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Suprascapular Nerve Block for Postoperative Pain Control in Shoulder Arthroscopic Surgery: A Randomized Control Trial

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Arthroscopic shoulder surgery is known to cause severe postoperative pain. We conducted a randomized control trial to evaluate the efficacy of suprascapular nerve block (SSB) in the reduction of this pain and the increase of patient satisfaction.
Methods: 34 patients undergoing arthroscopic shoulder surgery under general anesthesia were prospectively randomized into two groups: 20 patients received suprascapular nerve block (SSB) and 14 patients received placebo (control group). Patient pain levels were measured using the

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numerical rating scale (NRS) in the recovery room, 2-4 hours, and 24 h after surgery. Analgesic and opioid consumption was evaluated during the first 24 hours. Patient satisfaction was assessed at 48 hours post-operatively.

Results: compared to the control group, the SSN group reported significantly lower levels of postoperative pain in the recovery room (3.2 vs. 7.7), 2-4 hours postoperatively (3.6 vs. 7.6) and at 24 hours post-operatively (5.35 vs. 7.2). Also, SSB patients required significantly less analgesic (60% requiring 1-2 ampoules vs. 83% requiring 2-3 ampoules) and no opioids at all (0% vs. 14.3%). They had higher levels of postoperative satisfaction (1.55 vs. 0.6).

Conclusion: Patients treated with suprascapular block had less pain during the first 24 hours after surgery, which led to a decreased need for analgesics. Furthermore, patients were significantly more satisfied with the operation. We conclude that SSB may be an effective modality for post-operative analgesia.

Level of Evidence: Prospective, randomized, double-blinded clinical trial, Level I evidence

Keywords: Suprascapular; nerve block; shoulder; arthroscopy; post-operative analgesia.

1. INTRODUCTION

Arthroscopic procedures of the shoulder are often associated with severe postoperative pain [1,2] (especially on day 1) [3] which can lead to stress and chronic regional pain syndrome [4]. This is usually managed by large doses of opioids [5–9] But using high amounts of opioids has a lot of complications like sedation, confusion, dizziness, pruritus, nausea, vomiting, gastroparesis, constipation, urine retention, cardiovascular depression (vasodilation and hypotension, bradycardia), respiratory depression (apnea), seizures, muscle rigidity, and myoclonus [10]. In addition, there is an entity called opioid-induced hyperalgesia, where increasing doses of opioids may increase sensitivity to both pain (hyperalgesia) and non-painful stimuli (allodynia) [11]. Thus, a number of analgesic modalities to limit opioid intake has been used, with different success rates and side effects.

Interscalene brachial plexus block (ISB) is considered the gold standard for postoperative analgesia following shoulder arthroscopy [12–14], as it has consistently been shown to significantly reduce postoperative pain [15]. It can even be used to provide surgical anesthesia [16] without general anesthesia. Despite the fact that it outperforms other modalities, it has relative contraindications; for example, it is contraindicated in patients with severe chronic obstructive pulmonary disease because of phrenic nerve issues [17]. Diaphragmatic paresis appears to be an inevitable consequence of interscalene brachial plexus block when providing anesthesia sufficient for shoulder surgery, occurring in almost all cases [18,19].

ISB is also associated with other neural complications, such as hoarseness [7.1%], Horner syndrome [10%], prolonged motor block [14.6%] [15], brachial plexus injury [20,21], idiopathic brachial plexitis [22], unintended spinal [23] or epidural [24] anesthesia, and seizures [25]. Persistent neurological complications following ISB range from 2.5% to 4.2% [26–28]. In a prospective study of 520 patients [29], 14% reported paresthesia, dysesthesia, or pain apparently not related to surgery at day 10. At 1 month, 8% still had symptoms, and 4% had symptoms persisting at 3 months. It was difficult to explain the reasons for the persistence of paresthesia or dysesthesia in these patients, because the electroneuromyography did not show even the smallest sign of increased latency or decrease of conduction velocity.

ISB also may predispose to some serious, life-threatening accidents such as cardiac intoxication with cardiovascular collapse, pneumothorax, severe respiratory depression, and vertebral artery injection [17,28,30–33].

For this reason, some surgeons suggested the use of suprascapular nerve block (SSNB) and axillary Nerve Block (ANB) as an alternative with fewer reported side effects for shoulder arthroscopy [34,35].

Intra-articular/subacromial injection of Bupivacaine is widely used at the end of the procedure and is believed to reduce postoperative pain. However, evidence-based literature shows that it provides little clinical benefit for post-operative analgesia [15,36]. In addition, 9to its inefficiency, it predisposes to post-arthroscopic glenohumeral chondrolysis, as evidenced by multiple clinical [37–41] and animal model studies [42,43]. Because of this

irreversible chondrotoxicity, these injections are not presently recommended [14].

Suprascapular nerve block (SSB) has been proposed based on the anatomic fact that the suprascapular nerve innervates approximately 70% of the shoulder joint, capsule, subacromial space, acromioclavicular joint, and coracoacromial ligament [14,44], with the remaining 30% thought to be innervated by the lateral pectoral and axillary nerve [14,45]. As well as motor innervation of the supraspinatus and infraspinatus muscles [46]. Concerning efficacy, the literature features randomized control trials which found significantly reduced post-operative pain scores in the SSB group compared with controls [15,45,47], while other studies reported no significant difference [48–50].

One study done in 2018 showed that anterior suprascapular block, but not the supraclavicular, provides noninferior analgesia compared to the interscalene approach for major arthroscopic shoulder surgery. But it did not study the effect of main suprascapular nerve block, not only the anterior branch [51].

The aim of this randomized control trial is to assess the effectiveness of SSB (Suprascapular Nerve Block) in achieving analgesic outcomes following shoulder arthroscopy. This investigation seeks to emphasize the significance of SSB, particularly in situations where alternative options such as ISB (Interscalene Nerve Block) are not feasible or applicable. The hypothesis being examined posits that when a patient undergoes shoulder arthroscopy under general anesthesia, the inclusion of SSB will significantly diminish postoperative pain during the initial 24-hour period. Additionally, this approach is expected to reduce complications in specific patient groups, such as by preserving the integrity of the phrenic nerve, for instance [46]. The end-points are pain score and the consumption of analgesics within the 24-hour period post-operatively, and patient satisfaction at 48 hours.

2. METHODS

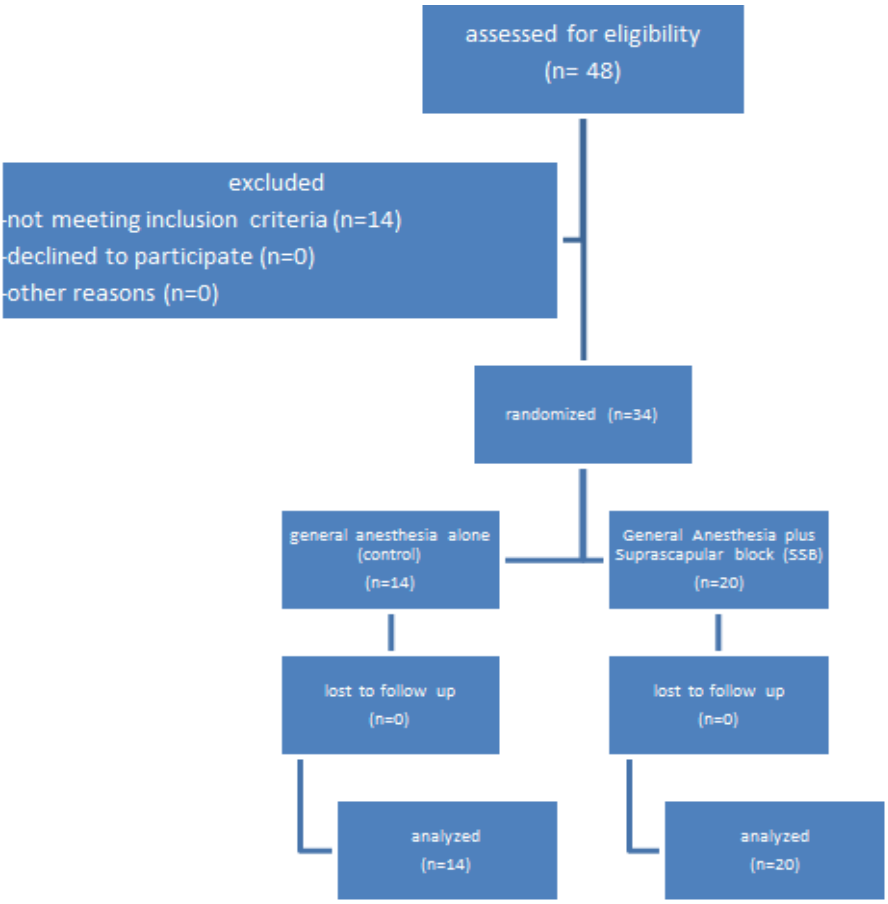

Fig. 1. The way of the conducted study

This is a prospective, double-blinded, randomized control trial (RCT), which was commenced after receiving institutional review board clearance. 48 consecutive patients scheduled for unilateral shoulder arthroscopy during a three-month period (march, April and May 2023) in Lebanese Military Hospital were reviewed for eligibility. Exclusion criteria were having a previous surgery in the same shoulder, having possible confounding factors like cervical radiculopathy, receiving chronic pain medications pre-op (e.g., gabapentin), and being scheduled by the anesthesiologist for an interscalene block. Thirty four patients were eligible to be enrolled. Preoperative data was collected and included the initial pain score evaluated on the numerical rating scale (NRS) [52,53], the numerical version of visual-analog-scale, in which the patient selects the whole number (0-10) best reflecting the intensity of his or her pain, with 0 being no pain and 10 being the most intense pain a patient can imagine.

Scheduled surgery type was classified into one of three categories: decompressive, repair, or instability. Additional information included sex, age, and side dominance. These patients were randomized by a non-blinded statistician into two groups: 14 patients were elected to receive only general anesthesia (control group) with the placebo, and 20 patients elected to receive general anesthesia and suprascapular block (SSB group). The randomization process took into priority a similar distribution of patients according to the type of surgery and preoperative pain.

Neither before nor after surgery would a patient know his category, or whether he/she would be injected with saline or Bupivacaine. He must consent to receive either solution, blinded as to what solution he/she would be actually subjected to.

On the surgery day, a closed envelope containing the randomization choice was handed to a non-blinded anesthesia technician who is not involved in the general anesthesia of the patient, data collection, or result analysis. He prepared a standard 15 cc syringe containing one of two solutions: 15 cc normal saline if the patient is included in the control group, and 15 cc Bupivacaine 0.25% if the patient is included in the SSB group. The consistency, density and color of Bupivacaine solution is indistinguishable from that of normal saline. After preparing the syringe in a different room, the technician entered the operative room and handed the syringe to the blinded operating surgeon.

All patients had a standard general anesthesia, where maintenance was achieved with Sevoflurane inhalation and Remifentanil infusion. After scrubbing and draping, in a lateral decubitus position, and before introducing the scope, the operating surgeon injected the needle at the intersection of a line 2 fingers medial to acromioclavicular joint posterior edge, and a line parallel to the Scapular Spine 1.5cm anterior to it. He then advanced it until it struck the scapula body at 4 to 5 cm depth, then the needle was retracted 1cm and the anesthetic was injected. Echography guidance was not employed to emphasize the simplicity of this procedure, making it accessible to all orthopedic surgeons, even those without expertise in echography, especially in situations where echography guidance is not readily available.

At the end of the procedure, all patients received 1g of paracetamol IV before being extubated.

Postoperative evaluation was done by a blinded physician who didn't interact with the patient preoperatively, and didn't participate in the surgery. He was asked to objectively assess pain level according to NRS score at three incidences: in the recovery room, at 2-4 hours post-op, and at 24 hours post-op. Patients were discharged on day 1 and the same physician contacted them by phone at 48 hours post surgery to collect information about their satisfaction. (0: not satisfied, 1: satisfied, 2: very satisfied).

Data was computerized and analyzed by the same statistician who conducted the randomization process, using the SPSS 15.0 software (statistical packages for Social Science; SPSS Inc., Chicago, Illinois, USA). Normality of the distribution of data was assessed by the Kolmogorov– Smirnov test. Continuous variables were expressed as mean ± SD. Means were compared using ANOVA test. Student's T-test and Chi square test were used to compare the two groups. A P-value of 0.05 or less was considered statistically significant.

3. RESULTS

The total number of eligible participants in this randomized control trial was 34. Among those, 14 patients, with a mean age of 38 years, underwent general anesthesia alone (control group), while 20 patients, averaged at 42 years

old, had general anesthesia plus suprascapular nerve block (SSB group). The randomization process led to a similar distribution of patients according to the type of surgery (56% had decompressive surgery, 32% repair surgery, and 12% instability surgery) and pre-op NRS scores (2.8 in control group, 2.2 in SSB group). Of the 14 patients in the control group, 8 were males and 6 were females, while in the SSB group there were 4 females and 16 males. In both groups, more than 70% of participants had surgery on the dominant side. The mean duration of surgery was 75 minutes in the GA group, compared to 87 minutes in the SSB group (Table 1).

Post-operative pain scores for the control group were 7.7, 7.6 and 7.2 in the recovery room, 2-4 hours after surgery, and 24 hours after surgery, respectively. As for the SSB group, the means were respectively 3.2, 3.6 and 5.4 (Table 2).

Within the first 24 hours following surgery, 13 out of 14 patients (92.86%) of the control group used paracetamol, 6 (46%) of whom used 2 ampoules, and 7 (54%) used 3 ampoules (Table 3).

Table 1. patient characteristics

Variable	General Anesthesia alone (control group) N=14	General Anesthesia +suprascapular nerve block (SSB group) N=20	Total N=34
Sex			
Males	8(57.14%)	16(80%)	24 (70.6%)
Females	6(42.86%)	4(20%)	10 (29.4%)
Dominant side	10/14 (71.4%)	14/20 (70%)	24/34 (70.5%)
Mean age (years)	37.643	42	40.2
Type of surgery • Decompressive • Repair • instability	 8(57.14%) 5(35.72%) 1(7.14%)	 11(55%) 6(30%) 3(15%)	 19(55.9%) 11(32.3%) 4(11.8%)
Mean surgery duration ± S.D (minutes)	75	87	
Mean pre-op pain at rest ±SD	2.8 ± 1.7	2.2 ± 0.9	

Table 2. Postoperative NRS scores and patient satisfaction

	General Anesthesia alone (control group)	General Anesthesia and suprascapular nerve block (SSB group)	P value
Mean post-op pain in recovery room ± S.D	7.692 ± 1.888	3.2 ± 1.765	<0.001
Mean post-op pain after 2-4hrs ± S.D	7.571 ± 1.399	3.6 ± 0.94	<0.001
Mean post-op pain at 24 hours ± S.D	7.231 ± 0.927	5.35 ± 1.785	<0.001
Patient satisfaction in 48 hours	0.6 ± 0.5	1.55 ± 0.5	<0.001

In the SSB group, 12 out of 20 patients (60%) did require paracetamol, 9 (75%) of them used 1 ampoule, and 3 (25%) used 2 ampoules.

Overall, a mean quantity of 2.35 ampoules of paracetamol was used in the control group, compared to 0.75 ampoules in the SSB group.

Two patients (14.29%) needed Pethidine in the control group, each one took 1 ampoule. None of the patients in the SSB group needed pethidine.

Eight patients (40%) of those who received the block required neither paracetamol nor pethidine during the whole 24 hour period.

Patient satisfaction at 48 hours was only 0.6 (not satisfied to satisfied) in those who didn't receive the block, compared to 1.55 (satisfied to very satisfied) in those who did (Table 2).

4. DISCUSSION

In our study, 40% of the patients who received the block didn't require any analgesic medication (not even paracetamol) within the first 24 hours. For the majority of those who required medication, pain was controlled with only one ampoule of paracetamol, and no opioid was needed. This reflects, objectively, the low perception of pain in the first 24 hours following suprascapular block. Subjectively, patients' reported scores imply minimal pain in the early post-operative period as well, with a little surge at 24 hours, but not reaching the extent of those who didn't receive the block. As a matter of fact, the timing of paracetamol administration was mostly coinciding with this 24-hour-surge, and was seldom needed prior to it. This pain-rebound at day 1 is reported in the literature [3]. Similarly, a rebound phenomenon of increased pain 12 hours postoperatively has been reported following ISB [54].

Kay et al. [16] conducted an extensive literature review in 2018, and identified three RCTs which found significantly reduced post-operative pain scores in the SSB group compared with controls, and three studies which reported no significant difference. After meta-analysis of the data, the authors concluded that SSB is efficacious in improving pain control in the early post-operative period; however, the effect may abate beyond 24 hours post-operatively. This was actually seen in our study.

None of the 20 patients in the SSB group needed any opioid at all. This is a significant finding that is worth mentioning. Similarly, Lee et al. compared SSB and placebo injection, reporting that significantly fewer morphine boluses were required for the SSB group. SSB, thus, seems to spare the patient from the need for opioids.

Table 3. Post-operative consumption of analgesic and opioid

	General Anesthesia alone (control group)	General Anesthesia and suprascapular nerve block (SSB group)	P value
Consumption of paracetamol	13/14 (92.86%)	12/20 (60%)	<0.001
Mean paracetamol quantity± S.D (ampoules)	2.35 ampoules (overall) 2.53 ampoules (among those who took it): 46% used 2 amp, 54% used 3 amp.	0.75 ampoules(overall) 1.25 ampoules (in those who needed it): 75% used 1 ampoule, 25 % needed 2 ampoules	
Consumption of Pethidine	2/12 (14.29%)	0	<0.001
Mean Pethidine quantity± S.D (ampoules)	0.143 (overall) 1 ampoule (among those who needed it)	0	

Despite being less effective than single dose ISB, especially in the short-term period (within 6 hours post-operatively), SSB provides better pain scores than parenteral or intra-articular analgesia [15]. SSB is more efficient and induces fewer side effects than IV patient-controlled analgesia with morphine [55]. Also, it provides better pain scores than intra/peri-articular Bupivacaine [15]. However, literature states that after 24 hours, there is no difference in pain between all of these modalities [51,56]. Specifically, no difference was found at 24 hours in pain control or morphine intake between SSB and ISB [16,57,58] which is considered the gold standard for postoperative analgesia [12–14].

Residual pain felt in the first 24 hours after SSB block (NRS scores in our patients: 3.2-5.35) may be explained by the fact that 30% of the joint and capsule is innervated by the lateral pectoral and axillary nerves, which are not blocked during SSB. Moreover, the suprascapular nerve rarely gives proper cutaneous innervation [59], and therefore the SSB does not provide analgesia for the pain from skin incisions. This may explain the residual low-intensity pain that the patients felt in the immediate postoperative period.

We are not proposing SSB as a replacement for ISB, but patients with moderate-to-severe respiratory disease who might be expected to be intolerant to both ipsilateral phrenic nerve block (associated with interscalene block) and high doses of peri-operative opioids may represent prime candidates for this technique [14], as its safety profile is well documented [16]. In addition, it is a feasible option in patients with obese necks, in whom ISB block may cause complications [60].

Achieving good pain control is paramount in elective surgery. It is strongly needed for outpatient practice, as pain during the first day post-op is found to be the main factor of failure of outpatient surgery [3], and poor pain control is thought to be responsible for more than 60% of unplanned or prolonged hospitalizations [16]. Also, achieving good pain control is an important factor in determining patient-reported postoperative satisfaction [55]. Jeske et al. [43] found that, when compared with placebo, SSB resulted in significantly higher patient satisfaction at 48 hours. This was also observed with our SSB patients. All of them were more satisfied at 48 hours than those who didn't receive the block. This is probably attributed to their higher pain relief that was documented in the first 24 hours. Furthermore, aside from its general safety, SSB doesn't usually cause symptoms of discomfort, such as nausea and vomiting [45], adding further to the satisfaction of patients.

Gerber et al. [61] found experimentally that SSB leads to a loss of approximately 70%-80% of external rotation strength and approximately 45%-75% of abduction strength. However, muscle strength recuperates after the effect of the block wanes. Jeske et al. [43], in subacromial decompression patients, reported significantly improved range of motion (ROM) and muscle power in SSB patients compared to controls not only at 48 hours, but also at 6 weeks post-operatively. Skedros et al. [62] found that postoperative pain is often a concurrent problem that delay rehabilitation and lower the quality of life. This highlights a practical benefit for SSB that is beyond the first 24 hours. Pain control associated with SSB may enable a better postoperative mobilization of the shoulder, thereby contributing to the superior clinical outcome in ROM, weeks after the block had ceased.

5. CONCLUSION

The most significant finding of the present RCT is that SSB results in significantly improved pain control during the first 24 hours after arthroscopic shoulder surgery compared with control. This pain relief does reflect into both, a decrease in analgesic intake, and a higher patient satisfaction. Thus, SSB represents a beneficial adjunct to shoulder arthroscopy surgery.

ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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