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Comparison of patients undergoing general anesthesia or ultrasonography-guided interscalene block in shoulder surgery in terms of postoperative analgesia: A retrospective study

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MAIN POINTS

- This study demonstrated that when performed by experienced anesthesiologists using ultrasound guidance to minimize widespread postoperative pain during the first 24 hours after arthroscopic shoulder surgery; SBPB results in lower complication rates,
- Increased patient and surgeon satisfaction,
- Earlier mobilization, and a more comfortable surgical experience,
- Low analgesic consumption,
- Low VAS scores. Furthermore, patients undergoing ISBPB experienced shorter operative times. These positive results are contributing to the growing popularity of ISBPB among orthopedic shoulder surgeons.

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ABSTRACT

Aim: We aimed to evaluate the pain scores with visual analog scale and compare opioid consumption in the early postoperative period in cases where single-shote interscalene brachial plexus block and general anesthesia or general anesthesia alone have been applied for arthroscopic shoulder surgery.

Materials and Methods: Seventy-one patients, aged 18-65, who had undergone elective arthroscopic shoulder surgery were included in this study. Participants were allocated to one of two groups: the General Anesthesia (GA) group (n=36) or the Interscalene Block and General Anesthesia (ISBPB+GA) group (n=35). The severity of postoperative pain was evaluated using Visual Analog Scale (VAS) scores.

Results: The VAS scores and analgesic requirements of patients in the ISBPB+GA group were significantly lower than GA group. Although the duration of operation was shorter in the ISBPB+GA group (87.37±17.65 min), it did not reach statistical significance ($p>0.05$). Surgeon and patient satisfaction scores were higher in the ISBPB+GA group compared to patients who underwent GA alone.

Conclusion: The cases that underwent ISBPB+GA had notably lower pain scores and decreased additional analgesic consumption in the postoperative period. We believe that this anesthesia technique provides a more comfortable recovery process in patients undergoing shoulder surgery and can be safely utilized by experienced anesthesiologists.

Keywords: Interscalene block, Shoulder surgery, Postoperative analgesia

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INTRODUCTION

A significant challenge for patients undergoing shoulder surgery is postoperative pain. Approximately 45% of adult patients experience severe acute pain, which can complicate early mobilization and rehabilitation, negatively affecting their overall recovery and functional outcomes. Consequently, many methods have been developed to control this pain. If not adequately managed, this acute pain can also progress to chronic pain, driven by peripheral and central nervous system sensitization [1-4]. Regional techniques, such as the interscalene brachial plexus nerve block (ISBPB), are frequently employed in shoulder surgeries. They are valued both for their role as regional anesthesia and as a valuable component of postoperative multimodal analgesia. The adoption of these techniques is associated with a decrease in perioperative opioid consumption and a reduced frequency of opioid-

related adverse effects, including urinary retention, respiratory dysfunction, pruritus, hypotension, dyspeptic complaints, and ileus [5]. ISBPB is usually indicated for procedures involving the proximal upper extremity, such as the shoulder. It can also be used in the differential diagnosis of central and peripheral pain syndromes of the region. It can be safely performed to block sympathetic nerves in cases where stellate ganglion block is not possible [6]. In recent years, ultrasonography (USG)-guided peripheral nerve blocks have become popular. Ultrasonography (USG) facilitates improved sonoanatomical visualization of muscle, vascular, and nerve structures, thereby increasing the success rate of regional blocks and mitigating the risk of complications associated with blocks performed near nerve plexuses. The interscalene brachial plexus nerve block (ISBPB) is recognized for its efficacy in postoperative pain treatment and its ability to provide effective muscle relaxation [7,8]. The present study aimed to retrospectively analyze the postoperative pain scores and opioid analgesic requirements of our patients who underwent USG-guided ISBPB and general anesthesia in comparison to only general anesthesia alone during shoulder surgery.

MATERIALS AND METHODS

This retrospective study analyzed recorded pain and patient follow-up forms from patients who underwent shoulder surgery at the Orthopedics Clinic of Elazığ Fethi Sekin City Hospital between January and June 2019. The study received approval from the institutional review board (10.01.2019/01-03) and was conducted in accordance with the Declaration of Helsinki.

Patient selection

The study included 71 patients, aged 18-65 years, who underwent elective unilateral shoulder surgery for various clinical diagnoses. All included patients were categorized as American Society of Anesthesiologists (ASA) Physical Status I or II, received either general anesthesia alone or general anesthesia combined with an interscalene block, and had complete follow-up forms.

Patients receiving general anesthesia alone were assigned to Group GA (n=36), while those receiving general anesthesia with an interscalene block were assigned to Group ISBPB+GA (n=35). This sample size was determined based on a G*Power 3.10 analysis, which recommended at least 65 individuals with an alpha error of 0.05 and a beta error of 0.10 (power=0.90).

Patients were excluded if they had incomplete pain or patient follow-up forms, were outside the 18-65 age range, were in ASA Physical Status III-V risk groups, received upper extremity block solely for analgesia, received different peripheral nerve blocks, had neurological diseases or inflammatory joint diseases, a history of opioid use for other reasons.

Anesthesia and Block procedure

In the preoperative preparation area, all patients received intravenous access via an 18-gauge venous needle in the forearm, followed by 10 mL of balanced electrolyte solution. Sedation was achieved with 0.05 mg kg^{-1} intravenous midazolam. Non-invasive blood pressure, peripheral oxygen saturation (SpO_2), and cardiac monitoring via electrocardiogram (ECG) were performed for all cases.

Interscalene brachial plexus nerve blocks (ISBPBs) were administered by experienced anesthesiologists. Patients in the ISBPB group were positioned supine with their head turned away from the operative side. The skin in the ISBPB application area was sterilized with 10% povidone-iodine solution.

Under ultrasound guidance (USG), a high-frequency (8-12 MHz) linear probe (Philips-Healthcare, L22-2, probe, Cambridge, US) was placed vertically along the line of the cricoid cartilage and external jugular vein. The carotid artery and internal jugular vein were visualized anteromedially. The sternocleidomastoid (SCM) muscle was observed superficial to the brachial plexus, which was identified between the anterior and middle scalene muscles, lateral to the carotid artery. After identifying the C5-C7 nerve tract, the probe was rotated to visualize the round, hypoechoic images of the C5-7 nerve roots. Local anesthesia of the skin was performed using 1% lidocaine.

In addition to USG guidance, a peripheral nerve stimulator (Stimuplex, Braun, Melsungen, Germany) was used. To avoid intraneural injection, a 21-gauge 50 mm needle (Stimuplex® D16, B. Braun, Melsungen, Germany) was advanced using the in-plane technique. If motor movement in the distal deltoid muscle was observed at currents below 0.5 mA, and the response disappeared at currents below 0.2-0.3 mA, 15 mL of 0.5% bupivacaine (Bustesin® 0.5% VEM İlaç AS, Ankara, Turkey) was administered into the brachial plexus nerve sheath. The spread of the local anesthetic between the plexus and middle scalene fascia was confirmed by USG. Following local anesthetic injection, sensory changes and motor function (inability to extend the arm) were assessed every 5 minutes for the first 20 minutes. Successful block was defined as complete loss of motor function and positive pinprick sensory testing at the block onset.

General anesthesia was administered to all patients. Induction included 2-3 mg kg^{-1} propofol, 0.5 mg kg^{-1} vecuronium, and 2 μg kg^{-1} fentanyl. Anesthesia was maintained with sevoflurane in 50% O_2 + 50% air and 0.5 μg kg min^{-1} remifentanil. At the end of the surgical procedure, spontaneous breathing was achieved by antagonizing with 4 mg kg^{-1} sugammadex, followed by extubation. Patients were then transferred to the Post Anesthesia Care Unit (PACU).

Postoperative assessment and Pain management

Upon arrival in the postoperative recovery room, patients' Visual Analog Scale (VAS) scores (0: no pain, 10: unbear-

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Table 1. Demographic data and surgical procedures of the study groups.

	GA (N=36)	ISBPB+GA (N=35)	P value ∫
Gender (F/M) (%)	20(55.54)/16(44.46)	19(54.28)/16(45.72)	0.217*
Age (years)	52.2±13.7	51.7±15.2	0.367 ‡
Weight (kg)	73.3± 15.4	71.5±16.7	0.355 ‡
Height (cm)	171±9.7	169±10.8	0.426 ‡
BMI (kg/m²)	25.9±4.6	26.1±5.4	0.379 ‡
ASA I/II*(%)	14(38.88)/22(61.22)	15(42.86)/20(57.14)	0.141*
Surgical procedure	16/18/2	14/17/4	
(Subacromialprocedure/ rotator cuff repair/glenohumeroidal repair) (%)	(44.4/50.0/5.6)	(40.0/48.57/11.43)	0.673*

Data are presented as number (n) or mean ± SD, Qualitative variables were performed by Pearson chi-square and Fisher's Exact test-chi-square analysis. Quantitative data were presented as mean, and standard deviation. P-value of less than 0.05 was considered significant. (Chi-square-Fisher's Exact test, ‡ Independent Sample t-test. GA: General anesthesia, ISBPB: Interscalene Brachial Plexus Block, F: Female, M: Male, BMI: Body Mass Index, ASA: American Society of Anesthesiologists, SD: Standard Deviation, cm: centimeter, kg: kilogram).

Table 2. Data are presented as mean ± SD. (VAS: Visual Analog Scale, GA: General Anesthesia, ISBPB: Interscalene Brachial Plexus Block), ∫P<0.05 is statistically significant.

	GA (N=36)	ISBPB+GA (N=35)	P value ∫
Recovery	6.41±1.25	3.45±1.13	<0.001
2nd hour	5.61±1.47	3.26±1.17	<0.001
4th hour	4.98±1.16	3.01±1.57	<0.001
12th hour	4.41±1.07	3.02±0.97	<0.001
24th hour	3.96±1.27	2.83±0.91	<0.001

Data are presented as mean ± SD. (VAS: Visual Analog Scale, GA: General Anesthesia, ISBPB: Interscalene Brachial Plexus Block), ∫P<0.05 is statistically significant.

Table 3. Additional analgesic consumption in the study groups.

	GA (N=36)	ISBPB+GA (N=35)	P value ∫
Step 0	5 (13%)	19 (52.7%)	<0.001
Step 1	7 (19.44%)	6 (17.14%)	>0.05
Step 2	4 (11.11%)	5 (14.28%)	>0.05
Step 3	17 (47.22%)	6 (17.14%)	<0.001

Data are presented as N (%). (GA: General anesthesia, ISBPB: Interscalene Brachial Plexus Block), ∫P<0.05 is statistically significant.

able pain), mean arterial pressure (MAP), and heart rate (HR) were recorded at 2, 4, 12, and 24 hours postoperatively.

Postoperative pain management followed a step-wise protocol. Patients experiencing pain despite baseline treatment routinely received 500 mg paracetamol tablets three times a day (08:30, 12:30, and 20:30) and 75 mg diclofenac tablets twice a day (08:30 and 20:30). Intravenous analgesics were administered as needed based on pain severity, according to an 11-point Numerical Rating Scale (NRS) where 0 indicates no pain and 10 represents the worst imaginable pain:

- Step 0 (NRS 0–2): No additional analgesic.
- Step 1 (NRS 3–4): 1000 mg paracetamol.
- Step 2 (NRS 5–6): 30 mg ketorolac and 1000 mg paracetamol.
- Step 3 (NRS 7–10): 30 mg ketorolac, 1000 mg paracetamol, and 100 mg tramadol.

Additional analgesic consumption was recorded. Patient and surgeon satisfaction scores at discharge were assessed using a Likert scale (0: dissatisfied, 7: very satisfied)

Statistical analysis

Statistical analysis for this study was performed using SPSS 26 (International Business Machines Corporation, USA). Data are presented as the number of cases (N) or mean ± standard deviation (SD).

The Shapiro-Wilk test was used to assess the normality of data distribution between groups. For continuous variables with a normal distribution, Student's t-test was applied. The Mann-Whitney U test was used for comparisons between paired groups that did not conform to a normal distribution. Chi-square test or Fisher's exact test was utilized for the analysis of categorical variables. A p-value of <0.05 was considered statistically significant for all analyses.

RESULTS

The 71 patients who underwent various shoulder surgeries were included in the analysis of our study. Here's a revised version of your results section, focusing on clarity, conciseness, and impact. A total of 71 patients were included in the study: 36 received general anesthesia (GA) alone, and 35 received general anesthesia combined with an interscalene brachial plexus block (GA + ISBPB). There were no statistically significant differences in the demographic characteristics or surgical procedures between the two groups (p>0.05, Table 1).

The primary outcome of our study was the comparison of Visual Analog Scale (VAS) scores between the ISBPB+GA and GA groups on the day of surgery and at specific intervals during the first 24 postoperative hours. Secondary outcomes included additional analgesic consumption, surgical duration, anesthesia induction times, hemodynamic findings, length of hospital stay, and patient and surgeon satisfaction scores. When comparing VAS scores, patients in the ISBPB+GA group reported statistically significantly lower pain scores upon admission to the postoperative recovery room and at 2, 4, 12, and 24 hours postoperatively compared to the

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Table 4. Duration of surgery, anesthesia induction times, hemodynamic findings, length of hospital stay, and patient and surgeon satisfaction scores of the study groups.

	GA (N=36)	ISBPB+GA (N=35)	P value ∫
Duration of surgery (min)	99.18±25.13	87.37±17.65	˂0.001‡
Anesthesia induction time (min)	7.5±4.47	11.6±5.9	˂0.001†
Heart rate (beat min^{-1})	75.32±9.76	64.85±7.87	˂0.001**
Systolic arterial blood pressure (mm/Hg)	102.56±14.51	97.81±11.78	0.017**
Postoperative hospital length of stay (day)	2.15±0.73	2.11±0.71	0.81**
Patient satisfaction score	7±0.54	9±0.35	0.023**
Surgeon satisfaction score	7±0.87	9±0.63	0.018**

Data are presented as mean ± SD **, †Mann Whitney U test, ‡ Independent Sample t-test, ∫P<0.05 is statistically significant. (GA: General anesthesia, ISBPB: Interscalene Brachial Plexus Block, min: minutes).

GA group (p=0.001, Table 2). Furthermore, the ISBPB+GA group required significantly less additional analgesic in the early postoperative period (p<0.001, Table 3).

The mean intraoperative mean arterial pressure (MAP), mean heart rate (HR), and mean duration of surgery were significantly lower in the ISBPB+GA group compared to the GA group (p<0.05). Additionally, patient and surgeon satisfaction scores were higher in the ISBPB+GA group (p=0.023, p=0.018, respectively). However, there was no statistically significant difference in the duration of hospital stay between the groups (p>0.05, Table 4).

No life-threatening complications occurred in either group. Only one patient in the ISBPB+GA group developed recurrent laryngeal nerve paresis, which fully resolved within 24 hours after surgery. No local anesthetic toxicity was observed in the ISBPB+GA group.

DISCUSSION

The increasing frequency of arthroscopic shoulder surgery necessitates an anesthetic technique that is safe, effective, and provides both long-term analgesia and enables early mobilization. Postoperative pain is a significant challenge in these patients, leading to the use of various analgesic methods. While techniques like subacromial bursa block, intra-articular local anesthetic injection, oral analgesics, single-shot or continuous interscalene brachial plexus blocks (ISBPBs), suprascapular blocks, and axillary blocks have been employed for pain control [9,10], ISBPBs are widely considered the most effective [11].

The PROSPECT study, a comprehensive review of 59 randomized controlled studies on pain control in shoulder surgery, recommended single-shot ISBPB as a component of multimodal analgesia [12]. Similarly, a meta-analysis of randomized controlled trials (RCTs) evaluating single-shot ISBPB for shoulder surgeries, including rotator cuff repair, found it more effective than systemic analgesics or placebo [13]. However, this review also noted a short duration of analgesia (6 hours with movement and rest) and the occurrence of rebound pain at 24 hours [13].

Consistent with these findings, our study revealed statistically significantly lower VAS scores in the ISBPB+GA group across all measured time points. Notably, 91% of patients in the GA group required opioid analgesics upon admission to the recovery room, whereas none in the ISBPB+GA group required additional opioid intervention. Similarly, VAS scores and additional analgesic consumption at 2, 6, 12, and 24 hours were significantly lower in the ISBPB+GA group compared to the GA group. This reduction in opioid consumption is crucial, as opioid agonists can induce nausea and vomiting in the late postoperative period. Consequently, patient satisfaction in the ISBPB+GA group was high due to decreased opioid use.

While Fredrickson et al. reported that continuous ISBPB provides superior analgesia, faster recovery, and lower pain scores, particularly within the first 24 hours of movement, it carries a risk of complications. These include infection, local anesthetic toxicity, central neuraxial block, nerve damage, Horner's syndrome, phrenic nerve palsy, and a catheter dislodgement rate as high as 22% [14]. Given these potential complications, we opted for a single-shot ISBPB in our patients. Oh et al. also suggested that a single-shot interscalene block combined with continuous intrabursal local anesthetic infusion offers comparable analgesic efficacy to continuous interscalene catheters, presenting a safer alternative with fewer motor and sensory deficits [15]. Some studies, however, argue that continuous interscalene blocks are superior to single-shot blocks in reducing postoperative opioid consumption and pain, attributing this to a later onset of rebound pain after the maximum 12-hour effect of a single dose [16,17]. Despite this, our study demonstrated a statistically significant decrease in VAS scores at 24 hours postoperatively in the single-shot ISBPB group compared to the GA-only group. The most significant findings of our study were the remarkably lower pain levels in the ISBPB+GA group on the day of surgery, coupled with reduced additional analgesic consumption and higher patient and surgeon satisfaction.

ISBPB is generally considered superior to intra-articular injection or subacromial bursa block, techniques linked to serious complications such as chondrolysis [18-20]. Nevertheless, ISBPB itself can lead to acute and chronic complications, including pneumothorax, neurotoxicity, complex regional pain syndrome, and plexus injury [21]. During ISBPB, accidental spread of the local anesthetic or misdirection of the nee-

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dle tip can block the vagus, recurrent laryngeal, and sympathetic nerves [6]. Using ultrasound guidance (USG) with a nerve stimulator (Stimuplex needle) to elicit contractions in the pectoral, deltoid, arm, forearm, and hand muscles at 0.2-0.5 mA indicates a successful block. Conversely, contractions in the neck, trapezius, scapular, or pectoral muscles suggest the need for needle repositioning [6,8]. In line with Lehmann et al. [8], our approach of performing local anesthetic injection under USG guidance with a stimplex device improved block success and significantly reduced potential complications. While Lenters et al. [22] reported transient complications like brachial plexus injuries, respiratory, central nervous system, and cardiovascular issues associated with interscalene brachial plexus block, we encountered no chronic or life-threatening complications. Only one patient in the ISBPB group experienced recurrent laryngeal nerve paresis, which resolved completely within 24 hours. We believe that combining the Stimplex device with USG in ISBPB procedures significantly mitigates the risk of plexus damage and local anesthetic toxicity.

Despite the literature supporting ISBPB for shoulder surgeries, it has reported disadvantages, including the necessity for high practitioner experience, procedural time investment, increased cost, and the possibility of serious and long-term neurological complications [23,24]. In our study, ISBPB was performed by the most experienced anesthesiologists. However, the retrospective nature of our review and the exclusion of incomplete patient files limited our sample size for accurately evaluating complications. Additionally, patient file data were insufficient to assess long-term neurological complications.

Examination of intraoperative hemodynamic parameters revealed lower heart rate and systolic blood pressure in the ISBPB+GA group compared to the GA group. Controlled hypotension during shoulder surgery contributes to a more comfortable procedure and reduces bleeding risk. Studies indicate that effective analgesia, by reducing bleeding and enhancing arthroscopic visualization, yields positive outcomes in shoulder arthroscopy performed with ISBPB+GA [13-15,25]. In our research, we observed shorter operating times in the ISBPB+GA group, which contributes to reduced complication rates and costs.

Liu et al. [25] assessed pain scales in 62 patients undergoing rotator cuff repair, comparing those receiving general anesthesia alone with those receiving general anesthesia and a single dose of interscalene block. They found lower VAS scores during the first 12 hours and reduced opioid use in the first 6 hours in the ISBPB+GA group. Additionally, in the ISBPB group, rescue analgesics were not needed during the first 24 hours, although opioid requirements were similar on days 2 and 3 [25]. Our study similarly showed a significantly lower rate of rescue analgesic use in the ISBPB+GA group during the first 24 hours compared to the GA group. Wong et al. [26] explored different ropivacaine doses for ISBP, finding lower VAS scores and opioid consumption at 72 hours with 2% ropivacaine compared to 1%. Conversely, another study comparing 5 mL and 10 mL single-dose ropivacaine for ISBPB found no difference in pain scores or opioid consumption [27]. In our study, we aimed for standardization by including patients who received a single-shot ISBPB with 15 mL of 0.5% bupivacaine.

A meta-analysis involving 746 patients undergoing arthroscopic shoulder surgery indicated that ISBPB+GA, compared to GA alone, resulted in a lower heart rate, lower pain scores on the day of surgery and the following day, lower intraoperative systolic blood pressure, shorter extubation time, and a lower incidence of side effects [28]. Postoperative pain control is crucial for facilitating early mobilization in shoulder surgery patients [25,28]. In our study, all patients in the ISBPB+GA group experienced a decrease in the need for additional analgesics over a 24-hour period and achieved earlier mobilization compared to the GA group, aligning our findings with previous studies [25-28]. Although satisfaction rates were higher in the ISBPB+GA group, no significant difference in hospital stay duration was observed.

Limitations

This study has several limitations. First, the relatively small sample size, resulting from including only patients who received shoulder surgery with 15 mL of 0.5% bupivacaine for their blocks and excluding cases with incomplete file information, may impact the robustness of our findings. Second, preoperative pain intensity and analgesic use could influence rescue analgesic consumption and pain scores, but our patient files contained limited information regarding analgesic history. One of the most significant limitations is the lack of data from patient files to evaluate long-term upper extremity motor functions. We recommend future prospective randomized controlled studies to further investigate the long-term upper extremity motor functions of patients undergoing ISBPB for postoperative pain control after shoulder surgery.

CONCLUSION

The findings of this study indicate that ISBPB, when performed by an experienced team, is associated with low complication rates, a shortened duration of operation, and effective postoperative analgesia. These favorable outcomes contribute to the growing popularity of ISBPB among orthopedic surgeons for shoulder joint surgeries.

A part of this study was presented in the 58th Turkish Anesthesiology and Reanimation Congress with National and International Participation dated; Nov 28-Dec 1, 2024.

Ethics Committee Approval: The study was conducted by retrospectively examining the pain and patient follow-up forms recorded in the files of patients who underwent shoulder surgery between January 2019 and June 2019, at Elazığ Fethi Sekin City Hospital Orthopedics clinic, after receiving approval from the Ethics Committee of Fırat University Faculty

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REFERENCES

1. Kumara AB, Gogia AR, Bajaj JK, Agarwal N: Clinical evaluation of post-operative analgesia comparing suprascapular nerve block and interscalene brachial plexus block in patients undergoing shoulder arthroscopic surgery. *J Clin Orthop Trauma.* 2015;7(1):34–9. doi: 10.1016/j.jcot.2015.09.003
2. Carr DB., Goudas LC. Acute pain. *Lancet.* 1999;353(9169):2051–2058. doi: 10.1016/S0140-6736(99)03313-9.
3. Samad TA, Moore KA, Sapirstein A. et al. Interleukin1 β-mediated induction of Cox-2 in the CNS contributes to inflammatory pain hypersensitivity. *Nature.* 2001;410(6827):471-5. doi: 10.1038/35068566.
4. Woolf CJ, Salter MW. Neuronal plasticity: increasing the gain in pain. *Science.* 2000;288(5472):1765–1768. doi: 10.1126/science.288.5472.1765.
5. Morey TE, Wright TW, Chidgey LK, Enneking FK. Continuous interscalene brachial plexus block for postoperative pain control at home: a randomized, doubleblinded, placebo-controlled study. *Anesth Analg.* 2003;96(4):1089–95. doi: 10.1213/01.ANE.0000049824.51036.EF
6. Erdine S. Regional Anesthesia. Peripheral Nerve Blocks pages (83-91). 2nd Edition. 2008; Nobel Medicine Bookstore, Istanbul, Turkey.
7. Wu CL, Rouse LM, Chen JM, Miller RJ. Comparison of postoperative pain in patients receiving interscalene block or general anesthesia for shoulder surgery. *Orthopedics.* 2002;25:45-8. doi: 10.3928/0147-7447-20020101-15.
8. Lehmann LJ, Loosen G, Weiss C, Schmittner MD. Interscalene plexus block versus general anaesthesia for shoulder surgery: a randomized controlled study. *Eur J Orthop Surg Traumatol.* 2015;25(2):255–261. doi: 10.1007/s00590-014-1483-3.
9. Fredrickson MJ, Krishnan S, Chen CY. Postoperative analgesia for shoulder surgery: a critical appraisal and review of current techniques. *Anaesthesia.* 2010;65:608-624. doi: 10.1111/j.1365-2044.2009.06231.x.
10. Calvo E, Torres MD, Morcillo D, Leal V. Rotator cuff repair is more painful than other arthroscopic shoulder procedures. *Arch Orthop Trauma Surg.* 2019;139(5):669-674. doi: 10.1007/s0040 2-018-3100-0.
11. Bowens C Jr, Sripada R. Regional blockade of the shoulder: approaches and outcomes. *Anesthesiol Res Pract.* 2012:971963. doi: 10.1155/2012/971963.
12. O.Toma, B.Persoons, E.Pogatzki-Zahn, M.Van de Velde and G.P.Joshi on behalf of the PROSPECT Working Group collaborators. PROSPECT guideline for rotator cuff repair surgery: systematic review and procedure-specific postoperative pain management recommendations. *Anaesthesia.* 2019;74,1320–1331. doi:10.1111/anae.14796.
13. Abdallah FW, Halpern SH, Aoyama K, Brull R. Will the real benefits of single-shot interscalene block please stand up? A systematic review and meta-analysis. *Anesth Analg.* 2015;120(5):1114–29. doi: 10.1213/ANE.0000000000000688.
14. Fredrickson MJ, Ball CM, Dalgleish AJ. Analgesic effec tiveness of a continuous versus single-injection inter scalene block for minor arthroscopic shoulder surgery. *Reg Anesth Pain Med.* 2010;35:28-33. doi: 10.1097/AAP.0b013e3181c771bd.
15. Oh JH, Rhee KY, Kim SH, Lee PB, Lee JW, Lee SJ. Comparison of analgesic efficacy between single inter scalene block combined with a continuous intra-bursal infusion of ropivacaine and continuous interscalene block after arthroscopic rotator cuff repair. *Clin Orthop Surg.* 2009;1:48-53. doi: 10.4055/cios.2009.1.1.48.
16. Salviz EA, Xu D, Frulla A, Kwofie K, Hadzic A et al. Continuous interscalene block in patients having outpatient rotator cuff repair surgery: a prospective randomized trial. *Anesth Analg.* 2013;117(6):1485–1492. doi: 10.1213/01.ane.0000436607.40643.0a.
17. Kim JH, Koh HJ, Kim DK, Lee HJ, Kwon KH et al. Interscalene brachial plexus bolus block versus patient controlled interscalene indwelling catheter analgesia for the first 48 hours after arthroscopic rotator cuff repair. *J Shoulder Elbow Surg.* 2018;27(7):1243–1250. doi: 10.1016/j.jse.2018.02.048
18. Beaudet V, Williams SR, Tetreault P, Perrault MA. Perioperative interscalene block versus intra-articular injection of local anesthetics for postoperative analgesia in shoulder surgery. *Reg Anesth Pain Med.* 2008; 33:134–138. doi: 10.1016/j.rapm.2007.10.005
19. Busfield BT, Romero DM. Pain pump use after shoulder arthroscopy as a cause of glenohumeral chondrolysis. *Arthroscopy.* 2009;25:647–652. doi: 10.1016/j.arthro.2009.01.019.
20. Laurila PA, Lopponen A, Kanga-Saarela T, Flinkkila T, Salomaki TE. Interscalene brachial plexus block is superior to subacromial bursa block after arthroscopic shoulder surgery. *Acta Anaesthesiol Scand.* 2002;46:1031–1036. doi: 10.1034/j.1399-6576.2002.460818.x.
21. Borgeat A, Ekatodramis G, Kalberer F, Benz C. Acute and nonacute complications associated with interscalene block and shoulder surgery: a prospective study. *Anesthesiology.* 2001;95(4):875-80. doi: 10.1097/00000542-200110000-00015
22. Lenters TR, Davies J, Matsen FA. The types and severity of complications associated with interscalene brachial plexus block anesthesia: local and national evidence. *J Shoulder Elbow Surg.* 2007;16(4):379–387. doi: 10.1016/j.jse.2006.10.007.
23. Warrender WJ, Syed UA, Hammoud S, et al. Pain management after outpatient shoulder arthroscopy: a systematic review of randomized controlled trials. *Am J Sports Med.* 2017;45:1676-86. doi: 10.1177/0363546516667906
24. Buise MP, Bouwman RA, van der Gaag A, Piot V, Korsten HH. Phrenic nerve palsy following interscalene brachial plexus block; a long lasting serious complication. Acta Anaesthesiol Belg 2015;66: 91-4. PMID: 26767234
25. Liu XN, Noh MN, Yang CJ, Kim U, Chung MH et al. Effects of a Single-Dose Interscalene Block on Pain and Stress Biomarkers in Patients Undergoing Arthroscopic Rotator Cuff Repair: A Randomized Controlled Trial. *Arthroscopy.* 2017;33(5):918-926. doi: 10.1016/j.arthro.2016.09.018.
26. Wong AK, Keeney LG, Chen L, Williams R, Liu J, Elkassabany NM. Effect of Local Anesthetic Concentration (0.2% vs 0.1% Ropivacaine) on Pulmonary Function, and Analgesia After Ultrasound-Guided Interscalene Brachial Plexus Block: A Randomized Controlled Study. *Pain Med.* 2016;17(12):2397-2403. doi: 10.1093/pm/pnw057.
27. Lee JH, Cho SH, Kim SH, Chae WS, Jin HC, Lee JS, Kim YI. Ropivacaine for ultrasound-guided interscalene block: 5 mL provides similar analgesia but less phrenic nerve paralysis than 10 mL. *Can J Anaesth.* 2011;58(11):1001-6. doi: 10.1007/s12630-011-9568-5.
28. Yan S, Zhao Y, Zhang H. Efficacy and safety of interscalene block combined with general anesthesia for arthroscopic shoulder surgery: A meta-analysis. *J Clin Anesth.* 2018;47: 74-79. doi: 10.1016/j.jclinane.2018.03.008.

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