



COMPARISON OF QUALITY OF BLOCK IN FOREARM AND HAND SURGERIES UNDER SUPRACLAVICULAR AND INFRACLAVICULAR BLOCK; AN OBSERVATIONAL STUDY

Anaesthesiology

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ABSTRACT

Background: Supraclavicular and infraclavicular brachial plexus blocks have a comparable distribution of anaesthesia, and both can be effectively used for surgeries of the forearm, wrist and hand. **Aim:** Comparison of quality of blockade and postoperative analgesia in forearm and hand surgeries done under ultrasound guided Supraclavicular and Infraclavicular brachial plexus blocks. **Method:** In this prospective observational study 80 male and female patient aged 13-60 years; of ASA I & II undergoing hand, wrist and forearm surgery under ultrasound guided Supraclavicular and Infraclavicular blocks were divided in 2 groups (40 each). Group-S received ultrasound guided supraclavicular and group-I received infraclavicular brachial plexus blocks. Demographic parameter, Time to perform block, scan time, Tourniquet Inflation Time and pain, sedation, duration of surgery, Time taken to start rescue analgesia, numerical rating scale (NRS) score were noted at specified intervals. **Results:** Demographic variables, block performance time, Tourniquet Inflation Time and pain, sedation and mean pain score were comparable at all time interval between the groups. Duration of surgery and scan time was significantly longer in group-S ($p=0.002$). Time for onset of motor and sensory block was significantly higher in group-I. More patients in S group required surgical anesthesia supplementation than I group ($p<0.05$). **Conclusion:** Compared to USG guided supraclavicular block, infraclavicular brachial plexus block provides superior surgical anesthesia. Also, ICB success rate more than that of SCB,

KEYWORDS

INTRODUCTION

Regional nerve block avoids the unwanted effects of anesthetic drugs used during general anesthesia and laryngoscopic stress response. A well conducted regional anesthetic technique has very much to offer to anaesthesiologist, surgeon, as well as patients owing to its advantages over general anaesthesia such as remaining conscious, avoiding polypharmacy, better haemodynamic stability and excellent post-operative analgesia.

The ultrasound (US)-guided technique gives the best quality of regional block, irrespective of the approach, most probably due to the visualization of the target structures.

The supraclavicular brachial plexus block is a popular technique for surgeries below the shoulder because of its quick onset and high success rate. However, the major disadvantages are higher incidence of complications such as inadvertent vascular injections, pneumothorax, phrenic nerve palsy and Horner's syndrome.

Brachial plexus block in the infraclavicular approach offers the advantages of avoiding pneumothorax while affording block of the musculocutaneous and axillary nerves.

The main advantage of infraclavicular block is the fewer incidences of complications with ultrasound. The disadvantage is that plexus is situated deeper at this level and the angle of approach is more acute making synchronized visualization of the relevant anatomy and needle challenging in inexperienced hands especially in obese patients.

The aim of this study is to compare infraclavicular and supraclavicular approaches to brachial plexus block using ultrasound guidance in forearm and hand surgeries.

MATERIAL AND METHODS

This is a prospective observational study was conducted in the Department of Anaesthesiology, Pain Medicine and Critical Care, All India Institute of Medical Sciences, Bhopal after obtaining Institutional Ethics Committee approval to compare infraclavicular and supraclavicular approaches to brachial plexus block using ultrasound guidance in forearm and hand surgeries.

Inclusion Criteria:-

Patients aged 13 to 60 years (age range: 13 to 60) male and female patients with ASA physical status 1 or 2 undergoing hand, wrist and

forearm surgeries.

Exclusion Criteria:-

1. Patient's refusal to the procedure.
2. Contraindications to regional technique e.g., allergy to local anesthetic drugs, infection around site of block, any coagulation disorder, sepsis.
3. Patients with significant pulmonary pathology (like COPD, Emphysema).
4. Patients with chest deformity or distorted anatomy in the area of procedure.
5. ASA grade 3 and 4 patients.

Sample size:-

This was an exploratory study where primary objective was to compare the quality of surgical block provided by ultrasound guided supraclavicular and infraclavicular blocks. We expect that in a month on average of 8 to 10 patients would be enrolled, giving rise to total sample size of 80 to 100 patients.

Procedure methodology

After written informed consent form had been obtained, detailed history of the presenting symptoms and their onset was recorded. All selected patients underwent routine investigations such as Complete blood count; Liver function test, serum urea, serum creatinine, blood sugars, electrocardiography (ECG) and chest Xray PA view were done and noted on patient proforma.

All the patients were explained about the study protocol, and informed written consent for the participation were obtained.

Methodology:-

Supraclavicular Block Technique was Performed under all aseptic precautions under USG guidance:-

Patients were positioned in the supine at 30-degree head up with the pillow supporting their head but not obscuring the block with head turned to 45 degree towards contralateral side, using bolster kept below the interscapular region. 2 – 3ml of local anaesthetic (lidocaine 1%) is given subcutaneously after the skin was disinfected and draped. In Transverse plane, ultrasound linear transducer probe of 7-13 MHz was placed in the supraclavicular fossa as described in a review of Koscielniak Nielsen ZJ to locate the pulsatile hypoechoic subclavian artery, as it makes easier to view all the three trunks of brachial plexus enclosed in a sheath as hypoechoic structures just superficial and

posterior to it. Sonoplex 22G needle is connected to a 10cm extension line which is further connected to a 20ml disposable syringe containing local anaesthetic solution containing 0.5% bupivacaine and 2% lignocaine with adrenaline mixed in 1:3 ratio and consequently, the needle was inserted in-plane lateral to the probe directed medially along the longitudinal axis using single injection technique, LA mixture was injected resulting in its spread around the plexus (proximal approach).

Infraclavicular Block Technique was Performed under all aseptic precautions under USG guidance:-

Patients were positioned in supine position with head turned to 45 degree towards contralateral side, arm abducted to 90 degrees with elbow flexion was demonstrated as described by Amany El Sawy et al. 2–3ml of local anaesthetic (lidocaine 1%) is given subcutaneously after the skin was disinfected and draped. The USG linear transducer probe 7–13 MHz positioned in parasagittal plane and placed below the clavicle, medial to the coracoid process.⁹ Skin, subcutaneous tissue, pectoralis major and pectoralis minor muscles were penetrated en route toward the infraclavicular plexus aspect as demonstrated by Padraig O Scanaill et al. To achieve the desired “u-shaped” crescentic distribution of LA around the artery: -

- Two-third of the LA mixture was injected posterior to the axillary artery, around the posterior and medial cord.
- The remaining one-third of the LA mixture injected more superficial towards lateral cord by redirecting and retracting the needle.

1. Assessment of Sensory block: -

Assessment of sensory block was done every 5min after the needle removal for 20 minutes and evaluated by using pin prick stimulation in the areas supplied by the radial nerve-dorsum of hand, median nerve-thenar eminence, ulnar nerve-hypothenar eminence and musculocutaneous nerve - lateral aspect of the forearm.

2. Assessment of Motor block: -

Assessment of motor block was done every 5min after the needle removal for 20min in hand, wrist joint and elbow joint and evaluated by examining: -

- Elbow flexion (musculocutaneous nerve)
- 3rd finger flexion (median nerve)
- Thumb abduction (radial nerve)
- Little finger flexion (ulnar nerve)

3. USG imaging time: -

Time to obtain adequate USG image was taken from the start of scanning till an adequate image is obtained (maximum allowed time was 10min) beyond which the procedure shall be deemed failed with an imaging time of 10 min.

4. Block performance time: -

The time to perform the block was taken from the start of the needle insertion till the removal of the needle (maximum time, 10min) beyond which the procedure shall be deemed failed with a procedure time of 10min.

5. Pain assessment: -

Pain was assessed using numerical rating scale at 24 hrs after surgery.

6. Complications:

- Patients were observed intraoperatively and 24 hrs postoperatively for complications.
- Intraoperative complications – Vessel puncture, Hematoma formation and any toxic or Allergic reaction
- Post-Operative complications – Nerve injury, Pneumothorax.

Data Analysis: -

We used Microsoft Excel for data entry and EPI-Info 7 for data analysis. All patients meeting the inclusion and exclusion criteria were enrolled for the study. Comparison of categorical data was used by Chisquare test/ Fisher's exact test. The continuous data was compared by Student test/Mann Whitney test as applicable. Further, $p < 0.05$ considered significant.

Observation/results

This study is an observational study, and includes patients scheduled

for hand, wrist and forearm surgeries, aged 13 to 65 years with mean age 31.13 ± 10.82 and 30.53 ± 10.92 respectively for SCB and ICB group. Males and ASA grade I patients were in majority in both the group as compared to the females. Also all the demographic details were insignificantly associated among the groups. [Table No. 1]

Scan time (significantly lower in ICB group), Time for onset of Sensory Block and Motor Block (significantly higher in ICB group) [Table No. 2]

The comparison of tourniquet pain and sedation for comfort during intra operative period between two groups was done and they also formed an insignificant association among the groups. Also, duration of Surgery was insignificantly associated among the groups; Time taken to start rescue analgesia was significantly higher in ICB group. [Table No. 3]

The pain score was measured after 24 hours in patients of both the groups and it was found that the score was almost similar in both the groups ($p > 0.05$) [figure No. 1]

The proportion of patients with Suspected diaphragmatic paresis and Horner's syndrome of Group-S was significantly higher than that of the patients of Group-I ($p < 0.01$). [Table No. 4]

Table No. 1 Comparison of demographic Details among the two groups

Parameters		Groups		P-value
		SCB (n=40)	ICB (n=40)	
Mean Age in years		31.13 ± 10.82	30.53 ± 10.92	0.806
Gender	Male	32 (80.0%)	33 (82.5%)	0.775
	Female	8 (20.0%)	7 (17.5%)	
Mean weight in kilograms		55.975 ± 9.464	59.675 ± 7.908	0.061
Surgeries	Forearm & Wrist	32 (80.0%)	26 (65.0%)	0.331
	Hand	8 (20.0%)	14 (35.0%)	
ASA Grade	I	33 (82.5%)	35 (87.5%)	0.531
	II	7 (17.5%)	5 (12.5%)	

Table No. 2 Time parameters

Parameters	Groups		P-value
	SCB (n=40)	ICB (n=40)	
Scan time (seconds)	126.750 ± 33.599	102.375 ± 22.217	0.001
Time for onset of Sensory Block (Minutes)	10.05 ± 1.41	11.53 ± 1.89	0.001
Time for onset of Motor Block (Minutes)	14.48 ± 1.78	17.05 ± 2.28	0.001

Table No. 3 Comparison of tourniquet pain and sedation for comfort during intra operative period between two groups (SCB has only 37 patients as inadequate block occurs in 3 patients)

Parameters	Groups		P-value
	SCB (n=37)	ICB (n=40)	
Tourniquet Inflation Time (Minutes)	85.25 ± 22.13	82.50 ± 16.13	0.527
Tourniquet pain	0 (0.0%)	2 (5.0%)	0.147
Sedation for comfort during Intra operative Period	7 (19%)	8 (20.0%)	0.99
Duration of Surgery (in minutes)	113.4 ± 18.2	109.6 ± 21.9	0.412
Time taken to start rescue analgesia (in minutes)	262.20 ± 23.10	288.10 ± 28.90	0.001

Table No. 4 Comparison of side effects between two groups

Side effects	Groups		P-value
	SCB (n=37)	ICB (n=40)	
Accidental vascular puncture	0 (0.0%)	0 (0.0%)	1.00
Pneumothorax	0 (0.0%)	0 (0.0%)	1.00
Inadequate block	3 (10.8%)	0 (0.0%)	0.033

DISCUSSION

In this study 80 adult patients of age between 18 and 80, with ASA physical status I & II were randomly allocated to receive either USG guided supraclavicular block (Group SCB) or USG guided infraclavicular block (Group ICB). 40 (50.0%) patients were in the Group-SCB and rest 40 (50.0%) patients were in the Group-ICB. Thus the patients of the two groups were in ratio 1:1.

Peripheral nerve blocks (PNB) are getting significant recognition for intraoperative and postoperative pain control because of their distinct advantage over general anaesthesia. In this prospective observational study we compare infraclavicular and supraclavicular approaches to brachial plexus block using ultrasound guidance in forearm and hand surgeries.

The two groups were similar in terms of demographic parameters, ASA Grade and site of surgeries. Our findings were in accordance with the findings of Abhinaya RJ et al³ who reported the mean age of SCB as 32.40±11.25 and that of ICB as 33.53±14.21, weight as 65.87±10.47 and 67.27±8.77 and male predominance ($p>0.05$). Also, Stav A et al² and Bharti N et al reported the insignificant association among the two groups in regards of demographic details ($p>0.05$).

The time needed to perform the block was comparable between the two groups. This finding is in sync with the findings of Arcand et al and Arnuntasupakul V et al.

A greater number of patients in the SCB group failed to achieve surgical anaesthesia (3 versus 0), however the differences was statistically insignificant ($P=0.24$). The overall success rate for SCB group was 95% while that in ICB group was 100.0%. Our observations for SCB success rate are similar to the observations of De Jose et al and Pelas A et al, but our ICB success rate is better than theirs (88.0%). Abhinaya RJ et al³ reported the success rate of both the group as 93.3% ($p>0.05$).

Sedation for comfort during Intra operative Period was in 7(19.0%) of SCB and 8(20.0%) of ICB group. This incidence of tourniquet pain is lower than that documented by Chin et al (12.0%) and Brenner et al (8.0%). Lesser tourniquet pain can be attributed to the more complete sensory block of the musculocutaneous nerve and axillary nerve. In our study the time for onset of Sensory (10.05±1.41 vs. 11.53±1.89) and motor block (14.48±1.78 vs. 17.05±2.28) was significantly lesser for group SCB. The duration of surgery was almost similar in both the groups ($p>0.05$). Time taken to start rescue analgesia (262.20±23.10 vs. 288.10±28.90) were significantly higher for group SCB ($p<0.05$). Our findings were similar to Yazer MS et al⁶ who reported that due to a quicker onset the total anaesthesia-related time was shorter with SCB. In contrast to the Abhinaya RJ et al³ who found group ICB faster than SCB for sensory block and motor block which might be because of smaller sample size.

On the basis of duration of surgery our findings were supported by Malik A et al⁵ who reported that there was no significant difference between mean duration of surgery of the two groups ($p>0.05$). Thus two groups were matched for duration of surgery. (S-89.33±6.58, I-89.45±7.72 $P=0.92$). Bharti N et al⁴ reported that the duration of surgery for group SCB was 109.6±21 and that of group ICB it was 113.4±18 and the difference was insignificant ($p>0.05$). Abhinaya RJ et al³ reported the mean duration of surgery for group-S as 99.52±4.84 and for group-I it was 96.41±8.23 ($p=0.079$) similar to the present study.

Time to rescue analgesia was significantly longer in the ICB group (288 vs. 262 minutes). Vazin M et al, found that duration of analgesia was more in infraclavicular group than supraclavicular group. Holmberg A et al also reported the similar findings as in our study.

In this study we did not encounter any serious procedure related adverse events.

Mallik A et al⁵ reported block performance time and block performance related pain were comparable at all time intervals between two groups similar to the present study.

In the present study in group-SCB side effects like suspected diaphragmatic paresis (7.5%) and Horner's syndrome (12.5%) were observed while none of the patient from group-ICB shows any side

effect or complications during or after the surgery. Our findings were similar to the findings of Malik A et al⁵ who reported that proportion of patients with Horner's syndrome of Group-S (16.7%) was significantly higher than that of the patients of Group-I (0%) ($p<0.01$). This finding corroborates with study done by Koscielniak-Nielsen ZJ et al⁹, Gurkan Y et al, and Stav A et al² where S group experienced more side effect than I group.

CONCLUSION

We concluded that both supraclavicular and infraclavicular brachial plexus block approaches are safe and are comparable in providing sensory and motor block in patients undergoing forearm and hand surgeries. The infraclavicular block is more rapidly executed compared to supraclavicular block with more success rates but did not reach statistical significance and fewer complications in the presence of ultrasound, hence should be preferred.

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