IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 22, Issue 2 Ser.17 (February. 2023), PP 15-22
www.iosrjournals.org

Comparison Of Supraclavicular And Retroclavicular Brachial Plexus Block In Upper Limb Orthopedic Surgeries: A Randomised Controlled Study.

DR RAJIB HAZARIKA[1], DR SHUBHANGI BHATTACHARYYA[2], DR TRINA SEN[3],

1. *Professor, Department of Anaesthesiology and Critical Care, Gauhati Medical College and Hospital, Assam*
2. *Post graduate trainee, Department of Anaesthesiology and Critical Care, Gauhati Medical College and Hospital, Assam*
3. *Assistant Professor, Department of Anaesthesiology and Critical Care, Gauhati Medical College and Hospital, Assam*

***Address for correspondence: Dr. Shubhangi Bhattacharyya, Department of Anaesthesiology and Critical Care, Bhangagarh, Indrapur-781032, Kamrup(metro), Assam, India*

Financial support and sponsorship:
Nil
Conflicts of interest:
There are no conflicts of interest

ABSTRACT
Background*:*
This randomised control study has been conducted in Gauhati Medical College and Hospital with the view of comparing the supraclavicular brachial plexus with the retroclavicular brachial plexus block using ultrasonographic guidance for patients undergoing operative orthopedic intervention for upper limb trauma.
Methodology*:*
This study included cases between the ages 18 to 60 years, posted for elective orthopaedic surgery. All patients were admitted under the Department of Orthopaedics, Gauhati Medical College and Hospital. A written and informed consent was taken. Eighty eight patients meeting the criterias and consenting were divided into two groups A and B, by a computer-generated block randomization. Concealment of allocation was done by sealed envelope technique. On the day of operation, a designated O.T technician opened the sealed envelopes, once the patient was shifted to the operation theatre.
Group A (n=44) : Patients received ULTRA-SOUND GUIDED supraclavicular brachial plexus block with 30 ml 0.4% ropivacaine.
Group B (n=44) : Patients received ULTRA- SOUND GUIDEDretroclavicular brachialplexus plexus block with 30 ml 0.4% ropivacaine.
Results*:*
The primary outcome of our study was to evaluate the block success rate amongst the two groups. The success rate in the supraclavicular group was 98.8% and in the retroclavicular group it was 98.6%. Thus the success rate was similar between the two groups.Needle tip visibility in the supraclavicular group was 3.89±0.321 (median-4) and in the retroclavicular group was 3.05±0.429 (median -3) infering that the supraclavicular group had better needle tip visibility. There was no significant differences in terms of onset of sensory, motor blocks and duration of analgesia. In the supraclavicular group one developed Horner's syndrome(2.3%) while two others developed neurovascular complications (2%) . No complications were observed in the retroclavicular group.
CONCLUSION:
Both the retroclavicular and supraclavicular approaches have similar block success rate. Even though the onset of sensory block and motor block showed difference between the two block approaches, it is not clinically relevant.A higher level of expertise is required for performing the retroclavicular block, and the chances of injury to the neurovascular structures due to poor visibility must be kept in mind.Considering the limited sample size in our study ,larger studies are required to extrapolate the results to a larger population.
KEYWORDS: SUPRACLAVICULAR, RETROCLAVICULAR, ROPIVACAINE,ULTRASONOGRAPHY, BRACHIAL PLEXUS BLOCK, HORNERS SYNDROME.

Date of Submission: 14-02-2023 Date of Acceptance: 28-02-2023

I. Introduction

With the emergence of regional anaesthetic technique orthopedic anaesthesia has shown tremendous growth.Although regional anaesthesia has been part of perioperative medicine for more than a century,recent studies have sparked new enthusiasm for this practice by supporting the notion that regional anaesthetic techniques have not only significant perioperative impact but also long term outcomes.(1)

According to recent literature ultrasound guidance reduces if not eliminate the most common complications of regional anesthesia such as blood vessel puncture or inadvertent intraneural or intravascular injection .The use of ultrasound doesnot replace experience and knowledge of relevant anatomy especially for the visualisation of deeper structures and sometimes may require substantial amount of time in case of an inexperienced operator.Using ultrasound alone or in combination with PNS are superior as it increases performance time.(2)

The supraclavicular approach of brachial plexus blockade is usually preferred for being at a higher level where the brachial plexus nerve trunks are tightly packed together which ensures a very rapid block onset following single point injection.The nerve visibility is very good as the structures are shallow(20-30mm).Supraclavicular region sonography will image the division of brachial plexus.Principle concern is of vascular punctures in that area that is difficult to compress and the risk of pneumothorax which is effectively avoided when ultrasound is used.(3)

In retroclavicular approach there is less trauma to the cephalic vein,acromial branch of acromioclavicular artery and lateral cord useful for block placements in patients with limited range of movements like patients with arthritis and trauma for whom movements can be painful.Disadvantage is difficult needle insertion in correct orientation for patients with full,non compliant supraclavicular fossa.(4)

A retroclavicular block although recently described in some literatures has not been adequately compared with another approach.Hence this randomised control study has been conducted in Gauhati Medical College and Hospital with the view of comparing the supraclavicular brachial plexus with the retroclavicular brachial plexus block using ultrasonographic guidance.

II. Aims And Objectives

Primary aim

To compare rate of block success of supraclavicular and retroclavicular approaches of brachial plexus block.

Secondary aim

Block performance time ,Onset of sensory and motor blockade ,Duration of analgesia
And any other relevant finding.

III. Methodology:

This study included cases of both sexes, between the ages 18 to 60 years, posted for elective orthopaedic surgery under supraclavicular brachial plexus block. All patients were admitted under the Department of Orthopaedics, Gauhati Medical College and Hospital. A written and informed consent was taken from all the patients after explaining the procedure involved, its benefits and possible adverse effects. Eighty eight patients meeting the inclusion criteria and consenting to participate in the study were divided into two groups A and B, by a computer-generated random selection using block randomization with blocks of variable sizes. Concealment of allocation was done by opaque sealed envelope technique. On the day of operation, a designated O.T technician opened the sealed envelopes, once the patient was shifted to the operation theatre.
Group A (n=44) : Patients received ULTRA-SOUND GUIDED supraclavicular brachial
plexus block with 30 ml 0.4% ropivacaine.

Group B (n=44) : Patients received ULTRA- SOUND GUIDEDretroclavicular brachialplexus
plexus block with 30 ml 0.4% ropivacaine.

All the drugs used perineurally were preservative free.

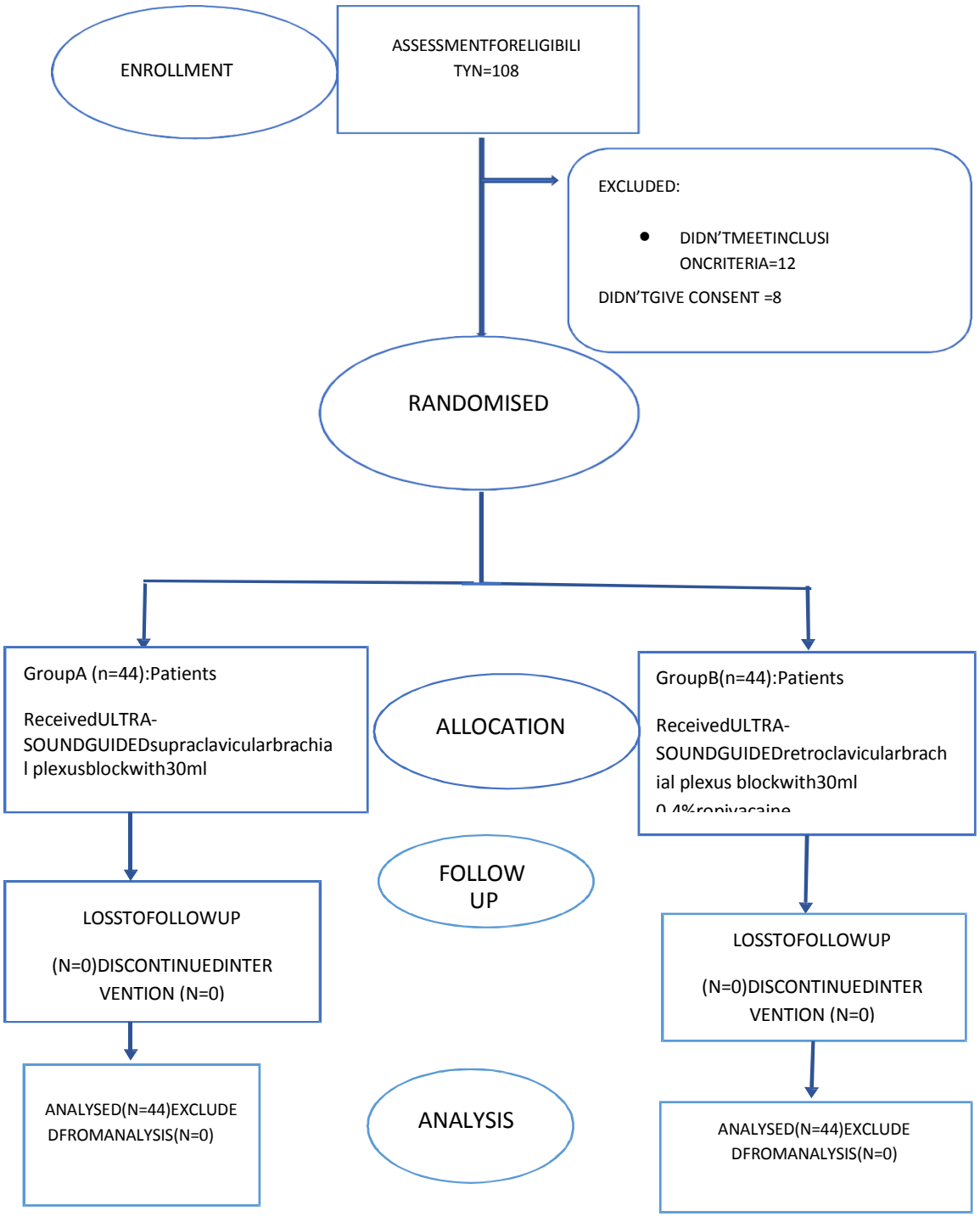

Table 1-CONSORTFLOWDIAGRAM

PROCEDURE OF THE BLOCK:

Patients will be positioned supine with the head turned 45 degrees to the non operative side,and with the ipsilateral arm adducted by the patient's side.Under sterile conditions,a high frequency linear array transducer (13-6MHz) will be used.

For the supraclavicular brachial plexus block, the probe will be placed firmly over the supraclavicular fossa, parallel to the clavicle to obtain a short-axis view of divisions of brachial plexus and subclavian artery lying on the first rib. After skin infiltration with 1%lidocaine, a stimuplex 50mm needle will be inserted in-plane with

the ultrasound beam in a lateral to medial direction until the needle tip is positioned at the junction of the first rib and subclavian artery

For the retroclavicular block, the probe was placed below and perpendicular to the clavicle, in para median saggital plane medial to the coracoid process to obtain a short-axis view of the cords of brachial plexus and axillary vessels. The needle was then inserted into the supraclavicular fossa approximately 1cm posteriorly to the clavicle and was advanced in a plane strictly parallel to the transducer. After passing the initial blind zone of the about 2cm caused by the acoustic shadow of the clavicle the needle tip will be constantly seen until positioned posterior to the axillary artery.
The limb will be evaluated for sensory and motor blockade every 5mins for 30mins.Sensory blockade will be tested in the dermatomes of using a blunt tip needle pinprick test.

After administration of the block the following were noted- block success rate (primary outcome), needle tip visibility, onset of motor and sensory blocks, duration of block and analgesia and complications.

STATISTICAL ANALYSIS
Sample size calculation:
Based on a previous study, to detect a difference of 20% in the rate of block success with a power of 80% and level of significance of 5%, 40 patients will be needed in each group, considering an attrition rate of 10%, we'll study 44 patients in each group with a total sample size of 88 patients.
All data were analyzed using Microsoft Excel, Graph Pad Prism and IBMSPSS V21.Chi square and Fisher's exact test is used to evaluate association between categorical variables. Data were checked for normality usingKolmogorov-Smirnova and Shapiro-Wilk test. Independent T test is used tocompare mean difference between two or ANOVA is used for more thantwo groups depending on fulfilment of normality assumption for continuous variables. For non-normal data Mann Whitney test & Kushkar Wallis andFriedmann and Wilcoxon test is used.

At 5% level of significance, Statistical significance between the groups wasinterpreted as follows:
- p value > 0.05 = not significant
- p value <0.05 = significant
- p value <0.001 = highly significant

IV. Results And Observations

• The primary outcome of our study was to evaluate the block success rate amongst the two groups. The success rate in the supraclavicular group was 98.8% and in the retroclavicular group it was 98.6%. Thus the success rate was similar between the two groups.

BLOCKSUCCESSRATE

GROUP	**MEAN BLOCKPERFORMANCESCORE**	**PVALUE** **(Mann– Whitneytest)**
A	98.8	0.96
B	98.6	

Table 2-MEANBLOCKPERFORMANCESCORE

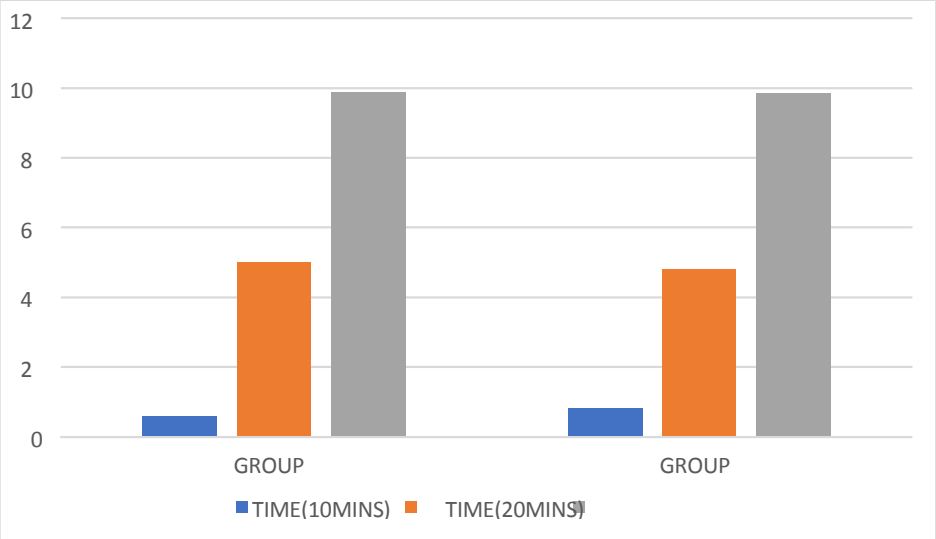

Figure 2- Block performance score

NEEDLE TIP VISIBILITY

• Needle tip visibility in the supraclavicular group was 3.89±0.321 (median-4) and in the retroclavicular group was 3.05±0.429 (median -3) infering that the supraclavicular group had better needle tip visibility**.** (Mann-whitney test) (p value< 0.001)

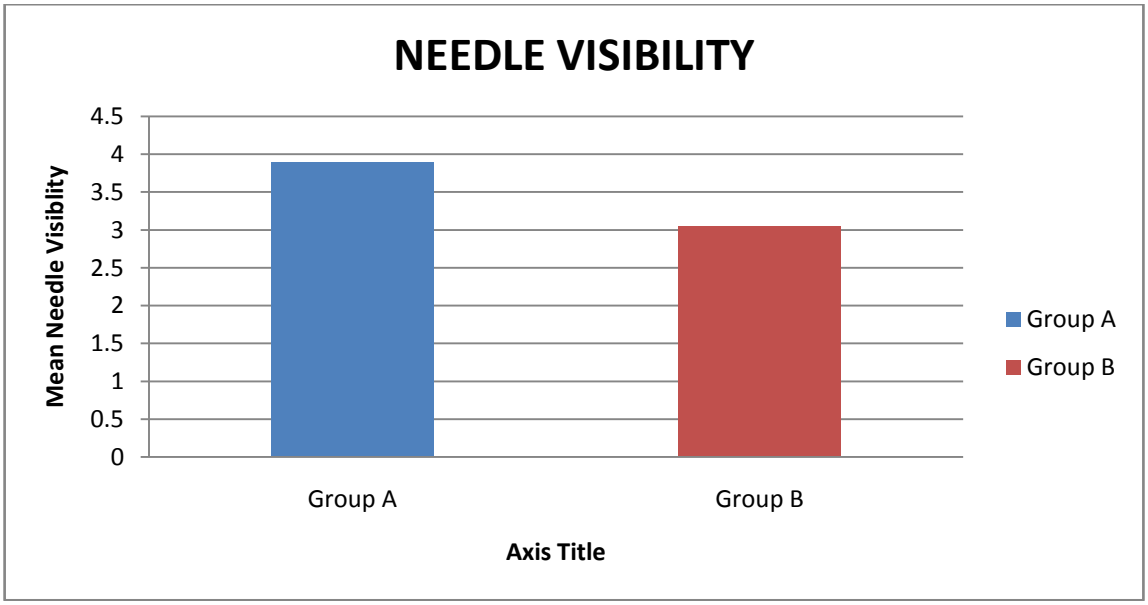

Figure 3- Needle visibility

• The onset of senory block in the supraclavicular group was 13.36 ±2.35 and in the retroclavicular group was 14.48±2.69 mins. (p value = 0.025) (Kolmogorov-Smirnov and Mann - Whitney test)

• The onset of motor block in the supraclavicular group was 13.57±2.43 mins and in the retroclauviclar group was 15.23±2.56 mins. (pvalue = 0.001)(Kolmogorov-Smirnov and Mann-Whitney test)

• The duration of analgesia in the supraclavicular group was 432.57±15.96 mins and in the retroclavicular group was 444.95±39.50 mins .(p value = 0.04)(Kolmogorv-Smirnov and Mann- Whitney test)

• Upto intial 12-18 hours there was no statistical significance between the vas scores of group A and B.However there is statistically significant difference at the 24th post operative hour in the VAS score with the GROUP A showing lower pain score (p value- 0.043) (Kolmogorov-Smirnov and Mann- Whitney test)

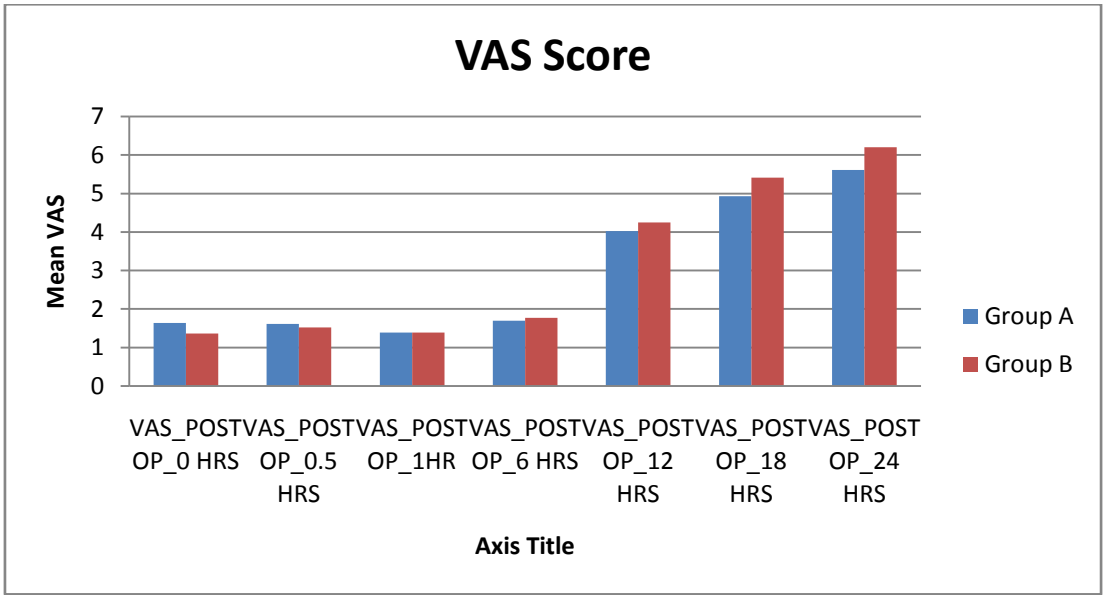

Figure 4- VAS Score

COMPLICATIONS

• In the supraclavicular group one developed Horner's syndrome(2.3%) while two others developed neurovascular complications (2%) . No complications were observed in the retroclavicular group. (Chi- Square test) (p value = 0.212)

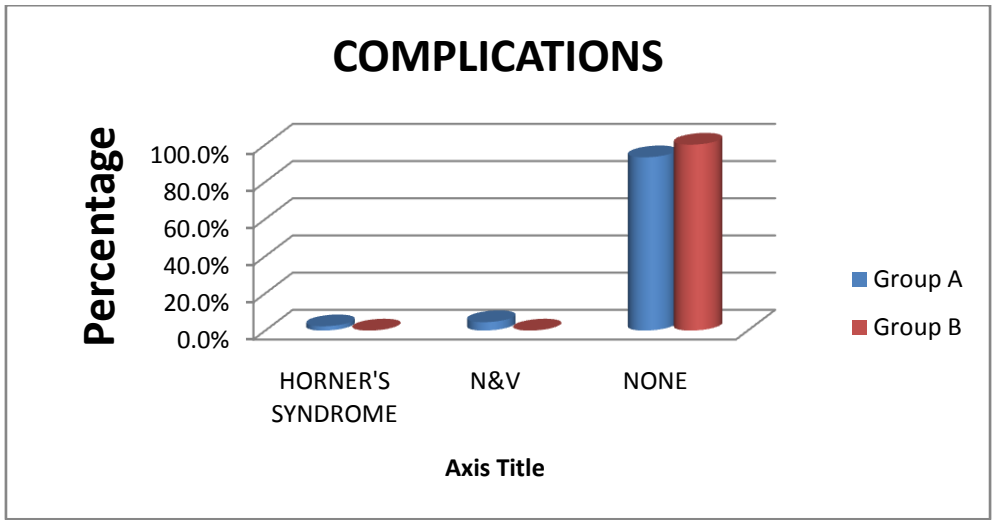

Figure 5- Complications

V. Discussion:

The primary outcome of our study was to evaluate the block success rate amongst the two groups. The success rate in the supraclavicular group was 8.8% and in the retroclavicular group it was 98.6%. Thus the success rate was similar between the two groups.Similar to our study, Sina Grape et al[5] in their study mentioned similar successrates of 98% in both the procedures.However, in contrast to our findings, Charbonneau[6] and colleagues reported alower success rate of 90% in the retroclavicular approach. This difference may have been due to the difference in expertise of the physician performing theblocks.

In terms of needle tip visibility which was assessed by the 5 point Likert grading, the median visibility score was 4 in the supraclavicular group while it was 3 in the retroclavicular group. This difference was statistically significant inferring that the supraclavicular approach has better needle tip visibility. Similar to our study, Charbonneau et al[6] in their study of ultrasound guided retroclavicular block had an average visibility score of 3.0 which was similar to our study.

Despite the high success rate in our study we think that the retroclavicular brachial plexus block suffers from drawbacks and should only be recommended for use in selected patients. The main technical drawback in the retroclavicular block is created by theacoustic shadow of the clavicle. There is a approximate distance of 2 cm where visualisation of the needle path behind the clavicle is not possible because of the acoustic shadow of the bony structure, placing neurovascular structures at risk of being punctured. A supraclavicular procedure on the other hand has certain advantages as the superficial location of the anatomical structures facilitates the identification of the needle and the speed of the procedure. The mean onset of senory block in our study in the supraclavicular group was 13.36 ±2.35 min and in the retroclavicular group was 14.48±2.69 min and the difference was found to be statististically significant. Similar to our findings, Sina Grape et al(5) had a mean onset time of the sensory blockade of 13.2 min in the supraclavicular vs 14.1 min in the retroclavicular group which was comparable to our study.

Regarding the delayed onset time of sensory blockade in the retroclavicular group it is hypothesised that there might be a delayed onset of sensory blockade for the musculocutaneous nerve as the nerve exits off the lateral cord early as also stated in the studies by Sina grape et al(5)and Charbonneau et al(6) and reported by Pianezza et al. (7) The mean onset of motor block in the supraclavicular group in our study was 13.57±2.43 mins and in the retroclavicular group was 15.23±2.56 mins and was found to be statistically significant. These differences were also similar to those noted by Sina grape et al(5) where the mean onset times of motor blockade were 13.5 min and 15.3 min in the supraclavicular and retroclavicular groups, respectively. The duration of analgesia in the supraclavicular group was 432.57±15.96 mins and in the retroclavicular group was 444.95±39.50 mins and there was statistical significant difference between the two groups with regard to the duration ofanalgesia. These differences were also similar to those noted by Sina grape et al(5)who found a longer duration of analgesia where the time to first opioid request were 439min and 447 mins in the supraclavicular and retroclavicular groups, respectively. With respect to the VAS Scores- up to 18 hours there was no statistical significance between the vas scores of group A and B. Also, there is no statistically significant difference at the 24th post operative hour in the VAS score with the supraclavicular approach showing lower pain score. This was similar to that observed in the study by Sina Grape et al.(5) Though the differences in onset of sensory block, motor block and duration of analgesia is found to be statistically significant in terms of the actual time differences doesn't bear much clinical impact as reiterated by Sina Grape et al(5)in his clinical study.

In our study we used 0.5% Ropivacaine for both the groups. It is said that an ideal local anaesthetic agent should be offering fast and long-acting analgesia with lower motor block and lesser hemodynamic side effects along with a higher toxic range. Bupivacaine is a long acting local anaesthetic agent that provides a prolonged duration of action with a favourable ratio of sensory to motor nerve block. To overcome these fatal effects of bupivacaine, ropivacaine and levobupivacaine which are pure S-enantiomers, had been introduced into clinical practice. So we chose to use ropivacaine in our study(8)(9)(10) In the study conducted by Sina Grape et al(5) and Charbonneau et al(6) they used mepivacaine for both supraclavicular and retroclavicular blocks. Although bothhave similar clinical profile however the postoperative duration of analgesia was found to be longer with the use of mepivacaine. Even though the rate of Complications encountered were extremely low in our study ,there was one patient in the supraclavicular group who developed Horner's syndrome(2.3%) while two others in the same group developed neurovascular complications (2%) whereas it was found that in retroclavicular group the patients developed no such complication.

In the study by Sina grape et al(5) no patients developed hematoma, persistent paraesthesia,or weakness in the upper limb, with assessment 24 h after the procedure. In the study conducted by Charbonneau et al(6) also had no major complication reported in the retroclavicular group. They also made the following observations- supraclavicular fossa and lack of compressibility of this fullness increased technical difficulty. Before their study, they also failed to achieve the retroclavicualr approach on a patient with a previously broken and unrepaired clavicle. The needle reverberation artifact as well as the bayonet artifact were often encountered but did not pose a specific problem. Therefore, in our study the block success rate was similar in both the groups, but the procedure time was shorter for supraclavicular group due to better needle tip visibility. Even though no major complications occurred in our study, the relatively low incidence of such events precludes any conclusion about safety until more data is obtained. CONCLUSION: Both the retroclavicular and supraclavicular approaches have similar block success rates. Even though the onset of sensory block and motor block showed difference between the two block approaches it is not clinically relevant. A higher level of expertise is required for performing the retroclavicular block. And the chances of injury to the neurovascular structures due to poor visibility must be kept in mind. Considering the limited sample size in our study, larger studies are required to extrapolate the results to a larger population.

References:

[1]. Alfred VM, Srinivasan G, Zachariah M. Comparison of Ultrasound with Peripheral Nerve Stimulator-guided Technique for Supraclavicular Block in Upper Limb Surgeries: A Randomized Controlled Trial. Anesth Essays Res. 2018;12(1):50–4.

[2]. Khanduri K. Regional Anaesthesia Techniques for Orthopaedic Surgery. Med J Armed Forces India. 2008 Apr;64(2):108–10.

[3]. Rashiq S, Finegan BA. The effect of spinal anesthesia on blood transfusion rate in total joint arthroplasty. Can J Surg. 2006 Dec;49(6):391–6.

[4]. Retroclavicular vs Infraclavicular block for brachial plexus anesthesia: a multi-centric randomized trial | BMC Anesthesiology | Full Text [Internet]. [cited 2022 Oct 7]. Available from: https://bmcanesthesiol.biomedcentral. com/articles/10.1186/s12871-019-0868-6

[5]. Retroclavicular vs supraclavicular brachial plexus block for distal upper limb surgery: a randomised, controlled, single-blinded trial Sina Grape1 , Amit Pawa2 , Eric Weber1 and Eric Albrecht3, * 1 Department of Anaesthesia, Valais Hospital, Sion, Switzerland, 2 Department of Anaesthesia, Guy's & St Thomas' NHS Foundation Trust, London, UK and 3 Department of Anaesthesia, Lausanne University Hospital, Lausanne, Switzerland, British Journal of Anaesthesia, xxx (xxx): xxx (xxxx) doi: 10.1016/j.bja.2018.12.022 \

[6]. Charbonneau J, Fréchette Y, Sansoucy Y, Echave P. The Ultrasound- Guided Retroclavicular Block: A Prospective Feasibility Study. Reg Anesth Pain Med. 2015 Oct;40(5):605–9.

[7]. Pianezza A, Salces y Nedeo A, Chaynes P, Bickler PE, Minville V. The emergence of the musculocutaneous nerve from the brachial plexus: implications for infraclavicular nerve blocks. Anesth Analg. 2012;114: 1131–1133.

[8]. Kuthiala G, Chaudhary G. Ropivacaine: A review of its pharmacology and clinical use. Indian J Anaesth. 2011;55(2):104.

[9]. Åberg G. Toxicological and Local Anaesthetic Effects of Optically Active Isomers of Two Local Anaesthetic Compounds. Acta Pharmacol Toxicol (Copenh). 1972;31(4):273-286. 10. McClure JH. Ropivacaine. Br J Anaesth. 1996;76(2):300-307.

DR RAJIB HAZARIKA, et. al. "Comparison Of Supraclavicular And Retroclavicular Brachial Plexus Block In Upper Limb Orthopedic Surgeries: A Randomised Controlled Study." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 22(2), 2023, pp. 15-22.