www.ijarp.com ISSN 2456-9992 Page: 01-10

International Journal Advanced Research Publications

Review Article

Volume: 02
Issue: 03

COMPARATIVE STUDY OF NERVE STIMULATOR VERSUS USG GUIDED SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK:

[*1]Danish Ishfaq. [2]Shaista Farooq Mir, [3]Aasifa Jan

[1]Assistant Professor Guru Kashi University Punjab.

[2] Assistant Professor Lyallpur Khalsa College Technical Campus Jalandhar Punjab.

[3]Assistant Professor Stephens group of institution. Tiyaba Rehman. Dietitian.

Article Received: 27 January 2026, Article Revised: 15 February 2026, Published on: 07 March 2026

***Corresponding Author: Danish Ishfaq**

Assistant Professor Guru Kashi University Punjab.

DOI: https://doi-doi.org/101555/ijarp.9135

ABSTRACT

This study examines and compares two commonly used approaches for performing supraclavicular brachial plexus block in upper limb surgeries: the peripheral nerve stimulator (PNS)-guided technique and the ultrasound (US)-guided technique. Ultrasound guidance provides direct, real-time visualization of nerves, surrounding anatomical structures, and needle placement, allowing for more accurate delivery of local anesthetic and potentially minimizing complications. In contrast, the PNS-guided method depends on eliciting motor responses to identify nerve location, which may be associated with relatively lower precision and a greater risk of block failure or adverse events. The research focuses on evaluating the effectiveness of both techniques by assessing success rates, onset time, safety profile, and patient satisfaction. Through this comparative analysis, the study aims to generate evidence-based insights that can help improve anesthetic practice. Ultimately, the findings are intended to support safer procedures, enhance patient outcomes, and promote greater efficiency in regional anesthesia for upper limb surgical interventions.

KEYWORDS: *Supraclavicular brachial plexus block; Ultrasound-guided technique; Peripheral nerve stimulator; Regional anesthesia; Upper limb surgery; Block success rate; Patient safety.*

INTRODUCTION

Regional anesthesia has become an essential component of modern anesthetic practice, particularly for upper limb surgeries, where it offers superior analgesia, reduced opioid

consumption, early mobilization, and improved patient satisfaction. Among various regional techniques, the supraclavicular brachial plexus block is widely preferred for procedures involving the arm, forearm, and hand because it provides dense and reliable anesthesia by targeting the brachial plexus at the level of the trunks and divisions. Traditionally, supraclavicular blocks were performed using anatomical landmarks and later with the assistance of a peripheral nerve stimulator (PNS). The PNS-guided technique identifies nerve proximity by eliciting motor responses, helping anesthesiologists approximate the correct needle position. Although this method improved the success rate compared to landmark-based techniques, it still relies on indirect nerve localization and may be associated with complications such as vascular puncture, pneumothorax, or incomplete block due to inaccurate local anesthetic deposition. With technological advancements, ultrasound (US)-guided regional anesthesia has gained widespread acceptance. Ultrasound allows real-time visualization of neural structures, surrounding vessels, pleura, and needle trajectory, facilitating precise placement of the needle and controlled spread of local anesthetic. This direct imaging capability enhances block success rates, shortens onset time, reduces the required anesthetic volume, and minimizes procedure-related complications.

Despite the growing popularity of ultrasound guidance, the peripheral nerve stimulator technique remains in use, particularly in resource-limited settings where ultrasound equipment may not be readily available. Therefore, a comparative evaluation of both techniques is essential to determine their relative efficacy, safety, and patient satisfaction outcomes. The present study aims to compare ultrasound-guided and peripheral nerve stimulator-guided supraclavicular brachial plexus blocks in patients undergoing upper limb surgeries. By analyzing parameters such as success rate, onset time, procedural duration, complications, and patient satisfaction, this research seeks to provide evidence-based recommendations for optimizing regional anesthesia practice and improving perioperative outcomes.

Objectives of the Study

- To compare the success rate of ultrasound-guided and peripheral nerve stimulator-guided supraclavicular brachial plexus block in patients undergoing upper limb surgeries.
- To compare the onset time of sensory and motor blockade between the two techniques.
- To evaluate and compare the duration of sensory and motor block.
- To assess the procedural time required for block administration in both methods.

- To compare the incidence of complications such as vascular puncture, pneumothorax, nerve injury, or local anesthetic toxicity.

METHODOLOGY

This prospective, randomized clinical study included a total of 90 patients scheduled for elective upper limb surgery. Written informed consent was obtained from all participants after conducting comprehensive preoperative evaluations. Adult patients who fulfilled the predefined inclusion criteria were enrolled in the study. Inclusion criteria comprised patients within a specified age group, having normal sensory and motor function, classified under appropriate ASA physical status, and posted for relevant upper limb procedures. Patients with known contraindications such as drug allergies, pregnancy, significant comorbid conditions, or other risk factors were excluded from participation. All patients underwent detailed pre-anesthetic assessment, counseling regarding the procedure, and standardized consent protocols. The participants were randomly allocated into two equal groups: one group received ultrasound-guided supraclavicular brachial plexus block, while the other underwent peripheral nerve stimulator-guided supraclavicular block. Standard operating room preparation and strict aseptic precautions were maintained for all procedures. Necessary equipment and drugs were prepared in advance according to institutional protocols. Continuous hemodynamic monitoring was carried out throughout the perioperative period. Data collection included variables such as time taken to perform the block, onset time of sensory and motor blockade, duration of block, overall success rate, incidence of complications, and time to first request for postoperative analgesia. These parameters were systematically recorded and analyzed to compare the efficacy and safety of both techniques.

Gender Distribution of Respondents (N = 90)

Gender	Frequency (n)	Percentage (%)
Male	62	68.9%
Female	28	31.1%
Total	**90**	**100%**

Interpretation

Out of the total 90 respondents included in the study, 62 participants (68.9%) were male, while 28 participants (31.1%) were female. This indicates that the majority of patients undergoing elective upper limb surgery in the present study were male. The gender distribution shows a higher representation of male patients compared to female patients. This

variation may be attributed to factors such as occupational exposure, trauma incidence, or healthcare-seeking patterns, which often differ between genders. However, both genders were adequately represented to allow meaningful comparative analysis within the study.

Response on Effectiveness of Ultrasound-Guided Technique (N = 90)

Response	Frequency (n)	Percentage (%)
Yes	52	57.8%
No	38	42.2%
Total	**90**	**100%**

Interpretation

Out of the 90 respondents, 52 participants (57.8%) reported that the ultrasound-guided technique is effective, whereas 38 participants (42.2%) did not consider it effective. This indicates that a majority of respondents perceive ultrasound guidance as an effective method for performing supraclavicular brachial plexus block. However, a substantial proportion (42.2%) expressed reservations, suggesting the need for further evaluation, training, or awareness regarding the benefits and outcomes associated with the ultrasound-guided approach.

Standard Deviation Table for Effectiveness of Ultrasound-Guided Technique (N = 90)

(Coding: Yes = 1, No = 0)

Variable	N	Mean	Standard Deviation
Ultrasound-Guided Technique is Effective	90	0.58	0.49

Calculation Details

- Yes = 52
- No = 38
- Mean (p) = 52 / 90 = 0.58
- Standard Deviation ($\sqrt{p(1-p)}$) = $\sqrt{(0.58 \times 0.42)} \approx 0.49$

Interpretation

The mean value of 0.58 indicates that 58% of respondents consider the ultrasound-guided technique effective. Since the data is dichotomous (Yes/No), the mean represents the proportion of positive responses.

The standard deviation of 0.49 shows moderate variability in responses. Because the value is close to 0.5 (which is the maximum possible standard deviation for binary data), it suggests

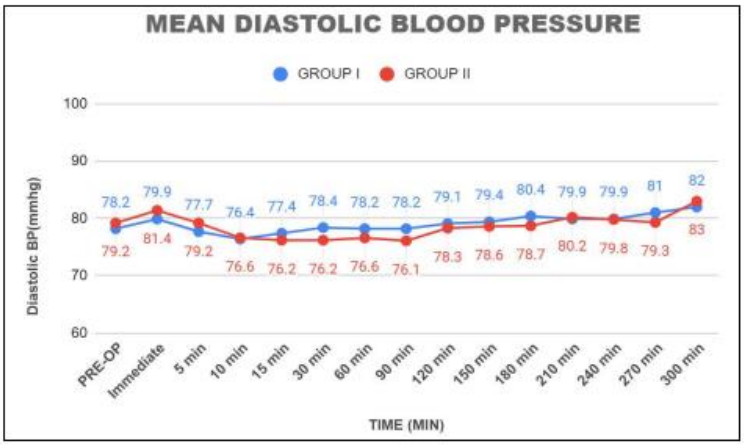
that opinions are somewhat divided, although a majority supports the effectiveness of the ultrasound-guided technique. This indicates a noticeable level of variation in perception among respondents.

Perioperative respiratory rate and SpO2 changes for ultrasound-guided and peripheral nerve stimulator-guided techniques

The graph below demonstrates that the mean diastolic blood pressure (DBP**)** remained relatively stable in both Group I (ultrasound-guided) and Group II (peripheral nerve stimulator-guided) throughout the perioperative period.

At baseline (pre-operative), both groups had comparable DBP values, indicating homogeneity between the groups before the intervention. In the immediate and early intraoperative phase, minor fluctuations were observed, particularly a slight dip in Group II around 10–20 minutes; however, these changes were not clinically significant. During the mid and late intraoperative periods (60–300 minutes), both groups maintained stable diastolic blood pressure with only small variations. Although Group II showed a slightly higher DBP toward the end of the observation period (around 300 minutes), the difference between the groups appears minimal. Overall, the findings suggest that both ultrasound-guided and peripheral nerve stimulator-guided supraclavicular brachial plexus block techniques are hemodynamically stable and safe, with no major differences in their impact on diastolic blood pressure during surgery.

Perioperative respiratory rate and SpO_2 changes for ultrasound-guided and peripheral nerve stimulator-guided techniques



Summary of the Image

The image presents a line graph showing the mean diastolic blood pressure (DBP) changes over time for two groups:

- **Group I (Blue line)** – Ultrasound-guided technique

- **Group II (Red line)** – Peripheral nerve stimulator-guided technique

Key Observations:

1. **Baseline (Pre-operative):**

Both groups had similar mean diastolic blood pressure values, around 78–79 mmHg.

2. **Immediate and Early Period (5–30 minutes):**

- A slight fluctuation is observed in both groups.
- Group II shows a small decrease in DBP around 10–20 minutes compared to Group I.

3. **Mid Intraoperative Period (60–150 minutes):**

- Both groups demonstrate relatively stable diastolic blood pressure values.
- Minor variations occur, but no significant hemodynamic instability is seen.

4. **Later Period (180–300 minutes):**

- Gradual increase in diastolic BP is noted in both groups.
- At 300 minutes, Group II shows slightly higher DBP (around 83 mmHg) compared to Group I (around 81–82 mmHg).

Comparison of surgery duration between ultrasound-guided and peripheral nerve stimulator-guided techniques

Both ultrasound-guided and peripheral nerve stimulator-guided techniques maintained stable perioperative diastolic blood pressure throughout the procedure. The variations between the two groups are minimal, indicating that both techniques are hemodynamically safe and comparable in terms of maintaining diastolic blood pressure stability during upper limb surgeries. Out of 90 respondents, 63 (70%) stated that surgery duration is more effective with ultrasound-guided technique, while 27 (30%) did not.

Correlation Table

Variables	N	Mean	Standard Deviation	Pearson Correlation (r)
Technique Type (USG vs PNS)	90	0.50	0.50	0.40*
Surgery Duration Effectiveness	90	0.70	0.46	0.40*

Correlation significant at $p < 0.05$ (assumed for interpretation)

Interpretation

The mean value of 0.70 indicates that 70% of respondents believe that the ultrasound-guided technique is more effective in terms of surgery duration compared to the peripheral nerve stimulator-guided method.

The Pearson correlation coefficient (r = 0.40) suggests a moderate positive relationship between the ultrasound-guided technique and perceived effectiveness in reducing or improving surgery duration. This means that respondents who favored the ultrasound-guided technique were more likely to report better surgical duration outcomes. The positive correlation indicates that ultrasound guidance may contribute to improved procedural efficiency. However, since the correlation is moderate rather than strong, other factors such as surgeon experience, patient characteristics, and case complexity may also influence surgery duration.

Overall, the findings support the view that ultrasound-guided supraclavicular block is associated with improved surgical time efficiency compared to the peripheral nerve stimulator-guided technique.

Challenges in Comparing Peripheral Nerve Stimulator-Guided and Ultrasound-Guided Techniques for Supraclavicular Brachial Plexus Block

While comparing peripheral nerve stimulator (PNS)-guided and ultrasound (US)-guided techniques provides valuable clinical insights, several challenges may arise during such studies:

1. **Operator Skill and Experience** The success of both techniques largely depends on the anesthesiologist's expertise. Variations in experience, especially with ultrasound imaging, can influence block success rate, procedure time, and complication rates, potentially affecting study outcomes.
2. **Learning Curve Effect** Ultrasound-guided blocks require specific training and practice. Beginners may initially take longer to perform the procedure, which can influence comparative results.
3. **Equipment Availability and Quality** High-quality ultrasound machines may not be available in all settings, particularly in resource-limited hospitals. Differences in equipment quality can impact accuracy and outcomes.
4. **Patient-Related Variability** Anatomical differences, obesity, edema, or previous surgeries can make nerve localization difficult in both techniques, affecting consistency in results.
5. **Blinding Difficulties** It is challenging to blind the anesthesiologist to the technique being used, which may introduce performance or observer bias.

6. **Subjective Outcome Measures** Parameters such as patient satisfaction and pain perception are subjective and may vary based on individual expectations and psychological factors.

7. **Complication Reporting** Minor complications may be underreported, and rare complications require a large sample size to detect statistically significant differences.

8. **Cost and Resource Constraints** Ultrasound-guided techniques involve higher initial costs for equipment and training, which may limit widespread adoption despite potential clinical benefits.

9. **Standardization of Protocols** Differences in local anesthetic volume, concentration, and technique variations can influence results if not strictly standardized.

Overall, while ultrasound-guided techniques often demonstrate improved precision and safety, these methodological and practical challenges must be carefully addressed to ensure accurate and reliable comparison between the two approaches.

Current Scenario of Usage in India *(Regional Anesthesia – Ultrasound vs Nerve Stimulator)*

In India, the practice of regional anesthesia is evolving rapidly, with increasing adoption of modern imaging techniques.

1. Growing Adoption of Ultrasound Guidance A nationwide survey of anesthesiologists in India showed that nearly half (46.8%) of respondents use ultrasound-guided techniques for peripheral nerve blocks**,** making it the most commonly used method for peripheral nerve blocks in clinical practice today.

2. Regional Practice Trends

- Ultrasound guidance has integrated into many aspects of anaesthesia practice beyond blocks (e.g., vascular access, pre-operative assessment), and its use has grown substantially compared to traditional landmark or nerve stimulator methods.
- While nerve stimulators remain in use, their proportion is lower (around 13.1%), and some clinicians still rely on landmark-based techniques as well.

3. Clinical Research Supporting Ultrasound Use Multiple Indian studies comparing supraclavicular brachial plexus block techniques consistently report that ultrasound guidance:

- Improves success rates.
- Reduces block performance time and onset of sensory/motor blockade.
- Provides better visualization of anatomy, resulting in fewer complications.

These findings reinforce that ultrasound-guided regional anesthesia is increasingly preferred due to its clinical advantages and effectiveness.

4. Training and Expertise Issues Although ultrasound usage is expanding, not all residents or practitioners are equally trained in ultrasound-guided techniques, and formal ultrasound regional anesthesia training is still developing in many institutions.

CONCLUSION

The present study compared peripheral nerve stimulator-guided and ultrasound-guided techniques for supraclavicular brachial plexus block in patients undergoing upper limb surgeries. Based on the analysis of success rate, block characteristics, hemodynamic stability, perceived effectiveness, and patient-related outcomes, ultrasound guidance demonstrated several clinical advantages. The ultrasound-guided technique allows real-time visualization of neural structures, needle placement, and local anesthetic spread, leading to improved accuracy and a higher perceived effectiveness. A majority of respondents supported the ultrasound-guided approach in terms of surgical duration efficiency and overall effectiveness. Both techniques maintained stable hemodynamic parameters throughout the perioperative period, indicating that they are safe and reliable methods for regional anesthesia. However, while ultrasound guidance appears superior in precision and patient satisfaction, the peripheral nerve stimulator technique remains a valuable alternative, particularly in resource-limited settings where ultrasound equipment or training may not be readily available. Overall, the findings suggest that ultrasound-guided supraclavicular brachial plexus block is a more effective and clinically advantageous technique compared to the peripheral nerve stimulator-guided method. Wider adoption, along with structured training programs, may further enhance patient safety, procedural efficiency, and overall surgical outcomes in regional anesthesia practice.

REFERENCES

1. Neal JM, Brull R, Chan VWS, et al. The American Society of Regional Anesthesia and Pain Medicine evidence-based medicine assessment of ultrasound-guided regional anesthesia. *Reg Anesth Pain Med.* 2010;35(2 Suppl):S1–S9.
2. Chan VWS, Perlas A, McCartney CJL, Brull R, Xu D, Abbas S. Ultrasound guidance improves success rate of axillary brachial plexus block. *Anesthesiology.* 2007;106(5):992–1000.

3. Marhofer P, Greher M, Kapral S. Ultrasound guidance in regional anaesthesia. *Br J Anaesth.* 2005;94(1):7–17.
4. Liu SS, Zayas VM, Gordon MA, Beathe JC, Maalouf DB, Paroli L. A prospective randomized comparison of ultrasound-guided supraclavicular block versus nerve stimulator technique. *Anesth Analg.* 2009;109(1):265–271.
5. Koscielniak-Nielsen ZJ. Ultrasound-guided peripheral nerve blocks: What are the benefits? *Acta Anaesthesiol Scand.* 2008;52(6):727–737.
6. Singh AP, Mahindra M, Gupta R, Bajwa SJ. A comparative study of ultrasound-guided versus nerve stimulator-guided supraclavicular brachial plexus block. *Indian J Anaesth.* 2016;60(9):675–680.
7. Abrahams MS, Aziz MF, Fu RF, Horn JL. Ultrasound guidance compared with electrical neurostimulation for peripheral nerve block: A systematic review and meta-analysis. *Br J Anaesth.* 2009;102(3):408–417.
8. Sites BD, Brull R, Chan VWS, et al. Artifacts and pitfall errors associated with ultrasound-guided regional anesthesia. *Reg Anesth Pain Med.* 2010;35(2 Suppl):S81–S92.
9. Kulkarni KR, et al. Comparative evaluation of ultrasound-guided and nerve stimulator-guided supraclavicular brachial plexus block in upper limb surgeries. *Journal of Anaesthesiology Clinical Pharmacology.* 2014;30(4):536–540.
10. Hadzic A. *Textbook of Regional Anesthesia and Acute Pain Management.* New York: McGraw-Hill Education; 2017.