

An Observational Study of Patients Undergoing Below Knee Surgeries under Popliteal Fossa Block and Saphenous Nerve Block**Viralkumar Ashokbhai Vaghela¹, Kinjal Ashokbhai Vaghela², Hetal Chaudhari³, Dharmesh Galiya^{4*}**¹Senior Resident, Department of Anesthesia, GMERS Medical College and Hospital, Vadnagar²Senior Resident, Department of Anesthesia, GMERS Medical College and Hospital, Gandhinagar³Senior Resident, Department of Anesthesia, GMERS Medical College and Hospital, Gandhinagar⁴Consultant Radiologist, Department of Radiodiagnosis, SMVS Hospital, Gandhinagar

Received: 30-11-2023 / Revised: 10-12-2023 / Accepted: 12-12-2023

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Conflict of interest: Nil

Abstract:

Background and objectives: Most of the below knee surgeries are done under spinal anaesthesia. Due to more haemodynamic stability, better postoperative analgesia, early mobilization and less hospital stay, popliteal-sciatic nerve block more preferable over conventional methods. Popliteal-sciatic nerve block at branching point of tibial and common peroneal component prevents nerve sparing effects and saphenous nerve block along with it provide better analgesia over medial aspect of leg. There are various methods to perform block. In this prospective observational study, we used dual technique (USG & PNS guided technique) for popliteal-sciatic-saphenous nerve block to observe technical difficulty, ease of insertion, onset, duration and complications of block.

Methods: Thirty patients were included in this study. Under all aseptic precautions, we performed popliteal-sciatic nerve block with posterior approach in prone position and saphenous nerve block in supine position by using dual technique with local anesthetic agent inj. Bupivacaine 0.5% 30ml and 10ml respectively. Data were analyzed by using STATA 14.2 version.

Results: The average mean time for performing block was 33.4min while, in in-plane and out of plane techniques were 33.2min and 34min respectively. The mean onset time of sensory and motor blockade were 16.1min and 19.03min respectively. The average total mean duration of sensory blockade, motor blockade and analgesia were 8.16hours, 6.83hours and 9hours.

Conclusion: We observed that dual technique for popliteal-sciatic-saphenous nerve block is very helpful for achieving analgesia and anesthesia in below knee surgeries.

Keywords: Block, Knee Surgeries, Sciatic Nerve, Saphenous Nerve.

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Introduction

Most of the below knee surgeries are done under spinal anaesthesia but, sciatic nerve block at popliteal fossa can also be used for the same. Popliteal-sciatic nerve block provides several advantages over conventional anaesthesia methods [1] i.e. more haemodynamic stability, better postoperative analgesia, early mobilization, No airway manipulation. Sciatic nerve is thickest nerve of human body and consist of tibial component and peroneal component.[2] Below knee surgeries like wound debridement, ray's amputation, vein stripping, below knee amputation, tendon repair surgeries, can be done by performing popliteal-sciatic block.

Popliteal-sciatic nerve block [3] for below knee surgeries can be achieved by blocking tibial component or peroneal component but sometimes

patchy effect can be seen which can be prevented by blocking at branching point.[11] The popliteal block can be performed by blind technique (Anatomical surface landmarks technique) or using peripheral nerve stimulator (PNS) [3] or by ultrasound (USG) guided technique.

In blind technique [3], the main advantage is that, it is cost effective but requires high knowledge of anatomical landmarks. In presence of anatomical variations in individuals, it can be difficult to perform and can subsequently lead to block failure. It may cause accidental intravascular infiltration, accidental nerve injury and may require large volume of drug at times leading to local anaesthesia systemic toxicity (LAST). Peripheral nerve stimulator [4] is used to locate exact site of nerve by delivering electrical stimuli that stimulates the

nerve and causes muscle contraction. However, the drawbacks are it cannot visualize the anatomical structures, needle placement, needle penetration and infiltration of drug

Ultrasound guided block technique [5] provides real time image so that it is more accurate to visualize the nerve and drug delivery. However, the drawbacks are it is expensive; it requires knowledge about sono-anatomy and well-experienced operator hand to use the ultrasound probe.

If we use dual technique (USG guided technique + PNS guided technique) for popliteal-sciatic-saphenous nerve block [6], we can visualize the sciatic nerve before branching into tibial nerve and common peroneal nerve and this will be further confirmed by PNS and provides complete sensory blockade over medial aspect of leg and foot with assisted saphenous nerve block.

In this observational study, we gave posterior approach popliteal fossa block and saphenous nerve block (adductor canal block) by dual technique for below knee surgeries [6]. We observed technical difficulty, ease of insertion, onset of action, duration of action and complications of this technique.

Material and Methods

After obtaining institutional ethics committee approval (IEC/BU/131/Faculty/12/239) and Clinical Trial Registry of India registration-(CTRI/2022/04/041640) this prospective observational study was carried out in 30 patients with inclusion criteria's are age > 18 years of either gender, American Society of Anaesthesiologist (ASA) grade I-III physical status and patients underwent below knee surgeries of either limb at Shree Krishna Hospital, Karamsad, Anand.

The analysis was performed by using STATA (14.2). Descriptive statistics [Mean (SD), Frequency (%)] were used to portray the base line profile of the study population and clinical outcomes. Pre-anaesthetic check-up was carried out in all patients with detailed clinical history, general history, as well as general and systemic examination. After confirmation of nil per oral status, preoperative preparations were done for the patient. A peripheral intravenous line was secured, a blood pressure cuff, ECG leads and pulse oximetry probe were attached. All the patients were hydrated with intravenous fluid to ensure adequate hydration. Standard pre-operative and intra-operative monitoring with continuous electrocardiogram, heart rate, pulse oximetry and non-invasive arterial blood pressure was done.

We used dual technique (ultrasound guided + peripheral nerve stimulator guided technique) for

popliteal-sciatic-saphenous nerve block in this study. We randomly used in-plane and out-of plane approach for ultrasound guidance. Popliteal-sciatic nerve block was done by posterior approach in prone position. Transducer was placed in transverse position at the level of popliteal crease and the popliteal artery and vein were identified and confirmed with color Doppler. The tibial nerve and common peroneal nerves are positioned superficial and lateral to the vein, which is seen as a hyperechoic, oval or round structure with a honeycomb pattern. Patient was asked to dorsiflex and plantarflex the ankle that makes the two sciatic nerve branches twist or move in relation to each other.

Transducer was slid proximally until the tibial and peroneal nerves were visualized coming together to form the sciatic nerve before its division. This junction usually occurs at a distance 5–10 cm from the popliteal crease. After proper visualisation, 50-100mm, 21/22gauge stimplex needle was advanced towards sciatic nerve; electric current from peripheral nerve stimulator was fired. The nerve stimulator was initially set to deliver 1.5 mA current (2 Hz, 100µsec) Common peroneal nerve stimulation results in dorsiflexion and eversion. Tibial nerve stimulation results in plantar flexion and inversion. Then the current was decreased up to 0.5 mA, to prevent inadvertent needle placement inside the nerve bundle. Then on stabilizing the needle and after negative aspiration for blood, 30ml of local anaesthetic agent- inj. Bupivacaine (0.5%) was slowly injected which was confirmed by visualising real time image of drug delivery by ultrasound.

Saphenous nerve block was done at adductor canal in supine position transducer was placed in transverse position over the antero-medial aspect of thigh at the junction between middle third and distal third of the thigh, femoral artery was identified and traced distally by Doppler mode. A hyperechoic structure identified just anterior to the femoral artery is the saphenous nerve passing through the adductor canal. Block needle was inserted and advanced from lateral to medial direction towards the saphenous nerve. The nerve stimulator was initially set to deliver 1mA current, which produced contractions of muscles of antero-medial thigh. Later on current was minimized up to 0.5mA and twitches over patella and vastus medialis muscle were sought for. This sign suggests that needle is at the site of saphenous nerve. After intermittent negative aspiration for blood local anaesthetic agent- inj. Bupivacaine (0.5%) 10ml was delivered. Dispersion of drug was seen under real time ultrasound guidance.

We noted various timing of observation and assessed the outcome

T0-Time of complete administration of drug

T1-Time of complete absence of sensation

T2-Time of complete return of sensation

T3-Time of complete loss of muscle function.

T4-Time of complete return of muscle function.

Onset of sensory block (T1-T0) – it is defined as the time interval between the complete administration of drug (T0) and absence of sensation to pinprick (T1).

Duration of sensory block (T2-T1) it is defined as the time interval between onset of complete sensory blockade(T1) to return of normal sensation to pinprick(T2).

Onset of motor block(T3-T0) It is defined as the time interval between the complete administration of drug(T0) and complete loss of muscle function(T3).

Duration of motor block (T4-T3) it is defined as the time interval between onset of complete motor blockade(T3) to return of normal muscle function(T4)

Duration of Analgesia – Time interval between onset of complete sensory block to postoperative VAS score $\geq 4/10$ or time for 1st rescue analgesics

Results

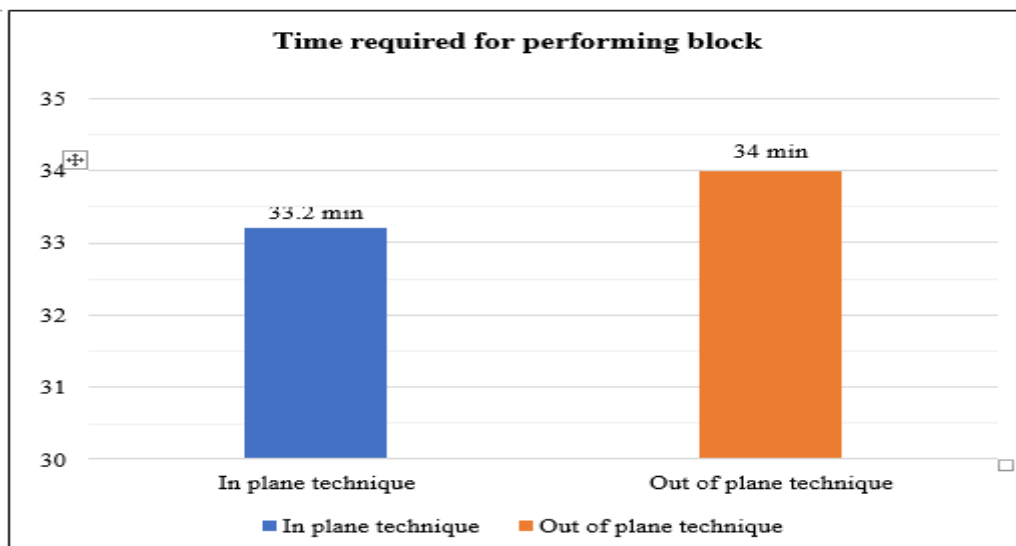
According to our observation, there were 30 patients from various age group included in this study. The mean age was 61.7 years (SD +/- 9.09). Out of all these patients, there were 23 male patients and 7 female patients all the 30 patients had various nutritional status, which was assessed by body mass index (BMI).

The average mean BMI of the patients was 24.1 (SD+/- 5.97). The mean time required for performing both the blocks together was 33.4min (SD +/- 3.61), mean average time required to perform both the blocks in in-plane technique and out-of-plane technique were 33.2 min (SD+/- 3.76) and 34min (SD +/- 3.41) respectively After performing the block, the mean onset of sensory blockade and mean onset of motor blockade were 16.1(SD +/- 2.76) min and 19.03min (SD +/- 2.33) respectively.

The average total mean duration of sensory blockade was 8.16 hours and total mean duration of motor blockade was 6.83 hours, however total mean duration of analgesia was 9 hours We compared for correlation between BMI and time required to perform the blocks, but there was no significant difference observed p value 0.7812 (> 0.05).

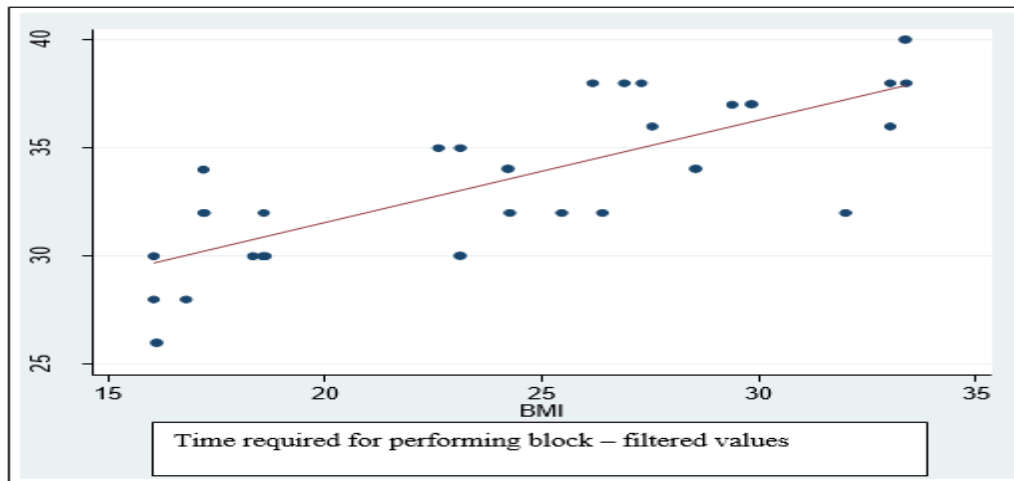
Table 1: Mean onset of blockade

Mean onset of sensory blockade	16.1 min
Mean onset of motor blockade	19.03 min



GRAPH 1: MEAN TIME REQUIRED FOR PERFORMING BLOCK

Figure 1:



GRAPH 2: CORRELATION BETWEEN BMI AND TIME TO PERFORM BLOCK

Figure 2:

Discussion

Most of the below knee surgeries are done under spinal anaesthesia but, sciatic nerve block at popliteal fossa provides better haemodynamic stability and postoperative analgesia. There were so many studies done regarding popliteal-sciatic nerve block to ensure the better outcome.

We conducted a prospective observational study to analyse the effects, technical difficulties and the duration of anaesthesia and analgesia with this block in detail. We used popliteal- sciatic nerve block and saphenous nerve block for providing prolonged anaesthesia and analgesia in below knee surgery patients at our hospital. We used ultrasound guidance for better visualisation of internal anatomy and posterior approach for popliteal-sciatic nerve block for better visualisation of clinical anatomy. An additional use of nerve stimulator in this study provided an accuracy and good outcome of the study. Using combined technique in this study gives better anatomical localisation and visualisation, accuracy for block, visualisation of drug delivery and long duration of analgesia.

Vloka JD et al [1] compared popliteal nerve block with posterior cutaneous nerve of the thigh block versus spinal anaesthesia and demonstrated that both are equally good in anaesthesia. They also confirmed that popliteal-sciatic nerve block is devoid of complications like hypotension, bradycardia, post dural puncture headache and meningitis. In our study, also, we got haemodynamic stability and no adverse events related to the block

Rorie DK et al [3] published the first case report of popliteal block by using anatomical landmark technique. They used classical approach or

posterior approach for better anatomical visualisation. They achieved 66% success rate in this study. In our study, we used classical or posterior approach for better visualisation of anatomy, which was helpful while performing block along with ultrasound and peripheral nerve stimulator. In our study, we achieved 100% success rate with dual technique.

Gouverneur JM et al [4] studied sciatic nerve block in the popliteal fossa with specially designed atraumatic needles and nerve stimulation. He concluded that with nerve stimulator they had better success rate (96%) than the blind technique (54%). However, in our study we used ultrasound for better visualisation of anatomy and real time drug delivery along with peripheral nerve stimulator, which provided 100% success rate as compared to **their study**.

Vincent W. S. Chan et al [5] conducted an observational study in 15 volunteers regarding sciatic nerve examination under ultrasound. They used curved ultrasound probe with range of 2-5Mhz and they examined gluteal, infra gluteal and proximal thigh region.

They used nerve stimulation for confirmation. Hence, they concluded that curved 2-5 MHz ultrasound probe provided good quality sciatic nerve imaging and is a potentially valuable tool for clinical sciatic nerve block. In our study, we used linear probe with range of 5-10Mhz at popliteal fossa, as sciatic nerve is more superficial as compared to gluteal region.

Cornelius M. Donohue et al [6] performed saphenous block by landmark technique along with popliteal block by using peripheral nerve stimulator for ankle and foot surgeries in more than 60 patients over period of 3 years. They concluded

that combined block provides better anaesthesia rather than single popliteal block and none of their patients required conversion into general anaesthesia. However, they performed saphenous nerve block by landmark technique and got 100% success rate, which was clearly explained by superficial location of saphenous nerve at anteromedial aspect of upper part of the leg.

In our study we included dual technique for saphenous nerve block along with popliteal-sciatic nerve block, which was very helpful in providing sensory block specially when operating site involves medial aspects of leg e.g. below knee amputations, foot surgeries.

Shiv Kumar Singh et al [10] studied Peripheral nerve stimulator guided adductor canal block. They used this technique in approximately 300 procedures. They described this novel approach to widen the acceptance of adductor canal block, as it mostly requires ultrasound machine, which might be not accessible at many places easily.

They described this method, which utilizes peripheral nerve stimulation of motor nerves that are found in distal part of adductor canal i.e., the nerve to vastus medialis. The presence of vastus medialis contraction at 0.3 – 0.5 mA can be considered as the end point and the local anaesthetic solution can be injected. They used 20 ml of ropivacaine 0.2% in these cases and observed excellent postoperative analgesia.

In our study, we used saphenous nerve block under ultrasound and peripheral nerve stimulator guidance. Only in few patients' ultrasound guided location of saphenous nerve was accompanied with the twitches of vastus medialis. As per their study, we also got better outcome in analgesia. We used inj. Bupivacaine 0.5% 10ml instead of inj. Ropivacaine 0.2% 20ml used in their study.

Conclusion

We observed that dual technique for posterior approach of popliteal fossa block before bifurcation of sciatic nerve along with saphenous nerve block is very helpful for achieving analgesia and anaesthesia in below knee surgeries. There was no significant difference observed between in-plane and out of plane technique for time to perform block. There was no technical difficulty observed while performing block in high BMI patients.

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