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The comparative study of anterior combined approach with conventional two skin injection sites for lower limb anaesthesia

Deepti Satish Nagrale[1], Sudhir Shinde[2], Pushpa Agrawal[3]

[1] Assistant Professor, Department of Anesthesiology, Government Medical College, Dharashiv, Maharashtra, India

[2] General and Plastic surgeon, Noble super speciality hospital, Dharashiv, Maharashtra, India

[3] Professor & HOD, Department of Anesthesiology, Government Medical College, Dharashiv, Maharashtra, India

Corresponding Author:

Dr Deepti Satish Nagrale, Assistant Professor, Department of Anesthesiology, Government Medical College, Dharashiv, Maharashtra, India

Phone no. 9371640252

Email id : drdeepti0205@gmail.com

Abstract:

Background: ln past few decades, there has been an increased interest in performing lower extremity peripheral blocks as it offers certain advantages over other anesthetic techniques. In cases of difficult airway, where General anaesthesia may pose difficulties and in spine deformities where Spinal anesthesia may be difficult, peripheral nerve blocks can be used safely.

Objective: To compare anterior combined approach as described by Chelly and Pierre Pandin with conventional two skin injection (Winnie's and Beck's) sites for lower limb anesthesia

Methods: Intervention study was conducted on 90 patients >18 years with ASA grade I-III. They were randomly divided into three groups of 30 each. Group A received '3-in-1' block by Wnnie's approach and sciatic nerve block by Beck's approach with two different skin injection sites. Group B received Femoral nerve block and Sciatic nerve block by anterior combined approach through single skin injection site as directed by Chelly. Group C received '3-in-1' block and Sciatic nerve block by anterior combined approach through single skin injection site as directed by Pierre Pandin. Time required for onset of Sensory and Motor block and total duration of analgesia were observed.

Results: All three groups were comparable for age and sex ($p>0.05$). Time required for onset of Sensory and Motor block in femoral, tibial and obturator nerve was comparable across three groups ($p>0.05$) and total duration of analgesia was also similar in three groups ($p>0.05$).

Conclusion: We can conclude that, all three anterior approaches for the Sciatic nerve block for lower limb surgeries below knee, not requiring tourniquet for prolonged period, can be safely used in high risk patients where General anaesthesia and other modalities of regional anaesthesia can't be used and repositioning of the patient for posterior approach is difficult. Hence, conventional. two skin injection sites approach can be preferred for lower limb anaesthesia.

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Key words: anesthesia, sensory block, motor block

Introduction

ln the past few decades, there has been an increased interest in performing lower extremity peripheral blocks as it offers certain advantages over other anesthetic techniques. In cases of difficult airway, where General anaesthesia may pose difficulties and in spine deformities where Spinal anesthesiamay be difficult, peripheral nerve blocks can be used safely. Also, they provide excellent postoperative analgesia and facilitate timely discharge. Lower limb anesthesia requires the combination of, at least, three in-one and Sciatic nerve blocks. The Sciatic nerve can be approached posteriorly, anteriorly or laterally. The anterior approach to a sciatic nerve block is an advanced herve block technique. Combined with the femoral nerve block, anaesthesia of the entire knee level and the leg below the knee level is achieved. Although the posterior approach is most commonly performed, it necessitates patient repositioning, which limits its use in patients with compromised mobility, caused by severe arthritis, obesity, or trauma. [1]

The anterior approach is unique as it can be performed in the supine position without limb flexion or patient positioning. Another benefit is that a femoral nerve block can be performed using same skin preparation. [2] The anterior approach, as first described by Beck in 1963, may be difficult to perform, because the appropriate femoral anatomical landmark e.g. the greater trochanter is not easily identified in obese patients. In addition, its identification may be extremely painful in patients with lower extremity fractures. [1] To overcome this limitation, Chellyand Delaunay developed a new anterior approach in 1999, that necessitates neither repositioning nor identification of greater trochanter. In both of these approaches, two different site injections are needed, one for '3-in-1' block and another for sciatic nerve block.

In an approach described by Chelly and Delaunay, only sciatic nerve blocks were given and para-vascular '3-in-1' block were performed separately. While performing block by this approach, the femoral nerve also get stimulated. They also stated that when a femoral and a sciatic block are required and there is no indication for a tourniquet for prolonged periods, it is possible with their approach to block both nerves. We are performing the femoral nerve block and the sciatic nerve block through the same injection site using the landmarks described by Chelly and Delaunay. In 2003, Pierre Pandin, N. Vancutsem, JC Salengros, I. Huybrechts, A. Vandesteene studied a modified technique of the anterior combined approach, via a single skin needle entry, in supine patients to achieve lower limb anesthesia. The needle insertion site is the midpoint of the classical Winnie's and Beck's landmarks. They concluded that this was technically easy and reliable combined approach to perform lower limb anesthesia can be considered a valuable alternative to traditional multiple punctures especially in supine patients who cannot be mobilized easily because of trauma, arthrosis, arthritis, etc. [3]

Our study is to compare the anterior combined approach as described by Chelly and Pierre Pandin with conventional two skin injection (Winnie's and Beck's) sites for lower limb anesthesia.

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MATERATSAND METHODS:

Present study was a hospital based intervention study. With the approval of ethical committee we conducted this study in Department of anaesthesiology. Ninety patients belonging to ASA grade I to III who fulfilled the following criteria, were recruited for this study.

Inclusion criteria:

1) Patients scheduled for lower limb surgeries of the knee and below the knee.
2) Patients aged 18 years and above.
3) Patients posted for electives well as emergency procedures.

Exclusion criteria

1) Patient's refusal.
2) Patients with known sensitivity to local anesthetics.
3) Patients with bleeding disorders.
4) Skin infection at the site of needle insertion

A written informed consent was obtained from each of the considered patient after explaining regarding anaesthesia and drugs in vernacular language. Patient co-operation was requested. Prior sensitivity test for local anesthetics was done. Whenever possible, patient's weight was recorded. All the equipments and drugs necessary for General anaesthesia and emergency resuscitation were kept ready.

Baseline readings of pulse rate and non-invasive blood pressure were noted. ln the operation room, we secured a wide bore IV access with 18 G intravenous cannula. All the patients were given Inj. Midazolam 0.03mg/kg and Inj. Pentazocin 0.3 mg/kg as premedication.

The perþheral nerve blocks were performed under all aseptic precautions. Blocks were given according to the group they belong.

Group A: 30 Patients were given '3-in-1' block by Winnie's approach and Sciatic nerve block by Beck's approach with two different skin injection sites.

Group B: 30 Patients were given Femoral nerve block and Sciatic nerve block by anterior combined approach through single skin injection site as directed by Chelly.

Group C: 30 Patients were given '3-in-1' block and Sciatic nerve block by anterior combined approach through single skin injection site as directed by Pierre Pandin.

Anesthesia was given to each group patients as per the standard technique.

The following readings were recorded:

Pulse rate, non invasive BP, SPO2 was taken as base line reading.

Time required for identification of anatomical landmarks.

Time required for identification of Sciatic nerve.

Time required for onset of sensory blockade of nerves of Lumbar plexus i.e. Femoral nerve, Lateral femoral cutaneous nerve and Obturator nerve.

Time required for onset of sensory blockade of nerves of Sacral plexus i.e. Posterior femoral cutaneous nerve, Sciatic nerve (Tibial and Common peroneal nerve).

Time required for onset of motor blockade of femoral nerve, Obturator nerve, Tibial nerve and Common peroneal nerve.

Quality of sensory block was assessed by intra-operative supplementation of analgesics. Extent of motor block assessed according to the modified Bromage scale.

Duration of analgesia from the onset of sensory blockade

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The quality of analgesia assessed and graded into 3 categories:
A) Excellent- total absence of pain
B) Good- pain relieved by analgesia
C) poor- pain that required either general or Spinal anaesthesia.
Motor block was assessed by Modified Bromage scale: [4]
0 = no blockade: extended limb lift off the bed,
1 = flexion/extens¡on at knee and ankle joint,
2 = no flexion/extension at knee or ankle joint,
3 = complete blockade.

RESULTS

Table 1: Age and sex distribution of study subjects

Characteristics		Group A	Group B	Group C	Chi square	p
Age (years)	15-30	14	13	12	0.4504	0.9782
	31-50	14	14	15		
	> 50	2	3	3		
Sex	Male	28	28	26	1.098	0.5777
	Female	2	2	4		

All the three groups were comparable for age and sex (p>0.05). (Table 1)

Table 2: Comparison of time taken for various events in three groups

Time in min required for (mean±SD)	Group A	Group B	Group C	t value	p value
Determination of anatomical landmark	1.28±0.36	0.92±0.31	1.38±0.43	13.06	< 0.05
Identification of sciatic nerve	2.67±1.01	2.95±0.88	3.07±1.00	1.86	> 0.05
Onset of sensory blockade of femoral nerve	18.62±8.65	23.79±9.27	18.79±8.62	3.1	> 0.05
Onset of sensory blockade of lateral femoral cutaneous nerve	20.76±7.16	22.69±5.78	20.27±7.07	0.73	> 0.05
Onset of sensory blockade of obturator nerve	22.18±6.59	25.71±7.31	21.15±6.15	1.33	> 0.05
Onset of sensory blockade of posterior femoral cutaneous nerve	21.87±3.72	25±4.08	23.33±2.67	1.09	> 0.05

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Onset of sensory blockade of tibial nerve	26.4±9.99	31.08±9.08	26.13±5.13	2.34	> 0.05
Onset of sensory blockade of common peroneal nerve nerve	25.4±9.48	30.22±11.02	23.33±8.68	2.59	> 0.05
Onset of motor blockade of femoral nerve	26.6±9.4	29.62±9.32	25.71±9.25	1.52	> 0.05
Onset of motor blockade of obturator nerve	28.33±6.17	28.33±2.88	27±6.8	4.97	> 0.05
Onset of motor blockade of tibial nerve	33.26±8.27	35.71±8	30.47±9.31	2.11	> 0.05
Onset of motor blockade of common peroneal nerve nerve	31.81±8.13	23.36±9.23	31.05±8.52	0.14	> 0.05
Duration of analgesia	367.2±104.61	321.9±98.07	327±108.28	0.88	> 0.05

Time required for onset of Sensory and Motor block in femoral, tibial and obturator nerve was comparable across three groups ($p>0.05$) and total duration of analgesia was also similar in three groups ($p>0.05$). (Table 2)

DISCUSSION:

In the present study, maximum numbers of patients were of 2nd and 3rd decade in all the three groups. There was preponderance of male patients in all the three groups.

The average time required was 1.28±0.36 min in Group A, 0.92±0.31 min in Group B and 1.38±0.43 min in Group C. There iwa significant statistical difference observed. In Group A and Group C, the Sciatic nerve was approached anteriorly by using the anatomical landmarks as described by Beck. [5] This approach may be difficult to perform because the appropriate femoral anatomical landmarks, i.e. the greater trochanter, which is not easily identified in obese patients. In addition, its identification may be extremely painful in patients with lower extremity fractures. In Group B, the Sciatic nerve blocks performed by anterior approach using the anatomical landmarks as described by Chelly. [1] This approach does not require identification of the greater trochanter. So, the time required to identify the anatomical landmarks was less as compared with Group A and Group C.

The average time required for identification of the Sciatic nerve was 2.67±1.01 min in Group A, 2.95±0.88 min in Group B and 3.07±1.00 min in Group C. The ANOVA test was used for the comparison. There was no significant statistical difference observed. These observations are in accordance with the study done by Dalens et a1. [6] They compared the success rate of the posterior, lateral, and anterior approaches to the Sciatic nerve in children. They had success rate of 90% with all approaches. They also reported that fewer manipulations were required to perform either lateral or posterior approach compared with the anterior approach.

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In all the three groups the Femoral nerve was successfully located and blocked. The average time required for the onset of the sensory blockade of the Femoral nerve was 18.62±8.65 min. in Group A, 23.79±9.27 min in Group B and 18.79±8.62 min. in Group C. The observations were comparable to the study done by Piene Pandin, [3] in which the sensory blockade of the Femoral nerve was seen in all patients.

The Lateral cutaneous Femoral nerve was blocked in 86.67% (n=30) in Group A, 6070 (n=30) in Group B and 63.33% (n=30) in Group C. The average onset of time was 20.76±7.16 min. in Group A, 22-69±5.78 min. in Group B and 20.27±7.07 in Group C. The ANOVA test was used for comparison. There was no significant statistical difference. The results obtained in Group B and C were comparable to the study done by Capdevilla et al [7] They studied comparison of the 3-in-1 and fascia iliaca compartment blocks in adults clinically and by radiographic analysis. They also observed sensory blockade of lateral Femoral cutaneous nerve in 62% cases in '3-in-1' block group.

The average time required for the onset of sensory blockade of Obturator nerve was 22.18±6.57 min in Group A, 25.71±7.31min in Group B and 21.15±6.55 min in Group C. The ANOVA test was used for the comparison. There was no significant statistical difference observed. The results obtained in Group A and Group B were comparable to study done by X Capdevilla et al. [7] They studied comparison of '3-in-1' and fascia iliaca compartment blocks in adults clinically and by radiographic analysis. The sensory block of the Obturator nerve was 5270.

The average onset of time for sensory blockade was 21.87±3.72 min in Group A, 25±4.08 min in Group B and 23.33±2.67 min in Group C. The ANOVA test was used for the comparison. There was no significant statistical difference observed. The success rate was less in all the three Groups and least in Group B. The Chelly's [1] approach for Sciatic nerve block does not provide a good block of the Posterior femoral cutaneous nerve that separate from sciatic nerve at the level of Sciatic notch. The success rate was also less in Group A and Group C. In a USG guided comparative study of anterior approach to sciatic nerve block with the posterior (sub-gluteal) approach done by J Ota et al [8], the sensory block in the Posterior Femoral cutaneous nerve was achieved less often with the anterior approach compared with sub-gluteal approach (14.9% & 61.1% respectively). [8]

The average onset of sensory blockade of the Tibial nerve was 26.4±9.99 min in Group A, 31.08±9.32 min in Group B and 26.13±5.63 min in Group C. The ANOVA test was used for the comparison. There was no significant difference observed. The results obtained in all the three groups were comparable to the studies done by Chelly [1] and Pierre Pandin. [3] In both studies the success rate was 100%.

The success rate of sensory blockade of the Common Peroneal nerve was 92.86% (n=28) in Group A, 92% (n=25) in Group B and 91.67% (n=24) in Group C. The average time required for onset of sensory blockade was 25.4±9.48 min in Group A, 30.22±11.82 min in Group B and 23.33±8.68 in Group C. The ANOVA test was used for the comparison. There was no significant difference observed. The results obtained were comparable to study done by Pierre Pandin. [3] The success rate was 98.2% in their study.

The average onset of Time of motor blockade of the Femoral nerve was 26.60±9.40 min in Group A, 29.62±9.32 min in Group B and 25.7±9.25 min in Group C. The ANOVA test was

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used for the comparison. There was no significant statistical difference observed. These results were comparable to a study done by Pierre Pandin. [3] In their study, the motor blockade of Femoral nerve was seen in 98.3% cases.

The average time required for onset of motor blockade of Obturator nerve was 28.33±6.17 min in Group A, 28.33±2.88 min in Group B and 27±6.80 min in Group C. The ANOVA test was used for the comparison. There was no significant statistical difference observed. Marhofer P et al [9] demonstrated that in '3-in-1' block, Femoral nerve blocked directly, lateral spread of local anesthetic can block Lateral Femoral Cutaneous nerve, slight medial spread can block Anterior branch Obturator nerve (articular branch to hip joint, motor to superficial adductors, and skin of medial distal thigh) but there is no spread to posterior obturator nerve. (deep adductors, articular branch to posterior knee joint). There was slight cephalad spread, but not to the level of psoas compartment. The results were in accordance with the study done by Parkinson et al. [10] They stated the anterior approach (Femoral) resulted in blockade of only the Femoral and Lateral Femoral Cutaneous nerve. Motor blockade of the Obturator nerve was not produced using the anterior approach.

The average time required for onset of motor blockade of Tibial nerve was 33.26±8.27 min in Group A, 35.71±8.00 min in Group B and 30.47±9.31 min in Group C. The ANOVA test was used for the comparison. There was no significant statistical difference observed. The results obtained in all the three groups were comparable to the results of study done by Pierre Pandin et al. [3] The motor blockade of Tibial nerve was observed in 97.4% of cases in their study.

The average onset of motor blockade of the Common peroneal nerve was 31.81±8.1 3 min in Group A, 32.36±9.23 min in Group B and 31.05±8.52 min in Group C. The ANOVA test was used for the comparison. There was no significant statistical difference observed. The success rate of motor blockade in all the three groups were comparable to study done by Pierre Pandin et al. [3] In their study, the motor blockade of the Common peroneal nerve was seen in 85.7% cases.

The duration of analgesia is measured from the onset of sensory blockade up to the patient complains of pain in a post operative period. The average duration of analgesia was 367.2±104.61 min in Group A, 321.90±98.07 min in Group B and 327±108.28 min in Group C. The ANOVA test was used for the comparison. There was no significant statistical difference observed. In a study performed by Bernhard Urbanek et a1 [11] 0.5% Bupivacain, 0.5% Levobupivacain and 0.25% Levobupivacain was used. Sensory onset time was 27 min. (20-33 min) with Bupivacain 0.5% and the duration of the block was 1053 min. (802-1304 min) Fanelli G. et al [12] performed double blind comparison of 0.75% Ropivacain, 0.5% Bupivacain and 2% Mepivacain during Sciatic and Femoral nerve blockade. Duration of postoperative analgesia in Bupivacain group was 880±312 min. This longer duration of action in both the above trials, compared to our study may be because we used 0.25% Bupivacain instead of 0.5% Bupivacain. In our study we encountered no complications.

CONCLUSION:

We can conclude that, all the three anterior approaches for the Sciatic nerve block for lower limb surgeries below knee, not requiring tourniquet for prolonged period, can be safely used in high risk patients where General anaesthesia and other modalities of regional anaesthesia can't be used and repositioning of the patient for the posterior approach is difficult. Also,

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failure rate of identification of Sciatic nerve and blockade of Lateral femoral cutaneous and Obturator nerves is less with conventional two skin injection sites approach (Winnie's and Beck's). Hence, the conventional. two skin injection sites approach can be preferred for lower limb anaesthesia.

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