ORIGINAL ARTICLE

Lung Ultrasound Assessment of Diaphragm Sparing Function After Ultrasound Guided Combined Suprascapular/ Axillary Nerve Blocks or Erector Spinae Plain Block for Shoulder Arthroscopy Analgesia A Controlled Comparative Study

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Abstract

Background: ***Shoulder surgery is characterized by relatively high intraoperative and postoperative pain. Reduction in postoperative pain is essential to promote rehabilitation and increase patient satisfaction. Opioid medications are commonly used to reduce postoperative pain; however, they have significant drawbacks, including side effects and possibly leading to dependency.***

Aim and objectives: ***This study aims to compare the diaphragmatic function after a shoulder arthroscopic surgery procedure using ultrasonography of the lungs following an ultrasound-guided combined suprascapular (SSNB) and axillary nerve block (AN) as opposed to an erector spinae plane block (ESPB) or an interscalene brachial plexus block (ISPB).***

Subjects and methods: ***From March 2023 through January 2025, 93 patients on the shoulder arthroscopy waiting list at Al-Azhar University Hospitals in Cairo, Egypt (specifically, Al-Hussein and Bab El-Sharia) were enrolled in this prospective randomized controlled clinical trial.***

Results: ***The ISPB group experienced a significant decrease in heart rate and mean arterial pressure compared to the SSNB+ANB and ESPB groups. As regard the diaphragmatic excursion measurements, which is a key focus of this study, our results indicate that the ISPB group had significantly lower diaphragmatic excursion compared to the SSNB+ANB and ESPB groups.***

Conclusion: ***While ISPB provides superior pain control and reduces opioid consumption, the combined SSNB and ESPB offer advantages in terms of diaphragmatic function preservation and hemodynamic stability.***

Keywords: Ultrasound; ESPB; ISPB; Shoulder arthroscopy

1. Introduction

Even after beginning a regimen of multimodal analgesics, postoperative pain may last for up to 48 hours. There are a lot of pain management therapy options out there, but each one comes with its own set of pros and cons. Reduced platelet function, longer bleeding time, and stomach ulcers are side effects of nonsteroidal anti-inflammatory medications (NSAIDs). Side effects of opioids include drowsiness, constipation, vomiting, nausea, and intestinal ileus.[1]

The interscalene brachial plexus block (ISPB) has been the gold standard in regional anesthesia for shoulder surgeries for decades due to its proven ability to deliver superior analgesia. Phrenic nerve palsy can occur in as few as one in ten cases, according to some research. Interscalene block is linked to Horner's syndrome, hoarseness of voice, dense motor blockade, and hemi-diaphragmatic paresis, as well as a 25-30% decrease in pulmonary function, which can lead to symptomatic dyspnea or desaturation.[2]

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The risks associated with intraoperative spinal plexus blockade (ISPB) are numerous and serious. It has been used for pain management and intraoperative anesthesia, but it can also accidentally administer epidural or spinal anesthesia, cause brain damage or spinal cord injury, paralyze vagus and laryngeal recurrent nerves, cervical sympathetic nerve, and pneumothorax.[3]

A new method for administering anesthesia and relieving pain after surgery in this group of patients is a combination of suprascapular and axillary nerve blocks, which is referred to as SSNB+ANB. Both of these nerve blocks deprive the shoulder of its sensory innervation. Because it does not cause respiratory impairment as a result of phrenic nerve palsy or other major consequences, SSNB+ANB is beneficial to the interscalene brachial plexus block.[4]

Another new block is the erector spinae plane block (ESPB). Depending on the injection site and the way it works, this interfascial plane block could be considered a paraspinal block. A small number of case reports have shown promising results in the treatment of acute postoperative and chronic shoulder pain using ESPB.[5]

The aim of this study was to evaluate the diaphragmatic function via lung ultrasound after ultrasound-guided combined SSNB and AN versus ESPB in comparison to ISPB used for postoperative analgesia after shoulder arthroscopic surgery.

2. Patients and methods

From March 2023 through January 2025, 93 patients hospitalized at Al-Azhar University Hospitals in Cairo, Egypt, for shoulder arthroscopy were included in this prospective randomized double-blind controlled clinical trial. The hospitals are located in Al-Hussein and Bab El-Sharia. Following the institution's ethical committee's clearance.

Inclusion criteria:

Shoulder arthroscopy procedures utilizing general anesthesia were scheduled for patients ranging in age from 21 to 60 years, with both sexes and ASA classifications of I and II.

Exclusion criteria:

Patient refusal, history of bleeding diathesis, known local anesthetics allergy, infection of the skin at the site of the needle puncture, neurological disorders, psychological instability, and dependency on chronic pain medications.

Randomization and blindness:

Patients were randomly allocated with a 1:1:1 allocation ratio into three groups in a parallel manner: Group I (ISBP) (n=31): patients received an interscalene brachial plexus block, Group II (SSNB+ANB)(n=31): patients received a combined suprascapular and axillary nerve block, and Group III (ESPB)(n=31): patients received erector spinae plane block. All blocks were done following general anesthesia induction; 20ml of 0.25% bupivacaine(50mg) was used for the unilateral blocks.

Methodology:

Preoperative:

The patients underwent a thorough clinical examination, standard laboratory tests, and a review of their medical and surgical histories. Postoperative pain assessment using the numeric rating scale (NRS) was a topic of instruction for all patients. NRS (interval 0–10) On a scale from 0 (no pain) to 10 (the worst pain possible).[6]

Preoperative monitoring:

All patients were premedicated with midazolam(3mg), ondansetron(4mg), cefotaxime 2gm, and dexamethasone(8mg) intravenously 30 minutes prior to surgery for sedation and prevention of postoperative nausea and vomiting.

Intraoperative:

As a rule, patients were monitored using pulse oximetry, electrocardiogram (lead II), non-invasive blood pressure (mmHg), and capnography. All patients were put to sleep for endotracheal intubation by inducing general anesthesia with intravenous propofol (2mg/kg), fentanyl (2μg/kg), and cis-atracurium (0.15mg/kg). To keep the endotracheal carbon dioxide (EtCO2) level at 35±2mmHg, mechanical ventilation was started after endotracheal intubation using an appropriate reinforced (armored) tube, and the ventilator settings were modified based on the patient's age.

The anesthesia was sustained by inhaling a mixture of 1.2%-1.4% isoflurane with 100% oxygen to achieve the required hypotension. On demand, cis-atracurium was administered intravenously at a dose of 0.03 mg/kg to keep the muscles relaxed.

Ultrasound-guided Diaphragm Assessment:

An investigator, who was not informed about the participants' groups, measured the diaphragmatic thickness during maximal inspiration and expiration at the anterior axillary line and bilateral diaphragmatic excursion before patients were discharged from the PACU. The measurements were taken using an ultrasound machine (Sonosite EdgeTM, FUJIFILM Sonosite Inc., USA), and variations in the number of intercostal spaces and diaphragmatic motion were evaluated. Clinically significant diaphragmatic affection was defined as a 50% decrease in ipsilateral diaphragmatic mobility relative to baseline (before GA introduction). We also compared changes in contralateral diaphragmatic motion to changes in ipsilateral measurement because diaphragmatic excursion can decrease due to surgery, anesthesia, and opioid pain medications.

Interscalene Plexus Block:

In order to do US ISPB, patients were placed in a semi-lateral position with their necks stretched to the opposite side. Following the application of sterile skin, the interscalene groove was examined with a 5-13MHz probe to reveal the brachial plexus. Along the same transverse plane as the US probe, a 5cm 22G needle was inserted. For the spread to be visible immediately posterior to or between the C5 and C6 nerve roots, 20 ml of 0.25% bupivacaine was administered.

Figure 1. US-guided ISBP.

Anterior approach for suprascapular nerve block:

Ultrasound was used to confirm the location of the posterolateral brachial plexus and supraclavicular fossa, which were found after the skin was cleansed with an antiseptic solution. Following this, the probe was advanced cranially to localize the ventral rami of the C5 and C6 nerves, and the brachial plexus was scanned back and forth.

Going back to where the C5 and C6 nerves converged allowed us to locate the superior trunk of the brachial plexus. After moving further away, the course of the suprascapular nerve (SSNB) was followed beneath the omohyoid muscle; this nerve was determined to have its origins in the superior trunk or ventral ramus of the C5 nerve. Once the aspiration of blood was confirmed to be negative and there was no pain or resistance during injection, a 10-milliliter volume of 0.25 bupivacaine was given using a block needle that was put in-plane to the probe.

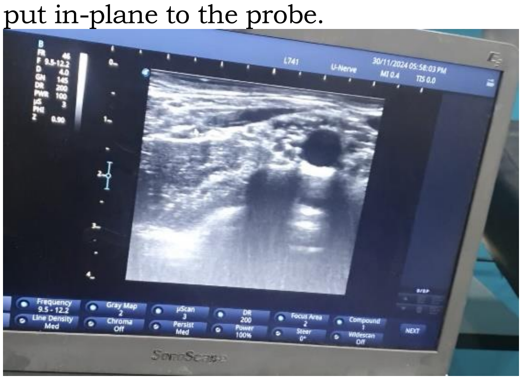

Figure 2. US-guided anterior approach for SSNB.

Axillary Nerve Block:

Following a thorough cleansing with an antiseptic solution, the ultrasonography probe was used to image the back of the humerus in both the long- and short-axis views, revealing the circumflex artery and the axillary nerve. Then, 10 milliliters of 0.25% bupivacaine was injected onto the back of the humerus.

Figure 3. US-guided ANB.

Erector Spinae Plane Block:

Thanks to the sagittal line, we were able to place the probe two or three centimeters laterally opposite the T2 spinous process. By physically counting down from the vertebra prominence (C7), we were able to identify the T2 spinous process, and by using real-time ultrasound guidance, we were able to view the T2 transverse process starting at the first rib. The erector spinae muscles were evident above the T2 transverse process. The needle was implanted in a caudal-cranial direction using the in-plane method. The linear distribution of the solution could be seen after injecting 20 mL of 0.25% bupivacaine, thanks to the interfacial plane.

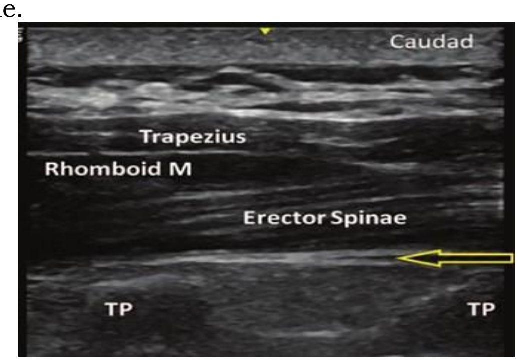

Figure 4. US guided ESPB.

After each group's surgery, the anesthetic was withdrawn and any remaining neuromuscular blockage was treated with neostigmine (0.05 mg/kg) and atropine (0.02 mg/kg). Extubation was then performed after good, regular tidal volume was taken and airway protective reflexes had recovered.

Postoperative:

In the time following surgery, a regular pain medication schedule was given. Paracetamol 1 gm every 8 hours was administered to all patients as a usual analgesic in the first 24 hours after surgery. If the patient's respiration rate was more than 10 breaths per minute, they were given an IV dose of morphine (0.04 mg/kg) as a rescue drug, with a maximum dose of 0.2 mg/kg, and their intake was documented.

The adverse effects in the PACU were also evaluated: intravenous fluid was used to treat hypotension (a 20% decrease in basal mean arterial blood pressure), intravenous atropine (0.02 mg/kg) was used to treat bradycardia (a 20% decrease in basal heart rate), respiratory depression (a SpO2<95% and the need for O2 supplementation) was treated with ondansetron 0.1 mg/kg IV, and postoperative nausea and vomiting (PONV) was treated with ondansetron.

Statistical Analysis:

IBM's Chicago-based SPSS v27 was used for statistical analysis. The Shapiro-Wilks test and histograms determined data normality. Mean and SD were used to illustrate quantitative parametric data, which were tested using an ANOVA (F) and Tukey post hoc test. A Kruskal-Wallis test with a modified Bonferroni adjustment was used to compare each group. Median and interquartile range were used for quantitative non-parametric data. Using the Chi-square test, qualitative variables were presented as frequency and percentage. A two-tailed P-value <0.05 was used to define statistical significance.

Primary outcome:

The goal was to examine how used blocks affect diaphragmatic excursion.

Secondary outcomes:

During the first twenty-four hours following surgery, variables such as opioid consumption, duration until analgesia was needed for the first time, pain scores, and problems involving nerve blocks were carefully monitored.

3. Results

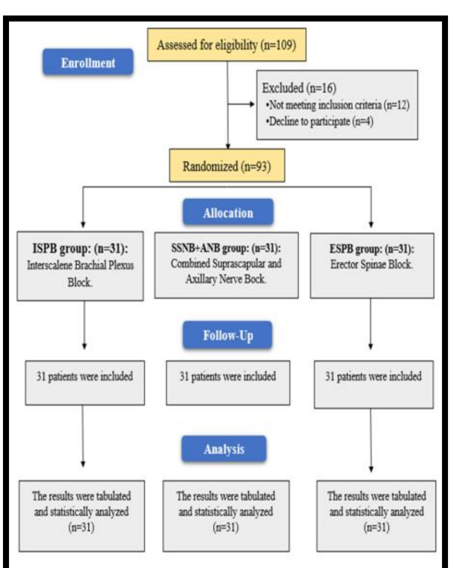

Figure 5. enrolled patients' CONSORT flowchart

Table 1. The investigated groups' demographic information, length of operation, and length of anesthesia.

	ISPB GROUP (N=31)	SSNB+ANB GROUP (N=31)	ESPB GROUP (N=31)	P-VALUE
AGE(YEARS)	38.9±11.86	42.5±14.32	41.3±11.23	0.515
SEX MALE	23(74.19%)	20(64.52%)	22(70.97%)	0.699
FEMALE	8(25.81%)	11(35.48%)	9(29.03%)	
WEIGHT(KG)	71.5±10.55	71.4±11.09	66±10.9	0.083
HEIGHT(M)	1.68±0.07	1.67±0.07	1.68±0.06	0.741
BMI(KG/M^2)	25.3±3.64	25.7±4.39	23.8±3.71	0.122
ASA PHYSICAL STATUS I	17(54.84%)	15(48.39%)	19(61.29%)	0.594
II	14(45.16%)	16(51.61%)	12(38.71%)	
DURATION OF SURGERY(MIN)	102.6±4.81	101.9±7.15	99.2±7.31	0.101
DURATION OF ANESTHESIA(MIN)	150.6±4.23	149.4±5.88	152.1±3.82	0.079

BMI:Body mass index, ASA:American Society of Anesthesiologists.

Age, sex, weight, body mass index, ASA physical status, duration of operation, and duration of anesthesia were all variables in which the three groups showed little variation.

Table 2. Intraoperative HR measurements of the groups under study.

	ISPB GROUP (N=31)	SSNB+ANB GROUP (N=31)	ESP GROUP (N=31)	P-VALUE	POST HOCK
BASELINE	77.97±10.05	81.52±7.74	82.71±8.78	0.099	
30MIN	73.03±8.14	80.26±7.84	81.19±8.58	<0.001*	P1=0.002* P2=0.001* P3=0.895
60MIN	71.48±6.87	78.81±7.57	79.10±8.41	<0.001*	P1<0.001* P2<0.001* P3=0.895
90MIN	70.32±6.88	80.22±7.70	83±8.06	<0.001*	P1<0.001* P2<0.001* P3=0.397
END OF SURGERY	78.97±7.34	81.10±7.50	81.84±8.55	0.328	

*:Significantly at P-value<0.05 P1:P-value between groups ISPB and SSNB+ANB,

P2:P-value between group ISPB and ESP, P3:P-value between group SSNB+ANB and ESP.

The ISPB group's intraoperative heart rate was considerably lower than that of the ESP and SSNB+ANB groups at 30 minutes, 60 minutes, and 90 minutes (P-value<0.05), and it was not statistically different from that of the ESP and SSNB+ANB groups at baseline or at the end of surgery, (table 2; figure 6).

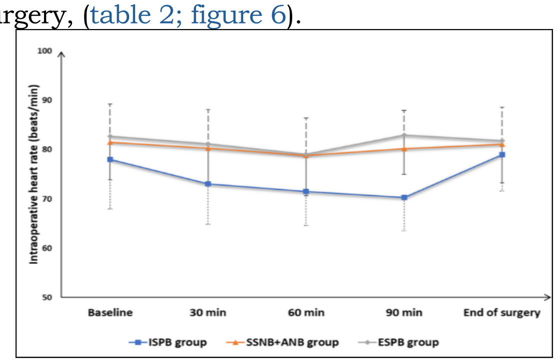

Figure 6. Intraoperative HR of studied patients.

Table 3. Intraoperative MAP measurements of the studied groups.

	ISPB GROUP (N=31)	SSNB+ANB GROUP(N=31)	ESP GROUP (N=31)	P-VALUE	POST HOCK
BASELINE	76.29±11.02	82.03±10.48	82.39±11.28	0.053	
30MIN	72.39±10.1	79.23±10.82	80.77±11.89	0.008*	P1=0.042* P2=0.009* P3=0.844
60MIN	70.29±9.07	77.77±9.91	78.1±10.93	0.003*	P1=0.011* P2=0.008* P3=0.991
90MIN	71±8.88	77.67±10.32	78.91±11.51	0.009*	P1=0.039* P2=0.016* P3=0.902
END OF SURGERY	75.74±8.83	79.9±9.88	81.52±10.24	0.058	

*:Significantly at P-value <0.05, P1:P-value between groups ISPB and SSNB+ANB,

P2:P-value between group ISPB and ESP, P3:P-value between group SSNB+ANB and ESP.

Between the three groups, intraoperative MAP was not substantially different at baseline or at the conclusion of surgery. It was significantly lower at 30 minutes, 60 minutes, and 90 minutes in the ISPB group compared to the ESP and SSNB+ANB groups (P-value<0.05), and it was not significantly different between the ESP and SSNB+ANB groups, (table 3; figure 7).

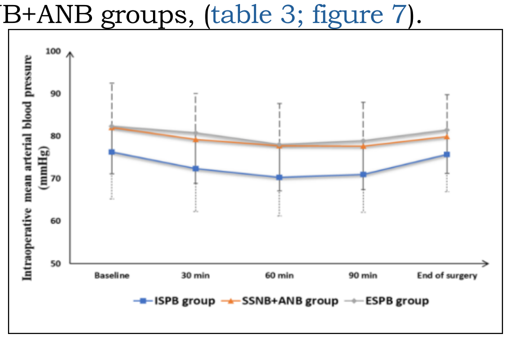

Figure 7. Intraoperative MAP of studied patients.

Table 4. Diaphragmatic excursion measurements of the studied groups.

	ISPB GROUP (N=31)	SSNB+ANB GROUP (N=31)	ESP GROUP (N=31)	P VALUE	POST HOC
PREOPERATIVE	4.55±0.49	4.41±0.34	4.61±0.66	0.307	
BEFORE DISCHARGE FROM PACU	2.28±0.19	3.91±0.54	4.1±0.68	<0.001*	P1<0.001* P2<0.001* P3=0.089

*:Significantly at P-value <0.05, P1:P-value between groups ISPB and SSNB+ANB,

P2:P-value between group ISPB and ESP, P3:P-value between group SSNB+ANB and ESP.

Before being discharged from the PACU, the ISPB group's diaphragmatic excursion was considerably smaller than that of the SAG and ESP groups (P-value<0.001), and it was not statistically different from the three groups' preoperative diaphragmatic excursion, (table 4).

Table 5. Patient satisfaction of the studied groups.

	ISPB GROUP (N=31)	SSNB+ANB GROUP (N=31)	ESP GROUP (N=31)	P-VALUE
EXCELLENT	14 (45.16%)	11 (35.48%)	12 (38.71%)	0.364
GOOD	8 (25.81%)	9 (29.03%)	12 (38.71%)	
FAIR	7 (22.58%)	11 (35.48%)	7 (22.58%)	
POOR	2 (6.45%)	0 (0%)	0 (0%)	

Patient satisfaction was insignificantly different among three groups, (table 5).

4. Discussion

Postoperative pain treatment following shoulder surgery is a key priority for patients, and the Interscalene Brachial Plexus Block (ISPB) is the preferred method for this procedure since it successfully lowers pain for 6 to 12 hours and lasts longer than other methods. A number of complications, including hemidiaphragmatic paralysis (HDP) and ipsilateral phrenic nerve block, which affect 43–100% of patients, limit its application.[7]

Diaphragmatic paralysis happens when the local anesthetic from the high dosages used spills over onto the phrenic nerve, which is located near the brachial plexus. When a patient already has pulmonary impairment, phrenic nerve palsy becomes a major worry. Some attempts to prevent phrenic nerve palsy have been unsuccessful. These include reducing the amount of local anesthetic used, focusing solely on the brachial plexus, and approaching the brachial plexus from above the collarbone.[8]

In this study, regarding the diaphragmatic excursion measurements, results indicate that the ISPB group had significantly lower diaphragmatic excursion at the end of operation before discharge from PACU compared to the (SSNB+ANB) and ESPB groups (2.28±0.19), (3.91±0.54), and (4.1±0.68), respectively (p<0.05). This finding supports the hypothesis that (SSNB+ANB) and ESPB techniques offer better diaphragmatic sparing compared to the interscalene block.

These results are consistent with the study by Auyong et al.,[9] which demonstrated that combined suprascapular and axillary nerve blocks resulted in less diaphragmatic paralysis compared to interscalene block.

Similarly, Forero et al.,[10] stated that the erector spinae plane block effectively reduced postoperative pain following shoulder surgery without affecting their ability to breathe in or out.

Kumar et al.,[11] aimed to study the effects of ultrasonography on diaphragmatic motion monitoring following single-shot upper thoracic (T2) ESPB on phrenic nerve function in patients undergoing shoulder surgery. The absence of phrenic nerve palsy in their series suggests that local anesthetics did not reach the cervical nerve roots (C3, C4, C5) that comprise the phrenic nerve.

At 30, 60, and 90 minutes, the ISPB group exhibited significantly lower heart rates and mean arterial pressures compared to the SSNB+ANB and ESPB groups (p<0.001), according to the current study results.

Nelson et al.,[12] reported that the interscalene block was associated with a higher incidence of hypotension and bradycardia compared to the supraclavicular block in shoulder surgery patients.

However, it's worth noting that the SSNB+ANB and ESPB groups had no "Poor" ratings, while the ISPB group had 6.45% of patients rating their experience as "Poor". This suggests that while the interscalene block may provide better pain control, it may also be associated with some less desirable effects that impact patient satisfaction for a small subset of patients.

Soliman [13] reported that, despite showing very high levels of anesthetic satisfaction, patients in the ESPB group (90%) and shoulder block group (80%) did not vary statistically from one another.

Albahar et al.,[14] discovered a high level of aesthetic satisfaction. They did not discover a statistically significant difference between the two groups ESPB group and shoulder block group.

Sun et al.,[15] both the SSNB+ANB and ISPB groups demonstrated high levels of patient satisfaction. Neither group regularly outperformed the other in terms of patient satisfaction.

Neuts et al.,[16] found no significant difference in treatment satisfaction between the ISPB and SSN+ANBB groups.

Limitations: Our results may not be applicable to larger populations due to the small sample size. Longer-term follow-up was not conducted, which limits our understanding of the sustained effects of each block type on diaphragmatic function, respiratory outcomes, and overall analgesic efficacy. The lack of direct motor block assessment could provide further insights into unintended motor involvement, particularly in the ESG group. Variations in anesthetic volume or concentration were not extensively explored, and these factors may influence the degree of spread and block efficacy, potentially affecting respiratory function and sympathetic involvement.

4. Conclusion

While ISPB provides superior pain control and reduces opioid consumption, the combined SSNB and ESPB offer advantages in terms of diaphragmatic function preservation and hemodynamic stability.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

References

1. Yamakado K. Efficacy of arthroscopically placed pain catheter adjacent to the suprascapular nerve (continuous arthroscopically assisted suprascapular nerve block) following arthroscopic rotator-cuff repair. Open access journal of sports medicine.2014:129-36.
2. Lim YC, Koo ZK, Ho VW, et al. Randomized, controlled trial comparing respiratory and analgesic effects of interscalene, anterior suprascapular, and posterior suprascapular nerve blocks for arthroscopic shoulder surgery. Korean Journal of Anesthesiology.2020;73(5):408-16.
3. Basat HÇ, Uçar DH, Mehmet A, et al. Post operative pain management in shoulder surgery: Suprascapular and axillary nerve block by arthroscope assisted catheter placement. Indian journal of orthopaedics.2016;50:584-9.
4. ªahin A, Baran O, Çetin MÜ, et al. Combined suprascapular nerve block and axillary nerve block approach vs. peri-articular infiltration analgesia for postoperative pain management following arthroscopic shoulder surgery: a randomized clinical trial. European Review for Medical & Pharmacological Sciences.2022;26(24).
5. Ciftci B, Ekinci M, Gölboyu BE, et al. High thoracic erector spinae plane block for arthroscopic shoulder surgery: a randomized prospective double-blind study. Pain Medicine.2021;22(4):776-83.
6. Nugent SM, Lovejoy TI, Shull S, et al. Associations of pain numeric rating scale scores collected during usual care with research administered patient reported pain outcomes. Pain Medicine.2021;22(10):2235-41.
7. Abdallah FW, Halpern SH, Aoyama K, et al. Will the real benefits of single-shot interscalene block please stand up? A systematic review and meta-analysis. Anesthesia & Analgesia.2015;120(5):1114-29.
8. Oh C, Noh C, Eom H, et al. Costoclavicular brachial plexus block reduces hemidiaphragmatic paralysis more than supraclavicular brachial plexus block: retrospective, propensity score matched cohort study. The Korean journal of pain.2020;33(2):144-52.
9. Auyong DB, Hanson NA, Joseph RS, et al. Comparison of anterior suprascapular, supraclavicular, and interscalene nerve block approaches for major outpatient arthroscopic shoulder surgery:A randomized, double-blind, noninferiority trial. Anesthesiology.2018;129(1):47-57.
10. Forero M, Adhikary SD, Lopez H, et al. The erector spinae plane block: a novel analgesic technique in thoracic neuropathic pain. Regional Anesthesia & Pain Medicine.2016; 41(5):621-7.
11. Kumar D, Talawar P, Dhar M, et al. The efficacy of ultrasound-guided upper thoracic erector spinae plane block for postoperative analgesia in proximal shoulder surgery and its effect on phrenic nerve function: A prospective exploratory study. Journal of Anaesthesiology Clinical Pharmacology.2024;40(2):312-7.
12. Nelson M, Reens A, Reda L, et al. Profound prolonged bradycardia and hypotension after interscalene brachial plexus block with bupivacaine. The Journal of emergency medicine.2018;54(3):e41-3.
13. Soliman NM. Comparison of ultrasound-guided high Thoracic Erector Spinae Plane Block with Shoulder Block for Postoperative Analgesia in Arthroscopic Shoulder Surgery Phrenic sparing blocks in shoulder arthroscopy. Menoufia Medical Journal.2024;37(2):1.
14. Albahar MY, Moustafa AM, Eskandr AM, et al. Comparison between Ultra-Sound Guided Inter-Scalene and Shoulder Block in Shoulder Arthroscopy:A Randomized Blinded Study. Menoufia Medical Journal.2023;36(3):21.
15. Sun C, Zhang X, Ji X, et al. Suprascapular nerve block and axillary nerve block versus interscalene nerve block for arthroscopic shoulder surgery:A meta-analysis of randomized controlled trials. Medicine.2021;100(44):e27661.
16. Neuts A, Stessel B, Wouters PF, et al. Selective suprascapular and axillary nerve block versus interscalene plexus block for pain control after arthroscopic shoulder surgery:a noninferiority randomized parallel-controlled clinical trial. Regional Anesthesia & Pain Medicine.2018;43(7):738-44.