

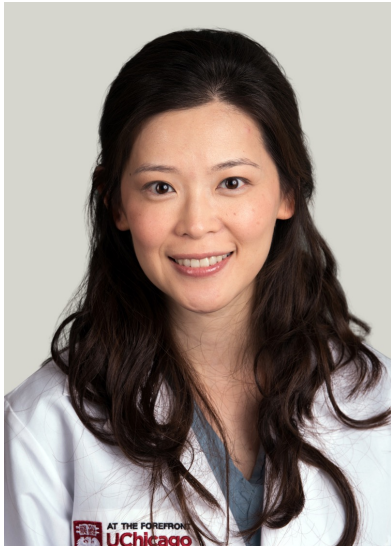
SOCIETY FOR
SAMBA ULATORY
ANESTHESIA

Outpatient • Office Based • Non-Operating Room

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SAMBA 2024 Annual Meeting

May 2-4, 2024



Blocks for Outpatient Orthopedic Surgeries

Jihye Ha, MD

Assistant Professor, University of Chicago

Clinical Director, DCAM Operating Rooms

Objectives



Preview the projected growth of joint replacement surgeries and its potential impact on ambulatory surgery

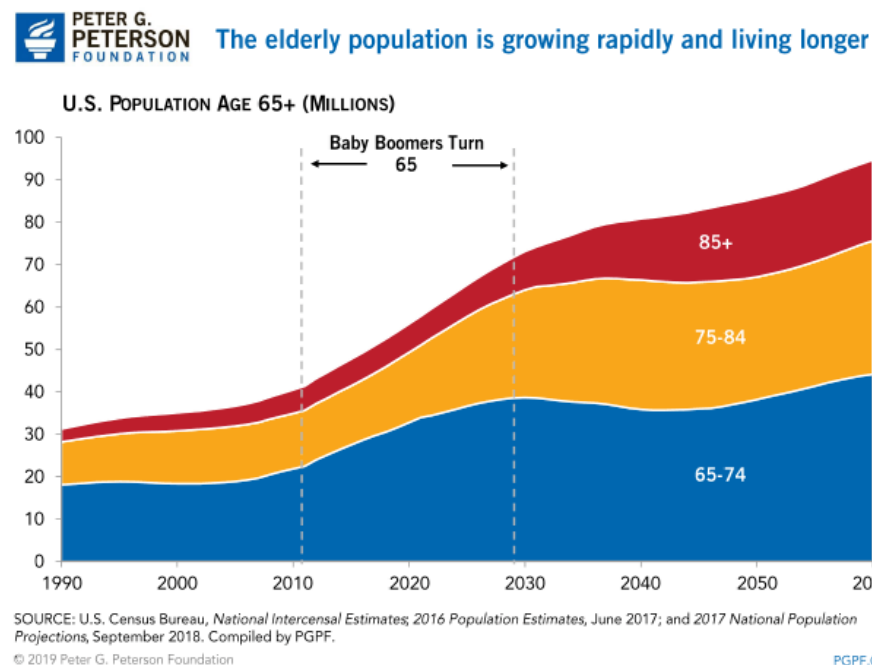
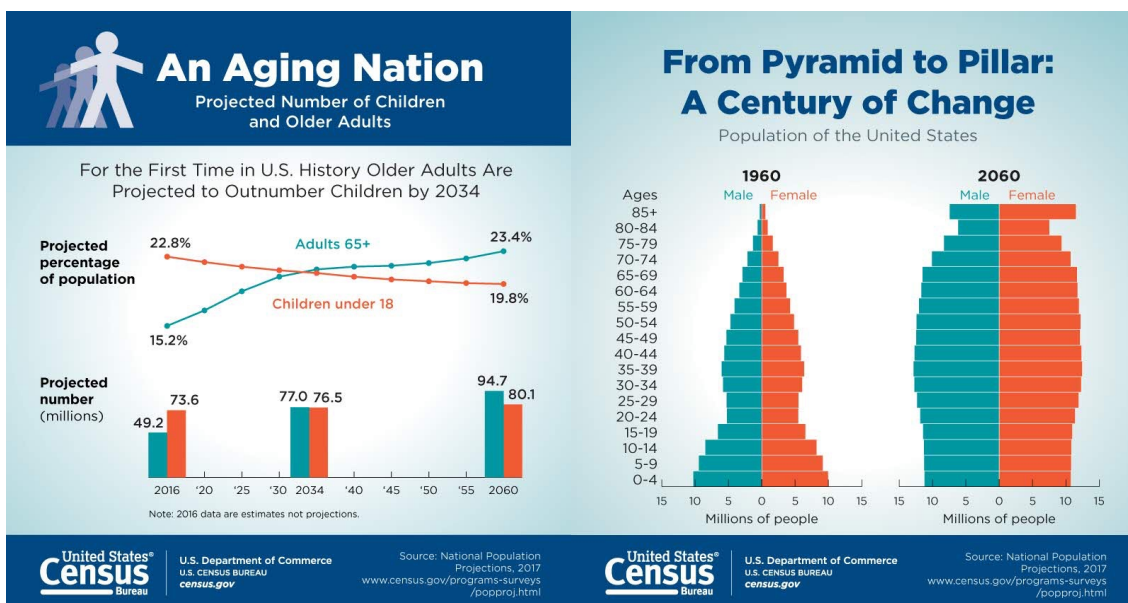


Discuss the regional anesthetic techniques for total joint arthroplasty



Explore regional anesthetic options for outpatient spine surgery

Impact of an Aging Nation



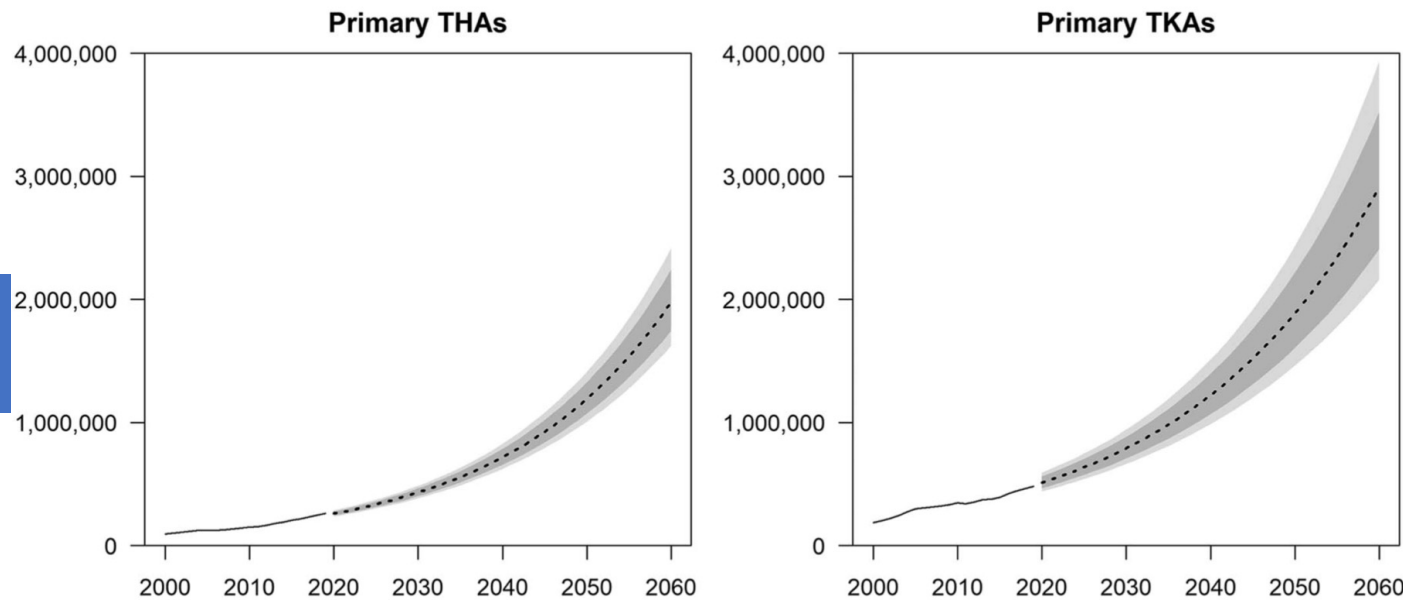
- <https://www.census.gov/library/stories/2018/03/graying-america.html>
- https://www.pgpf.org/chart-archive/0045_elderly-population-trends

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Projections and Epidemiology of Primary Hip and Knee Arthroplasty in Medicare Patients to 2040-2060

Ittai Shichman, MD, Mackenzie Roof, MD, MBA, Neil Askew, MSc, Leo Nherera, PhD, Joshua C. Rozell, MD, Thorsten M. Seyler, MD, PhD, and Ran Schwarzkopf, MD, MSc



176% by 2040
659% by 2060

139% by 2040
469% by 2060

Regression analysis projected an annual growth rate of 5.2% for THA and 4.44% for TKA.

Shichman I et al. JB JS Open Access. 2023 Feb 28;8(1):e22.00112.



Length of Stay

<https://www.aaos.org/registries/publications/ajrr-annual-report/>

Figure 2.3 Mean Length of Stay for Hip Arthroplasty Procedures, 2012-2022 (N=752,866)

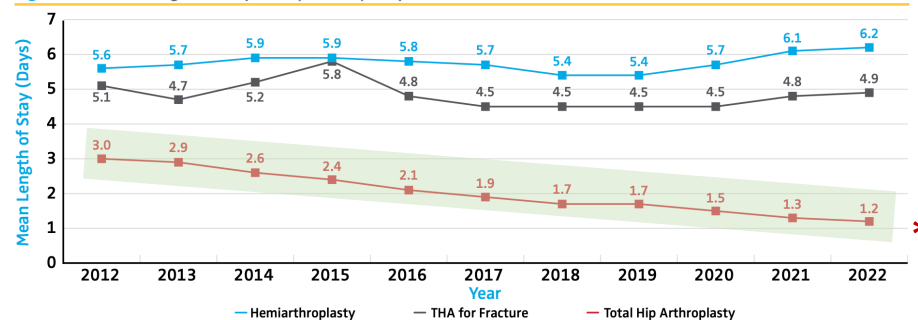


Figure 3.2 Mean Length of Stay for Knee Arthroplasty Procedures, 2012-2022 (N=1,151,042)

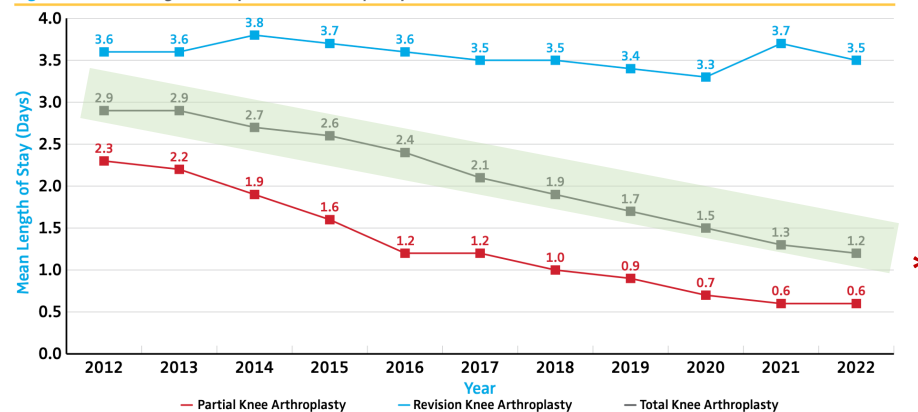
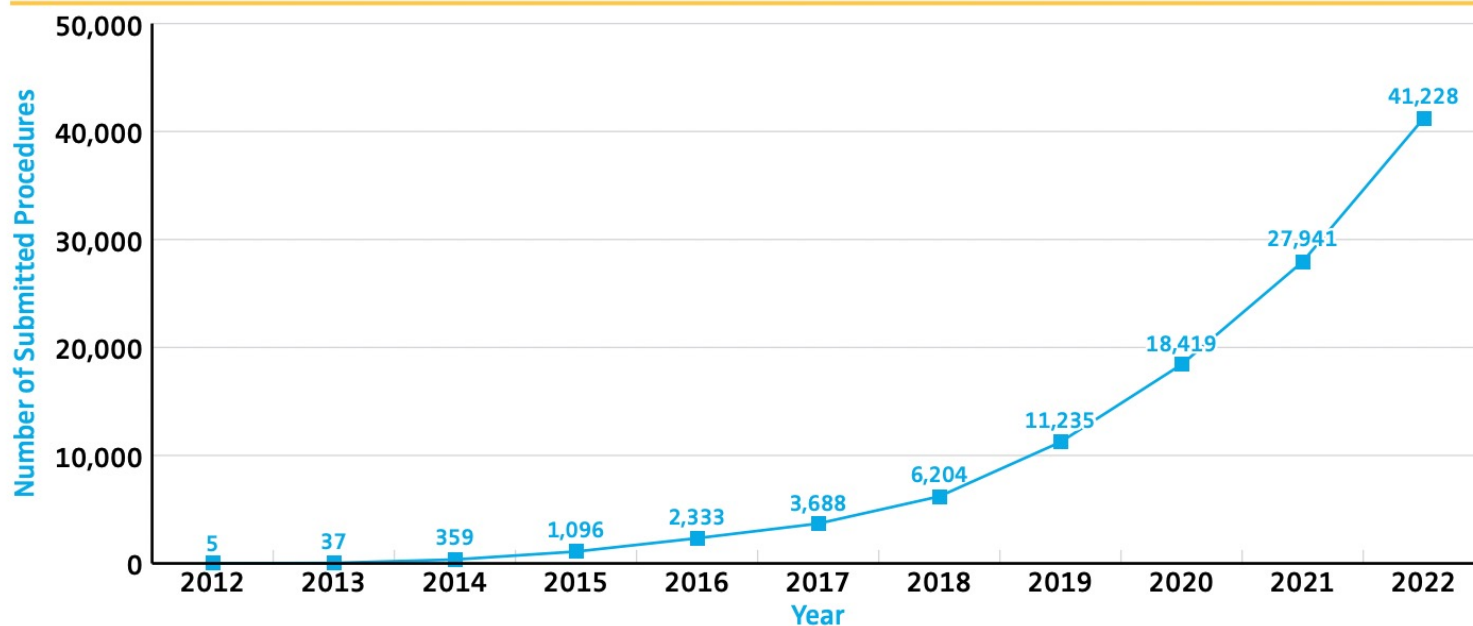


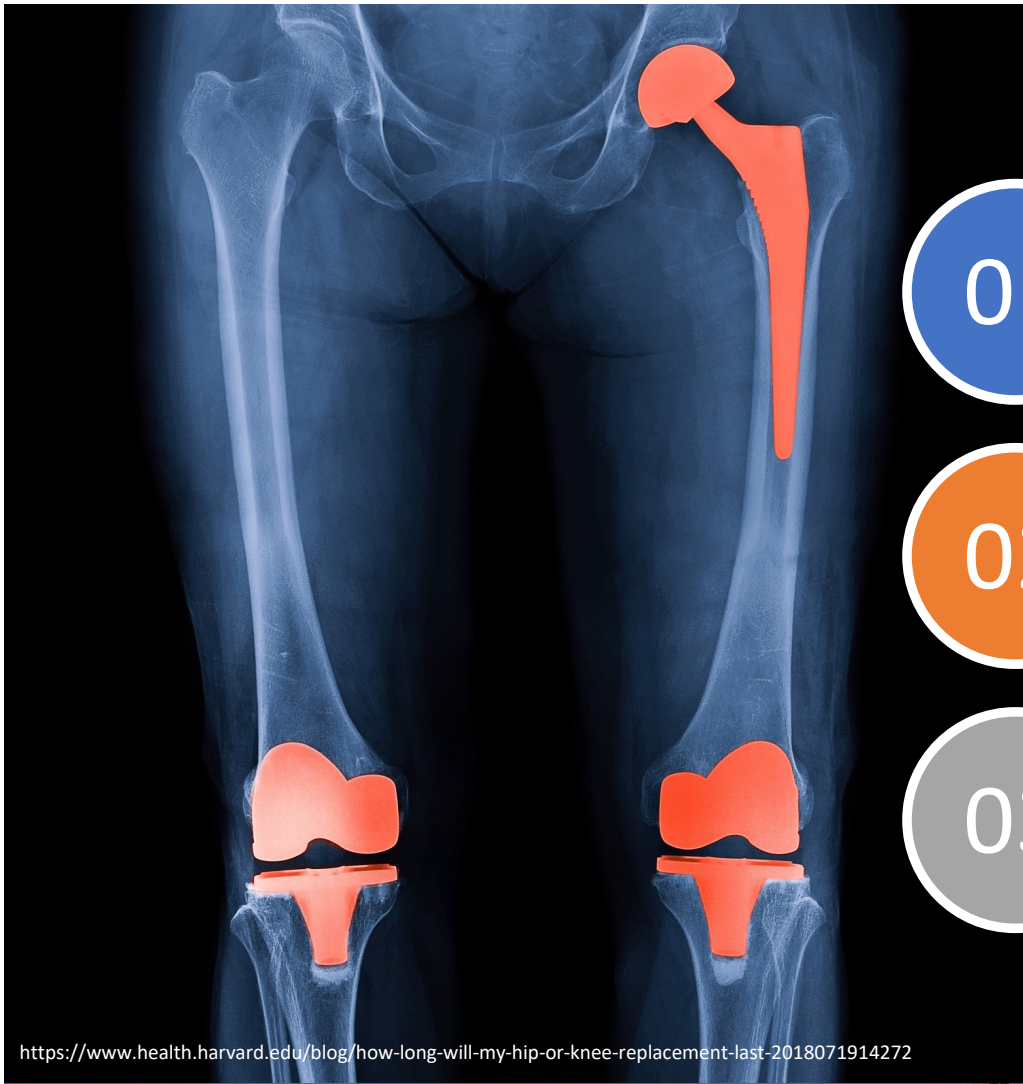
Figure 1.11 Cumulative Procedure Volume from Ambulatory Surgery Centers by Year, 2012-2022 (N=41,228)



<https://www.aaos.org/registries/publications/ajrr-annual-report/>

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Goals of TJA

01

Analgesia

02

Early Rehabilitation

03

Prevent Chronic Pain

<https://www.health.harvard.edu/blog/how-long-will-my-hip-or-knee-replacement-last-2018071914272>

Sreckovic S, et al. Chronic post-surgical pain after knee arthroplasty: a role of peripheral nerve blocks. Front Med (Lausanne). 2024 Jan 11;10:1335405.

Regional Anesthesia Benefits



- Hadzic A, Karaca PE, Hobeika P, et al. Peripheral Nerve Blocks Result in Superior Recovery Profile Compared with General Anesthesia in Outpatient Knee Arthroscopy. *Anesthesia & Analgesia*. 2005;100(4):976-981
- Greensmith JE, Murray WB. Complications of regional anesthesia. *Current Opinion in Anaesthesiology*. 2006;19(5):531-537
- Russell RA, Burke K, Gattis K. Implementing a Regional Anesthesia Block Nurse Team in the Perianesthesia Care Unit Increases Patient Safety and Perioperative Efficiency. *Journal of PeriAnesthesia Nursing*. 2013;28(1):3-10
- Nixon HC, Wheeler P. Wrong-site Lower Extremity Peripheral Nerve Block. *International Anesthesiology Clinics*. 2011;49(2):116-124.

History of Regional Anesthesia

1800s

1859 Isolation of Cocaine (Niemann)
1884 Cocaine Topical/Regional (Axillary)
1889 Rectus Sheath
1898 Spinal Anesthesia

Late 1900s

1962 Nerve stimulation
1967 Ankle
1979 Interscalene
1993 Adductor Canal
1994 Ultrasound
1994 NYSORA website
1997 Popliteal sciatic

2010s

2012 PECS, iPACK
2013 Serratus Anterior
2016 Erector Spinae
2018 PENG

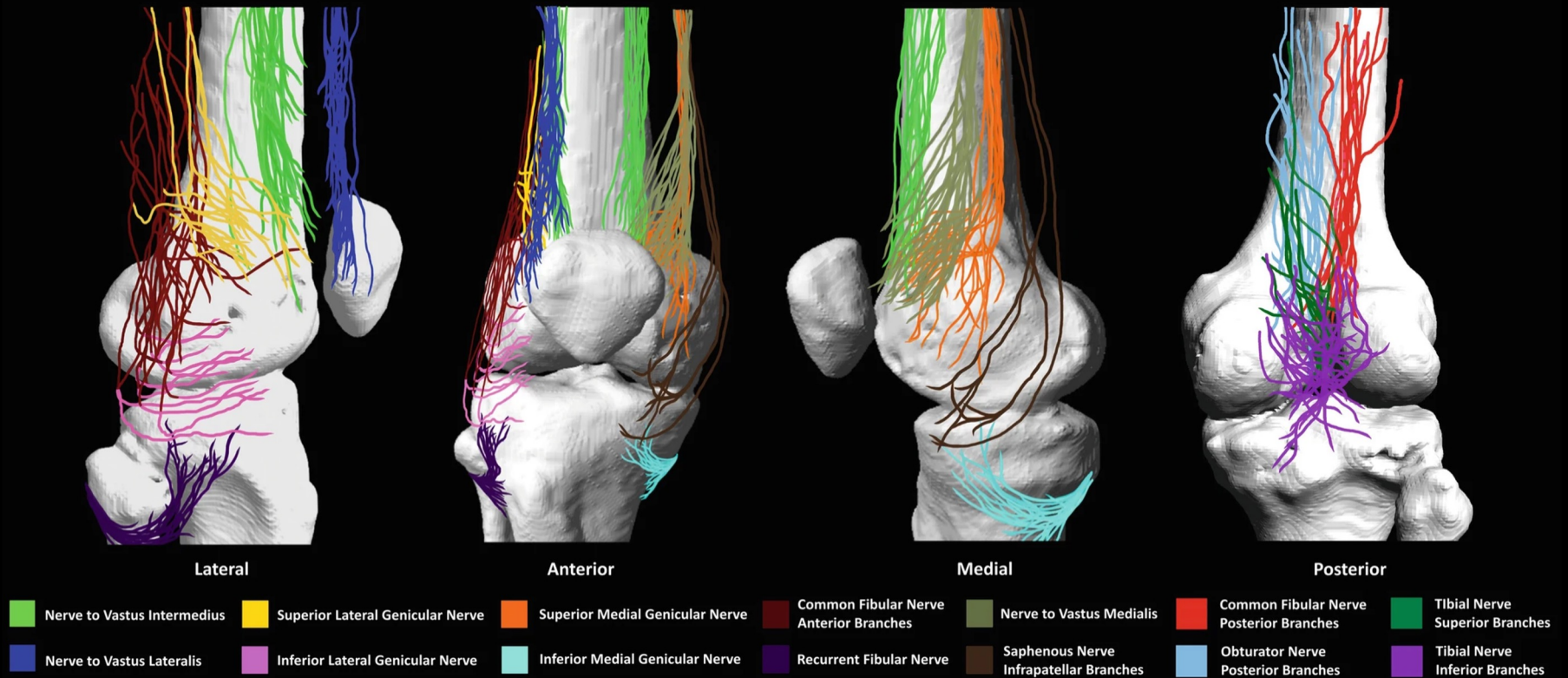
Early 1900s

1905 Paravertebral
1908 Bier block
1911 Supraclavicular
1914 Infraclavicular
1920 Sciatic
1921 Epidural anesthesia
1923 ASRA
1946 Continuous
peripheral nerve block

2000s

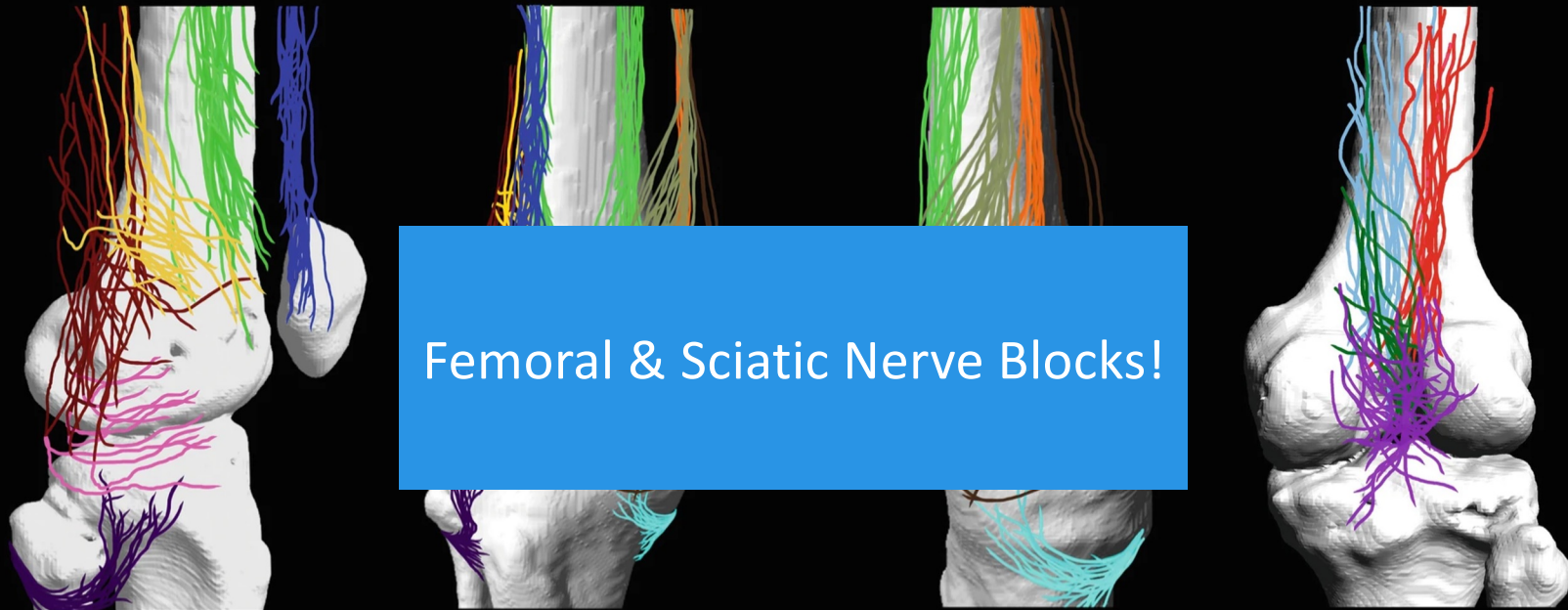
2001 Transversus Abdominis Plane
2007 Quadratus Lumborum

Innervation of Knee Joint Capsule



Tran J, Peng PWH, Lam K, Baig E, Agur AMR, Gofeld M. Anatomical Study of the Innervation of Anterior Knee Joint Capsule: Implication for Image-Guided Intervention. Reg Anesth Pain Med. 2018 May;43(4):407-414.

Innervation of Knee Joint Capsule

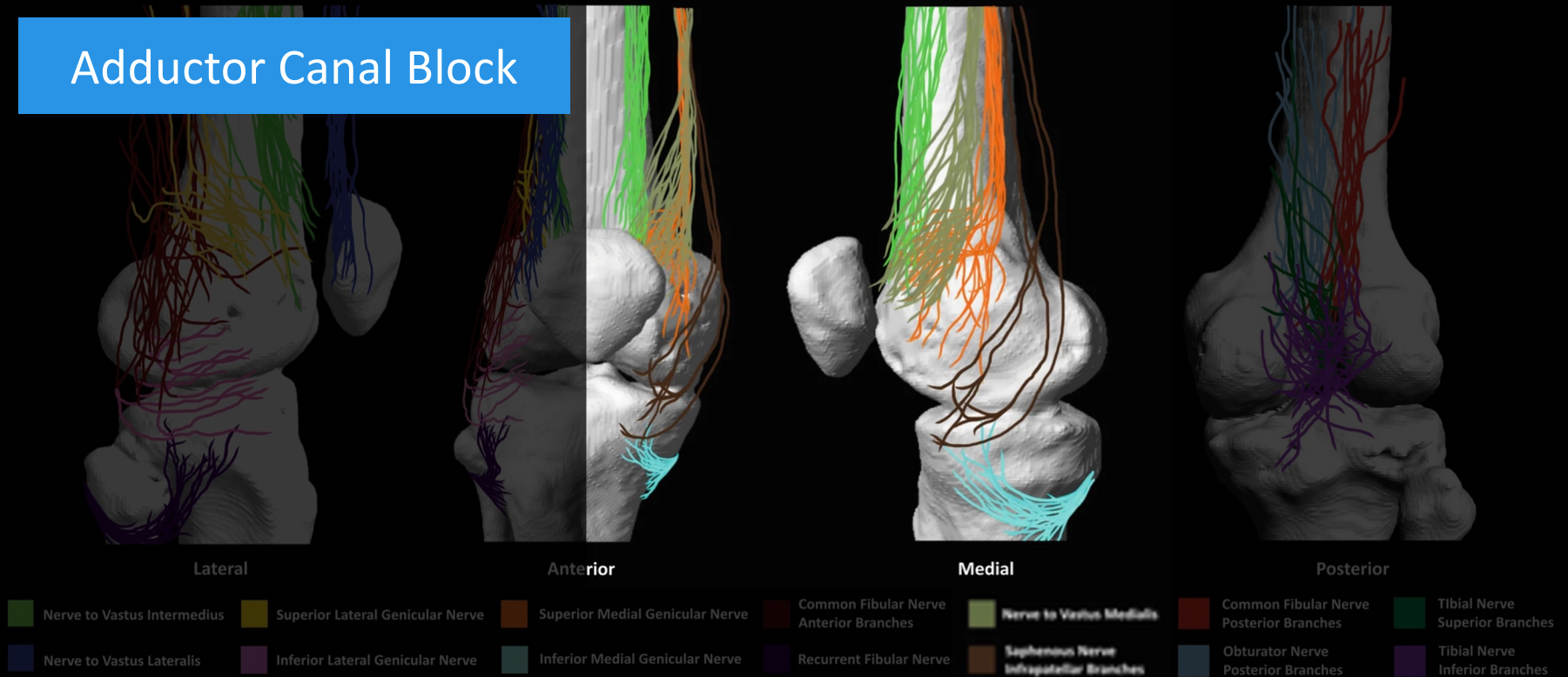


Femoral & Sciatic Nerve Blocks!

Lateral	Anterior	Medial	Posterior
- Nerve to Vastus Intermedius - Nerve to Vastus Lateralis	- Superior Lateral Genicular Nerve - Inferior Lateral Genicular Nerve	- Superior Medial Genicular Nerve - Inferior Medial Genicular Nerve - Recurrent Fibular Nerve	- Common Fibular Nerve Anterior Branches - Saphenous Nerve Infrapatellar Branches - Common Fibular Nerve Posterior Branches - Obturator Nerve Posterior Branches - Tibial Nerve Superior Branches - Tibial Nerve Inferior Branches

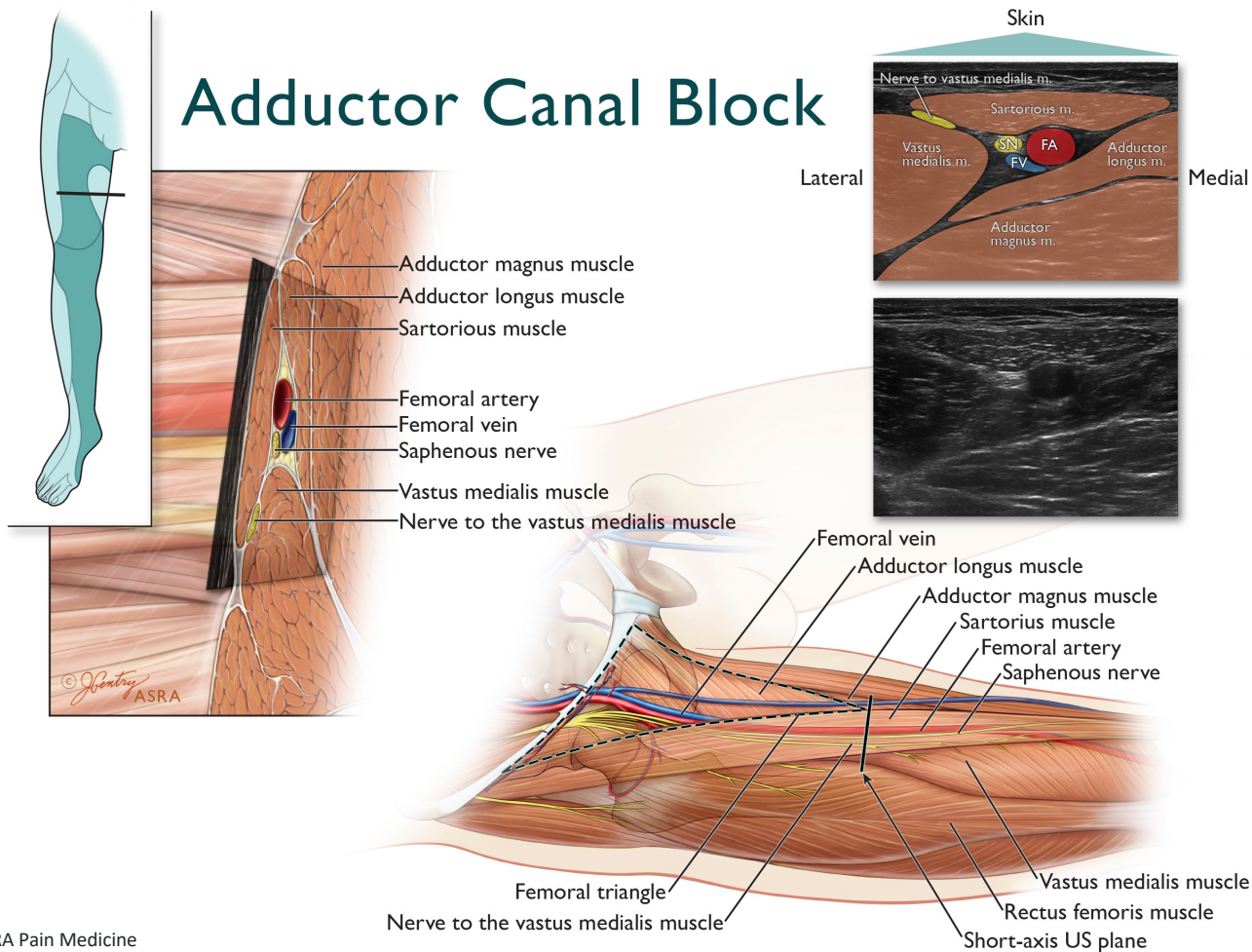
Motor-Sparing Techniques

Adductor Canal Block



Tran J, Peng PWH, Lam K, Baig E, Agur AMR, Gofeld M. Anatomical Study of the Innervation of Anterior Knee Joint Capsule: Implication for Image-Guided Intervention. Reg Anesth Pain Med. 2018 May;43(4):407-414.

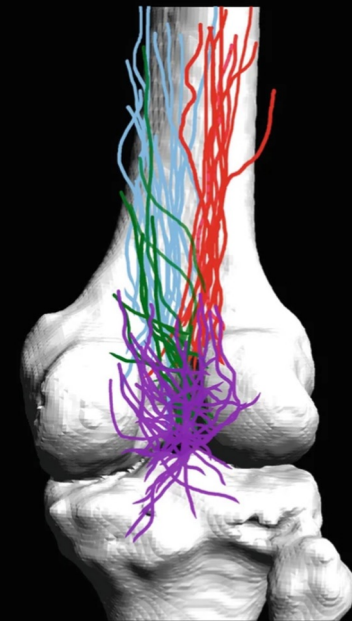
Adductor Canal Block



©ASRA Pain Medicine

Motor-Sparing Techniques

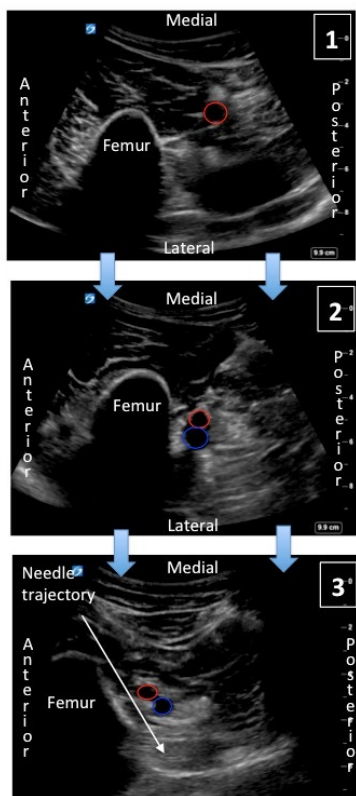
Infiltration of the space between the popliteal artery and capsule of the posterior knee (iPACK)



Lateral	Anterior	Medial	Posterior
- Nerve to Vastus Intermedius - Nerve to Vastus Lateralis	- Superior Lateral Genicular Nerve - Inferior Lateral Genicular Nerve	- Superior Medial Genicular Nerve - Inferior Medial Genicular Nerve - Recurrent Fibular Nerve - Saphenous Nerve Infrapatellar Branches	- Common Fibular Nerve Anterior Branches - Nerve to Vastus Medialis - Common Fibular Nerve Posterior Branches - Obturator Nerve Posterior Branches - Tibial Nerve Superior Branches - Tibial Nerve Inferior Branches

iPACK Block

Infiltration Between Popliteal Artery and Capsule of Knee



Position

Prone, supine, lateral decubitus

Local Anesthetic

20mL Bupi 0.25% + epi

Clinical Pearls

Medial to lateral

Do not extend 2cm beyond
edge of popliteal artery

<https://www.asra.com/news-publications/asra-newsletter/newsletter-item/asra-news/2020/05/03/how-i-do-it-infiltration-between-popliteal-artery-and-capsule-of-knee-%28ipack%29>

Chronic post-surgical pain after knee arthroplasty: a role of peripheral nerve blocks

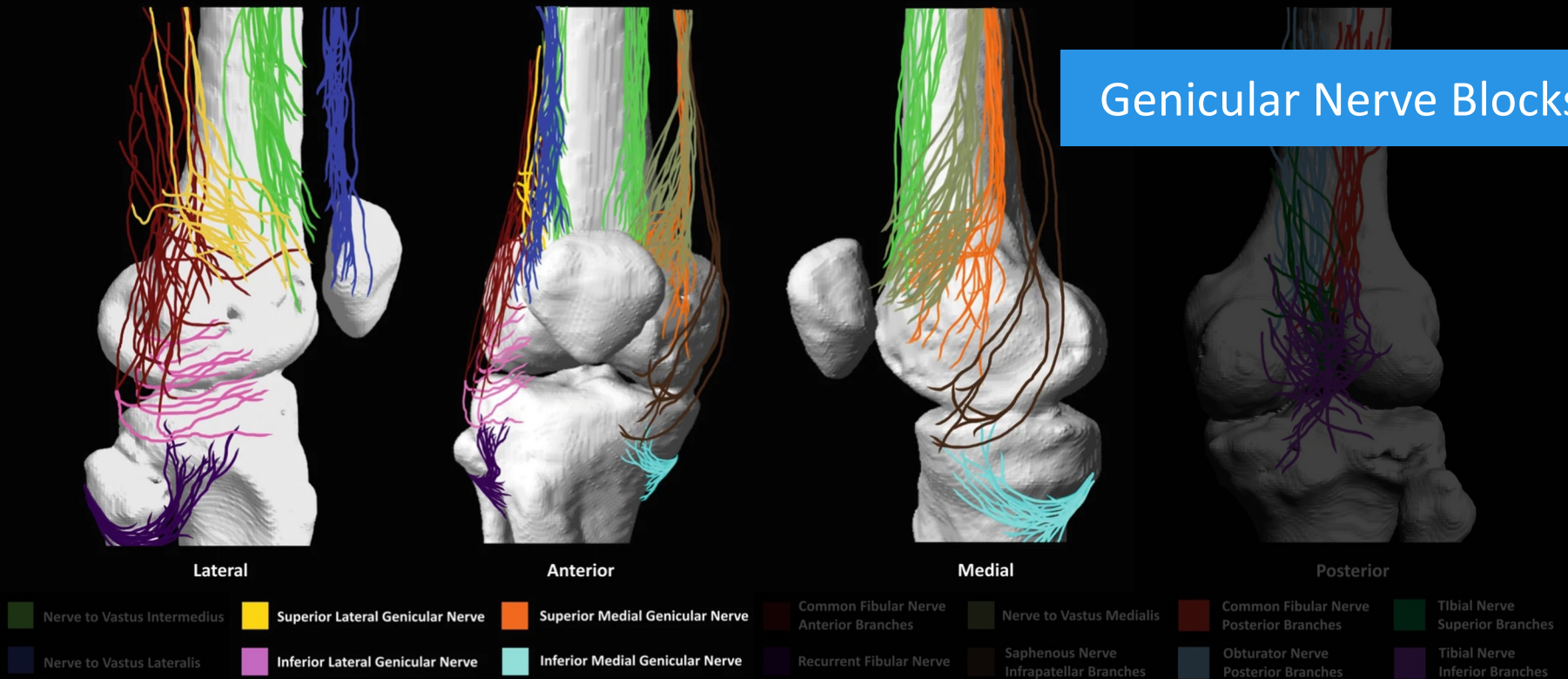
Svetlana Sreckovic^{1,2*}, Nebojsa Ladjevic^{1,3}, Biljana Milicic^{4,5},
Goran Tulic^{2,3}, Darko Milovanovic^{2,3}, Marija Djukanovic^{1,3} and
Marko Kadija^{2,3}

ACB + iPACK block provide adequate analgesia, significantly decrease opioid consumption, improve functional outcomes, and reduce CPSP 2 years after surgery (20% vs 6%).

Sreckovic S et al. Front Med (Lausanne). 2024 Jan 11;10:1335405.

Motor-Sparing Techniques

Genicular Nerve Blocks



Tran J, Peng PWH, Lam K, Baig E, Agur AMR, Gofeld M. Anatomical Study of the Innervation of Anterior Knee Joint Capsule: Implication for Image-Guided Intervention. Reg Anesth Pain Med. 2018 May;43(4):407-414.

Genicular Nerve Blocks

- Often targeted for RFA in chronic osteoarthritic knee pain
- Inferolateral genicular nerve not blocked due to proximity to common peroneal n.

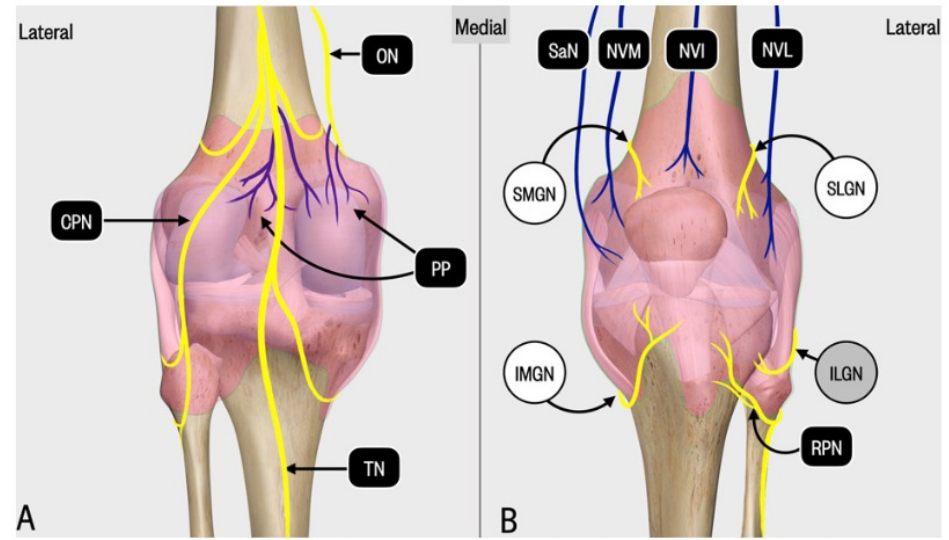


Figure 1 Schematic anatomy diagram of the posterior (A) and anterior (B) innervation of the knee capsule and joint. The three genicular targets are the SMGN, SLGN, and IMGN. CPN, common peroneal nerve; ILGN, inferolateral genicular nerve; IMGN, inferomedial genicular nerve; NVI, nerve to vastus intermedius; NVL, nerve to vastus lateralis; NVM, nerve to vastus medialis; ON, posterior branch of the obturator nerve; PP, popliteal plexus; RPN, recurrent peroneal nerve; SaN, saphenous nerve; SLGN, superolateral genicular nerve; SMGN, superomedial genicular nerve; TN, tibial nerve.

Rambhia M et al. Ultrasound-guided genicular nerve blocks following total knee arthroplasty: a randomized, double-blind, placebo-controlled trial. Reg Anesth Pain Med. 2021 Oct;46(10):862-866.

Ultrasound-guided genicular nerve blocks following total knee arthroplasty: a randomized, double-blind, placebo-controlled trial

Milly Rambhia,¹ An Chen,¹ Amanda H Kumar,² W Michael Bullock
Michael Bolognesi,³ Jeffrey Gadsden ²

- Genicular n blocks in addition to MMA, spinal anesthetic, iPACK block, and postoperative adductor canal perineural infusion.



60% reduction in the mean opioid consumption in 1st 24 hrs

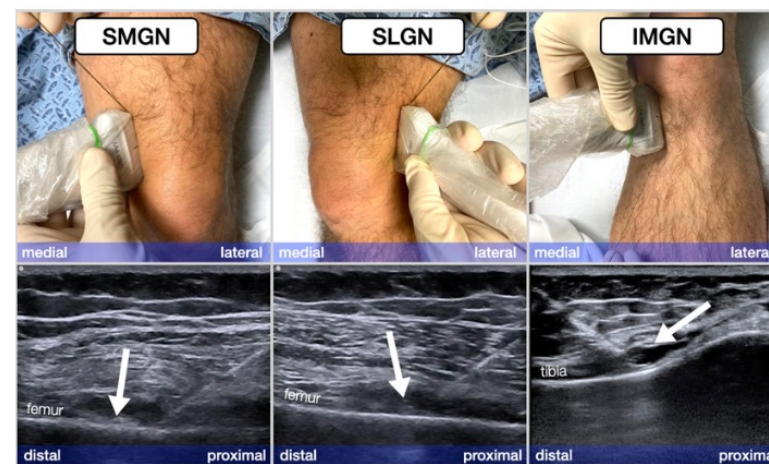
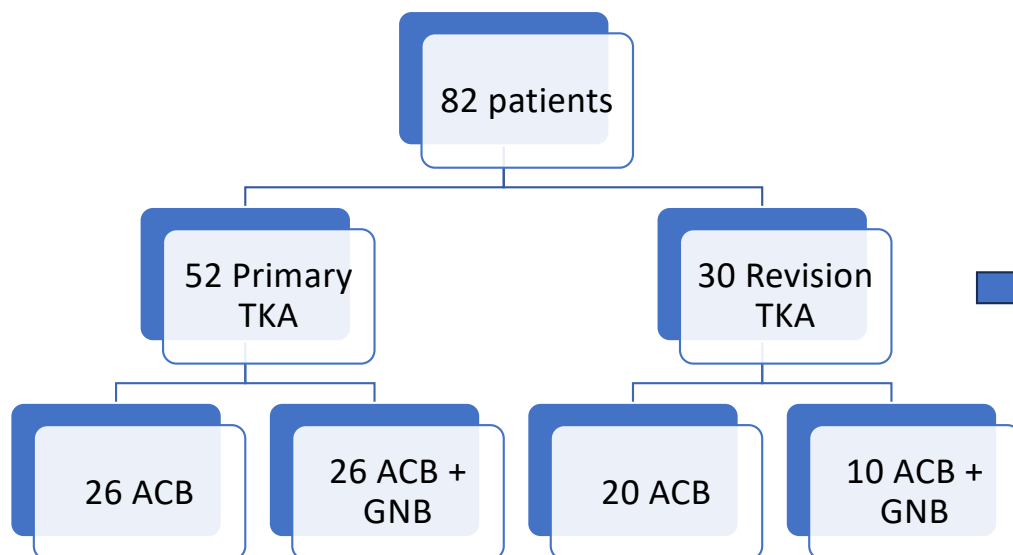


Figure 2 Ultrasound transducer position and needle approach for genicular nerve blockade. A, genicular artery; IMGN, inferomedial genicular nerve; SLGN, superolateral genicular nerve; SMGN, superomedial genicular nerve.

Comparison of Genicular Nerve Block in Combination With Adductor Canal Block in Both Primary and Revision Total Knee Arthroplasty: A Retrospective Case Series

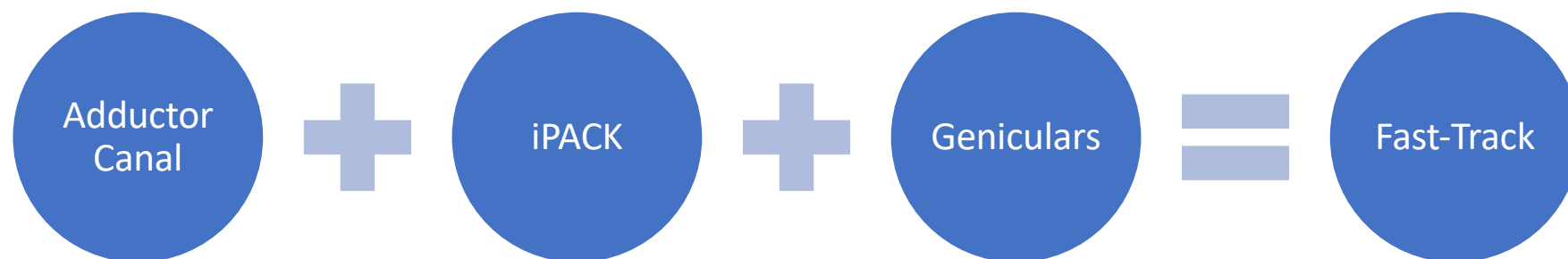
Promil Kukreja¹, Alana Venter¹, Lauren Mason², Alexander M. Kofskey³, Theresa Northern¹, Sameer Naranje⁴, Elie Ghanem⁴, Prentiss A. Lawson¹, Hari Kalagara¹



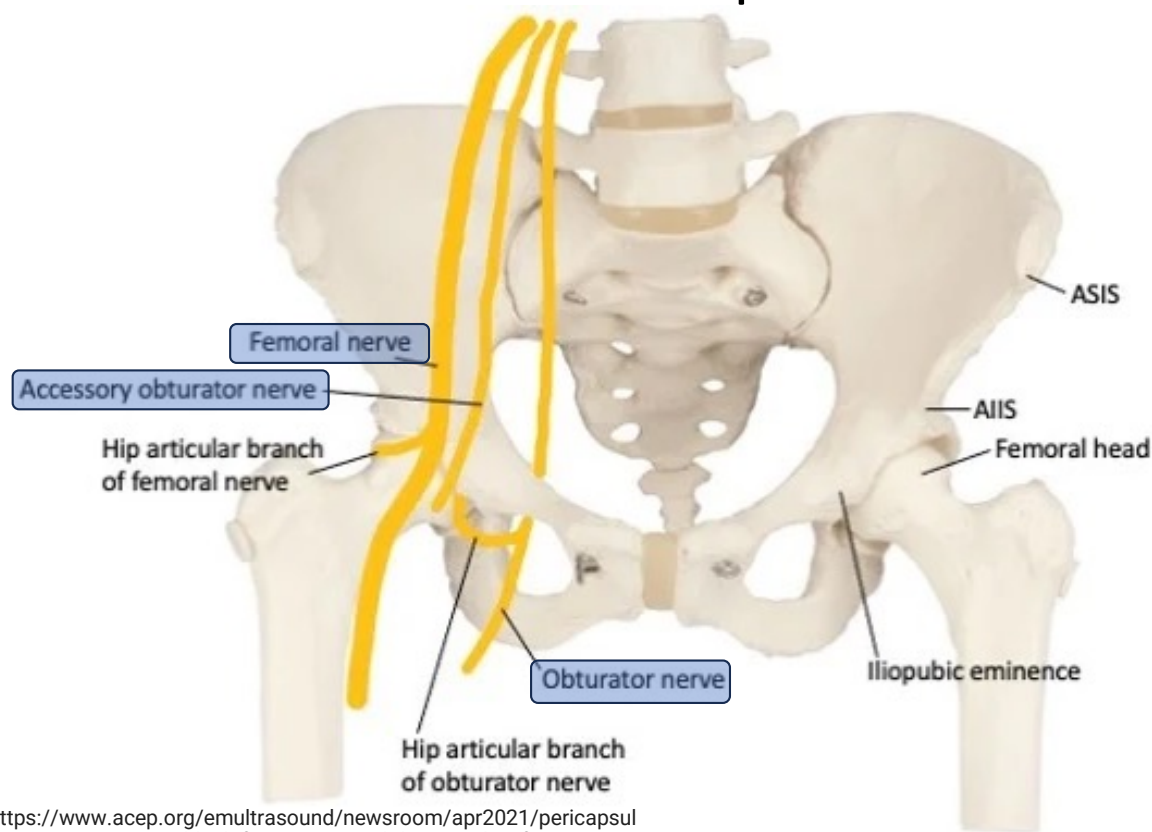
ACB + GNB resulted in better pain scores, lower opioid consumption during early phase of recovery, which also resulted in better ambulation

Kukreja P et al. Cureus. 2021 Jul 29;13(7):e16712.

Summary for TKA



Innervation of Hip Joint

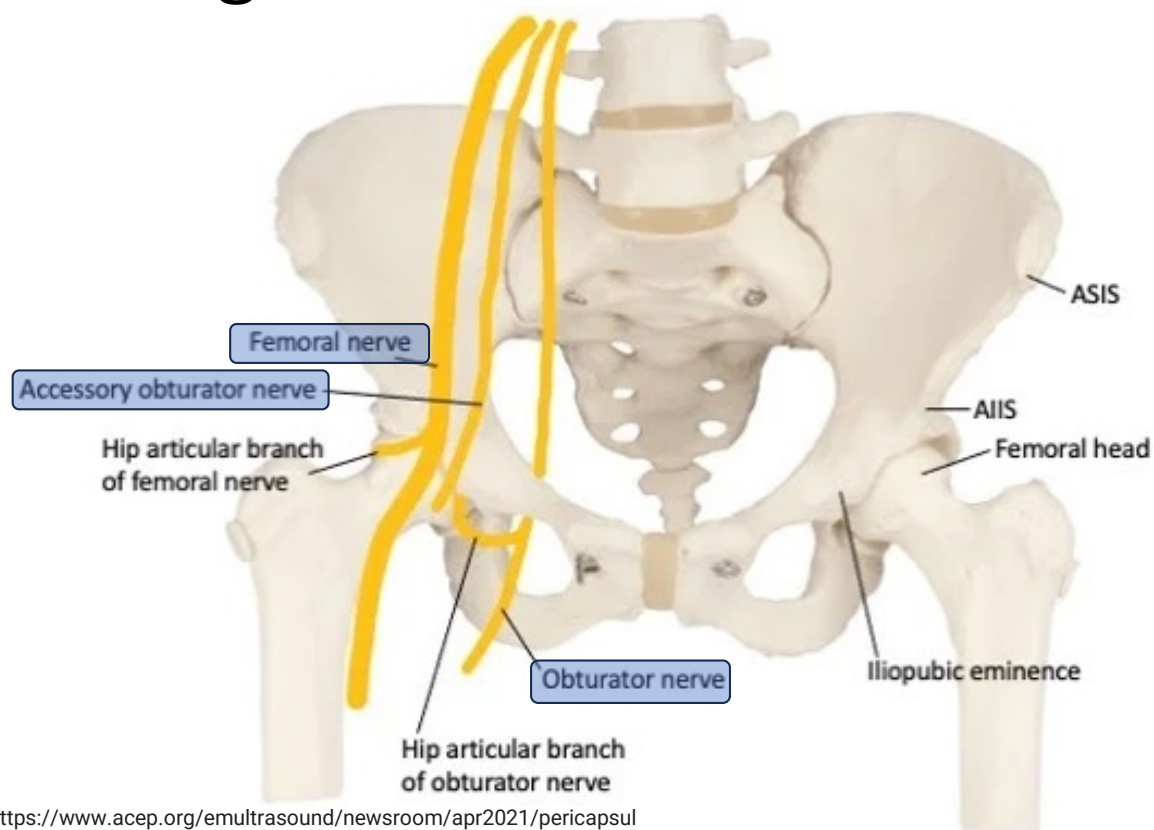


<https://www.acep.org/emultrasound/newsroom/apr2021/pericapsular-nerve-group-peng-block-for-patients-with-hip-or-pelvis-fractures-in-the-ed>

Histologically, the anterior capsule has predominantly nociceptive fibers while, the posterior capsule is largely made up of mechanoreceptors and have no sensory fibers.

Gerhardt M et al. Characterisation and classification of the neural anatomy in the human hip joint. Hip Int. 2012 Jan-Feb;22(1):75-81.

Targets for THA

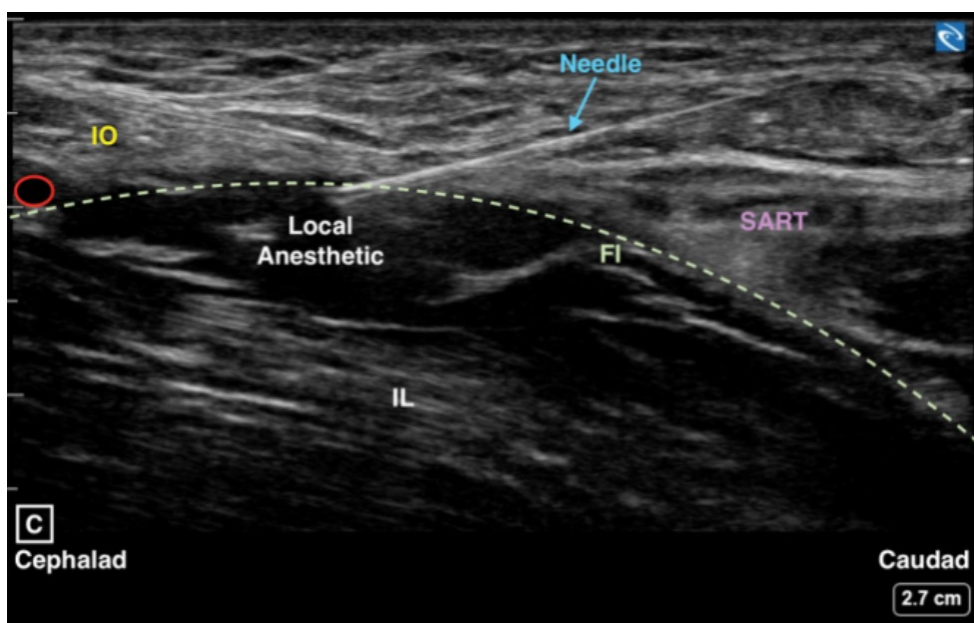


Lateral Femoral
Cutaneous Nerve

<https://www.acep.org/emultrasound/newsroom/apr2021/pericapsular-nerve-group-peng-block-for-patients-with-hip-or-pelvis-fractures-in-the-ed>

<https://www.kenhub.com/en/library/anatomy/lateral-femoral-cutaneous-nerve>

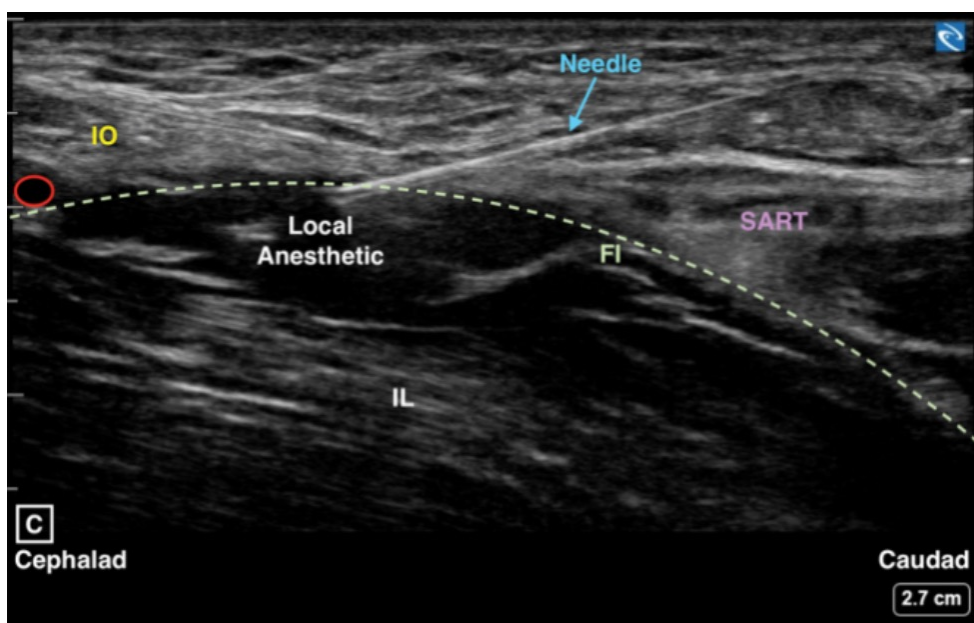
Suprainguinal Fascia Iliaca Block



The US-guided SIFIB, described by Hebbard in 2011 blocks the femoral and lateral femoral cutaneous nerve.

<https://www.asra.com/news-publications/asra-newsletter/newsletter-item/asra-news/2020/11/01/how-i-do-it-suprainguinal-fascia-iliaca-block>

Suprainguinal Fascia Iliaca Block



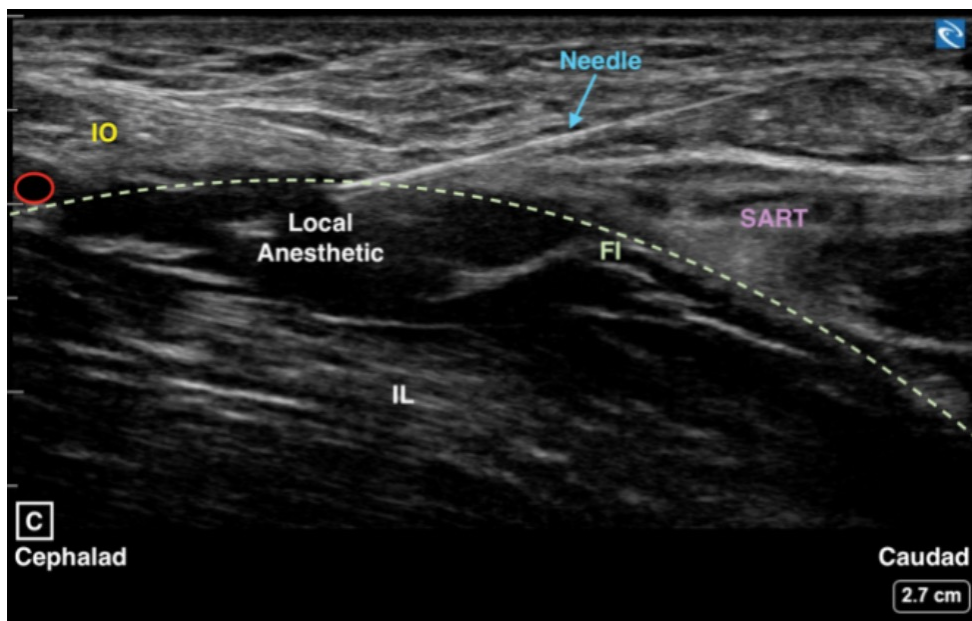
<https://www.asra.com/news-publications/asra-newsletter/newsletter-item/asra-news/2020/11/01/how-i-do-it-suprainguinal-fascia-iliaca-block>

A Longitudinal Supra-Inguinal Fascia Iliaca Compartment Block Reduces Morphine Consumption After Total Hip Arthroplasty

Matthias Desmet, MD,* Kris Vermeulen, MD,† Imré Van Herreweghe, MD,‡ Laurence Carlier, MD,‡
Filiep Soetens, MD,† Stijn Lambrecht, PharmD, PhD,§ Kathleen Croes, PharmD, PhD,§
Hans Pottel, PhD,|| and Marc Van de Velde, MD, PhD‡

Reg Anesth Pain Med. 2017 May/Jun;42(3):327-33.

Suprainguinal Fascia Iliaca Block



<https://www.asra.com/news-publications/asra-newsletter/newsletter-item/asra-news/2020/11/01/how-i-do-it-suprainguinal-fascia-iliaca-block>

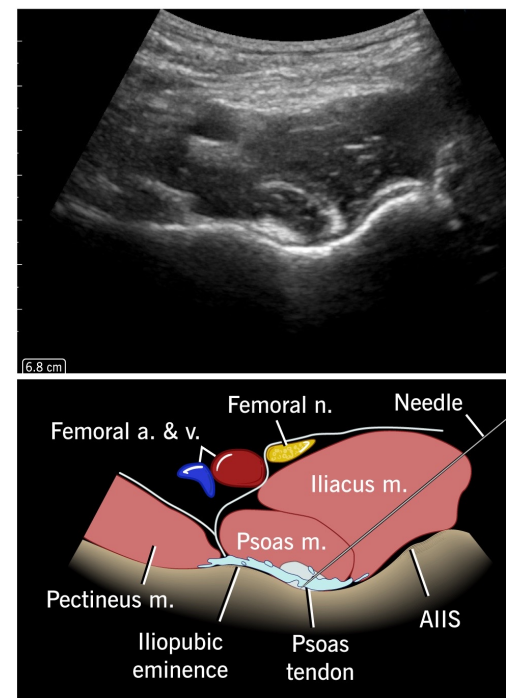
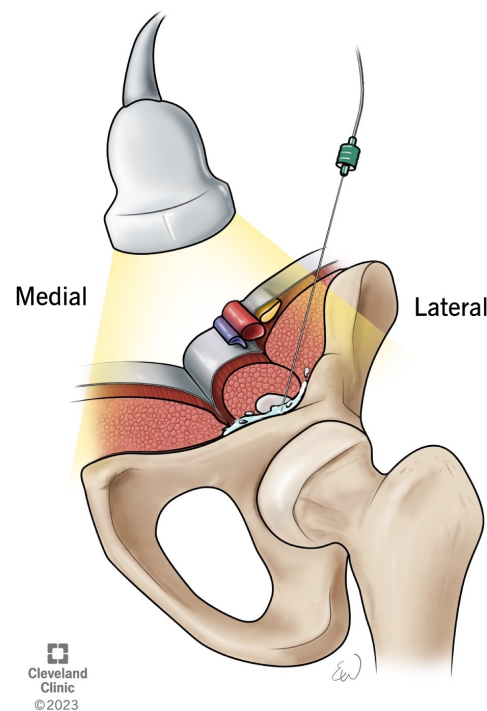
The US-guided SIFIB, described by Hebbard in 2011 blocks the femoral and lateral femoral cutaneous nerve.



Motor weakness

PENG Block

- Described in 2018, pericapsular nerve group (PENG) block, selectively targets the articular branches of the femoral and accessory obturator nerves while sparing their motor components



<https://www.asra.com/news-publications/asra-newsletter/newsletter-item/asra-news/2023/08/01/how-i-do-it-pericapsular-nerve-group-%28peng%29-block>

Aliste J, Layera S, Bravo D, Jara Á, Muñoz G, Barrientos C, Wulf R, Brañez J, Finlayson RJ, Tran Q. Randomized comparison between pericapsular nerve group (PENG) block and suprainguinal fascia iliaca block for total hip arthroplasty. Reg Anesth Pain Med. 2021 Oct;46(10):874-878.

PENG in THA

Year	Intervention	Study	Result
Mysore 2020	PENG + LIA	Retrospective study	Reduction in opioid consumption
Aliste 2021	PENG vs SIFIB	Randomized trial	Lower incidence of motor block
Pascarella 2021	PENG vs no block	RCT	- Lower max pain score - Reduction of opioid - better range of hip motion - shorter time to ambulation
Zheng 2022	PENG + LIA	RCT	- Difference in highest pain score in PACU but not after discharge - Lower intraoperative opioid & PONV, although similar levels of rescue opioid.
Kukreja 2023	PENG + MMA	RCT	- QoR at 24h and 48h higher & opioid use lower - No difference in pain score, distance to ambulation, or antiemetic use
Liang 2023	PENG + LFCN vs SIFIB	RCT	- Earlier postop walking time - Greater postop hip flexion & muscle strength

PENG in THA

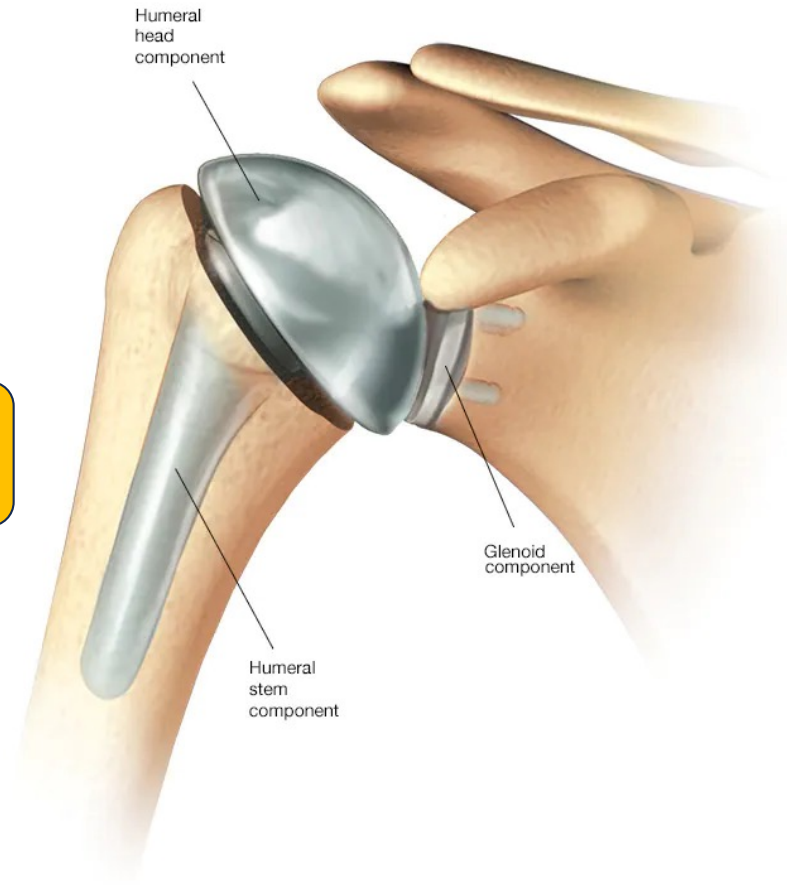
Year	Intervention	Study	Result
Mysore 2020	PENG + LIA	Retrospective study	Reduction in opioid consumption
Aliste 2021	PENG vs SIFIB	Randomized trial	Lower incidence of motor block
Pascarella 2021	✓ PENG is better than no block. ✓ Compared to SIFIB, lower incidence of motor block with similar pain control. ✓ Inconclusive as to whether it is helpful when there is LIA.		
Zheng 2022			
Kukreja 2023			
			- No difference in pain score, distance to ambulation, or antiemetic use
Liang 2023	PENG + LFCN vs SIFIB	RCT	- Earlier postop walking time - Greater postop hip flexion & muscle strength

Shoulder Arthroplasty



Interscalene Brachial Plexus Block

- Single injection
- Continuous peripheral nerve catheter



Shoulder Arthroplasty

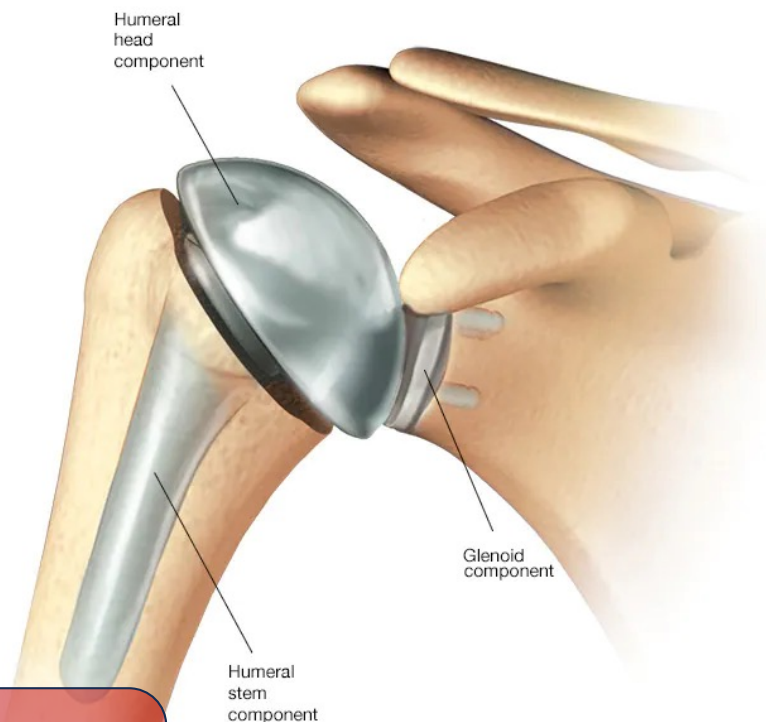


Interscalene Brachial Plexus Block

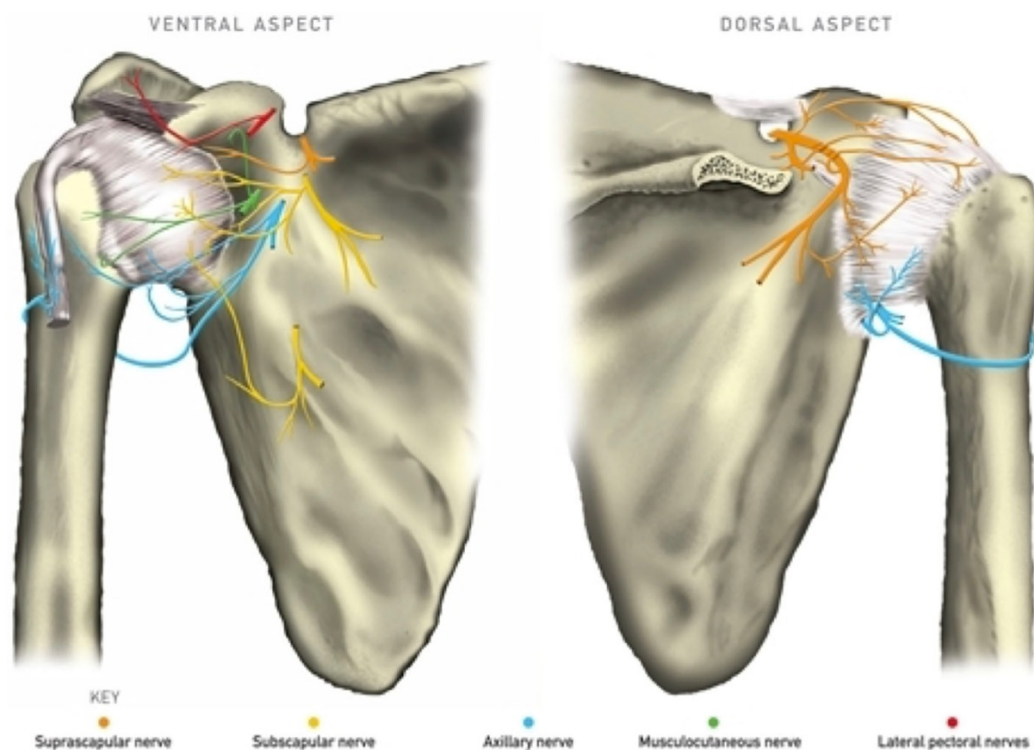
- Single injection
- Continuous peripheral nerve catheter



**100% Ipsilateral phrenic nerve block & diaphragmatic paralysis →
↓ 25% pulmonary function**



Phrenic-Sparing Shoulder Blocks



Suprascapular nerve

Subscapular nerve

Axillary nerve

Musculocutaneous n.

Lateral pectoral n.

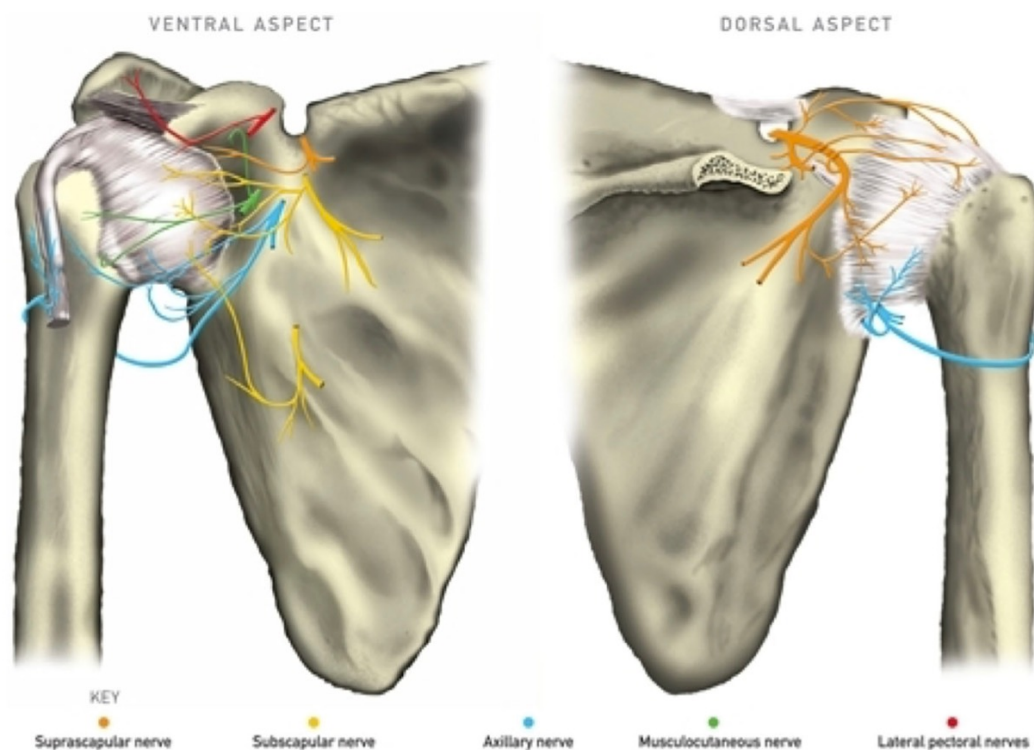
Mansfield JT, Desai MJ. Axillary Peripheral Nerve Stimulation for Painful End-Stage Primary Osteoarthritis of the Shoulder: A Case Report. *Neuromodulation*. 2020 Aug;23(6):878-880.

Hussain N et al. Suprascapular and Interscalene Nerve Block for Shoulder Surgery: A Systematic Review and Meta-analysis. *Anesthesiology*. 2017 Dec;127(6):998-1013.

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Phrenic-Sparing Shoulder Blocks



Suprascapular nerve

Axillary nerve

Mansfield JT, Desai MJ. Axillary Peripheral Nerve Stimulation for Painful End-Stage Primary Osteoarthritis of the Shoulder: A Case Report. *Neuromodulation*. 2020 Aug;23(6):878-880.

Hussain N et al. Suprascapular and Interscalene Nerve Block for Shoulder Surgery: A Systematic Review and Meta-analysis. *Anesthesiology*. 2017 Dec;127(6):998-1013.

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Suprascapular and Interscalene Nerve Block for Shoulder Surgery

A Systematic Review and Meta-analysis

Nasir Hussain, M.Sc., M.D., Ghazaleh Goldar, M.D. (Cand.), Neli Ragina, M.Sc., Ph.D.,
Laura Banfield, M.L.S., John G. Laffey, M.D., M.A., F.C.A.I., Faraj W. Abdallah, M.D.

- **Meta-analysis of 16 studies demonstrates suprascapular block results opioid consumption and pain scores similar to ISB**
- **Pain control may be better with ISB at 1h postop**
- **Reduced odds of block-related & respiratory complications**

Anesthesiology. 2017 Dec;127(6):998-1013.

Efficacy and safety of suprascapular nerve block combined with axillary nerve block for arthroscopic shoulder surgery: A systematic review and meta-analysis of randomized controlled trials

Jinlong Zhao^{a,b,1}, Nanjun Xu^{a,b,1}, Jiahui Li^{a,b,1}, Guihong Liang^{a,e}, Lingfeng Zeng^{a,e},
Minghui Luo^{a,e}, Jianke Pan^{a,e}, Weiyi Yang^{a,e,**}, Jun Liu^{a,c,d,*}

Purpose: Meta-analysis to compare efficacy & safety of SSNB + ANB and ISB versus SSNB alone

Results:

- 9 RCTs involving 543 cases
- Compared with SSNB alone, SSNB + ANB is more effective for pain relief and had higher patient satisfaction score
- No difference in pain score or patient satisfaction between SSNB + ANB and ISB
- Safety: SSNB + ANB reduced incidence of dyspnea > ISB

Selective Suprascapular and Axillary Nerve Block Versus Interscalene Plexus Block for Pain Control After Arthroscopic Shoulder Surgery *A Noninferiority Randomized Parallel-Controlled Clinical Trial*

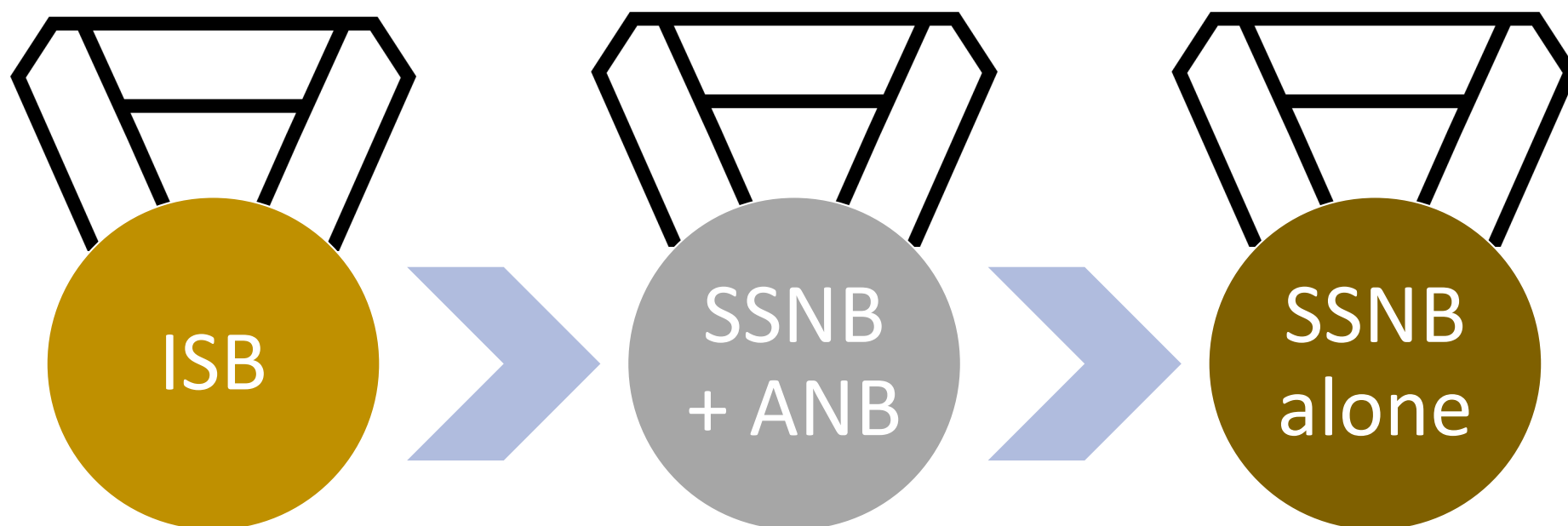
Anneleen Neuts, MD,*† Björn Stessel, MD, PhD,*‡§ Patrick F. Wouters, MD, PhD,† Carl Dierickx, MD,§||
Wilfried Cools, PhD,** Jean-Paul Ory, MD,* Jasperina Dubois, MD,* Luc Jamaer, MD,*
Ingrid Arijs, PhD,†† and Dirk Schoorens, MD*

Objective: SSNB + ANB non-inferior to ISB?

Results:

- N=100
- During 1st 4 hours after surgery, mean pain score was higher than 2.5 in SSB + ANB, but decreased to 1.1 at 8 hrs
- Opioid consumption was higher in the SSB + ANB group in 1st 8 hrs
- Incidence of dyspnea & discomfort was higher after ISB

Summary for Shoulder Surgery



Spine Surgery



Statistics

Spinal fusions in the US increased by 77% from 2002-2011

Volume of thoracolumbar spine surgeries expected to increase from 46,903 to 55,528 and posterior fusion surgeries 248,416 → 297,994 from 2020 to 2040



Analgesia

Up to 57% of patients undergoing elective major spine surgeries experience poor pain control after surgery



Chronic Pain

For every 10% of patients suffering from severe pain in the postoperative period, there is a 30% risk of development of chronic pain



FBSS

Failed Back Surgery Syndrome occurs in 10-40% of patients treated with lumbar spinal surgery

- Birnbaums JV et al. Efficacy of erector spine plane block in two different approaches to lumbar spinal fusion surgery: a retrospective pilot study. Front Med (Lausanne). 2024 Feb 14;11:1330446.
- Puvanesarajah V et al. Analgesic therapy for major spine surgery. Neurosurg Rev. 2015 Jul;38(3):407-18; discussion 419.
- Sikachi, R et al. Perioperative pain management for spine surgeries. International Anesthesiology Clinics 62(1):p 28-34, Winter 2024.

Outpatient Spine Surgery

With safer and more efficient techniques, some spinal surgeries are now possible as ambulatory procedures → growing interest in role of regional anesthesia

Lumbar Spine Procedures

Lumbar Discectomy
Lumbar Laminectomy
Lumbar Spinal Fusion

Cervical Spine Procedures

Anterior Cervical Discectomy and Fusion (ACDF)
Cervical Disc Replacement
Posterior Cervical Foraminotomy

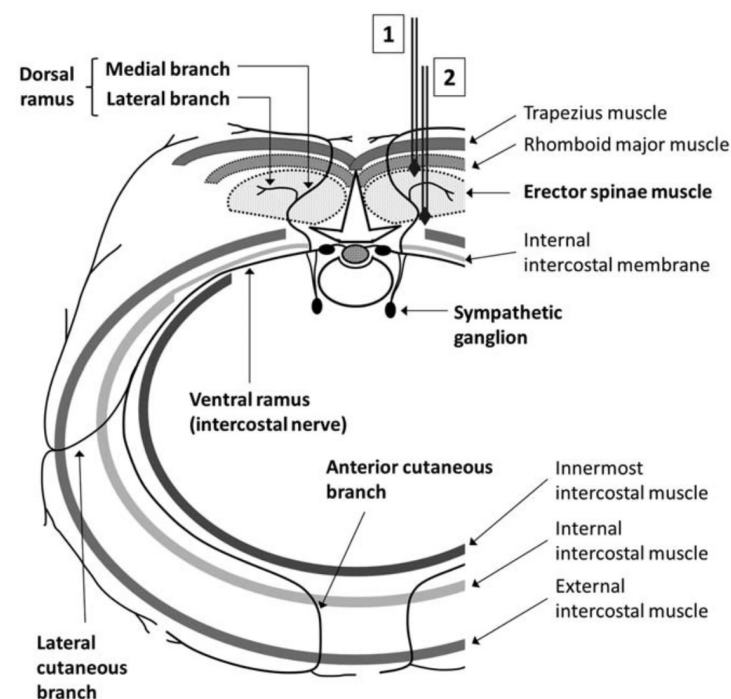
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CHRONIC AND INTERVENTIONAL PAIN

BRIEF TECHNICAL REPORT

The Erector Spinae Plane Block A Novel Analgesic Technique in Thoracic Neuropathic Pain

Mauricio Forero, MD, FIPP, Sanjib D. Adhikary, MD,† Hector Lopez, MD,‡
Calvin Tsui, BMSc,§ and Ki Jinn Chin, MBBS (Hons), MMed, FRCPC||*



Efficacy and Safety of Erector Spinae Plane Block for Perioperative Pain Management in Lumbar Spinal Surgery: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Meng-Yu Fu ¹, Jie Hao², Lun-Hui Ye³, Wei Jiang², Ying-Wen Lv¹, Jie-Liang Shen², Tao Fu¹

- Nineteen RCTs with 1381 participants
- ESPB group:
 - Lower intraoperative consumption of opioids
 - Lower total opioid consumption within 24h and 48h after surgery
 - Lower incidence of rescue analgesia
 - Longer time to 1st rescue analgesic & lower # of PCA button presses
 - Significantly lower pain scores at rest & on movement within 48h

Efficacy of erector spine plane block in two different approaches to lumbar spinal fusion surgery: a retrospective pilot study

Jānis Verners Birnbaums^{1,2*}, Agnese Ozoliņa^{1,2*},
Leonids Solovjovs³, Zane Glāzniece-Kagane², Jānis Nemme⁴
and Ināra Logina¹

- Analgesia for 7-9 hrs
- Prolongs time to rescue analgesia (~6 hrs)
- Decreased overall postoperative opioid consumption

Front Med (Lausanne). 2024 Feb 14;11:1330446.

ESP for Cervical Spine Surgery?

- Case reports by Goyal et al.
- Concerns for brachial plexus involvement as well as phrenic nerve paresis
- Selective blockade of the dorsal rami only would be more favorable

- Adamczyk K et al. Ultrasound-Guided Blocks for Spine Surgery: Part 1-Cervix. Int J Environ Res Public Health. 2023 Jan 23;20(3):2098.
- Kwon AH, Xu JL. Cervical erector spinae plane block: is it feasible for cervical spine surgeries? Reg Anesth Pain Med. 2021 Jun;46(6):552-553. doi: 10.1136/rapm-2020-101807. Epub 2020 Sep 7.

Paraspinal Interfascial Plane Blocks (PIP)

Selective blockade of the dorsal rami only

2017

Cervical Interfascial
Plane Block (CIP)

Multifidus Cervicis
Plane Block (MCP)

2018

Inter-semispinal Plane
Block (ISP)

2021

Retrolaminar

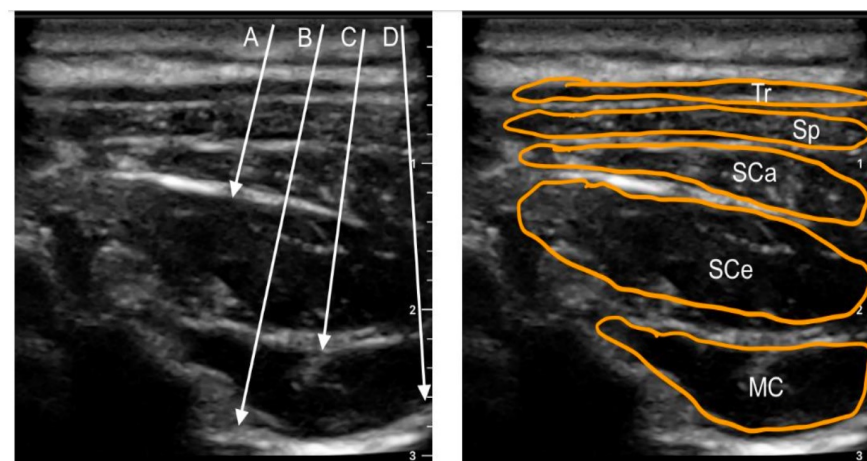


Figure 2. Transverse sonogram of the posterior neck area at the C5 level. The arrows indicate the needle trajectories for: A—inter-semispinal plane block; B—retrolaminar cervical block; C—multifidus cervicis plane block; D—cervical erector spinae plane block. MC—multifidus cervicis muscle; SCe—semispinalis cervicis muscle; SCa—semispinalis capitis muscle; Sp—splenius muscle; Tr—trapezius muscle.

Summary



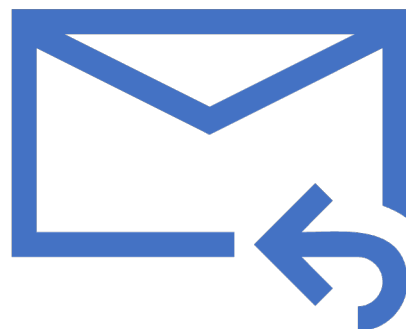
Due to the aging population, there is a rapid growth of orthopedic surgical volumes, including total joint arthroplasties and spine surgeries, many of which are being performed in an outpatient setting.



Anesthesiologists must be aware of the goals of TJA, which entails the use of regional anesthetics, many of which are becoming more tailored and motor-sparing.



Outpatient spine surgery is coming to your ASC and ESP blocks may play a pivotal role in analgesia and reducing the risk of chronic pain.



Thank you!

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AT THE FOREFRONT

UChicago Medicine