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Research

Comparison of the Efficacy of Different Local Anesthetic Volumes on the Success of Combined Interscalene-Supraclavicular Nerve Block

Farklı Lokal Anestetik Hacimlerinin Kombine İnterskalen-Supraklavikular Sinir Bloğunun Başarısına Olan Etkinliklerinin Karşılaştırılması

Özlem Melike Ekşi[1], Gökhan Sertcakacılar[2,3], Yaser Pektaş[2], Güneş Özlem Yıldız[2], Zafer Çukurova[2], Gülsüm Oya Hergünsel[2]

[1]Marmara University Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Division of Pain Medicine, İstanbul, Türkiye
[2]University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital, Clinic of Anesthesiology and Intensive Care, İstanbul, Türkiye
[3]Outcomes Research Consortium, Texas, USA

ABSTRACT

Objective: Brachial plexus blocks are used as an alternative to general anesthesia for most procedures performed in the upper extremity. This study aimed to compare the perioperative anesthetic and analgesic efficacy of combined interscalene block-supraclavicular brachial plexus block (ISB+SCB), with different volumes of local anesthetic (LA) under ultrasound guidance.

Methods: Data from 85 patients who underwent ISB+SCB for anesthesia in proximal upper extremity surgery including unilateral humerus and shoulder procedures between March 2021 and September 2023 were retrospectively reviewed. According to the local anaesthetic volume of bupivacaine administered, the patients were divided into two groups: the high volume group (Group H), with 18 mL or more, and the low volume group (Group L), with less than 18 mL. Patients were evaluated in terms of anesthetic and analgesic effects in the perioperative period.

Results: Postoperative pain scores and additional analgesic requirements were not significantly different between the two groups during the follow-up period. Motor block was terminated in all patients (100%) at the 8th postoperative hour in Group L, whereas the rate was 89.4% in Group H. A statistically significant difference was found between the two groups (p=0.047). In Group H, the resolution of motor block in all patients was determined at the 12th postoperative hour. The volume of LA given in both groups was sufficient for surgical anesthesia.

Conclusion: Ultrasound-guided ISB+SCB with lower LA volume may provide effective surgical anesthesia and analgesia with similar efficacy and shorter duration of motor block in shoulder and humerus surgery.

Keywords: Upper extremity, interscalene block, supraclavicular block, low volume local anesthetic

ÖZ

Amaç: Brakiyal pleksus blokları, üst ekstremitede gerçekleştirilen çoğu prosedür için genel anesteziye alternatif olarak kullanılmaktadır. Bu çalışmada, ultrason eşliğinde farklı volümlerde lokal anestezi (LA) ile yapılan kombine interskalen blok-supraklavikular brakiyal pleksus bloğunun (İSB+SCB), perioperatif anestezik ve analjezik etkinliğinin karşılaştırılması hedeflenmiştir.

Gereç ve Yöntem: Mart 2021 ile Eylül 2023 tarihleri arasında tek taraflı humerus ve omuz girişimlerini içeren proksimal üst ekstremite cerrahisinde anestezi amacıyla İSB+SCB uygulanan 85 hastanın verileri geriye dönük olarak tarandı. Uygulanan bupivakaine LA volümüne göre hastalar, 18 mL ve üstü uygulanan yüksek hacimli grup (Grup H) ve 18 mL'den daha düşük volüm uygulanan düşük hacimli grup (Grup L) olmak üzere iki gruba ayrıldı. Hastalar perioperatif dönemde anestezik ve analjezik etki açısından değerlendirildi.

Bulgular: Postoperatif ağrı skorları ve ek analjezik gereksinimi karşılaştırıldığında iki grup arasında takip süresince anlamlı fark saptanmadı. Motor blok ise Grup L'de postoperatif 8. saatte hastaların tamamında (%100) sonlanırken, Grup H'de bu oran %89,4 olarak saptandı ve iki grup arasında istatistiksel olarak anlamlı fark bulundu (p=0,047). Grup H'de motor bloğun tüm hastalarda geri dönüş zamanı postoperatif 12. saat olarak belirlendi. Her iki grupta da verilen LA hacmi cerrahi anestezi için yeterli idi.

Address for Correspondence: Özlem Melike Ekşi, Marmara University Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Division of Pain Medicine, İstanbul, Türkiye
E-mail: ozlemeksi91@hotmail.com **ORCID ID:** orcid.org/0000-0002-9947-979X

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ÖZ

Sonuç: Ultrason kılavuzluğunda daha düşük LA hacmi ile uygulanan İSB+SCB, omuz ve humerus cerrahisinde benzer etkinlik ve daha kısa motor blok süresi ile etkin cerrahi anestezi ve analjezi sağlayabilir.

Anahtar Kelimeler: Üst ekstremite, interskalen blok, supraklavikular blok, düşük hacim lokal anestezik

INTRODUCTION

Anesthesia for upper extremity and shoulder surgery can be provided by general anesthesia, regional anesthesia, or a combination of these. Although general anesthesia provides precise airway control, side effects related to general anesthesia and opioids may adversely affect patient comfort and prolong hospital stays with inadequate pain control in a fragile patient population (1). Regional anesthesia techniques maintain more stable hemodynamics compared to general anesthesia, prevent airway instrumentation, and provide adequate intraoperative and postoperative analgesia (2).

Peripheral nerve blocks used for anesthesia and analgesia in upper extremity and shoulder surgery vary according to the patient and the surgical procedure to be performed (1). The distribution, size, and innervation of the blocked surgical area may not be fully achieved with a single peripheral nerve block (3). For this reason, combined block applications are becoming increasingly popular. For example, interscalene block (ISB) and supraclavicular block (SCB) may be sufficient for the proximal arm, but if the surgical intervention involves the distal arm, the ulnar nerve must also be blocked (4).

The interscalene approach to the brachial plexus is the preferred technique for shoulder and proximal arm surgical procedures. However, there is a 100% incidence of ipsilateral phrenic nerve involvement and hemidiaphragm paralysis, resulting from blockade of the C3-5 cervical nerve roots at high volumes. There is also a risk of Horner's syndrome secondary to sympathetic blockade hoarseness and respiratory distress with recurrent laryngeal nerve blockade, and hypotensive-bradycardic events with the Bezold-Jarisch reflex (5). This limits the use of ISB, aimed at reducing the volume of LA used in ISB by increasing dual block applications (6). Infraclavicular-suprascapular block to prevent phrenic nerve paralysis in humeral head fracture repair; axillary-ISB in multiple fractures of the humerus, shoulder, and elbow, and supraclavicular-ISB used for multiple fractures of the humerus are some of the dual blocks in the literature (6-10). However, dual block application requires high doses of local anesthetic (LA) (6). Although the use of a lower volume of LA when performed under ultrasonography (USG) guidance has reduced complications, there are not enough studies on combined blocks, to reach the required area in the proximal upper extremity (11). In addition, there is no clear consensus on the appropriate dose of LA for surgical anesthesia (12).

The extent of blockage in peripheral nerve block applications depends on the neural structure, anatomy, volume, and concentration of the LA used (13). Although the amount of LA required can be reduced by closer perineural needle placement under USG guidance, especially in dual block applications, the minimum required LA dose in peripheral nerve blocks cannot be standardized because it also depends on the structure of the nerve (14).

The primary aim of this study was to compare the effect of different volumes of LAs on perioperative anesthetic and 24-hour pain scores in patients undergoing ISB+SCB for shoulder and humerus surgery. The secondary aim was to evaluate the need for additional postoperative analgesics, changes in vital parameters, and sensory and motor block return times between the two groups.

METHODS

Patient Selection

Our retrospective, single-center, observational study was performed after Clinical Research Ethics Committee of University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital (approval no.: 2023-22-10, date: 20.11.2023) was obtained. The data of patients who underwent shoulder arthroscopy operation for unilateral humeral fracture open reduction internal fixation, shoulder impingement syndrome, slap lesion surgery, and rotator cuff rupture, and who underwent ISB+SCB for anesthesia between 02.03.2021 and 18.09.2023 in the orthopedic clinic, were retrospectively reviewed. Eighty-five patients with American Society of Anesthesiologists (ASA) physical status I-III, aged 18-75 years, in whom the operation was completed uneventfully with regional anesthesia were included in the study. Patients excluded from the study included those with incomplete information in the pain and patient follow-up form, those younger than 18 years of age, those with a neurological deficit involving the upper extremity, those with a bleeding coagulation disorder, those with a history of alcohol-substance abuse, those with psychological illness, those with advanced chronic obstructive pulmonary disease, and those in whom the block was performed only for analgesia, were excluded from the study.

Preoperative Preparation & Block Technique

Peripheral vascular access was provided to all patients after preoperative monitoring in accordance with ASA guidelines. Intravenous (i.v.), midazolam 0.02 mg/kg was administered as premedication before the procedure.

SCB

The patient was placed in a supine position with the head rotated 45 degrees to the opposite side. After sterilization of the area to be blocked, the brachial plexus was identified around the subclavian artery in the supraclavicular fossa using a 5-13 MHz linear ultrasound probe (Esaote MyLabSeven/Esaote S-P.A, Genoa, Italy) for SCB. A 100 mm 22 gauge insulated needle (Stimuplex Insulated B Braun Medical, Germany) was used to target the deep brachial plexus above the first rib using the inplane technique. LA was injected after negative aspiration, from posterior to anterior and lateral to medial. After the corner pocket was formed, the remaining volume was injected just above and lateral to the subclavian artery.

ISB

For USG-guided ISB, the brachial plexus was re-imaged from the supraclavicular fossa. The probe was advanced cephalad along the level of the cricoid cartilage, and hypoechoic, oval C5 and C6 cervical nerve roots were visualized between the anterior and middle scalene muscles in the interscalene groove. The LA was injected after aspiration. Diffusion of LAs was visually confirmed by USG. All blocks were performed by an anesthetist with at least five years of experience.

When scanned retrospectively, standard 6 mL 2% prilocaine for rapid onset of action and 0.5% bupivacaine in different volumes for prolonged duration of action were used as LA agents in both blocks. According to the volume of bupivacaine LA administered, the patients were divided into two groups: high volume group (Group H), with 18 mL or more, and low volume group (Group L), with less than 18 mL.

Perioperative Evaluation

Patient and pain follow-up form, pinprick test, and modified Bromage scale were used as data collection tools. In addition to demographic data; ASA score; operation information; operation time and volume of LAs administered; numeric pain score (NRS) at 0-1-4-8-12-16-20 and 24 hours; additional rescue analgesic requirement; return time of sensory and motor block; and hemodynamic and vital parameters (systolic, diastolic, and mean blood pressure), which were evaluated by the routine pain team using the postoperative pain assessment form in our hospital, were documented on these forms. In the ward, 3 doses of 1 g paracetamol and 3 doses of 50 mg tramadol hydrochloride, were administered IV as routine analgesia protocol. In patients with an NRS score above 3 who needed additional analgesia, 50 mg dexketoprofen trometamol i.v. was administered as rescue analgesia. Our study was conducted in accordance with the 1995 Declaration of Helsinki (as revised in Brazil, 2013).

Statistical Analysis

In this study, the Number Cruncher Statistical System 2017 (Kaysville, Utah, USA) program will be used for statistical analyses. While evaluating the study data, the frequency and percentage values for categorical variables, as well as the mean and standard deviation values for continuous variables, will be given. Normal distribution tests of continuous variables will be conducted using the Kolmogorov-Smirnov test. Chi-square analysis will be used for the relationships between categorical variables. Where appropriate, categorical variables will also be evaluated with Fisher's exact, and Fisher's Freeman Halton test. Independent Samples t-tests will be used for two-group comparisons in continuous independent variables that exhibit a normal distribution. For variables that do not fulfill the assumption of normal distribution, the Mann-Whitney U test will be used for two independent group comparisons. $P<0.05$ will be considered statistically significant.

RESULTS

After the application of inclusion and exclusion criteria, a total of 85 patients, 38 (44.7%) in Group L and 47 (55.2%) in Group H, were included in the study. When demographic data were analyzed, the mean age of all patients was 57.8±15.9 years; 63.5% were male and 36.5% were female. ASA risk groups were similar between the two groups ($p>0.05$). 55.3% of the patients in Group L and 48.9% in Group H were in the ASA II risk group. Similar operations were performed between the two groups, with humeral surgery being the predominant operation in 68% of patients in Group L and 55% in Group H. Surgical time was 125.2±42.3 min in Group L and 122.3±37.2 min in Group H ($p=0.73$). Anesthesia times were similar between the two groups ($p=0.75$) (Table 1).

There was no significant difference between the two groups during the follow-up period when systolic-diastolic blood pressure and peak heart rate were compared (Table 2). There was also no significant difference between the two groups when postoperative pain scores and additional analgesic requirements were compared (Table 3).

When the duration of the motor-sensory block was analyzed, the sensory block was terminated at the 12th postoperative hour in both groups. The block efficiency

was similar between the two groups during the follow-up period. The motor block duration returned to function at the 8th hour postoperatively in all patients (100%) in Group L. In contrast, this rate was 89.4% in Group H, and a statistically significant difference was found between the two groups (p=0.047). The return of motor function in all patients in Group H was determined as the 12th hour postoperatively. During the follow-up period, the duration of sensory-motor block was similar between the two groups except for the 8th postoperative hour (Table 3).

Complications were observed in each of 3 patients in Groups 1 and 2 (7.9% and 6.4%, respectively), and no significant difference was observed between the two groups. Ptosis resolved at 4 hours with conservative treatment in 3 patients in Group L and 2 patients in Group H; while 1 patient in Group H had hoarseness that resolved spontaneously.

Table 1. Demographic data

Parameters (mean ± SD)	Total (n=85)	Grup L (n=38)	Grup H (n=47)	p
Age (year)	57.8±15.9	58.5±16.6	57.1±15.4	0.698
Gender (n; %)				0.821
1 (Male)	54 (63.5)	25 (65.8)	29 (61.7)	
2 (Female)	31 (36.5)	13 (34.2)	18 (38.3)	
ASA (n; %)				0.695
1	10 (11.8)	5 (13.2)	5 (10.6)	
2	44 (51.8)	21 (55.3)	23 (48.9)	
3	31 (36.5)	12 (31.6)	19 (40.4)	
Operation type (n; %)				0.155
1 (Arthroscopy)	22 (25.9)	6 (15.8)	16 (34)	
2 (ORİF)	52 (61.2)	26 (68.4)	26 (55.3)	
3 (Other)	11 (12.9)	6 (15.8)	5 (10.6)	
Duration of anesthesia (min)	158.8±36.2	160.2±38.4	157.7±34.7	0.754
Surgical time (min)	123.6±39.4	125.2±42.3	122.3±37.2	0.736

ASA: American Society of Anesthesiologists, SD: Standard deviation, ORIF: Open reduction internal fixation

Table 2. Vital parameters

HR (beats/min)				
0th hour	70.8±11.7	68.9±13.2	72.3±10.2	0.189
1st hour	73.1±14.6	70.2±11.3	75.9±16.9	0.102
4th hour	79.1±12	78.1±12.1	79.8±12.1	0.590
8th hour	80.8±13.4	79.5±13.2	82.2±13.8	0.443
12th hour	82.2±11.7	81.3±11.5	83.2±12.1	0.588
16th hour	80.5±9.8	79±11.4	81.7±8.2	0.350
20th hour	77.7±8.7	79.2±9.9	76.8±7.8	0.303
24th hour	80.8±11	79.4±10.9	82±11.2	0.484
SBP (mmHg)				
0th hour	118.5±20.8	117.2±19.6	119.4±21.9	0.639
1st hour	121.6±18.6	119.9±15.4	123.3±21.4	0.456
4th hour	122.9±16.9	125.1±18.5	121.4±15.6	0.373
8th hour	122.9±16.1	124.1±17.1	121.5±14.9	0.531
12th hour	128.6±14.2	131.6±14	125.4±14	0.140
16th hour	125.9±16.8	126.9±15.4	125.1±18.2	0.727
20th hour	124.7±13.3	125.6±13.6	124.1±13.3	0.689
24th hour	125.4±13.8	126.9±14.8	124.2±13.1	0.562
DBP (mmHg)				
0th hour	71.1±12.1	71.1±13.4	71.1±11.2	0.982
1st hour	72±9.9	71.1±8.4	72.8±11.3	0.494
4th hour	71.8±8	73.4±8.5	70.7±7.4	0.178
8th hour	71.3±7.8	71.2±7.7	71.6±8	0.842
12th hour	75±8.9	74.5±8.4	75.4±9.6	0.736
16th hour	71.6±8.6	72±6.2	71.3±10.3	0.768
20th hour	73.5±7.6	74.7±7.8	72.2±7.5	0.232
24th hour	73.1±8.2	73.6±7.7	72.7±8.8	0.743

HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure

DISCUSSION

In our study, combined ISB+SCB was performed under USG-guided guidance, and postoperative efficacy of high- and low-volume LAs (18 mL and above and less than 18 mL) was evaluated. Postoperative pain scores and additional analgesic requirements were similar between the two groups.

Blockade of the brachial plexus can provide effective anesthesia and analgesia in the entire upper extremity. However, the type of block applied differs according to the location of the operation (15). While distal extremity anesthesia can be achieved with infraclavicular and isolated nerve blocks, the ISB and SCB should be combined to ensure a high success rate in procedures requiring anesthesia of the proximal arm. This is because even if a sufficient volume of LA is injected into the SCB, it may fail to block the C5 and C6 nerve roots (16). However, dual block (ISB and SCB) requires a high dose of LA agent, which increases the risk of LA toxicity and side effects (3). Studies with ultrasound guidance and electrical nerve stimulation techniques have focused on block success rate, block initiation time, and LA dose (15). Although ultrasonographic visualization of the needle, the target nerve, and the injected LA have been associated with increased block success rates, decreased block initiation times, and decreased amount of LA required for successful nerve block, there is no clear consensus on the dose, and volume to be administered (17-19). In our study, we aimed to evaluate the effect of different volumes of ISB-SCB block on anesthetic success, postoperative pain

Table 3. Postoperative data

Additional analgesia (n; %)				
0th hour	2 (2.4)	1 (2.6)	1 (2.1)	0.697
1st hour	6 (7.1)	4 (10.5)	2 (4.3)	0.243
4th hour	7 (8.2)	2 (5.3)	5 (10.6)	0.314
8th hour	19 (22.4)	8 (21.1)	11 (23.4)	0.796
12th hour	22 (25.9)	12 (31.6)	10 (21.3)	0.281
16th hour	29 (34.1)	10 (26.3)	19 (40.4)	0.173
20th hour	31 (36.5)	13 (34.2)	18 (38.3)	0.697
24th hour	26 (30.6)	13 (34.2)	13 (27.7)	0.515
NRS (mean±SD)				
0th hour	0 (0)	0 (0)	0 (0)	0.249*
1st hour	0 (1)	0 (1)	0 (1)	0.861*
4th hour	0 (2)	1 (2)	0 (2)	0.365*
8th hour	2.5 (2)	2 (2)	3 (2)	0.576*
12th hour	3 (2)	3 (3)	2 (1)	0.853*
16th hour	3 (2)	2 (3)	3 (2)	0.122*
20th hour	3 (2)	3 (2)	3 (2)	0.541*
24th hour	3 (2)	3 (2)	3 (2)	0.671*
Sensory (n ; %)				
0th hour				0.842
Negative	53 (62.4)	24 (63.2)	29 (61.7)	
Partial	6 (7.1)	2 (5.3)	4 (8.5)	
Positive	26 (30.6)	12 (31.6)	14 (29.8)	
1st hour				0.529
Negative	27 (31.8)	14 (36.8)	13 (27.7)	
Partial	12 (14.1)	6 (15.8)	6 (12.8)	
Positive	46 (54.1)	18 (47.4)	28 (59.6)	
4th hour				0.768
Negative	17 (20)	7 (18.4)	10 (21.3)	
Partial	7 (8.2)	4 (10.5)	3 (6.4)	
Positive	61 (71.8)	27 (71.1)	34 (72.3)	
8th hour				0.467
Negative	3 (3.6)	1 (2.6)	2 (4.3)	
Partial	5 (6)	1 (2.6)	4 (8.5)	
Positive	77 (90.6)	36 (94.7)	41 (87.2)	
12th hour				n/a
Positive	85 (100)	38 (100)	47 (100)	
16th hour				n/a
Positive	85 (100)	38 (100)	47 (100)	
20th hour				n/a
Positive	85 (100)	38 (100)	47 (100)	
24th hour				n/a
Positive	85 (100)	38 (100)	47 (100)	

Table 3. Continued

Motor (n; %)				
0th hour				0.335
Negative	45 (52.9)	17 (44.7)	28 (59.6)	
Partial	15 (17.6)	7 (18.4)	8 (17)	
Positive	25 (29.4)	14 (36.8)	11 (23.4)	
1st hour				
Negative	24 (28.2)	10 (26.3)	14 (29.8)	0.590
Partial	14 (16.5)	8 (21.1)	6 (12.8)	
Positive	47 (55.3)	20 (52.6)	27 (57.4)	
4th hour				
Negative	11 (12.9)	2 (5.3)	9 (19.1)	0.165
Partial	8 (9.4)	4 (10.5)	4 (8.5)	
Positive	66 (77.6)	32 (84.2)	34 (72.3)	
8th hour				0.047
Partial	5 (5.9)	0 (0)	5 (10.6)	
Positive	80 (94.1)	38 (100)	42 (89.4)	
12th hour				
Positive	85 (100)	38 (100)	47 (100)	n/a
16th hour				
Positive	85 (100)	38 (100)	47 (100)	n/a
20th hour				
Positive	85 (100)	38 (100)	47 (100)	n/a
24th hour				
Positive	85 (100)	38 (100)	47 (100)	n/a
Complications (n; %)	6 (7.1)	3 (7.9)	3 (6.4)	0.787

*Values presented as median (interquartile range) and comparisons made using the Mann-Whitney U test
+presented as median (IQR)
NRS: Numeric rating scale, IQR: Interquartile range, SD: Standard deviation

scores, and the need for additional analgesia in shoulder and humerus surgical procedures.

The use of low-dose 0.5% ropivacaine in ultrasound-guided ISB was first reported by Riazi et al. (20). The study included patients who underwent open and arthroscopic shoulder surgery and ISB in 5 mL and 20 mL volumes for analgesia. In this prospective randomized controlled trial (RCT), no significant difference was found between the two groups in LA volume and pain scores, sleep quality, and total opioid consumption up to 24 hours postoperatively (20). In the present study, similar results were obtained in the groups. In another RCT, Abdelhaq et al. (3) divided 93 patients who underwent combined SCB+ISB for humeral fracture, into three groups according to the volume of LA administered. Standard 20 mL (10 mL 0.5% bupivacaine + 10 mL 2% lidocaine), and different volumes (20-15-10 mL) of LA were administered for SCB and ISB, respectively. It was emphasized that the amount of LA administered to the ISB could be reduced with dual block, but that the duration of analgesia was significantly reduced with the reduction of LA volume (3). In another RCT, 5 or 15 mL, 0.5% ropivacaine doses were compared for patients undergoing superior truncal block (STB) during shoulder arthroscopies. Postoperative pain score, additional analgesic use, duration of analgesia, side effects, and patient satisfaction were found to be similar between the two groups (21). This contrast in the literature may be explained by differences in the volume of LA administered, the use of blocks for postoperative analgesia, and the fact that the operation was performed under general anesthesia (20,21). In the present study, the median volume of bupivacaine administered was 18 mL because of applying a combined block (ISB-SCB) and the provision of surgical anesthesia with a regional block in all patients.

One of the factors affecting the duration of peripheral nerve block is the dose of LA, which is the product of volume and concentration. The effect of LA volume, concentration, and dose on the duration of the block varies in studies (22). In one study, it was shown that the duration of motor and sensory block was significantly shortened by decreasing 1.5% mepivacaine, from 40 mL to 15 mL in patients undergoing axillary brachial plexus block (23). In another study, no significant correlation was found between volume increase and onset of block, and motor block duration in patients undergoing humeral surgery. Sensory block duration was found to be prolonged with volume increase (3). In the present study, sensory block duration was similar between the two groups, whereas motor block duration was significantly prolonged in the high-volume group. Although there are many publications in the literature indicating a direct relationship between the amount of LA given and duration, it is not clear whether this effect depends on dose, volume, or their combination (22-25). In another study evaluating the effect of different volumes and concentrations

of ropivacaine on the duration of analgesia after ISB in shoulder surgery, it was concluded that both volume and concentration affected the duration independently (26). In another study conducted to evaluate whether the decrease in the duration of sensory and motor block was mainly related to the decrease in volume or the decrease in dose, patients who underwent axillary block were divided into three groups. Group 1 used 20 mL of 1.5% mepivacaine (300 mg), Group 2 used 30 mL of 1% mepivacaine (300 mg) and Group 3 used 30 mL of 1.5% mepivacaine (450 mg). When the groups with equal doses were compared, it was reported that sensory and motor block lasted longer in the group with higher concentration and smaller volume (Groups A and B), but this was not statistically significant. The use of diluted and low-dose LAs (Group B) was shown to significantly shorten the duration of motor and sensory blocks compared to high doses and high concentrations (Group C) (22). The difference may be related to variations in concentration and dose reported in the literature.

LA systemic toxicity and the development of complications are directly related to the dose, volume, concentration, and site of administration of LA (14). In a study investigating the relationship between the volume of LA administered (5 mL vs 20 mL) and complications in shoulder surgery, ultrasonographic measurements and respiratory function tests showed that the incidence of diaphragm paralysis was significantly reduced in the 5 mL group. Although Horner's syndrome, hoarseness, hiccough, and respiratory distress occurred in 8 patients (40%), no adverse outcome was reported in the low-volume group (20). Similarly, Kim et al. (21) evaluated the efficacy of STB with 5 mL and 15 mL of LA in shoulder surgery and showed that analgesic efficacy was similar, with less hemidiaphragm paralysis in the low-volume group. This is due to the spread of LA along the prevertebral fascia, resulting in phrenic nerve block and hemidiaphragm paralysis due to C3-C5 involvement. There is also a risk of Horner's syndrome secondary to sympathetic blockade, hoarseness with recurrent laryngeal nerve blockade, respiratory distress, and hypotensive-bradycardic events with the Bezold-Jarisch reflex (5). In addition, proximity to the epidural space may cause neuraxial spread and LA systemic toxicity (LAST) at high doses (27). Although phrenic nerve involvement was not evaluated in our study, respiratory distress was not observed in any patient. Horner's syndrome was seen in three patients in each group, with there being no statistically significant difference between them.

Study Limitations

The main limitations of our study are its retrospective nature, the small number of patients, and the fact that it was conducted at a single center. Sufficient data on volume and block onset time could not be obtained in the groups. In addition, phrenic nerve involvement was not evaluated in patients who underwent a block. However, providing surgical anesthesia as well as postoperative analgesia with regional block, and avoiding the possible effects of general anesthesia are the strengths of our study.

CONCLUSION

Effective anesthesia and optimal surgical conditions can be achieved by using low-volume ISB-SCB applied in shoulder and humerus surgery. In addition, the shortening of motor block return time and the ability to provide effective analgesia up to 24 hours postoperatively may encourage the use of low doses for peripheral nerve blocks in clinical practice, highlighting additional advantages of this application.

ETHICS

Ethics Committee Approval: Ethical approval was obtained from the Clinical Research Ethics Committee of University of Health Sciences Türkiye, Bakırköy Dr. Sadi Konuk Training and Research Hospital (approval no.: 2023-22-10, date: 20.11.2023).

Informed Consent: Retrospective, single-center, observational study.

FOOTNOTES

Authorship Contributions

Surgical and Medical Practices: Ö.M.E., Y.P., Z.Ç., Concept: Ö.M.E., G.S., Y.P., G.O.H., Design: Ö.M.E., G.S., G.Ö.Y., Data Collection or Processing: Ö.M.E., Y.P., Z.Ç., Analysis or Interpretation: Ö.M.E., G.Ö.Y., G.O.H., Literature Search: Ö.M.E., G.Ö.Y., G.O.H., Writing: Ö.M.E., G.S., Z.Ç.

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