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ULTRASOUND GUIDED SCIATIC NERVE BLOCK IN THE POPLITEAL FOSSA USING LATERAL APPROACH AND COMPARISON OF ONSET TIME WITH SEPARATE TIBIAL AND COMMON PERONEAL INJECTIONS VERSUS SINGLE INJECTION OF THE SCIATIC NERVE PROXIMAL TO THE BIFURCATION.

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ABSTRACT

INTRODUCTION. The last decade has seen the increasing use of ultrasound for peripheral nerve blocks. Sciatic nerve can be blocked using ultrasound in the popliteal fossa after the bifurcation in tibial and common peroneal for faster onset sensory block as compared to blocking before the bifurcation. It can be used in surgeries below the knee and ankle.

METHODOLOGY. Patients were divided into two groups. Group 1- sciatic group, in which the block was given before the bifurcation in popliteal fossa. Group 2- tibial and common peroneal group, in which both the nerves were blocked separately using ultrasound.

RESULTS. Blocking the Tibial and Common peroneal nerves separately in the popliteal fossa has a faster onset of sensory blockade as compared to blocking the sciatic nerve before the bifurcation. Time taken for complete loss of motor function in the tibial nerve distribution is faster if the tibial and common peroneal nerves are blocked separately after division, whereas complete motor blockade in the common peroneal nerve distribution shows no significant difference between the two techniques used in the study.

CONCLUSION. Popliteal fossa sciatic nerve block is a relatively easy, safe and an effective block for surgeries involving the ankle and foot. Blocking the Tibial and Common peroneal nerves separately in the popliteal fossa has a faster onset of sensory blockade as compared to blocking the sciatic nerve before the bifurcation.

KEYWORDS : Ultrasound, sciatic nerve, tibial and common peroneal nerve.

INTRODUCTION.

Ultrasound is been used for vascular access, lung ultrasound, TEE and most recently nerve blocks in anesthesia. With the increasing availability of relatively inexpensive, portable, high quality ultrasound equipment, the use of ultrasound for needle guidance in local or regional anaesthesia is becoming increasingly popular.

Sciatic nerve (L4,5 S1,2,3) is the longest nerve in the body. The sciatic nerve block in the popliteal fossa is frequently used for peripheral nerve block in surgeries below the knee. Previous studies have evaluated the benefit of targeting both the tibial and common peroneal nerve responses with double Vs single nerve stimulation technique. However a double stimulation technique is not synonymous to separate tibial (L4,5 S1,2,3) and common peroneal nerve(L4,5 S1,2,3) injections, given the variability of the bifurcation of the sciatic nerve and blind nature of stimulating technique [1].

Since a better identification of the point of bifurcation is possible with the use of ultrasound imaging, in this study we hypothesized that using ultrasound to block the tibial and common peroneal nerves individually (double injection) in the popliteal fossa would provide a faster onset of action as compared to blocking the sciatic nerve proximal (single injection) to the point of bifurcation [1].

MATERIALS AND METHODS.

The study protocol was approved by the Hospital's Ethical Committee. It was a Prospective, Randomised study.

INCLUSION CRITERIA-

- Age > 18 years having unilateral limb surgery on foot or ankle,
- ASA physical status 1, 2, 3,
- Patients complaining pain in the post- operative period.

EXCLUSION CRITERIA-

- Diabetes with peripheral neuropathy,
- Coagulopathy,
- Pregnancy,Disorders of the knee,
- Inability to perform or comprehend verbal commands,
- Previous h/o allergy to Local anesthetics,
- Infection at the site of injection.

Baseline assessment of vital signs namely age, sex, height, weight and BMI was recorded before starting the procedure, along with sensory and motor function of the lower limb. Patients were randomly assigned to one of the two groups by Random number generator-

GROUP 1 : Sciatic group- Pre bifurcation Sciatic group.

GROUP 2 : Tibial- Common Peroneal group- Post bifurcation group.

Blocks were performed in Lateral or Supine position depending on the patients comfort level. The nerves were visualized in short axis and an in- plane technique was used.

Drugs used was a mixture of 28 ml 0.5% ropivacaine, 1 ml 1: 300,000 epinephrine and 1 ml 8.4% sodium bicarbonate.

For the patients in sciatic group, the sciatic nerve was identified using a linear 10- 12 mHZ probe. Once the point of bifurcation was identified, the sciatic nerve was traced cephalad. A 22G spinal needle was introduced laterally and was advanced using an in- plane technique until the tip was visualized in close proximity of the sciatic nerve. Once the needle was in optimal position, 30 ml of the solution was slowly injected in a 5ml increments with intermittent aspiration.

Similarly for the tibial- peroneal group, the sciatic nerve was identified in a similar manner as in the sciatic group and then the transducer moved caudally from the bifurcation where the tibial and common peroneal nerves could be clearly identified. After this a 22G spinal needle was introduced laterally in the intertendinous groove between the vastus lateralis and tendinous head of biceps femoris. After this 15ml of the solution was injected around the tibial nerve in incremental doses of 5ml with intermittent aspirations. The needle is then redirected around the common peroneal nerve and the remaining 15 ml was injected in the same manner. In both the cases the needle tip was repositioned if necessary to obtain a circumferential spread.

After the solution was injected, progress of the sensory and motor blockade was assessed beginning 10 min after injection and every 3 min for total of 46 min.

- **Sensory function was assessed in both the groups by pinprick using the following score-**
- Grade 0 – No change from the baseline,
- Grade 1 – Diminished sensation,
- Grade 2 – Complete loss of pinprick sensation.
- Similarly Motor function was assessed using the following scale-
- Grade 0 – No change from baseline,
- Grade 1 – Diminished strength,
- Grade 2 – complete loss of motor strength.

Block onset time was defined as sensory score of 2 in both the tibial and common peroneal distribution within 46 min.

Block procedure time was documented from the point where spinal needle pierced the skin until the last of the solution was injected.

OBSERVATION AND RESULTS.

Patients from both the group were comparable with respect to age, sex, height and weight. Test of significance used was Chi- Square test and p value ≤ 0.05 was considered significant. Continuous variables are presented as mean ± SD. Discrete and categorical variables were presented as N (%). Test of significance used was NON PARAMETRIC, MANN- WHITNEY U TEST as the values were not found to be Normal i.e. SD was more more than one- third of the MEAN values.

Table 1 : Demographic Profile.

	SCIATIC GROUP, N=20 MEAN ± SD	TIBIAL COMMON GROUP, N=20 MEAN ± SD	p VALUE
AGE (years)	48.55 ± 19.07	45.50 ± 13.99	0.56
HEIGHT (cms)	164.65 8.45	165.2 7.28	0.82
WEIGHT (kgs)	68.75 8.05	63.95 10.36	0.11
BMI	25.42 3.03	23.34 2.79	0.03
GENDER MALE FEMALE	13 (65%) 7 (35%)	8 (40%) 12 60%)	

Table 2 : Block Success Rate.

		SCIATIC GROUP	TIBIAL-COMMON PERONEAL GROUP	TOTAL	p VALUE
BLOCK SUCCESS	YES	17 85 %	16 80 %	7 17.5%	0.5
	NO	3 15 %	4 20 %	33 82.5%	0.6
TOATAL		20 100 %	20 100%	40 100%	

Block success rate was found to be 85% in the sciatic group and 82.5% in the tibial- common peroneal group. As the p value was > 0.05, there was statistically no difference between both the groups as far as Block success rate was concerned.

Table 3: Anaesthetic Data

VARIABLE	SCIATIC GROUP N = 20 (min)	TIBIAL-COMMON PERONEAL GROUP N = 20 (min)	p VALUE
Block performance time	6.56	6.88	0.511
Complete sensory block, both nerves.	22.3 ± 9.9	16.45 ± 8.64	0.007
Complete sensory block, tibial nerve.	20.5 ± 9.49	14.65 ± 8.32	0.009
Complete sensory block, common peroneal nerve.	17.65 ± 8.54	13.9 ± 7.2	0.03
Complete motor block, both nerves.	23.9 ± 11.09	18.89 ± 7.94	0.08
Complete motor block, tibial nerve.	22.15 ± 10.44	16.6 ± 8.27	0.007
Complete motor block, common peroneal nerve.	19.6 ± 9.98	16.36 ± 7.12	0.89

Data are mean ± SD.

RESULTS.

Time for complete sensory block (sensory score of 2) was longer in sciatic group (22.3 ± 9.9) as compared to tibial- common peroneal group (16.45 ± 8.64) with p value of 0.007 which is statistically significant.

Time for complete sensory block of tibial (20.5 ± 9.49) and common peroneal nerves (14.65 ± 8.32) separately was longer in sciatic group as compared to tibial- common peroneal group (17.65 ± 8.54 and 13.9 ± 7.2) with a p value of 0.009 for tibial nerve and 0.03 for common peroneal nerve which is statistically significant.

Time for complete loss of motor function (motor grade of 2) was longer in sciatic group (23.9 ± 11.09) as compared to tibial- common peroneal group (18.89 ± 7.94). But as the p value is 0.08, this difference is not significant Similarly time for complete motor block for tibial nerve (22.15 ± 10.44) was longer in sciatic group as compared to tibial- common peroneal group (16.6 ± 8.27) with a p value of 0.007 which is statistically significant.

Whereas there was no significant time difference for complete block of common peroneal nerve. p value is 0.89.

DISCUSSION.

In our study, Block performance time was similar in both the groups. Though statistically no significant difference was found in both the groups (6.56±1.5 Vs 6.88± 1.54) with a p value of 0.51, clinically some difficulty was encountered in group 2 locating the tibial and common peroneal nerve separately in about 4 patients during the initial part of the study. This may be attributed to the inexperience of the operator.

Time for complete sensory block (sensory score of 2) was longer in sciatic group (22.3 ± 9.9) as compared to tibial- common peroneal group (16.45 ± 8.64) with p value of 0.007 which is statistically significant.

Time for complete sensory block of tibial (20.5 ± 9.49) and common peroneal nerves (14.65 ± 8.32) separately was longer in sciatic group as compared to tibial- common peroneal group (17.65 ± 8.54 and 13.9 ± 7.2) with a p value of 0.009 for tibial nerve and 0.03 for common peroneal nerve which is statistically significant.

Time for complete loss of motor function (motor grade of 2) was longer in sciatic group (23.9 ± 11.09) as compared to tibial- common peroneal group (18.89 ± 7.94). But since the p value is 0.08, this difference is not significant.

Similarly, time for complete motor block for tibial nerve (22.15 ± 10.44) was longer in sciatic group as compared to tibial- common peroneal group (16.6 ± 8.27) with a p value of 0.007 which is statistically significant.

Whereas there was no significant time difference for complete block of common peroneal nerve. p value is 0.89.

Block success rate was found to be similar in both the groups (85% vs 80%) with a p value of 0.5, which was statistically not significant.

SOME SIMILAR AND RELATED STUDIES.

Jerry D. Vloka et al in 2001 studied the level of bifurcation of sciatic nerve and its implication in popliteal nerve blockade in 28 cadaver leg specimen. They concluded that the sciatic nerve divided at a mean distance of 60.5 ± 27.0 mm (range 0 to 115 mm) above the popliteal fossa crease.

In our study, the point where the Sciatic nerve was located with the help of ultrasound was around 80 to 100 mm.

Paul J. Zetlasui et al in 1998 studied a Lateral approach to block the sciatic nerve in the popliteal fossa, to block the tibial and common peroneal nerve separately in 40 patients as compared to the posterior approach used before that. The point of needle insertion was in the intermuscular groove between the vastus lateralis and the tendinous head of biceps femoris with the needle direction 20 to 30 degrees to the horizontal plane. It concluded that this approach resulted in decreased incidence of vascular puncture as compared to the posterior approach. It also concluded that blocking the tibial and the common peroneal nerves separately improves the success rate and shortens the onset time of the block [2].

In our study, the site of needle insertion was similar to what was used by Paul J. Zetlausi et al and the position of the patients were supine or lateral depending on the patient preference. Also our study group 2 in which the tibial and common peroneal were blocked separately showed faster onset of action as compared to group1 in which sciatic nerve was blocked as a whole before its division.

Duane K. Rorie et al in 1990 did a study in which they assessed the success of sciatic nerve block in the popliteal fossa and the presence of complications during the post operative period of 30 days in 130 patients. It was concluded that it is a safe block with no occurrence of hematomas and infection in the post operative period. The sciatic nerve block in popliteal fossa was found to be useful in short surgeries of around 2 hours involving the ankle and foot and the block was relatively simple to execute [3].

In our study, the block was given in cases of simple Orthopedics and General Surgical procedures lasting for about 2 to 3 hours. Also all the patients who underwent the procedure didn't have any complications like hematomas or infections.

Xavier Paqueron et al in 1999 performed a study in 50 patients in which they compared one Vs two injections for blocking the sciatic nerve in the popliteal fossa in lateral position. They found out that better success rate was achieved when two injections were used for blocking the tibial and common peroneal nerves separately as compared to single injection for the sciatic nerve before division. The study was done using Nerve stimulation. The volume of Local anesthetic used was 20 ml [4].

Our study was similar to study done by Xavier Paqueron et al except that Ultrasound was used for executing the block in our study and the amount of local anesthetic used was 30ml. But the conclusion with respect to outcome in which two injections for blocking the tibial and common peroneal nerves separately after the division showed better success rate was similar to the study done by Xavier Paqueron et al.

Antoun Nader et al in 2009 did a study comparing the modified Intertendinous vs classical approach for performing Sciatic nerve block in popliteal fossa. They concluded that the modified intertendinous approach resulted in more rapid onset of action with less chances of vascular puncture [5].

Same inter-tendinous technique was used in our study design with faster onset in the tibial- common peroneal group.

Xavier March et al in 2006 performed a study in which he compared single Vs double injections in the popliteal fossa via posterior approach. Conclusions were that the onset time and the success rate was similar in both the groups. More paraesthesia was achieved as compared to single injection. However onset of action of superficial peroneal (branch of common peroneal) was shorter and the success rate of deep peroneal (branch of common peroneal) was increased with double injections. So the double injections technique was recommended when the surgery involved the common peroneal innervated area [6].

In our study, there was significant difference between the single Vs double injections group with faster onset of sensory block in the double injections group, but no statistically significant difference was found in common peroneal nerve distribution in both the groups .

Castelein T et al in 2000 did a study in which they concluded that sciatic nerve block in the popliteal fossa was an easy technique for fore foot sugeries. They reported a success rate of 92% after 6 months of introduction period. It was concluded that popliteal sciatic nerve block is a safe, simple, effective block and patients also had good post operative analgesia without any major side- effects [7].

In our study the success rate was 82.5% and also the patients had good post operative analgesia without any complication in any of the patients. The low success rate was due to the relative inexperience of the operator and the results should have been comparable with more experience of the operator.

H. Lin et al did a study to find the minimum effective dose of 0.5% ropivacaine for popliteal Sciatic nerve block. The volume of the injected solution was varied using the up and down staircase method according to the response of previous patients (initial volume 18ml, up and down steps - 2ml). The minimum effective volume in 50% of patients of 0.5% ropivacaine was found to be 13.0 ml [8].

In our study, volume of 0.5% ropivacaine used was 28.0 ml. Our study mainly focused on comparing the onset time of sensory and motor block with single Vs double injections, so the volume of drug was kept constant, although it could had been reduced.

Michael J. Buys et al in 2010 conducted a study in 76 patients using Ultrasound guided sciatic nerve block in popliteal fossa using lateral approach: comparing onset time for separate tibial and Common peroneal nerve Vs single injection proximal to the bifurcation. They used 28 ml mepivacaine + 1 ml of 100µg/ml of clonidine + 1:300,000 epinephrine + 1 ml 8.4% sodium bicarbonate [4].

CONCLUSIONS:

In the above study block performance time was similar in both the groups (2.9 ± 1.7vs 3.3 ± 1.1). In our study, block performance time was similar in both groups (6.56 ± 1.5 vs 6.88 ± 1.54). The longer time may be due to relative inexperience of the operator In the above study time for complete sensory block and complete tibial block was longer in the sciatic group as compared with tibial- peroneal group. In our study also results for the complete sensory and complete tibial block were longer in sciatic group.

In the above study time for complete sensory block for peroneal nerve were similar in both the groups. In our study, time for complete sensory block for peroneal nerve showed statistical significance between both the groups. In the tibial- peroneal group the onset of action was faster as compared to sciatic group ($p = 0.030$).

In the above study time for loss of motor function was significantly longer in sciatic group in tibial distribution but not in common peroneal distribution. Our study also showed that the time for complete loss of motor function was longer in the sciatic group for tibial distribution ($p = 0.007$) but not for the common peroneal distribution ($p = 0.89$).

CONCLUSION.

Popliteal fossa sciatic nerve block is a relatively easy, safe and an effective block for surgeries involving the ankle and foot. Blocking the Tibial and Common peroneal nerves separately in the popliteal fossa has a faster onset of sensory blockade as compared to blocking the sciatic nerve before the bifurcation. As far as motor blockade is concerned, time taken for complete loss of motor function in the tibial nerve distribution is faster if the tibial and common peroneal nerves are blocked separately after division, whereas the time taken for complete motor blockade in the common peroneal nerve distribution shows no significant difference between the two techniques used in the study.

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