

ULTRASOUND-GUIDED SUPRASCAPULAR NERVE BLOCK COMBINED WITH INTRA-ARTICULAR INJECTION OF BUPIVACAINE VERSUS ULTRASOUND-GUIDED INTERSCALENE NERVE BLOCK IN SHOULDER ARTHROSCOPY

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ABSTRACT:

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Background: The interscalene nerve block (ISNB) is widely recognized as the most optimal technique for effectively managing postoperative pain following shoulder surgery. Nevertheless, this technique is linked to adverse effects and potential complications. The current work sought to compare the efficacy of ISNB with a selective suprascapular nerve block and intra-articular injections of bupivacaine (SSNB + IAI) for postoperative analgesia following shoulder arthroscopy guided by ultrasonography (US).

Patients and Methods: This study included thirty patients (aged 21-60 years) who were slated to undergo elective shoulder arthroscopy under general anesthesia. They were categorized into two groups: Group A underwent ultrasound-guided ISNB after general anesthesia (GA), and Group B received ultrasound-guided SSNB + IAI after GA induction. The postoperative pain was estimated utilizing the visual analog scale (VAS) as a main measure. Secondary outcomes included total pethidine dose administered within 24 hours after surgery, patient satisfaction, and other complications.

Results: The VAS scores at various time points after the surgery showed non-significant changes among the ISNB and SSNB groups, except at VAS 0 hours postoperatively, where a notable distinction was observed; however, the VAS score remained below 3; therefore, no analgesics were administered. Surprisingly, the expression of postoperative pain reportedly improved. This might be because ISNB offers a particularly dense block compared to SSNB.

Conclusion: Ultrasound-guided SSNB, when used with IAI, was nearly as effective in providing postoperative analgesia following shoulder arthroscopy while offering lower potential side effects.

Keywords: Suprascapular nerve block, Interscalene nerve block, intra-articular injection of bupivacaine, Ultrasound, Shoulder arthroscopy.

INTRODUCTION:

Several shoulder injuries and diseases can be successfully treated with shoulder arthroscopy on an ambulatory basis ⁽¹⁾. Despite being regarded as less invasive, shoulder arthroscopy is accompanied by severe intra- and post-operative pain.

Consequently, this procedure requires sufficient analgesia and muscle relaxation. Due to prolonged postoperative analgesia, combined general and regional anesthesia is preferable to GA alone for shoulder arthroscopy ⁽²⁾. Additionally, combining a regional nerve block with general anesthesia

minimizes intraoperative anesthetic requirements, which accelerates recovery⁽³⁾.

ISNB is among the most used and dependable regional block methods for shoulder surgery; nonetheless, it carries a considerable risk of complications. The most prevalent side effect was phrenic nerve palsy. This side effect usually subsides after a few days but can be prolonged in patients with associated lung disease. Other less common complications of ISNB encompass Horner's syndrome, vascular puncture, brachial plexus neuropathy, recurrent laryngeal nerve block, and inadvertent injection of local anesthetic into the epidural space, subarachnoid space, or vertebral artery⁽⁴⁾.

ISNB creates a strong blockade in shoulder movement that can reach the hand, causing injury to the patient. Consequently, it may be better and safer to use a sensory block⁽⁵⁾. By blocking the C5 and C6 nerves, the ISNB anesthetizes the shoulder joint⁽⁶⁾.

The suprascapular nerve supplies sensory signals to the superior, medial, and posterior portions of the shoulder joint capsule. Moreover, it transmits some branches to the rotator cuff's infraspinatus and supraspinatus muscles and the acromion, glenoid, teres minor, and posterior portion of the scapula⁽⁵⁾.

Better nerve localization and visualization were made possible using ultrasound, leading to successful blockade with fewer side effects⁽⁷⁾.

AIM OF THE WORK:

This study hypothesized that SSNB+IAI under US guidance could offer comparable benefits to ISNB in terms of pain management following shoulder arthroscopy while minimizing the occurrence of adverse effects.

PATIENTS AND METHODS:

Thirty patients were enrolled who were scheduled to have elective shoulder arthroscopy under general anesthesia.

The selected patients had an ASA physical status of I/II, were of both sexes, and ranged in age from 21 to 60 years old. Refusal to give informed consent for regional anesthesia, known allergies to study drugs, history or evidence of coagulopathy, use of anticoagulant or antiplatelet therapy, or infection at the injection site were all exclusion factors. Patients with a history of upper limb neuronal injury in the same limb as the block or a history of respiratory distress due to fear of diaphragmatic paralysis were also excluded.

Two equal groups were randomly assigned from the patients (15 patients each). Figure (1).

Group A (GA+ISNB): It comprised patients who underwent ultrasound guided ISNB after GA administration.

Group B (GA+SSNB+AI): It comprised patients undergoing ultrasound-guided suprascapular nerve block and intra-articular injections of bupivacaine 0.25% after induction of GA.

Study Procedure:

All patients underwent a preoperative evaluation that included medical history, clinical inspection, and investigations such as blood and ECG tests, as well as an ultrasound to examine the diaphragmatic movement according to age, physical condition, and procedure.

The Visual Analog Scale (VAS) and its interpretation were explained to all study participants who had fasted for 6 to 8 hours without solid meals and 4 hours without clear liquids before surgery.

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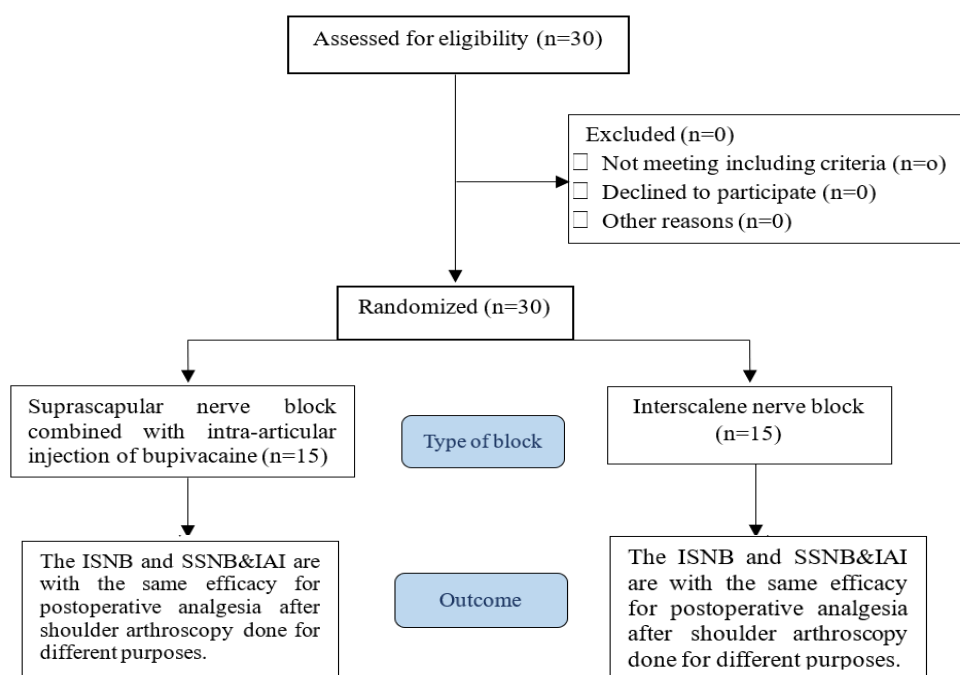


Figure 1: The trial flow chart illustrates the allocation and randomization of participants.

Once the patient entered the operating room, continuous monitoring was initiated, which encompassed pulse oximetry, non-invasive arterial blood pressure measurements, and electrocardiography. Before the administration of general anesthesia (baseline), the heart rate (HR), respiratory rate (RR), and mean arterial blood pressure (MAP) were documented.

IV Granisetron (0.01 mg/kg) and IV Pantoprazole (40 mg) would be administered as premedication once intravenous access was placed. Propofol (2 mg/kg), Atracurium (0.5 mg/kg loading, and 0.1 mg/kg every 30 minutes), and Fentanyl (2 μ g/kg) would be used for the general IV anesthetic induction. The Patients were mechanically ventilated using an appropriately sized endotracheal tube. The ventilator settings were adjusted to keep end-tidal CO₂ levels between 30-35 mmHg. An ultrasound machine was used to check diaphragmatic mobility before performing a regional block. Anesthesia was maintained with isoflurane, which was adjusted to maintain stable hemodynamic (\pm 20 % of the baseline for MAP and HR).

Once general anesthesia was induced, a senior staff member with expertise performed group-specific regional blocks under aseptic conditions. Once the desired block has been achieved, the surgical operation begins.

Diaphragmatic mobility was re-evaluated using an ultrasound machine following surgery, but before the patient recovered. To reverse the effects of muscle relaxants, atropine 0.02 mg/kg and neostigmine 0.05 mg/kg were given. After recovery, patients were relocated to the post-anesthesia care unit (PACU). HR and systolic, diastolic, and mean pressures were recorded.

Before surgery, patients were taught how to utilize a VAS to evaluate their pain.

Interscalene brachial plexus block: An ultrasound probe was placed transversely above the clavicle and pointed caudally into the thoracic cavity to visualize the brachial plexus near the subclavian artery. The plexus was usually seen at the interscalene groove as several anechoic circular structures that resemble "stoplights." Typically, C5 is the

highest component, while C6 is the middle and lower structures. The block needle was positioned in-plane from lateral to medial and posterior to anterior to access the interscalene groove. To guarantee dissemination into the interscalene groove, a local anesthetic (1-2 ml) was administered after confirming the absence of any aspiration. The usual amount of local anesthetic injected was 10–20 ml.

Combining intra-articular injection of bupivacaine 0.25 % with suprascapular nerve block: The patient was seated with his elbow bent and arm resting on a bellow. At the scapula's upper medial border, in the sagittal plane, a linear ultrasound probe was positioned. The probe was positioned parallel to the scapular spine. Subsequently, the head was rotated to the side to locate the scapular fossa, which could then be seen as a circular, hypoechoic structure behind the transverse scapular ligament. When color Doppler confirmed no vascular structure, the needle tip became visible within the suprascapular notch. Then, of 0.25 % bupivacaine (7–10 ml) was administered, with aspiration every 3 ml. The surgeon also administered 7.5 ml of intra-articular 0.25% bupivacaine.

Postoperative pain was measured at 0, 2, 4-, 8-, 16-, and 24-hours following surgery using the VAS score (where 10 represents the worst pain and 0 represents no pain). The main goal of our study is to evaluate this specific outcome.

As part of multimodal analgesia, all postoperative patients received 1 g IV paracetamol every 8 hours and 30 mg IM Ketorolac every 12 hours. If a patient experienced pain between the scheduled doses of paracetamol and ketorolac, IV pethidine sulfate (50 mg/dose) was administered (if VAS was > 4). However, the total dosage of pethidine sulfate within 24 hours did not surpass 50 mg every 8 hours.

Secondary outcomes included the total amount of pethidine administered over 24 hours following the procedure, patient

satisfaction the day after the procedure (measured using a 10-point scale from 0 = not satisfied to 10 = fully satisfied), any complications that arose during and following the block (e.g., breathing difficulties, hoarseness, Horner's syndrome, pneumothorax, arm paresthesia, and diaphragmatic paralysis), and postoperative nausea and vomiting.

Statistical Analysis:

Using a statistical package for social sciences (SPSS 15.0.1. for Windows (SPSS, Inc., Chicago, IL, USA) 2001), the collected data were revised, coded, and entered a PC. Quantitative Prometric data are displayed as mean \pm standard deviation (\pm SD). The Kolmogorov–Smirnov test was employed to ascertain the normality of the distribution. When analyzing continuous variables, nonparametric Mann–Whitney U tests or independent t-tests were utilized as required. Additionally, Fisher's exact test was employed for comparing categorical variables. At $P < 0.05$, statistical significance was achieved.

Sample Size:

Employing the Power Analysis & Sample Size (PASS) 15 software package for calculating sample size and according to *Choi et al.*,⁽⁸⁾ the expected mean VAS score 2 hours postoperatively among the C-SSNB group = 4.8 ± 2.1 and the S-ISNB group = 2.4 ± 2.3 , a 15 patients sample size for each group was necessary to identify any differences between both groups. Figure (1).

Ethical Consideration:

This trial was blinded, randomized, and prospective. Ethical approval was provided by Ain Shams University, Faculty of Medicine, Research Ethics Committee with approval no. (FMASU MS 208/2023), and informed written consent,

Trial Registration:

The study was registered at the Pan-African Clinical Trials Registry

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(<https://pactr.samrc.ac.za>; registration no. PACTR202308722616710).

Concerning demographic data, such as age, weight, sex, ASA, type, and length of procedure, no significant differences were noted between the groups ($p > 0.05$). Table (1)

RESULTS:

Table 1: Demographic and surgical characteristics in cases.

Demographic data	Group A (n=15)	Group B (n=15)	P-value
Age (y)	34 (27-47)	37 (32- 48)	0.503
Weight (kg)	90 (78- 100)	80 (70- 96)	0.662
Sex			0.573
Female	2 (13.3%)	1 (6.66%)	
Male	13 (86.6%)	14 (93.3%)	
ASA			0.761
I	11 (74.1%)	10 (66.6%)	
II	4 (25.9%)	5 (33.3%)	
Duration of surgery (minutes)	101.13±9.459	97.13 ±7.395	0.739
Type of surgery			0.666
Diagnostic	3 (20%)	4 (26.6%)	
Subacromial decompression	9 (60%)	7 (46.6%)	
Shoulder dislocation with anchor application	3 (20%)	4 (26.6%)	

Values are expressed as median (IQR), or number (%). $P > 0.05$ was considered nonsignificant.

P-values for the VAS at 2, 4, 8, 16, and 24 hours, respectively, were 0.27, 0.378, 0.358, and 0.451. The VAS scores at various postoperative times consistently revealed no

difference between the ISNB and SSNB+IAI groups. But with a p-value of 0.029, the VAS 0 hour revealed a significant difference. Table (2).

Table 2: Comparison of VAS in group A and group B

		Group A	Group B	P-value	Sig.
		No. = 15	No. = 15		
VAS 0	Median (IQR)	0 (0 – 0)	0 (0 – 2)	0.029	S
	Range	0 – 1	0 – 2		
VAS 2	Median (IQR)	0 (0 – 0)	0 (0 – 1)	0.071	NS
	Range	0 – 2	0 – 2		
VAS 4	Median (IQR)	0 (0 – 1)	0 (0 – 1)	0.280	NS
	Range	0 – 2	0 – 4		
VAS 8	Median (IQR)	0 (0 – 1)	0 (0 – 2)	0.378	NS
	Range	0 – 4	0 – 4		
VAS 16	Median (IQR)	0 (0 – 2)	1 (0 – 4)	0.358	NS
	Range	0 – 4	0 – 6		
VAS 24	Median (IQR)	0 (0 – 4)	1 (0 – 4)	0.451	NS
	Range	0 – 8	0 – 6		

Values are expressed as median (IQR) or range. $P < 0.05$ was considered significant.

In the ISNB group, four patients required analgesics following surgery, while in the SSNB + IAI group, 7 patients required them ($p = 0.239$). Additionally, no significant

variance was noted in the total quantity of pethidine utilized in 24 hours between both groups ($p = 0.865$). Table (3).

Table 3: Comparison of analgesic, time of 1st analgesic, and total dose of pethidine in 24 h in group A and group B

		Group A	Group B	P-value	Sig.
		No. = 25	No. = 25		
Analgesic	No	11 (72.0%)	8 (56.0%)	0.239	NS
	Yes	4 (28.0%)	7 (44.0%)		
Time of 1st analgesic (in hours)	Median (IQR)	19 (13-22)	16 (7-21)	0.940	NS
Total dose of pethidine in 24 h (mg)	Median (IQR)	100 (70-130)	70 (50-160)	0.860	NS

Values are expressed as number (%) or median (IQR). P > 0.05 was considered nonsignificant.

With a p-value of 0.042, PONV was observed in three patients who underwent ISNB and one patient who received

SSNB+IAI, yielding almost comparable outcomes. Table (4).

Table 4: Comparison of patient satisfaction (1-10), PONV, and any complication in Group A and Group B.

		Group A	Group B	Test value	P-value	Sig.
		No. = 15	No. = 15			
Patient Satisfaction (1-10)	Mean ± SD	9.20 ± 0.87	9.64 ± 0.70	-1.976•	0.054	NS
PONV	Negative	12 (76.0%)	14(96.0%)	4.153*	0.042	S
	Positive	3 (24.0%)	1 (4.0%)			
Horner		2 (13.3%)	0(0.0%)	2.143*	0.143	NS

Values are expressed as number (%) or mean (± SD). P < 0.05 was considered significant.

Phrenic nerve paresis, measured using diaphragmatic ultrasound, showed a highly

significant (p < 0.000) difference between both groups. Table (5).

Table 5: Comparison between pre-operative and post-operative number of patients with phrenic nerve paresis.

	Group A	Group B	Test value	P-value	Sig.
	No. = 15	No. = 15			
Phrenic nerve paresis	7 (46.7%)	0 (0.0%)	9.130*	0.003	S
No phrenic nerve paresis	8 (53.3%)	15 (100.0%)			

Values are expressed as number (%). P < 0.05 was considered significant.

DISCUSSION:

This study intended to assess the impact of ISNB and SSNB + IAI on postoperative VAS scores and postoperative complications, such as diaphragmatic paralysis, following shoulder arthroscopic surgery guided by ultrasound. In both the ISNB and SSNB groups, the pain threshold scores, as measured by the VAS at various points after surgery, consistently revealed non-significant changes; nonetheless, the VAS score remained below 4. The overall dose of pethidine consumed within 24 hours did not

significantly vary between both groups. Therefore, ISNB and SSNB + IAI have the same efficacy for postoperative analgesia after shoulder arthroscopy performed for different purposes. However, the suprascapular block has fewer adverse outcomes. These results imply that the suprascapular block could be regarded as a secure and successful substitute for the interscalene block in shoulder surgery.

Regarding postoperative complications, PONV was reported in one case that received

SSNB + IAI, and in 3 patients who received ISNB, there was an insignificant difference.

In a study accomplished by *Hussain et al.*⁽⁹⁾ to evaluate the effectiveness of interscalene and suprascapular nerve blocks in shoulder surgical procedures, the results indicated no significant disparity in the 24-hour morphine consumption between the two blocks. However, the interscalene block demonstrated a slightly higher pain score area under the curve for the 24-hour duration, with a difference of 1.1 cm/h. Despite this variance, it was concluded that it was not clinically significant.

In the study conducted by *Zanfaly and Aly*⁽¹⁰⁾, the researchers assessed the efficacy of GA either alone or combined with an intraarticular shoulder block or interscalene block in providing pain management following shoulder arthroscopy. The results indicated that the interval until the initial request for analgesics was significantly extended in the groups receiving GA combined with an intraarticular shoulder block or interscalene block compared to the group receiving only GA. Additionally, the total average morphine usage within the 24-hour postoperative period revealed a significant increase in the group receiving only GA compared to the other two groups. Interestingly, there was no significant difference in the total number of patients who required postoperative analgesics between both groups, with only four patients in the interscalene block group and seven in the group receiving both interscalene and intraarticular blocks, as shown by the p-value of 0.239.

In the study conducted by *Abdallah et al.*,⁽¹¹⁾ the pain relief duration and opioid consumption provided by the ISNB were found to be limited to 8 and 12 hours after surgery, respectively. Although the ISNB offered limited analgesia, it was observed to have a significant frequency of unfavourable side effects, such as rebound pain. Additionally, a concerning risk profile was

associated with the proximity of the ISNB location to the neuroaxis and other neck structures. Research revealed that 14% of individuals who underwent an ISNB experienced neurological side effects seemingly unrelated to the surgical procedure. These symptoms persisted in 7.8% of instances⁽¹²⁾.

In a comparison of ISNB and GA for shoulder arthroscopy, *Brown et al.*⁽¹³⁾ reported that 6% of patients reported hoarseness (recurrent laryngeal nerve block), and 5% experienced Horner's syndrome. Importantly, none of these adverse effects resulted in any subjective complaints from the patients and were resolved independently.

Another study by *Simeoforidou et al.*⁽¹⁴⁾, found that 33.3% of patients reported signs of Horner syndrome. These signs were observed approximately 30 minutes after the administration of ISNB, and all patients had resolved symptoms before being discharged from the PACU. This high percentage may be due to the block being performed without ultrasound guidance. According to *Liu et al.*⁽¹⁵⁾, employing ultrasound as blockade guidance makes it easier to visualize and localize the neural structure directly. This enables more effective local anesthesia disposition around the plexus roots and peripheral nerves, enhancing block performance and lowering the complications associated with individual blockades.

Conclusion:

ISNB and SSNB + IAI demonstrated comparable postoperative analgesia and patient satisfaction. However, the higher occurrence of complications in ISNB made SSNB + IAI a preferable choice for arthroscopic shoulder surgery.

Conflicts of Interest:

The authors state that they have no conflicts of interest.

Acknowledgment:

None

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إحصار العصب فوق الكتف الموجه بالموجات فوق الصوتية مع حقن البوبيفاكاين داخل المفصل مقابل إحصار العصب بين الإسكاليين الموجه بالموجات فوق الصوتية في عملية منظار الكتف

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الخلفية: إحصار العصب بين الأضغعية (ISNB) هو المعيار الذهبي لتسكين الألم بعد العملية الجراحية بعد جراحة الكتف. ومع ذلك، فإن هذا الإحصار العصبي له آثار جانبية ويمكن أن يسبب مضاعفات خطيرة.

تهدف هذه الدراسة إلى مقارنة ISNB مع التخدير الانتقائي للعصب فوق الكتف وحقن البوبيفاكاين داخل المفصل (SSNB+IAI) لتسكين الألم بعد العملية الجراحية لمنظار الكتف الموجه بالموجات فوق الصوتية.

الطرق: تم تسجيل ثلاثين مريضاً (العمر، 21-60 سنة) المقرر لإجراء منظار مفصل الكتف الاختياري تحت التخدير العام. تم تقسيمهم بشكل عشوائي إلى مجموعتين: المجموعة أ تلقت ISNB الموجهة بالموجات فوق الصوتية بعد بدء التخدير العام (GA) والمجموعة ب تلقت SSNB + IAI الموجهة بالموجات فوق الصوتية بعد بدء GA وكانت النتيجة الأولية هي درجة المقياس التناظري البصري (VAS) المستخدم لقياس الألم بعد العملية الجراحية. وشملت النتائج الثانوية الجرعة الإجمالية لعقار البيثيديين المستخدمة خلال الـ 24 ساعة الأولى بعد العمل الجراحي، ورضا المريض، والمضاعفات الأخرى.

النتائج: أظهرت مقاييس التناظرية البصرية في أوقات مختلفة بعد العمل الجراحي تغييرات غير هامة بين مجموعات ISNB و SSNB في جميع الأوقات، باستثناء ساعات VAS 0 بعد العمل الجراحي، حيث تم العثور على فرق كبير؛ ومع ذلك، كانت الدرجة أقل من 3؛ لذلك لم يتم إعطاء أي مسكنات. والمثير للدهشة أن التعبير عن الألم بعد العملية الجراحية قد تحسن. قد يكون هذا بسبب أن ISNB يقدم كتلة كثيفة بشكل خاص مقارنة بـ SSNB.

الاستنتاج: كان SSNB الموجه بالموجات فوق الصوتية، عند استخدامه بالتزامن مع IAI، فعالاً تقريباً في توفير تسكين الألم بعد العملية الجراحية بعد تنظير الكتف، مع آثار جانبية محتملة أقل.