**Original article:**

**Landmarks for sciatic nerve block in pre-term and term babies: an anatomical study**

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**Abstract**

**Background:** Advances in neonatology have improved the survival of preterm and term infants with life threatening conditions. Over past two decades there has been renewed interest in regional anesthesia (RA) for pediatric procedures and has been suggested as good alternative to general anaesthesia (GA). Classical posterior approach of Labat modified by Winnie, one of the most commonly used approach for giving sciatic nerve block in children and adults has not been used in preterm babies. We checked the possibility of localization of sciatic nerve by posterior approach of Labat modified by Winnie and compared all the measurements with crown heel length.

**Materials and method:** Relationship of sciatic nerve with bony landmarks namely posterior superior iliac spine, greater trochanter and centre of sacral hiatus in 50 lower extremities of 25 spontaneously aborted fetuses with crown heel lengths ranging from 400 to 510mm was studied.

**Results:** Iliotrochantric and sacrotrochantric distances ranged from 27.7 to 45.12mm and 30.28 to 45.09 mm respectively. Point of intersection of perpendicular drawn from the midpoint of Iliotrochantric to sacrotrochantric line was considered as point of insertion of needle. In 64% of cases, needle passed through sciatic nerve and in 22% cases it was just touching the medial margin of the nerve and in 14% cases, needle was lying 0.9-5.4 mm medial to nerve. Diameter of sciatic nerve at this point ranged from 1.9-6.84 mm.

**Conclusion:** Simple landmark based technique for sciatic nerve block in gluteal region, classical posterior approach of Labat modified by Winnie may also be used in preterm and term babies.

**Key words:** Regional anesthesia, sciatic nerve, gluteus maximus, greater trochanter

**Introduction**

Advances in neonatology are associated with improvement of the survival rate of preterm infants. Number of premature infants presenting for early surgery has increased. This has led to new challenge for paediatric anaesthetists. Preterm infants subjected to general anaesthesia (GA) are definitely at higher risk for respiratory and cardiovascular complications. Over past two decades there has been renewed interest in regional anesthesia (RA) for pediatric procedures and has been suggested as good alternative to GA as it avoids manipulation of the air way, the use of muscle relaxants and inhalational agents. Advantages of combining light GA with
regional block have become more widely recognized. Survey conducted by Giaufre et al revealed efficiency and safety of peripheral nerve block even in premature children. The main requirement of any orthopedic procedure of lower limb is profound analgesia. Sciatic is the main nerve supply of lower extremity and sciatic nerve block has wide range of clinical applications. The classical posterior approach of Labat modified by Winnie is most frequently used approach for sciatic nerve in adults. This approach of blocking the sciatic nerve is gaining popularity even in paediatric anaesthesia as it has been proved to be safe and effective in neonates and children without any morbidity in post operative period and remains the easiest approach. Main prerequisite of sciatic nerve block is to locate it correctly, which depends primarily upon its relationship with nearby bony landmarks.

For safety and consistency of any peripheral nerve block procedure, bony landmarks may have the advantages of better visualization with ultrasound than soft tissue. Application of landmarks by anaesthetists enables them to locate the nerve and may increase the success rate of sciatic block. Vast literature is available on sciatic nerve block in children but there is scarcity of literature addressing this issue in neonates and premature babies. Main goal of this study was to elucidate relationship of sciatic nerve with bony landmarks in gluteal region and to check whether it is possible to locate sciatic nerve via classical posterior approach of Labat modified by Winnie in preterm and term babies with crown heal length varying between 400 and 510mm.

Materials and Methods

After getting approval from institute ethical committee and written informed parental consent, twenty five spontaneously aborted fetuses (8 males and 17 females) of 31 to 41 week with crown heal length ranging between 400 and 510 mm were fixed in 10% formalin. Fetuses with any congenital limb anomaly were excluded. Fifty lower limbs (25 right and 25 left) were studied. Skin and subcutaneous fat were removed from the gluteal and sacral regions (Fig 1). Knee and hip joints of the side to be studied were kept in flexion at 90 degree. Fetus was placed in lateral position with the side to be approached facing superiorly. Highest point of greater trochanter (GT) and posterior superior iliac spine (PSIS) were identified. An iliotrochanteric line (line1) was drawn between these two landmarks. Center of sacral hiatus (SH) was joined with GT to represent sacrotrochanteric line (line 2). After measuring iliotrochanteric distance its mid point was marked. A perpendicular drawn from midpoint of iliotrochanteric line (line1) was extended medially until it intersects the sacrotrochanteric line (line2). The point intersected of two lines was considered as point of insertion of needle. At this point a needle was inserted perpendicular to the body surface. Gluteus maximus muscle was removed to reveal relationship of sciatic nerve with the point of insertion of needle. Diameter of sciatic nerve at the point of insertion of needle was also measured. All measurements were performed using digital caliper (Mitutoyo) with 0.02 mm precision.

Statistical analysis was done using SPSS (SPSS 15 for windows, Chicago, IL, USA). Kolmogorov–Smirnov test was applied to see the normal distribution of cases. Sexual differences between the means of measurements were compared using unpaired ‘t’ test. Difference between means of right and left sides were also compared using paired ‘t’ test.
Pearson correlation coefficient was found out to see the correlation between various variables.

**Results**

Mean, SD and range of crown heel lengths, distances between landmarks and diameter of sciatic nerve at point of insertion, distance of point of insertion of needle from sciatic nerve are summarized in Table 1 and 2. All the parameters tested by Kolmogorov–Smirnov test were found to be normally distributed. Using these landmarks, in 64% of cases needle was penetrating nerve and in 22% of cases needle was just touching the medial margin of the nerve and in 14% of cases, the distance between needle and the medial margin of nerve was 0.9-5.4 (Fig 2, Table 2). Thus in 86% of cases (64% + 22%) needle was either passing through the nerve or along the medial margin of the nerve. Distance of point of insertion of needle from SH showed significant positive correlation with sacrotrochanteric distance ($r = 0.324$; $p$ value 0.022). Point of insertion of needle was falling on mid 1/3rd of this distance in 46 (92%) cases, medial 1/3rd i.e. towards SH in three cases (6 %) and lateral 1/3rd i.e. towards GT in one (2 %) case (Fig 3).

Measures of iliotrochanteric (line 1) and sacrotrochanteric distances (line 2) showed strong positive correlation with CHL ($r = 0.441$; $p$ value 0.001 for line 1 and $r = 0.423$; $p$ value 0.002 for line 2). These two lines showed positive correlation with each other as well ($r = 0.655$; $p$ value 0.000). A perpendicular drawn from the midpoint of line 1 to line 2 measured 5.5 to 15.4mm. This distance showed positive correlation with the iliotrochanteric distance (line 1) ($r = 0.297$; $p$ value 0.036). Diameter of sciatic nerve at the point of insertion of needle did not show correlation with CHL. No statistically significant difference between measurements of right and left sides and two sexes was found.

**Discussion**

Accurately estimating the location of sciatic nerve, the largest peripheral nerve of the body is an essential part of administering the sciatic nerve block at different levels. Our study describes relationship of sciatic nerve with the bony landmarks namely GT, PSIS and SH in gluteal landmarks using technique of Labat modified by Winnie in preterm babies so that by accurate palpation of these bony landmarks one can predict the position of nerve. This will potentially decrease the number of attempts of needle insertion and time to perform the nerve block as well as improve the patient’s comfort and enhance the success rate of block. Though this technique has been successfully used in adults but has not been tried in preterm and term babies.

In our study nerve was found to be located at an average distance of 10.44 mm along the perpendicular line drawn from midpoint of iliotrochanteric line. In adults various authors have seen the need to prolong this perpendicular line up to 50 mm to locate the nerve. Traditional posterior approach Labat has been tried in children but distance of nerve from this perpendicular line has not been mentioned. Winnie et al modified Labat’s approach in 1974 by adding a sacrotrochanteric line and extending the perpendicular line until it intersects the sacrotrochanteric line. This point of intersection indicates the point of needle entry into the nerve. In our study we evaluated the relationship of nerve with point of intersection of lines. In 86% of cases needle was either passing through the nerve or touching the medial margin of the nerve (Fig 2,3). We studied relationship of sciatic nerve with sacrotrochanteric
line as well. Sacrotrochanteric line measured 37.69±4.41 mm and the average distance of sciatic nerve from sacral hiatus along this line was 18.22±3.54 mm. In 92% cases the nerve was lying deep to middle third of this line suggesting site of highest likelihood of sciatic nerve localization. Such relationship has not been studied before. Iliotrochanteric and sacrotrochanteric lines showed positive correlation with CHL but no correlation of perpendicular line and distance of sciatic nerve from sacral hiatus with CHL were found implying that the length of baby does not have consistent relationship with these distances. Many people have made attempts to measure transverse diameter of sciatic nerve at origin and at lower border of piriformis muscle in adults. At origin mean diameter has been reported to be 20 mm and 17 mm at lower border of piriformis \(^8,9\). In our study we measured the diameter at the point of insertion of needle. The mean diameter was found to be 4.33±0.78 mm.

Various approaches of sciatic nerve block like classic posterior, lateral, modified subgluteal and lateral popliteal have been used in adult. Taboada et al\(^{10}\) compared time of onset of nerve block and efficacy with single injection of same volume of drug in three different approaches (classic posterior of Labat, modified subgluteal and lateral popliteal approach). Faster onset and higher success of nerve block was observed in posterior and subgluteal approaches than more distal popliteal approach. These observations support the use of proximal over distal approaches.

Dalens et al\(^{6}\) compared posterior, anterior and lateral approaches in 180 pediatric patients (3 months to 18 years weighing from 5.5 to 79 kg). The overall success rate was more than 90% in all the three groups but significantly fewer difficulties were encountered in posterior group than anterior group. They recommended posterior and lateral approaches are the most suitable for blocking the sciatic nerve in children. Our observations also suggest suitability of this approach even for preterm children. Survey conducted by Giaufre et al\(^{5}\) demonstrates the safety of regional anaesthesia in pediatric patients of all ages, including premature babies. This study was based on data prospectively collected in a large number of children in several countries at the same time. Morbidity of peripheral nerve blocks and local anesthesia was extremely low (zero complications in this study).

After extensively reviewing the literature authors did not come across any study done on sciatic nerve localization in preterm and term babies. For giving regional block or combining light general anaesthesia with regional block for any surgical procedure of lower extremity in early period of life especially in preterm children, knowledge of
relationship of sciatic nerve with neighbouring bony landmarks would be helpful. In conclusion simple landmark based technique for sciatic nerve block in gluteal region, classical posterior approach of Labat modified by Winnie may also be used in preterm babies.

Acknowledgement: Authors wish to thank Mr Vijaykant Bakshi, senior artist of the department of anatomy PGIMER, Chandigarh India for his art work.

Abbreviations:
Regional Anesthesia (RA)
General Anaesthesia (GA)
Posterior Superior Iliac Spine (PSIS)
Greater Trochanter (GT)
Crown heel length (CHL)
Sacral hiatus (SH)

Figure. 1 Landmarks after skin removal over gluteal region: A- posterior superior iliac spine; B-Highest point of greater trochanter; C- center of sacral hiatus; D- point of insertion of needle; line1- iliotrochanteric line; line 2-sacrotrochanteric line.

Figure. 2 Relations of sciatic nerve with point of insertion of needle. Needle is (a) passing through the nerve; (b) passing to medial margin of the nerve; (c) away from medial margin of the nerve ‘*’ representing point of insertion of needle.
**Figure. 3** Relationship of sciatic nerve with sacrotrochanteric line (nerve deep to middle third of line in 92%, towards sacral hiatus in 6%, towards greater trochanter in 2% cases)

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**References**

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