Print ISSN 1110-208X

Online ISSN 2357-0016

Original article

Comparison of the Onset Time between 0.25% Bupivacaine and 0.5% Bupivacaine for Ultrasound-Guided Infraclavicular Brachial Plexus Block: A Randomized Clinical Trial

Ahmed S. Elnoury, Yehya S. Dabour, Mahmoud M Elnady

Department of Anesthesia, Faculty of Medicine Benha University, Egypt.

Corresponding to: Ahmed S. Elnoury, Department of Anesthesia, Faculty of Medicine, Benha University, Egypt.

Email:

hbasant602@gmail.com

Received: 25 March 2024

Accepted:10July 2024

Abstract

Background: Infraclavicular brachial plexus block is a suitable regional anaesthesia technique for hand, wrist and elbow operations and it is usually performed in conjunction with nerve stimulation. We aimed to compare the onset times of sensory block with equipotential 0.25% bupivacaine and 0.5% bupivacaine. **Methods:** This prospective double-blinded randomized controlled study was conducted on 60 patients, aged > 18 years, with ASA physical status I–III, and scheduled for upper extremity surgery with infraclavicular brachial plexus block. The participants were randomized into two equal groups; group I in which ICB performed with 0.25%, 20 mL bupivacaine and group II in which ICB performed with 0.5% 20 mL bupivacaine. **Results:** Regarding the block performance, group II showed earlier onset time and longer duration of sensory and motor blocks compared to group I ($P<0.05$) and the performance time was significantly shorter in in group II compared to group I ($P=0.015$). Number of patients required analgesia was significantly lower in group II compared to group I ($P=0.003$) was significantly lower in group II compared to group I ($P=0.003$) and the first rescue analgesic requirement was significantly delayed in group II compared to group I ($P<0.001$). **Conclusions:** We found that 0.5% bupivacaine showed earlier onset time and longer duration of sensory and motor blocks compared to 0.25% bupivacaine in infraclavicular block. Thus, when a quicker block onset is required, 0.5% bupivacaine is a better choice than 0.25% bupivacaine.

Keywords: Onset Time; Bupivacaine; Ultrasound-Guided Infraclavicular Brachial Plexus Block; Motor; Sensory

Introduction

The brachial plexus is responsible for entire motor function of the upper extremity and large part of sensory function [1]. Brachial plexus block of interscalene, supraclavicular, infraclavicular, axillary region and terminal nerves can be performed [2].

Infraclavicular brachial plexus block is a suitable regional anaesthesia technique for hand, wrist and elbow operations and it is usually performed in conjunction with nerve stimulation. However, stimulation of nerve during regional anaesthesia is a blind method [3]. Infraclavicular brachial plexus block provides sufficient anesthetic and analgesic effect for lower arm surgery. Infraclavicular approach is not only advantageous for inserting a perineural catheter, but also has a short procedure time compared to other approaches including supraclavicular and axillary approaches [4].

In recent years, with the introduction of ultrasound-guided peripheral nerve blocks, applications and approaches have begun to change. The anatomy of this region, the target nerve or nerves, the vascular structures around the nerve and the lung tissue in the vicinity can be visualized by the ultrasonography. The use of USG improves block success rate, shortens block start time, and reduces side effects and local anesthetic volume [5, 6]. Therefore, ultrasound-guided infraclavicular brachial plexus block has been increasingly used since the first report in 2000 [7]. Although peripheral nerve blocks have several benefits over general anaesthesia, some clinicians are still reluctant in using it because of the relatively long latency period. At centres with pressure on rapid operating room turnover, onset time is one of the important considerations for choosing a local anesthetic drug [8].

Bupivacaine is the first local anesthetic which combines its long-acting effect with deep conduction blockage, and distinct separation of sensory block and motor block [9]. Bupivacaine is one of the longest acting anaesthetics (3-5 hours). It is three to four times more effective than lidocaine but four times more toxic. Its effect starts within 5-10 minutes. At low concentrations (≤2.5 mg /mL) is effective on motor nerve fibres and the duration of action is shorter. However, its low concentrations can be used to reduce postoperative pain [10].

A successful peripheral nerve block depends on the correct identification of nervous structures and the injection of a suitable dose of local anesthetic around them to obtain a complete impregnation of all the nerves involved in the surgery. The use of large amounts of local anesthetic increases the chance of systemic toxicity, which is the major complication of regional anaesthesia. Although the incidence of systemic toxicity is less than 0.2%, this complication is difficult to treat and potentially fatal [11].

We aimed to compare the onset times of sensory block with equipotential 0.25% bupivacaine and 0. 5% bupivacaine. In addition, other block characteristics and clinical outcomes were also analysed. According to our theory, the block made with the higher local anesthetic

concentration in the equivalent volume is more effective.

Patients and Methods

This prospective double-blinded randomized controlled study was conducted on 60 patients, aged > 18 years, with ASA physical status I–III, and scheduled for upper extremity surgery with infraclavicular brachial plexus block at Benha university from November 2023 to February 2024. The study was approved by the ethics committee of Benha University. A written informed consent was obtained from all patients. This study was conducted in compliance with the 1964 Helsinki declaration and its later amendments. We registered this study on ClinicalTrials.gov (registration date: RC 40/11/2023). The manuscript is written in accordance with Consolidated Standards of Reporting Trials (CONSORT) guidelines.

Exclusion criteria were patient with significant neurological, psychiatric, or neuromuscular disease, suspected coagulopathy, morbid obesity, chronic renal failure, cardiopulmonary compromise, cerebral vascular disease, hypersensitivity to local anaesthetics, or local infection at the site of the infraclavicular block, pregnant women and those who refused to participate in the clinical trial.

Randomization and blindness:

The participants were randomized into two equal groups using a computer-generated list of random numbers sealed in an opaque envelope and were randomly allocated into two groups on a scale of 1:1. Group I included 30 patients in which ICB performed with 0.25%, 20 mL bupivacaine and group II included 30 patients in which ICB performed with 0.5% 20 mL bupivacaine. Both patients and assessors, in this trial was blinded.

Preoperatively:

All patients were evaluated by complete history taking and full clinical assessment including general examination of chest, heart, abdomen and vitals and laboratory investigations including complete blood picture and renal function tests.

Procedures:

All the blocks were performed in the pre-induction room using parasagittal approach and dual-injection technique to increase the success rate of the block [12]. ICB was performed in all patients by the same anaesthesiologists. After the patients arrived in the pre-induction room without any premedication, they were positioned supine. Standard monitoring, including electrocardiography, non-invasive blood pressure, and pulse oximetry were applied. Five to six litters of oxygen per minute was supplied via a simple facial mask. Patients were positioned supine with their head turned to the contralateral side and the ipsilateral arm was kept neutral.

The skin near the clavicle was disinfected and sterile drapes were applied. The high frequency 5–13 Hz linear transducer of the ultrasound machine (Logiq P5; GE health care, Nolensville, Tennessee, US) was used, and the probe was located just medial to the coracoid process in the sagittal direction. The lateral, medial, and posterior cords around the axillary artery beneath the pectoralis muscles were identified in the ultrasound view. The site

of needle entry was located 1 cm medial to the coracoid process and 1 cm below the clavicle [13]. At the insertion point of the needle, 1 mL of 2% lidocaine was injected for local infiltration. A 22-G, 60-mm 7 stimulating needle (Stimuplex D; B.Braun AG, Melsungen, Germany) was inserted in-plane initially toward the posterior cord. An additional dose of 0.2–0.3 mL/kg was injected with the visualization of the spread of local anaesthetics.

Throughout the administration of the study drug, the nurse performed intermittent aspiration of the syringe to avoid inadvertent intravascular injections. In all cases, the local anesthetic agent was deposited so as to surround the medial, lateral, and posterior cord around the axillary artery in the ultrasound view. The patient and the surgeon did not know the concentration of the anesthetic agent, and concentration of local anesthetic was prepared by an assistant before the procedure.

Induction of general anaesthesia:

An 18-or 20-gauge intravenous catheter was placed in the premedication room and standard intravenous premedication with IV midazolam 30 μg/ kg and fentanyl 2 μg /kg and was induced by IV propofol 2-2.5 mg / kg was administered and was induced by IV propofol 2-2.5 mg / kg. After IV cisatracurium (0.15mg / kg) endotracheal intubation was done. Anesthesia was maintained with a mixture of oxygen and air (50-50%) and isoflurane (1-1.5%). Patients were ventilated with parameters adjusted to maintain end-tidal CO2 at 35-45 mmHg. At the end of the surgery, ondansetron 0.1 mg/kg was administered IV and muscle relaxation was reversed with IV neostigmine 50 μg/ kg. After the surgery, the patient was transferred to the post-anesthetic care unit and then taken to a general ward.

Brachial plexus blockade measurements were performed by a single-blind observer at every 5 minutes for 45 minutes. We used 3-point scale cold test: 0 = no block, 1 = analgesia (patient can feel touch, not cold), and 2 = anesthesia (patient cannot feel touch) for sensory block of the musculocutaneous, median, radial, and ulnar nerves. Sensory block of the nerves was assessed for musculocutaneous (the lateral side of the forearm), median (the volar side of the thumb), radial (the lateral side of the dorsum of the hand) and ulnar (the volar side of the fifth finger) nerves. Motor function were evaluated by the Modified Bromage scale. **Table 1**

Table 1: Modified Bromage scale [14]

Degree	Definition
4	Full muscle strength in relevant muscle groups
3	Reduced strength, but able to move against resistance
2	Ability to move against gravity, but not against resistance
1	Discrete movements (trembling) of muscle groups
0	Lack of movement

Sensory onset time, which is the primary outcome of this study, was defined as the time required to achieve an absence of sensation in response to the pinprick stimuli at all distributions of the four nerves. In addition, we defined the success of complete sensory or motor block as when the sum of sensory or motor scores in each of the four nerve territories reached zero. Total performance time was defined as the time from the needle insertion to the completion of the injection. On the first postoperative day, an assessor visited the patients
and questioned them regarding the duration of the sensory and motor block [15].

Patient satisfaction was evaluated using 5-point Likert scale, (1=extremely dissatisfied; 5=extremely satisfied) at 24 hrs. postoperatively [16]. Assessments were done by anaesthesiologist not involved in the administration of block or intraoperative management of patients.

Sample size:

The sample size calculation was performed using G. power 3.1.9.2 (Universität Kiel, Germany). The sample size was calculated according to the onset of sensory and motor block were significantly delayed in the Group III (0.25% bupivacaine) than the group I (0.5% bupivacaine) (9.8±2.8 vs, 7.5±3.1, for SB onset time and 12.1±4.3 vs 9.7±4.3 for MB onset time) according to a previous study [17]. Based on the following considerations: 0.05 α error and 80% power of the study, allocation ration 1:1. Six cases were added to overcome dropout. Therefore, 60 patients were allocated.

Statistical analysis:

Statistical analysis was done by SPSS v28 (IBM©, Armonk, NY, USA). Shapiro-Wilks test and histograms were used to evaluate the normality of the distribution of data. Quantitative parametric data were presented as mean and standard deviation (SD) and were analysed by unpaired student t-test. Qualitative variables were presented as frequency and percentage (%) and analysed using the Chi-square test or Fisher's exact test when appropriate. A two-tailed P value < 0.05 was considered statistically significant. Kaplan Meier curve was used to assess the achievement of complete sensory and motor block outcome of the studied groups.

Results

In this study, 97 patients were assessed for eligibility, 23 patients did not meet the criteria and 14 patients refused to participate in the study. The remaining 60 patients were randomly allocated into two groups (30 patients in each). All allocated patients were followed-up and analysed statistically. **Figure 1**

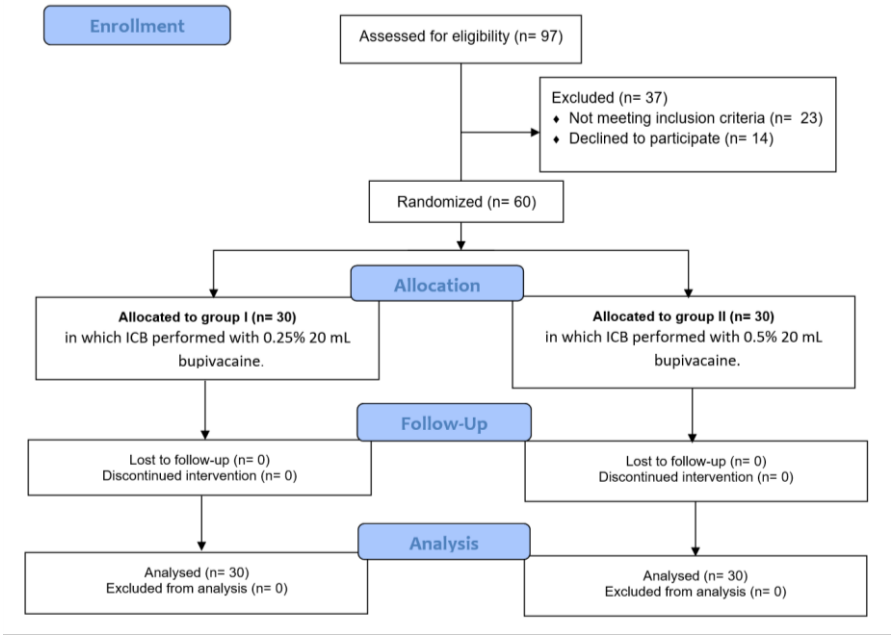


Figure 1: CONSORT flowchart of the enrolled patients

Table 2 shows that there were insignificant differences between the studied groups regarding the baseline characteristics (age, sex, weight, height, BMI, and ASA).

There were insignificant differences between the studied groups regarding the surgery type and duration of surgery. Regarding the block performance, group II showed earlier onset time and longer duration of sensory and motor blocks compared to group I (P<0.05) and the performance time was significantly shorter in in group II compared to group I (P=0.015).

Number of patients required analgesia was significantly lower in group II compared to group I (P=0.003) and the first rescue analgesic requirement was significantly delayed in group II compared to group I (P<0.001) **Table 3**. **Table 4** shows that regarding the adverse effects, nausea occurred in 4 (11.43%) patients in group I and 3 (8.57%) patients in group II, vomiting occurred in 3 (8.57%) patients in group I and 1 (2.86%) patient in group II, and LA toxicity didn't occur to any patient in both groups. There was an insignificant difference between both groups regarding the incidence of adverse effects. Regarding the satisfaction, there was a significant difference between the studied groups regarding the satisfaction, with higher rate of satisfied and very satisfied patients in group II compared to group I (P=0.007).

The achievement of complete sensory block was significantly earlier in group II compared to group I with (HR= 0.1308 (95% CI) 0.05572 to 0.3070, P<0.001). Additionally, the achievement of complete motor block was significantly earlier in group II compared to group I with (HR= 0.1757 (95% CI) 0.08464 to 0.3648, P<0.001). **Figure 2**

Table 2: Baseline characteristics, surgical data and block performance of the studied groups

		Group I (n=30)	Group II (n=30)	P value
Age (years)		43.2 ± 13.67	42.5 ± 13.41	0.849
Sex	**Male**	18 (60%)	20 (66.67%)	0.592
	Female	12 (40%)	10 (33.33%)	
Weight (Kg)		74.7 ± 9.5	74.9 ± 10.88	0.940
Height (m)		1.7 ± 0.05	1.7 ± 0.05	0.903
BMI (Kg/m^2)		26.95 ± 4.37	26.91 ± 3.62	0.971
ASA	**ASA I**	18 (60%)	16 (53.33%)	0.602
	ASA II	12 (40%)	14 (46.67%)	
Surgery type	**Elbow**	16 (53.33%)	13 (43.33%)	0.737
	Forearm	6 (20%)	7 (23.33%)	
	Hand	8 (26.67%)	10 (33.33%)	
Duration of surgery (min)		95.6 ± 14.98	92.9 ± 15.14	0.506

Data presented as mean ± SD or frequency (%), BMI: body mass index, ASA: American society of anesthesiologists.

Table 3: Block performance and postoperative analgesic requirement of the studied groups

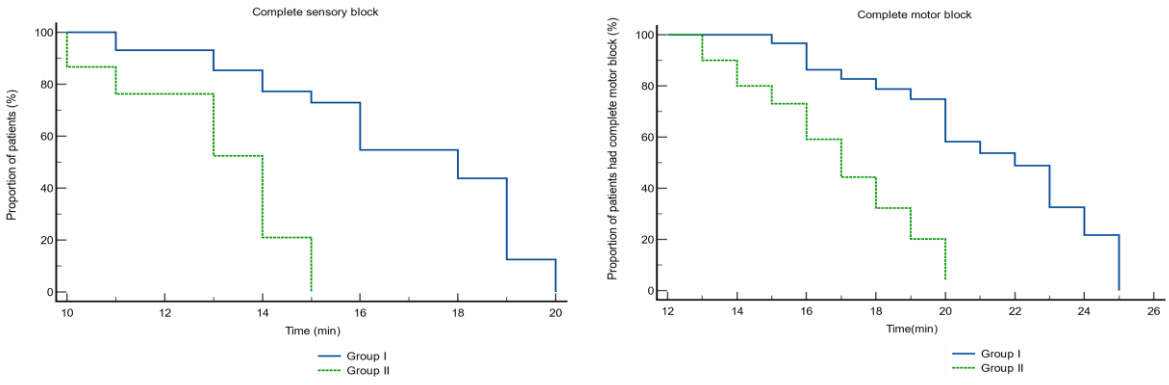
	Group I (n=30)	Group II (n=30)	P value
SB onset time (min)	15.5 ± 2.93	12.4 ± 1.68	<0.001*
MB onset time (min)	20.03 ± 3.16	16.7 ± 2.31	<0.001*
Duration of sensory block (min)	916.4 ± 48.13	1049.0 ± 114.45	<0.001*
Duration of motor block (min)	980.5 ± 84.04	1069.3 ± 79.66	<0.001*
Performance time (min)	2.9 ± 0.8	2.5 ± 0.51	0.015*
Number of patients required analgesia	25 (83.33%)	14 (46.67%)	**0.003***
First rescue analgesic requirement (hr.)	13.6 ± 2.6	16.8 ± 2.12	**<0.001***

Data presented as mean ± SD or frequency (%), SB: sensory block, MB: motor block, *: statistically significant as P value <0.05

Table 4: Adverse effects and satisfaction of the studied groups

	Group I (n=30)	Group II (n=30)	P value
Nausea	4 (11.43%)	3 (8.57%)	1.0
Vomiting	3 (8.57%)	1 (2.86%)	
LA toxicity	0 (0%)	0 (0%)	
Very dissatisfied	0 (0%)	0 (0%)	**0.007***
Dissatisfied	9 (25.71%)	2 (5.71%)	
Neutral	12 (34.29%)	7 (20%)	
Satisfied	9 (25.71%)	17 (48.57%)	
Very satisfied	0 (0%)	4 (11.43%)	

Data presented as mean ± SD, *: statistically significant as P value <0.05. LA: local anesthetic.



(A) **(B)**

Figure 2: Kaplan–Meier curve of proportion of patients who achieved complete sensory block (**A**) and complete motor block (**B**) after infraclavicular brachial plexus block

Discussion

The choice of the local anesthetic, its volume and concentration in the solution, and thus the dose of the injected drug, affect several parameters of the peripheral nerve block. It determines the onset of block, the duration of analgesia and motor block. The total dose of local anaesthesia also directly correlates with the risk of side effects (total overdosing) [18].

To hasten the onset of local anesthetic agent, some anaesthesiologists increase the concentration of local anesthetics6. However, higher concentration of local anaesthetics not only has been associated with increased direct neurotoxicity to the neurons, but the volume must be carefully selected to avoid exceeding the maximal dose. Finding a lower concentration local anesthetic agent with quicker onset is important to anaesthesiologists, especially in centres without a preparation room for performing blocks [19].

We aimed to compare the efficacy of bupivacaine at 2 concentrations and doses in equivalent volume used in USG infraclavicular brachial plexus block in upper extremity surgery.

In the present study, regarding the block performance, group II showed earlier onset time and longer duration of sensory and motor blocks compared to group I ($P<0.05$) and the performance time was significantly shorter in in group II compared to group I ($P=0.015$). Number of patients required analgesia was significantly lower in group II compared to group I ($P=0.003$) and the first rescue analgesic requirement was significantly delayed in group II compared to group I ($P<0.001$). Regarding the adverse effects, nausea occurred in 4 (11.43%) patients in group I and 3 (8.57%) patients in group II, vomiting occurred in 3 (8.57%) patients in group I and 1 (2.86%) patient in group II, and LA toxicity didn't occur to any patient in both groups. There was an insignificant difference between both groups regarding the incidence of adverse effects. Regarding the satisfaction, there was a significant difference between the studied groups regarding the satisfaction, with higher rate of satisfied and very satisfied patients in group II compared to group I ($P=0.007$).

A group of scientists [17] performed a double-blinded, randomized, prospective

study compared 3 different concentrations of bupivacaine using the same total volume for ultrasound-guided infraclavicular block applied in the upper extremity surgery. The patients were equally and randomly distributed into three groups (n=50). Under ultrasound guidance, the first group received 20 mL of 0.5% bupivacaine, the second group 20 mL of 0.375% bupivacaine and the third group 20 mL of 0.25% bupivacaine injected into the brachial plexus cords. They found that the onset of sensory block, motor block and SCT were significantly longer in the 0.25% bupivacaine group than the other groups ($p \leq 0.05$).

In the literature, researchers showed that manipulation of volume or concentration can affect the nerve block. In the studies that compared the different volume/concentration combinations for sciatic nerve blocks shorter onset times with a higher concentration/lower volume of LA compared with a higher volume/lower concentration have been observed [20, 21]. In another study it was found that higher volume and lower concentration provided faster motor block of axillary nerve compared with a lower volume/higher concentration [22].

The brachial plexus block (delay of sensory and motor blockade, duration of motor and sensory blockade) using 0.375% bupivacaine with epinephrine and 0.5% ropivacaine were measured and did not differ between the two groups. Additionally, Watanabe et al. [24] in their study did not notice differences in time from the end of the procedure until the administration of rescue painkillers and during the duration of the motor blockade of the operated limb. Researchers found that ropivacaine and levobupivacaine (used in equal concentrations of 0.375%) provided the same level of postoperative analgesia [23].

In the study done previously, brachial plexus blockade with 0.5% levobupivacaine resulted in a significantly faster sensory and motor block compared to 0.5% ropivacaine, with comparable postoperative analgesia 6 h after performing the block [25]. It was however claimed that ropivacaine induces faster onset of motor block than levobupivacaine with shorter analgesic effect. In their study, however, the difference between the concentrations of local anaesthetics was 0.25% (0.75% ropivacaine vs. 0.5% levobupivacaine). With similar pharmacologic properties and the lack of inevitable advantages of any of the drugs in clinical trials, the safety profile may support the choice of ropivacaine for volume blocks in regional anesthesia [26].

According to Kaplan Meier curve, we reported that the achievement of complete sensory block was significantly earlier in group II compared to group I with (HR= 0.1308 (95% CI) 0.05572 to 0.3070, $P<0.001$). Additionally, the achievement of complete motor block was significantly earlier in group II compared to group I with (HR= 0.1757 (95% CI) 0.08464 to 0.3648, $P<0.001$).

A prospective, double-blinded (participants and assessors), randomized controlled study was performed on a total of 46 patients. They observed that 0.375% ropivacaine had a shorter onset time of sensory and motor block than 0.25% levobupivacaine. Additionally, the proportion of patients who achieved a

complete sensory block revealed that the complete sensory block incidence was higher in group R than in group L (log-rank test, p = 0.032 and proportion of patients who achieved a complete motor block, demonstrated that the complete motor block proportion was higher in group R than in group L (log-rank test, p = 0.045) [4]. A review article indicated that the concentration of local anaesthetics was unlikely relevant to block onset, success, and duration, but the mass of local anaesthetics was the most determinant factor in the peripheral nerve block [27].

Based on the results of the study done previously, although 0.25% bupivacaine could provide sufficient surgical anesthesia, it may not be the most appropriate drug considering the onset time, especially in clinical environments where rapid turnover is required [4]. In addition, there was no notable benefit over 0.5% bupivacaine considering other block-related characteristics. Therefore, 0.5% bupivacaine may be a better choice than 0.25% levobupivacaine in clinical settings.

Rapid onset of action is important in the clinical setting for several reasons when a surgical peripheral nerve block is applied. The rapid action of local anaesthetics will improve the efficiency in operating room management, reduces surgeon's concerns for the time consumption, and increases the patient satisfaction by reducing anxiety [28].

As the limitation of our study, we had relatively small sample size we used 2 different concentrations but the same commonly used volume of bupivacaine. However, it is not possible to determine the maximal, and minimum longevities of block obtained without determining the minimum effective concentration of bupivacaine. Second, the onset time we measured may not be very accurate, as the procedure took a few minutes; dual-injection rather than single-injection techniques were used, and the assessment of the blockade extent was not continuously performed. However, the aim of this study was not to find out the exact onset time of each drug, but to identify the drug which shows faster sensory onset at an equipotent concentration. Moreover, we used infraclavicular block which could be performed quickly to reduce the confounding effect by the onset of the drug during the block procedure.

Conclusion

We found that 0.5% bupivacaine showed an earlier onset time and longer duration of sensory and motor blocks compared to 0.25% bupivacaine in infraclavicular block. Thus, when a quicker block onset is required, 0.5% bupivacaine is a better choice than 0.25% bupivacaine.

References

1. Feigl GC, Litz RJ, Marhofer P. Anatomy of the brachial plexus and its implications for daily clinical practice: regional anesthesia is applied anatomy. Reg Anesth Pain Med. 2020;45:620-7.

2. Nho JH, Jang BW, An CY, Yoo JH, Song S, Cho HB, et al. General versus brachial plexus block anesthesia in pain management after internal fixation in patients with distal radius fracture: A randomized controlled trial. Int J Environ Res Public Health. 2022;19:45-56.

3. Songthamwat B, Karmakar MK, Li JW, Samy W, Mok LYH. Ultrasound-guided infraclavicular brachial plexus block: Prospective randomized comparison of the lateral sagittal and costoclavicular approach. Reg Anesth Pain Med. 2018;43:825-31.

4. Kim HJ, Lee S, Chin KJ, Kim JS, Kim H, Ro YJ, et al. Comparison of the onset time between 0.375% ropivacaine and 0.25% levobupivacaine for ultrasound-guided infraclavicular brachial plexus block: a randomized-controlled trial. Sci Rep. 2021;11:4703-9.

5. Karm MH, Lee S, Yoon SH, Lee S, Koh W. A case report: the use of ultrasound guided peripheral nerve block during above knee amputation in a severely cardiovascular compromised patient who required continuous anticoagulation. Medicine (Baltimore). 2018;97:93-7.

6. Exsteen OW, Svendsen CN, Rothe C, Lange KHW, Lundstrøm LH. Ultrasound-guided peripheral nerve blocks for preoperative pain management in hip fractures: a systematic review. BMC Anesthesiol. 2022;22:192-8.

7. Ootaki C, Hayashi H, Amano M. Ultrasound-guided infraclavicular brachial plexus block: an alternative technique to anatomical landmark-guided approaches. Reg Anesth Pain Med. 2000;25:600-4.

8. Dost B, Kaya C, Ustun YB, Turunc E, Baris S. Lateral sagittal versus costoclavicular approaches for ultrasound-guided infraclavicular brachial plexus block: A comparison of block dynamics through a randomized clinical trial. Cureus. 2021;13:141-9.

9. Sandhu HK, Miller CC, 3rd, Tanaka A, Estrera AL, Charlton-Ouw KM. Effectiveness of standard local anesthetic bupivacaine and liposomal bupivacaine for postoperative pain control in patients undergoing truncal incisions: A randomized clinical trial. JAMA Netw Open. 2021;4:210-9.

10. Jin Z, Ding O, Islam A, Li R, Lin J. Comparison of liposomal bupivacaine and conventional local anesthetic agents in regional anesthesia: A systematic review. Anesth Analg. 2021;132:1626-34.

11. Desai N, El-Boghdadly K, Albrecht E. Peripheral nerve blockade and novel analgesic modalities for ambulatory anesthesia. Curr Opin Anaesthesiol. 2020;33:760-7.

12. Abhinaya RJ, Venkatraman R, Matheswaran P, Sivarajan G. A randomised comparative evaluation of supraclavicular and infraclavicular approaches to brachial plexus block for upper limb surgeries using both ultrasound and nerve stimulator. Indian J Anaesth. 2017;61:581-6.

13. Şengel A, Seçilmiş S. Ultrasound-guided bilateral infraclavicular brachial plexus block: A report of three cases. Saudi J Anaesth. 2022;16:232-5.

14. Ferraro LH, Takeda A, dos Reis Falcão LF, Rezende AH, Sadatsune EJ, Tardelli MA. Determination of the minimum effective volume of 0.5% bupivacaine for ultrasound-guided axillary brachial plexus block. Braz J Anesthesiol. 2014;64:49-53.

15. Pathak A, Sharma S, Jensen MP. The utility and validity of pain intensity rating scales for use in developing countries. Pain Rep. 2018;3:672-9.

16. Chyung SY, Roberts K, Swanson I, Hankinson A. Evidence-based survey design: The use of a midpoint on the Likert scale. Performance Improvement. 2017;56:15-23.

17. Başkan S, Acar F, Demirelli G, Unal H. Comparison of 3 different bupivacine concentrations used in the ultrasound guided infraclavicular brachial plexus block. JARSS. 2019:142-9.

18. Almasi R, Rezman B, Kriszta Z, Patczai B, Wiegand N, Bogar L. Onset times and duration of analgesic effect of various concentrations of local anesthetic solutions in standardized volume used for brachial plexus blocks. Heliyon. 2020;6:47-58.

19. Verlinde M, Hollmann MW, Stevens MF, Hermanns H, Werdehausen R, Lirk P. Local anesthetic-induced neurotoxicity. Int J Mol Sci. 2016;17:339-46.

20. Shevlin S, Johnston D, Turbitt L. The sciatic nerve block. BJA Educ. 2020;20:312-20.

21. Wang L, Qu Y, Deng Y, Li J, Liu Y, Wu C. Evaluation of a new method of sciatic nerve block: A prospective pilot study. J Pain Res. 2023;16:2091-9.

22. Bangera A, Manasa M, Krishna P. Comparison of effects of ropivacaine with and without dexmedetomidine in axillary brachial plexus block: A prospective randomized double-blinded clinical trial. Saudi J Anaesth. 2016;10:38-44.

23. Bobik P, Kosel J, Świrydo P, Tałałaj M, Czaban I, Radziwon W. Comparison of the pharmacological properties of 0.375%

bupivacaine with epinephrine, 0.5% ropivacaine and a mixture of bupivacaine with epinephrine and lignocaine - a randomized prospective study. J Plast Surg Hand Surg. 2020;54:156-60.

24. Watanabe K, Tokumine J, Lefor AK, Moriyama K, Sakamoto H, Inoue T, et al. Postoperative analgesia comparing levobupivacaine and ropivacaine for brachial plexus block: A randomized prospective trial. Medicine (Baltimore). 2017;96:64-7.

25. Mageswaran R, Choy YC. Comparison of 0.5% ropivacaine and 0.5% levobupivacaine for infraclavicular brachial plexus block. Med J Malaysia. 2010;65:300-3.

26. Piangatelli C, De Angelis C, Pecora L, Recanatini F, Cerchiara P, Testasecca D. Levobupivacaine and ropivacaine in the infraclavicular brachial plexus block. Minerva Anestesiol. 2006;72:217-21.

27. Eng HC, Ghosh SM, Chin KJ. Practical use of local anesthetics in regional anesthesia. Curr Opin Anaesthesiol. 2014;27:382-7.

28. Başkan S, Vural Ç, Erdoğmuş NA, Aytaç İ. Determination of the minimum effective volume of bupivacaine for ultrasound-guided infraclavicular brachial plexus block: a prospective, observer-blind, controlled study. Braz J Anesthesiol. 2022;72:280-5.

To cite this article: Ahmed S. Elnoury, Yehya S. Dabour, Mahmoud M Elnady Comparison of the Onset Time between 0.25% Bupivacaine and 0.5% Bupivacaine for Ultrasound-Guided Infraclavicular Brachial Plexus Block: A Randomized Clinical Trial. BMFJ 2024;41(8):513-524.