Section: Anaesthesiology

Original Research Article

ULTRASOUND GUIDED IN-PLANE VS OUT-OF-PLANE SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK FOR BELOW ELBOW SURGERIES –A COMPARATIVE STUDY

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ABSTRAC

Background: Ultrasound (USG) guided Supraclavicular (SC) Brachial Plexus Block is the gold standard BLOCK for anaesthesia and post-operative analgesia of upper limb surgeries. The in-plane approach is commonly used for single injection blocks, whereas the Out-of-plane approach is commonly used for blocks with catheter insertion. **Objectives:** In this study, we will compare the In-Plane/Out-of-Plane approach in USG guided Supraclavicular Brachial Plexus Block for Anaesthesia of below elbow surgeries.

Material and Methods: 140 patients scheduled to undergo below elbow surgeries were taken and randomly divided into 2 Groups. Group I (In-Plane) received the USG guided SC Brachial plexus block via In-Plane approach and Group O (Out-of-plane) received the block via Out-of-plane approach. The time from the insertion to removal of the block needle, the number of attempts of manipulation to reach the Brachial Plexus, time required for onset of Sensory and Motor block and complications and side effects (if any) were recorded.

Results: The procedural time, number of attempts, motor block, were found to be similar and comparable in both In-Plane/Out-of-Plane Groups. Whereas the Onset of sensory blocks was shorter in the Out-of-plane group. The mean procedural time was 7.57 ±1.62 and 6.84 ±1.62 minutes. The mean onset time for the sensory block was 3.8 ±0.75 and 3.5 ± 0.75 minutes and the motor block was 5.75 ±0.6 and 5.55 ± 0.75 minutes in Group I and Group O respectively.

Conclusion: In our study, we have found thatIn-Plane/Out-of-Plane has similar procedural time and motor block. However, onset to sensory block was significantly shorter in Out-of-plane group. The results of our study allows more scope for the Out-of-plane approach.

Keywords: USG guided Supraclavicular Brachial plexus block, Out-of-plane approach.

INTRODUCTION

Supraclavicular Brachial Plexus Block is the commonly used block for anaesthesia and post-operative analgesia for upper limb surgeries.[1] It is often termed as the “spinal of upper limbs”.[2,3] It effectively blocks nerve roots and trunks of the Brachial plexus.[3] The Local Anaesthetic (LA) injected is directed towards the C5,6,7 nerve roots and even C8 nerve roots may be blocked depending on the volume of the LA used.

With the advent of Ultrasound Guided Supraclavicular Block, there has been decrease in the number of needle passes, offers rapid onset and improves the Local Anaesthetic distribution and thus the sensory blocks, with decreased risk of major vessels and nerve injury.[4] With the introduction of ultrasound-guided peripheral nerve

blocks, it is now relatively easy to target any desired portion of the brachial plexus.[5]

There are two methods of orienting the needle relative to the ultrasound beam in ultrasound-guided peripheral nerve blocks In-plane and out-of-plane approaches.[6]

The in-plane approach is commonly used for single injection blocks, whereas the Out-of-plane approach is commonly used for blocks with catheter insertion.[7,8].

Objectives: In this study, we compare theIn-Plane/Out-of-Plane approach in USG guided Supraclavicular Brachial Plexus Block for anaesthesia of below elbow surgeries. We compared the time required to conduct the block (procedure time), the number of attempts required to achieve the brachial plexus, time to the onset of Sensory and Motor block and observed for any Complication or Side effects in both the groups.

MATERIAL AND METHODS

After obtaining the approval of Lakhimpur Medical College and Hospital's Ethical Committee, informed consent was taken from 140 patients of ASA physical status I and II, aged between 18 – 60 years scheduled to undergo below elbow surgeries in the Orthopaedic OT, Lakhimpur Medical College and Hospital. The patients were randomly divided into 2 groups. All the patients were explained in their own language about the study procedure and the possibility of aborting the procedure if the patients were unwilling at any moment of the procedure.

Exclusion criteria were

1. Patients refusal
2. Obesity classes 1 and 2 (BODY MASS INDEX >= 30 KG/m2)
3. Infection at injection site
4. Known allergic to Local Anesthetics
5. Coagulopathy
6. Neuropathy involving brachial plexus
7. Vulnerable subjects (eg Pregnancy, Mentally challenged, differently abled, Seriously ill, etc)

Drugs preparation

10 ml of 0.5 % Bupivacaine + 10ml of 2% Lox with Adrenaline (1: 200,000) was freshly prepared just before the procedure

2 ml of 2% Lox with Adrenaline for local infiltration

USG (SONOSCAN X3) with Linear probe L7141 (9.5 – 12.2) frequency + 50mm, 22 gauge Stimuplex needle was used as a block needle.

The patients were cannulated with 18 G IV cannula on the non-operative hand, 500ml RL infusion was connected. All the basic parameters were connected to the monitor. All patients were placed in supine position with the head rotated towards the non-operated side. After proper antiseptic and aseptic dressing of the block site, a local infiltration with 1ml of 2% lignocaine injected to form a 'wheal'. The Linear probe was placed in the Supraclavicular fossa. The probe was moved cephalad to caudal or caudal to cephalad, to scan the subclavian artery. The Supraclavicular Brachial plexus was identified as a' bunch of grapes' in the superolateral aspect of the Subclavian Artery.

Group I

The Stimuplex needle was inserted in the same plane as the linear probe from the posterior edge of the probe. As the needle was in the same plane, the whole needle can be seen and and was inserted further till the tip reached the brachial plexus. After negative aspiration, 10 ml of Local anaesthetic mixture was injected at the posterior and the anterior aspects of the brachial plexus respectively. If any kind of resistance was felt, the needle was withdrawn a bit and the procedure repeated. Hydrodissection is seen around the plexus.

Group O

Here the Stimuplex needle was inserted perpendicular to the probe, preferably just above the level of the brachial plexus, visualized in the screen. The needle was directed towards the probe and inserted. The needle appeared as a 'dot' in the screen and the tip could be identified just by tilting the probe where the dot disappeared. After negative aspiration, 10 ml of Local anaesthetic mixture was injected at the posterior and the anterior aspects of the brachial plexus respectively. If any kind of resistance was felt, the needle was repositioned and the procedure repeated. A proper Hydrodissection around the plexus confirms appropriate injection of LA.

The procedure time is defined as the time taken from skin infiltration with lignocaine until removal of the stimulating needle from the skin. The number of attempts is defined as the number of manipulations required to reach the Brachial Plexus.

The Sensory block was assessed by a pinprick test using a 3-point Scale[9].

0= normal sensation

1= loss of sensation to pin prick (analgesia)

2= loss of sensation to touch (anaesthesia)

The onset of sensory block (time to C6 block) is defined as the time taken from completion of local anaesthetic (LA) mixture administration and the loss of sensation to pinprick (score 1) in C6 dermatome performed every 1 min.

The Motor Block was assessed by shoulder, arm, and fingers movement using a 3-point scale[9].

0= normal movement

1= diminished but not totally absent motor strength (paresis)

2= unable to elevate the shoulder, flex the arm, or move the fingers (paralysis)

The onset of motor block is defined as the time taken from completion of local anaesthetic (LA) mixture administration till no movement of shoulder, arm, or fingers performed every 1 min.

The Quality of Anaesthesia was assessed by an anesthesiologist, who performed a blind evaluation of the study regarding the patient satisfaction, with 4-point scale[10].

1= excellent; no pain or discomfort,
2= good; mild pain and discomfort that does not require analgesia or sedation,
3= moderate; pain or discomfort tolerable with additional analgesic or sedation,
4= bad; not tolerable even with narcotic pain killers or sedation
The surgeon's satisfaction was assessed with the 3-point scale[10]
1= good,
2= sufficient,
3= unfavorable.

RESULTS

DEMOGRAPHIC PROFILE

There were 2 groups, Group I and Group O, with (n= 70) each. Both of them were comparable demographically in respect to Age, Sex, Height, weight and ASA status. They were statistically insignificant with p values > 0.05.

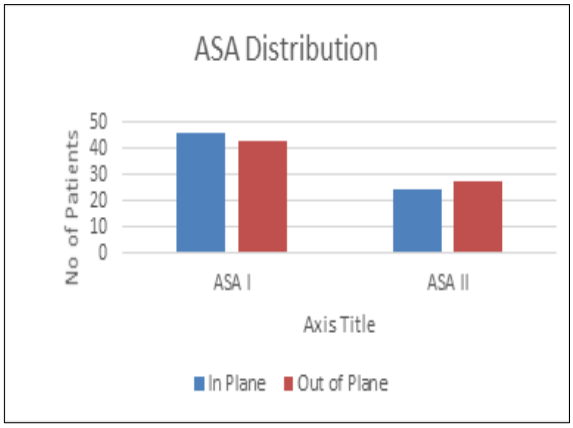
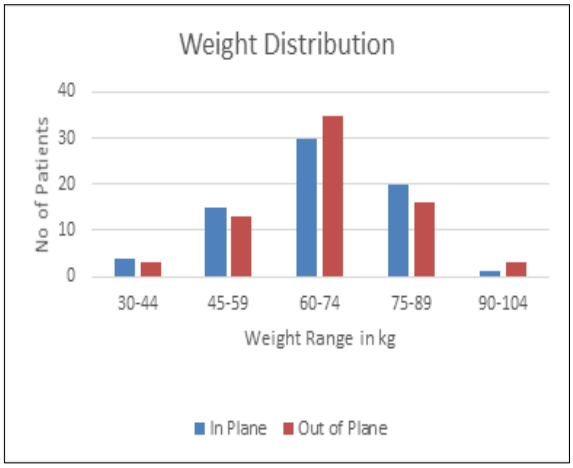


Figure 1



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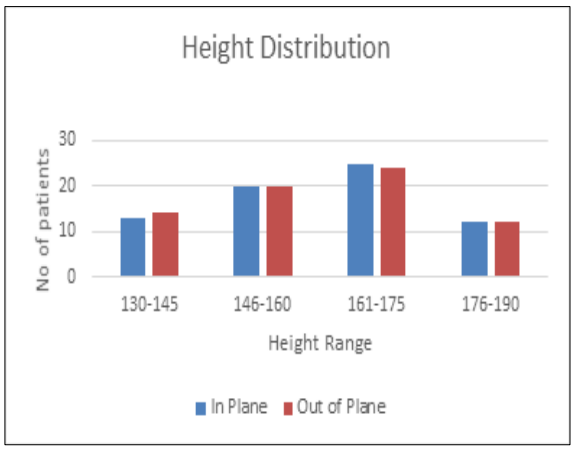

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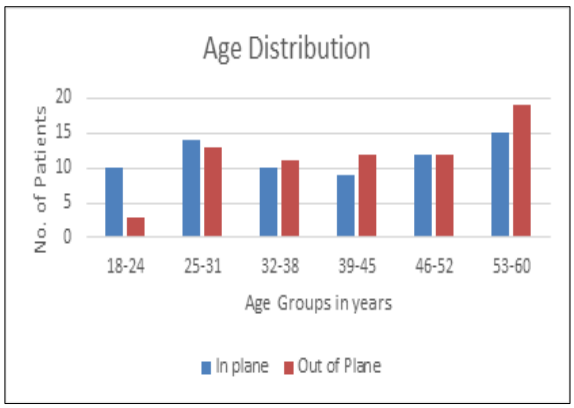

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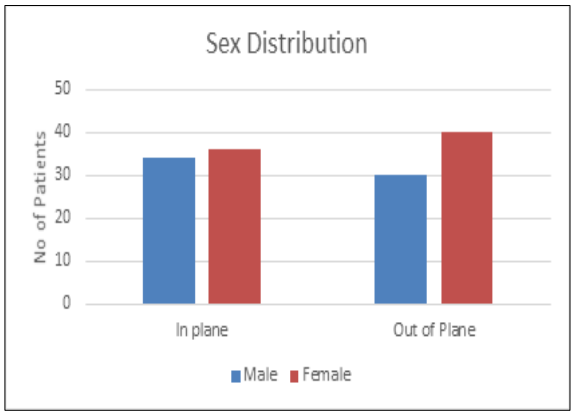
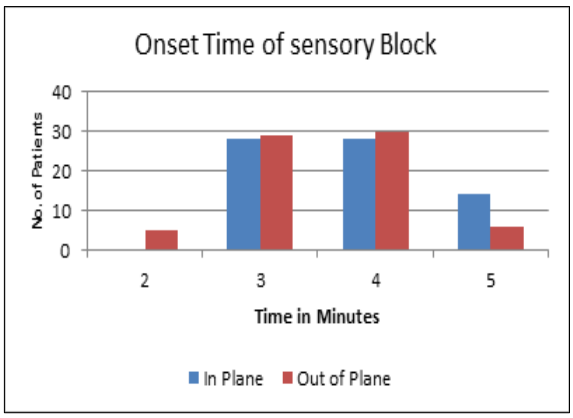


Figure 5

The Block procedure time was found to be 7.57 ± 1.62 in Group I and 6.84 ± 1.62 in Group O. which was statistically insignificant with p value 0.30. The number of attempts required to achieve the brachial plexus by the stimuplex needle was found to be statistically insignificant, with P value >0.05. Group I and Group O needed 3.42 ± 1.64 and 2.80 ± 1.33 attempts respectively.

The onset of sensory block (C6 dermatome) for Group I and Group O was 3.8 ± 0.75 and 3.5 ± 0.75 respectively, which was statistically significant with P value = 0.04

The onset of motor block (unable to move shoulder, arm and fingers) for Group I and Group O was 5.75± 0.6 and 5.55 ± 0.75 with p value 0.078.



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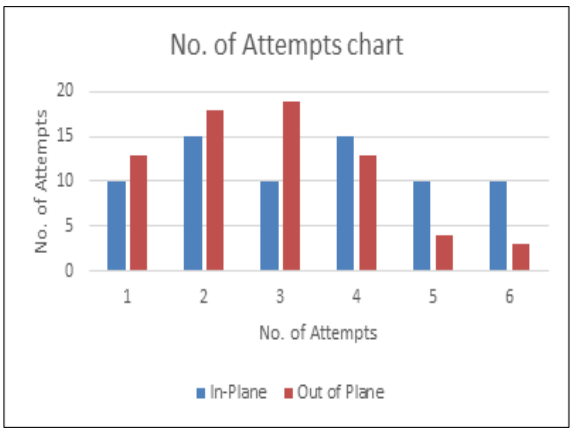

Figure 9

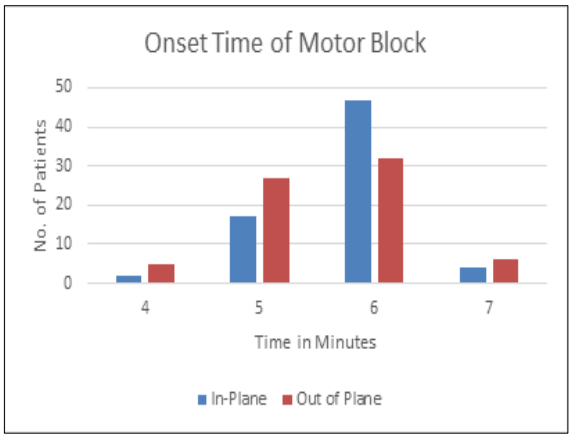

Figure 7

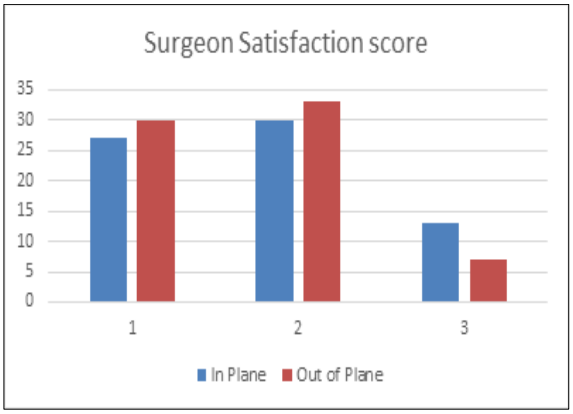

Figure 10

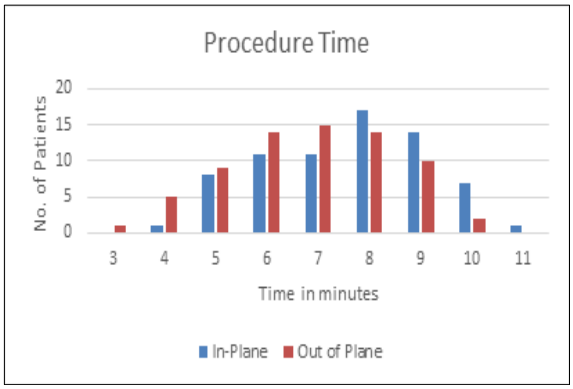

Figure 8

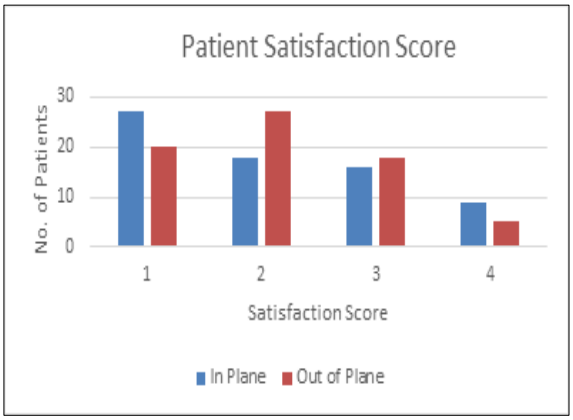

Figure 11

Table 1: Gender Distribution of Neonates

Variable	Group I n= 70	Group O n = 70	P value
Age (years)	39.54 ± 12.27	42. 74 ± 11.53	0.466
Sex (M/F)	34 / 36	30 / 40	0.155
Height (cms)	160.72 ± 15.39	160.27 ± 15.27	0.996
Weight (kgs)	66.314 ± 12.39	66.77 ± 12.07	0.714
ASA (I/II)	46 / 24	43 / 27	0.598

Table 2:

Parameter	Group I n= 70	Group O n= 70	P value
Block Procedure time	7.57 ± 1.62	6.84 ± 1.62	0.30
Number of attempts	3.42 ± 1.64	2.80 ± 1.33	0.076
Onset of sensory block	3.8 ± 0.75	3.5 ± 0.75	***0.04***
Onset of motor block	5.75 ± 0.6	5.55 ± 0.75	0.078

Table 3:

Parameters	Group I n= 70	Group O n= 70	P value
Surgeon satisfaction	1.8 ± 0.73	1.67 ± 0.65	0.349806
Patient satisfaction	2.1 ± 1.07	2.1 ± 0.91	0.250549

DISCUSSION

With the advent of Ultrasound guided nerve plexus block, the block performance has become easier and there is less incidence of complications. In our study, we have compared the In-Plane/Out-of-Plane approach in USG guided supraclavicular brachial plexus blocks.

In our study, we have found that the procedure time was similar in the in-plane group (7.57 ± 1.62) minutes and Out-of-plane group (6.84 ± 1.62), which was statistically insignificant with p value 0.30. Our findings correlate with Schwenk et al,[1] Whereas, Pester JM et al,[3] found the performance time shorter in the Out-of-plane technique, which can be due to the 2 points injection vs the 4-point injection in In-Plane and Out-of-Plane respectively.

We have found that the onset of sensory block was statistically shorter in the Out-of-plane than the In-plane approach. Our results are similar to the study by Tomasseti et al., Reg Anesth Pain Med 33(5):64 (2008) and Pester JM et al., Journal of Anesthesiology 12:16 (2020)

In our study, we found no difference in onset of motor block in both the groups. It was similar to the results by Schwenk et al.[1] We observed that the mean patient satisfaction scores were 2.1±1.07 and 2.1±0.91 in in-plane and Out-of-plane groups respectively and this difference is statistically insignificant with p value of 0.25.

The surgeon satisfaction scores in in-plane and Out-of-plane groups were 1.8±0.73 and 1.67±0.65 and this is also statistically insignificant with p value of 0.35.

Limitations: Our study is not without limitations. Since we could not blind the operator performing the block, it is possible that one's preference for a particular technique may influence the no. of attempts or procedure time. Also the operator skill variability can influence block performance

CONCLUSION

Supraclavicular Brachial plexus block is the most commonly used anaesthetic approach for upper limb surgeries. It is further benefited with the ultrasonic real time visualization technology. Various studies have proposed the In-Plane technique to achieve the SC brachial plexus block, because of its less chance of complication, as the whole needle can be visualized throughout the procedure. In our study, we have found that In-Plane/Out-of-Plane has similar procedural time. Onset of sensory block was significantly shorter in the Out-of-plane group, while onset to motor block was similar in both groups. The results of our study allows more scope for the Out-of-plane approach. Although, more studies are required to establish the Out-of-plane as an appropriate alternative in expert hands.

Conflict of interest: nil.

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