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COMPARISON OF INFRACLAVICULAR BRACHIAL PLEXUS BLOCK WITH SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERIES UNDER ULTRASOUND GUIDANCE

DR HANAN U NABI*
POSTGRADUATE RESIDENT ANESTHESIA, SHAIKH ZAYED HOSPITAL, LAHORE, EMAIL: drhananunabi@gmail.com

DR MEHTAB AHMED KHAN
REGISTRAR ANESTHESIA, SHAIKH ZAYED HOSPITAL, LAHORE, EMAIL: mak.khaan33@gmail.com

DR ZEMAL TARIQ
POSTGRADUATE RESIDENT ANESTHESIA, SHAIKH ZAYED HOSPITAL, LAHORE, EMAIL: dr.zemaltariq@gmail.com

DR MUHAMMAD JAWAD
POSTGRADUATE RESIDENT FAMILY MEDICINE, ALI HOSPITAL, KINGRA, EMAIL: muhammadjawadgardezy@gmail.com

DR SYED MEHMOOD ALI
MBBS, FCPS, FIPP HEAD OF DEPARTMENT ANESTHESAIA DEPARTMENT, SHAIKH ZAYED HOSPITAL, LAHORE

DR ARFAT KHAWAR
POSTGRADUATE RESIDENT ANESTHESIA, SHAIKH ZAYED HOSPITAL, LAHORE, EMAIL ID: arfatkhawar680@gmail.com

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ABSTRACT:
Objective: To compare the infraclavicular BPB with the supraclavicular BPB in terms of block performance time and time to onset of sensory and motor block in upper limb surgeries under ultrasound guidance.
Study design: Randomized controlled trial
Place and duration: Department of Anesthesia and ICU, Shaikh Zayed Hospital, Lahore, during May 2025 and September 2025.
Methodology: After obtaining written informed consent, 184 patients who met the selection criteria were enrolled. Patients were divided into two equal-number groups—92 in each group—by lottery. Under ultrasound guidance, patients in Group B underwent infraclavicular BPB, while those in Group A underwent supraclavicular BPB. Results were evaluated and statistically examined.
Results: Patients in Group A and Group B had median ages of 36 (15) and 36 (11) years, respectively. The median time to sensory block onset was 18 (3) minutes versus 15 (2) minutes ($p < 0.001$), the median time to onset of motor block was 16 (3) minutes versus 17 (4) minutes ($p > 0.046$), and the median block performance time was 9 (3) minutes in Group A and 14 (2) minutes in Group B ($p < 0.001$).
Conclusions: Compared to SC BPB, IC BPB under ultrasound guidance had a significantly longer block performance time but a much shorter onset of sensory and motor block.
KEYWORDS: Anesthesia, conduction, peripheral nerve block, Infraclavicular Block, Sensory Block

INTRODUCTION

Regional anesthesia, and particularly peripheral nerve blocks (PNB), has experienced a remarkable comeback. PNBs are now widely used in pain treatment and improved postoperative recovery pathways[1]. PNBs (by single injection or

continuous infusion) and adjuvant medications for pain relief are common ways to lessen the need for opioids during perioperative pain management[2]. Earlier PNB was done using surface landmarks. This blind technique of PNB is linked to a higher failure rate and nerve damage. One of the most significant developments in regional anesthesia was the creation and application of the portable nerve stimulator in clinical settings[3]. Ultrasound (US) and peripheral nerve stimulator methods allow for an excellent and tried-and-true localization of the nerves and surrounding structures[4].
PNBs for regional anesthesia have become less difficult since the development of ultrasonography[5]. The use of ultrasound guidance (USG) for nerve blocks is quickly becoming the norm thanks to the advent of portable, high-resolution ultrasound devices that are more affordable. Real-time viewing of the needle and pertinent anatomy, such as brachial plexus blocks (BPBs), is facilitated by ultrasound guidance[6]. When compared to nerve stimulation, USG for BPB has been shown to improve efficiency and block success while reducing issues such as puncture of the vessels and systemic toxicity due to local anesthetics. Faster block performance times and onset times have also been seen with the use of ultrasound[7].
Regional anesthetic techniques are well suited for surgical procedures involving the shoulder and upper limb because they are linked to a high rate of success and a low frequency of complications. As a safe substitute for general anesthesia in upper limb surgeries and for the management of postoperative pain, BPB has developed into a valuable tool in the practice of anesthesiologists[8]. Supraclavicular (SC) and infraclavicular (IC) techniques are appropriate for elbow proximally to hand distally procedures. Another anatomical benefit of the SC approach is that it allows for single-point injection by blocking the brachial plexus at a position where it is densely packed. Nonetheless, there have been reports of a high incidence of sequelae, including vascular punctures, pneumothorax, and Horner syndrome. The infraclavicular technique, which allows for a single injection with a lower risk of pneumothorax, has a compact anatomical distribution of the plexus[9,10].
Various studies have been conducted internationally that assessed the outcomes of both approaches to BPB, i.e., SC and IC, and have yielded contradictory results. Furthermore, there is a paucity of local data. Therefore, the current study aimed compare the IC BPB with SC BPB in terms of mean block performance time, mean time to onset of sensory and motor block in upper limb surgeries under ultrasound guidance. The study would guide a better approach, which was associated with less time to perform, had a rapid onset of sensory and motor blockade, and thus would help in improving the patient's satisfaction with the procedure.

MATERIALS AND METHODS

A randomized controlled trial was conducted at the Department of Anesthesia and ICU, Shaikh Zayed Hospital, Lahore from May 2025 to September 2025. A total of 184 patients who underwent elective upper limb surgeries were enrolled. The sample size calculated was 184 patients (92 in each group), keeping a 95% confidence level and a 5% margin of error, taking the expected mean block performance time in the IC BPB as 14.83±1.45 minutes and in the SC group as 10.31±1.52 minutes[5]. A simple random sampling technique was used.
Inclusion criteria: Patients with ASA grades I and II who underwent elective upper limb procedures and were between the ages of 18 and 60, regardless of gender, were included.
Exclusion criteria: Patients with severe lung disease, clinically significant coagulopathy, infection at the injection site, and pre-existing motor and sensory deficits were not allowed to participate.
After providing written informed consent, 184 patients who met the selection criteria were added to the research. The researcher collected demographic information, a thorough clinical history, and physical examinations for each patient. The results were recorded on a pre-made proforma. Both the day before and the day of the procedure, a pre-anesthetic examination was carried out. All patients received an intravenous injection of midazolam (1 mg) and glycopyrrolate (0.004 mg/kg) as premedication. Every patient was fitted with an operating theater monitor (ECG, pulse oximetry, and NIBP) upon arrival, and baseline values were recorded. After that, patients were divided into two equal-number groups (92 in each group) at random using the lottery method. Patients in Group B received IC BPB, while those in Group A received SC BPB. Each patient was given 50 µg of dexmedetomidine and 30 cc of 0.5% levobupivacaine. The BPBs were administered by a skilled anesthesiologist using a linear ultrasound probe. A short-axis view of the subclavian artery was obtained by placing the ultrasound probe in the frontal plane in the fossa above the collarbone for the SC BPB. After that, the needle was advanced in the plane while being directly visible from the lateral aspect until its tip was closer to the subclavian artery. Following a complete negative aspiration, the medication was administered into the brachial plexus with a small amount of needle tip manipulation to ensure that it was properly distributed across all of the plexus compartments. The ultrasagittal plane inferior to the clavicle was where the ultrasound probe was positioned in the IC BPB to acquire a short-axis image of the axillary artery. The needle was inserted and advanced in-plane until the tip was situated between the cords of the brachial plexus and the axillary artery, directly posterior to it. The local anesthetic was given following confirmation of the proper needle tip position and negative aspiration. Outcomes were assessed and were subjected to statistical analysis.
To analyze the data, SPSS version 25.0 was employed. To determine whether the data was normal, the Shapiro-Wilk test was used. Due to the non-normal distribution of the data, quantitative factors like age, block performance duration,

and time to commencement of sensory and motor block were displayed as median and interquartile range (IQR). Gender and ASA grade were examples of qualitative variables that were displayed as percentages and frequencies. Age, gender, and ASA grade were used to stratify the data. A post-stratification Mann-Whitney U test was performed to analyze effect modifiers, with a p-value of less than or equal to 0.05 indicating significance. When comparing the two groups' median block performance time and median onset time of motor and sensory block using the Mann-Whitney U test, a p-value of less than or equal to 0.05 was considered significant.

RESULTS

There were 184 patients in all. Patients in Group A and Group B had median ages of 36 (15) and 36 (11) years, respectively. Group A's median block performance time was 9 (3), whereas Group B's was 14 (2) ($p < 0.001$). In Group A, the median sensory block onset time was 18 (3) minutes, while in Group B, it was 15 (2) minutes ($p < 0.001$). In Group A, the median time to motor block onset was 16 (3) minutes, while in Group B, it was 17 (4) minutes ($p > 0.046$) (Table I).
The distribution of patients according to age group, gender, and ASA grade is mentioned in Table II.
Regarding age, gender, and ASA grade, there were notable variations between the two groups in terms of median block performance time and median time to commencement of sensory block (Table III, IV). There was a significant difference between the two groups in terms of the median time to onset of motor block for the female gender but not for the male gender, age group, or ASA grade (Table V).

Table I: Baseline demographic and clinical features of patients in both groups presented as median and interquartile range (n=184)

Variable	**Group**		**P Value**
	A (supraclavicular block) n=92	**B(Infraclavicular block) n=92**	
Age (in years)	36 (15)	36 (11)	-
Block performance time (in minutes)	9 (3)	14 (2)	<0.001
Time to onset of sensory block (in minutes)	18 (3)	15 (2)	<0.001
Time to onset of motor block (in minutes)	16 (3)	17 (4)	0.046

Table II: Frequency of demographic and clinical characteristics of the patients in both groups (n=184)

Variable	**Group**	
	A (supraclavicular block) n=92	**B (infraclavicular block) n=92**
Age group:		
18 to 30 years	27 (14.7%)	26 (14.1%)
31 to 45 years	44 (23.9%)	56 (30.4%)
46 to 60 years	21 (11.4%)	10 (5.4%)
Gender:		
Male	61 (33.2%)	60 (32.6%)
Female	31 (16.8%)	32 (17.4%)
ASA grade:		
Grade I	37 (20.1%)	45 (24.5%)
Grade II	55 (29.9%)	47 (25.5%)

Table III: Stratification of block performance time with respect to age, gender and ASA grade (n=184)

Stratification with respect to age			
Age group	**Block performance time**		**p Value**
	A (supraclavicular block)	**B (infraclavicular block)**	
18 to 30 years	9 (2)	15 (2.25)	<0.001
31 to 45 years	9 (3)	14 (2.75)	<0.001
46 to 60 years	9 (2.5)	14.5 (4)	<0.001
Stratification with respect to gender			
Gender	**Block performance time**		**p Value**
	A (supraclavicular block)	**B (infraclavicular block)**	
Male	9 (3)	14 (3)	<0.001
Female	9 (3)	14 (3)	<0.001
Stratification with respect to ASA grade			
ASA Grade	**Block performance time**		**p value**
	A (supraclavicular block)	**B (infraclavicular block)**	
Grade I	9 (2)	14 (3)	<0.001
Grade II	9 (3)	15 (2)	<0.001

Table IV: Stratification of sensory block onset time with respect to age, gender and ASA grade (n=184)

Stratification with respect to age			
Age group	**Sensory block onset time**		**p Value**
	A (supraclavicular block)	**B (infraclavicular block)**	
18 to 30 years	18 (3)	15 (2)	<0.001
31 to 45 years	18 (2)	15 (2)	<0.001
46 to 60 years	18 (3.5)	15 (1.25)	0.001
Stratification with respect to gender			
Gender	**Sensory block onset time**		**p Value**
	A (supraclavicular block)	**B (infraclavicular block)**	
Male	17 (2.5)	15 (2)	<0.001
Female	18 (2)	14 (2.75)	<0.001
Stratification with respect to ASA grade			
ASA Grade	**Sensory block onset time**		**p value**
	A (supraclavicular block)	**B (infraclavicular block)**	
Grade I	18 (2)	14 (1)	<0.001
Grade II	18 (3)	15 (2)	<0.001

Table V: Stratification of block performance time with respect to age, gender and ASA grade (n=184)

Stratification with respect to age			
Age group	**Motor block onset time**		**p Value**
	A (supraclavicular block)	**B (infraclavicular block)**	
18 to 30 years	16 (3)	15.5 (3.25)	0.942
31 to 45 years	16 (3)	17.5 (4)	0.123
46 to 60 years	15 (4)	18 (1.25)	0.096
Stratification with respect to gender			
Gender	**Motor block onset time**		**p Value**
	A (supraclavicular block)	**B (infraclavicular block)**	
Male	16 (3)	17 (3)	0.347
Female	16 (3)	18 (3.75)	0.042
Stratification with respect to ASA grade			
ASA Grade	**Motor block onset time**		**p value**
	A (supraclavicular block)	**B (infraclavicular block)**	
Grade I	16 (3)	17 (3.5)	0.069
Grade II	16 (3)	17 (4)	0.318

DISCUSSION

The current study findings revealed that in patients who underwent upper limb surgeries under ultrasound guidance, while the median block performance duration was found to be significantly longer in the IC block than in the SC block, IC BPB was significantly related to a shorter median time to the beginning of sensory and motor block as compared to the SC approach. Most of the individuals in our study were male, ASA grade II, and between the ages of 31 and 45.

For improved postoperative recovery pathways, PNBs are now considered standard of care[11,12]. SC and IC procedures for brachial plexus anesthetic delivery have been shown to require less additional anesthesia, be completed more quickly, have a faster start time, and have fewer rates of problems when compared to other methods (axillary, interscalene, etc.)[13-15]. USG is frequently used to enhance results, minimize the need for general anesthesia or severe sedation, and lessen procedural problems[16,17]. The present work critically evaluated the distinctions between the SC and IC techniques, which are the most used methods for BPBs.

Based on the results of our investigation, the IC group's median block performance time was 14 (2), while the SC group's was 9 (3). Statistical significance was found in this difference ($p < 0.001$). According to a study by Guru et al., the average block performance time with the IC block was 14.83±1.45 minutes ($p<0.001$) and with the SC BPB was 10.31±1.52 minutes[5]. In a review, Chang *et al.* revealed that the SC block was significantly linked to reduced block performance time compared to the IC, i.e., the standard mean difference was -3.06 ($p=0.03$)[18]. On the contrary, in another study, Gurav *et al.* revealed that the mean block performance time using the SC BPB was 12.33±3.10 minutes and with the IC block was 10.43±4.16 minutes ($p=0.023$)[19]. Zhang *et al.,* on the other hand, revealed that the two methods' block performance times were identical[20]. There is conflicting evidence regarding block performance time between the SC block and IC block due to variations in operator competence and experience, USG-guided procedures (needle angle, single versus numerous injections), and inconsistent definitions of performance time. Some studies claim that SCB is faster because it is simpler to identify landmarks at the neck, while others believe ICB to be faster.

Regarding block onset, our results indicated that the median time to sensory block onset was 18 (3) minutes in the SC group and 15 (2) minutes in the IC group ($p<0.001$), while the median time to motor block onset was 16 (3) minutes in the SC group and 17 (4) minutes in the IC group ($p<0.046$). According to Guru et al., the start of sensory block took an average of 17.33±2.54 minutes in the SC block group and 13.67±22.25 minutes in the group that had a block via IC approach ($p<0.001$), whereas the motor block onset took an average of 18.5±2.33 minutes in both groups. ($p=0.999$)[5]. According to Gurav et al., the mean duration of sensory block onset was 9.25±3.17 minutes in the SC block and 7.23±3.41 minutes in the group which underwent block via IC approach, ($p=0.007$), while the average motor block onset time was 9.36±4.20 minutes in the SC block and 8.12±3.20 minutes in the IC group. ($p=0.14$)19. These results corroborate our study's conclusion that, in comparison to the SC block, the IC block is linked to a shorter period of onset for both the sensory and motor blocks.

The shorter onset of sensory and motor block suggested that IC nerve block would be better than SC nerve block for upper limb procedures. The anesthetic distributions of the supraclavicular and infraclavicular techniques are comparable. The infraclavicular block is the best strategy for catheter insertion procedures and has fewer ultrasound-related problems. The IC block can provide total anesthesia of the upper arm by BPB, where the axillary artery and the three cords are most closely spaced.

CONCLUSIONS

Our study results concluded that compared to SC BPB, IC BPB under ultrasound guidance was associated with a significantly longer block performance time but a significantly shorter onset of sensory and motor block in patients undergoing upper limb operations. Our findings proposed for the analgesia of distal arm procedures, an IC nerve block may be better than an SC nerve block, although it requires more block performance time. The results of our study must be validated by bigger sample sizes in future research.

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LIMITATIONS:
The study was limited in some ways. Firstly, we did not assess the adverse events that might be associated with these approaches. Secondly, different types of fractures and their position may affect the outcomes, which were not assessed in our study. Lastly, the type of anesthetic used can vary in different institutions and thus can affect the outcome.

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