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COMPARATIVE STUDY OF APPROACHES FOR SCIATIC NERVE BLOCK FOR LOWER LEG, ANKLE AND FOOT SURGERIES

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ABSTRACT

Introduction: The co-administration of sciatic and Saphenous nerve blocks can provide anaesthesia and analgesia in patients undergoing lower extremity surgeries. Several approaches to achieve sciatic nerve block have been described, including anterior and posterior approaches. **Methods:** In total, 60 study patients were randomly assigned to receive either anterior (group A, n=30) or posterior (group b, n=30) sciatic nerve block. Thereafter, the following parameters were determined: sensory and motor block start and end times, number of attempts, duration of analgesia, failure rates. **Results:** Patients of anterior approach had a mean time of onset of sensory block of 9.1±2.5 min compared to 9.8±3.8 min with posterior group. Patients of group A had longer duration of analgesia (188.85±64.08 min) than group B (182.59±54.08 min) which was statistically not significant (p=0.68) between the groups. Out of 60, 4 of anterior approach & 1 of posterior approach had a failed block. **Conclusion:** Sciatic nerve block with nerve stimulator/ locator is a simple, safe and effective anesthetic technique for surgical procedures on lower extremity, providing cardiovascular stability and good postoperative analgesia. Anterior approach of Beck to SNB is as effective as classical posterior approach of Winnie's with additional advantage, of positioning the patients.

INTRODUCTION

Regional anesthesia is safe and effective for surgical procedures involving lower limbs and optimizes postoperative pain relief. Sciatic nerve block has been described as the peripheral nerve block of choice for operations performed below the knee. Least hemodynamic alterations, good anesthesia and post operative analgesia, thereby early postoperative ambulation, early recovery, less economical burden are the major advantages with peripheral nerve blockade techniques.[1,2]

The sciatic nerve can be approached at the pelvic level, mid thigh level or at the popliteal fossa. The sciatic nerve can be approached at the pelvic level with the patient supine (anterior approach) or in the Sims position (posterior approach).[3,4]

The classic posterior approach of Labat necessitates patient repositioning, which limits its use in patients with compromised mobility, it requires the identification of multiple landmarks, and the stimulating needle has to pass through different layers of muscles, often causing discomfort and pain to the patient during block placement.[2]

The anterior approach to the sciatic nerve is performed with the patient remaining in the supine position and advantageous in situations where patient mobilization is limited.[3]

Therefore, this study was performed to compare the efficacy of anterior and posterior approaches to block sciatic nerve block for surgeries involving lower limb.

MATERIALS AND METHODS

Aim

To compare the clinical utility of proximal sciatic approaches with different BMI.

Objectives

To compare time taken to perform, number of attempts, onset of sensory blockade, onset of motor blockade and duration of analgesia between proximal sciatic nerve block approaches.

Type Of Study: Randomized comparative study

Sample Size: 60 patients posted for lower leg, ankle, foot surgeries

Study Site: Department of Anaesthesiology, Valluvanad Hopsital, Ottappalam, Palakkad, Kerala.

Duration Of Study: 1 year

Patients assigned through computer generated random numbers to receive the anterior approach (group A, n=30) and classic posterior approach (group B, n=30) of sciatic nerve block. Saphenous nerve block was performed if needed for surgery.

Inclusion Criteria:

Patients scheduled for foot and ankle surgery belonging to ASA grade I, II & III.

Exclusion Criteria:

1) Patients' refusal.
2) Patients with neuromuscular disease and established peripheral neuropathy.
3) Patients with haemostatic abnormalities or on anticoagulation.
4) Patients with skin infection at the site of needle insertion.
5) Patients with chronic pain syndromes or receiving chronic analgesic therapy.
6) Patients with reported history of allergy to amide local anesthetic drugs.

Group A (n= 30) Sciatic Nerve Block By Anterior Approach:

Patients were placed in supine position after standard skin preparation the landmarks for the anterior approach to sciatic nerve block were drawn according to the classic description by Beck, after local skin infiltration, Needle (21-gauge, 10 cm long) was inserted at this site, with the Nerve Locator sciatic

nerve was identified after eliciting plantar response and 20 mL of local anaesthetic mixture (10 ml 2 % lignocaine,9 ml of 0.5 % bupivacaine and 1ml of sodium bicarbonate) was injected slowly with careful aspiration after every 5 mL.

Group B (n= 30) Sciatic Nerve Block By Posterior Approach:

Patients were placed in the Sim's position. After standard skin preparation Landmarks for the posterior approach to sciatic nerve block were drawn according to the Winnie's description after local skin infiltration, the needle was inserted at the site, with the Nerve Locator sciatic nerve is identified after eliciting plantar response and 20 mL of local anaesthetic mixture (10 ml 2 % lignocaine,9 ml of 0.5% bupivacaine and 1ml of sodium bicarbonate) injected slowly with careful aspiration after every 5 mL .

Saphenous Nerve Field Block Technique:

Patients were placed in supine position after standard skin preparation, a linear subcutaneous injection of 5 ml of local anesthetic (lignocaine with adrenaline 2%) is made in an anterior and posterior direction at a level 3–4 cm beginning at the medial aspect of the tibial tuberosity and ending at the medial aspect of the calf (gastrocnemius muscle).

For each patient, time required to perform the block was noted. Assessments for the onset of sensory and motor block was performed every 2 min for 10 min and then at 5-min intervals up to 30 min.

A sensory block assessment was performed in the distribution of the superficial peroneal nerve, common peroneal nerve, posterior tibial nerve, and sural nerve. A 3-level scale was used to grade the intensity of sensory block using pinprick stimulation, 0 = normal sensation, 1 = blunted sensation (analgesia), and 2 = absence of sensation (anesthesia). Sensory block was considered complete when each sensory testing had a score of 2.

Motor Block Was Assessed Using A Simple 3 Point Score:

0=normal muscle power;
1=reduced power (plantar or dorsiflexion); and
2=complete motor block (plantar and dorsiflexion).

Motor block was considered complete when motor response in both TN and PN distributions had a score of 2.

A complete block was defined as one associated with Grade 2 sensory anesthesia and Grade 2 motor block in the distribution of both the tibial as well as peroneal nerves. Onset time of sensory block and of motor block was defined as the interval between Time 0 and a complete block.

Patients who did not have complete anesthesia at the surgical site by the end of a 30-min period were given the option of Propofol sedation.

Time for first request for pain medication (duration of analgesia) was noted and details of any untoward event were recorded in post anaesthetic recovery room and then in ward.

OBSERVATION AND RESULTS

Statistical analysis was performed by using the program SPSS V24. A p value of less than 0.05 was considered statistically significant.

On analyzing the data we found that the demographic parameters such as age, gender, BMI, ASA grade were similar in both the groups and there was no statistically significant difference. Similarly the number of attempts to perform block, onset of sensory and motor block, duration of analgesia and failure rates were similar in both the groups.

Table 1: Comparision Of Time Taken To Perform, No Of Attempts, Sensory Block, Motor Block, Duration Of Analgesia Among Groups With Bmi 19-24.9 Kg/m^2

	Group-A, BMI (19-24.9)					Group-B, BMI (19-24.9)					P-value
	N	Min	Max	Mean	SD	N	Min	Max	Mean	SD	
Time taken to perform block	13	4	10	7.62	2.063	14	4	15	7.14	2.91	0.31
No of Attempts	13	1	5	2.38	1.387	14	1	4	2.14	1.03	0.76
Sensory Block	13	6	15	9.54	2.696	14	6	20	10.00	4.13	0.96
Motor Block	13	10	25	17.31	4.385	14	10	25	16.07	4.46	0.43
Duration of Analgesia	13	60	270	183.85	67.889	14	160	270	218.57	33.19	0.25

When compared the BMI of 19-24.9 between the groups time taken to perform the block, no of attempts, sensory block, motor block, duration of analgesia were not statistically significant. Duration of analgesia was more with group B, when compared with group A.

Table 2: Comparision Of Time Taken To Perform, No Of Attempts, Sensory Block, Motor Block, Duration Of Analgesia Among Groups With Bmi >25 Kg/m^2

	Group-A, BMI (>25)					Group-B, BMI (≥ 25)					P-value
	N	Min	Max	Mean	SD	N	Min	Max	Mean	SD	
Time taken to perform block	12	4	10	6.00	1.859	13	5	12	7.46	2.26	0.07
No of Attempts	12	1	3	2.42	.669	13	1	4	2.38	0.87	0.88
Sensory Block	12	6	10	8.17	1.337	13	6	15	10.15	3.46	0.23
Motor Block	12	8	20	14.42	4.209	13	10	25	15.38	5.19	0.65
Duration of Analgesia	12	100	300	198.33	62.933	13	90	240	154.62	49.43	0.09

Time taken to perform, no of attempts, sensory block, motor block and duration of analgesia were statistically not significant ($p>0.05$).Time taken to perform the block was slightly more with group B. Duration of analgesia was more with group A than group B, when compared with BMI >25 between the groups but not statistically significant ($p=0.09$).

DISCUSSION

The sciatic nerve, the largest branch of Lumbosacral plexus is composed of ventral and dorsal divisions of ventral rami of L4 to S3 spinal nerves. The sciatic nerve is formed when the large dorsal component of the sacral plexus (common fibular nerve) and the ventral component (tibial nerve) move downward close together and hence the common peroneal and tibial components can separate from each other at various levels from their origin[5,6,7].

This was a randomized study in patients posted for lower leg, ankle and foot surgery. 60 patients were selected based on inclusion criteria, Patients were randomly assigned to receive the anterior approach (group A; n = 30), and classic posterior approach of Labat modified by Winnie (group B; n = 30) of sciatic nerve block. With the Nerve Locator sciatic nerve was identified after eliciting plantar response and 20 mL of local anaesthetic mixture of 10 ml 2 % lignocaine, 9ml of 0.5 % bupivacaine and 1ml of sodium bicarbonate was injected slowly.

Present study was undertaken based on the anatomical land marks of sciatic nerve through anterior and posterior approaches.

The knowledge regarding the level of division and distribution of the sciatic nerve and its location is of great importance. The sciatic nerve is frequently involved in daily medical practice of neurology, orthopedics, rehabilitation and anesthesia. Its long course makes it vulnerable to nerve

injury. Even in this era the cadaver is the best means to study anatomy.

Most techniques described to date rely on surface anatomical landmarks, which can be complex. Although anatomical landmarks provide valuable clues to the position of the sciatic nerve, they are only surrogate markers, can vary in patients, and may be difficult to locate in obese patients. Even nerve stimulation that is considered the 'gold standard' for peripheral nerve localization may not always elicit a motor response and also does not guarantee success.

Hanks RK and Pietrobon R 2006[8] studied effect of age on sciatic nerve block. They prospectively studied the duration of sciatic nerve block using mepivacaine in younger and older patients. The time for complete return of both sensory and motor function was longer in the older group, 329 +/- 47 min compared with 306 +/- 46 min (mean +/- SD) in the younger group (P = 0.04). Age also increased the time to return of vibratory sensation (younger = 292 +/- 58 min, older = 257 +/- 50 min; P = 0.007). The other measurements did not differ between groups.

In present study the mean age distribution was 45.8 ± 12, minimum 25 yrs, maximum 65yrs, both groups were age matched with p value 0.91 which was not significant.

Palaniappan T, Vani.S, Ravikumar.S, Mohan V [9], found that the lateral approach is slightly more difficult technically, but the advantages are that it is more convenient with respect to the patient positioning and ease of needle placement, the success of blockade and number of attempts were better in the posterior approach than lateral approach, hence concluding both the methods have their own merits and demerits.

Various factors markedly affect the onset time of peripheral nerve blocks. These include the concentration and volume of the injected anesthetic solution, the use of additives, the type of evoked motor response obtained, and the intensity of the current at which peripheral nerve stimulation is achieved Because all these factors were kept constant in the two groups, the site of injection may explain the time difference in completion of the regional anesthetic.

Using the anterior approach as described by Beck, Manani et al.[10] reported a 14% rate of failure. Davies and McGlade[11] reported that for a posterior approach to the sciatic nerve the use of paresthesia resulted in less than 50% positive identification of the sciatic nerve versus 92% with a nerve stimulator. Therefore, the identification of the sciatic nerve is greatly facilitated by the use of a nerve stimulator.

The distance between the skin and the sciatic nerve equals the distance between the skin and the femur plus the estimated thickness of the femur (3 or 4 cm). Furthermore, at the level of the lesser trochanter, the position of the sciatic nerve is known to be medial and posterior to the femur.

Hadzic et al [12] demonstrated that if the needle is above the lesser trochanter, an internal rotation facilitates the location of the sciatic nerve, whereas an external rotation facilitates an approach of the sciatic nerve below the lesser trochanter.

In present study, for most of the patients the time taken to perform sciatic nerve block for anterior approach was approximately 6.8±2.1 min & 7.2±2.5 min with Posterior approach. Longer time for performing posterior approach to sciatic nerve was probably due to positioning and identifying the sciatic nerve. In this study when the two groups were sub divided based on the BMI the time taken to perform anterior approach was less with patients of BMI 25-29.9 & above, when compared to posterior approach, Whereas for patients with BMI of <25 posterior approach has lesser execution time for SNB.

Junichi Ota, Shinichi Sakura, Kaoru Hara, Yoji Saito [13] did a similar comparative study & found that the execution time for SNB was 5.0± 1.8 min & 6.0 ± 3.0min with anterior & posterior approach respectively.

Present study has got similar results; lesser time is taken to perform anterior approach than posterior approach.

Comparison Of No Of Attempts To Achieve Block

Present study did not demonstrate any statistically significant difference between the two groups for No of attempts taken to identify the SN. When the two groups were sub divided based on the BMI, there was no statistical significance between the two groups on No of attempts taken to identify sciatic nerve.

Comparison Of Onset Of Sensory & Motor Block:

Patients of anterior approach had a mean time of onset of sensory block of 9.1±2.5 min compared to 9.8±3.8 min with posterior group. Patients of anterior approach had a mean time of onset of motor block of 16.3±4.7 min compared to 15.5±4.7 min with posterior group. The difference was not statistically significant (p=0.54) between the two groups and among sub groups based on BMI in the two groups.

Pia di Benedetto, Laura Bertini, Andrea Casati, Battista Borghi, Andrea Albertin, and Guido Fanelli [14] in a comparative study between a New Posterior Approach to the Sciatic Nerve Block & Classic Posterior Approach showed that The onset time of sensory and motor blocks was similar in those patients receiving the classic posterior approach (9 min [3–20 min] and 16 min [3–75 min], respectively) and those receiving the new subgluteus approach (8 min [1–25 min] and 14 min [10–50 min], respectively [P=0.12 and P= 0.59]), without differences in the final distribution of nerve blockade.

Comparison Of Duration Of Analgesia:

Patients of group A had longer duration of analgesia (188.85±64.08 min) than group B (182.59±54.08 min) which was statistically not significant (p=0.68) between the groups. In present study when the two groups were sub divided based on the BMI shorter duration of Analgesia was with posterior group of BMI>25. Longest duration of Analgesia was seen with posterior group of BMI (19-24.9). But these differences were not statistically significant (p > 0.05).

Comparison Of Block Failure Rates Between The Groups In Present Study:

Out of 60, 4 of anterior approach & 1 of posterior approach had a failed block.

Failure rate between the groups is statistically not significant with p=0.16

CONCLUSION

Despite being a procedure that provides excellent anesthesia and postoperative analgesia, the sciatic nerve block is relatively underused when compared with other anesthetic techniques. Data comparing the success rates of various techniques for sciatic nerve block are lacking.

In present study time taken to perform SNB was shorter with Anterior approach than posterior. No of attempts to locate SN was equal in Anterior and Posterior approach. Onset of sensory, motor block and analgesia were similar in both approaches. Duration of Analgesia was similar with both groups. Duration of analgesia was more with anterior group in high BMI patients in both groups. Failure rate between the approaches was not statistically significant.

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