



## IMAGE GUIDED BRACHIAL PLEXUS BLOCK AS A RESCUE TECHNIQUE

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### ARTICLE INFO

#### Article History:

Received 10<sup>th</sup> May, 2021

Received in revised form 2<sup>nd</sup>

June, 2021

Accepted 26<sup>th</sup> July, 2021

Published online 28<sup>th</sup> August, 2021

#### Key words:

Brachial Plexus Block

### ABSTRACT

**Objective:** To introduce a rescue technique for supraclavicular Brachial Plexus Block (BPB), when the anesthesiologist does not have access to ultrasound machine (U.S.G), peripheral nerve stimulator (PNS) or patient is not eliciting paresthesia. **Method:** Study design Prospective randomised study, a total of 76 patients were included in the study. BPB was administered using fluoroscopic guidance in patients posted for upper limb surgeries. **Results:** During surgery in 95%, after 30 min of surgery in 87.30% cases and after one hour of surgery in 63.49% cases visual analog scale (VAS) was zero. **Conclusion:** Fluoroscopic guided technique can be a very good alternative for those who do not have access to U.S.G or PNS and is easily accessible as image intensifier is mostly available in Operating Rooms.

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### INTRODUCTION

Regional anaesthesia is preferred in upper limb surgeries because of lesser systemic side effects as compared to General anaesthesia; especially in high-risk patients. Among all approaches of the brachial plexus block, supraclavicular approach is the most preferred. It is favorable for most upper limb procedures; especially operations of the distal arm, elbow, forearm & even hand. Supraclavicular brachial plexus block is also known as 'spinal of the arm'.<sup>(1)</sup>

Trunks & divisions of the brachial plexus are relatively very close as they pass over the first rib. Supraclavicular brachial block as compared to other approaches, has lesser side effects, decreased incidences of nerve sparing effect and is easier to perform.

Ropivacaine is a new amide local anaesthetic with a higher toxic threshold than other long-acting local anesthetics<sup>(1)</sup>. Various controlled clinical studies have demonstrated that ropivacaine may be a suitable choice for peripheral nerve block, including axillary and subclavian perivascular brachial plexus anaesthesia<sup>(2-5)</sup> and combined sciatic-femoral nerve block<sup>(6-7)</sup>.

#### Different techniques for brachial plexus block

- |   |   |
|---|---|
| 1 | Paraesthesia based – oldest                                       |
| 2 | Anatomical landmarked based – least useful                        |
| 3 | Using Peripheral nerve stimulator                                 |
| 4 | Ultrasound guided   |
| 5 | Using Peripheral nerve stimulator with ultrasound – gold standard |

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Indian setup, especially the Bundelkhand area of Madhya Pradesh has lesser accessibility to technological resources. There is very less availability of peripheral nerve stimulators and USG machines and due to strictness in legal issues, it is not easy for a new centre to get enrolled for USG machines. These devices are more so less feasible when it comes to centers which enroll private practitioners.

It is well known that USG guided block is the gold standard technique, but when one does not have access to such modalities, image intensifiers can be the answer, as blocks are most frequently administered for orthopedic surgeries and image intensifiers are a part of every orthopedic OT in the present era. Hence, this technique is especially helpful when advanced machinery is not available; patient is not eliciting paresthesia, or in cases where there is altered anatomy due to fracture clavicle, in children or when the patient is not mentally sound so as to understand our commands.

The brachial plexus block near the first rib at the level of the trunks and divisions provides the most reliable efficacy as per Lanz and Theiss<sup>(8)</sup>. Advantage of use of the approach near the first rib is limited because of the risk of pneumothorax<sup>(9)</sup>. Eliciting paraesthesia is also important to obtain a high degree of success<sup>(9,10)</sup>; however, eliciting paresthesia is uncomfortable for patient and even may result in nerve injury<sup>(11-16)</sup>

### METHODS

After obtaining ethical committee approval, the study was conducted in a tertiary referral centre of Bundelkhand area in

M.P., between January 2016 to December 2018, after taking informed written consent from the patients and their relatives. This prospective study was conducted on 76 patients posted for upper limb surgery.

Exclusion criteria for patients were as follows:

1. Patients with ASA III, IV
2. With neuropathy
3. With coagulopathy
4. Posted for shoulder and wrist surgery
5. Patient weighing less than 50kg or more than 80 kg
6. Chronic analgesic therapy
7. Infections or malignant diseases in the area of the throat and neck
8. Infection of the skin in the injection area.
9. Contralateral paresis of the phrenic nerve or recurrent laryngeal nerve
10. Contralateral pneumothorax.

Patients were shifted to the operating room and standard monitors were attached (E.C.G, Pulse oximeter, non-invasive blood pressure, temperature), a 20-gauge intravenous cannula was inserted in the non operating forearm and infusion of lactate Ringer's - solution 5 ml/ kg/ hr was given intravenously. No premedication was administered. All patients were placed supine with the arms extended at the side and the head turned to the contralateral side. No support was placed under the back to elevate the shoulders.

An anteroposterior (AP) fluoroscopic view at 90° was obtained. A 5 cm, 25- gauge needle was inserted 0.5 cm lateral to the palpated subclavian artery and 1-2 cm above the clavicle, which is believed to correspond to the inner side of the costal attachment of the middle scalene muscle then advanced under fluoroscopic guidance to touch a specific part of the first rib where first rib changes its direction (dividing 1<sup>st</sup> rib in 3 parts, 1/3 each, so the target area is junction of anterior 1/3<sup>rd</sup> and middle 1/3<sup>rd</sup>). The transverse tubercle and the groove were identified by the transverse process of the first vertebra and by the curve of the first rib, respectively. (See figure 1) <sup>(17)</sup>

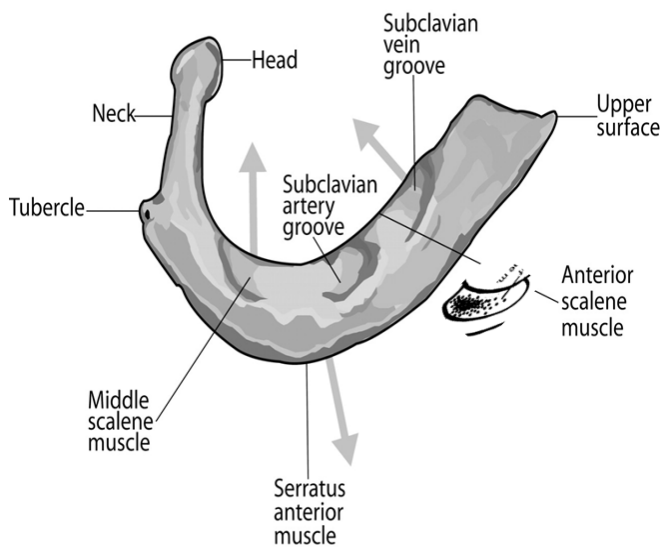


Figure 1

Drug was injected in small aliquots of 3 to 4 ml after negative aspiration every time. Ropivacaine 40 ml volume was used in concentration of 0.375%. After giving the drug, patient's sensory and motor blockade was assessed after 5, 10, 15, and

20 min after injection, immediately after completion of surgery and after 30 min and 60 min of completion of surgery.

Sensory blockade was determined in the zones innervated by the axillary, musculocutaneous, radial median, ulnar, and median antebrachial cutaneous nerves by using the response to pinprick (fig 2) <sup>(18)</sup>.

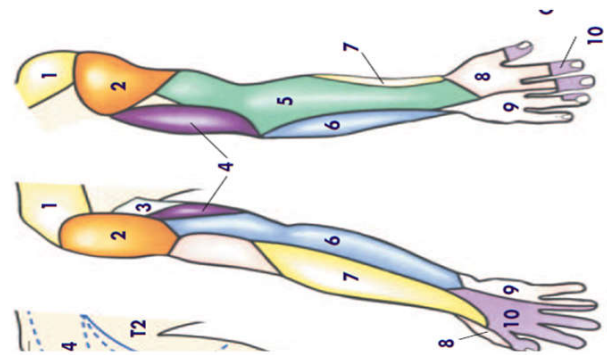


Fig 2

1. Supraclavicular Nerve
2. Axillary Nerve (lateral cutaneous brachial)
3. Intercostobrachial Nerve
4. Medial Brachial Cutaneous Nerve
5. Antebrachial Cutaneous Dorsal Nerve (radial N)
6. Medial Antebrachial Cutaneous Nerve
7. Lateral Antebrachial Cutaneous Nerve (Musculocutaneous)
8. Radial Nerve
9. Ulnar Nerve
10. Median Nerve

Sensory Rating Scale was used in which <sup>(19)</sup>

- S0 – complete anesthesia,
- S1 - dull sensation of the pin,
- S2 - sharp sensation with some radiation without accurate localization,
- S3 - normal sharp sensation with accurate localization

The motor examination was performed for

1. Axillary nerve- by turning the forearm upward,
2. Musculocutaneous nerve - by flexing the elbow,
3. Radial nerve - by extending the elbow and the wrist,
4. Median nerve- by flexing the wrist and the metacarpopharyngeal joints of the fingers,
5. Ulnar nerve- by abducting and adducting the fingers.

Pain relief was evaluated by using a Visual Analog Scale (score 1–10).

The brachial plexus block was considered successful when all the specific sensory nerves obtained S0 or S1, with a visual analog scale score of 0-2.

**Table 1** Sensory blockade of supra clavicular brachial plexus after 20 min

Nerve	S0	S1	S2	S3
Musculocutaneous nerve	62	1	0	0
Radial nerve	59	1	0	3
Median nerve	58	2	0	3
Ulnar nerve	61	2	0	0
Median antebrachial cutaneous nerve	61	2	0	0

**Table 2** VAS Score

Vas score	0	2	4	6	8	10
During surgery	60	-	3	-	-	-
AFTER 30 min	55	5	-	3	-	-
AFTER 60 min	40	15	5	3	-	-

## RESULT

Patient demographic data in Table 3.

**Table 3** Demographic Data

N=63	
Age (yrs) mean +_ SD	35+ 7
Male/female	43/20
Weight (kg) mean +_ SD	69+ 7

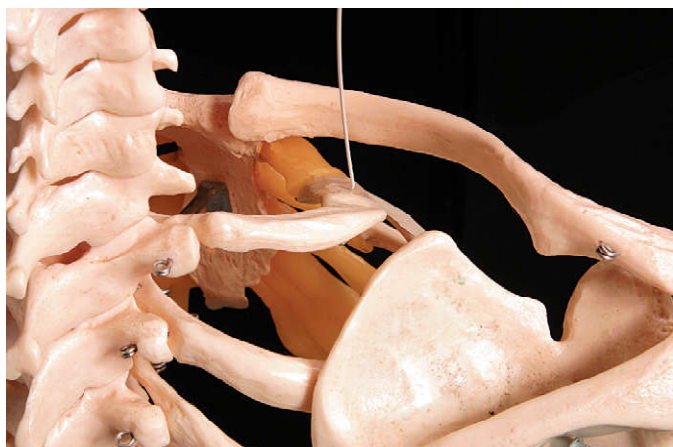
There were three cases of failed block in this study, hence these patients were administered general anesthesia. The mean duration of anesthesia was 159.9±46.4 min, and the mean duration of the operation was 111.5±46.3 min. Out of 76 patients, 13 patients gave paresthesia during procedure so they were excluded from study. The success rate was 95.23% (60 out of 63 patients did not require additional analgesia during surgery). The proper part of the first rib was determined by plotting the points, which the tip of the needle touched in the successful blocks (fig 1)

During surgery in 95.23 % cases, after 30 min of surgery in 87.30% cases and after 1 hr of surgery in 63.49% cases VAS score was zero. Not a single case of pneumothorax was noted (in the postoperative period of 48 hours).

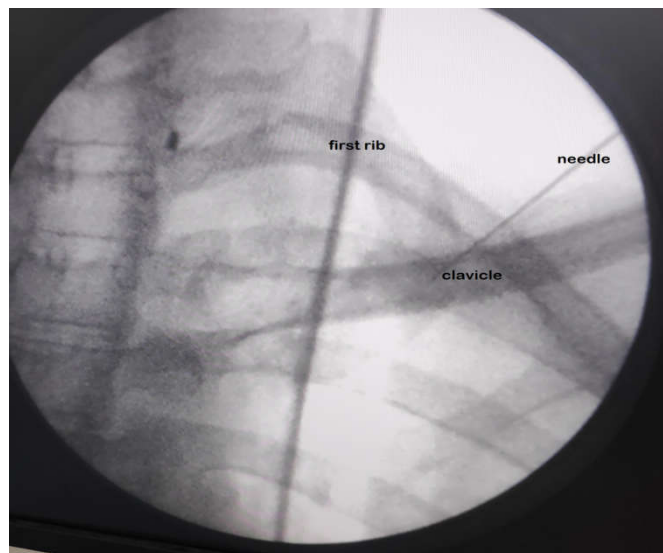
Muscle strength and skin sensation completely recovered within 12 hours, and numbness disappeared within 8 hours.

## DISCUSSION

Winnie and Collins first described the technique where brachial plexus was blocked in the caudal part of the interscalene groove and here the trunks of brachial plexus are most compact, just above the clavicle. Divisions of brachial plexus start at the lateral border of the first rib and lie behind the clavicle. The rib hitting technique causes blockade at this level.<sup>(21, 22)</sup> as shown in figure. The first rib may be contacted on deep insertion.



Winnie emphasizes that with his technique, and with any technique performed above the clavicle, the production of paraesthesia is the most accurate indicator of the proper placement within the sheath. 13 patients gave paraesthesia during procedure and in all 13 patients there was complete sensory and motor blockade.



However, with the subclavian perivascular approach, the solution was confined within the perineural sheath and it spread below the first rib towards the axilla. The anatomical studies could explain this difference, revealing that the perineural space of the brachial plexus is not identical to the interscalene space<sup>(17)</sup>.

There were three failures in which the placement of the tip of the needle did not correspond to the proper part of the first rib. To avoid puncturing the subclavian artery and the brachial plexus, we inserted the needle 1 cm lateral to the palpated subclavian artery and 1–2 cm above the clavicle. Under fluoroscopic guidance, we advanced and placed the tip of the needle on the proper part of the first rib; therefore, the direction of the needle will depend on the patient's anatomical characteristics, such as the size of the first rib and its angle to the vertebra. Whether eliciting paraesthesia causes nerve injury remains controversial. However, it is an uncomfortable experience for the patient. Avoiding paraesthesia is one of the advantages of the supracostal approach. We can advance the needle to touch the first rib within 5–10 s; therefore, the risk from radiation exposure is minimal.

In fact, a small number of patients in this study complained of anxiety owing to numbness and delayed motor and sensory recovery after the surgical procedure. These adverse events likely occurred because of a combination of factors, including nerve blockade by ropivacaine, tourniquet compression, and other surgical procedures. Have shown that one shot of 30 mL 0.5% ropivacaine with a continuous infusion of 0.2% ropivacaine at 6 mL/h or 8 mL/h for BPB without general anesthesia provided similar clinical efficacy<sup>(23)</sup>.

One of limitations of this study is that it used fixed doses of ropivacaine that was not based upon patient bodyweight. Doses determined by the patient bodyweight may have influenced the results described herein 13 patients which gave paraesthesia during procedure, drug was given on basis of paraesthesia and not waited to hit 1<sup>st</sup> rib they all had good sensory and motor blockade which signifies that our landmark is near to brachial plexus

## CONCLUSION

This fluoroscopic guided technique can be a very good alternative for those who don't have access to USG and PNS this is very good technique in anesthesiologist armamentarium

because image intensifier is mostly available in OT so can be used very easily meanwhile prior to inserting needle you can decide not to go beyond line medial to ant 1/3 of rib so chances of pneumothorax also will be less.

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### How to cite this article:

Rachna Richi Pandey *et al* (2021) 'Image Guided Brachial Plexus Block as a Rescue Technique', *International Journal of Current Advanced Research*, 10(08), pp. 24922-24925. DOI: <http://dx.doi.org/10.24327/ijcar.2021.4970.24925>

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