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Safety and efficacy of anterior and posterior approaches of sciatic nerve block in high risk diabetic foot surgeries in a tertiary referral hospital

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Abstract
Background: Elderly diabetic Patients often have unstable hemodynamic states. Spinalor general anesthesia in such patients, requiring lower limb surgeries carry high risk. Surgery under effective peripheral nerve blocks is relatively safer.
Aims and Objectives: To test the clinical efficacy of Sciatic Nerve Block (SNB) in elderly diabetic patients undergoing lower limb surgeries without interfering with cardiovascular stability.
Methods: Anterior & Posterior approach of SNB, were performed on 100 diabetic patients of ASA I,II,III and IV, of either sex in a randomized prospective study. All blocks were performed with the use of a nerve stimulator, with 20 ml of local anesthetic mixture (10 ml 2% lignocaine, 9 ml of 0.5% bupivacaine and 1ml of sodium bicarbonate). The time of onset of sensory and motor block was assessed. Duration of analgesia following block was recorded. Data was subjected to statistical analysis.
Results: Out of 100 patients 2 of anterior approach and 4 of posterior approach had a failed block and the difference had no statistical significance. Onset of block was faster with anterior group than posterior group. Duration of analgesia was significantly more with Anterior group (3.152Hrs, p=0.9864) than posterior group (2.606Hrs, p=0.9864)
Conclusion: SNB for diabetic patients requiring lower limb surgeries is effective in providing excellent analgesia not interfering with cardiovascular stability. Anterior approach is more effective than posterior approach.

Keywords: Sciatic nerve block; beck's anterior approach posterior approach of labat diabetic foot surgery

Introduction
Diabetic foot surgeries can reduce the morbidity and mortality in diabetic patients. Patients requiring such procedures are usually elderly with neuropathic ulcers, peripheral vascular disease, gangrene and sepsis. These patients often have hypertension, ischemic heart disease and unstable hemodynamic status. They will be at high risk for general anesthesia and neuraxial (spinal or epidural) anesthesia. A regional block of the affected lower limb using a combination of a sciatic nerve block and saphenous nerve block has been in practice as a relatively safe alternative for such procedures.

Aims and Objectives: The purpose of this study was to perform and study the anterior and posterior proximal approaches on the sciatic nerve block using a peripheral nerve stimulator. The time required in performing the technique, onset of anesthesia, efficacy and duration of analgesia were assessed for both approaches of SNB and compared.

Materials and Methods: This was a randomized study conducted on 100 diabetic patients, who underwent debridement and other lower leg, ankle and foot surgery at S V R R Govt. General Hospital, S V Medical College, Tripathi between April 2016to April 2018 (period of 2years). Patients were selected based on inclusion criteria. Patients were randomly assigned to receive the anterior approach (group A; n = 50), and posterior approach (Labat) (group B; n = 50) of sciatic nerve block.

Pre-operative preparation
A pre-anesthetic thorough clinical evaluation of all the systems and meticulous airway assessment was undertaken on the preoperative day. Hematological and biochemical lab

investigations were confirmed to be fit. The anesthetic procedure to be undertaken was explained to the patients and written informed consent was taken. All patients received tab. Alprazolam 0.25mg night before surgery with a period of overnight fasting as pre-anesthetic preparation.
An autoclaved pack for sciatic nerve block consisting of the necessary items (Table 1) was kept ready. Drugs and disposables (Table 2) were maintained sterile throughout the procedure. For each patient, time required to perform the block was noted.

Table 1: Autoclaved pack for Sciatic nerve block

1.	Sterile towel for draping.
2.	Sterile gown and latex gloves.
3.	Cotton swabs and gauze pieces.
4.	Sterile Bowl to mix local anesthetics.

Table 2: Drugs and disposables

1.	Bupivacaine 0.5% 20 ml vial.
2.	Lignocaine 2% 40 ml vial.
3.	Lignocaine with adrenaline 2% 40 ml vial.
4.	Gentian violet dye & insulin syringe (for drawing landmarks).
5.	Inj. Sodium bicarbonate 1 ampule.
6.	2 ml syringe with 26 G hypodermic needle for skin infiltration.
7.	10 ml syringes with 22 G hypodermic needle.
8.	Disposable Insulated nerve stimulator needle.
9.	Nerve Locator with electrodes.

Anterior Approach (Group A)
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 with elicitation of plantar response and 20 ml of local anesthetic mixture (10 ml 2% lignocaine, 9 ml of 0.5% bupivacaine and 1ml of sodium bicarbonate) was injected slowly with careful aspiration at every 5 ml instillation.

Posterior approach (Group B)
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 classic description by Labat. After local skin infiltration, the needle was inserted at the site. With the Nerve Locator sciatic nerve is identified with elicitation of plantar response and 20 ml of local anesthetic 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 instillation.

Interpretation and recording
Onset of sensory and motor block was assessed every 2 min for 10 min and then at 5-min intervals up to 30 min. Onset time of sensory block and of motor block was defined as the interval between Time 0 and a complete block.
Sensory block assessments were 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 Bromage's modified scale (50). Motor block was assessed for voluntary motor responses by asking the patient to plantar flex (TN) or dorsiflex (CPN) the foot and was classified as follows: (from Bromage 1 =the full capacity for flexion and adduction of the ankle for the tibial nerve or the opposite for the peroneal nerve to Bromage 4 = a total inability to perform the relevant movement). Motor block was considered complete when motor response in both TN and PN distributions had a score of 2(Ref.1, 2, 3).
A complete block was taken as Grade 2 sensory anesthesia and Grade 2 motor block in the distribution of both the tibial as well as peroneal nerves. Duration of analgesia was taken as the period from the onset time to the time of first request for pain medication by the patient. Rescue analgesia was provided by Inj. Diclofenac Sodium 75 mg intramuscular. Patients who did not have complete block at the surgical site by the end of a 30-min period were considered as failed block, and given the option of Propofol sedation.

Results
Observations and results were recorded and summarized. The gender distribution showed no significant difference (Table 3.). Samples are gender matched with Z=0 (Not Significant).

Table 3 Gender	Group A		Group B	
	Number of Patients	(%)	Number of Patients	(%)
Male	24	48	50	50
Female	26	52	50	50
Total	50	100	50	100

Age distribution showed a marginally higher mean age in group 'A' with p value of 0.2514 (Table 4.).

Table 4.	Group A Mean ± SD	Group B Mean ± SD
Age (Yrs)	49.72 ± 7.78025	48.12 ± 5.97833

The mean of number of attempts made was 3.12 in group A and 2.98 in group B (Table 5.). This difference was not statistically significant (P=0.4811).

Table 5.	Group A Mean ± SD	Group B Mean ± SD
Number of attempts in performing block	3.12 ± 1.0029	2.98 ± 0.9792

Time taken to perform the block was noted. The mean time for posterior approach was 6.336 minutes and 5.726 minutes in group A (Table 6.). The difference was statistically significant (P=0.9811).

Table 6.	Group A Mean ± SD	Group B Mean± SD
Time taken to perform block in minutes	5.726± 1.2731	6.336 ± 1.6065

The ASA grade of each patient was determined and distributed among group A and group B (Table7.)

Table 7. ASA Grades	Group A		Group B	
	Number of Patients	(%)	Number of Patients	(%)
Grade I	7	14	5	10
Grade II	22	44	25	50
Grade III	15	30	12	24
Grade IV	6	12	8	16
Total	50	100	50	100

The mean time for onset of sensory block in group A was 10.74 minutes and it was 12.76 minutes in group B. The difference was statistically not significant with p value of 0.1096 (Table 8.).

Table 8	Group A Mean ± SD	Group B Mean ± SD
Onset of sensory block in minutes	10.74 ± 5.51	12.76 ± 6.92

The mean time for onset of motor block in group A was 20.56 minutes and it was 21.00 minutes in group B. The difference was statistically not significant with p value of 0.7546(Table 9.).

Table 9.	Group A Mean ± SD	Group B Mean ± SD
Onset of motor block in minutes	20.56 ± 7.1832	21.00 ± 6.77

The duration of analgesia in group A was 3.152 hours and it was 2.606 hours in group B. Thus the sciatic nerve block by anterior approach offered a longer duration of analgesia. The difference was statistically significant with p value of 0.9864 (Table 10.).

Table 10.	Group A Mean ± SD	Group B Mean ± SD
The duration of analgesia in hours	3.152 ± 1.24	2.606 ± 1.19

The duration of block with respect to BMI was recorded and summarized (Table 11). Longer duration of analgesia was seen with both groups with decreasing BMI.

Table 11. Group	BMI	Mean duration of analgesia in hours	Number of patients
A1	19-24.9	4.0429	7
A2	25-29.9	3.1636	22
A3	30-35	3.0167	15
A4	> 35	2.4083	6
B1	19-24.9	3.24	25
B2	25-29.9	2.672	12
B3	30-35	2.6333	8
B4	> 35	1.9625	5

Failure of block was observed in 2 of group A patients and 4 of group patients. The difference in failure rate was statistically not significant with Z=0.421(Table 12).

Table 12	Group A		Group B	
	Number of Patients	(%)	Number of Patients	(%)
Failed Block	2	4	4	8

Discussion

Several different proximal approaches for the sciatic nerve block have been described in the literature, however, the classical posterior approach of Labatis the most often used. The anterior approach (Beck) to the sciatic nerve is performed with the patient remaining in the supine position. The patient needs to be put in the sim's position for the posterior approach. Hence, both approaches has advantages and disadvantages in patients with limited mobilization, morbid obesity, spine and hemodynamic instability.

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 each peripheral nerve stimulation is achieved (Ref. 4,5,6.). 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.

Time taken to perform block: In our study, for most of the patients the time taken to perform sciatic nerve block for anterior approach was approximately 5.726±1.27 min and 6.336±1.6 min with Posterior approach. Longer time for performing posterior approach to sciatic nerve was probably due to positioning and identifying the sciatic nerve. Junichi Ota, Shinichi Sakura, Kaoru Hara, Yoji Saito, did a similar comparative study and found that the execution time for SNB was 5.0± 1.8 min and 6.0±3.0min with anterior and posterior approach respectively (Ref 7). This study also showed similar results.

Onset of sensory & motor block: Patients of anterior approach had a mean time of onset of sensory block of10.74±5.51min compared to 12.76±6.92 min with posterior group. Patients of anterior approach had a mean time of onset of motor block of 20.56±7.18 min compared to 21±6.77 min with posterior group. Piadi Benedetto, Laura Bertini, Andrea Casati, , Battista Borghi, AndreaAlbertin,, and Guido Fanelli,(Ref.8)in a comparative study between a New Posterior Approach to the Sciatic Nerve Block and 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]).

Duration of analgesia: Patients of group A had longer duration of analgesia (3.152±1.24Hrs) than group B (2.606±1.19Hrs) which was statistically significant between the groups. In this study when the two groups were sub divided based on the BMI shorter duration of Analgesia was with posterior group of BMI of more than 35.Longest duration of Analgesia was seen with anterior group of BMI19 to 24.9.An inverse relation of duration of Analgesia with BMI was observed in this study.

Block Failure rates: Out of 100, 2 of anterior approach group A and 4 of posterior approach group B had a failed block. Failure rate between the groups is not statistically significant with Z=0.421, 2-TailConfidence Level: 32.6% (Not Significant)

Conclusion

SNB with nerve stimulator/locator is a simple, safe and effective anesthetic technique for many surgical procedures on lower extremity especially for high risk diabetic patients complicated with multiple medical problems. It has provided adequate intensity and duration of analgesia without interfering with cardiovascular stability of the patient. Insignificant rates of block failure were encountered in this study.

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