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Anterior approach of ultrasound guided sciatic nerve block for knee and below knee surgeries: A pilot study

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ABSTRACT

Background and Aims: Sciatic nerve block with femoral nerve block besides its advantages has been used to achieve complete anaesthesia for knee and below knee surgery. The anterior approach has been the most seldom used due to absence of reliable landmarks and technical difficulty. We evaluated the clinical application of the anterior approach to Sciatic nerve block under ultrasound guidance. **Methods:** This pilot study was conducted in 30 patients aged 18-59 yrs of ASA I-II who underwent knee and below knee surgery. With patient supine and knee externally rotated, sciatic nerve was approached under ultrasound guidance and 15 ml 0.5% bupivacaine along with 10 ml2% lignocaine with adrenaline was injected. Then 10 ml 0.5% bupivacaine&5 ml 2% lignocaine with adrenaline was injected at femoral nerve. Number of attempts, block execution time, onset of complete sensory and motor block, patient satisfaction was measured. **Results:** Surgical anaesthesia was achieved in 22 patients. 8 patients needed SAB wereas this was a pilot study no comparisons could be made and hence there was no p valueconsidered as failure of procedure. We observed themean number of attempts required to place the needle at site 3.50 ± 1.106; mean block execution time 9.66 ± 3.63 min; mean onset time of sensory block & motor block was 17.83 ± 7.552 min & 24.97 ± 3.479 min respectively. 12 (40%) patients were satisfied with the technique used and reported it as excellent. **Conclusion:** Results of this study show promising outcome in terms of the number of attempts, block execution time, onset of sensory & motor block and patient satisfaction and indicate the need to conduct this study on a larger scale. We conclude that anterior approach is an excellent alternative approach to other approaches for sciatic nerve block especially in patients with multiple injuries

Key words: Anterior approach, pilot study, sciatic nerve anatomy, various approaches for block

INTRODUCTION

The regional anaesthesia has become increasingly popular for lower-limb procedures, especially with the advent of ultrasound guided interventions. Because of its wide sensory distribution, a sciatic nerve block can be used, together with a saphenous or femoral nerve block, for any surgical procedure below the knee that does not require a thigh tourniquet. This form of anaesthesia avoids the sympathectomy associated with neuraxial blocks and may therefore be advantageous when any shift in hemodynamics could be deleterious for the patient.[1-3]

The sciatic nerve supplies motor and sensory innervations to the posterior aspect of the thigh, as well as the entire lower leg, except for the medial side of leg which is supplied by the saphenous nerve (the terminal branch of the femoral nerve). The anterior approach for sciatic nerve block offered several advantages.As it is approached in supine position, it does not require change in patient position and

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could be combined with other lower extremity blocks in the same position. Thereby reducing the time required for performing the combination of blocks as only one area of skin needed to be prepared and the block could be repeated in case of an unexpectedly prolonged surgery.[4,5] An anterior approach should also be considered and preferred in patients after trauma and severe postoperative pain where change of patient positioning can be challenging.[4,5]

However, with the increased use of ultrasound, the anterior approach has gained popularity.Ultrasonography avoids the requirement for the palpation of a femoral pulse or the use of geometry for identification of the skin puncture point.[6,7] In addition, using the ultrasound-guided approach reduces the risk of puncture of the femoral artery as compared with the landmark-based approach.[8]In present pilot study, we studied the usefulness of anterior approach to sciatic nerve block along with femoral nerve block under ultrasound guidance as an alternative anaesthesia technique for procedures involving knee and below knee surgeries.

MATERIAL AND METHODS

The present prospectiveinterventional pilot study was conducted in Department of Anesthesiology and Critical Care, Pt. J N M Medical College and Dr. B R A M Hospital, Raipur(C.G.) after getting permission from the Institutional ethics committee in 30American society of anaesthesiologists grade I & II patients aged between 18- 59 yrs of either sex posted for knee and below knee surgery. Patients who had refused for the procedure, hadneuromuscular disease, CNS disorders especially paraplegia, autonomic dysfunction, diabetes, haemostatic abnormalities, skin infection at the site of needle insertion, on anticoagulation, receiving chronic analgesic, historyof allergy to amide local anaesthetic drugs and could not tolerate positioning for the anterior approach were excluded from the study. Informed, written consent was taken. All patients were advised to remain nil orally for 6 hrs prior to surgery and were given tab Alprazolam 0.25mg orally the night before surgery. Upon arrival in the operation theatre, patients were asked to lie supine on the table, a peripheral vein was cannulated, and infusion of ringer lactate was started. Multipara monitors were attachedand baseline pulse, blood pressure electrocardiogram was noted. Premedication was done with intravenous Metoclopramide 0.2 mg/kg body weight, intravenousranitidine 50mg, intravenous glycopyrolate 0.2 mg. All the patients received ultrasound guided sciatic nerve block by anterior approach combined with femoral nerve block.

For Sciatic nerve block by anterior approach, patients were placed in supine position with the hip and knee on the operated side flexed and the leg externally rotated at approximately 45 degrees. Under all aseptic and antiseptic precautions a low-frequency, 5 to 2 MHz, curved array ultrasound machine Mind ray model m5 C60e was first positioned perpendicular to the skin on the lesser trochanter. The location was then scanned by sliding downward and tilting the transducer until a clear transverse image of the hyper-echoic sciatic nerve located posterior and medial to the lesser trochanter was obtained. After skin infiltration with lignocaine (2%), a short bevel 100-mm, 21-gauge insulated nerve block needle connected to a nerve stimulator Stimuplex BBraun Melsungen AG was inserted parallel and in linefrom anteromedial to posterolateral of the thigh while the sciatic nerve was kept in the middle of the ultrasound screen. The needle was advanced slowly under real-time ultrasound guidance until it was in close proximity to the nerve. A nerve stimulator with a pulse duration of 0.1 ms and stimulating frequency of 2 Hz was then turned on to elicit foot plantar flexion or dorsiflexion. The needle was further adjusted as needed to evoke a motor response at 0.5 mA or less. 25 mllocal anaesthetic mixture of 15 mL bupivacaine (0.5%) and 10 ml lignocaine (2%) with 1:200000 epinephrine was then injected incrementally. The needle-tip was repositionedby tilting laterallyand sideways so that a circumferential spread of the solution could be produced. If the sciatic nerve was not visualized with ultrasound, the patient was excluded from the study.

After sciatic nerve block patient's leg was extended for femoral nerve block. Femoral nerve block was then performed under real-time ultrasound guidance using a high-frequency, 13 to 6 MHz, linear array transducer. With the patient in the supine position, the transducer was positioned to identify the femoral artery and/or nerve. Once the femoral nerve is identified, a skin wheal of local anaesthetic was made on the lateral aspect of the thigh 1 cm away from the lateral edge of the transducer with 26G hypodermic needle using 2 ml of lignocaine (2%). 50-mm, 21-gauge insulated nerve block needle connected to a nerve stimulator was inserted in-plane in a lateral-to-medial orientation and advanced toward the femoral nerve. With nerve stimulation ≤0.3 mA and a pulse of 0.1 ms, the passage of the needle through the fascia iliaca and contact of the needle tip with the femoral nerve was usually associated with a motor response of the quadriceps muscle group. After careful aspiration, 15 ml local anesthetic mixture of 10 ml bupivacaine(0.5%)and 5 ml lignocaine (2%) with 1:200000 epinephrine was then

injected incrementally. During surgery, no additional local anaesthetics were administered, but patients were sedated as requested with bolus IV midazolam 1-2 mg. If surgical anaesthesia was deemed inadequate during surgery, bolus IV injections of pentazocine 30 mg were given at the discretion. If central neuraxial blockade was required in any patient, that patient was considered a failure and details noted.

The primary objective was block execution time for the sciatic nerve block, number of attempts to place the needle at site, time for onset of sensory and motor blocks of the sciatic nerve and patient satisfaction were recorded in all patients.

The secondary objectives were heart rate, systolic blood pressure, diastolic blood pressure, mean blood pressure, respiratory rate and SpO_2 were recorded at every 5 minute till the first 30 minutes, every 10 minutes till 30 minutes, and thereafter hourly till 4hrs.

ASSESSMENT OF SCIATIC NERVE BLOCK

Following parameters were recorded -

Number of attempts to place the needle at site, Block execution time- Time taken from needle insertion through skin to the time when the needle came into close proximity to the nerve [Plantar flexion (tibial nerve)/ Dorsiflexion (common peroneal nerve) of the ankle joint on stimulation with a peripheral nerve stimulator with ≤0.3mA of current]. Onset of sensory block (mins) - Sensory blockade on the operated limb was evaluated every min after injection of local anaesthetic for 15 min, thereafter every 5 mins till 30 mins by pin prick method. Sensory examination was conducted on the plantar aspect of the foot (tibial nerve), the dorsal aspect of the foot (superficial peroneal nerve), and the posterolateral area of the leg (sural nerve). Sensory block was scored as: 0- Normal sensation, 1- Blunted sensation, 2- Absence of all sensation.Sensory block was considered adequate with a score of 2 (absence of all sensations). Onset time was defined as the time required achieving a score of 2. Onset of motor block (mins) - Motor block was assessed by Bromage scale[1,3]every min after injection of local anaesthetic for 15 min, thereafter every 5 mins till 30 mins. For that, Patient was asked to plantar (Tibial Nerve) and dorsiflex (Common Peroneal Nerve) his foot. Motor block was considered complete when patient was neither able to plantar or dorsiflex his foot with a score of 3. Onset time was defined as the time required achieving a score of 3. Motor block was scored[9] as: 0- Full flexion of knee & feet, 1- Partial (able to move knee only), 2- Almost complete (able to move foot), 3- Complete (unable to move foot and knee). Patient Satisfaction-It was assessed using a three point scale[10].1- Poor, 2- Good, 2- Excellent.

Complications like respiratory depression, hypotension, and arrhythmia, cardiac arrest, shivering, delayed recovery of nerve block, paresthesia and numbness associated with block.

Patients were considered completely anesthetized with sensory score of 2 and motor score of 3 in Tibial Nerve and Common Peroneal Nerve distribution. Patients who did not show complete anaesthesia at the end of 30 min period were given central neuraxial anaesthesia and were considered a failure of procedure and details noted. The observed parameter were tabulated and statistically analyzed to determine the overall efficacy and to draw conclusion. The statistical values derived were mean, standard deviation. Software used was Graph Pad Prism 6.07 for Windows.

RESULTS

The demographic profile of the patients is described in table 1.

Table 1: Showing a comparison of the incidence of difficult intubation in children with hydro-cephaulus with the normal paediatric population

Age (yrs)	34.4± 10.07
BMI (kg/m^2)	24.11 ± 0.8731
Sex	Male- 22, Female- 8
Duration of surgery (hrs)	2.253 ±0.5022

Table 2: Showing a comparison of the incidence of difficult intubation in children with hydrocephaulus with the normal paediatric population

Number of attempts	Number of patients
2	6
3	11
4	5
5	8

The numbers of attempts for the blocks are detailed in table 2. Maximum number of patients in this study required at least 3 attempts to place the needle at appropriate site to block Sciatic Nerve. The mean number of attempts was 3.50 ± 1.106 (Table 2). Mean block execution time was 9.66 ± 3.63 mins. Block execution time was 8 mins in maximum number of patients i.e. 14 (46.67%) patients. Minimum & maximum block execution time was 6 mins & 16 mins, respectively. Onset of sensory block was 14-15.9 minsin 13 (43.33%) patients, 12-13.9 mins in 8 (23.33%) patients & 10-11.9 mins in 1 (3.33%) patient.In

8 patients sensory block could not be achieved even after 30 mins. Mean onset of sensory block was 17.83 ± 7.552 mins. Onset of motor block was 24-25.9 minsin 9 (30%) patients, 22-23.9 mins in 7 (23.33%) patients, 20-21.9 mins in 4 (13.33%) patients & 26-27.9 mins in 2 (6.67%) patient. Mean onset time of motor block was found to be 24.97 ± 3.479 mins. 12 (40%) patients were satisfied with the technique used and reported it as excellent. 10 (33.33%) patients were satisfied with the technique used and reported it as good. 8 (26.67%) patients were not satisfied with the technique used and reported it as poor. In these 8 patients, sensory and motor block could not be achieved even after 30 mins, so the technique of anaesthesia was converted to subarachnoid block and were not satisfied with the technique.

One patient had a foot drop following injection of local anaesthetic mixture. In this patient the time to recovery of nerve block was 24 hrs. This patient had a prolonged duration of analgesia for 24 hrs. Post 24 hrs recovery of sciatic nerve was normal. No delayed sequelae of nerve injury were seen. No other complications were observed in rest of the patients.

DISCUSSION

The research question in our study was to check whether sciatic nerve block can be used as a sol modality of anaesthesia for knee and below knee surgeries.The anterior approach was chosen because of its advantages of avoiding patient repositioning in especially in polytrauma patients and in ease of administering sciatic nerve block and femoral nerve block in the same position and thus shortening the performance time & also have best result as regards to patient satisfaction.

In present pilot study, for Sciatic nerve block by anterior approach at the level of lesser trochanter, patients were placed in supine position with the hip and knee on the operated side flexed and the leg externally rotated at approximately 45 degrees. The position of the patient in our study was similar to other studies. [11-13]The mean number of attempts required to place the needle at site was 3.50 ± 1.106 mins. It was more than that required in studies by Jacques E Chelly et al,[14] and Alain C Van Elstraete, et al[15]. This could be because it was a new procedure performed for the first time in our institute and we were not well acquainted with the technique and was taken as a limitation of our experience in performing the block.

Mean block execution time was 9.66 ± 3.63 mins. Block execution time was 8 mins in maximum number of patients i.e. 14 (46.67%) patients. Minimum & maximum time taken to place needle at the appropriate site was 6 mins & 26 mins, respectively. Thus the time taken to execute the sciatic nerve block via anterior approach was more in our study and it did not correlate with studies by Régis Fuzier, et al, Junichi Ota et al & Raed A Alsatli et al. This could be because it was a new procedure performed for the first time in our institute and we were not well acquainted with the technique.

Onset of sensory block was 14-15.9 mins in 13 (43.33%) patients, 12-13.9 mins in 8 (26.67%) patients & 10-11.9 mins in 1 (3.33%) patient. 8 patients took ≥ 30 mins for onset of sensory block and these patients were converted to subarachnoid block. Mean onset of sensory block was 17.83 ± 7.552 mins in tibial nerve/ common peroneal nerve territory. It correlates well with studies by RégisFuzier et al, Wafik A Amin et al & Raed A Alsatli et al., but it was prolonged as compared to the findings of George P Beck, et al, Jacques E Chelly et al and Alain C Van Elstraete et.al.This could be because they had used lidocaine and mepivacaine in their study which has a shorter onset of action as compared to bupivacaine.

The mean onset time of motor block was found to be 24.97 ± 3.479 mins. Onset of motor block was 24-25.9 mins in 9 (30%) patients, 22-23.9 mins in 7 (23.33%) patients, 20-21.9 mins in 4 (13.33%) patients & 26-27.9 mins in 2 (6.67%) patient. In 8 patients it took ≥ 30 mins for onset of motor block and these patients were converted to subarachnoid block. The time to onset of sensory block in this pilot study correlates well with studies by Jacques E Chelly et al., Alain C Van Elstraete et al., & Wafik A Amin et al. Thus patient satisfaction in our study was less as compared to those reported by Wafik A Amin et al.,and Raed A Alsatli et al.

CONCLUSION

This study shows that sciatic nerve block using the anterior approach along with femoral nerve block under ultrasound guidance is an effective and alternative technique of anaesthesia to central-neuraxial block & other approaches of Sciatic Nerve Block for lower limb surgeries with regards to better patient satisfaction and better hemodynamic stability. The visualization of nerve under real time ultrasonography eliminates the potential complications of peripheral nerve blockade. The result of this pilot study can be used as a reference for further larger studies.

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