Original Article

Post-operative analgesia for shoulder arthroscopic surgeries: A comparison between inter-scalene block and shoulder block

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ABSTRACT

Background and Aims: Shoulder arthroscopic surgeries can produce intense post-operative pain. Inter-scalene block (ISB) provides good analgesia after shoulder surgery, but concerns over its associated risks have prompted the search for alternatives. Shoulder block (SHB), which includes suprascapular block along with axillary nerve (AN) block, was recently proposed as an alternative to ISB, but evidence of its efficacy is conflicting. The aim of our study was to compare SHB with ISB in shoulder surgery for post-operative analgesia. **Methods:** A total of 76 patients scheduled for shoulder arthroscopic surgery were equally divided into 2 groups of 38 patients each: ISB group and SHB group. Both the nerve blocks were achieved by using ultrasound and a nerve stimulator. Visual analogue scale (VAS) scores were evaluated at 1, 4, 6, 12 and 24 h post-operatively. The time to first analgesia request, total analgesic requirement for 24 h post-operatively, patient satisfaction and any complications were recorded. **Results:** SHB provided equivalent analgesia to ISB in terms of post-operative VAS scores. Time to first analgesic request was 6.2 ± 1.3 h in ISB group and 5.9 ± 1.2 h in SHB group, which was not statistically significant. Complications like subjective dyspnoea and weakness of arm were significantly higher in ISB group compared to SHB group. Patient satisfaction scores were also significantly higher in SHB group compared to ISB group. **Conclusion:** SHB is as effective as ISB for post-operative pain relief and with fewer complications due to selective blockade of suprascapular and axillary nerves.

Key words: Inter-scalene block, Shoulder arthroscopy, Shoulder block

INTRODUCTION

Shoulder arthroscopy is a minimally invasive, ambulatory surgery useful for treating a variety of shoulder pathologies. But it is associated with severe post-operative pain, which causes significant discomfort to the patient and hence interferes with recovery and rehabilitation of the shoulder.[1] Of all blocks, employed for post-operative pain after shoulder surgery, the inter-scalene block (ISB) is the most widely used block. It has been reported to provide excellent post-operative analgesia but can produce side effects like phrenic nerve blockade resulting in diaphragmatic paresis causing respiratory distress to the patient. Other common complications associated with ISB are weakness of arm, hoarseness of voice and Horner's syndrome.[2] This necessitates the search for other nerve blocks which has similar analgesic efficacy as the ISB but without any associated complications. So, instead of the ISB, targeting selective blockade of nerves supplying to the shoulder may be a better alternative. The suprascapular nerve (SSN) supplies about 60–70% of the shoulder joint and axillary

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nerve (AN) supplies about 25–30% of the shoulder joint.[3] The SSN supplies sensation for most of the posterior, medial and superior part of the shoulder joint capsule. It also supplies the supraspinatus and infraspinatus muscles of the rotator cuff and some branches to the teres minor, the glenoid, acromion and the posterior surface of the scapula.[4] The anterior, lateral and inferior structures of the shoulder joint are supplied by the AN, which also supplies the deltoid muscle and gives some fibres to the teres minor. The AN also supplies the skin overlying the deltoid muscle.[5] The use of ultrasound and nerve stimulator in performing the blocks provided better visualisation and localisation of the nerves, resulting in successful blockade with fewer complications.[6,7] So instead of the ISB, combined blockade of these two nerves can be useful for providing analgesia in surgeries of the shoulder joint.[8] But there is a conflicting view in the literature regarding the efficacy of combined blockade of SSN and AN when compared with ISB. So, this study was done to compare the analgesic profiles of ISB and shoulder block (SHB) for post-operative analgesia after shoulder arthroscopy. The primary aim of the study was to compare the analgesic efficacy of the ISB and SHB, which was measured in terms of the visual analogue scale (VAS) score in the first 24 h after surgery. The secondary aims were to study the time to first analgesia request, total analgesic consumption, patient satisfaction scores and incidence of complications. We hypothesised that the selective blockade of the suprascapular and axillary nerve (SHB) using ultrasound and nerve stimulation may be as effective as ISB for post-operative pain relief after shoulder arthroscopy, with better patient satisfaction.

METHODS

The study was conducted from June 2017 to December 2018 after obtaining approval from the Institutional Ethics Committee. The study included males/females of 18–60 years. with ASA I/II/III, undergoing unilateral shoulder arthroscopy who had given consent to the procedure. Patients having BMI >30 kg/m^2, mental illness, chronic obstructive pulmonary disease or any respiratory disease, coagulopathy, prior trauma, neuropathy, myopathy and requiring open surgery were excluded from the study. A total of 76 patients were recruited after satisfying the inclusion criteria. They were randomly allocated into one of the two groups (i.e., ISB or SHB group) using a computer-generated sequence of random numbers in 1:1 ratio. The results were stored sequentially in a sealed, opaque envelope only to be opened by the anaesthesiologist just prior to performing the nerve block. The study undertaken was a randomised, interventional single blind trial. The pre-anaesthetic check-up was done and written informed consent was taken. All the patients were also explained regarding the VAS score and its usage in the study. The patients were shifted 60 min prior to the surgery to the operation theatre. An intravenous access was achieved and all routine monitoring parameters (i.e., noninvasive blood pressure, heart rate, SpO_2 and electrocardiogram) were recorded. Patients were sedated with midazolam (0.05 mg/kg IV) and pentazocine (0.5 mg/kg IV). Oxygen was provided by nasal prongs at 2–4 L/min. Baseline sensory assessment was done over the shoulder (C_4 –top of the shoulder, C_5 – lateral shoulder, C_6 – thumb, C_7 – third finger and C_8 – fourth finger). For all purposes, a GE Logiq F™ (General Electric Healthcare, Little Chalfont, United Kingdom) ultrasound with a high frequency (6–15 MHz) 38 mm L6–12 linear probe and a Stimuplex® A 50 mm (B Braun HNS 11-12218, Stockert GmbH, BotzingerStrabe 72, D-79111 Freiburg, Germany) were used. As the literature advocates higher concentration of ropivacaine for SHB, we have used 0.75% ropivacaine in both nerve blocks to maintain study homogeneity.

The ISB was performed by the technique described by Spence *et al*.[9] The patient was positioned supine with the face turned away from the side of the block and the neck slightly extended. An in-plane puncture through the middle scalene muscle was done using a 50-mm nerve block needle. The C_6 root was identified and the tip of the needle was kept infero-posterior to it. After confirming extravascular placement of the needle, using Doppler and observing contraction of the deltoid and pectoralis (maximum current of 0.4 mA, pulse width 0.1 ms, frequency 2 Hz), 10 ml of 0.75% ropivacaine was injected into the groove avoiding intravascular injection.

SHB was performed according to the method described by Harmon *et al*.,[10] Peng *et al*.[11] and Price *et al*.[12] For the Suprascapular nerve block (SSNB), the patient was positioned in a semi-recumbent position with the operating arm on the contralateral shoulder. The probe was kept over the scapular spine to identify the trapezius and the supraspinatus muscle. Then, it was moved laterally to identify the concavity of the supraspinatus fossa and the hyper-echoic fascia of the

supraspinatus muscle. In the concavity of the fossa, the suprascapular artery and the suprascapular nerve run in close proximity. A 50-mm nerve block needle was used in the long axis view for the block. After confirming extravascular placement of the needle by Doppler and stimulation of the supraspinatus and infraspinatus muscles (maximum current of 0.4 mA, pulse width 0.1 ms, frequency 2 Hz), 10 ml of 0.75% ropivacaine was injected below the supraspinatous fascia.

For the axillary nerve block (ANB), the patients were positioned in a semi-recumbent position with the arm slightly flexed and adducted at the elbow. The posterior surface of the humerus was visualised in the short axis view. So, the AN and posterior circumflex artery were visualised longitudinally. After confirming extra-vascular placement of the needle and observing the deltoid response to a stimulation (maximum current of 0.6 mA, pulse width 0.1 ms, frequency 2 Hz), 10 ml of 0.75% ropivacaine was injected into space. The block was considered a failed block if the block was not successful 30 min after the injection of the local anaesthetic. To maintain a strict observer blinding, whether used or not, all the three sites of the block were covered with surgical dressing prior to inspection. All patients received general anaesthesia using glycopyrrolate 0.005 mg/kg IV, propofol 1–2 mg/kg IV and rocuronium 0.3–0.6 mg/kg IV and were maintained with sevoflurane at minimum alveolar concentration (MAC) 1 with tracheal intubation and controlled ventilation. Ondansetron 4 mg IV was administered intraoperatively to all patients. Patients were extubated successfully and shifted to post-anaesthesia care unit. All results were recorded by the blinded observer. The observations included mean VAS scores at 1, 4, 6, 12 and 24 h after surgery, time required for first rescue analgesia, total dose of rescue analgesia required, incidence of subjective dyspnoea, hoarseness of voice, weakness of arm, Horner's syndrome, post-operative nausea and vomiting and patient satisfaction. Paracetamol IV (1 gm) was used as rescue analgesia when VAS >4. Patient satisfaction scores were assessed on the basis of a questionnaire and graded on a 4-point scale (excellent/good/fair/poor).

A difference in VAS between SHB and ISB group of fewer than 1.3 points measured at various fixed time points was considered significant.[13] Based on a previous study,[14] it was assumed that the standard deviation would be1.5 in the VAS between the techniques on the first post-operative day. Thus, the minimum required sample size was estimated to be 32 for each group (α =0.05 and power = 0.90) at each of separate time points. To account for a possible 15% loss to follow-up, the sample size was inflated to 38 participants per group. The categorical data were analysed using the Chi-square test and the numerical data using the Student *t* or ANOVA as per need with any *P* values <0.05 to be statistically significant.

RESULTS

The distribution of demographic data (age, sex, ASA and BMI) was comparable between both the groups [Table 1]. Figure 1 shows the consort flow diagram of patient selection and dropouts. In ISB group, there was one failed block, and in SHB group, there were three failed blocks. Rotator cuff pathologies were the most common type of surgery requiring shoulder

Table 1: Patient characterisetics

		ISB Group	SHB Group	p Value
Age (years)		37.694 ± 13.648	37.055 ± 12.516	0.452
Sex, n (%)	Female	8(21.62%)	6(17.14%)	0.603
	Male	29(78.37%)	29(82.85%)	0.542
ASA, n (%)	ASA I	25(67.56%)	29(82.85%)	0.155
	ASA II	10(27.02%)	5(14.28%)	0.285
	ASA III	2(5.4%)	1(2.85%)	0.745
BMI (kg/m^2)		25.083 ± 3.483	26.027 ± 3.629	0.584
Preop VAS Scores (at rest)		2.183 ± 1.147	2.227 ± 1.181	0.580
Surgical Procedure, n (%)				
Rotator Cuff repair		19(51.35%)	19(54.28%)	0.550
Decompression+Rotator Cuff repair		5(13.51%)	5(14.28%)	0.576
Decompression+BicepsTenodesis		4(10.81%)	4(11.42%)	0.580
Bankart repair		9(24.32%)	7(20.0%)	0.385

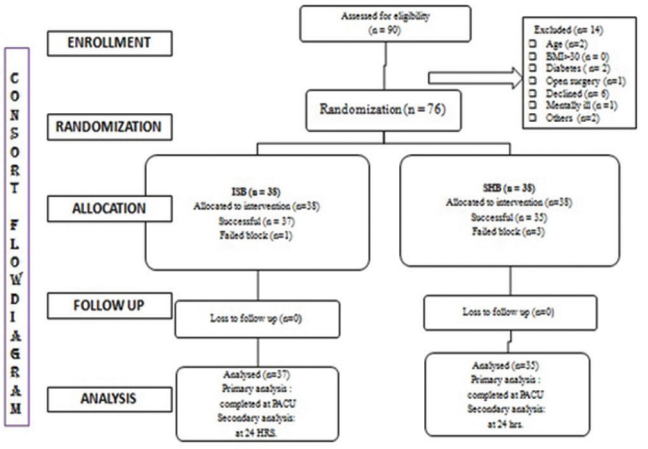

Figure 1: CONSORT flow diagram

arthroscopy. In the group ISB, pre-operative VAS score was 2.183 ± 1.147, and in the group SHB, it was 2.227 ± 1.181. The post-operative mean VAS scores were recorded at 1, 4, 6, 12 and 24 h after surgery. There was no statistical difference in VAS scores over a period of 24 h in both groups ($P > 0.05$) [Figure 2]. The difference in time to first analgesia request and total paracetamol consumption was not significant during 24 h post-operatively [Table 2]. In the current study, the incidence of dyspnoea and discomfort was significant in the ISB group compared to SHB group. The SHB group had the lowest incidence of complications compared with the other groups. In the ISB group, Horner's syndrome appeared with the onset of the block in one patient who was reassured about its benign nature. There were no dreaded complications such as pneumothorax in either groups [Figure 3]. Out of 37 patients in ISB group, 27 had excellent-to-good satisfaction score and 10 patients had fair-to-poor satisfaction score. Out of 35 patients in SHB group, 34 had excellent-to-good satisfaction score while one had fair satisfaction score. Number of patients with excellent-to-good satisfaction scores were higher in SHB group compared to ISB group and hence analysed to be statistically significant ($P < 0.05$) [Figure 4].

DISCUSSION

The incidence of post-operative pain after arthroscopic shoulder surgery is reported to be around 30–70%. Since pain is a distressful entity, it causes a delay in recovery and rehabilitation of the operated shoulder.[14] So, post-operative pain management is an important modality in these surgeries. In the current study, SHB, when compared to ISB, provided equivalent analgesia in the post-operative period after arthroscopic shoulder surgery with minimal complications. The usage of an ultrasound with a nerve stimulator facilitated direct visualisation and hence localisation of the underlying neural structures. This, in turn, confides the deposition of local anaesthetics to a particular area of concern and hence improves the success rate of block performances with fewer complications.[15] The time to first analgesic request was significantly lengthened in both groups due to the blocks. There was no difference in the total dose of paracetamol consumption in the first 24 h after surgery. These results were in agreement with the results of Checcucci *et al*., who reported low VAS score during the first 24 h after SHB.[16] Price *et al*. also found that a combination of suprascapular with axillary block resulted in the complete shoulder joint analgesia. They also reported that shoulder blockade gave pain relief similar to ISB with low morphine consumption post-operatively.[17] In the current study, patient satisfaction was significantly higher in theSHB group compared to the ISB group. Checcucci *et al*. Also found out that suprascapular with axillary block provided high level of patient satisfaction.[16] Our

Table 2: Time to first analgesia request and analgesic consumption in 24 hrs

Parameters	ISB Group(n=37)	SHB Group(n=35)	P value
Time to 1st analgesia request(hrs)	6.2±1.3	5.9±1.2	p>0.05
Total analgesic consumption in 24 hrs(gram)	2.8±0.9	3.0±1.1	p>0.05

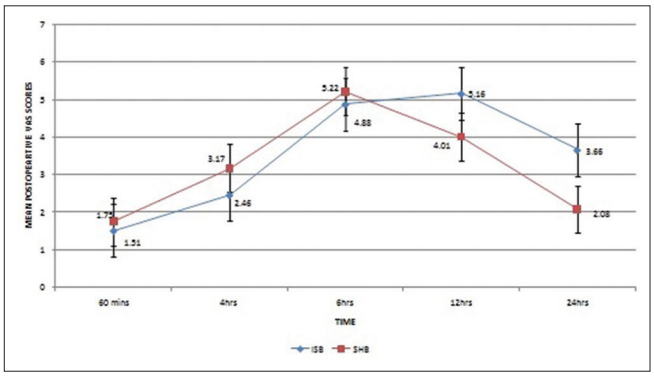

Figure 2: Post-operative mean VAS score

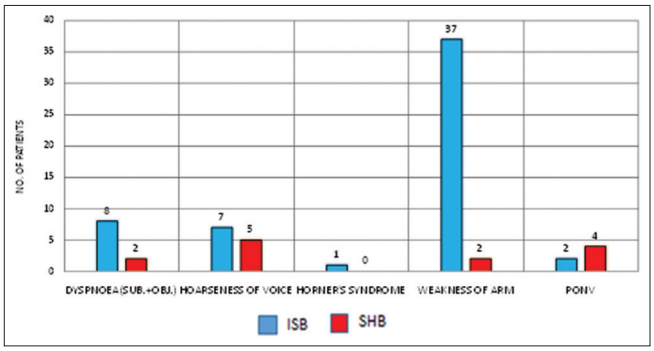

Figure 3: Complications

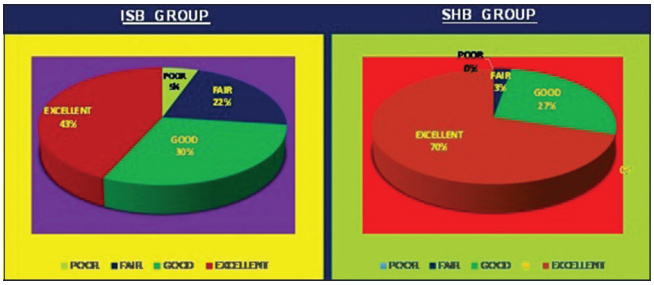

Figure 4: Patient satisfaction scores

findings also agree with the previous trials conducted by Pitombo *et al*.[18] and Dhir *et al*.[19] Pitambo *et al*. concluded that both techniques are safe, effective and with the same degree of satisfaction and acceptability. The selective blockade of nerve blocks provided satisfactory analgesia with the advantage of providing motor blockade restricted only to the shoulder. Dhir *et al*.[19] concluded that combined suprascapular and ANB provides equivalent analgesia as with ISB after arthroscopic shoulder surgery. In our study, the incidence of dyspnoea and muscle weakness was pronounced and statistically significant in the ISB group than the SHB group. Recent studies recommended lowering the concentration of ropivacaine for ISB in order to minimise the extensive motor block and hence to increase patient satisfaction. In contrast, the literature on SSNB generally advocates the usage of a higher ropivacaine concentration. Thus, to minimise study heterogeneity, we opted to use 0.75% ropivacaine in both groups.[20,21] Checcucci *et al*., Barber *et al*. and Feigl *et al*. Reported that there were no complications with shoulder blockade during the performance of block like SSN injuries, haematoma and pneumothorax.[16,22,23] Singdyn *et al*. reported Horner's syndrome and hoarseness of voice as complications of ISB.[24] Other studies reported extensive paralysis of the muscles of the upper limb, which was a sign of effective ISB but caused discomfort to the patient. Urmey *et al*. reported the phrenic nerve block in all patients undergoing ISB. It may be due to the unpredictable local anaesthetic spread to adjacent structures like neural structures or the stellate ganglion.[25] Zanfaly *et al*. in their study concluded that SHB is as effective as ISB for post-operative pain relief but with fewer complications.[26] Thus, SHB is a good alternative for patients at high risk for adverse events with ISB, which was similar to our study. These findings suggest that SHB may be considered a safe and effective option to the ISB for shoulder surgery. Our study was also similar to study conducted by Desroches *et al*.[27] and Lee *et al*.[28] In a recently published study by Neuts *et al*., they concluded that suprascapular–ANB is not inferior to ISB in terms of analgesia, which is in agreement with our study. It reduced the opioid requirements in the immediate post-operative period which was associated with a lower incidence of dyspnoea and discomfort.[29] In the present study, both SHB and ISB provided similar post-operative analgesia. ISB group had a high rate of complications than SHB group which made it inferior for use in patients with pulmonary pathologies undergoing arthroscopic shoulder surgery. Our study has some limitations. First, because of the different number of injections, patients could not be blinded to group allocation. Second, dyspnoea was reported with a VAS score which is a subjective approach that lacks sensitivity and specificity to diagnose phrenic nerve palsy. Third, all blocks were performed by an experienced anaesthesiologist, so success rate may vary according to the experience of anaesthesiologist. Fourth, we have used higher concentration (0.75%) of ropivacaine in ISB which may have produced more complications. Also, our study did not measure the cortisol level intraoperatively to assess the stress response and the analgesic effect of the block, which needs further research.

CONCLUSION

SHB provides equivalent analgesia as the ISB for the relief of post-operative pain in adults undergoing shoulder arthroscopy with a lower incidence of complications.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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