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Enhanced Recovery After Ambulatory Surgery: Who Cares? The Patient is Going Home, Anyways!

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Disclosures

- Baxter Pharmaceuticals
- Pacira Pharmaceuticals

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Enhanced Recovery After Surgery

- Perioperative interventions that mitigate surgical stress response
- Maintain perioperative physiological function
- Minimize postoperative organ dysfunction
- Reduce postoperative complications and enhance recovery
- ERPs designed for hospitalized patients - focus on hospital LOS

Enhanced Recovery After Surgery: Current Controversies and Concerns

Anesth Analg 2017; 125: 2154-5
Henrik Kehlet, MD, PhD, FACS(Hon),* and Girish P. Joshi, MBBS, MD, FFARCSI†

Enhanced Recovery Pathways: Looking Into the Future

Anesth Analg 2019; 128: 5-7
Girish P. Joshi, MBBS, MD, FFARCSI,* and Henrik Kehlet, MD, PhD, FACS (Hon)†

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Enhanced Recovery Program

Preoperative	Intraoperative	Postoperative
Optimize comorbid conditions	Fast-track GA	Early oral intake
Minimal fasting	Pain prophylaxis	Early ambulation
Pre-habilitation	Fluid Balance	
Patient education	Ventilation	
	PONV prophylaxis	Minimally invasive approach
	Normothermia	Avoid or remove early tubes/drains
	SSI prophylaxis	
	VTE prophylaxis	

Joshi GP, Kehlet H.; *Anesth Analg* 2019; 128: 5-7

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Fast Track Surgery (AKA Enhanced Recovery After Surgery)

Arthroscopy		
Hernia repair		
Lap Cholecystectomy		
Mastectomy	Carotid endarterectomy	
Lap Fundoplication	Lap. nephrectomy	
Lap Vag Hyst	Lap. hysterectomy	
Thyroidectomy	Prostatectomy	Aortic aneurysm
Parathyroidectomy	Knee/Hip replacement	Colonic resection
Lap Adrenalectomy		
Ambulatory	1-2 days	2-3 days

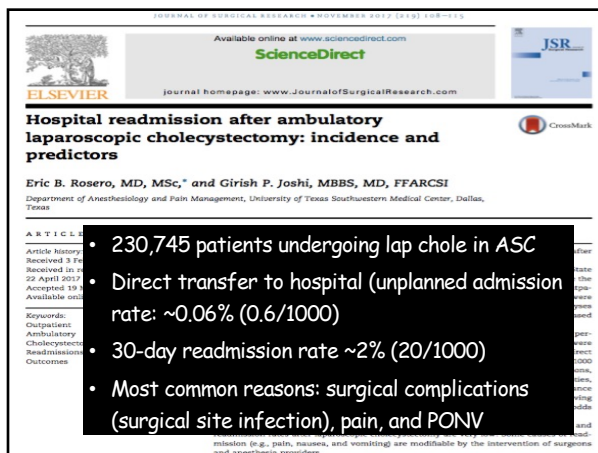
Kehlet H, Wilmore DW. *Am J Surg* 2002; 183: 630-41; Kehlet H, Dahl JB *Lancet* 2003; 363: 1921-8

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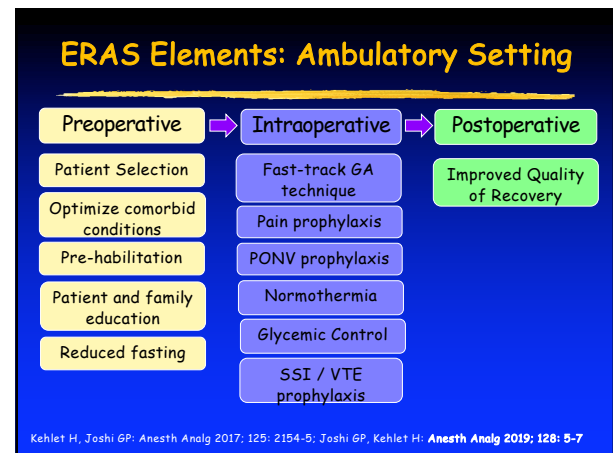
ERAS in Ambulatory Setting

- ERP for ambulatory surgery involves
 - Early discharge home
 - No hospitalization after discharge
 - Improve quality of recovery (patient-reported outcomes)
 - Physical: Pain, nausea/vomiting, sleep disturbance, fatigue, appetite, ambulation, activities of daily living
 - Mental: anxiety, depression, cognitive function
 - Social: participation in social roles and activities

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Patient Selection For Ambulatory Surgery

- Surgical procedure
 - Cataract, peripheral, cavity
- Proposed anesthetic technique
 - Local/regional, Sedation, GA
- Patient's preoperative health
 - ASA Physical status
- Suitability of surgical facility
 - HOPD, ASC, Office-based
- Social considerations
 - Appropriate caregiver availability

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Patient Comorbidities and Selection

- Stable and well controlled coexisting medical conditions (ASA ≤ 3)
- ASA-PS, 4 = not suitable for ambulatory surgery
 - Recent (<3 months) MI, CVA, TIA, or CAD/stents
 - Ongoing cardiac ischemia, Severe valve dysfunction, Severely reduced EF
 - Sepsis
 - DIC
 - ARD or ESRD not undergoing regular dialysis

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Association of Patient Frailty With Increased Morbidity After Common Ambulatory General Surgery Operations

Carolyn D. Seib, MD, MAS; Holly Rochefort, MD; Kathryn Chomsky-Higgins, MD, MS; Jessica E. Gosnell, MD; Insoo Suh, MD; Wen T. Shen, MD, MA; Quan-Yang Duh, MD; Emily Finlayson, MD, MS

Abstract: OBJECTIVE: Assess the association of frailty with increased morbidity after common ambulatory general surgery operations, independent of age, type of anesthesia, and other comorbidities. DESIGN: Retrospective cohort study. SETTING: Ambulatory surgery center. PARTICIPANTS: 1000 patients undergoing common ambulatory general surgery operations. MEASUREMENTS AND MAIN RESULTS: Frailty was associated with increased perioperative morbidity, independent of age, anesthesia type, and comorbidities. CONCLUSIONS: Consider frailty rather than age when counseling and selecting patients for ambulatory surgery.

JAMA Surg 2018; 153: 160-6

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Preoperative Risk Reduction

- Preoperative screening and optimization of comorbidities reduces complications
 - Lienhart A, et al. Anesthesiology 2006; 105: 1087-97
 - Hove LD, et al. Anesthesiology 2007; 106: 675-80
- Optimization of chronic medications
 - β -blockade, ACE inhibitors, statins, aspirin, anti-coagulants, anti-diabetic drugs
- Patient (and caregiver) education and psychological preparation
 - Reduces anxiety and fear
 - Improves overall patient satisfaction

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Preoperative Risk Reduction Through "Pre-habilitation"

- Preoperative training: muscle strengthening
 - Improves functionality
 - Reduces frailty and disability
- Preoperative cardiovascular conditioning
 - Snowden CP, Minto G: Br J Anaesth 2015; 114: 186-9
 - West MA, et al: Br J Anaesth 2015; 114: 244-51
- Correct preoperative malnutrition
 - Low serum albumin (<3.5 g/dL) and serum transferrin (<200 mg/dL)
- Smoking cessation 4-8 weeks prior to surgery

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Network meta-analysis of the effect of preoperative carbohydrate loading on recovery after elective surgery

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Br J Surg 2017; 140: 187-97

- 43 trials
 - Groups: low-dose(10-44 gm) and high-dose (>45 gm) carbohydrate loading, fasting, water/placebo before elective surgery
 - No difference in complication rate between groups
 - Compared to fasting, CHO loading reduced LOS by 0.2-0.4 days (statistically significant, but clinically ?)
 - Compared to water/placebo no difference in LOS
- complication rate, or in most of the secondary outcomes, between carbohydrate and control groups.
- Conclusion:** Carbohydrate loading before elective surgery conferred a small reduction in length of postoperative hospital stay compared with fasting, and no benefit in comparison with water or placebo.

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Preoperative Fasting

- Minimize duration of preoperative fasting
- Avoidance of preoperative dehydration
 - Encourage water intake throughout the fasting period
 - Two glasses of water prior to going to bed
 - Two glasses OR Gatorade®, if patient wishes, just before leaving for hospital
 - Allow water if patient complaints of thirst until 30-60 min preoperatively

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EJA

Eur J Anaesthesiol 2018; 35:337-342

ORIGINAL ARTICLE

Postoperative nausea and vomiting after unrestricted clear fluids before day surgery

A retrospective analysis

Graham C. McCracken and Jane Montgomery

BACKGROUND Guidance on pre-operative fluids fasting procedures, from whom patient experience data are not

- Liberal consumption of clear liquids before induction of anesthesia reduced the rates of PONV
- 6-4-0 rule for NPO

SETTING Single district general hospital between November 2013 and February 2016.

PATIENTS A total of 11500 patients on the day case pathway who were receiving either sedation, general anaesthesia, regional anaesthesia or their combination. The data from these patients were collected routinely. This number of patients represents approximately 78% of all patients before the change in fluids policy and 74% after the change. Exclusions were patients undergoing a termination of pregnancy, or patients undergoing community dental

drink up until surgery, a relative rate (95% confidence interval) of 0.73 (0.61 to 0.88), $P=0.00074$. The corresponding rates of vomiting were 146/2186 (2.8%) and 104/4716 (2.2%), a relative rate (95% confidence interval) of 0.78 (0.61 to 1.00), $P=0.053$.

CONCLUSION Our data suggest that the liberal consumption of clear fluids before the induction of scheduled day case anaesthesia reduced the rates of postoperative nausea and vomiting.

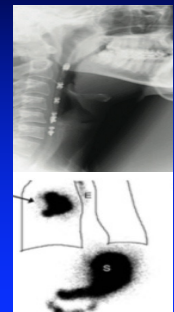
Published online 12 December 2017

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Fast-Track General Anesthetic Technique

Residual Effects Increase Postoperative Complications

- Benzos, opioids, propofol, inhaled anesthetics, NMB, alpha-2 agonists
 - Reduce ventilatory response to hypoxia/hypercarbia
 - Compromise airway patency
 - ↑ laryngopharyngeal dysfunction
 - ↑ postop pulm complications, tracheal intubation, ICU admission, LOS
 - ↑ delirium and cognitive dysfunction

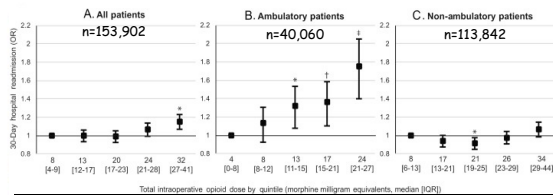


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Association between intraoperative opioid administration and 30-day readmission: a pre-specified analysis of registry data from a healthcare network in New England

D. R. Long¹, A. L. Lihn^{1,2}, S. Friedrich¹, F. T. Scheffenbichler¹, K. C. Safavi¹, S. M. Burns¹, J. C. Schneider³, S. D. Grabitz¹, T. T. Houle¹ and M. Eikermann^{4,5,6}
Br J Anaesth 2018; 120: 1090-1102



Ambulatory surgery: fentanyl >100 mcg and hydromorphone >0.4mg

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Association between intraoperative non-depolarising neuromuscular blocking agent dose and 30-day readmission after abdominal surgery

T. Thevathasan^{1,†}, S. L. Shih^{2,†}, K. C. Safavi¹, D. L. Berger³, S. M. Burns¹, S. D. Grabitz¹, R. S. Glidden⁴, R. D. Zafonte², M. Eikermann^{4,5,*} and J. C. Schneider²

Br J Anaesth 2018; 119: 595-605

Abstract

Background. We hypothesised that intraoperative non-depolarising neuromuscular blocking agent (NMBA) dose is associated with increased risk of 30-day readmission after abdominal surgery. **High doses of NMB during abdominal surgery was associated with increased risk of 30-day readmission, particularly after ambulatory surgery** **Results.** Prolonged hospital length of stay (adjusted incidence rate ratio [aIRR] 1.20 [95% CI 1.11-1.29]; P for trend: P<0.001) and increased hospital costs (aIRR 1.18 [95% CI 1.13-1.24]; P for trend: P<0.001). Admission type (same-day vs inpatient surgery) significantly modified the risk (interaction term: aOR 1.31 [95% CI 1.05-1.63], P=0.02), and the adjusted odds of readmission in patients undergoing ambulatory surgical procedures who received high-dose NMBA vs low-dose NMBA amounted to 2.61 [95% CI 1.11-6.17], P for trend: P<0.001. Total intraoperative rocuronium dose increased the risk of 30-day readmission (aOR 1.04 [1.0-1.08], P=0.048). **Conclusions.** In a retrospective analysis, high doses of NMBA given during abdominal surgery was associated with an increased risk of 30-day readmission, particularly in patients undergoing ambulatory surgery.

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Intraoperative Care Influences Long-term Outcomes

- Use minimal number of drug combinations
- Use shortest-acting drugs at the lowest possible doses

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Avoid Routine Preoperative Benzodiazepine

- Delays emergence from anesthesia
 - La Colla L, et al: Br J Anaesth 2007; 99: 353-8
- Increases emergence delirium
 - Lepouse C, et al: Br J Anaesth 2006; 96: 747-53
- Increases cognitive dysfunction
 - Maurice-Szamburski, et al: JAMA 2015; 313: 916-25
- Increases pharyngeal/laryngeal dysfunction and micro aspiration
 - Haardemark Cedborg AI, et al: Anesthesiology 2015; 122: 1253
- Pre-induction midazolam does not reduce awareness
 - ASA Practice Guidelines: Anesthesiology 2006; 104: 847

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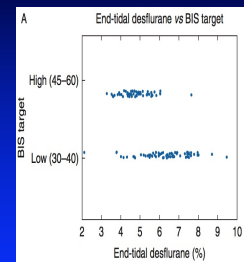
Deep Anesthesia Influences Postoperative Outcomes

- Delays emergence from anesthesia
- Reduces ventilatory response to hypoxia
- Compromises airway patency, increases pharyngeal dysfunction, risk of aspiration
 - Vab Den Elsen M, et al: Br J Anaesth 1998; 80: 174-82
 - Sundman E, et al: Anesthesiology 2001; 95: 1125-32
- Increases delirium
 - Chan MTV, et al: J Neurosurg Anesthesiol 2013; 33-42
 - Whitlock EL, et al: Anesth Analg 2014; 118: 809-17
 - Punjasawadwong Y, et al: Cochrane Database Syst Rev 2018, Issue 5, Art. No.: CD011283

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Inhaled Anesthetic Concentrations For Prevention of Recall

- Inhaled conc. required to prevent awareness (recall) ~0.8 - 1 MAC
- Desflurane conc. for BIS~50
 - Young (20-30 yrs): 4.25%
 - Middle age (31-65 yrs): 3.58%
 - Elderly (66-80 yrs): 2.75%
 - Kanazawa S, et al: Acta Anaesthesiol Scand 2016; 60: 177-82
- Do not use inhaled anesthetics to control blood pressure



Law CJ, et al: Br J Anaesth 2014; 112: 675-80

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Nitrous Oxide

Advantages

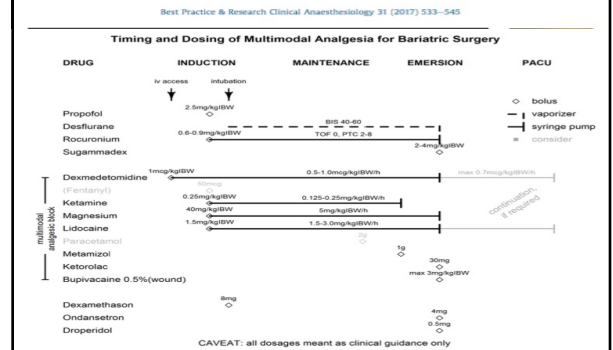
- Amnesia and analgesia
 - ↓ anesthetic and opioid dose
- ↑ circulatory stability
- Facilitates emergence
 - Peyton PJ et al: Anesthesiology 2011;114:596
- ↓ persistent postop pain
 - Chan MT et al: Pain 2011; 152: 2514-20
 - Echevarria G et al: Br J Anaesth 2011;107:959

Disadvantages

- Does not increase PONV
 - Fernandez-Guisasa et al: Anaesthesia 2010; 65: 379-87
 - Myles P, et al: Anesthesiology 2016
- Does not influence surgical conditions during abdominal surgery
 - Krough et al: Br J Anesth 1994; 72: 55-7
- Does not increase cardiopulmonary morbidity
 - Leslie K, et al: Anesth Analg 2011;112:387
 - Turan A et al: Anesth Analg 2013;116:1026
 - Leslie K, et al: Anesthesiology 2015: 123: 1267-80

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Different protocols used today to achieve total opioid-free general anesthesia without locoregional blocks



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Intraoperative 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 (PaCO₂ = 45 mmHg) improves tissue O₂

Intraoperative Protective Mechanical Ventilation for Prevention of Postoperative Pulmonary Complications

A Comprehensive Review of the Role of Tidal Volume, Positive End-expiratory Pressure, and Lung Recruitment Maneuvers

Andrew G. Davies, M.D., Thomas H. Lee, M.D., Aydin S. Hossain, M.D., M.Sc., Ph.D.,
Graham S. T. Hogg, M.D., John C. Goss, M.D., Ph.D., Peter H. Slater, M.D.,
Thomas R. M. Hogg, M.D., Ph.D., Maria J. Schell, M.D., Ph.D., Peter Hogg, M.D., FRCPC,
Michael G. Davies, M.D., M.Sc., Ph.D., J. L. Goss

ABSTRACT

Postoperative pulmonary complications are associated with increased morbidity, length of hospital stay, and mortality after major surgery. Intraoperative lung protective mechanical ventilation has been proposed to reduce the incidence of postoperative pulmonary complications. This review discusses the current literature on tidal volume, positive end-expiratory pressure, and lung recruitment maneuvers. The authors propose an algorithm for postoperative lung protective mechanical ventilation.

Moderate Hyperventilation during Intravenous Anesthesia Increases Net Cerebral Lactate Efflux

Frank O. Scholz, M.D., Stephan K. Hoyer, M.D., Ph.D., Hans-Joachim Hoyer, M.D., Ph.D.,
Hans-Joachim Hoyer, M.D., Ph.D., Andreas Hoyer, M.D., Ph.D.

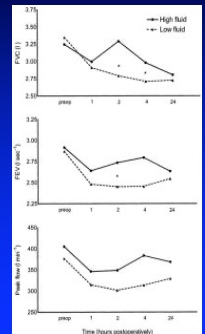
ABSTRACT

Background: Hyperventilation is known to decrease cerebral blood flow (CBF) and to impact cerebral metabolism. In the present study, we investigated the effect of moderate hyperventilation on cerebral metabolism during intravenous anesthesia. We hypothesized that moderate hyperventilation would lead to a decrease in cerebral metabolism and a decrease in net cerebral lactate efflux.

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Intraoperative Fluid Therapy: Mild-to-Moderate Invasive Surgery

- Patients (n=48) undergoing lap chole
- Higher volume (40 ml/kg LR)
 - Reduced nausea, thirst, dizziness, drowsiness, fatigue
 - Improved postop pulm function
 - Reduced neurohormonal stress response
 - Improved balance function, exercise capacity and general sense of well-being



Holte et al: Arch Surg 2004; 240: 892-9

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Maintain Perioperative Fluid Balance

- Emphasis on preoperative hydration
 - Avoids preoperative dehydration
- Intraoperative fluid balance
 - Avoidance of deep GA
 - Lung protective ventilation
 - Judicious intraop fluid administration
 - Crystalloid infusion 3 mL/kg/h
 - Accept lower urine output (0.3 ml/kg/h)
 - Mizota T, et al: Br J Anaesth 2017; 119: 1127-34
- Early oral intake
- Early ambulation
 - Fluid redistribution and excretion

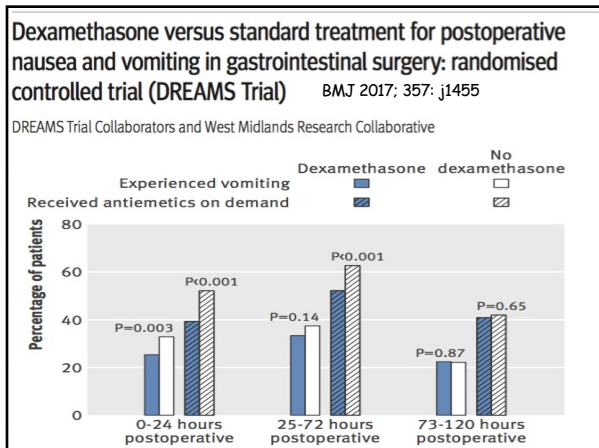
Joshi GP, Kehlet H. Anesth Analg 2016; 122: 1261-3

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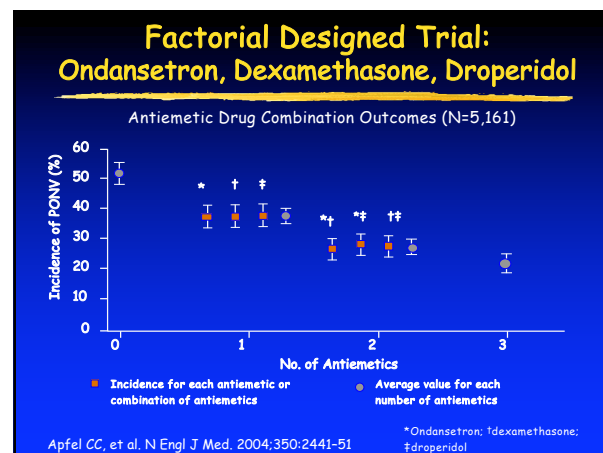
Multimodal Antiemetic Therapy

- Intraoperative
 - Dexamethasone 8 mg
 - Ondansetron 4 mg (end of surgery)
 - Haloperidol 1 mg, IV
- High risk population (add)
 - Transderm scopolamine (preop)
- Postoperatively
 - Promethazine (Phenergan) 6.25 mg
- Post-discharge
 - Dimenhydrinate 25 mg, po
 - Ondansetron ODT

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Pain Management: Best Practice

- "Basic" analgesic regimen for a procedure
 - Acetaminophen + NSAID + Dexamethasone + Local/regional analgesic technique
- Additional analgesic intervention only if basic analgesics are inadequate
- Consider balance between the invasiveness of the analgesic technique and consequences of pain
- Consider balance between the analgesic efficacy and adverse event profile of the intervention
- Type and number of analgesics should be procedure and patient specific

Joshi GP, Kehlet H, et al: Br J Anaesth 2017; 119: 720-2

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Role of Analgesic Techniques in Current Perioperative Care

Analgesic Technique	Indications
Acetaminophen	All cases except patients with compromised hepatic function, severe alcoholism, cirrhosis or hepatitis
NSAIDs / COX-2 specific inhibitors	All cases except in patients with contraindications
Dexamethasone	All cases except in patients with contraindications
Ketamine infusion	Major thoracic, upper abdominal and orthopedic surgery in opioid tolerant patients or if commonly used non-opioid approaches are not possible. No role for single bolus doses.
Dexmedetomidine	No evidence of significant benefit in the postoperative period
Opioids	As rescue when non-opioid approaches are inadequate

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Role of Analgesic Techniques in Current Perioperative Care

Analgesic Technique	Indications
Peripheral nerve blocks	Major upper limb surgery (brachial plexus blocks). Major foot and ankle surgery (popliteal sciatic ± adductor canal blocks)
Field blocks	Open abdominal surgery
Surgical site infiltration	Most surgical procedures, when other RA techniques
IV lidocaine infusion	Major open abdominal surgery with contraindications to commonly used non-opioids approaches (e.g. regional analgesia, acetaminophen and NSAIDs)

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Post-Discharge Analgesia

- Acetaminophen and NSAID or COX-2 specific inhibitor – scheduled (round the clock)
- Oxycodone as rescue
- Avoid combinations of acetaminophen and weak opioids (codeine, hydrocodone, oxycodone) only marginally superior to NSAIDs alone

- McQuay et al: BMJ 1997; 314: 1531-5

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- ERP for ambulatory surgery improve quality recovery and allow early return to activities of daily living
- Essential elements include:
 - Appropriate patient selection
 - Optimization of comorbid conditions
 - Patient/family education
 - Fast-track anesthetic technique
 - Aggressive pain and PONV prophylaxis
- Early identification and management of complications
- Protocols should be updated regularly based on recent evidence

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