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The analgesia in arthroscopic shoulder surgeries with emphasiss on efficacy of ultrasound-guided interscalene block and combined shoulder anterior capsular block and suprascapular nerve block

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Abstract
Shoulder arthroscopic operations may produce severe postoperative pain. Interscalene block (ISB) offers effective analgesia following shoulder surgical treatment, but considerations regarding its potential risks have motivated the explore for replacements. Suprascapular nerve block (SSNB) is the most often performed regional nerve block. Recently, the shoulder block, which combines the suprascapular nerve block with an axillary nerve (AN) block, has been proposed as an alternative to ISB, however proof of its effectiveness is inconsistent. The AN supplies the anterior, lateral, and inferior tissues of the shoulder joint, as well as the deltoid muscle and some fibers to the teres minor. The AN furthermore innervates the deltoid muscle skin.

Keywords: Arthroscopic shoulder surgeries, axillary nerve block, suprascapular nerve block, interscalene block, shoulder anterior capsular block

Introduction
Shoulder arthroscopy is a less invasive technique which results in substantial post-surgical pain due to major resection of bone, significant exclusion of bursal tissue, the insertion of suture anchors, and soft tissue distension from irrigation fluid. As a result, effective pain treatment frequently requires a combination of systemic and localized analgesics [1].
Opioids, interscalene block, and peripheral nerve block are among the various options for managing postoperative pain. Opioids and PCA exhibit systemic impact and may not provide significant pain relief due to side effects, for example vomiting, nausea, and drowsiness. The interscalene block is widely utilized and successful in shoulder arthroscopy. Although this type of block is quite effective in relieving pain, 5% to 10% of patients may experience rebound pain as a side effect. Because the phrenic nerve can be affected by the interscalene block, it may result in pulmonary troubles such as diaphragmatic paresis or respiratory difficulty. The axillary nerve block (ANB) and SSNB are two examples of peripheral nerve blocks that used recently and have shown promise in managing pain [2].

Shoulder arthroscopy
Following knee arthroscopy, shoulder arthroscopy is the second frequent orthopedic treatment. Pathologic shoulder problems as labral tears, proximal biceps pathology, rotator cuff tears, loose bodies, adhesive capsulitis, degenerative arthritis, and subacromial impingement are repeatedly treated with shoulder arthroscopy [3].
Arthroscopy offers several advantages over open surgery, such as a more thorough visualization of intra-articular pathology, smaller incisions and reduced morbidity rates, the possibility of quicker rehabilitation, and a quicker go back to work [4].
The surgeon inserts fluid inside the shoulder to swell the joint. This allow to see all the structures of the shoulder via the arthroscope, then the surgeon will create a minor puncture in the shoulder (about the size of a buttonhole) for the arthroscope [4].

Regional anesthesia
In patients schedule for shoulder surgical procedures, regional anesthesia (RA) is a useful anesthesia and analgesic method. In general, RA includes blockade of the brachial plexus from different anatomic lines (supraclavicular, interscalene, infraclavicular) [5].

Regional anesthesia upgrades postoperative pain control, reduces use of opioid, and diminishes recovery times in comparison to general anesthesia. In addition, autonomic functions are maintained throughout RA, admitting the patient to control their own essential functions. Lastly, various publishers revealed on the effectiveness of blockade of brachial plexus in shoulder surgical procedure in offering good muscle relaxation, superior stable hemodynamics, decrease stay of post anesthesia care unit (PACU), decreased unplanned hospital readmission for pain management, enlarged operating room effectiveness, superior satisfaction of patient and diminishes time to discharge for patients receiving ambulatory surgeries, however there were some complications regarding using RA techniques such Horner's syndrome, hoarseness, local anesthetic systemic toxicity (LAST), ipsilateral hemi diaphragmatic paralysis (HDP), phrenic nerve (PN) palsy and further nerve injuries [6].

Advancement in US technology can increase clinical applications for peripheral nerve blocks. Real time US using while applying the block can decrease the complications, performance time, and LA requirement [7].

Regional anesthesia for management of pain postoperatively

The RA is the methods of accomplishing of sensory and motor nerves blockade through use of LA and adjuvants in a special anatomic zone [8]. During upper extremity procedures, RA is frequently a peripheral block of the brachial plexus, which may be anesthetized in several anatomic regions to accomplish the needed anesthetic effect. Universally, RA of the brachial plexus is aimed at the interscalene, supraclavicular, infraclavicular, or axillary regions [9].

The introduction of US and neurostimulation for locating these regions has raised the safety, adoption, and effectiveness of RA as an replacement to GA [10].

i. Interscalene brachial plexus block (ISB)

The ISB is frequently Utilized upper extremity surgery and is mostly suitable for shoulder surgical treatment. Also, ISB targets the supraclavicular nerves and supports sensory block to the shoulder's skin. While it is regarded "ulnar sparing" due to its limited block of the C8 and T1 ventral rami, making it less effective for surgeries involving the forearm and hand [8, 11].

The ISB is considered the ideal approach for analgesia following shoulder surgical treatment. However, the risk of ipsilateral PN palsy and HDP limits utilization in preexisting pulmonary issues patients, who paradoxically are the ones who are most likely to benefit from RA and the prevention of injectable opioids. [12].

Before the US introduction, the occurrence of HDP related to ISB achieved 100% due to the necessity of using larger volumes of LA injections (eg, 34–52 mL) [13, 14]. The regular usage of guided US in ISB has assisted surgeons to use lesser LA volumes [15], diluted concentrations (e.g., 0.125% bupivacaine, 0.1% ropivacaine) [16] and (extrafascial) points outside the brachial plexus sheath [17]. Though these policies decreased the occurrence of HDP to recently recorded rates of 15%–17%, they had been incompetent to totally avert it.

ii. Diaphragm sparing nerve blocks for shoulder surgery

HDP prevention in shoulder surgical procedure based on two elementary principles. Firstly, in preexisting pulmonary compromise patients, any chance for HDP, regardless of how little, becomes prohibitive. Thus, as contraception, HDP avoidance must be assessed as a binary phenomenon with 0% clinical target. Secondly, Glenohumeral Joint (GHJ) and its neighboring tendons ligaments, and bursae take sensory innervation from the axillary nerve (AN), lateral pectoral nerve (LPN), suprascapular nerve (SSN) and nerve to subscapularis (NS). Whereas the primary three nerves come from the posterior and lateral cords of the brachial plexus, the SSN extends from the upper trunk [18].

Accordingly, ISB replacements should aim to anesthetizing as several of these neural structures as feasible. Such replacements can take the form of single-location strategies (eg, supraclavicular brachial plexus block, C7 root block, upper trunk block, costoclavicular brachial plexus block). On the other hand, they may separate blockade of shoulder into isolated components (e.g., combined axillary and suprascapular nerve blocks, as well as infraclavicular brachial plexus block paired with a suprascapular nerve blockage) [18].

a) C7 nerve root block

The injection of 10 mL of 0.75% ropivacaine under US-guidance posterior to the C7 nerve root could reduce HDP occurrence to 13%, which reduced to 0 % when LA doses were preserved under 6 mL. Nevertheless, considering the higher incidence of the surrounding blood vessels of C7 intervertebral foramen, further trials still needed to show the threat of vascular puncture [19, 20].

b) Approach of supraclavicular brachial plexus

Very trials suggest that, in comparison with ISB, supra-clavicular blocks lead to comparable pain management, breakthrough analgesic utilization and patient satisfaction [21-23]. While supra-clavicular blocks are linked to superior maintenance of pulmonary function, the HDP occurrence still more than 60% when injection of LA within the neural cluster resulting from the union of the trunks and divisions of the brachial plexus [24]. On the other hand, Aliste *et al* [23] are capable to reduce HDP risk to 9% (whereas preserving analgesic equation to ISB) by adding LA posterolateral relative to the neural cluster.

c) Upper (superior) trunk block

The upper trunk blockage purposes to place LA along the brachial plexus' upper trunk, preceding the SSN takeoff. The basis for this is that, while the PN and brachial plexus shifts caudally, they separate from one another at a rate of 3 mm per centimetre beneath the cricoid cartilage. Therefore, the further distal injection location used in upper trunk block can ideally lead to decrease prevalence of HDP compared to ISB. [25]. Even though blocks of upper trunk could provide comparable analgesia to ISB, they are linked to a notable 5%-risk to HDP [25].

d) Suprascapular nerve block (SSNB)

The SSN may be blocked utilizing an anterior (at base of the neck, under omohyoid muscle) or a posterior (at suprascapular fossa) approach. Cadaveric studies showed that a notable portion of sensory and articular branches to GHJ and Acromioclavicular Joint (ACJ) split off from the main SSN proximal to the transverse scapular ligament, in that way minimizing blockade with the use of a posterior

approach. Therefore, from the anatomical point of view, anterior approach can achieve a more extensive block of the SSN [20, 26]. Though, this finding could not wholly justify the similar analgesic efficiency among anterior SSNB and ISB, as the latter does not provide sensory coverage for the AN, LPN, and NS [18]. Another cadaveric research that affected the anterior SSN with 5 mL of dye, observed that the dye extends to the SSN as well as to upper and middle trunks. Though, these outcomes should be interpreted cautiously by considering that the PN was also stained in 20% of the specimens [18, 27].

e) Approach of Costoclavicular brachial plexus block

Costoclavicular block (CCB) works by targeting brachial plexus within the costoclavicular space, at proximal infraclavicular fossa stage. Within the costoclavicular space, the three cords of the brachial plexus are closely grouped together, so supporting an effective way to anesthetize the NS, AN, and LPN. Additionally, the costoclavicular region might act as a backward pathway for LA to access the SSN in the supraclavicular fossa [28, 29]. CCB consider the only method proven to provide analgesic comparable with ISB combined with a 0% HDP rate [29]. Nevertheless, other verifying trials are needed to approve this 0%-incidence of HDP [18].

f) Combination of axillary and suprascapular nerve block

Combination of SSN and AN blocks has been described first by Dr Darcy Price [30] considered as replacement to ISB for shoulder surgical treatment. The nerves are blocked peripherally around the joint to provide analgesia rather than anesthesia. Unfortunately, this combination omits the contributions of the LPN and NS [18].

Combining axillary and suprascapular nerve blocks leads to poorer pain management and an elevated need for additional analgesics compared to ISB [31]. On the other hand, additional study showed that there was no differences of analgesic among ISB and blocks of axillary suprascapular nerve [32].

g) Combination of infraclavicular brachial plexus block and suprascapular nerve block

The infraclavicular blockage (ICB) works by targeting the brachial plexus cords hence anesthetizing the LPN (lateral cord), NS (posterior cord), and AN (posterior cord) whereas The final nerve in the shoulder joint innervation is anesthetized by the selective SSNB [18].

The combination of ICB and posterior SSNB provides 0%-incidence of HDP, however, analgesia stays lower than ISB through initial 30min [33]. However, ICB combined with anterior SSNB showed comparable analgesia with ISB with 6% HDP incidence [34].

h) Shoulder anterior capsular block (SHACB)

The SHACB involves two independent blocks. The initial block targets the interfacial space located among the superficial layer of the subscapularis fascia and the deep layer of the deltoid fascia, situated anterior to subscapularis myotendinous junction. The second block involves a pericapsular nerve block administered deep to the subscapular muscle [35]. For control of pain after shoulder surgery, blockade of the articular branches that supply the GHJ is necessary [36].

Conflict of Interest

Not available

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