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Original Research Article

To Compare the Efficacy of Sequential Ultrasound Imaging Approach versus Traditional Stop Light Sign Approach of Inter Scalene Brachial Plexus Block in Performing Proximal Humerus Surgeries

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Abstract

Introduction: The Stop Light Sign approach, based on identifying anatomical landmarks of the Brachial Plexus, is routinely used for ISBPB (InterScalene Brachial Plexus Block) during Proximal Humerus surgeries. Recently, SUIT (Sequential Ultrasound Imaging Technique) approach is practiced in human volunteers for the identification of elements of Brachial Plexus successfully. We aimed to compare the efficacy of the SUIT approach versus Stop Light Sign approach for ISBPB for the patients posted for Proximal Humerus surgeries.

Methods: It was a prospective, randomized comparative study conducted in Rangaraya Medical College, Kakinada over a period of 6 months from 1st December 2023 to 1st June 2024. A total of 70 patients aged 18–65 years, classified as ASA I or II, scheduled for elective unilateral proximal Humerus surgeries were randomly divided into Group A (ISBPB by Stop Light Sign approach) and Group B (ISBPB by SUIT approach). Study procedures followed standard guidelines. An experienced anaesthesiologist performed the ISBPB procedure in both research groups. Parameters like Quality, Effectiveness and Incidence of complications were studied. Levene's test, Welch's unpaired T-test were used. $P<0.05$ was considered statistically significant.

Results: There was no significant statistical difference in block procedure time and onset of sensory and motor blockade, but there was a significant statistical difference in effectiveness and incidence of complications. Block failure was detected in ISBPB by Stop Light Sign approach.

Conclusion: The SUIT approach reliably identifies individual elements, ensuring perfect visualization of the SPA arrangement of the superior trunk of the brachial plexus during ISBPB for proximal humerus surgeries. Its accuracy and lower complication rates, compared to the traditional stoplight sign, make it a valuable addition to routine practice before any brachial plexus block (BPB).

Keywords: InterScalene, Stop Light, SUIT, SPA.

Introduction

Ultrasound guided InterScalene Brachial Plexus Block (ISBPB) is now commonly used to perform for providing anesthesia or analgesia during proximal humerus surgeries. [1] The traditional Stop Light Sign of the Brachial Plexus, based on identifying anatomical landmarks, is the routinely used approach for locating the injection site during ISBPB. [2]

Recently, sequential ultrasound imaging technique (SUIT) is practiced in human volunteers for the identification of elements of brachial plexus successfully. [2,3] Systematic and Sequential transverse oblique scan may help in accurately identifying the individual elements of Brachial Plexus even in patients with anatomical variations. With this a study was conducted to compare the efficacy of the SUIT approach versus traditional stop light sign (SLS) approach for ISBPB for the patients posted for proximal humerus surgeries (PHS).

Methods

It was a prospective, randomized comparative study carried in the department of Anesthesia, Rangaraya Medical College, Kakinada. Study was conducted between November 2023 to April 2024. Study protocol was approved by the Institutional Ethics Committee. After explaining the study protocol, written informed consent was obtained from participants.

The study included adults aged 18–65 years, ASA I, II and scheduled for elective unilateral PHS. Patients with pre-existing respiratory, cardiac, renal, neurological, or hepatic disease, brachial plexus neuropathy, contraindications to nerve block, allergies to anesthetics, or without consent were excluded. Using a computer-generated randomization sequence the study members were divided to group A and B; group A by SLS and SUIT for group B.

Prior to surgery, participants were briefed about the study and instructed to fast for six hours for solid foods and two hours for clear liquids. In the operating room, intravenous access was established, fluids were administered, multipara monitors were connected, and anesthesia was administered according to organizational protocol. The ISBP procedure was performed by an experienced anesthesiologist using a GE Medical Systems Ultrasound with a high-frequency 4-12 Hz linear transducer in both groups.Patients were positioned supine with the head elevated at 30° and rotated 45° to the non-operative side. The supraclavicular anterolateral neck area was sterilized using 2% chlorhexidine in 70% isopropyl alcohol. After infiltrating the skin with 1 ml of 1% lidocaine, a 22-G needle was used for the block.

In group A, a transverse scan of the neck was used to identify the Stop Light Sign between the anterior and middle scalene muscles. The needle was introduced in-plane, and after negative aspiration, the local anesthetic was injected carefully under direct visualization to avoid vascular or intraneural injection. For hydrodissection, 2% Xylocaine was used. In Group B, a sequential transverse oblique scan was performed, starting from the supraclavicular fossa of the neck and progressing to the upper part of the interscalene groove (C5), then reversing direction back to the supraclavicular fossa. The ventral rami of C5, C6, and C7 were identified and followed to the superior trunk based on the SPA arrangement (Suprascapular Nerve, Posterior Division, and Anterior Division of the Superior Trunk). After negative aspiration, the local anesthetic was injected carefully under direct vision.

Both groups received 7.5 ml of 0.5% Bupivacaine, 5 ml of 2% Xylocaine with 1:200000 Adrenaline, 1 ml of Dexamethasone (4 mg), and 1.5 ml of distilled water for the ISBPB. Sensory dermatomes were assessed using a cold alcohol swab test, and a three-point scale was used to evaluate sensory blockade. Motor block was evaluated using the modified Lovett rating scale. The overall quality of the block was assessed on a three-point scale: 0 = complete failure, 1 = inadequate block, and 2 = successful block. The total duration of anesthesia was monitored from the onset of the blockade until rescue analgesia was administered. Complications such as block failure, intravascular or intraneural injections, pneumothorax, respiratory distress, hoarseness of voice, Horner's syndrome, and total spinal anesthesia were closely observed.

Statistical Analysis

Statistical analysis was carried using SPSS Version 21.0. Levene's test was employed to assess the equality of variances. Unpaired T-test was applied to determine the equality of means; $P<0.05$ was considered to be statistically significant.

Results

Total 70 member were included, 35 in each group. The demographical variables, Quality of block were compared and no statistical significance was found between the groups. Effectiveness of block was assessed in terms of inadequate block and block failure, statistically significant. Incidence of complications were more in group A, statistically significant (Table 1).When the quality of ISBPB between groups was considered, group A had slightly longer sensory (4.3±1.18) and motor (5.86±1.16) block onset time, but the differences were not statistically significant ($P > 0.05$). Surgery duration was similar in both groups (Table 2). In group A, 8.5% had failed blocks, 11.4% had incomplete blocks, and 80% had complete block; whereas in group B, complete block was 100% (Table 3). The incidence of complications was 28.6% (100) in group A; 2.85% (1) had vascular punctures, 5.71% (2) phrenic nerve involvement and it was 0 in group B.

Table 1: Demographic variables among the study members

Demographic Variables	Group A	Group B	P value
Mean age	28 ± 2.7	32 ± 3.1	
Male/Female	24/11	26/9	
Weight (Kgs)	56 ± 4	55 ± 4	
Height (cms)	156 ± 6	154 ± 3	
BMI	23 ± 2	23.2 ± 1.8	
ASA (**I / II**)	26/9	23/12	P > 0.05

Table 2: Quality of ISBPB among the study members

Parameters	Group A	Group B	P value
Onset of Sensory Block	4.3±1.18	4.1±1.06	0.45
Onset of Motor Block	5.86±1.16	5.46±1.12	0.14
Duration of Surgery	90 ± 4	89 ± 4	0.67

Table 3: Effectiveness of ISBPB among the study members; n (%)

Effectiveness of block	Group A	Group B
Failed Block	3 (8.5)	0
Incomplete Block	4 (11.4)	0
Complete Block	28 (80)	35 (100)
Total	35 (100)	35 (100)

Discussion

Traditional SLS approach was used for ISBPB for Humerus Surgeries. Franco and Williams discovered that the "stoplight sign" of Brachial Plexus involves only the C5 and C6 roots, not the C7 root. This finding could impact the quality and safety of USG ISBPB. [4] Karmakar MK et al. identified individual elements, trunks and SPA arrangement of Upper trunk accurately in volunteers. [5]

Table 1 presents the demographic variables of the study members. Group A had a mean age of 28 ± 2.7 years, while Group B had a mean age of 32 ± 3.1 years, with no statistically significant difference ($P > 0.05$). The gender distribution in Group A was 24 males and 11 females, and in Group B, it was 26 males and 9 females, indicating similar male predominance. The average weight was 56 ± 4 kg in Group A and 55 ± 4 kg in Group B, with no significant differences. Heights averaged 156 ± 6 cm in Group A and 154 ± 3 cm in Group B. BMI was 23 ± 2 in Group A and 23.2 ± 1.8 in Group B. Both groups had similar ASA classifications, suggesting any outcome differences can be attributed to the intervention rather than demographic factors. Demographic parity is crucial in clinical trials to ensure comparable baseline characteristics, reducing potential confounding variables or instance, comparable age and BMI across groups support the reliability of observed outcomes being due to the ISBPB techniques rather than demographic differences. Similarly, gender distribution and ASA classification are critical for ensuring that the groups are well-matched regarding baseline health status and physical condition. Such matching enhances the validity of comparative effectiveness studies in clinical settings. [6, 7]

SUIT technique accurately identify Brachial Plexus with enhancing quality, intensity and duration of blockade with less incidence of complications when compared to traditional Stop Light sign. These observations revealed that SUIT approach resulted in higher frequency of successful blocks. Additionally the quality of block was significantly improved when compared to traditional traffic stop light signal approach. In this research, the time taken to achieve adequate sensory block in the group B was 4.1± 1.06 min and it was 4.3±1.18 mins in the combined group; statistically it was not significant (p= 0.45). For motor block, 5.46 ± 1.12 mins and 5.86 ±1.16 mins, respectively and there was no statistical significance (p=0.14) between the groups. This finding align with the available literature. [5, 8]

Table 3 shows the effectiveness of ISBPB among study participants. In group A, 8.5% of patients experienced failed blocks, 11.4% had incomplete blocks, and 80% achieved complete blocks. In contrast, group B reported 100% complete blocks with no failed or incomplete blocks. These results highlight a notable difference in the effectiveness of ISBPB between the two groups. The higher success rate in group B may be attributed to the different techniques used. Precision in nerve block administration is crucial for efficacy and minimizing complications. Studies have shown that the use of ultrasound guidance can significantly improve the accuracy and success rate of nerve blocks by allowing real-time visualization of needle placement and local anesthetic spread. [9 – 11] This is consistent with findings from similar studies where ultrasound-guided ISBPB resulted in higher success rates and fewer complications compared to traditional techniques.

The differences in outcomes between the two groups in this study align with existing literature emphasizing the benefits of advanced imaging techniques in regional anesthesia. Moreover, the absence of failed or incomplete blocks in Group B underlines the importance of meticulous technique and potentially the experience of the anesthesiologist in achieving optimal results. This evidence supports the growing consensus that utilizing ultrasound guidance in ISBPB can enhance block effectiveness, reduce failure rates, and improve overall patient outcomes, as demonstrated in this study. [12, 13]

Conclusion

The SUIT technique offers reliable identification of elements, ensuring perfect visualization of the SPA arrangement of the superior trunk of the brachial plexus during ISBPB for proximal humerus surgeries. Its accuracy and lower complication rates compared to the traditional stoplight sign makes it a valuable addition to routine practice before any brachial plexus block.

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