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SCIENTIFIC ARTICLE

Anatomical basis for sciatic nerve block at the knee level[☆]



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Abstract

Background and objectives: Recently, administration of sciatic nerve block has been revised due to the potential benefit for postoperative analgesia and patient satisfaction after the advent of ultrasound. The aim of this study was to describe the anatomical relations of the sciatic nerve in the popliteal fossa to determine the optimal distance the needle must be positioned in order to realize the sciatic nerve block anterior to its bifurcation into the tibial and common fibular nerve.

Method: The study was conducted by dissection of human cadavers' popliteal fossa, fixed in 10% formalin, from the Laboratory of Human Anatomy and Morphology Departments of the Universidade Federal de Alagoas and Universidade de Ciências da Saúde de Alagoas. Access to the sciatic nerve was obtained.

Results: 44 popliteal fossa were analyzed. The bifurcation of the sciatic nerve in relation to the apex of the fossa was observed. There was bifurcation in: 67.96% below the apex, 15.90% above the apex, 11.36% near the apex, and 4.78% in the gluteal region.

Conclusions: The sciatic nerve bifurcation to its branches occurs at various levels, and the chance to succeed when the needle is placed between 5 and 7 cm above the popliteal is 95.22%.

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PALAVRAS-CHAVE

Anatomia;
Anestesia, condução;
Nervo isquiático

Bases anatômicas para o bloqueio anestésico do nervo isquiático no nível do joelho**Resumo**

Justificativa e objetivos: Recentemente a feitura de bloqueio do nervo isquiático tem sido revista devido ao potencial benéfico para analgesia pós-operatória e satisfação dos pacientes após o advento da ultrassonografia. O objetivo deste estudo foi descrever as relações anatômicas do nervo isquiático na fossa poplíteia para determinar a distância ideal em que a agulha deve ser posicionada para a feitura do bloqueio anestésico do nervo isquiático anterior a sua bifurcação em nervo tibial e fibular comum.

Método: O trabalho foi feito por meio de dissecação de fossa poplíteia de cadáveres humanos, fixados em formol a 10%, provenientes do Laboratório de Anatomia Humana dos departamentos de Morfologia da Universidade Federal de Alagoas e da Universidade de Ciências da Saúde de Alagoas. Obteve-se acesso ao nervo isquiático.

Resultados: Foram analisadas 44 fossas poplíteias. Observou-se a bifurcação do nervo isquiático em relação ao ápice da fossa. Houve bifurcação em 67,96% abaixo do ápice, 15,90% acima do ápice, 11,36% próxima ao ápice e 4,78% na região glútea.

Conclusões: A bifurcação do nervo isquiático em seus ramos ocorre em vários níveis e a chance de se obter sucesso quando a agulha é usada entre 5 e 7 cm acima da fossa poplíteia é de 95,22%. © 2014 Sociedade Brasileira de Anestesiologia. Publicado por Elsevier Editora Ltda. Todos os direitos reservados.

Introduction

The popliteal sciatic nerve block (PSNB) was first described in 1923, but its infrequent use in clinical practice may be justified by the difficulty in accessing the nerve in this region, high incidence of unwanted side effects, such as dysesthesia, and technical difficulty in the blockade.¹ Recently, the PSNB has been revised due to the potential benefit for postoperative analgesia and patient satisfaction because of the use of nerve stimulator.² The use of ultrasound to help the PSNB technique has also encouraged professionals to seek the advantages and benefits when they perform this blockade more often.³ The main disadvantage of S PSNB is little or no blocking action in saphenous nerve.³

Sciatic nerve is derived from the fibers of spinal segments L4-S3.⁴ Two nerve trunks originating from this nerve may be distinguished, which are the tibial and common fibular nerves.⁵ The sciatic nerve block in the area above these nerves bifurcation provides anesthesia below the knee level, except for the medial aspect of the leg, which is innervated by the saphenous nerve.⁴

Complete lower limb blockade requires saphenous nerve anesthetic block. Saphenous nerve block (SNB) may be performed above the knee, at the knee level, below the knee, and just above the medial malleolus.⁶ The SNB success rate varies according to its level of blockade with local anesthetic, and at the knee level it can be 40%.⁷

The objective of this study was to describe the anatomical relationships of sciatic nerve in the popliteal fossa to determine the optimal distance the needle should be positioned to perform the anesthetic block of the sciatic nerve before its bifurcation into tibial and common fibular nerves.

Method

Cadavers from the Morphology Department of the Federal University of Alagoas and the University of Health Sciences of Alagoas were used. The material comprised adult Brazilian cadavers of both sexes, with unknown ages, who died from different causes and were fixed with 10% formalin.

Material for dissection, pins, and mechanical caliper (Metrica®) were used to obtain the data.

The cadaver was placed in prone position on the dissection table to be dissected. Then the popliteal fossa was demarcated, whose limits are the superolateral with the biceps femoris muscle, the superomedial with the semimembranosus and semitendinosus muscles, the inferomedial and the inferolateral with the respective heads of the gastrocnemius muscle. Subsequently, a longitudinal incision was made in the center of the popliteal fossa, followed by two transverse incisions. After the skin and subcutaneous tissue removal, access to the popliteal fossa was achieved, and the dissection of fat and local fascia was performed, preserving the nerve in its original position. When the sciatic nerve was already bifurcated at the fossa level, the incision was extended upwards in search for the site of its bifurcation.

The following distances were measured: from the fossa apex to the sciatic nerve emergency point, from the nerve emergency point to the tibial and common fibular nerve bifurcation, from the bifurcation to the end of superolateral limit, and from the depths of sciatic nerve surface to the popliteal sheath and biceps femoris muscle.

Results

In total, 44 popliteal fossa were dissected from 20 male and 2 female cadavers.

Regarding nerve bifurcation in relation to the apex of popliteal fossa, it was observed that there was a bifurcation below the apex in 67.96%; above the apex in 15.90% with mean distance of 1.72 cm, greater distance of 3.40 cm, and shorter distance of 0.55 cm; and next to the apex in 11.36%. The sciatic nerve was already bifurcated at the gluteal region in 4.78%.

Regarding nerve emergence in relation to the apex of popliteal fossa, it was observed that the nerve emerged at the same level of the apex in 56.81%, below the apex in 42.86% with a mean distance of 1.67 cm, longer distance of 3.60 cm, and shorter distance of 0.80 cm. Tibial and common fibular nerves emerged separately in 2.36%.

Regarding the popliteal fossa limits, it was observed that the superomedial limit had an average length of 5.78 cm with a greater length of 10 cm and a shorter length of 2.5 cm. The superolateral limit had an average of 5.98 cm with a greater length of 11 cm and a shorter length of 2.25 cm. The inferior limit had an average length of 4.06 cm, with a greater length of 8.80 cm and a shorter length of 1.70 cm.

Regarding the distance from the sciatic nerve sheath that coats the popliteal vessels, the average was 1.35 cm, with a greater distance of 2.60 cm and shorter distance of 1.35 cm.

Regarding the distance from the sciatic nerve to the long head of the biceps femoris muscle, the average distance was 1.23 cm, with a greater distance of 3 cm and a shorter distance of 0.40 cm.

Discussion

There are several approaches to sciatic nerve block, such as posterior, anterior, lateral, and popliteal, but the popliteal approach has been associated with a good score of patient satisfaction.³ A blockade of sensory and sympathetic fibers may occur, so that PSNB can be indicated not only for pain control during anesthesia but also for analgesia in foot trauma or pain caused by burns.³

Knowledge of peripheral nerves and its anatomical relationships facilitates its location during the execution of anesthetic techniques, reduces the rate of complications associated with anesthesia, and increases the frequency of successful blockades.⁸

This study observed the anatomical relationships of the sciatic and saphenous nerves and did not aim to study the anesthetic techniques and type of anesthetics, as well as its quantity and concentration.

The popliteal sciatic nerve block is known as popliteal block, in which a needle is inserted between 5 and 7 cm above the fossa apex and advanced toward the nerve.⁴ The

needle should be inserted near the main trunk before this nerve bifurcation into the tibial and common fibular nerves.⁴ The chance of a needle to be near the sciatic nerve before its bifurcation into other nerves when inserted 5–7 cm above the fossa is 95.22%, regarding the bifurcation in relation to the apex of popliteal fossa.

A randomized clinical trial that evaluated the effectiveness of sciatic nerve block at the knee level found that the injection of anesthetics in two points would have a higher success rate, but at the time of this study the use of ultrasound in anesthesia had not been widely publicized.⁹ Anatomical studies may contribute to improve the blockade techniques using ultrasound and thus contribute to increase effectiveness, with a higher score of patient satisfaction.

The sciatic nerve bifurcation in its branches occurs at various levels, and the chance to succeed is 95.22% when the needle is placed between 5 and 7 cm above the popliteal fossa.

Conflicts of interest

The authors declare no conflicts of interest.

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