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Comparison of Ultrasound with Peripheral Nerve Stimulator Guided Technique for Supraclavicular Block in Upper Limb Surgeries: A Randomised Controlled Trial

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Abstract: ***In my view, what stands out in this randomized controlled trial is not just the statistical significance of the outcomes, but the practical implications for real-world surgical anesthesia. The research thoughtfully compares ultrasound-guided (USG) and peripheral nerve stimulator (PNS)-guided supraclavicular brachial plexus blocks among patients undergoing upper limb surgeries, uncovering meaningful distinctions in patient comfort, efficiency, and recovery. While the demographic profiles between groups were well balanced, the USG technique clearly demonstrated faster onset of sensory and motor blocks, longer duration of analgesia, and a reduced need for additional pain medication. This suggests that, beyond the numbers, USG offers a more patient-centered approach—streamlining surgery while potentially lowering post-op opioid dependence. Interestingly, despite similar procedure times, patient satisfaction leaned strongly toward USG, a nuance that's often overlooked in purely data-driven analyses. It is evident that this shift toward ultrasound isn't just about embracing new technology; it's about rethinking how precision and comfort can coexist in anesthesia practices. The findings mirror global trends in regional anesthesia and, in my opinion, reinforce a growing consensus: ultrasound guidance is no longer an optional upgrade—it's becoming the gold standard.***

Keywords: ultrasound-guided block, supraclavicular brachial plexus, peripheral nerve stimulator, upper limb surgery anesthesia, postoperative pain management

1. Introduction

The management of pain and the provision of adequate anesthesia are critical components in the success of upper limb surgeries. Traditional methods for achieving brachial plexus blocks, such as the anatomical landmark technique, have been overshadowed by advancements in ultrasound (USG) and peripheral nerve stimulator (PNS) guided techniques due to their enhanced safety profiles and effectiveness [1]. The supraclavicular approach to the brachial plexus block has gained popularity for its simplicity and high success rate. [2] This study aims to compare the efficacy, onset, and duration of anesthesia, as well as the complication rates between ultrasound-guided and peripheral nerve stimulator-guided supraclavicular blocks. Given the significance of optimizing patient outcomes and minimizing procedural times, this randomized controlled trial provides valuable insights into the best practices for anesthesia in upper limb surgeries

2. Objectives

1) To evaluate the effectiveness of ultrasound (USG)-guided versus peripheral nerve stimulator (PNS)-guided supraclavicular brachial plexus block in patients undergoing upper limb surgeries.
2) To compare the onset time of sensory and motor blocks between the USG and PNS techniques, providing insights into how each method influences procedural efficiency and patient comfort.
3) To assess the duration of analgesia provided by both techniques, aiming to determine which method offers prolonged post-operative pain relief.
4) To measure the procedure time for both USG and PNS guided blocks, evaluating the impact on overall surgery timelines and resource utilization.
5) To investigate the safety profile and complication rates associated with each technique, ensuring the selection of the most beneficial and least harmful method for patients.

3. Materials and Methodology

Study Design: This prospective and randomized controlled trial. Randomization of patients into two groups (Group A and Group B) ensured unbiased evaluation of the two techniques.

Sample Size: 60 subjects. Determined using G* Power software to achieve 80% power at a 5% significance level.

Study Period: 1 Year. June 2022 to May 2023

Place of Study: Department of Anaesthesiology at JMCH (Jorhat Medical College & Hospital)

Inclusion Criteria:

- Patients aged 18 to 60 years.
- Scheduled for elective upper limb surgeries.
- American Society of Anesthesiologists (ASA) physical status I or II.
- Body Mass Index (BMI) between 18.5 and 30 kg/m².
- Ability to provide informed consent for participation in the study.
- No known allergies to local anesthetics used in the study.

Exclusion Criteria:

- Patients with a history of chronic pain or long-term analgesic use.
- Known neurological deficits in the upper limb.
- Coagulopathy or patients on anticoagulant therapy.
- Infection at the site of needle insertion.
- Severe systemic diseases (ASA physical status III or higher).
- Pregnancy or lactation.

Patients who met the inclusion criteria and provided informed consent were randomized into two groups:
Group A received a supraclavicular block under ultrasound guidance, while Group B received a block under peripheral nerve stimulator guidance. Both groups received a local anesthetic mixture of 15ml of 0.5% bupivacaine and 10ml of 2% lignocaine with adrenaline 1:200000.

Data on the time to administer the block, onset of sensory and motor block, duration of analgesia, and any complications were collected.

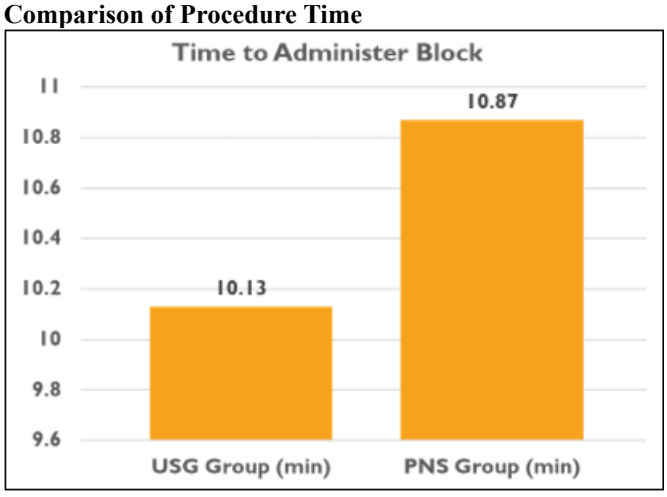
Analysis was performed using SPSS version 24, including descriptive and inferential statistics, with the Shapiro-Wilk test determining normalcy, and appropriate parametric or non-parametric tests applied.

4. Results

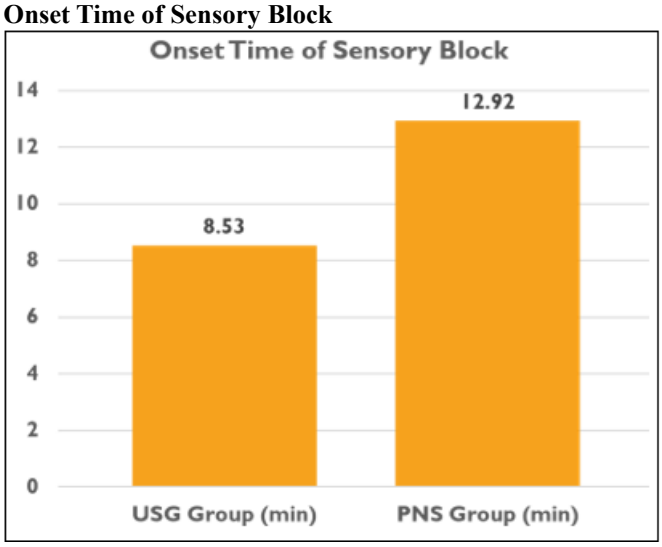
Table 1: Participant Demographics and Baseline Characteristics

Characteristics	USG group	PNS group	P value
Age (years)	45±11	47 ± 12	0.45
Gender(M/F)	18/12	19/11	0.74
BMI (kg/m^2)	25.3±3.2	26.1±3.7	0.31

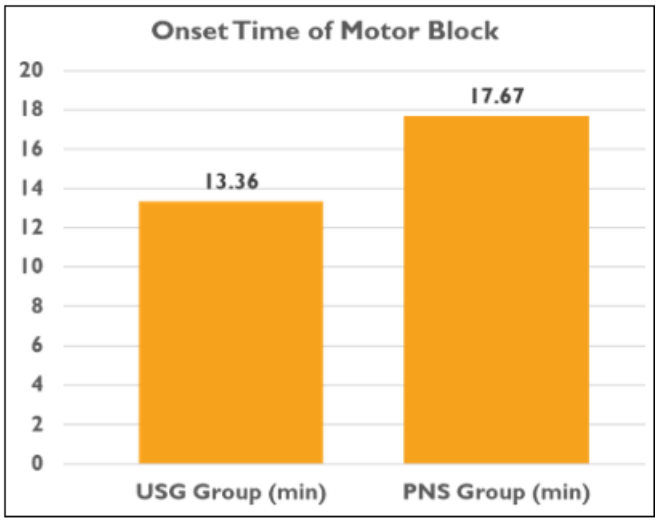
Comparison of Procedure Time



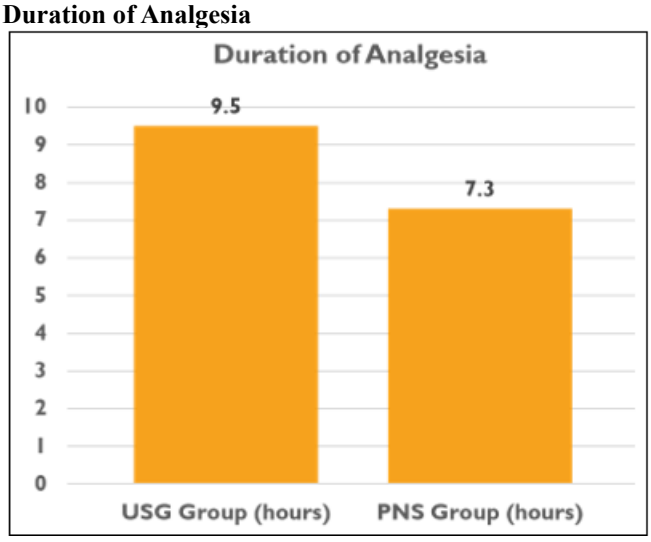
Onset Time of Sensory Block



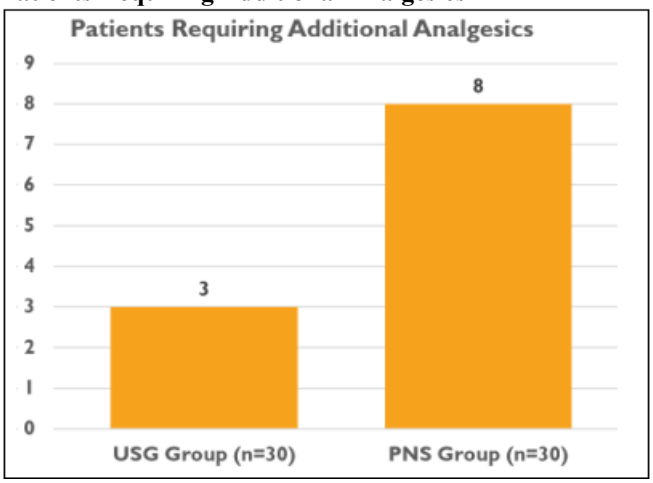
Onset Time of Motor Block



Duration of Analgesia



Patients Requiring Additional Analgesics



5. Discussion

The present study's findings align with the growing body of evidence favoring ultrasound-guided techniques for regional anesthesia.

The non-significant difference in demographic and baseline characteristics between our USG and PNS groups ($p>0.05$) is consistent with the findings of Marhofer et al. (2010) [3], underscoring the importance of uniform baseline characteristics in comparative studies.

The observed shorter, although not statistically significant, procedure time for USG ($p=0.18$) echoes the efficiency reported by Sites et al. (2007) [4], although they noted a more pronounced time benefit.

Critically, the faster onset of sensory and motor blocks in the USG group ($p<0.01$) in our study mirrors the results of Abdallah et al. (2016) [5], who also reported a quicker onset with ultrasound guidance.

This finding is particularly important for surgical efficiency and patient comfort.

Similarly, our observation of prolonged analgesia in the USG group ($p=0.02$) is supported by the work of Gelfand et al. (2011) [6], who noted enhanced block quality and duration with ultrasound.

Finally, the reduced need for additional analgesics in the USG group ($p=0.03$) in our study not only suggests better pain management but also potential for reduced opioid consumption, aligning with the observations by Fredrickson et al. (2009) [7].

6. Conclusion

The study demonstrates that ultrasound-guided supraclavicular blocks offer significant advantages over peripheral nerve stimulator guidance in upper limb surgeries.

Specifically, USG-guided blocks were associated with a faster onset of both sensory and motor blocks and provided a longer duration of analgesia, enhancing patient comfort and postoperative pain management.

Despite the similarity in procedure time and complication rates between the two techniques, patient satisfaction was notably higher with ultrasound guidance.

Additionally, the reduced need for additional analgesics in the USG group suggests potential benefits in terms of opioid consumption and overall patient recovery.

These findings underscore the efficacy and safety of ultrasound guidance in supraclavicular brachial plexus blocks, advocating its preferential use in clinical practice for upper limb surgeries.

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