Case Series

Low-volume C5–6 interscalene and supraclavicular nerve blocks for arthroscopic shoulder surgery: A case series

Sandeep Diwan, Divya Sethi[1], Nilesh Kamath[2], Abhijit Nair[3]

Department of Anesthesiology, Sancheti Institute of Orthopedics and Rehabilitation, Pune, Maharashtra, [1]Department of Anesthesia, Employees' State Insurance Cooperation Postgraduate Institute of Medical Sciences and Research (ESIC–PGIMSR), New Delhi, [2]Department of Orthopedics, Sancheti Institute of Orthopedics and Rehabilitation, Pune, Maharashtra, [3]Department of Anesthesiology, Basavatarakam Indo-American Cancer Hospital and Research Institute, Hyderabad, Telangana State, India

Abstract

Interscalene block (ISB) is considered a gold standard regional anesthesia technique for shoulder surgery. Conventionally, 20 ml of local anesthetic is used for ISB. Nevertheless, this high-volume traditional ISB is associated with a high incidence of hemidiaphragmatic paresis due to phrenic nerve block. Recent evidence suggests that low-volume ultrasound-guided (USG)-ISB can provide effective analgesia whilst avoiding complications. Thirty patients of American Society of Anaesthesiologist ASA status I/II undergoing arthroscopic rotator cuff repair surgery under general anesthesia were administered low-volume USG-ISB and supraclavicular nerve block (SCNB). The block provided effective analgesia in 90% (27/30) of the patients as their visual analog score was below 4 at all times in the 24-h postoperative period. Only three patients required a single dose of rescue analgesic (diclofenac 50 mg iv) in the 24-h postoperative period. In postoperative recovery, two patients (6.67%) had desaturation due to hemidiaphragmatic paresis and three patients (10%) had a transient neurological deficit. In conclusion, low-volume USG-ISB with SCNB provides effective analgesia for arthroscopic rotator cuff repair surgery. The advantages of this technique include a low incidence of respiratory and neurological complications.

Keywords: Anaesthesia, ankylosing spondylitis, caudal anaesthesiaAnalgesia, arthroscopy, interscalene block, postoperative, ultrasound

Introduction

Up to 45% of the patients undergoing complex shoulder arthroscopic surgeries experience severe postoperative pain. Opioid-sparing techniques are the mainstay of postoperative pain relief strategies. Interscalene block (ISB) is considered a gold standard regional anesthesia technique for shoulder surgery as it provides effective analgesia with reduced opioid consumption in the postoperative period.[1] Conventionally, 20 ml of local anesthetic (LA) is injected for an effective ISB. However, the potential complications associated with this traditional high-volume ISB include epidural spread, phrenic nerve palsy, and potential nerve damage.[2] Recent evidence suggests that low-volume ISB provides effective analgesia whilst avoiding the above complication.[3]

In this case series, we performed low-volume ultrasound-guided (USG)-ISB with supraclavicular nerve block (SCNB) in patients undergoing arthroscopic shoulder surgeries under general anesthesia. We aimed to evaluate the visual analog score (VAS) and analgesic requirement in postoperative first 24 h. The patients were also assessed for any respiratory or neurological complications postoperatively.

Address for correspondence: Dr. Divya Sethi,
A-2B/118-B, Ekta Apartment, Paschim Vihar, New Delhi -110063, India.
E-mail: divyasth@gmail.com

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Case Report

Thirty patients of ASA status I/II undergoing arthroscopic shoulder surgeries for rotator cuff tears were enrolled after approval of the institutional ethics committee (Sancheti Institute of Orthopaedics and Research, Pune, India). Written informed consent was taken from all the patients. Patients with chronic obstructive pulmonary disease, massive rotator cuff tears, fractures of the shoulder girdle, and obesity were excluded. All patients underwent thorough preoperative evaluation and were kept fasting for 8 h before the surgery.

In the operation theater, standard monitors were applied and general anesthesia was induced with intravenous fentanyl 2 mcg/kg, propofol 2–3 mg/kg, and vecuronium 0.1 mg/kg. The airway was secured with an appropriately sized endotracheal tube. For the USG-ISB, the linear array US probe (5–13 MHz, M-Turbo, Sonosite, USA) was placed on the lateral aspect of the neck and the C7 root was identified emerging from C7 vertebra (absent anterior tubercle). The probe was moved cephalad to identify C6 and C5 roots sandwiched between the anterior scalene muscle (ASM) and middle scalene muscle (MSM). The dorsal scapular and long thoracic nerve traversing the MSM were identified before needle insertion. A 50-mm Stimuplex needle was inserted in-plane; after piercing the perimysium of MSM, the needle tip was positioned in the interscalene groove lateral to C5–6 roots [Figure 1]. With the needle immobile in this position, 5 ml of 0.5% bupivacaine was injected [Figure 2]. For the SCNB, the needle was withdrawn out of the MSM and redirected in the connective tissue plane between the SCM (sternocleidomastoid) and the MSM; 2 ml of 0.5% bupivacaine was injected taking care to avoid spreading on to the ASM [Figure 3].

Thereafter, the patient was positioned in lateral decubitus with traction weight applied to the shoulder and the surgery commenced. Anesthesia was maintained with inhalational agents, an intermittent bolus of vecuronium bromide and volume-controlled ventilation. Thirty minutes before skin closure, paracetamol 1 g iv was administered which was repeated 8 h postoperatively. After completion of the surgery, the neuromuscular blockade was reversed and the trachea extubated. The patient was monitored for the first six postoperative h in postoperative care unit (PACU) before transfer to the ward. The VAS at 1, 3, 6, 12, 18, and 24 h was recorded and diclofenac 50 mg iv (Dynapar, Neon, India) was given as rescue analgesic for VAS >4. The first analgesic request time and the total dose of rescue analgesia needed in 24 h were recorded. The patients were followed up at 24 h and before discharge for any residual neurological deficits.

The low-volume USG-ISB with SCNB was successfully performed in all the 30 patients. Only three patients required a single dose of rescue analgesic (diclofenac 50 mg iv) in the 24-h postoperative period. The mean first analgesic request time was 10.38 ± 2.3 h. In 27 patients, the VAS was below 4 at all times in the 24-h postoperative period [Table 1]. Thus, we can infer that the low-volume USG-ISB with SCNB provided effective analgesia in 90% (27/30) of the patients.

In PACU, two patients (6.67%) had SaO_2 (oxygen saturation) below 90% even after oxygen supplementation with a face mask. An abdominal US examination confirmed hemidiaphragmatic paresis (HDP). The patients were

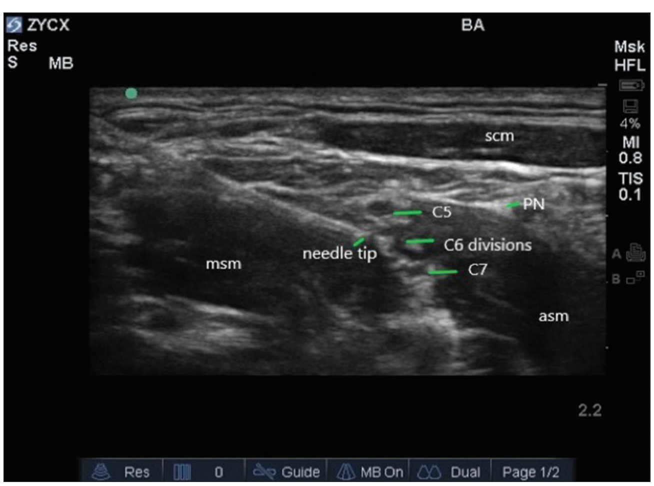

Figure 1: Needle position in ISB Needle tip (green) positioned between the C5 root and the C6 divisions. C5–7 are the cervical nerve roots forming the brachial plexus. The PN is seen over the ASM. Marker (blue dot) is lateral. ASM – anterior scalene muscle; MSM – middle scalene muscle, SCM – sternocleidomastoid, PN – phrenic nerve

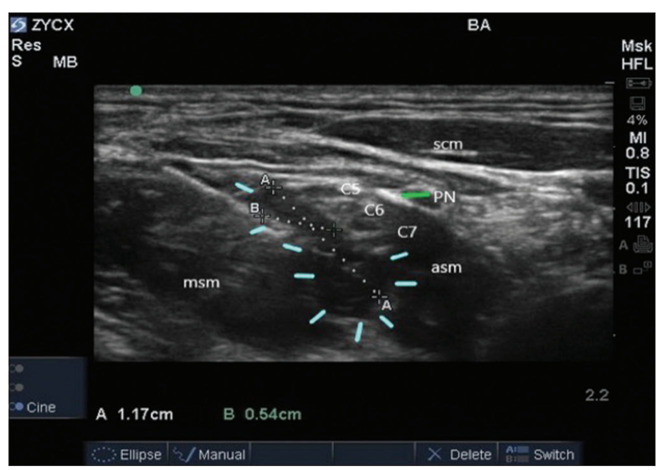

Figure 2: Injection of LA in ISB The spread of LA (light blue) is visualized lateral to the epineurium of the brachial plexus, sandwiched between the MSM (lateral) and ASM (medial). Marker (blue dot) is lateral. ASM – anterior scalene muscle; MSM – middle scalene muscle, SCM –sternocleidomastoid, PN – phrenic nerve; LA – local anesthetic

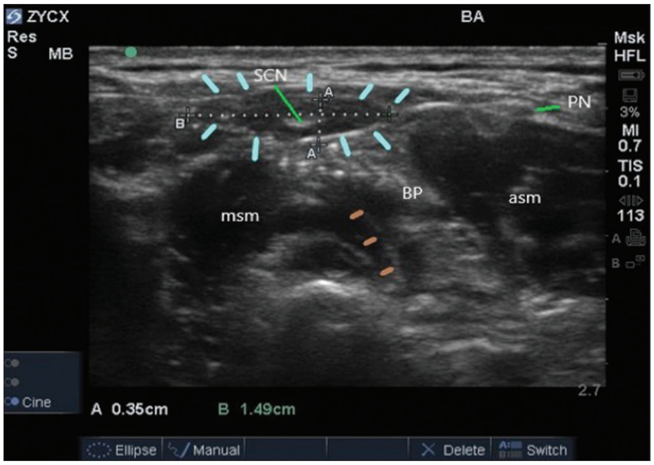

Figure 3: Supraclavicular nerve block The needle is positioned between the SCM and the MSM and is lateral to BP. The supraclavicular nerve is visualized (green) and engulfed by the LA (blue lines). The initial injection of LA lateral to BP is surrounded by perimysium of MSM (brown). ASM – anterior scalene muscle; MSM – middle scalene muscle, SCM –sternocleidomastoid, PN – phrenic nerve; LA – local anesthetic; BP – brachial plexus; SCN – supraclavicular nerve

stabilized by oxygen supplementation through venturi mask using inspired oxygen concentration of 0.5 and their respiratory function was normalized in 12 h. On follow-up at 24 h, three patients (10%) had a residual neurological deficit. One patient complained of neck pain, which persisted for 5 days and resolved naturally after 2 weeks. The second patient was diabetic and had tingling numbness of the middle finger, which settled in 2 weeks with tablet duloxetine (antidepressant) 10 mg per oral. The third patient had paresthesia in the thumb but he was lost for follow-up. In our case series, we cannot solely attribute neurological complication to the ISB as various studies have shown brachial plexus neuropraxia to be associated with the traction weight on the shoulder in lateral decubitus position.[4]

Discussion

The intensity of pain, its duration, and analgesic requirement after arthroscopic rotator cuff repair are comparable to that of open-rotator cuff-repair surgery.[5] A study showed that patients undergoing arthroscopic rotator cuff repair commonly had prolonged opioid requirement and were prone to opioid dependence in the extended postoperative period.[6] Hence, it is important to have a well-managed multimodal analgesic regime with the use of regional anesthesia techniques and minimal reliance on opioids.

The traditional high-volume ISB is associated with a high incidence of HDP due to phrenic nerve block. Studies have established that phrenic nerve block is volume related with strong evidence suggesting that LA in volume 20 ml or more almost always leaded to HDP.[3,7] Falcao *et al*. confirmed that the volume of LA below 4.3 ml did not cause a diaphragmatic block.[7] In addition, Gautier *et al*. reported that the minimum effective LA volume required for USG-ISB was only 5 ml; accordingly, we used 5 ml of LA for the USG-ISB in the case series.[8]

Table 1: Postoperative VAS

Time (h)	VAS
1	1.11±0.32
3	1.34±0.47
6	1.60±0.50
12	2.43±0.50
18	3.13±0.34
24	3.36±0.48

Data presented as mean±SD

Apart from volume, there is evidence which suggests that phrenic nerve block is site dependent and HDP can be decreased by a low approach to ISB. In human volunteer study by Renes *et al*., the incidence of HDP was very significantly reduced with USG-ISB at C7 compared to traditional nerve stimulator guided ISB (13% vs. 93%, respectively).[9] However, for shoulder surgery, targeting the lower cervical nerves may not provide adequate surgical anesthesia. The shoulder joint has complex innervation from several nerves including suprascapular, axillary, musculocutaneous, and the lateral pectoral. Fascicles traced cephalad from these nerves are concentrated in the superior trunk of brachial plexus.[10] Therefore, it is prudent to inject low volumes of LA lateral to C5–6 to provide complete blockade of the superior trunk and reduce the incidence of phrenic nerve paresis- related HDP. With this approach, the incidence of HDP was only 6.67% in this case series.

The limitation of our work was that we could not assess motor function and sensory loss after administering the low-volume USG-ISB as all the patients were given general anesthesia for shoulder arthroscopic surgery. The diaphragmatic excursion was monitored only in patients who demonstrated a fall in SaO_2 (≤90%) postoperatively in PACU. Also, there was no control group to compare analgesic efficacy and other outcomes. To conclude, low-volume USG-ISB with SCNB provides effective analgesia for arthroscopic rotator cuff repair surgery. Moreover, this technique offers the advantage of low incidence of HDP and neurological complications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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