Section: Pediatrics

Original Research Article

ULTRASOUND-GUIDED CROSSWISE APPROACH OF POPLITEAL SCIATIC NERVE BLOCK VERSUS SUPINE LATERAL APPROACH FOR POPLITEAL SCIATIC NERVE BLOCK FOR BELOW-KNEE SURGERIES IN COMBINATION WITH ADDUCTOR CANAL BLOCK : A RANDOMIZED CONTROLLED TRIAL

Boyapati Gowtham Krishna[1], Vijayakumar.S[2], Hari Babu.V[3]

[1]Postgraduate, Department of Anaesthesiology, AVMCH, Puducherry, India.
[2]Assistant professor, Department of Anaesthesiology, AVMCH, Puducherry, India.
[3]Professor, Department of Anaesthesiology, AVMCH, Puducherry, India.

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Corresponding Author:
Dr. Boyapati Gowtham Krishna,
Email: gkpboyapati1@gmail.com

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ABSTRACT

Background: The Combination of Ultrasound-Guided Popliteal Sciatic Nerve Block and Adductor Canal Block serves as the standard method for performing Below-knee procedures. The technical efficiency of various ultrasound methods still needs to receive more investigation. The Study Evaluated Comparison of Block performance time between Crosswise approach and Supine Lateral approaches of ultrasound-guided popliteal sciatic nerve block. **Materials and Methods:** The study involved 82 patients who Underwent Elective Below-knee Surgeries at the hospital. Patients were randomized into two groups: Crosswise approach (Group C, n=41) and Supine Lateral approach (Group S, n=41). The patients received Popliteal Sciatic Nerve Block through 15 mL 0.5% levobupivacaine and Adductor canal block through 10 mL 0.25% levobupivacaine. The researchers measured Block Performance Time as the Primary outcome. The secondary outcomes included Four different time measurements which were Imaging time, Needling time and Time of Onset of Motor Block and Time of Onset of Sensory Block. **Results:** The performance time for blocks in Group C showed a significant reduction because they completed their tasks in 3.8 minutes with a standard deviation of 0.8 minutes but Group S needed 4.7 minutes with a standard deviation of 0.9 minutes to complete their tasks ($p < 0.001$). The crosswise group completed all tasks faster than the other group which included imaging time of 1.4 ± 0.5 versus 2.0 ± 0.6 minutes and needling time of 2.3 ± 0.6 versus 3.0 ± 0.7 minutes and sensory onset of 7.6 ± 1.2 versus 8.8 ± 1.3 minutes and motor onset of 11.0 ± 1.5 versus 12.4 ± 1.6 minutes ($p < 0.001$). **Conclusion:** The crosswise approach has better technical performance and higher operational efficiency than the supine lateral approach for ultrasound-guided popliteal sciatic nerve block.

INTRODUCTION

The use of regional anaesthesia has become essential for lower limb surgical procedures because it delivers focused pain relief while maintaining stable blood pressure and reducing the need for opioids. The use of peripheral nerve blocks has become a preferred method in enhanced recovery protocols because they help patients move better while achieving better health results.[1,6]

The popliteal sciatic nerve block serves as an essential anesthesia method for patients undergoing knee and foot surgical procedures. The combination of an adductor canal block with this technique provides patients complete sensory coverage while allowing them to keep their quadriceps strength. The use of ultrasound guidance enables medical professionals to directly see neural structures and needle pathways and the distribution of local anaesthetic which leads to higher safety and success rates for block procedures.[2,3]

Multiple ultrasound approaches for popliteal sciatic nerve block have been described. The supine lateral approach is widely used but may be technically challenging due to steep needle angles and suboptimal visualization in some patients. The crosswise (transverse) approach provides short-axis imaging of the nerve, potentially improving needle control and reducing procedure time.[4,5]

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The performance time of block procedures functions as a significant outcome measurement which still remains poorly documented because it affects both patient satisfaction and the efficiency of operating rooms. This study aimed to compare technical performance parameters between crosswise and supine lateral approaches.[6]

MATERIALS AND METHODS

The Institutional Ethics Committee approved the randomized controlled trial which required participants to provide written informed consent.

The study included adults aged 18 to 60 years who had ASA I to III medical conditions and required elective below-knee surgery. The study excluded participants who had allergies or infections or coagulopathy or body mass index exceeding 30 kg/m² or who were pregnant.

The Anesthesia Team conducted randomization through the use of sealed opaque envelopes which kept patient identities hidden from the study team. The study employed patient blinding methods.

The popliteal sciatic block required 15 mL of 0.5% levobupivacaine The adductor canal block required 10 mL of 0.25% levobupivacaine

The main outcome measure assessed the duration needed to complete the medical procedure. The secondary outcome measures included duration for medical imaging and duration for needle insertion and time for sensory and motor functions to begin.

The Anesthesia Team applied an independent t-test which revealed significant results at $p<0.05$.

Statistical Analysis: Data were analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation. The independent t-test was used for intergroup comparison. A p-value < 0.05 was considered statistically significant.

RESULTS

Eighty-two patients completed the study

Parameter	Crosswise	Supine lateral	p-value
Block performance time (min)	3.8 ± 0.8	4.7 ± 0.9	<0.001
Imaging time (min)	1.4 ± 0.5	2.0 ± 0.6	<0.001
Needling time (min)	2.3 ± 0.6	3.0 ± 0.7	<0.001
Sensory onset (min)	7.6 ± 1.2	8.8 ± 1.3	<0.001
Motor onset (min)	11.0 ± 1.5	12.4 ± 1.6	<0.001

Table 1: Comparison of Block Performance Time

Group	Mean ± SD (minutes)	p-value
Crosswise approach	3.8 ± 0.8	
Supine lateral approach	4.7 ± 0.9	< 0.001

Table 2: Comparison of Imaging Time

Group	Mean ± SD (minutes)	p-value
Crosswise approach	1.4 ± 0.5	
Supine lateral approach	2.0 ± 0.6	< 0.001

Table 3: Comparison of Needling Time

Group	Mean ± SD (minutes)	p-value
Crosswise approach	2.3 ± 0.6	
Supine lateral approach	3.0 ± 0.7	< 0.001

Table 4: Comparison of Sensory Block Onset Time

Group	Mean ± SD (minutes)	p-value
Crosswise approach	7.6 ± 1.2	
Supine lateral approach	8.8 ± 1.3	< 0.001

Table 5: Comparison of Motor Block Onset Time

Group	Mean ± SD (minutes)	p-value
Crosswise approach	11.0 ± 1.5	
Supine lateral approach	12.4 ± 1.6	< 0.001

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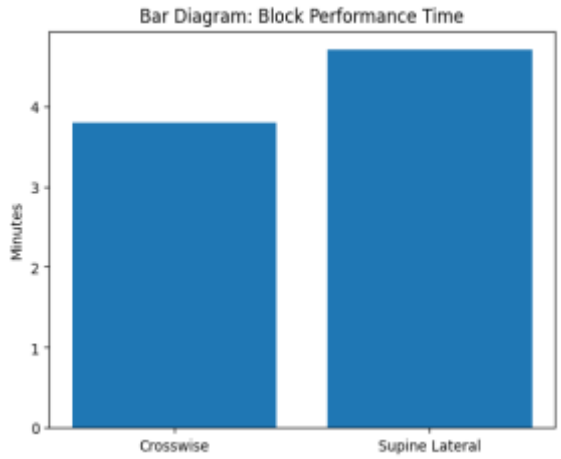

Figure 1: Bar diagram showing block performance time

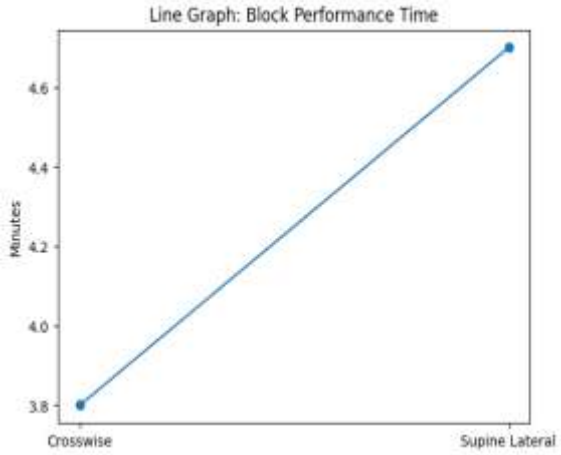

Figure 2: Line graph comparing block performance time

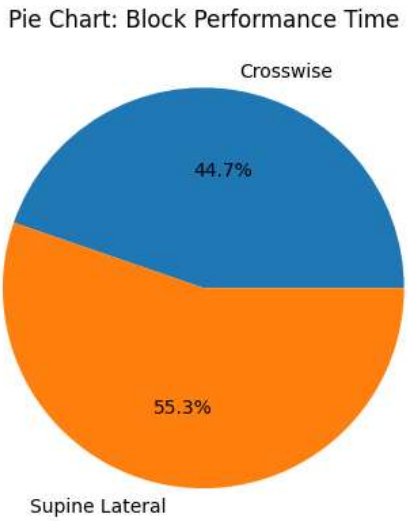

Figure 3: Pie chart distribution of block performance time

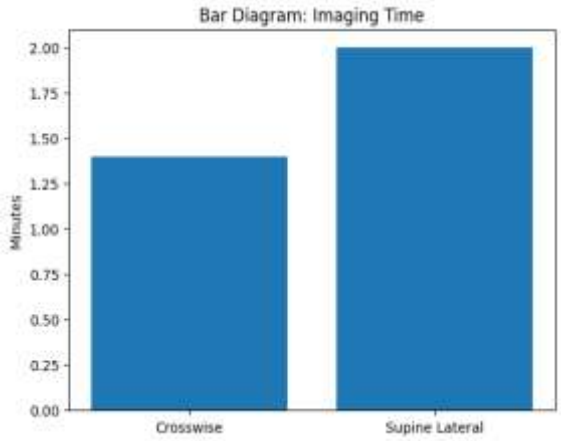

Figure 4: Bar diagram showing imaging time

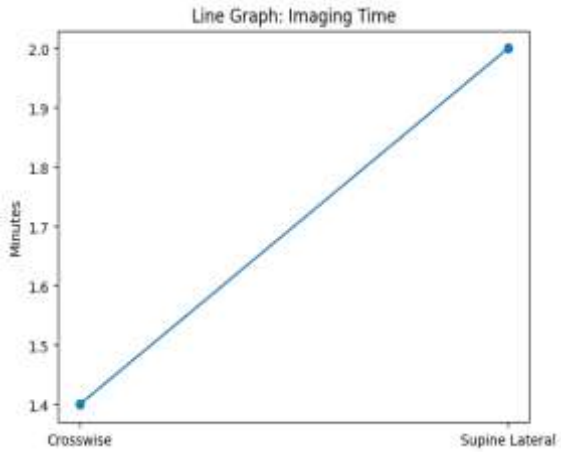

Figure 5: Line graph comparing imaging time

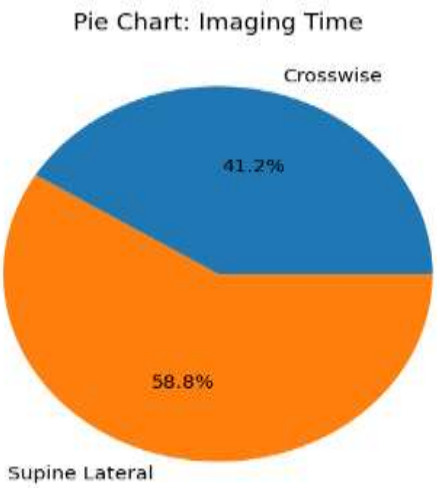

Figure 6: Pie chart distribution of imaging time

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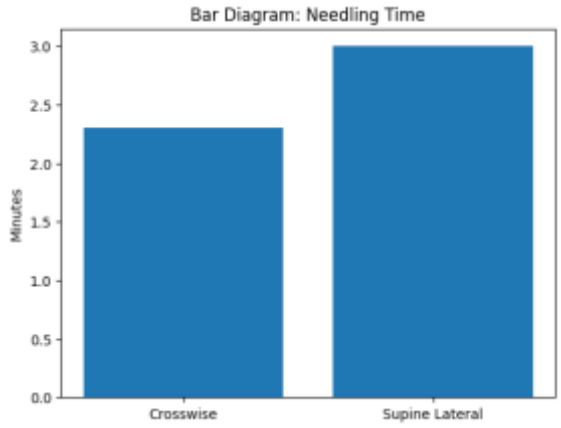

Figure 7: Bar diagram showing needling time

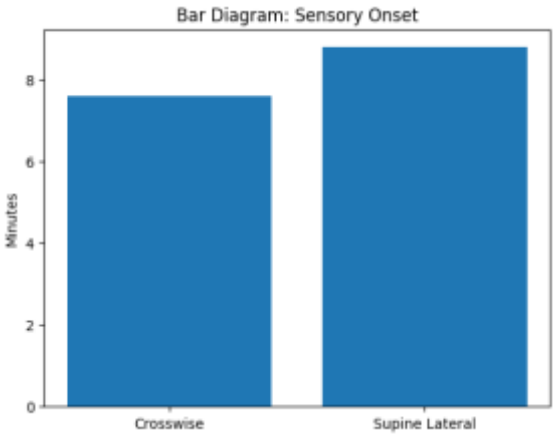

Figure 10: Bar diagram showing sensory block onset

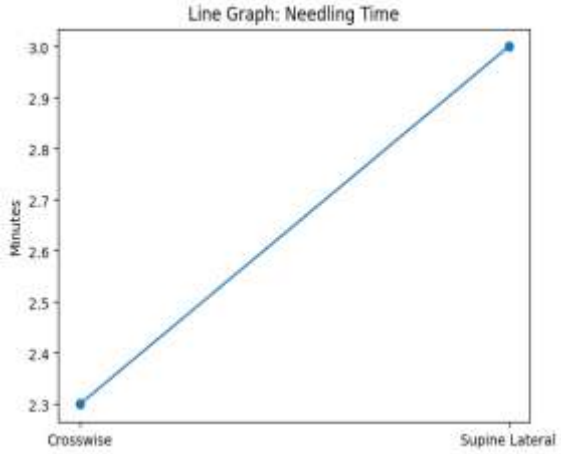

Figure 8: Line graph comparing needling time

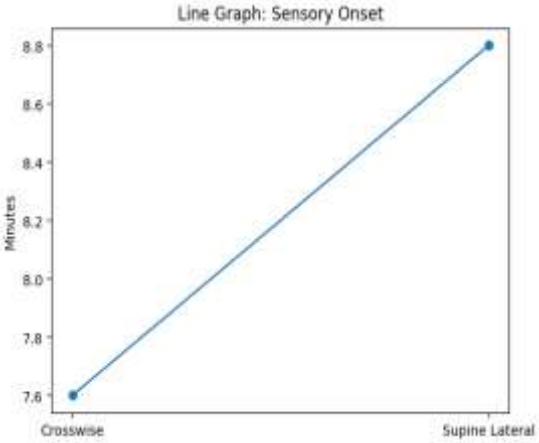

Figure 11: Line graph comparing sensory block onset

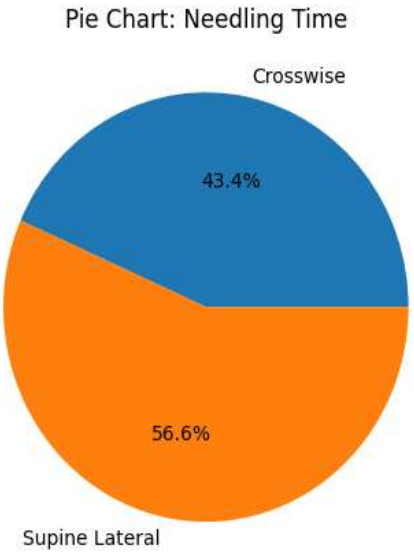

Figure 9: Pie chart distribution of needling time

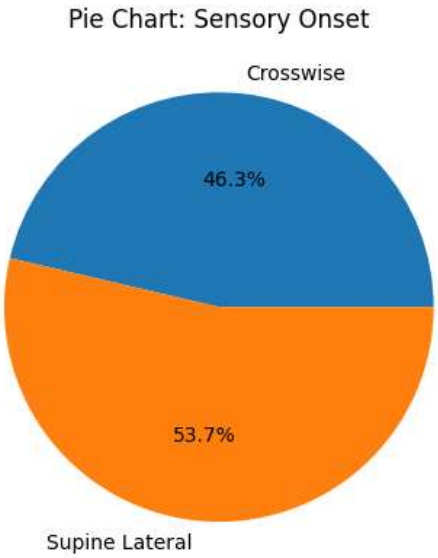

Figure 12: Pie chart distribution of sensory block onset

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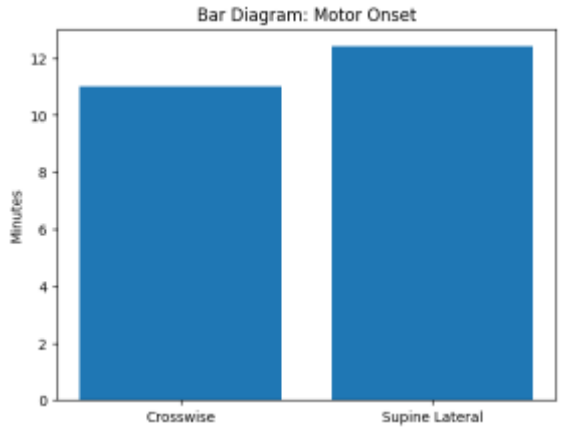

Figure 13: Bar diagram showing motor block onset

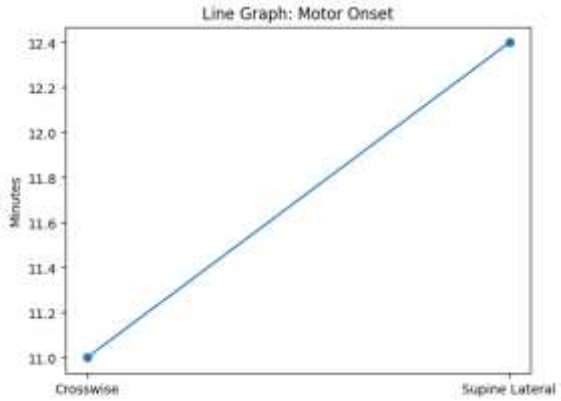

Figure 14: Line graph comparing motor block onset

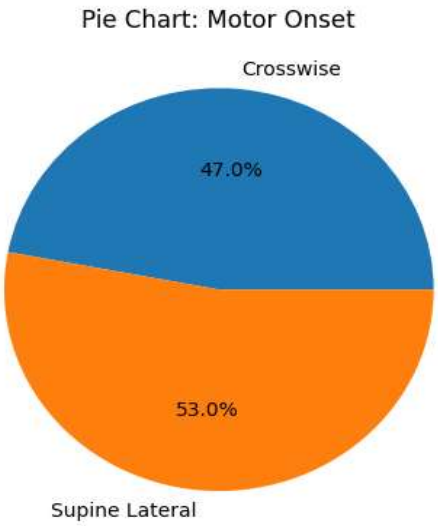

Figure 15: Pie chart distribution of motor block onset

Figure 16: Levobupivacaine 0.25%

Figure 17: CAPS Block Positioning

Figure 18: USG Image of CAPS Block

DISCUSSION

The current trial shows that the crosswise ultrasound-guided method delivers better technical performance than the supine lateral method. The research showed that all essential times for blocking and imaging and needling activities decreased while patients achieved sensory and motor blockage faster than expected. The results demonstrate that the way doctors position the probe and see the needle affects their ability to perform medical procedures.[2,5]

The time required to complete block procedures serves as a practical measurement for determining how efficiently regional anaesthesia procedures are

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executed.[6] The crosswise method in our research reduced total blocking duration by almost one minute. Saving time at each individual level leads to significant clinical benefits when applied in medical facilities with high patient volume. The researchers established that fast nerve detection combined with constant needle visibility serves as the foundation for effective block execution.[6]

The crosswise group experienced decreased imaging duration because they obtained superior viewing capabilities of the sciatic nerve through short-axis imaging. The process of transverse scanning enables users to observe precise cross-sectional body structures while decreasing the frequency at which they must make changes to their scanning equipment. Schafhalter-Zoppoth et al. used transverse imaging to demonstrate that this method improves both anatomical understanding and the scanning method of operation.[7] Kim et al. achieved shorter imaging durations through short-axis ultrasound methods which maintained their success rates intact.[8]

The crosswise group experienced reduced needling time according to their findings. The method of continuous in-plane visualization enables more precise needle control which results in fewer instances of needle redirection. The study by Brull et al. demonstrated that continuous needle tracking system improves both safety and efficiency during medical procedures.[9] The supine lateral approach requires extensive needle angling because it obstructs view of the needle tip which extends the time needed to handle the needle.[4]

The crosswise group showed better local anaesthetic distribution because their blockade effects began earlier than control group members. Short-axis imaging allows confirmation of circumferential spread around both tibial and common peroneal components. Casati et al. reported that accurate perineural deposition of levobupivacaine accelerates onset without increasing volume.[10] The observation of faster sensory and motor onset results from the even distribution of anaesthetic throughout the body. Previous literature has primarily evaluated block success and analgesic duration rather than technical performance.[5,8] Transverse ultrasound orientation shows that our research provides objective proof which results in better procedural efficiency without block quality loss.

The medical field benefits from techniques which produce fast results because they provide consistent outcomes which improve patient experiences while streamlining hospital procedures. Improved needle visualization may also reduce complications such as vascular puncture. The crosswise approach therefore represents a practical advancement in routine regional anaesthesia practice.[2,6]

CONCLUSION

The ultrasound-guided crosswise popliteal sciatic nerve block showed superior technical efficiency compared to the supine lateral approach. It significantly reduced overall block performance time. Imaging and needling times were shorter, indicating easier sonoanatomy identification and needle handling. The onset of sensory blockade was faster with the crosswise technique. Motor blockade also occurred earlier, reflecting better anesthetic spread. Thus the crosswise ultrasound-guided approach shows greater efficiency and faster results than the supine lateral approach, which makes it suitable for common below-knee surgical procedures.

Limitations

The study was limited by its single-center design, restricting generalizability. Use of convenience sampling introduced potential selection bias. Only technical performance parameters were evaluated. Postoperative analgesia, patient satisfaction, and functional recovery were not assessed. The trial was single-blinded due to the impracticality of operator blinding. Long-term outcomes and rare neurological complications were not evaluated.

Declarations

Ethical Approval: This Study Was Approved By The Institutional Ethics Committee.

Patient Consent: Written Informed Consent was Obtained from Patients or Guardians

Financial support and Sponsorship: Nil

Conflicts of Interest: There are No Conflicts of Interest

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