

EFFICACY OF LANDMARK VS. ULTRASOUND-GUIDED TECHNIQUES FOR SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK IN UPPER LIMB SURGERY: A RANDOMIZED PROSPECTIVE TRIAL

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Abstract

Background: This study compares the effectiveness of the landmark technique and ultrasound-guided technique for performing supraclavicular brachial plexus block in patients undergoing upper limb surgeries. The aim was to evaluate differences in procedure time, sensory and motor block onset, block effectiveness, and complications. **Materials and Methods:** A total of 50 patients were randomly assigned to two groups (25 patients each): Group LM (landmark technique) and Group US (ultrasound-guided technique). Outcomes such as procedure time, sensory and motor block onset, block effectiveness, and complications were recorded and analyzed. **Result:** The ultrasound-guided technique resulted in significantly better block effectiveness (100% complete block in Group US vs. 90% in Group LM) and fewer complications (0% vs. 16.7% in Group LM). However, Group US required more time to perform the procedure (590.12 seconds vs. 310.45 seconds for Group LM). **Conclusion:** Ultrasound guidance provides improved block effectiveness and fewer complications compared to the landmark technique, although it requires a longer procedure time. Ultrasound guidance may be the preferred method for supraclavicular brachial plexus block, especially when precision and safety are critical.

INTRODUCTION

Supraclavicular brachial plexus block (SCBPB) is one of the most commonly used regional anesthesia techniques for upper limb surgeries, offering effective analgesia and muscle relaxation. The technique targets the brachial plexus at the level of the supraclavicular fossa, providing anesthesia to the entire upper extremity. Traditionally, SCBPB has been performed using the landmark technique, which relies on the identification of anatomical landmarks to guide needle placement. Despite its widespread use, the landmark technique has limitations, including the potential for inadvertent complications and a relatively higher failure rate in certain patients.^[1]

In recent years, the introduction of ultrasound guidance has revolutionized regional anesthesia by offering real-time visualization of anatomical structures such as blood vessels, nerves, and surrounding tissues.^[2] Ultrasound-guided techniques are believed to improve the accuracy and safety of regional blocks, reducing the risk of complications

such as inadvertent vascular puncture or nerve injury.^[3] Furthermore, ultrasound guidance may enhance the effectiveness of the block by allowing for better needle placement and precise deposition of local anesthetics around the nerve.^[4]

The landmark technique, while effective, is not without its drawbacks, including variability in the procedure time and difficulties in identifying optimal needle placement, especially in patients with anatomical variations or obesity.^[5] Conversely, the ultrasound-guided technique offers the advantage of real-time feedback, which may reduce the overall procedure time and improve the onset and duration of sensory and motor blockade.^[6] Several studies have shown that ultrasound guidance results in a quicker block onset and more consistent outcomes compared to the landmark technique.^[7] Additionally, the visual guidance offered by ultrasound may reduce the occurrence of complications associated with needle misplacement, such as pneumothorax or vascular puncture.^[8]

The aim of this study is to compare the effectiveness of the landmark technique and the ultrasound-guided technique for supraclavicular brachial plexus block,

focusing on several key parameters. These include procedure time, the onset and duration of sensory and motor blockade, the effectiveness of the block, and the incidence of complications. By evaluating these outcomes, this study seeks to determine which technique provides superior results in terms of both clinical efficacy and patient safety for upper limb surgeries.

MATERIALS AND METHODS

This was a prospective, randomized, controlled trial conducted at a tertiary care hospital in Gujarat. The study aimed to compare the effectiveness of the landmark technique versus the ultrasound-guided technique for performing supraclavicular brachial plexus block in patients scheduled for upper limb surgeries.

The study was conducted after obtaining ethical committee clearance and institutional approval. Informed consent was obtained from all patients before their participation in the study.

A total of 50 patients scheduled for upper limb surgeries were included in the study. Patients were selected based on specific inclusion and exclusion criteria. The inclusion criteria included adults between the ages of 18 and 60 years, ASA physical status I and II, and those undergoing elective upper limb surgeries requiring regional anesthesia. Exclusion criteria included patients with allergies to local anesthetics, a history of neurological disorders, poor general health, or contraindications to regional anesthesia.

All patients underwent a routine pre-anesthetic evaluation, which included a thorough clinical history, physical examination, and relevant investigations. Premedication was administered according to standard protocols. An intravenous (IV) access was established using a 20G IV cannula on the opposite side of the limb undergoing surgery.

The patients were randomly allocated into two groups using a computer-generated randomization table.

Each group consisted of 25 Patients

- Group LM (Landmark Technique): Patients in this group underwent supraclavicular brachial plexus block using the traditional landmark technique.
- Group US (Ultrasound-guided Technique): Patients in this group underwent supraclavicular brachial plexus block with the assistance of ultrasound guidance.

Procedure

1. Group LM (Landmark Technique): The landmark technique was performed by identifying the clavicular head of the sternocleidomastoid muscle and the subclavian artery. The block was performed using a single injection technique under local anesthesia with a 22G needle.

2. Group US (Ultrasound-guided Technique): The ultrasound-guided technique was performed using a high-frequency linear ultrasound probe to visualize the brachial plexus in the supraclavicular fossa. A 22G needle was used to inject the local anesthetic after identifying the brachial plexus and surrounding structures.

Data were analyzed using appropriate statistical methods. Descriptive statistics were used to summarize the patient demographics and baseline characteristics. Continuous variables were compared using the t-test, and categorical variables were analyzed using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

[Table 1] compares the age distribution between two groups. Group LM had a mean age of 32.45 years with a standard deviation of 9.87, and a p value of 0.62, indicating no significant age difference. Group US had a mean age of 37.82 years with a standard deviation of 14.22, though t value and p value were not provided.

[Table 2] presents the sex distribution across the study groups. In Group LM, 52% were male and 48% were female, while in Group US, 56% were male and 44% were female. The total study population consisted of 54% males and 46% females, with no significant difference between the groups ($p = 0.352$).

[Table 3] compares the time taken for the procedure between the two groups. Group LM had a mean time of 310.45 seconds with a standard deviation of 65.23, while Group US had a mean time of 590.12 seconds with a standard deviation of 115.67. The difference was statistically significant ($p < 0.05$).

[Table 4] compares the onset of sensory and motor blockade between the two groups. Group LM had a faster onset for sensory (11.5 seconds) and motor blockade (18.4 seconds) compared to Group US (7.98 seconds and 16.3 seconds, respectively). Both differences were statistically significant ($p < 0.0001$).

[Table 5] presents the effectiveness of the block in the two groups. In Group LM, 10% of patients experienced incomplete blocks, while 90% had complete blocks. In Group US, all patients (100%) had complete blocks. Overall, 95% of the total study population had a complete block. The difference between the groups was statistically significant ($p = 0.0212$).

[Table 6] presents the complications observed in the study groups. In Group LM, 16.7% of patients experienced complications, while none in Group US had complications. Overall, 8.3% of the total study population experienced complications. The difference between the groups was statistically significant ($p = 0.001$).

Table 1: Age distribution in study group.

Group	Mean Age	Standard Deviation	t value	p value
Group LM	32.45	9.87	-1.526	0.62
Group US	37.82	14.22		

Table 2: Sex distribution in study group.

Sex	Group LM	Group US	Group Total	Percentage LM	Percentage US	Percentage Total	p value
Male	13	14	27	52.00%	56.00%	54.00%	0.352
Female	12	11	23	48.00%	44.00%	46.00%	

Table 3: Time taken for procedure.

Time Taken for Procedure (in seconds)	Mean	Standard Deviation	t value	p value
Group LM	310.45	65.23	-13.235	<0.05
Group US	590.12	115.67		

Table 4: Onset of sensory and motor blockade.

Onset of Sensory Blockade	Mean	Standard Deviation	t value	p value
Group LM	11.5	2.17	7.98	<0.0001
Group US	7.98	1.55		
Onset of Motor				
Group LM	18.4	1.43	8.43	<0.0001
Group US	16.3	1.51		

Table 5: Effectiveness of the block.

Effectiveness of the Block	Group LM	Percentage	Group US	Percentage	Group Total	Percentage	p value
Incomplete	3	10.00%	0	0.00%	3	5.00%	0.0212
Complete	27	90.00%	30	100.00%	57	95.00%	

Table 6: Complications

Complications	Group LM	Percentage LM	Group US	Percentage US	Group Total	Percentage Total	p value
Present	5	16.70%	0	0.00%	5	8.30%	0.001
Absent	25	83.30%	30	100.00%	55	91.70%	

DISCUSSION

This study aimed to compare the efficacy and outcomes of supraclavicular brachial plexus block performed using the landmark technique (Group LM) and ultrasound-guided technique (Group US) for upper limb surgeries. The findings highlight key differences between the two techniques in terms of age distribution, sex distribution, time taken for the procedure, onset of sensory and motor blockade, effectiveness of the block, and complications.

The study revealed no significant differences in age distribution between the two groups ($p = 0.110$). Group LM had a mean age of 34.07 years, while Group US had a mean age of 39.67 years. Both groups were comparable in terms of the age range, which reduces the potential bias related to age in the comparison of the two techniques. The sex distribution also did not show any significant difference between the two groups ($p = 0.352$), ensuring that the gender factor did not influence the study outcomes.

A significant difference was observed in the time taken for the procedure between the two groups ($p < 0.05$). Group LM took a mean of 310.45 seconds, whereas Group US took significantly longer, with a mean of 590.^[12] seconds. This finding is consistent with previous studies, which suggest that ultrasound-guided blocks tend to take longer initially due to the need for real-time visualization of the anatomical structures. However, despite the longer procedure time, ultrasound guidance may provide more precise needle placement and increase safety by reducing the

likelihood of complications such as vascular puncture or pneumothorax.^[9]

The study found that Group LM had a faster onset of sensory and motor blockade compared to Group US. Group LM showed a mean onset of sensory blockade of 11.5 seconds and motor blockade of 18.4 seconds, while Group US showed a mean onset of 7.98 seconds and 12.10 seconds, respectively. The faster onset in Group US is likely due to the superior precision of ultrasound guidance in targeting the nerve directly. The difference in onset times between the groups was statistically significant ($p < 0.0001$), highlighting the faster and more reliable blockade achieved with ultrasound guidance.^[10]

The effectiveness of the block was assessed based on the number of incomplete and complete blocks in each group. In Group LM, 90% of the patients achieved a complete block, while in Group US, all patients (100%) had a complete block. The statistical analysis showed a significant difference in block effectiveness between the two groups ($p = 0.0212$), indicating that ultrasound guidance may enhance the overall effectiveness of the block by providing more accurate placement of the anesthetic.^[11]

The incidence of complications was significantly lower in Group US compared to Group LM. In Group LM, 16.7% of patients experienced complications, whereas none in Group US experienced complications. This difference was statistically significant ($p = 0.001$), suggesting that the ultrasound-guided technique may reduce the likelihood of complications by allowing for real-time visualization of the anatomy, thereby improving the accuracy and safety of the procedure.^[2,13]

CONCLUSION

In conclusion, the ultrasound-guided technique for supraclavicular brachial plexus block demonstrated several advantages over the landmark technique, including a higher success rate, lower complication rate, and more reliable block. Although it required a longer time to perform, the ultrasound-guided technique provided better control and accuracy, leading to improved overall outcomes. These findings suggest that ultrasound guidance should be considered the preferred method for performing supraclavicular brachial plexus blocks, particularly in patients where precision and safety are paramount. However, further studies with larger sample sizes and long-term follow-up are needed to confirm these findings and assess the clinical implications of the time difference and effectiveness over a prolonged period.

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