

## A Study on Ultrasound Guided versus Ultrasound, Peripheral Nerve Stimulator Guided Interscalene Brachial Plexus Nerve Block in Patients Undergoing Upper Limb Surgeries.

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### Abstract

**Introduction:** The interscalene brachial plexus block (ISB) stands out as a reliable and widely practiced method for providing regional anesthesia during upper limb surgeries. Previous studies have independently compared ultrasound-guided interscalene brachial plexus block (US-ISB) and nerve stimulator-guided interscalene brachial plexus block (NS-ISB). In light of this, we aim to assess the effectiveness and safety of US-ISB alone versus a combination of PNS and US-ISB for achieving ISB block in the shoulder and upper arm surgeries.

**Methods:** It was a prospective research conducted in Rangaraya Medical College, Kakinada. The study was conducted over a period of 6 months from 1<sup>st</sup> February 2023 to 1<sup>st</sup> August 2023. Individuals of both gender, aged 18 – 60 years with ASA grades I and II scheduled for proximal humerus, shoulder or clavicle surgery under ISB were included. The participants were randomly divided into US-ISB and NS-ISB groups. Study procedures were carried as per the standard guidelines. The ISB procedure was carried by an experienced anesthetist in both research groups. Total duration of anaesthesia was recorded from the onset of blockade to the administration of rescue analgesic. Care was taken to note block complications. Levene's test, Welch's unpaired T-test were used; P<0.05 was considered to be statistically significant.

**Results:** Total 70 members were included, 35 in each group. Male female ratio was 3.37 and 1.92, respectively. Statistically there was no significant difference in block procedure time whereas there was significant difference in total anaesthetic time, respectively in the groups. Block failure was detected in USG but statistically there was no significant difference respectively in the groups.

**Conclusion:** The combined technique ensures an extended duration of ISB, demonstrating enhanced efficacy and heightened safety in nerve block administration. This has resulted in a notable decrease in complications and nerve block failures, consequently reducing the necessity for general anesthesia.

**Keywords:** Block, Nerve, Stimulator, Study.

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### Introduction

The interscalene brachial plexus block (ISB) stands out as a reliable and widely practiced method for providing regional anesthesia during upper limb surgeries, particularly those involving the shoulder and upper arm. This technique ensures comprehensive intraoperative anesthesia and analgesia. [1] ISB can be executed through various standard approaches, including the conventional landmark technique involving paraesthesia elicitation, peripheral nerve stimulator (PNS) guided

procedures, and Ultrasound guidance (USG) methods. [2]

For the past two decades, the electrical nerve stimulator has been the established standard for nerve localization. [3] However, the advent of USG regional anesthesia techniques has introduced significant advantages. These include the ability to precisely locate and visualize the peripheral nerve intended for blocking and monitor the real-time dispersion of local anesthetics. [4] Despite the

advancements with ultrasound-guided techniques, instances of block failure and the occurrence of local anesthetic systemic toxicity (LAST) have been reported.

Previous studies have independently compared Ultrasound-Guided Interscalene Brachial Plexus Block (US-ISB) and Nerve Stimulator-Guided Interscalene Brachial Plexus Block (NS-ISB). [5] In light of this, we aim to assess the effectiveness and safety of US-ISB alone versus a combination of PNS and US-ISB for achieving ISB block in surgeries involving the shoulder and upper arm.

### Methods

It was a prospective research conducted in Rangaraya Medical College, Kakinada. The study was conducted over a period of 6 months from 1<sup>st</sup> February 2023 to 1<sup>st</sup> August 2023. Study protocol was approved by the Institutional Ethics Committee. An informed written consent was taken from the study members.

Individuals of both gender, aged 18 – 60 years with ASA grades I and II scheduled for proximal humerus, shoulder or clavicle surgery under ISB were included. Non cooperative individuals, those with significant cardiac and pulmonary pathology, ASA grade III and IV, known allergic history to local anaesthetics were not considered in this research.

Pre-operative assessment was carried as per institutional protocol and the participants were randomly divided into USG and PNS+US groups. The study was explained before the surgical procedure, instructions were issued for a 6-hour fasting period for solid foods and a 2-hour fasting period for clear liquids. In addition, a dosage of 0.25mg Alprazolam tablet was administered at bedtime to alleviate anxiety. Upon the patient's transfer to the operating room, intravenous access establishment, fluid administration multiparameter monitor connection and administration of anesthetic medication were practiced as per the organization protocol. The ISB procedure was carried by an experienced anesthetist in both research groups. Among the US group, imaging was applied as Chan VW et al. [6] and in PNS+US group as per Banerjee S et al. [7]

Total duration of anaesthesia was recorded from the onset of blockade to the administration of rescue analgesic. Watched carefully for complications such as block failure, intravascular injection, intraneural injection, pneumothorax, and respiratory distress, hoarseness of voice, Horner's syndrome and total spinal anaesthesia after ISB.

**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 members were included, 35 members in each group. Male female ratio was 3.37 and 1.92, respectively in the groups and statistically there was no significant difference. Statistically there was no significant difference in block procedure time whereas there was significant difference in total anaesthetic time, respectively in the groups. Block failure was detected in USG but statistically there was no significant difference respectively in the groups.

### Discussion

General anesthesia (GA) is a common choice for upper extremity procedures; nevertheless, there is a growing trend in utilizing ISB for such procedures. This offers several advantages over GA, including enhanced intraoperative analgesia, improved postoperative pain management, reduced postoperative need for opioids, shorter recovery times, and lower occurrence of postoperative complications such as nausea, vomiting, paralytic ileus, and deep vein thrombosis. These factors collectively support the feasibility of fast-track ambulatory surgery. [8]

The effectiveness of peripheral nerve block (PNB) hinges on the accurate identification of nerves and the precise administration of local anesthetic around them. Additionally, the success is influenced by the chosen technique, the proficiency of the anaesthetist, and the volume and type of local anesthetic used. [9] In recent years, real-time ultrasound-guided peripheral nerve blocks have emerged and become increasingly popular. Ultrasound facilitates the precise positioning of the needle, enables monitoring of the local anesthetic spread, thereby enhancing the onset, quality, and duration of the nerve block, ultimately contributing to the overall success of PNBs. [10, 11]

Our observation revealed that the combined approach of peripheral nerve stimulation (PNS) and US IBPB resulted in a higher frequency of successful blocks. Additionally, the quality and intensity of the block were significantly improved when compared to the US-alone group; statistically also there was significant difference ( $P=0.000$ ). In this research, the time taken to achieve adequate sensory block in US group was  $4.1 \pm 1.06$  min and it was  $4.3 \pm 1.18$  mins in the combined group; statistically it was not significant ( $p=0.45$ ). For motor block,  $5.46 \pm 1.12$  mins and  $5.86 \pm 1.16$  mins, respectively and here also there was no statistical significance ( $p=0.14$ ) between the groups. This finding aligns with a study conducted by Ratnawat et al., where the mean onset time for sensory and motor blocks was notably shorter in the US group

( $6.46 \pm 1.02$  min and  $8.10 \pm 1.02$  min, respectively) compared to the other group ( $7.68 \pm 1.33$  min and  $9.94 \pm 1.28$  min, respectively). [12] However, our results contrast with the findings of Duncan et al.'s study, where the onset time for sensory and motor blocks was comparable between the USG and PNS groups. [13]

In this research, block failure (2; 5.6%), peripheral nerve involvement (1; 2.8%), vascular puncture (1; 2.8%) were detected in US group and such findings were not identified in combined technique; statistically there was no significant difference respectively in the groups. With this we found that the combined technique is safe which an important aspect. But block failure was reported in both as per Williams et al. [14]

### Conclusion

The combined technique ensures an extended duration of ISB, demonstrating enhanced efficacy and heightened safety in nerve block administration. This has resulted in a notable decrease in complications and nerve block failures, consequently reducing the necessity for GA. To validate and further explore these findings, larger multicentric studies with substantial sample sizes are warranted.

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