadequate nursing /support staff to assist in the case of an emergency.
- A lack of laboratory and radiological services in the case of an emergency.
- Lack of blood bank or transfusion capabilities.

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Culture of Safety

Communication Gaps

- Effective communication is a cornerstone of providing safe and effective patient care.
- Communication breakdowns are the second most common cause of surgical errors and adverse events after technical errors.*
- The Joint Commission has previously concluded that failures of communication are the root cause of nearly every reported unexpected death and catastrophic injury.**

*Angeles, Ann Surg. 2013 May;233(5):849-54
**Office of Disease Prevention and Health Promotion

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Culture of Safety

- Handoff protocols enhance communication while decreasing errors among nurses, anesthesiologists and surgeons during the transfer of patients from the operating room to the PACU. Handover improvements and smooth transitions between care settings should be tailored to the specific ASC.
- Communication:
 - Anesthesia to nursing staff
 - Attending to resident
 - Caregiver to family

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Summary

- ASCs are a great example of a successful transformation in health care delivery
- Well-defined evidence-based selection criteria for pediatric patients undergoing surgery in a free-standing ASC will ensure safety of ambulatory surgery.
- Very obese children pose logistical and medical challenges and may have prolonged stay or require admission

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Summary

- The role of the patient information screening team at an ASC is extremely important developing and enforcing patient selection guidelines.
- Culture of safety must be prioritized and integrated into daily activities
- A cohesive team fosters a culture of safety, improves patient outcomes and patient satisfaction

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HANDOUTS



Panel: Pediatric Difficult Airway – Updates to the New (2022) Guidelines

Audra Webber, MD, FASA

05/20/2023

10:45am – 11:30am MST



The **NEW** 2022 ASA Practice Guidelines for Management of the Difficult Pediatric Airway

Audra Webber MD, FASA
University of Rochester
Department of Anesthesiology and Perioperative Medicine.



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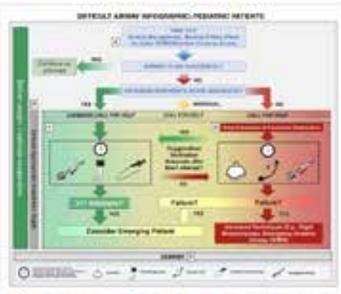


Apfelbaum JL, Hagberg CA, Connis RT, et al. 2022 American Society of Anesthesiologists Practice Guidelines for Management of the Difficult Airway. *Anesthesiology*. 2022 Jan 1;136(1):31-81. PMID 34762729

- **Revision of the 2013 Guidelines, overseen by an international task force.**
- **These new guidelines are the first to include evidence from pediatric airway management**

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Highlights

1. **Importance of Risk Assessment**
2. **Awareness of passage of time and oxygen saturation**
3. **Acknowledges that Awake Intubation is not usually feasible in the pediatric patient**
4. **Limit total number of airway attempts**

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Highlights

5. **Continuous oxygenation throughout**
6. **Maintain adequate anesthetic depth and distinguish between functional and anatomic obstruction**
7. **Assess ventilation after every attempt**
8. **Confirm intubation with capnography**
9. **Have a plan for extubation**

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YOU are an important component of the algorithm

- **The airway manager's assessment and choice of techniques should be based on:**
 - Previous Experience
 - Available Resources (including equipment availability)
 - Competency of help
 - Context in which the airway management will occur
 - If possible move to the OR
- **If you don't perform a lot of pediatric airway management, you should not be managing the ANTICIPATED difficult pediatric airway.**
 - Refer the patient to a tertiary care center

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Risk Assessment

Approximately 80% of pediatric difficult intubations can be identified preoperatively². However, this leaves 20% unanticipated.

Neonates and infants³ are more likely to present with difficulty in airway management compared to older children.

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Risk Assessment

Look for characteristics that can indicate the possibility of a difficult airway:

- Indicators on the standard facial/airway exam
- Certain congenital anomalies are associated with difficult laryngoscopy – Treacher Collins, Klippel-Feil, cleft palate, mucopolysaccharidoses and airway masses.
- Comorbidities which are associated with difficult ventilation such as OSA and obesity – this holds for children as well as adults

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Preparation of Environment:

- **Formulate your plan, backup plan, and backup backup plan.**
- **Have your equipment in the room and checked**
- **Identify your (skilled) helper(s)**
- **Ensure everyone in the room is aware of your sequence of strategy**

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Early considerations

- **Surgeon trained in pediatric invasive airway techniques**
 1. A neonatal trach is a lot more difficult than an adult trach
- **ECMO**
 1. You need perfusionists, a primed ECMO circuit, and a surgeon.

Both of these require lead time and cannot be instituted instantaneously

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Preparation of Patient - Oxygen Supplementation

- **Properly position the patient**
- **Administer supplemental oxygen before initiating management**
- **Continue to deliver supplemental oxygen (whenever feasible) throughout the process of difficult airway management, including extubation.**

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Continuous Oxygen Supplementation

- *Can be via any number of modalities:*
 - Nasal Cannula
 - High flow nasal cannula
 - Nasal PAP
 - Continuous insufflation via modified nasal airway
 - Via auxiliary port on laryngoscope

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Pediatric Algorithm – Tools Highlighted

- Supraglottic Airway
- Flexible Intubation Scope
- Video Laryngoscopy
- *These can be used alone *or* in combination*

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Intubation : 3 + 1

- *Don't start with DL!!*
- *For pediatric patients, data shows advanced airway management techniques are more effective at securing a difficult airway.*
- *Meta - analyses of randomized trials⁴ have demonstrated that video assisted laryngoscopy in pediatric patients with predicted difficult airways:*
 1. IMPROVES LARYNGEAL VIEWS
 2. IMPROVES FIRST-ATTEMPT INTUBATION SUCCESS
- *Combination techniques MAY improve intubation success in patients with anticipated difficult airways⁵.*

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Be aware of the passage of time, the number of attempts, and oxygen saturation

- This amounts to an emphasis on situational awareness, which avoids TASK FIXATION.

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Functional versus anatomic obstruction

- *Laryngospasm is much more common in pediatric patients*
- *The pediatric guidelines highlight ensuring adequate anesthetic depth throughout secure airway acquisition.*
- *Postintubation bronchospasm is also incredibly common in neonates and infants and can be so severe as to not have any etCO₂ at first.*

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Attempt to ventilate after each unsuccessful attempt.

- *The ability/inability to ventilate is not set in stone – i.e. one attempt and that's it.*
- *If you were unable to ventilate when the patient was paralyzed, maybe you will be better able to ventilate when the paralysis begins to wear off*
- *You won't know unless you try (again)*

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Extubation should be planned as carefully as intubation



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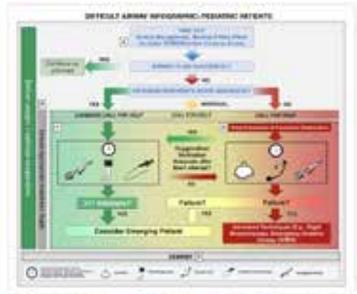
Pediatric specific suggestions

- *Get an IV up front in cases of suspected difficult airway. If you don't do a lot of inhalational inductions, now is not the time to practice.*
 - *That being said, you can still perform an inhalational induction to maintain spontaneous ventilation, with the added benefit of already having IV access.*
- *Don't attempt airway manipulation beyond the insertion of an OPA without IV access*
- *In premature children and infants, sometimes it is helpful to leave the feeding tube or repleg in situ, so long as it doesn't interfere with BMV.*
 - *It is a great indicator of which orifice to NOT place the ETT in.*



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Recommendations

- *Ask for help before you start (Surgeon, ECMO, assistant)*
- *Use supplemental oxygen*
- *Use advanced airway techniques for your first attempt (not DL)*
- *Avoid task fixation*
- *Check ability to ventilate after each attempt*
- *After 3+1 failed attempts don't delay waking up or an invasive airway*
- *Have an extubation plan*



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3. Diana N, Ying K, Riva T, Kadmanis J, Engelhardt T, Haber W et al. NECTARINE Group of the European Society of Anaesthesiology Clinical Trial Network. Difficult tracheal intubation in neonates and infants. NECTARINE and Children audit of Anaesthesia practice IN Europe (NECTARINE): a prospective European multicentre observational study. *Br J Anaesth*. 2021 Jan;126(5):1173-1181
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• **Thank you!**



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HANDOUTS



Pro/Con: You Should **ALWAYS** Manage a Patient with SQ Insulin in an ASC

Leopoldo V. Rodriguez, MD, MBA, FAAP, FASA, SAMBA-F (Pro)

Niraja Rajan, MD, SAMBA-F (Con)

05/20/2023

11:30am – 12:00pm MST

Pro/Con: You Should ALWAYS Manage a Patient with SQ Insulin in an ASC

Leopoldo V. Rodriguez, MD, MBA, FASA, SAMBA-F (Pro)
 Past-President, SAMBA
 Chair, ASA Committee on Ambulatory Surgical Care
 Anesthesiology & Perioperative Medicine Consultant
 Boulder Valley Anesthesiology PLLC, Boulder CO

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Disclosures

- No financial interests
- Based on a literature review and extensive clinical experience, this presentation represents my opinion on this topic. It does not represent the views of SAMBA or ASA.
- Recommendations based on inpatient and critical care literature may not always apply to the ambulatory setting.

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Two different types of patients in Outpatient surgery (Ambulatory, HOPD, NORA)

1. Healthy or well managed patient undergoing invasive procedures that may be associated with fluid shifts and surgical stress:
 - a. Total joint replacement
 - b. Spine surgery
2. Unhealthy or poorly managed patient undergoing a less stressful procedures
 - a. Cataracts
 - b. Podiatric surgery
 - c. Hand surgery
 - d. Other minor procedures, such as lipoma excision, etc.

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Goals

1. Avoidance of hypoglycemia
2. Maintenance of BG in target range
3. Adequate BG monitoring, and
4. Expeditious resumption of oral intake and patient's medication regimen.

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2022 ADA Guidelines: Diabetes Care in the Hospital

Diabetes Care 2022;45(Suppl. 1):S244–S253 <https://doi.org/10.2337/dc22-S016>

- Insulin therapy should be initiated for hyperglycemia >180 mg/dL and targeted to a glucose range of 140–180 mg/dL (7.8–10.0 mmol/L) for most critically ill patients.
- Not as well supported by data from randomized controlled trials, **these recommendations have been extended to hospitalized patients without critical illness.**
- On the other hand, and in **glucose concentrations between 180 mg/dL and 250 mg/dL (10–13.9 mmol/L) may be acceptable in patients with severe comorbidities** inpatient care settings where frequent glucose monitoring or close nursing supervision is not feasible.

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Perioperative Care

Many standards for perioperative care *lack a robust evidence base.*

- The target range for blood glucose in the perioperative period should be 80–180 mg/dL (4.4–10.0 mmol/L). We prefer 140–180 to prevent hypoglycemia.
- Metformin** should be continued on the day of outpatient surgery.
- Sulfonylureas** should be discontinued (risk of hypoglycemia)
- GLP-1 Receptor agonists (hold if at risk of aspiration) > consider gastric U/S. **Amylin** should be held (hypoglycemia)
- SGLT2 inhibitors** must be discontinued 3–4 days before surgery (euglycemic ketoacidosis)
- Withhold any other oral glucose-lowering agents the morning of surgery or procedure and give half of NPH dose or 75–80% doses of long-acting analog or pump basal insulin.
- Ultra and Long-acting insulin DM1: Administer full dose* DM2: Administer 75–80% of daily dose
- Monitor blood glucose while the patient is NPO and dose with short- or rapid-acting insulin as needed.
- Preferably earlier cases to avoid hypoglycemia

* 80% if history of AM hypoglycemia

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Hyperglycemia in critically ill patients

The American Heart Association guidelines of **post-cardiac arrest care** for hyperglycemic control is to maintain a blood glucose level of 144 mg/dL to 180 mg/dL (Class IIb). A more liberal target of 180 mg/dL to 200 mg/dL is to be avoided to prevent marked hyperglycemia.

- Longstreth WT Jr., Cobb LA, et al. Neurologic outcome and blood glucose levels during out-of-hospital cardiopulmonary resuscitation. *Neurology* 1986; 36:1186.
- Skrifvars MB, Pettia V, Rosenberg PH, Gastren M. A multiple logistic regression analysis of in-hospital factors related to survival at six months in patients resuscitated from out-of-hospital ventricular fibrillation. *Resuscitation* 2003; 59:319.
- 2016 American Heart Association Basic Life Support Provider Manual

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Decrease surgical site infections: A Perioperative Systems Design to Improve Intraoperative Glucose Monitoring Is Associated with a Reduction in Surgical Site Infections in a Diabetic Patient Population.

Jesse M. Ehrenfeld, M.D., M.P.H., Jonathan P. Wanderer, M.D., M.Phil., Maxim Terekhov, M.S., M.B.A., Brian S. Rothman, M.D., Warren S. Sandberg, M.D., Ph.D. *Anesthesiology* 2017; 126:431-40

Using an automatic system to identify diabetic patients, detect insulin administration, check for recent glucose measurements, and remind clinicians to check intraoperative glucose improved the reliability of intraoperative glucose management. After implementing this automated reminder system, improved glucose monitoring, increased insulin administration, reduced recovery room hyperglycemia, and fewer surgical site infections were observed.

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Control chart showing surgical site infection rates

Intraoperative glucose monitoring rose from 61.6 to 87.3% in cases after intervention (P = 0.0001) d

Control chart of hyperglycemia in PACU

More patients received intraoperative insulin after the intervention (30% before vs. 38% after; P < 0.0001)

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How much insulin do I use?

Correction factor = 1800/total daily dose of insulin: expected decrease in BG per one unit of insulin administered.

Example:
 Patient takes 60 units of long acting & 10 units with each meal
 90 units a day.
 $1800/90 = 20$
 For each unit administered the BG should be expected to decrease by 20 mg/dl

- BG is 250 > $250 - 140 = 110 / 20 = 5.5$ units > 5 units
- Monitor patient accordingly to type of insulin used.

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Short-acting and Rapid Acting Insulin

Short Acting Insulin	Human Regular (Novolin R, Humulin R): subcutaneous 2-4 times daily before meals or to correct hyperglycemia	Onset: 30 min Peak: 2-3hrs Duration: 4-6hrs	Administer usual daily dose	Hold
Rapid Acting Insulin	Insulin Lispro (Humalog, Admelog, Humalog 100, Humalog 200) Insulin aspart (Fiasp, Novolog) Insulin glulisine (Apidra) subcutaneous 2-4 times daily before meals	Onset: 15 min Peak: 1-2 h Duration: ~6 h + Fasting onset time ~ 2.5hr	Administer usual daily dose	DM1: Can administer for hyperglycemia DM2: Hold

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Semper imitatum, nunquam idem

Physician anesthesiologists are the perioperative medicine specialists who assess and modify risk factors to decrease complications and implement evidence-based medicine to decrease discharge time and postoperative visits to the ER and/or post-discharge hospitalizations.

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You Should ALWAYS Manage a Patient with SQ Insulin in an ASC: CON

Niraja Rajan MD FASA SAMBA-F
Professor
Department of Anesthesiology and Perioperative Medicine
Penn State Health
Medical Director
Hershey Outpatient Surgery Center

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- *If pro is the opposite of con is progress the opposite of congress?*

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- You should NEVER Manage a Patient with SQ Insulin in an ASC
- You should NOT ALWAYS Manage a Patient with SQ Insulin in an ASC
- You should ALWAYS Manage a Patient with IV Insulin in an ASC

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- Why insulin?

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Epidermis
Dermis
Subcutis
Muscle

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Factors affecting SQ insulin absorption

Type
Concentration
Exercise
Injection Site

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Factors affecting SQ insulin absorption

- Subcutaneous blood flow (SBF) at injection site
- Lipohypertrophy
- Skin temperature
- Local degradation
- Local massage
- Injection Site
- Skinfold Thickness/Obesity
- Exercise and activity level
- Smoking
- Body position

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IV route advantages

- 100% bioavailability
- Rapid onset
- Rapid peak effect
- Short duration

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INDICATIONS "Novolin R may be administered intravenously under proper medical supervision in a clinical setting for glycemic control";

DOSAGE AND ADMINISTRATION "Intramuscular and intravenous administrations of Novolin R are possible under medical supervision with close monitoring of blood glucose and potassium levels to avoid hypoglycemia and hypokalemia. For intravenous use, Novolin R should be used at concentrations from 0.05 U/ml to 1.0 U/ml in infusion systems with the infusion fluids 0.9% sodium chloride, 5% dextrose, or 10% dextrose with 40 mmol/l potassium chloride using polypropylene infusion bags."

Two insulin analogues, insulin aspart (Novolog) and glulisine (Apidra), which have rapid onset of action when absorbed SQ, but not when delivered via intravenous or peritoneal routes, have also acquired FDA approval for the intravenous administration indication. Their labels include similar language regarding the medical supervision, laboratory monitoring, and drug dilution required for safe use.

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Regular insulin IV vs SQ

	IV	SQ
Onset	5-10 minutes	30-40 minutes
Peak Effect	30-40 minutes	90-120 minutes
Duration	1-2 hours	4-6 hours

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Anesthesiologists are perioperative intensivists

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SQ route pitfalls

- Low blood flow states
- Anticipated fluid shifts
- Severe Hyperglycemia
- Short procedures

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Summary

- For predictability and precision, IV insulin is preferred for treating hyperglycemia.
- You should NOT ALWAYS Manage a Patient with SQ Insulin in an ASC

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SAMBA Annual Updates and Awards Luncheon

Dawn J. Schell, MD

05/20/2023

12:00pm – 1:00pm MST

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ASA Update

Ronald L. Harter, MD, FASA

05/20/2023

1:00pm - 2:00pm MST

**ASA and Society for Ambulatory Anesthesia:
Partnering for a Better Future**
 Ronald L. Harter, MD, FASA | President-Elect
 May 20, 2023



asahq.org

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Disclosures & Objectives

Nothing to disclose

Participants will learn:

- How ASA is working with SAMBA to address current and emerging opportunities
- Key trends and challenges facing the specialty in the market, legislatures, and regulatory agencies, both nationally and in the states

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We are ASA: Leaders in Patient Safety

Mission: Advancing the practice and securing the future

Vision: A world leader improving health through innovation in quality and safety

Values: Patient safety, physician-led care and scientific discovery

Strategic Pillars

1. Advocacy
2. Quality & Practice Advancement
3. Educational Resources
4. Member Engagement
5. Leadership & Professional Development
6. Research & Scientific Discovery
7. Stewardship of the Society & Specialty

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Ambulatory Anesthesia at ANESTHESIOLOGY® 2023

SAMBA Panel

Society for Ambulatory Anesthesia (SAMBA) Did You Know? Highlights 2022-23

Ambulatory Anesthesia Sessions

- 20 Ambulatory Anesthesia Sessions
- 76% of presentations submitted were accepted
- 7 Panels
- 4 Refresher Course Lectures
- 1 Clinical Forum
- 6 Snap-Talks
- 1 Point-Counterpoint
- 1 Workshop

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Ambulatory Anesthesia at ANESTHESIOLOGY® 2023

Special Thanks to Educational Track Subcommittee on Ambulatory Anesthesia

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|--|--|
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Advocacy Update



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Hot Issue – New DEA Training Requirement

- The Drug Enforcement Administration (DEA) and the Substance Abuse and Mental Health Services Administration (SAMHSA) recently released guidance on new one-time mandatory training
- 8-hour training requirement
- Effective June 27, 2023, **all** DEA registrants must complete the one-time training requirement prior to renewing their DEA registration
 - Note: June 27, 2023, is **not** the deadline for completing the training requirement
- Compliance is via attestation only
- Requirement can be met using resources from CME providers
- ASA resources are now available

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Courses to Meet New DEA Requirement

ASA Courses:

- DEA Medication-Assisted Treatment (MAT) of Opioid Use Disorder
 - Meets the 8-hour DEA training requirement
 - Free for ASA members
 - asahq.org/shop-asa/e023r00w00
- Opioid Safety Strategies Course
 - Meets 6 hours of the 8-hour requirement
 - \$49 for ASA members
 - asahq.org/shop-asa/e022s10w02

AMA Courses:

- As another option, the AMA is also offering courses that satisfy this requirement; some of which are available for free at their "Substance Use Disorders and Addiction Education to Meet New DEA Requirements" page
- edhub.ama-assn.org/course/302

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Worrisome Trifecta - Medicare, Insurers, AANA

- **Federal**
 - Medicare Payments
 - No Surprises Act (NSA) Implementation
 - Protecting Physician-Led Care
 - VA
 - Medicare Supervision
- **In the States**
 - Protecting Physician-Led Care
 - Medical Title Misappropriation
 - CAAs

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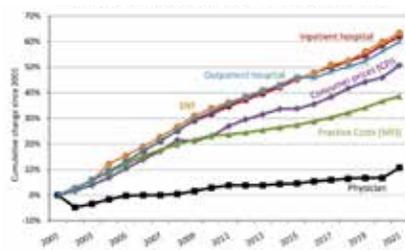
Medicare: Broken Payment System



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Medicare Updates Compared to Inflation (2001-2021)



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Medicare Payments 2023 – Next Steps

Consensus Reforms Sought

(Surgical Care Coalition, AMA)

- Annual Inflation Adjustment
- Reforms to Budget Neutrality
- More Opportunities for Alternative Payment Models

Bucshon Looks For Bipartisan Medicare Pay Reforms As Docs Push For Stability

"...the partial mitigation included in last year's spending bill isn't enough for physicians or to protect Medicare beneficiaries' access to care, and the first step lawmakers need to take is an oversight hearing on what he views as a flawed Medicare Access and CHIP Reauthorization Act and faulty physician pay policies.

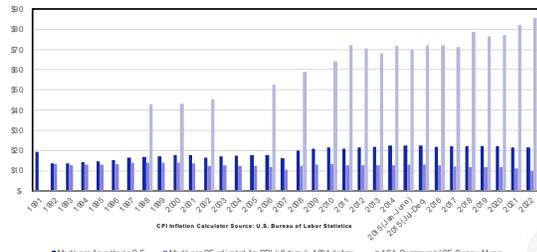
InsideHealthPolicy.com, February 1, 2023

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Medicare Conversion Factor – With and Without Inflation Adjustments and Commercial Anesthesia Conversion Factor



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“33% Problem”

- Committee on Economics – “33% Problem” Subcommittee
 - Compare Medicare fee-for-service payment rates for anesthesia services with payments in other government programs
 - Compare Medicare fee-for-service payment rates with Medicare per unit spending for the Medicare rural pass-through program
 - Explore other payment options

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New “33% Problem” Initiative: CMS vs. CMS

HEALTH DATA ANALYTICS INSTITUTE

Table 2. Estimated Rural Pass-through (RPT) Equivalent Conversion Factors (CFs) Compared to Medicare and Commercial CFs, 2017-2019

Metric	2017	2018	2019
Medicare Conversion Factor (CF)	\$22.05	\$22.19	\$22.28
ASA Survey Commercial CF	\$71.02	\$70.57	\$76.32
Rural Pass-through Equivalent CF			
Median	\$43.62	\$42.11	\$40.53
Mean ¹	\$81.02	\$83.73	\$76.26
Percentage Above/Below:			
Medicare CF	267	277	238
Commercial CF	14	7	(1)

Medicare Anesthesia Rural Pass-Through (RPT) is Part A reasonable cost-based mechanism for low-volume rural hospitals utilizing CRNAs only. Used in lieu of Part B fee-for-service.

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New “33% Problem” Initiative: Legal Challenge?

- Are anesthesiologists compelled to provide services to Medicare beneficiaries for unreasonable payments?
- Does the Fifth Amendment “Takings Clause” apply to “33% Problem?”
- Does the “No Surprises Act” federal rate setting of commercial payment strengthen “Takings Clause” argument?

Garelick v. Sullivan, decided against Garelick March 5, 1993

“The central questions presented by this appeal are whether a federal statutory scheme designed to control Medicare costs has caused a *taking of property from plaintiff anesthesiologists* requiring compensation under the Fifth Amendment...”

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Center for Anesthesia & Perioperative Economics (CAPE)

- Approved by the Board of Directors in August and House of Delegates in October
- Q1 2023 launch and will:
 - Elevate profile of payment strategy in ASA and serve as a point of interaction with CMS, the insurance industry, and other stakeholders
 - Serve as a resource for policy development
 - Focus member and staff on a comprehensive strategy
 - Medicare
 - Medicaid
 - Commercial payment
 - Current status:
 - Steering Committee being appointed
 - Initial work: SWOT analysis, 2 to 3-year goals, resource plan



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No Surprises Act Implementation



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No Surprises Act (NSA)

- Protect patients from surprise bills ✓
- Increase health care cost transparency for patients ✓
- Create a mechanism for physicians and payers to resolve payment disputes ✗



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No Surprises Act (NSA) Implementation

- Agencies have botched implementation of balanced law
- Erroneous and unlawful NSA rules and guidance are empowering payers to use aggressive negotiating techniques
 - Unreasonably low initial payments/qualifying payment amounts (QPA)
 - Improper weighting of QPA by independent dispute resolution (IDR) entities
 - Overly restrictive batching rules and guidance
 - Excessive administrative fees to access IDR process
 - Insurers withholding payments from physicians who prevail in IDR process

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Insurers Leveraging Flawed Implementation: Practices Pushed Out-of-Network

Following the passing of the No Surprises Act, [redacted] evaluated contracts for services associated with this Act and is bringing them in line with current market compensation for similar services. Due to the financial challenges impacting our customers and the healthcare environment, [redacted] is unable to move forward with the present contract in effect between [redacted] and [redacted].

Excerpt from a letter from a large national insurer to an anesthesiology group terminating an existing 10-year-old contract.

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Potential Remedies

- Regulatory
- Legal
- Legislative

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ASA NSA Coalitions and Workgroups

- ASA, ACR, ACEP
- Network Adequacy Workgroup
- No Surprises Act Workgroup

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ASA NSA Legal Efforts

- TMA I (2/25/2022) challenging primacy of QPA in IDR process - **Won**
 - AMA-AHA suit filed in DC (withdrawn)
 - ASA-ACEP-ACR suit filed in Chicago (withdrawn)
- TMA II (9/22/2022) challenging primacy of QPA in Final Rule – **Won (2/6/2023)**
(ASA-ACEP-ACR brief referenced in ruling)
 - ASA-ACEP-ACR amicus brief filed (10/19/2022)
- TMA III (11/30/2022) challenging calculation of QPA - **Pending**
 - ASA-ACEP-ACR amicus brief filed (1/31/2023)
- TMA IV (1/30/2023) challenging fee increase and batching rules - **Pending**
 - ASA-ACEP-ACR amicus brief filed (2/23/2023)

*All TMA suits filed in Tyler, Texas

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Partial Win with NSA Batching

“With regard to your specific recommendation that the Departments allow batching across claims paid under different fully-insured plans offered by the same issuer, I’m pleased to inform you that batching of these claims is allowed under the current batching system.”



March 16, 2023, CMS Letter to Dr. Michael Champeau permitting batching of claims by issuer instead of group health plan

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ASA NSA Member Education

- Monday Morning Outreach
- ASA Monitor Today and ASAP
 - “NSA Question of the Week”
- ASA Communities “Ask the Experts”
- ASA ADVANCE 2023
 - President’s Update
 - NSA Panel
- No Surprises Act Tool Kit (www.asahq.org)

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Safe VA Care



American Society of Anesthesiologists | SAMVA
[asahq.org](http://www.asahq.org)

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VA Scope of Practice: AANA Campaign



“It is imperative the VA move swiftly to grant CRNA’s full practice authority...”
 Rep. Lauren Underwood (D-IL), nurse

“Veterans need CRNA care now...”
 New AANA Misinformation Campaign

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ASA and Allies Preserving “Anesthesia Team”

- Congressman David Scott
- Other Congressional allies
- VA officials
- Veteran Service Organizations (VSO)
- ASA grassroots
- Public engagement – national media tour
- Association of VA Anesthesiologists (AVAA)



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Medicare Supervision

- “CMS will end this emergency waiver at the end of the PHE...”



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State Physician-Led Care

- Opt-outs
- APRN/CRNA independent practice legislation
 - Introduced in 17 states
 - Current: ASA/State Components have defeated 6 CRNA bills and 2 APRN Compact bills
- Pro-active Medical Title Misappropriation legislation
 - Introduced or being drafted in 9 states
- Pro-active Certified Anesthesiologist Assistants legislation
 - Introduced or being considered in 14 states

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Other Key Federal Initiatives

- Workforce legislation
 - Potential Cassidy-Sanders Senate package – ASA has provided recommendations
- REDI Act – resident debt relief
- Support for AHRQ funding via “Friends of AHRQ”
- FTC non-compete rule
- OTC Naloxone (Narcan)
 - 2/15/23 – FDA OTC Narcan hearing - Bonnie Milas, MD and ASA written comments
 - 3/29/23 – FDA approved Narcan for sale OTC

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Why Contribute? Our Dollars Make a Real Difference

- Patient safety and quality of care
- Economic strength and sustainability of our practices
- Assure anesthesiologist-led team-based care
- Advocating for scientific discovery, the cornerstone of what we are
- Assuring adequate support and advocacy for education and training the next generation of anesthesiologists
- **The power of unity and combined resources!**

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Fiscal Year 2022 Participation: Residency Programs

Platinum Status
Residency programs who achieve 100% ASAPAC participation



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2022 Election Cycle – ASAPAC is #1 again!

Organization	Dollar Amount	
American Society of Anesthesiologists PAC	\$3,950,530	Blue Cross Blue Shield
American Association of Orthopaedic Surgeons PAC	\$2,167,926	\$3,731,753
American Dental Association PAC	\$2,143,337	
American College of Radiology PAC	\$1,935,074	
American College of Dermatology PAC (SKINPAC)	\$1,792,866	American Medical
American College of Emergency Physicians PAC	\$1,677,334	Association
American Academy of Ophthalmology	\$921,776	\$1,780,757
American College of Ob-Gyns	\$830,418	
American Academy of Family Physicians	\$684,730	
American College of Surgeons Professional Assn PAC	\$664,357	
American College of Cardiology PAC	\$646,194	
American Osteopathic PAC	\$590,037	



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Education and Science




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ASA Education Portfolio

- Created and vetted by leading practicing anesthesiologists
- Efficiently master the skills and knowledge necessary for daily practice
- Fulfills MOCA® and CME requirements
- Wide range of topics and formats to suit schedules and preferred learning styles
- Complimentary resident member offerings include 28 patient safety education activities
- Robust joint provider program enabling components and subspecialty orgs to offer **AMA PRA Category 1 Credit™** for CME



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Diagnostic Point-of-Care Ultrasound Certificate Program (POCUS)

Diagnostic Point-of-Care Ultrasound Certificate 2022 Release with FAST exam
Claim up to 45 CME and 10 MOCA® Part 4 points

Part 1: Complete a QI Action Plan (optional)

Part 2: Provide evidence of past POCUS education/training

Part 3: Identify and interpret online cases

Part 4: Perform and acquire images for mentor review

Part 5: Take the final exam

Achieve your certificate of completion

Find out more: asahq.org/POCUS



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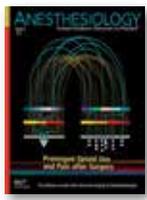
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Anesthesiology

The official peer-reviewed journal of the ASA

- **Enduring Importance and Foundational Value:** Impact factor 9.198 (previous year 7.892)
- **Publication Speed:** 3 days to online publication after acceptance for original research articles
- **Online Readership:** Over 3.8 million visits in 2022 (49% United States, 51% International)
- **Member Satisfaction:** 87% satisfied/extremely satisfied
- **International Reach:** Over 50% international authors

anesthesiology.org




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Pacira Libel Case Against Anesthesiology

- Lawsuit filed against ASA, *Anesthesiology* editor-in-chief and 11 authors by Pacira Biosciences Inc. dismissed 2/4/22
- Suit filed in April 2021 regarding articles about pain medication, EXPAREL, in February 2021 *Anesthesiology* issue, a related podcast and other materials
- Judge found that a "scientific conclusion based on nonfraudulent data in an academic publication is not a 'fact' that can be proven false through litigation," adding that holding otherwise "would chill robust and open debate about the efficacy of drugs within the medical community."
- Pacira appealed the dismissal and oral arguments were held on 3/6/23
 - Multiple groups filed amicus briefs in support of ASA's position, including the American Medical Association, the Association of American Publishers, and the Council of Medical Specialty Societies
 - On March 24, 2023, the Appellate Court issued an opinion affirming the District Court decision and denying Pacira the opportunity to amend its complaint

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ASA Monitor

asamonitor.org

Official news publication of the ASA

- Leading source for objective, timely, fact-based reporting, and thoughtful dialogue for the perioperative health care community
- Columns: In the Know, Trends & Technology, Facility Spotlight, Career Connection, Your Patient's Brain, Ask the Expert, The Curious Economist, Peering Over the Ether Screen, Dr. Gearhead, The Pulse
- Central Line: Inside the Monitor podcasts – monthly podcasts about the featured articles
- **ASA Monitor+ supplement – April 2023**
 - Redefining our Future through Economics, Equity, and Patient Safety



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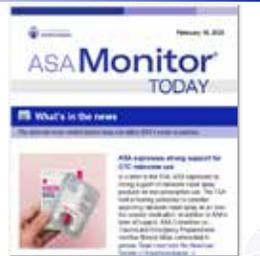


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ASA Monitor Today

In early January, *Anesthesiology Today eNews* was rebranded to **ASA Monitor Today** as the official digital companion to the monthly *ASA Monitor*

- Don't miss Tuesday–Friday:
- Aggregated health care news
 - What you should know from ASA



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Leadership and Professional Development Resources

ASA Leadership Academy

- Module 1 - Leadership Roles – Attendees learn ASA's mission and organization, its leadership path, and how to maximize member experience for personal and professional growth
- Module 2 - Creating a Personal Leadership Path - Attendees assess leadership gaps, strengths and create a personal leadership pathway
- **NEW Module 3 coming in 2Q 2023!**



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Residents and Medical Students

Anesthesia Toolbox - high-quality, peer-reviewed educational resources

Focused educational sessions at ASA® ADVANCE

Medical student career development resources

Educational sessions at the ANESTHESIOLOGY® annual meeting

Virtual Grand Rounds modules accessible in the ASA Education Center

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New Early-Career Membership Program

- Aimed at retaining and building loyalty after training
- Customized for graduating residents and fellows
- Offers simple no-fuss discounted three-year ASA membership
- Wealth of educational and professional development resources designed for newly minted anesthesiologist

Learn more about the program: asahq.org/ecmp



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Podcast Series

ASA's Central Line

- Hosted by Dr. Adam Striker
- Real conversations with peers and leaders, providing insights and personal experiences
- 2 episodes/month - covering everything from delirium biomarkers to pediatric pain scales, finding gratitude, and the value of specialty societies

Residents in a Room

- Candid resident conversations, what's keeping them interested and up at night
- 1 episode/month - covering everything from patient safety principles to clinical preparation, advocacy subspecialty pathways, and journal clubs



asahq.org/podcasts

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Thank You



American Society of Anesthesiologists



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HANDOUTS



Panel: Dental Ambulatory Anesthesia - M&M Case Presentation

Steve Yun, MD

05/20/2023

2:00pm - 3:15pm MST



Delayed Emergence in the Dental Office

Steve Yun, M.D.
Expert Consultant Dental Board of CA
Clinical Professor, Western U. of Health Sciences

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1

Financial Conflict of Interest

- No relevant conflicts of interest

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Case Presentation

50 y.o. male

- 5'9" and 265 lbs
- PMH: HTN, hypercholesterolemia, hypothyroidism, OSA on CPAP, PE/DVT 2009, Gastric sleeve 2011
- Meds: thyroxine, simvastatin, lisinopril-HCTZ
- ASA 2, MP 3



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June 2019

Full mouth extractions and implants

Start 7:50. Surgery end 14:06

Propofol 100-120 mcg/kg/min (300 ml total)
Midazolam 10 mg total
Fentanyl 200 mcg total

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Patient slow to wake up

BS tested = 148

VSS other than hypoxia that responded to supplemental oxygen saturation
SpO2 94% on 3L O2
on room air, SpO2 92%

At 16:03 patient deemed OK to D/C home with wife (2 hours after end of surgery)

With assistance, patient able to get into wheelchair

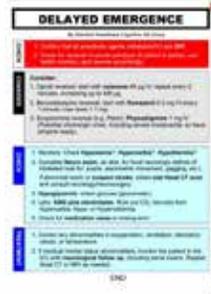
Later that night, patient still very sleepy but following commands

Next morning, patient returned to office but was still very sleepy

Patient referred to urgent care for further evaluation

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“With the variable rate infusion method, patients will generally require maintenance rates of 25 to 75 mcg/kg/min (1.5 mg/kg/h to 4.5 mg/kg/h) during the first 10 minutes to 15 minutes of sedation maintenance.

Infusion rates should subsequently be decreased over time to 25 mcg/kg/min to 50 mcg/kg/min and adjusted to clinical responses.”

From the Manufacturer’s Drug Prescribing Information Insert

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From the Manufacturer’s Drug Prescribing Information Insert

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Fig. 16. Time required for a 50% decrease in concentration after continuous infusion of variable lengths (context-sensitive half-time). Simulations were performed for a child (20 kg body weight, 5 yr of age), a lean adult (50 kg, 30 yr), an adult of average weight (70 kg, 30 yr), an obese adult (110 kg, 30 yr), and an elderly individual (65 kg, 60 yr), based on the final model parameters (table 4).

Population Pharmacokinetics of Propofol: A Multicenter Study. Anesthesiology 2000;92(3):727-738

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In Retrospect...

- Dentist noticed that the sclera was yellow,
- In recovery, the dentist noted a yellow tint to the commissures of his lips
- Alcohol smell to the breath
- But wife stated that his physicians have tested his liver and all “tests were fine”

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Table 1. Characteristics of Propofol Anesthesia

	Alcohol	Control	P
Induction			
Dose, mg/kg	1.81 ± 0.19	1.70 ± 0.29	NS
Time to LOC, s	63 ± 10	64 ± 12	NS
Infusion			
Time to intubation, min	8.4 ± 2.9	11.2 ± 5.1	NS
Measured concentration, µg/ml	6.33 ± 2.88	6.80 ± 5.52	NS
Intoxication			
Measured concentration, µg/ml	3.75 ± 1.27	4.64 ± 1.97	NS
Movements, No.	6/16	4/15	NS
Refractory anesthesia			
Measured concentration, µg/ml	4.84 ± 1.48	5.65 ± 2.67	NS
Mean infusion rate, µg · kg ⁻¹ · min ⁻¹	186 ± 29	178 ± 29	NS
End of anesthesia			
Duration of anesthesia, min	216 ± 151	170 ± 65	<0.01
Measured concentration at end of infusion, µg/ml	3.87 ± 1.87	5.08 ± 2.61	NS
Time to opening eyes, min	163.7 ± 12.83	123.6 ± 14.2	NS
Measured concentration at opening eyes, µg/ml	2.20 ± 0.74	2.25 ± 1.23	NS

Values are expressed as mean ± SD except where otherwise indicated.
 LOC = loss of consciousness; NS = not significant.

Frédérique S. Servin et al. Pharmacokinetics of Propofol Administered by Target-controlled Infusion to Alcoholic Patients. Anesthesiology 2003; 99:576-585

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Past Medical History

July 2016	Alcoholism, patient wants to detoxify
Feb 2018	Alcoholism Elevated liver enzymes AST 274 (5-34 U/L) ALT 133 (5-41 U/L) Alk Phosphatase 70 (10-130 U/L) Albumin 4.2 (3.5-5.5 g/dl) Total Bilirubin 1.4 (0-1.5 mg/dl)
April 2019	History of alcoholism noted but no further comment no jaundice noted on physical exam AST 65 ALT 25 Alk Phosphatase 80 Albumin 2.9 Total Bilirubin 4.0

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At Urgent Care

Sluggish speech
Confused
Diminished motor skills

Wife denies binge drinking, patient states only has 2 glasses of wine a night

Patient Axx3 but feels "foggy"

101/57 HR 80 RR 16 SpO2 100% RA

Gross scleral icterus

Labs Alk Phos 81
ALT 23
AST 65
Total Bilirubin 5.5
Albumin 2.5

Transferred by EMS to local hospital

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At Hospital

CT Head - negative

Labs: Ammonia 193 umol/L (11-32)
PT 27.9 seconds (9.4 - 12.5)
INR 2.5
Platelets 57

DX: hepatic encephalopathy
acute liver failure on chronic liver disease
alcoholic cirrhosis and hepatitis

Hospital Course: GI Bleed
Intubated
Passed away 3 days later

Autopsy: Esophageal varices
Advanced micronodular cirrhosis

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Alcohol Use Disorder (AUD) in the United States

29.5 million people aged 12 and older had AUD

Alcohol abuse, alcoholism, and alcohol use disorder (AUD) affect over 29 million people each year, accounting for up to 4% of global deaths.

Highlights

- 141K emergency room visits due to the effects of alcohol in an average year
- 10% of work hours were lost due to being affected by alcohol
- 60% of men had alcohol use disorder during COVID-19 lockdown

There are more than **380** deaths each day in the US due to excessive alcohol use.

www.DrinkBeetStatistics.com/2023

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Alcohol Kills More People Than Opioids in the U.S.

Alcohol use results in **88,300** deaths in the U.S. per year. That is more than ALL the illegal medicines in the U.S. in 2019.

Alcoholism Rates Are Soaring

Over the past decade, drinking rates in the U.S. have increased by **11%**

Between 2017 and 2019, drinking rates increased by **8%**, **6%**, and **5%**

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Causes of Alcohol-Related Deaths

95.2% Total Deaths

- Liver Disease 31.66%
- Alcohol Poisoning 14.65%
- Stroke 10.46%
- Heart Disease 9.18%
- Other Chronic Causes 8.05%
- Car Deaths 7.45%
- Homicide 7.38%
- Other Acute Causes 5.77%
- Thrombotic Diseases 5.37%

National Center for Drug Abuse Statistics 2023

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What's the Confusion? Cirrhosis and Hepatic Encephalopathy

Steinman-Kane MD, FRCPC, FRCPC, FRCPC

What to look for? Grades of Hepatic Encephalopathy

Grade 1	Grade 2	Grade 3	Grade 4
Personality and behavior changes	Personality and behavior changes	Personality and behavior changes	Personality and behavior changes
Personality and behavior changes	Personality and behavior changes	Personality and behavior changes	Personality and behavior changes
Personality and behavior changes	Personality and behavior changes	Personality and behavior changes	Personality and behavior changes

How to improve this? Prevention & Treatment

- Take lactulose up to 8 litres per day to ensure 2-4 soft bowel movements (adjustment based on stool)
- Take rifaximin 400, as prescribed by your physician
- Do not take new medications without checking with your physician
- If have symptoms of liver failure or encephalopathy, seek emergency care immediately

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Precipitating Factors for Hepatic Encephalopathy

- Gastrointestinal bleeding**
- Infection (including spontaneous bacterial peritonitis and urinary tract infections)
- Hypokalemia and/or metabolic alkalosis
- Renal failure
- Hypovolemia**
- Hypoxia and **Hypercapnia**
- Sedatives** or tranquilizers
- Hypoglycemia
- Constipation
- Rarely, hepatocellular carcinoma and/or vascular occlusion (hepatic vein or portal vein thrombosis)

Hepatic encephalopathy, Khungar V, Poordad F. Clin Liver Dis. 2012;16(2):301.

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Management of the Patient with AUD

- At least 4-6 weeks of abstinence supposedly improves morbidity and mortality, but longer period of abstinence is better for surgical outcomes?

Tonnesen H, Kehlet H. Preoperative alcoholism and postoperative morbidity. Br J Surg. 1999 Jul;86(7):869-874

- Scientific evidence is weak to support any clinical recommendations

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Effect of glucocorticoid therapy of severe alcoholic hepatitis on short-term survival: the result of a meta-analysis of individual data from three studies. Prednisolone, solid line; placebo, dotted line. (Adapted from P Mathurin et al. J Hepatol 36:480, 2002, with permission from Elsevier Science.)

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Alcohol Withdrawal Timeline

- 1: Anxiety, insomnia, nausea, & abdominal pain
- 2: High blood pressure, increased body temp...
- 3: Hallucinations, fever, seizures, & agitation

Stage Starts: Stage 1 (8 Hrs), Stage 2 (1-3 Days), Stage 3 (1 Wk), If not treated (Up to Weeks)

www.americanaddictioncenters.org

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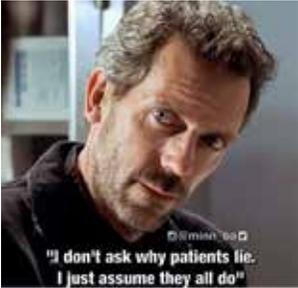
37

Alcohol Withdrawal Medication Comparison

	Onset	Time to Peak	Half Life	Equivalent Dose	Caution
Lorazepam	30-60 min	30-60 min	12-18 hours	1mg	sedation, respiratory depression, hypotension, falls, falls, falls
Clonazepam	30-60 min	30-60 min	12-18 hours	0.5mg	sedation, respiratory depression, hypotension, falls, falls, falls
Diazepam	30-60 min	30-60 min	20-30 hours	5-10mg	sedation, respiratory depression, hypotension, falls, falls, falls
Midazolam	30-60 min	30-60 min	2-3 hours	1-2mg	sedation, respiratory depression, hypotension, falls, falls, falls
Phenobarbital	30-60 min	30-60 min	100-120 hours	100-120mg	sedation, respiratory depression, hypotension, falls, falls, falls

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Steve Yun, M.D.

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HANDOUTS



Panel: Dental Ambulatory Anesthesia – Challenges in Starting a Mobile Dental Anesthesia Practice

Anastasios Sakellariou, MD, DMD

05/20/2023

2:00pm – 3:15pm MST

HANDOUTS



Panel: Dental Ambulatory Anesthesia – Building a Scalable Model for Mobile Dental Anesthesia

Shawn Nason

05/20/2023

2:00pm – 3:15pm MST

HANDOUTS



Panel: Dental Ambulatory Anesthesia – Pros/Cons of Using an LMA for Longer Dental Procedures

Steve Yun, MD

Anastasios Sakellariou, MD, DMD

05/20/2023

2:00pm – 3:15pm MST

PRO: Use of the LMA for Longer Dental Procedures

Steve Yun, M.D.
Expert Consultant Dental Board of CA
Clinical Professor, Western U. of Health Sciences

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1

Financial Conflict of Interest

- No relevant conflicts of interest

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2

Absolute Contraindications	Relative Contraindications
Trauma	Major abdominal surgery
Nonfasted patients	Pregnancy >14 weeks
Bowel obstruction	Prone position
Emergency surgery	Airway surgery
Delayed gastric emptying	Laparoscopic surgery
	Obesity, BMI >30
	Decreased lung compliance with PIP >20 on H ₂ O
	Altered mental status

Schwartz & Peng. The Laryngeal Mask Airway: Expanding Use Beyond Routine Spontaneous Ventilation for Surgery. *APSF Newsletter* Oct 2021

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3

Risks of LMA Use: Aspiration

- A survey of laryngeal mask airway (LMA) usage was conducted to provide general information about safety and efficacy with special emphasis on controversial issues such as positive pressure ventilation (PPV), prolonged anesthesia, and laparoscopic and non-laparoscopic intraabdominal surgery.
- During the 2-yr study period, of the 39,824 patients who underwent general anesthesia, 11,910 (29.9%) patient airways were managed with the LMA.
- 1 out of 11, 910 patients in a retrospective review**
- Forty-four percent underwent PPV. Placement was successful in 99.81%, and in 23 patients the LMA was abandoned in favor of the tracheal tube (TT). Use of the LMA for any **intraabdominal procedure** was considered nonconventional and occurred in 2222 (18.7%) patients.
- On 579 occasions procedures **lasted >2 h**. A total of 44 critical incidents were documented. Eighteen (0.15%) were related to the airway and none required intensive care management. There were 26 critical incidents not related to the airway which resulted in two admissions to the intensive care unit and one death.
- Use of the LMA for gynecologic laparoscopy, gynecologic laparotomy, and procedures >2 h also appears safe.

Verghese & Brimacombe. *Anesth Analg* 1996;82:129-33

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Risks of LMA Use: Aspiration

- Risk of pulmonary aspiration in patients whose lungs were mechanically ventilated through a laryngeal mask airway (**35,630 procedures**) or tracheal tube (30,082 procedures).
- 3 cases** of pulmonary aspiration occurred with the laryngeal mask airway and **7 cases** with the tracheal tube.
- There were no deaths related to pulmonary aspiration
- The adjusted odds ratio (OR) for pulmonary aspiration with the laryngeal mask airway was **1.06** (95% CI 0.20-5.62).
- There were contraindications and exclusions to the use of the laryngeal mask airway but in this selected population the use of a laryngeal mask airway was not associated with an increased risk of pulmonary aspiration compared with a tracheal tube.

Bernardini A, Natalini G. Risk of pulmonary aspiration with laryngeal mask airway and tracheal tube: Analysis on 65 712 procedures with positive pressure ventilation. *Anaesthesia*. 2009;64:1289-1294.

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Risks of LMA Use: Aspiration

- Meta-analysis of 1433 patients from 17 studies for laparoscopic surgery
- The incidence of desaturation (RR 3.65, 95% CI 1.39-9.62), gastric insufflations (RR 0.90, 95% CI 0.48-1.71), regurgitation (RR 0.98, 95% CI 0.02-49.13), and **aspiration** (RR 0.99, 95% CI 0.01-78.4) also showed no intergroup differences.
- However, the incidence of laryngospasm (RR 3.12, 95% CI 1.29-7.52), cough at removal (RR 6.68, 95% CI 4.70-9.48), dysphagia (RR 1.47, 95% CI 1.12-1.95) or dysphonia (RR 4.41, 95% CI 1.25-15.55), sore throat (RR 1.60, 95% CI 1.33-1.93), and hoarseness (RR 1.53, 95% CI 1.29-1.81) was higher in the ETT group than in the SGA group.

Park SK, Ba S, Choi GJ, Ahn JI, Yang H. Comparison between nasopharyngeal airway devices and endotracheal tubes in patients undergoing laparoscopic surgery: A systematic review and meta-analysis. *Medicine (Baltimore)*. 2016 Aug;95(16):e10158.

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The Laryngeal Mask Airway for General Anesthesia: The Case for Its Use

- 1800 cases with LMA
- No failures
- Avoided use in obese, GERD, or aspiration risk
- Relatively short procedures (40 minutes)
- Perceived decrease in bucking, sore throat, N/V and faster discharge times
- No laryngospasm, bronchospasm, vomiting or aspiration

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Figure 1.

A, LMA Retaining LMA-PROP Device.
 B, LMA Secured in LMA-PROP Device. The LMA is placed into the LMA-PROP by separating the two sides of the retaining area. The silicone nature of the material, non-slippery as well as its snug fit ensure that the LMA does not move or dislodge from the LMA-PROP.

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Figure 2.

LMA-PROP in the patient's mouth. LMA-PROP and laryngeal mask airway (LMA) in the patient's mouth. LMA is kept to the left side of the mouth, allowing the surgeon good access to the teeth on the right side.

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	Median Score	Range
Overall evaluation by surgeon	8.5	3-10
Ease of placement of LMA-PROP	9	6-10
Ease of removal of LMA-PROP	9.5	7-10
Ease of securing LMA	8	1-9
Flow of surgery	8.5	1-9
Movement of LMA	9	5-10
Overall evaluation by anesthesiologist	8	7-10
Ease of LMA placement	9.5	6-10
Movement of LMA	8	5-10
Ability to secure LMA	8	5-9

The LMA-PROP was evaluated by a single oral surgeon and 1 of 3 attending anesthesiologists using the device. All are median scores with a scale ranging from 1 to 10, 10 being the best performance for each category.

Abbreviation: LMA, laryngeal mask airway.

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Nasal LMA

- Easier to insert than ETT?
- Less risk of epistaxis?
- Avoids complications of nasal ETT insertion

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1. Epistaxis
2. Avulsion of turbinate
3. Obstruction of endotracheal tube lumen
4. Intracranial placement of endotracheal tube
5. Retropharyngeal dissection
6. Autonomic response to nasal intubation
7. Post intubation nasal pain

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LETTERS TO THE EDITOR

The Flexible Laryngeal Mask as a Nasal Airway

Author(s): L. MD, Dpt. F. MD, Dpt. A. MD, Dpt. C. Dpt. A. Dpt. Dpt. C. MD, Dpt. C.

Author: @drsteveyun

Journal: *Anesthesia & Analgesia* 127(1):175, November 2018

- The fifth patient was a mentally retarded adult presenting for dental clearance who had micrognathia and was a Mallampati Grade 4.
- It was felt that nasal intubation was essential for surgery. The patient was therefore sedated with thiopentone 2 mg/kg, and the FLMA was placed while the patient breathed spontaneously.
- Anesthesia was induced with isoflurane once the airway was secure. The time taken to convert from the oral to nasal airway was 20-70 s, and there were no problems with airway management during the 30- to 190-min procedures.
- Returning the FLMA tube to the oral cavity at the end of the procedure took 10-40 s.

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The laryngeal mask is stabilized in the oropharynx

Author: Dr. Yun, M.D.

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Steve Yun, M.D.

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www.DentalAnesthesiaMD.com

Follow on IG, LinkedIn, FB:
@drsteveyun

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D-A Facility Permit Equipment (cont'd)

- (13) Means of monitoring heart rate and rhythm, with battery pack back-up.
- (14) Means of monitoring respiratory.
- (15) Means of monitoring perfusion.
- (16) Means of monitoring pulse rate.
- (17) Method to accurately record elapsed time.
- (18) Neurological sensors (pediatric and adult).
- (19) Oropharyngeal airway (pediatric and adult).
- (20) Oxygen (portable Oxygen I tank) pediatric and adult masks capable of giving positive pressure ventilation including bag-valve-mask system.
- (21) Suction system, if intubation agents are used.
- (22) Aphorescence monitor and microscope (pediatric and adult).
- (23) Suction:
 - 1. Suction collector for individual tubes.
 - 2. Canister suction cup.
 - 3. Suction equipment for use during power failure and
 - 4. Capability of suction on all operations and recovery rooms.
- (24) Suction and bag by its checking and recording data when anesthesia machines and supply of emergency drugs have been checked.
- (25) If nitrous oxide and oxygen delivery equipment capable of delivering less than 20% oxygen is used, an in-line oxygen analyzer must be used, and
- (26) Any other equipment to may be required by the Board.

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D-A Facility Permit Drugs

(3) **Drugs Required for Facility Permit D-A.** The following drugs and/or categories of drugs shall be provided and maintained in accordance with the AHA/ACLS Guidelines (2017 CCR 6.02) or as determined by the Board for emergency use. All drugs shall be current and not expired.

- (4) Acetylsalicylic acid (regularly absorbable form).
- (5) Atropine inhalation.
- (6) Anticonvulsant.
- (7) Antibiotamane.
- (8) Antihypertensive agent.
- (9) Antihypertensive medication.
- (10) Antiseptic.
- (11) Atropine.
- (12) Bronchodilator.
- (13) Consciousness.
- (14) Dantrolene Sodium (equivalent of a halogenated anesthetic agent e.g. halothane, enflurane, isoflurane or used or depolarizing skeletal muscle relaxants e.g. rocuronium, vecuronium).

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D-A Facility Permit Drugs (cont'd)

- (15) Epinephrine pre-loaded syringes and ampules (pediatric and adult).
- (16) Lidocaine.
- (17) Intravenous antihypertensive agent (dextrose 50% or glucose).
- (18) Medication to treat supraventricular tachycardia (e.g. adenosine, verapamil, etc.).
- (19) Muscle relaxants.
- (20) Narcotic antagonist and reversing agents.
- (21) Oxygen.
- (22) Sodium bicarbonate.
- (23) Succinylcholine.
- (24) Vasodilator.
- (25) Vasopressor; and
- (26) And any other drugs or categories of drugs as may be required by the Board.

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6.09: Facility Permit D-P: Requirements for the Use and Provision of Portable and/or Mobile Anesthesia Services

6.09 (1) A qualified dentist anesthesiologist who travels to dental facilities or practice sites for the purpose of delivering anesthesia services or sedation services at the site must hold a Mobile Facility D-P Permit for the use of portable and/or mobile anesthesia equipment, supplies and personnel.

What about a physician anesthesiologist?

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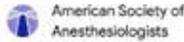
Board of Registration in Dentistry

- The Board of Registration in Dentistry has no jurisdiction on physicians.
- There is a lack of regulatory framework for portable anesthesia services to dental offices by physician anesthesiologists.
- There is no "Medical General Anesthesia License" provided by the Dental Board (as in CA).

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Medical Societies?

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Massachusetts Medical Society

Office-Based Surgery Guidelines

CHAPTER I: STATEMENT OF INTENT AND GOALS

"Nothing in these guidelines shall supersede the "Rules and Regulations for the Administration of General Anesthesia, Deep Sedation, Conscious Sedation, and Nitrous Oxide Sedation" of the Board of Dentistry (CMR 234-3.00) for those practitioners and facilities that qualify for regulation by the Board of Dentistry."

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American Society of Anesthesiologists

ASA Quality and Regulatory Affairs

Good morning Dr. Gonzalez,

Thank you for your question and, as you noted, the ASA does not have specific guidance on a checklist for providing mobile anesthetic services. The ASA has several documents related to providing anesthesia in office based and ambulatory settings, as well as some materials related to dental care. Please review the website <https://www.asa.org/ambulatory-and-office> and these specific documents:

- Guidelines for Ambulatory Anesthesia and Surgery
- Guidelines for Office-Based Anesthesia
- Statement on Sedation and Anesthesia Administration in Dental Office Based Settings

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Current Solution?

Each dental office working with a physician anesthesiologist obtains a D-A license. A D-H (hosting license) alone would not ensure the availability of the necessary anesthetic and emergency equipment.

The necessary office equipment should be provided by the physician anesthesiologist's portable unit.

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Main issues

The D-A application is lengthier and more complex than the D-H hosting license.

While the D-P application is similar to the D-A, you have to essentially obtain multiple D-A licenses instead of one D-P license.

The dentist can be faced with anesthesia questions that are far beyond their expertise and the anesthesiologist can give only a very limited input.

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Future Options

- Continue current practice

OR

- Create a new Code of Massachusetts regulations that would allow physician anesthesiologists obtain portable anesthesia license similar to the dentist anesthesiologist colleagues.
- Ideally, this would require collaboration from both the Dental and Medical Boards.

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Challenge #2: Equipment

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Comparison

<p style="text-align: center; color: blue;">Hospital</p> <ul style="list-style-type: none"> • High-speed piston ventilator: - Very short response time - Decelerating flow control in cases of increased inspiratory resistance - Synchronized volume control with adjustable flow trigger that decreases the patient's respiratory work • Weight: 365 lbs w/o vaporizer and gas cylinders • Price: \$15,000-\$16,000 (refurbished, no vaporizers) 	<p style="text-align: center; color: blue;">Office</p> <ul style="list-style-type: none"> • No ventilator • Single vaporizer • Flowmeters • Alarm module • Weight: 26 lbs w/o the vaporizer • Price: \$11,000-\$12,000 (new, vaporizer included)
--	--

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Office Equipment



1. Pipeline inlets (3)
2. Flowmeters
3. Single vaporizer
4. O2 flush valve
5. Common gas outlet
6. Switch
7. Visual indicator for low system pressure

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My anesthesia practice had to change



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➤ Manual leak test

<p style="font-size: small;">Hospital Machine</p> 	<p style="font-size: small;">Portable machine</p> 
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➤ APL valve w/o pressure indication



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➤ Scavenging interface vacuum adjustment



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➤ Lack of a ventilator

- Spontaneous breathing is the ventilation mode of choice.
- Apnea is occasionally unavoidable after induction or when remifentanyl is used.
 - Hand-assisted ventilation is the only option.
- This can complicate things when the patient is unstable:

➤ I assign this task to one of the dental staff members, always reminding them not to over-deflate the reservoir bag.

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Familiarize yourself with the new equipment

Shadow a colleague.

Confirm appropriate setup with the machine's company biomedical engineer (Facetime, send pictures).

After setting up the machine, test it out before your first patient by hand-ventilating a reservoir bag (test lung) connected to the Y piece.

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Challenge #3a: drug concentrations

- Selecting the drug, dose of administration, procuring the medication and ultimately administering the medication is a multi-step process.
- Medical errors constitute the third leading cause of mortality in the United States (1).
- Medication errors are commonly implicated in adverse medical events (19.4% of all events) (2).
- Reported anesthesia-related medication errors range widely from 0.0075% to 4.17% (3).
- Pediatric dosing calculations can only complicate the medication administration process.

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Hospital medications concentrations

- One common strategy to reduce the incidence of medication errors is the standardization of drug dilutions and prefilled syringes of commonly used medications.
- It's costly.
- Available for OR pharmacies that order in bulk.
- Early expiration date



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Changes in the dental office setting

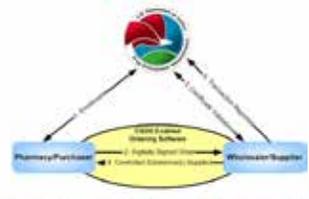


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Challenge #3b: Controlled Substances Ordering System (CSOS)



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CSOS Step 1: Form DEA-251

- DEA-251: Form for DEA registrants requesting a CSOS digital certificate
- Photocopies of:
 - 2 IDs (one government ID)
 - DEA registration certificate

The form has to be notarized and mailed.



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CSOS step 2: Signing certificates

The DEA registrant will receive:

- One **CSOS signing certificate** that can be activated after receiving:
 - an E-mail activation notice which contains a unique **access code**.
 - A postal mail activation notice that contains the **access code password**.

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Postal mail activation notice



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CSOS step 3: digital certificate retrieval

It requires Internet Explorer or Mozilla Firefox.

Certificate Retrieval.....	24
4.1 - Subscriber Certificate Retrieval Instructions.....	24
4.1.1 Policy Agreement.....	25
4.1.2 Trust Setup.....	25
4.1.3 Web site login.....	31
4.1.4 Firefox 52 and Greater Certificate Creation Steps.....	36
4.1.5 Enter a File name and Password.....	36
4.1.6 Save the Certificate to a .p12 File.....	37

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CSOS step 3: digital certificate retrieval (cont'd)

It is a multi-step process that includes:

- Installation of 2 certificates (Root CA and SubCA)
- Use of a certificate import wizard
- Security settings change

The certificate installation, will allow you to use the 3rd party service that the supplier uses, verifies your credentials and sends the transaction information to the DEA.

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What if you make an error?

Request new activation codes and passwords, causing a significant delay in the controlled substances ordering process.

What happens with DEA renewal?

Start from the beginning.

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Questions?



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HANDOUTS



PBLD Set 2

Conflict Resolution: Case Request/Block Time

Jarrett A. Heard, MD, MBA

05/20/2023

3:30pm – 5:00pm MST

HANDOUTS



PBLD Set 2 Ambulatory Anesthesia Management of Gender Affirmation Surgery Patients: Who, What, Where, Why?

Kelly Lebak, MD, FASA

05/20/2023

3:30pm – 5:00pm MST

Problem Based Learning Discussion: Ambulatory anesthetic management of gender affirmation surgery patients: who, what, where, why?

By Kelly Lebak, MD, FASA

Learning objectives:

- Participants will describe common gender affirmation surgeries done at ambulatory surgery centers.
- Participants will identify anesthetic concerns for patients undergoing gender affirmation surgeries.
- Participants will formulate an anesthetic plan for common ambulatory surgery center gender affirmation surgeries.

A 23 year old transgender male with a BMI of 38 presents for a bilateral mastectomy for gender change. Past medical history is significant for gender dysphoria, anxiety, depression, and THC use daily. Medications include testosterone and citalopram.

Who: What does “trans” even mean? Is the patient’s sex and gender male, female, none, both? How do you plan to address this patient, i.e., which pronouns do you use? Why does it matter?

What: What kinds of surgeries do transgender patients undergo?

Where: Which ones are generally done at ambulatory surgery centers?

Why: Why do transgender patients undergo gender affirmation surgeries?

What specific things need to be addressed in the patient history and physical?

Should pregnancy testing be done on transgender females?

What are the anesthetic considerations in transgender patients?

What is your anesthetic plan? What is your airway and induction plan? What is your postoperative pain control plan?

What are the ambulatory surgery center anesthetic considerations/pearls in transgender patients?

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HANDOUTS



PBLD Set 2 Dexmedetomidine in the Office: Route, Timing, and Patient Selection

Grace Lee Dorsch, MD

05/20/2023

3:30pm - 5:00pm MST

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HANDOUTS



PBLD Set 2 The Anemic Patient in the ASC

Kenneth Cummings, MD, MS, FASA

05/20/2023

3:30pm - 5:00pm MST

PBLD: The Anemic Patient at Your ASC

Kenneth Cummings, MD, MS, FASA

Case:

A 44-year-old woman presents to your preoperative clinic. In two weeks, she is scheduled to undergo a dilatation and curettage with intrauterine device placement at your hospital's freestanding ASC for progressively worsening menorrhagia. She also has a long history of Crohn's disease that is reasonably well controlled medically.

Past Medical History: Crohn's disease, hypertension, chronic kidney disease, and anxiety

Past Surgical History: Left hemicolectomy, small bowel resection

Social History: Uses THC gummies and occasionally "vapes" THC for anxiety

Medications: losartan/HCTZ, azathioprine, buspirone, clonazepam PRN

Vitals: HR 104, BP 165/85
5'6", 100 kg (BMI 35.5)

Labs: Hemoglobin 8.2 g/dL, hematocrit 22, platelets 550k, WBC 8.5
MCV 78 fL (ref 80-100), reticulocyte count 0.5%
Transferrin Saturation = 20%, Ferritin = 80 mcg/L, Reticulocyte hemoglobin content = 25%
Folate / B12 studies normal
K 4.4, Creatinine 1.3 (eGFR 49)
T&S A+, no antibodies

Questions:

What are the perioperative implications of anemia?

What are possible causes of this patient's anemia? How would you determine the cause?

Is she a candidate for surgery at the ASC?

What treatment options are available for preoperative anemia? What if preoperative treatment is not an option?

What are the available intravenous iron formulations? How do they differ? What are the adverse events and potential risks associated with iron infusions?

What is the role of erythropoiesis-stimulating agents (ESAs)? Are they contraindicated in a patient with cancer? What about patients with a history of thromboembolic disease?

Your health system balks at purchasing ferric carboxymaltose because of its high acquisition cost. Are there any arguments to support its use?

Is there evidence that correcting preoperative anemia improves outcomes?

What are the elements of Patient Blood Management (PBM)?

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HANDOUTS



PBLD Set 2 Pediatric Dental Patient with PMH of Asthma, Obesity, and Prematurity – What Do I Need to Know???

Audra Webber, MD, FASA

05/20/2023

3:30pm – 5:00pm MST

Audra Webber MD, FASA – PBLD for SAMBA 2023**Topic:***Pediatric Obesity, OSA, Prematurity, and Ambulatory Surgery***Objectives:***After reading this problem based learning case, the learner will be able to:*

1. Describe the perioperative management of obesity and obstructive sleep apnea (OSA) in patients presenting for ambulatory surgery;
2. Summarize the current literature examining pediatric obesity and OSA and how these comorbidities increase the risk for perioperative adverse events;
3. Identify which factors may make certain patients inappropriate candidates for ambulatory surgery – as applies to the patient themselves as well as the particular capabilities of your ASC;
4. Apply knowledge of the impact of pediatric obesity, prematurity and suspected or diagnosed OSA to everyday ambulatory anesthesia practice.

Background:**Patient:**

A 5 year old male is scheduled at your ambulatory surgical center for dentistry under GETA. His parents state that he snores AND “holds his breath when he sleeps” but he hasn’t had a sleep study. He also has a diagnosis of ADHD. They have Medicare and have been waiting 6 months for this procedure.

PMH: Obesity and prematurity – ex 31 weeker, intubated x 2 weeks, but no current respiratory diagnosis or symptoms.

PE: 3 feet 5 inches tall (107 cm) weighing 55 pounds (25 kg) (BMI 23: > 99th ile for age/sex)

LABS: None

Medications: Gummy vitamins, clonidine nightly for sleep.

PSH: No prior surgeries

Guiding Questions:

1. Is this patient appropriate for ambulatory surgery? What do you tell the parents about anesthetic risks?
2. Does the patient need a sleep study prior to dentistry? What data would you be looking for and how would it influence your decision making process?
3. What anesthetic challenges can you anticipate in an obese pediatric patient?
4. How does the patient’s previous prematurity impact your evaluation of perioperative risk?
5. What is your plan for perioperative pain control? Discuss how both obesity and obstructive sleep apnea affect your choice of analgesic agents, specifically opioids.
6. Should the fact that rescheduling the case will result in another 6 month wait for an open slot influence your decision?
7. How would the above issues impact your discharge policy for this patient?

Discussion:

There is no overarching list of selection criteria for ambulatory surgery for pediatric patients. Individual centers create criteria in alignment with the capacities of their staff and institution. For example, a university associated ambulatory surgery center staffed by fellowship trained pediatric anesthesiologists and with a transferring hospital 10 minutes away may have more lenient selection criteria than a rural ambulatory center staffed by general anesthesiologists who care for children infrequently and is an hour and a half away from any transferring hospital. That being said, there are certain patient characteristics and comorbidities predictive of an increased incidence of perioperative complications. One of the most common in the pediatric population is obesity.

Obese pediatric patients have an increased risk for perioperative adverse events¹⁻⁴, amongst these are increased incidence of upper airway obstruction, desaturations and bronchospasms. Most anesthesiologists who take care of children regularly are adept at managing these respiratory complications⁵, but individuals who care for children infrequently may have more difficulty. Again, the comfort level and skillset of the provider are what are most important in determining outcomes. Similarly to adults, obese children are more difficult to mask ventilate and tend to desaturate more quickly. They can be very difficult IV access, which can become an issue if there is ventilatory compromise during an inhalation induction. In addition, obese children may receive overdoses of opioids and underdoses of paralytic or reversal agents, leading to adverse sequelae⁶. They have greater rates of unplanned hospital admissions, prolonged PACU lengths of stay and an increased need for antiemetics¹⁻². All of this runs antithetical to the goals of an ambulatory surgery center which are efficiency and rapid throughput.

In pediatric patients, obesity is the major risk factor associated with obstructive sleep apnea (OSA)⁷. While not all obese children have OSA it is likely a majority of them do to some degree - estimates range from 50-60%. In addition, there is no good screening tool for OSA in children⁸. Snoring does not have a 1:1 correlation with OSA. While polysomnography is the gold standard for diagnosis of obstructive sleep apnea (OSA) in both adults and children, only a

small percentage of children with OSA will have undergone this testing. The reasons for this are multifactorial but involve expense, difficulties in scheduling, and poor patient cooperation. Regardless of definitive testing, the prevalence and severity of OSA increases with increasing BMI. Therefore the obese pediatric patient presents a twofold conundrum – do they have OSA, and if so to what degree? Most times the answer to this remains a mystery and it is safest to operate under the assumption that 1. Yes they do, and 2. Moderate – Severe. Children with OSA will demonstrate an increased sensitivity to opioid analgesics^{9,10}. This can lead to recurrent or prolonged apnea in the recovery period, especially if long acting opioids are used. While most of the literature regarding OSA examines adenotonsillectomy, dentistry under general anesthesia is generally performed with an intubated patient and arguably involves the airway. The same precautions in terms of opioid use and prescription should be applied. The dentist should be encouraged to use local anesthetic if performing extractions. Opioids can be avoided entirely or small doses of a short acting opioid given intraoperatively. Multimodal analgesia should be applied. Acetaminophen and ibuprofen or acetaminophan and ketorolac should be sufficient for the remaining discomfort.

Prematurity is a risk factor for increased respiratory complications during anesthesia and sedation well beyond infancy. Havidich et al.¹² demonstrated that patients born preterm (prior to 37 weeks PCA) are nearly twice as likely to develop sedation and or anesthesia adverse events – generally respiratory complications. In addition they found that this risk continues up to 23 years of age. This finding highlights the importance of asking about prematurity in the preoperative evaluation, especially when you are weighing risk factors.

In order to safely take care of a patient with multiple risk factors for respiratory complications one must do what is reasonable to minimize them. Along with the above mentioned minimization of opioids and utilization of multimodal analgesia the manner of anesthesia induction may have an impact. A recent study by Ramgolam et al.¹³ demonstrated that inhalation induction is associated with greater perioperative respiratory adverse events in children susceptible to respiratory complications when compared to IV induction. If a patient is at increased risk for respiratory complication performing an IV as opposed to an inhalational induction may temper those complications.

There are many factors involved in deciding how to or whether to proceed with an anesthetic for surgery. Evaluation of the child's risk factors for respiratory complications is chief amongst them. It is also reasonable to consider the time and effort put forth by the child's caregivers⁵ in terms of travel, time off work, etc. All of this should be done with an honest consideration of the skillset and comfort level of the anesthesia provider. There is no perfect answer, only the delicate interplay of what can be safely done at one particular institution, with one specific patient, and one particular provider – all of which are continually moving parts.

Be aware that the incidence of childhood obesity continues to increase¹⁴ and that obese children have a higher incidence of perioperative respiratory complications. The rise in pediatric obesity will be accompanied by a concomitant rise in the number children with OSA and its perioperative sequelae. Children presenting for surgical procedures will have comorbidities that need to be addressed and awareness of and careful planning for these patients will enable you to provide the safest anesthetic care.

The most significant thing you can do to enhance patient safety is to be aware of the likelihood of respiratory complications and be prepared to manage them.

Take Home Points:

1. Pediatric obesity and obstructive sleep apnea are closely related
2. Obese pediatric patients are at greater risk of respiratory complications during anesthesia and sedation
3. Multimodal analgesia and avoidance or minimization of opioids is recommended for obese pediatric patients
4. A history of prematurity is a significant compounding risk factor for perioperative respiratory complications
5. There is no one answer or guideline to determine the appropriateness of a patient for ambulatory anesthesia. There is a complex interplay of the skills and comfort level of the providers and the capabilities of the ASC in terms of staff, equipment, and transfer of care agreements.

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OBA Sub-Section: Pros & Cons of Transitioning to Office-Based Anesthesia

Grace Lee Dorsch, MD

05/20/2023

3:30pm – 5:15pm MST

Pros and Cons of Transitioning to Office-Based Practice
Grace Lee Dorsch, MD

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Disclosures

- None

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Learning Objectives

- Describe situations which may make you consider a transition
- Describe **advantages** of an office practice
- Describe **disadvantages** of owning, running, or being a part of an office practice
- Describe a typical day in an office practice

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Why Transition

- Businesses (not doctors) are running hospitals and anesthesia practices
- CRNA Supervision 1:2 now 1:4
- Corporatization of hospital practices, policies and procedures which might not align with yours

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Advantages to OBA

- NO CALL
- Work schedule and hours within your control
- Better work life balance
- YOU CHOOSE Surgeons and proceduralists
- YOU CHOOSE Case types
- YOU CHOOSE patient population

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Disadvantages to OBA

- Business side: lack of training in business, contracts, HR, record management ...(SAMBA network to help you through these waters)
- Marketing/office acquisition and retention (entrepreneurial spirit)
- No anesthesia back-up (Create your own by hiring or training assistants for emergency)
- No breaks or lunch relief (You create your schedule)

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Typical Day

- Load car and drive to office
- Meet assistant at office, unload, set-up for case(arrive ~30min ahead of start time)
- Greet patient/family in reception area: PE,Consent
- Walk to procedure room: monitors,IV, case...
- End of case bring family to room: discharge instructions, payment, assist to car.
- Turnover room and repeat
- Personally I try to be finished each day by 3pm to pick up daughter from school :)

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Thank you!

Please feel free to reach out if you have questions.

GLDORSCH@me.com

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HANDOUTS



OBA Sub-Section: How to Break into the Market

Stephen R. Smith, MD

05/20/2023

3:30pm – 5:15pm MST



How to Break into the OBA Market



Stephen R. Smith MD
Premier Dental Anesthesiology

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Disclosures

- No Disclosures

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Objectives

- Identify potential needs for for anesthesia services outside hospital operating rooms.
- Adapt individual anesthesia capabilities to create an OBA anesthetic technique for the planned procedure.
- Consider future directions for OBA procedures.

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3



Identify Existing Needs

- Hospital Constraints, Inefficiencies and Lack of Support
- Revocation of Surgical Scheduling Privileges
- Payer Incentivization

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4



Recruit Proceduralists

- Recruit (rescue) Proceduralists from Hospital
 - Surgeons, Interventional Medical Specialists, Dentists, Podiatrists
- Develop a Symbiotic Relationship
- Treat Greater Number of Patients than Hospital Setting

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Determine How to Fill the Need

- Adapt Anesthesia Techniques to the Planned Procedures
- Harness Technology to Augment Your Abilities
- Accommodate Procedural Space

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Create a Need/Future Directions

- Office Based Anesthesia is a Versatile and Powerful Service
- Technologic/Pharmacologic Advances Expand Safe Practice
- Develop Future Opportunities

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Questions

- Please save your questions for the end of the session

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OBA Sub-Section: Marketing Your Practice

Philip Yen, DDS

05/20/2023

3:30pm - 5:15pm MST



1



2



3



4



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6

Understand your market

- ▶ Who else are you competing with?
 - ▶ Hospital, surgery center, other providers
- ▶ What are the socioeconomic factors at play?
 - ▶ Insurance, state funding, etc.

7

Verbalize your Vision

- ▶ Induction Methods
- ▶ Maintenance Strategy
- ▶ Airway Management
- ▶ Pain Management Strategies

8

LOGISTICS TO CONSIDER

- ▶ Preoperative Screening and Data Collection
- ▶ History and Physical Examination
- ▶ Accompanying Personnel
 - ▶ NURSE, PARAMEDIC, EMT
- ▶ Recovery and Discharge Process

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RULES AND REGULATIONS

- ▶ Ensure familiarity with all rules and regulations governing anesthesia delivery
- ▶ Permits, certifications, on-site evaluations, registering with databases, DEA compliance
- ▶ Communicate how malpractice works, how does liability work in the event of an adverse outcome

10

Marketing

- ▶ Cold calls
- ▶ Online ads
- ▶ Print ads
- ▶ Local conferences
- ▶ Study groups
- ▶ Word of mouth

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Impression

- ▶ No one wanted to take the risk
- ▶ Very good hospital coverage
- ▶ Patients did not want to pay
- ▶ Rules and regulations were too restrictive

Reality

- ▶ No one UNDERSTOOD the risk
- ▶ Coverage was good, but was not comprehensive
- ▶ Pay structure was too high, no true assessment of what local demands dictated
- ▶ Unwillingness to engage rulemakers and governing bodies to improve conditions

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HANDOUTS



OBA Sub-Section: Safety in Office-Based Anesthesia

Fred E. Shapiro, DO, FASA

05/20/2023

3:30pm – 5:15pm MST



**Office Based Anesthesia Update:
safety and outcomes**



Fred E. Shapiro DO, FASA
Associate Professor of Anaesthesia,
Harvard Medical School
Mass Eye and Ear (MGB)
Boston, MA

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Disclosure

- Consultant- Fresenius-Kabi USA
- GE Healthcare- advisory

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2



Objectives

- Background
- Office Based Surgery literature review
- Educating the next generation
- APSF – Smart Assistant Simulation research
- Future direction

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3



Office Based Anesthesia and Surgery (1997)



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Office-based setting



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Two photographs of office-based anesthesia settings: one showing a procedure table in a room with monitors, and another showing a procedure table in a room with a window and chair.

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Cosmetic Surgery Safety: Putting the Scientific Data into Perspective

- 5 most commonly performed procedures are **breast augmentation, liposuction, rhinoplasty, blepharoplasty, and abdominoplasty**
- **Abdominoplasty** carries risk of VTE
- **Newer buttock augmentation with autologous fat grafting carries risk of fat embolism**
- Although new procedures and techniques may be challenged with increased morbidity and mortality, proper training in qualified individuals can often mitigate these complications.

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Safety of Outpatient Plastic Surgery: A Comparative Analysis of Patient, Procedure, and Facility Characteristics Using the TOPS Registry with 286,826 Procedures.

- **Tracking Operations and Outcomes for Plastic Surgeons (TOPS) Database between 2008 and 2016.**
- **286,826 procedures** were evaluated, of which **43.8% were performed at ASCs and 56.2% at OBS.**
- Incidence of adverse events was 5.7%, including antibiotic requirement (1.4%), wound dehiscence (1.3%), or seroma requiring drainage (1.1%).
- Overall, **no significant difference in adverse events between ASCs or OBS.**
- Age, ASA class, BMI, diabetes, smoking history, general anesthesia, CRNA involvement, operative duration, non-cosmetic indications, and body region were associated with adverse events.

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Interventional Vascular Center

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Outcomes of elective peripheral endovascular interventions for peripheral arterial disease performed in hospital outpatient departments, ambulatory surgical centers and office-based labs

- The Vascular Quality Initiative database 60,000 cases: January 2016 and December 2021
- 445 cases requiring hospital admission (HOPD, 398 [0.70%]; ASC, 26 [0.57%]; OBS, 21 [0.47%]; P = .126)
- No significant differences in cardiac, pulmonary, or renal complications
- Access site complications occurred in less than 1.7% of all cases, significantly higher in OBS when compared with ASCs and significantly lower in ASCs in comparison to HOPDs
- Elective PVI's performed in any outpatient setting proved to be safe and technically successful.

However, significant differences in the way PVI's are performed in each setting, such as the greater use of atherectomy devices in OBS and greater use of special balloons in HOPDs.

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Office-Based Cataract Surgery
Population Health Outcomes Study of More than 21,000 Cases in the United States

- Large-scale, retrospective, consecutive case series of cataract surgeries performed in Minor Procedure Rooms (MPRs) of a large healthcare center
- **13,600 patients** undergoing elective office-based cataract surgery 2011-2014
- Intraoperative adverse events included 119 (0.55%) cases of capsular tear and 73 (0.34%) cases of vitreous loss
- Postoperative adverse events included iritis (n = 330, 1.53%), corneal edema (n = 110, 0.53%), and retinal tear or detachment (n = 30, 0.14%).
- No life- or vision-threatening intraoperative or perioperative adverse events. OBS efficacy outcomes consistently excellent, safety profile similar to ASCs and HOPDs

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HARVARD MEDICAL SCHOOL

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HMS: Ambulatory Anesthesia Patient Safety Elective

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HMS Ambulatory Patient Safety Elective

- Expose students to adult and pediatric patients presenting for ambulatory surgical procedures in the **hospital, ambulatory surgery center (ASC) and office-based setting (OBS).**
- Appreciate **patient and procedure selection**
- Understand **the role of the anesthesiologist and the principles that guide the performance of safe anesthesia care in the pre, intra, and postoperative setting**

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Learning Objectives

- **Appreciate how the multidisciplinary interaction between the anesthesia care team, surgeons and nursing affects patient safety**
- Participate as a member of the anesthesia care team comprised of physicians and certified nurse anesthetists (CRNAs) helping gather information which will be integrated into the formulation of the anesthetic plan

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Anesthesia Patient Safety Foundation Grant

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Anesthesia Patient Safety Foundation Grant

“Testing a Proof of Concept Model for Real-Time, Dual Interactive Decision Support in the Perioperative Period Using the SMART Assistant Device”

APSF project on human workflow during perioperative deterioration:

- Making technology a meaningful contribution
- Integrating anticipation and planning for deterioration

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Anesthesia Patient Safety Foundation Grant: Smart Assistant

1. **Artificial Intelligence:** pattern recognition physiologic data+ med hx
2. **Differential dx coupled w best practices** and emergency checklist
3. **Customized:** provider need, clinical situation (OR, ICU, ASC, OBS)
4. SA software system **can be integrated into EMR**
5. **Visual** (glass wear e.g. google glass) or **audio response** (eg SIRI, or ALEXA)
6. **Clinician capture data w/ all senses** while viewing pt or surgical site

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Anesthesia Patient Safety Foundation Grant



Aim 1: Design a pilot simulation study that uses real time audio and visual cues to provide interactive decision support and provide anesthesia professionals with a faster effective way to treat patients at the bedside before or during patient deterioration.

Hypothesis: The Smart Assistant (SA) will aid clinicians in making quicker and more effective decisions at the point of care.

Action: Conduct simulation study that compares the present standard of care in clinician decision making for patients with physiologic deterioration vs. the decision making performed by clinicians with the enhanced capability of audio and visual cues.

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Pediatric Dental Case Flow

APSF Smart Assistant

Event	Vitals	Smart Assistant Prompts
Induction	HR: 100 SpO2: 95 BP: 90/60 Temp 35.5C ETCO2: 38	The patient is moving in the chair as the procedure is started. What factor could be contributing to this? • Light anesthesia • Inadequate sedation • Increased anesthetic requirements due to age
Propofol infusion increased due to moving	Pt is intubated HR: 110 BP: 90/60 SpO2: 99 Temp 35.5C ETCO2: 33	There has been a loss of your ETCO2 with transmitted upper airway sounds heard. Based on other ongoing patient factors this could be caused by: • ETCO2 tubing disconnection • Machine error or calibration of monitor • displacement of ETCO2 monitoring of Pt • water trap not emptied • airway obstruction Most likely dx is: upper airway obstruction
Patient snoring suggesting upper airway obstruction	Pt loses ETCO2 tracing HR: 110 BP: 90/60 SpO2: 99 Temp 35.5C ETCO2: Error or 0	Patient is found to have an upper airway obstruction with ETCO2 monitoring. Would you like me to provide you with steps to treat on airway obstruction?
	Pt starts to de-sat HR: 110 BP: 90/60 SpO2: 92 Temp 35.5C ETCO2: 10	

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Future Direction: Develop the highest quality and standard of safe patient care

- 25 years: changing landscape of OBA
- Number and complexity of pts and procedures continues to grow
- Lack of uniform regulation
- Proper patient selection
- **Develop and implement safe and efficient systems to optimize patient outcomes and minimize morbidity**

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Future research: Develop the highest quality and standard of safe patient care

- Evidence-based review of safety profiles by emerging specialties
- Ongoing quality and safety metrics analysis
- 'Global mobile' office-based anesthesia
- Health care disparities and OBA events? location, gender, ethnicity, socio-economic factors
- Current Opinion –Dec 2023

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HANDOUTS



OBA Sub-Section: Patient Selection and Outcomes for ASA 3-4 Patients

Penelope Duke, MD

05/20/2023

3:30pm - 5:15pm MST

Stayin' Alive in the Office Based Setting
Patient Selection and Outcomes for ASA III & IV
Penelope Duke, MD

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IS OBA SAFE FOR ASA III & IV?

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HOW DO WE GET TO YES SAFELY?

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Are there ABSOLUTE CONTRAINDICATIONS to OBA?

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HISTORICAL CONTRAINDICATIONS:

- BMI
- Age or minimum weight
- ASA Classifications
- Malignant Hyperthermia
- Pseudocholinesterase Deficiency
- DNR
- Pacemaker / ICD
- LVAD
- Adult Congenital Cardiac Anomaly
- Home O2
- Obstructive Sleep Apnea
- Known Difficult Airway

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Critical Conclusion IARS 2017:

- Safety analysis of 48 patients requiring minimally invasive oropharyngeal surgery between 2011-2015
- IV Sedation to loss of consciousness supplemented with local anesthetic in the office-based setting
- Same Board-Certified MDA and 3 Board Certified OMF surgeons
- No post-op complications reported

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How did we get here?

Proper Prior Preparation
Prevents
Pitifully Poor Performance

Team is everything!

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PAINSTAKING PRE-OPERATIVE EVALUATION:

- 100% of pediatric and ASA III & IV cases reviewed by provider
- Coordination of care between specialists
- Review of medical records and current medications
- Physical and mental status examination
- Informed consent with patient and family
- Communicate expectations clearly

9

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Pushing the Limits

- BMI
- Age or Minimum Weight
- ASA Classifications

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BROKEN HEARTS CLUB

- Pacemaker
- Defibrillator
- DNR
- LVAD
- Adult Congenital Heart Disease

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PULMONARY CHALLENGES:

- Home Oxygen Therapy
- Known Difficult Airway
- Obstructive Sleep Apnea



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HOT TOPICS OF DEBATE:

- Malignant Hyperthermia
- Pseudocholinesterase Deficiency



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ABSOLUTE CONTRAINDICATIONS TO OBA?

- Unstable Coronary Artery Disease
- RECENT MI or STINT placement
- Poorly Compensated Pulmonary HTN
- Chronic Unstable Medical Conditions
- Coagulopathy requiring transfusion
- Severe Uncontrolled Asthma



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State of the art monitoring allows for careful perioperative management.



Bluetooth Precordial Stethoscope

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HOW TO GET TO YES SAFELY:

1. Personalized, customized, dynamic care
2. Understanding the pathophysiology unique to each patient
3. Maximizing the patient's health pre-operatively

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Wellness and sustainability compliment each other.
GO GREEN! 

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Thanks for your time!
Comments, questions, concerns?

Penelope Duke, M.D.
Diplomate, American Board of Anesthesiology

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OBA Sub-Section: Importance of Benchmarking

Richard D. Urman, MD, MBA

05/20/2023

3:30pm – 5:15pm MST

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Phoenix, AZ

Ideas for Benchmarking in OBA

Richard D. Urman, MD, MBA, FASA
Jay J. Jacoby Professor and Chairman
Department of Anesthesiology
The Ohio State University & Wexner Medical Center
Columbus, OH

Secretary, SAMBA

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Outline

- Benchmarking – why?
- AQI
- MPOG/ASPIRE
- Other

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Disclosures:
Member, AQI Data Use Committee and AQI Closed Claims Oversight Committee
Former MPOG BWH site Principal Investigator
Merck, Covidien, Pfizer, AcellRx, NIH, NSF

2

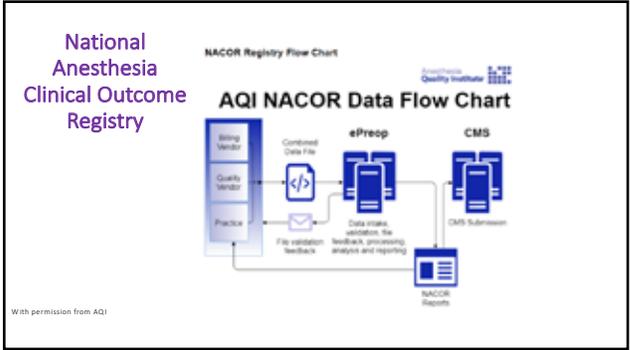
The Value of Capturing and Using Your Perioperative Data for Benchmarking

- Regulatory Reporting
- Internal quality improvement initiatives
- Process measures, outcomes measures
- Education of staff
- Research
- Practice management and contracting/negotiations
- Understanding your patient population and performance on:
 - individual, practice and facility level compared to chosen benchmark (regional, national)
 - Show value to hospitals, payers, malpractice carriers, patients, surgeons

Consider:

- Cost
- IT infrastructure
- Personnel
- Practice needs

3



4

NACOR Adverse event reporting

Sample metrics:

- Case Delay
- PONV
- Inadequate Pain control
- Hypotension
- Hypertension
- Hypoxemia
- Arrhythmia
- Difficult Intubation
- Aspiration
- Cardiac arrest

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NACOR Demographics Summary highlights and Benchmarks

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6

MIPS and Internal Improvement Measures (process & outcomes)

- MIPS 424 = Perioperative Temperature
- MIPS 463 = prevention of POV
- AQI61 = ambulatory post-d/c pt f/u
- AQI62 = OSA: pt education
- AQI71 = Ambulatory glucose mgmt
- AQI69 = Intraop Abx redosing

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NACOR Service Lines

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Submit data to NACOR	✓	✓	✓	✓
NACOR dashboard	✓	✓	✓	✓
MDCA® activity module	✓	✓	✓	✓
Local analytic reports	✓	✓	✓	✓
National benchmarks	✓	✓	✓	✓
National comparative analytic reports	✓	✓	✓	✓
MIPS Quality Reporting Component	✓	✓	✓	✓
MIPS Improvement Activities	✓	✓	✓	✓
Patient Experience Survey	✓	✓	✓	✓
Mobile app	✓	✓	✓	✓
Aggregation, merging and validation of data	✓	✓	✓	✓
Opiod Dependence Risk Alert	✓	✓	✓	✓
Full EHR integration	✓	✓	✓	✓
Realtime improvement activity tracking	✓	✓	✓	✓

EX: AQI/SAMBA participation agreement.
AQI: develop more ambulatory surgery measures.
Provide SAMBA with non-identifiable data for QI projects.
4 levels of services

8

Quality Improvement Tools:

- Data Query (Data Direct)
- QI reporting tool
- Provider feedback E-mail "Hello Richard"

With permission from MPOG

9

- To review a performance summary for any measure, select the measure of interest via the measure summary drop down or by simply clicking any measure card.
- Measure Summary:** includes overall performance, case counts, trend over time, breakdown of primary case attribution and breakdown by location.

With permission from MPOG

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MPOG ASPIRE Measures

- Blood pressure monitoring
- Acute kidney injury
- Fluid use
- Glucose management
- Medication overdosing
- Mortality
- Mycardial injury
- Neuromuscular monitoring
- Pain management (opioid use, multimodal analgesia)
- PONV
- Pulmonary (ventilation management)
- Sustainability (low fresh gas flow)
- Temperature (perioperative hypothermia)
- Transfer of care
- Transfusion

Source: <https://spec.mpog.org/Measures/Public>

11

Comparison of Anesthesia for Dental/Oral Surgery by Office-based Dentist Anesthesiologists versus Operating Room-based Physician Anesthesiologists

Anesth Prog 65:219-220 2018

Analysis of data from the SAMBA Clinical Outcomes Registry (SCOR) and the National Anesthesia Clinical Outcomes Registry (NACOR) over a 4-year period, between 2010 and 2014.

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Outpatient Surgery and Sequelae
An Analysis of the AAAASF Internet-based Quality Assurance and Peer Review Database

- Mortality 0.0017% of all procedures; ~ 1 in 41,726 (2001-2012)
- PE: most common cause of death, with 40 cases of PE causing mortality.
- Most fatal PEs, 20, were in cases where **abdominoplasty was combined with other procedures.**
- Other mortality causes: **cardiac arrhythmia, MI, drug overdose.**

Cause	Number of Cases
Pulmonary Embolism (PE)	40
Cardiac Arrhythmia, MI, Drug Overdose	20
Other causes	20

THANK YOU!
richard.urman@osumc.edu

Clin Plastic Surg 40 (2013) 465-473

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HANDOUTS



OBA Sub-Section: Compiled Data Outcomes for Dental Office Cases

Mark Saxen, DDS, PhD

05/20/2023

3:30pm - 5:15pm MST



Compiled Data Outcomes for dental office cases

Mark Saxen, DDS, PhD

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Objectives

Review of 5 peer-reviewed published outcome studies that:

- Draw on data derived from an outcomes-based project
- Published from 2000 to 2020
- Accessible on PubMed

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Dental OBA provider Training Comparison

Anesthesia Provider	Dedicated Anesthesia Training (Minimum/Usual)	Minimum number Pediatric Cases	Ages	Minimum number of Special Needs Cases	Office-Based Experience Required
Dentist Anesthesiologist	24 mo/33 mo	125 total	> 7 years	75	Yes
Physician Anesthesiologist	30 mo/32 mo	100 total 75 20 5	<12 years < 3 years < 3 months	No Special Requirement	No
Certified Registered Nurse Anesthetist	24 mo/24 mo	35 total 25 10	2 to 12 years < 2 years	No Special Requirement	No
Oral & Maxillofacial Surgeon	6 mo/6mo	50	< 13 years	No Special Requirement	Yes

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3

Perrott DH, Yuen JP, Andresen RV, Dodson TB. Office-based ambulatory anesthesia: outcomes of clinical practice of oral and maxillofacial surgeons. J Oral Maxillofac Surg. 2003 Sep;61(9):983-95; discussion 995-6.

- Earliest published report on dental OBA anesthesia outcomes
- Prospective cohort study of 30,058 patients undergoing office-based anesthesia in oral surgery offices from January 2001 through December 2001
- Complication rate of 1.3 per 100. All cases were minor and self-limiting. Two patients required hospital transfer
- > 95% of anesthetics provided by oral and maxillofacial surgeon directing staff while performing surgery

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Perrott DH, Yuen JP, Andresen RV, Dodson TB. Office-based ambulatory anesthesia: outcomes of clinical practice of oral and maxillofacial surgeons. J Oral Maxillofac Surg. 2003 Sep;61(9):983-95; discussion 995-6.

Provider and Case Profile

- > 90% of patients are ASA 1 or ASA 2
- > 95% of cases were for removal of third molars or other dentoalveolar surgery
- Mean patient age 28 yrs/35 yrs

Anesthesia time

	CS	DS/GA
< 10 min	4.0%	5.9%
10-30 min	45.7%	59.1%
61-120 min	4.5%	3.7%
> 120 min	1.9%	0.4%

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Saxen MA, Urman RD, Yepes JF, Gabriel RA, Jones JE. Comparison of Anesthesia for Dental/Oral Surgery by Office-based Dentist Anesthesiologists versus Operating Room-based Physician Anesthesiologists. Anesth Prog. 2017 Winter;64(4):212-220.

Hospital/ASC Based Anesthetics

- 106,420 records from NACOR database
- Dental cases identified by ICD-9 codes
- Demographic variables:
 - Age
 - ASA classification
 - Surgery and anesthetic stop/start times

Office Based Anesthetics

- 7133 records from SAMBA Clinical Outcomes Registry
- Dental cases identified by dentist anesthesiologists reporting CPT codes
- Demographic variables:
 - Age
 - ASA classification
 - Surgery and anesthetic stop/start times

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Saxen MA, Urman RD, Yepes JF, Gabriel RA, Jones JE. Comparison of Anesthesia for Dental/Oral Surgery by Office-based Dentist Anesthesiologists versus Operating Room-based Physician Anesthesiologists. Anesth Prog. 2017 Winter;64(4):212-220.

Key points

- Office-Based Dentist anesthesiologists and Hospital/ASC had nearly identical age distributions
- Matches the age distribution for early child caries (ECC)
- ECC is the dominant case treated in both settings

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Spera AL, Saxen MA, Yepes JF, Jones JE, Sanders BJ. Office-Based Anesthesia: Safety and Outcomes in Pediatric Dental Patients. Anesth Prog. 2017 Fall;64(3):144-152.

- First published clinical outcomes of OBA performed by dentist anesthesiologists on children
- Of 7,041 cases reported to SCOR database from 2010 to 2014:
 - Mean age of 4.7 years
 - 98% were ASA 1 or 2
- No major morbidity or mortality
- 3% postop adverse event rate
 - Most common predischarge event was laryngospasm (0.5%)
 - Most common post-discharge event was nausea (5%)
- Children < 6 had highest rates of laryngospasm and PONV

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Spera AL, Saxen MA, Yepes JF, Jones JE, Sanders BJ. Office-Based Anesthesia: Safety and Outcomes in Pediatric Dental Patients. Anesth Prog. 2017 Fall;64(3):144-152.

Physical Status and Case Duration

- Average surgery time 58.2 min
- Average recovery time 22.5 min
- ASA Physical status classification of ASA 1 or 2 for 99% of cases

Airway Management

Technique	%
Endotracheal intubation	39%
Non-intubated managed airway	60%
Laryngeal mask*	< 1%

* uncertain significance

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Silvers A, Licina A, Jolevska L. A clinical audit of an office-based anaesthesia service for dental procedures in Victoria. Anaesth Intensive Care. 2018 Jul;46(4):404-413.

- Retrospective audit of 1,323 dental office-based anaesthetics provided by specialist anaesthetists in Victoria, Australia from 2014 to 2017
- 93.6% patients were ASA 1 or 2
- Most common procedures:
 - 49% third molar extractions
 - 15.7% multiple tooth extractions
 - 6.8% implant procedures
- Mean age 33.3 years
- Mean weight 69,8 kg
- Population compared to AAOMS Outcomes Study (Perrott et al) by authors

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Silvers A, Licina A, Jolevska L. A clinical audit of an office-based anaesthesia service for dental procedures in Victoria. Anaesth Intensive Care. 2018 Jul;46(4):404-413.

Length of cases and adverse events

- Mean duration 117 min
- Std deviation 101 minutes
- 10% exceeded 265 min
- Adverse event rate: 0.2%
- 3 unplanned hospital transfers
- No sentinel events

Airway and Anesthetic Technique

Laryngeal mask	76.8%
Endotracheal tube	20.6%
Propofol TIVA	88.1%
Volatile agents	2.4%
Mixed volatile/TIVA	1.5%
Min/Mod sedation	7.8%

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Clark HM, Saxen MA, Yepes JF, Jones JE, Vinson LA, Eckert GJ, Tang Q. Comparison of Intubated Versus Nonintubated Airway Management in Children Under General Anesthesia Provided by Dentist Anesthesiologists. Pediatr Dent. 2019 Jan 15;41(1):52-55.

- Retrospective review of 9,333 dental anesthetics from 2010 to 2016 from SCOR Clinical Outcomes Registry
- All cases performed by dentist anesthesiologists in a pediatric dental setting
- Airway management techniques compared included
 - Native airway
 - Oxygen with nasal cannula
 - Oxygen with face mask
 - Nasopharyngeal or oropharyngeal airway
 - Laryngeal mask airway
 - Endotracheal intubation

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Clark HM, Saxen MA, Yepes JF, Jones JE, Vinson LA, Eckert GJ, Tang Q. Comparison of Intubated Versus Nonintubated Airway Management in Children Under General Anesthesia Provided by Dentist Anesthesiologists. *Pediatr Dent.* 2019 Jan 15;41(1):52-55.

- When endotracheal intubation was compared to all other techniques, no significant difference in respiratory complications was found
- Patients with a pre-existing pulmonary diagnosis displayed higher rates of complications across all techniques
- Adverse events included
 - Laryngospasm 0.3%
 - Bronchospasm 0.2%
 - Hypoxia 0.1%
- Overall rate of complications 0.6%

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Closing thoughts

- These studies, like all outcome data research share several significant limitations including:
 - Self-reported data entry by volunteers
 - Predesigned data entry forms with limited, broad parameters
 - Limited analysis of results
- Useful for identifying broad trends and directing future studies

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HANDOUTS



OBA Sub-Section: Case Types on the Horizon

Meghan C. Valach, MD

05/20/2023

3:30pm – 5:15pm MST

OBA Breakout Session
Case Types on the Horizon

Meghan C Valach MD
 Mobile Anesthesiologists

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Learning Objectives & Disclosure

At the end of this presentation the participants will be able to

- Contrast the various sites of service for procedural care.
- Analyze which site of service is most appropriate for a procedure.
- Prepare for the next procedures moving into the Office-based setting.

I have the following financial interests or conflicts to disclose:

- Chief Medical Officer for Mobile Anesthesiologists

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Sites of Service

- Hospital
 - Inpatient
 - Hospital Outpatient Department (HOPD)
 - Out of Operating Room Locations (Non-Operating Room Anesthesia – NORA)
- Ambulatory Surgery Center (ASC)
- Office Based location (3rd Site of Service)

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Determinants of Procedure Setting

- Anticipated need for level of care after surgery
- Procedure type
 - Specialized equipment
 - Duration of Procedure
 - Anticipated Blood loss
 - Required (Desired) level of sedation or Anesthetic needs
- Patient factors
 - Comorbidities
 - Social Support
- Legal or Regulatory Oversight
- Financial factors

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Case Types

ENT	GI	GYN	Other Specialties
<ul style="list-style-type: none"> • Balloon angioplasty • Tonsillectomy • Septorhinoplasty • Conscious sedation induction • Mandibular advancement • Tonsillectomy reduction • Myringotomy tube insertion • Ethmoidectomy • Cardiac ablation • Drug induced sleep endoscopy • Endoscopic procedures including balloon dilatation, airway stents and balloon dilatation with turbitates 	<ul style="list-style-type: none"> • Upper endoscopy • Colonoscopy • Flex sigmoidoscopy • Colonoscopy procedures <p>Pain</p> <ul style="list-style-type: none"> • Spinal steroid injections • Medial branch blocks • Radiofrequency ablation 	<ul style="list-style-type: none"> • Gynecologic, Minimally Invasive • Hysteroscopy • D&C • Polypectomy • Hysterectomy • Uterine repair <p>Urology</p> <ul style="list-style-type: none"> • Urology • Urology • Urology • Urology • Urology and prostate repair 	<ul style="list-style-type: none"> • Dental <ul style="list-style-type: none"> • Extractions, implants including full mouth restoration, pedicle and dental needs • Vascular <ul style="list-style-type: none"> • EVL, phlebectomy • Orthopedic <ul style="list-style-type: none"> • Carpal tunnel, knee and shoulder arthroscopic, tendon and ligament repair, rotator cuff repair, arthroscopy • Pediatric <ul style="list-style-type: none"> • Bariatric, bariatric, bariatric • Plastic <ul style="list-style-type: none"> • Bariatric, bariatric, bariatric

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2. American Society of Anesthesiologists. 2018. *Guidelines for Ambulatory Anesthesia and Surgery*. Retrieved from <https://www.asahq.org/standards-and-guidelines>.
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4. Aetna. 2023. Site of Service for Outpatient Surgical Procedures Policy. Retrieved from https://www.aetna.com/health-care-professionals/outpatient-surgical-procedures.html#tab_content_section_responsiveid_1874942777_responsiveid_tabs_copy_link_tabs_copy_1.
5. United Healthcare. 2023. Office-Based Procedures - Site of Service. Retrieved from <https://www.uhcoprovider.com/content/dam/provider/docs/public/policies/comm-medical-group/office-based-procedures-site-service.pdf>.

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HANDOUTS



Resident Panel: Practice vs. Academics

Dawn J. Schell, MD

05/20/2023

3:30pm – 5:00pm MST

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Resident Panel: Anesthesia Billing 101

Jamey E. Eklund, MD

05/20/2023

3:30pm – 5:00pm MST

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Resident Panel: Non-Clinical Anesthesia Careers and Locums Work

Simon Lee, MD

05/20/2023

3:30pm – 5:00pm MST