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Original Article

A comparison of two different doses of combined interscalene-infraclavicular block in humerus surgery

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Abstract: Aim: The aim of this study was to optimize the dose of local anesthetic with interscalene-infraclavicular brachial plexus block. Methods: In this retrospective study, an examination was made of the records and peripheral block monitoring forms of 55 patients who underwent humerus surgery under the combined interscalene and infraclavicular block necessary for whole arm surgical anesthesia in the Orthopaedics Clinic between 2015 and 2017. Postoperative analgesia was evaluated and recorded with a visual analog scale (VAS) from 0-10 (0 = no pain, 10 = the most severe pain) every hour in the first 12 hours and at every 4 hours between 12 and 24 hours. The duration of the procedure, the onset of the block, and the duration of the analgesia were recorded. The local anesthetic doses used in the peripheral block procedure were: Group A: interscalene block 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine) + infraclavicular block 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine); Group B: interscalene block 10 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine) + infraclavicular block 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine). Results: A statistically significant difference was determined between the two groups in terms of the first analgesia requirement time. The first analgesia requirement time was significantly longer in Group A (P = 0.004). In Group A, patient satisfaction was statistically significantly higher (P = 0.003). Conclusion: Using lower doses of local anesthetic in combined brachial plexus block under USG guidance, sufficient anesthesia can be obtained. In patients with comorbidities in particular, interscalene block + infraclavicular block under USG guidance can be used as an alternative to general anesthesia in surgical interventions involving the whole arm.

Keywords: Interscalene block, infraclavicular block, humerus surgery

Introduction

Peripheral blocks applied in upper extremity surgery show differences according to the patient and the surgical procedure to be carried out [1]. Regional anesthesia has an important place in the proximal upper extremities because of the characteristics of dermatomal distribution [2]. While interscalene block (ISB) may be sufficient for the proximal arm, if the surgical intervention includes the distal arm, it is necessary for the ulnar nerve to be blocked [3]. The use of combined brachial plexus block in humerus surgery interventions has recently been reported [4, 5]. In surgical procedures of the humerus, effective infraclavicular block (ICB) combined with interscalene block can provide sufficient surgical anesthesia to be able to continue the surgical procedure in patients at a high-risk for complications of general anesthesia. However, the most significant problem in this situation is the volume of local anesthetic (LA) to be used in the combination of the two blocks.

In recent years, the ease of application of the combined peripheral block techniques with the use of a lower volume of LA and USG has enabled complications to be overcome [6-9]. The aim of this study was to evaluate the effect on block success of the local anesthetic doses used in interscalene-infraclavicular brachial plexus block made with low doses of local anesthetic under ultrasound guidance. With ICB, the brachial plexus cord level (lateral, posterior, medial cord) is blocked and thus the distal third of the arm with the axillary and musculocutaneous nerves can be blocked. Generally, with a single brachial plexus block, sufficient anesthe-

sia may not be obtained especially in surgical interventions involving the whole arm.

To the best of our knowledge, this is the first study to identify the combined use of ISB and ICB under USG guidance in surgical interventions to the humerus.

Materials and methods

Approval for the study was granted by the Local Ethics Committee. A retrospective examination was made of the digital archive records and peripheral block monitoring forms of 55 patients who were underwent humerus surgery under combined interscalene and infraclavicular block necessary for whole arm surgical anesthesia in the Orthopaedics Clinic between 2015 and 2017.

All regional blocks were performed in the preoperative room. Patients were positioned supine with the head turned to the contralateral side. The skin over the interscalene area and the coracoid region was sterilized with 10% povidone-iodine. A portable US machine (Esaote MyLab Five, Italy) with a high frequency (5-10 MHz) linear probe were used in both groups. A 100-mm insulated needle (Ultraplex, Braun, Germany) was used in all blocks. The spread of the local anesthetic (LA) was visualized by US, and the achievement of the correct spread was considered as the definitive end point.

During the examination of the records, patients were excluded if there was severe neurological damage to the upper extremity, if they uses sedatives or anti-psychotics, had head trauma, had an inability to co-operate, had bleeding diathesis, had thrombocytopenia, or used oral anticoagulants or thoracic trauma.

From the peripheral block monitoring forms, a record was made including each patient's age, gender, operation performed, the duration of the operation, the duration of the peripheral block application, local anesthetic drug and dose used during the block, time to onset of sensory block and time to the first requirement for analgesia.

The sensation of the upper extremity was assessed by pinprick using a 23 G needle testing from C4 to T1 dermatomes and scored as full sensation = 1 and loss of sensation to touch or pinprick = 0.

According to the pin prick test, when the pinprick = 0 in the C4-T1 dermatome, the sensory block was assumed to be started and recorded as the block start time.

According to the postoperative analgesia protocol applied in the clinic, the patients were evaluated with a visual analog scale (VAS) from 0-10 (0 = no pain, 10 = the most severe pain) every hour in the first 12 hours and at every 4 hours between 12 and 24 hours. On patient request because of pain felt or when the VAS score was > 3, 75 mg oral diclofenac was administered, and the time was recorded from the end of the block procedure (the duration of analgesia). The duration of analgesia was recorded from the peripheral block monitoring forms. All patients were observed for 24 hours in case of complications such as respiratory problems, limited voice, dysesthesia, motor weakness, or pneumothorax, and these were recorded if present. In addition, after 24 hours, the patients were administered a patient satisfaction questionnaire (0 = not at all satisfied, 5 = very pleased) and the scores were recorded.

The patients were compared in groups according to the dosage of drug used in the peripheral block procedure. The group A patients were administered ISB 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine) + ICB 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine), and Group B was administered ISB 10 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine) + ICB 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine). The two groups were statistically compared.

Statistical analysis

Analyses of the data obtained were made using SPSS version 22 software (IBM SPSS for Windows version 22, IBM Corporation, Armonk, New York, USA). Conformity of the data to normal distribution was tested with the Ko-lmogorov-Smirnov test. In the comparison of groups showing a normal distribution, the Independent Samples *t*-test was applied and for groups not showing normal distribution, the Mann Whitney U-test. Descriptive statistics of data showing a normal distribution were stated as the mean ± standard deviation (SD) and

Table 1. Demographic data of the patients

		Group A (n = 26)	Group B (n = 22)
Gender	Female	13 (50.0%)	5 (22.7%)
	Male	13 (50.0%)	17 (77.3%)
Side	Right	14 (53.8%)	14 (63.6%)
	Left	12 (46.29%)	8 (36.4%)
Age (year) (Mean ± SEM)		45.00 ± 4.28	43.72 ± 4.14
Weight (kilograms) (Mean ± SEM)		76.53 ± 2.84	77.50 ± 3.67
Height (centimetre) (Mean ± SEM)		165.11 ± 1.82	167.22 ± 1.82

Data are expressed as mean ± SD or n (%).

Table 2. Duration of the procedure, duration of the surgery, analgesia duration, and patient satisfaction

	Dose Group		p
	Group A (n: 26)	Group B (n: 22)	
Block performance time (min)	6.58 ± 0.46	7.00 ± 0.53	0.551
Onset time of sensoriel block (min)[a]	12.65 ± 0.42	12.50 ± 0.45	0.805
Analgesia duration (hour)[a]	12.35 ± 1.19	7.32 ± 0.73	0.004*
Duration of surgery (min)[b]	85 (40-250)	80 (30-240)	0.985
Patient satisfaction[b]	5 (4-5)	4 (2-5)	0.003*

[a]Independent samples t test; [b]Mann-Whitney U test; α: 0.05; *Difference is statistically significant. Data are expressed as mean ± SD or median + (min-max).

those not showing a normal distribution as the median (min-max). A value of $P < 0.05$ was accepted as statistically significant. As a result of the comparisons of the dose groups, the power of the study was determined as 0.94.

Results

The patients included in the study included 30 (62.5%) males and 18 (37.5%) females, with a mean age of 44.1 ± 20.54 years, a mean body weight of 76.97 ± 15.65 kg and mean height of 166.35 ± 8.64 cm. The operated arm was the right side in 28 (58.3%) patients and the left side in 20 (41.7%) patients (**Table 1**). No complications were observed in any patient.

The mean duration of the procedure was 6.58 minutes in group A and 7.0 minutes in group B in terms of the duration of the procedure. There was no difference between the groups (P = 0.551).

The mean duration of the onset of the block was 12.65 minutes in group A and 12.5 minutes in group B. There was no statistically significant difference between the two groups in terms of the onset time of the block (P = 0.805).

A statistically significant difference was determined between the two groups in terms of the analgesia duration; the analgesia duration was significantly longer in Group A (P = 0.004).

A statistically significant difference was determined between the two groups in terms of patient satisfaction. The level of patient satisfaction was found to be higher in Group A (P = 0.003). (**Table 2**; **Figure 1**).

Discussion

The results of this study, which retrospectively compared the doses of combined blocks used in surgery, showed that ICB added to ISB at low doses applied with USG guidance was effective in providing surgical anesthesia. It was also determined that an increase in the anesthesia dose prolonged the time of postoperative analgesia.

There have been previous published studies related to the use of combined forms of brachial plexus blocks in surgical interventions. Christian et al. [4] described an interscalene-supraclavicular block combination under USG guidance in a patient with a pathological humerus fracture and treated with intramedullary nailing surgery. In that case report, the time to onset of the sensory block was reported to be approximately 10 mins. In the current study, no difference was observed between the groups with regard to the time to onset of the block, with the times of the two groups determined as 12.65 ± 0.42 and 12.50 ± 0.45 mins, respectively. Guttman et al. [11] reported that sufficient surgical anesthesia was obtained with a supraclavicular-interscalene block combination in a patient with a pathological humerus fracture. The amount of local anesthesia used in that patient was 20 ml 1.5% mepivacaine for the supraclavicular block and 20 ml

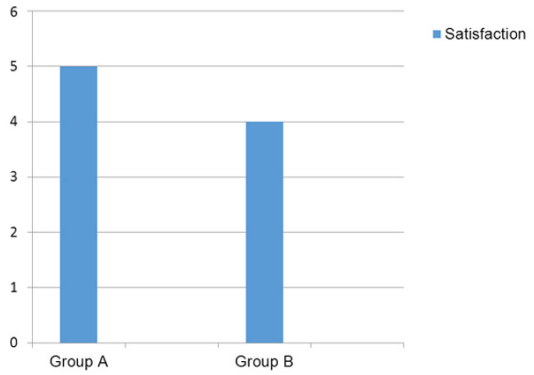

Figure 1. Bar graph of patient satisfaction by group Satisfaction is higher in Group A (P = 0.003). Group A. interscalene block 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine) + infraclavicular block 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine). Group B. interscalene block 10 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine) + infraclavicular block 15 ml (10 ml 0.5% Bupivacaine + 5 ml 2% Lidocaine).

0.5% bupivacaine + 10 ml 1.5% mepivacaine for the interscalene block. In comparison with that study, the local anesthetic dose used in the current study was lower, but sufficient surgical anesthesia was obtained.

In another study, combined axillary and interscalene block was reported to have obtained sufficient surgical anesthesia in a patient with fractures of the humerus, shoulder and elbow. In the combination in that study, 30 ml 1.5% mepivacaine was used for the interscalene block and 15 ml 1.5% mepivacaine for the axillary block. In the current study, by reducing the volume of local anesthetic used with the use of USG, it was aimed to avoid local anesthetic toxicity and other complications (diaphragm paralysis, Horner's syndrome, respiratory problems) [4].

Sinha et al. compared 20 ml and 10 ml local anesthetic volumes in interscalene block applied under USG guidance and in contrast to the findings of the current study reported no difference between the two groups with respect to the duration of the block and analgesia consumption [12].

Serradel et al. used 36 ml, 28 ml and 20 ml of 1% mepivacaine in an axillary plexus block and determined no statistically significant difference between the groups with respect to the duration of analgesia [13].

Abdelhaq et al. [14] a compared a supraclavicular block involving three groups with 20 ml (10 ml 0.5% bupivacaine + 10 ml 2% lidocaine) local anesthetic combined with interscalene block at different volumes of 20 ml + 20 ml, 20 ml + 15 ml and 20 ml + 10 ml. As in the current study, it was reported that as the local anesthetic volume was increased, the duration of the analgesia was prolonged, but no statistically significant difference was found between the groups.

In a study by Schoemakers et al. [15] in which an axillary block was applied, it was determined that with an increase in volume and concentration of the local anesthetic used, the block duration was prolonged and in the group where local anesthesia was used at the same concentration as in the current study but at a higher volume, the time to first requirement for analgesia was found to be longer.

Ghodki et al. [16] compared ISB in patients using 10 ml 0.5% bupivacaine in patients who underwent shoulder arthroscopy and no hemidiaphragmatic paresis was observed in the USG group patients. In the current study, no respiratory function tests were made, but no respiratory problems were encountered in any patient in the perioperative period.

In earlier studies, patient satisfaction scales have not been used. In the current study, patient satisfaction was found to be high in both groups, with a higher level observed in Group A.

The limitations of the current study were that it was conducted in a single center and applied by a single practitioner. More robust results could be obtained from future multi-center studies.

In the current study, it was seen that as the time to use the analgesia was prolonged with ISB + ICB in humerus surgery, the patients experienced a more comfortable operation because of the anesthesia.

Conclusion

Sufficient anesthesia can be obtained using local anesthetics at lower doses in combined blocks of the brachial plexus when applied under USG guidance. In patients with high

comorbidities in particular, an ISB + ICB block under USG guidance can be used as an alternative to general anesthesia in surgical interventions involving the whole arm. Although sufficient anesthesia was determined to have been obtained in the low dose group, to prolong the duration of analgesia and increase patient satisfaction, it should be recommended that a sufficient dose of local anesthesia is used for each patient.

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Disclosure of conflict of interest

None.

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