

Review

Evolution of Anesthetic Techniques for Shoulder Surgery: A Narrative Review

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Table S1. summary of the principal studies regarding anesthetic techniques for shoulder surgery.

Authors, year	Title	Study design	Outcomes/ Outcomes measures	Summary of findings
A. Ghaleb et al. 2012	Anesthesia for Shoulder Surgery: A Review of the Interscalene Block and a Discussion of Regional vs. General Anesthesia	Review	Review the performance of the interscalene block and discuss alternative choices for shoulder surgery, general anesthesia and a combined general/regional technique.	/
Sripada et al., 2012	Regional anesthesia procedures for shoulder and upper arm surgery upper extremity update-2005 to present	Review	Review of the literature since 2005 on developments of RA techniques commonly used for shoulder surgery.	The ISB provides effective analgesia with minimal complications; when combined with GA, ISB can be used in lower volumes and reducing the complications for shoulder and proximal upper extremity. USG ISB and SCB are both effective and safe for shoulder surgery with a low incidence of complications.
D.Y. Ding et al., 2017	Comparison of general versus isolated regional anaesthesia in total shoulder arthroplasty: A retrospective propensity-matched cohort analysis	A retrospective propensity-matched cohort analysis	In-hospital complications and 90-day readmission rates.	After total shoulder arthroplasty, isolated RA is associated with lower in-hospital complications, readmission rates and odds of hospital readmission than GA.
P.S. Sebel et al., 2004	The Incidence of Awareness During Anaesthesia: A Multicenter United States Study	Prospective, nonrandomized descriptive cohort study	BIS values associated with intraoperative awareness events.	The incidence of awareness with recall after general anesthesia (0.13%) in the US is comparable to that described in other countries. Assuming that approximately 20 million anesthetics are administered in the United States annually, approximately 26,000

				cases to occur each year.
A.R. Brown, 1993	Interscalene block for shoulder arthroscopy: comparison with general anesthesia	Comparative-study	The aim was to demonstrate that regional anesthesia has several benefits over general anesthesia for arthroscopic surgery, particularly in the ambulatory patient. The parameters taken into consideration: time from the start of administration of anesthetic until the incision was made; duration of surgery; postoperative side effects, including postoperative pain, nausea and vomiting, inability to void; number of patients requiring overnight hospital admission.	Interscalene brachial plexus block for shoulder arthroscopy is safe and effective, with a high degree of patient acceptance and satisfaction. Compared with general anesthesia, it results in significantly fewer complications and a shorter hospital stay, making this form of anesthesia ideal for outpatient surgery.
J.G. D'Alessio et al., 1995	A retrospective comparison of interscalene block and general anesthesia for ambulatory surgery shoulder arthroscopy	Retrospective comparative study	Total nonsurgical intraoperative time; use post-anesthesia care unit stay; unplanned admissions for therapy of severe pain, sedation, or nausea/vomiting.	Interscalene block should be considered as a viable alternative to general anesthesia for shoulder arthroscopy in ambulatory surgery patients.
C. Sun et al., 2021	Suprascapular nerve block is a clinically attractive alternative to interscalene nerve block during arthroscopic shoulder surgery: a meta-analysis of randomized controlled trials	Meta-analysis of randomized controlled trials	Comparison the impact of SSNB and ISB during shoulder arthroscopy surgery. Outcomes measures: VAS at rest VAS with movement Duration of PACU stay Patient satisfaction Opioid drugs consumption Nerve block-related complications	SSNB as an effective and safe analgesic technique and a clinically attractive alternative to interscalene block with the SSNB'S advantage of similar pain control, morphine use, and less nerve block-related complications during arthroscopic shoulder surgery, especially for severe chronic obstructive pulmonary disease, obstructive sleep apnea, and morbid obesity.

<p>S.S Liu et al., 2009</p>	<p>A Prospective, Randomized, Controlled Trial Comparing Ultrasound Versus Nerve Stimulator Guidance for Interscalene Block for Ambulatory Shoulder Surgery for Postoperative Neurological Symptoms</p>	<p>A Prospective, Randomized, Controlled Trial</p>	<p>This trial in order to determine whether ultrasound could reduce the incidence of postoperative neurological symptoms compared to nerve stimulator-guided interscalene blocks, for shoulder arthroscopy. A standardized neurological assessment tool (questionnaire and physical examination) designed by a neurologist was administered before surgery, at approximately 1 week after surgery and at approximately 4–6 weeks after surgery. Diagnosis of postoperative neurological symptoms was determined by a neurologist blinded to block technique.</p>	<p>Ultrasound reduces the number of needle passes needed to perform interscalene block and enhanced motor block at the 5 min assessment; however, not significant differences observed in block failures, patient satisfaction or incidence, and severity of postoperative neurological symptoms.</p>
<p>J.A. Lim et al., 2020</p>	<p>Comparison of ultrasound-guided and nerve stimulator-guided interscalene blocks as a sole anesthesia in shoulder arthroscopic rotator cuff repair</p>	<p>Retrospective study</p>	<p>To determine whether US-ISB reduces block failure rate and improves the quality of ISB relative to NS-ISB through comparison of the conversion ratio to general anesthesia and intraoperative use of analgesics and sedatives in arthroscopic rotator cuff tear surgery.</p>	<p>US-ISB is a more effective and safer approach for providing intense block to NS-ISB because it can decrease the incidence of conversion to general anesthesia and reduce the use of analgesics and sedatives during arthroscopic shoulder surgery.</p>
<p>N. Hussain et al., 2017</p>	<p>Suprascapular and Interscalene Nerve Block for Shoulder Surgery</p>	<p>Systematic Review and Meta-analysis</p>	<p>Comparison of the analgesic effect and safety of suprascapular block <i>versus</i> interscalene block for shoulder surgery through postoperative 24-h cumulative oral morphine consumption</p>	<p>There are no clinically meaningful analgesic differences between suprascapular block and interscalene block except for interscalene block providing better pain control during recovery room stay;</p>

			and analgesic and safety outcomes, particularly block-related and respiratory complications.	however, suprascapular block has fewer side effects. These findings suggest that suprascapular block may be considered an effective and safe interscalene block alternative for shoulder surgery.
M.S. Abrahams et al., 2009	Ultrasound guidance compared with electrical neurostimulation for peripheral nerve block: a systematic review and meta-analysis of randomized controlled trials	Systematic review and meta-analysis	The block success rate as the percentage of blocks which allowed patients to undergo a surgical procedure without supplementation or conversion to general anesthesia (GA) or spinal anesthesia (SA). Other outcomes: time to perform the block, onset time, duration of block and complications such as vascular puncture or persistent neurological symptoms.	US improves efficacy of peripheral nerve block compared with techniques that utilize PNS for nerve localization.
G. Pascarella et al., 2021	Triple Monitoring May Avoid Intra-neural Injection during Interscalene Brachial Plexus Block for Arthroscopic Shoulder Surgery: A Prospective Preliminary Study	A Prospective Preliminary Study	The aim: verify the clinical applicability, efficacy and sensitivity given by the triple monitoring (TM) method, a combination of US, NS and OIP, during the execution of the IBPB with a lateral approach for shoulder arthroscopy surgery and its ability to prevent an unsafe intra-neural injection.	Triple monitoring is a feasible technique that effectively identifies needle-to-nerve contact, which may potentially have implications for reducing nerve injury during IBPB for arthroscopic shoulder surgery. Ultrasound, NS, and OIP are synergistic, allowing for the optimal needle tip placement and preventing intra-neural injection of local anesthetic.
S. Dhir et al., 2016	A Comparison of Combined Suprascapular and Axillary Nerve Blocks to	Equivalence study	The aim: to prospectively assess and compare the analgesic effectiveness of SSAX with ISB for	Combined suprascapular and axillary nerve block provides non-equivalent

Interscalene Nerve Block for Analgesia in Arthroscopic Shoulder Surgery	arthroscopic shoulder surgery in a randomized controlled fashion.	analgesia compared with ISB after arthroscopic shoulder surgery. While SSAX provides better quality pain relief at rest and fewer adverse effects at 24 hours, ISB provides better analgesia in the immediate postoperative period. For arthroscopic shoulder surgery, SSAX can be a clinically acceptable analgesic option with different analgesic profile compared with ISB.	
A. Tognù et al., 2021	One needle insertion and one injection for a simple, safe and successful ultrasound-guided approach to interscalene brachial plexus block	Letter to the editor	The C6 nerve root is easy to identify by the US scout-scan of Chassaignac tubercle that represents a reproducible US landmark, increasing ISB safety and leading to one needle insertion and one injection without needle re-positioning.