

A practical approach to the lateral cutaneous nerve of the thigh: An anatomical study

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ARTICLE INFO

Article history:

Received 21 April 2010

Received in revised form 9 January 2011

Accepted 18 June 2011

Available online 18 July 2011

Keywords:

Lateral cutaneous nerve of the thigh

Lateral femoral cutaneous nerve

Peripheral nerve

Meralgia paresthetica

Anatomy

Surgery

ABSTRACT

Objectives: To study the main anatomical landmarks related to the lateral cutaneous nerve of the thigh (LCN) in the infrainguinal region and to define reliable criteria for identifying the nerve during the surgery and electrophysiological study.

Methods: Bilateral dissections of 60 adult non-fixed cadavers were performed with measurements of the distance between the inferior border of the anterior superior iliac spine (ASIS) and the LCN (DAL) and the internal angle between the LCN and the inguinal ligament (IA). The number of nerves exiting the inguinal ligament, the position of the LCN relative to the ASIS and to inguinal ligament were observed and registered. A triangle was designed using the inguinal ligament, the ASIS and the direction of tendinous insertions of the tensor of fascia lata muscle as parameters and the nerves were tested according its localization inside the triangle in each dissection.

Results: In 80% of the dissections, the LCN passed under the inguinal ligament and was identified lateral to ASIS in only three dissections. A great variability was observed in the values of DAL and IA. The values of DAL ranged from 0 (immediately medial to ASIS) to 5 cm on either side with means of 1.31 and 1.22 cm on the right and left side, respectively. The values of IA ranged from 40° to 120°, with a mean of 66.08° on the right side and from 40° to 130° with a mean of 69.92° on the left side. No significant differences were identified between the two sides with respect to the relationship between the nerve and the inguinal ligament (Chi-square test, $p=0.83$); DAL (t test, $p=0.37$) or IA (t test, $p=0.15$). A single nerve was found in 70.83% of the dissections. The nerve was found inside the triangle in 95% of the dissections.

Conclusions: Despite the symmetry found between the right and left sides, the values of the main anatomic parameters involved in the localization of the LCN presented a great degree of variability. Even so, dissection using the proposed anatomical triangle allows for the localization of the LCN in almost all cases.

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1. Introduction

The lateral cutaneous nerve of the thigh (LCN) is purely sensory and derives from the L2 and L3 spinal nerves. After its origin, the nerve emerges from the lateral border of the psoas major muscle and takes a retroperitoneal route crossing the iliac muscle obliquely [1]. The LCN exits the pelvis by passing above, through, or under the inguinal ligament, medially to the anterior inferior spine of the ileum, and continues to enter the proximal thigh.

There are various causes of LCN damage in the inguinal region. The entrapment neuropathy of the LCN, named meralgia paresthetica, results from the close relationship between the nerve and the

inguinal ligament. Classically this entrapment syndrome presents as pain, paresthesia and numbness on the anterolateral and lateral aspect of the thigh [2]. Compression of the LCN can result from a repetitive external source including direct trauma resulting, for example, from wearing a tight brace. Increase in abdominal volume due to obesity, ascites or pregnancy is listed as common causes of LCN compression [3]. Other mentioned causes of LCN injury include complication of surgery in the inguinal region as hernia repair, iliac bone graft harvesting, or direct compression of the nerve during thoracic or abdominal surgeries [4,5]. When a specific etiology is not demonstrated, functional anatomical changes with angulation and kinking of the LCN has been accepted as a causative factor.

Conservative treatment is effective in the majority of cases of meralgia paresthetica, although in less than 10% of cases, the non-operative treatment is unsuccessful and surgical intervention is needed [1–3]. Surgical failure is not unusual and one of the causes

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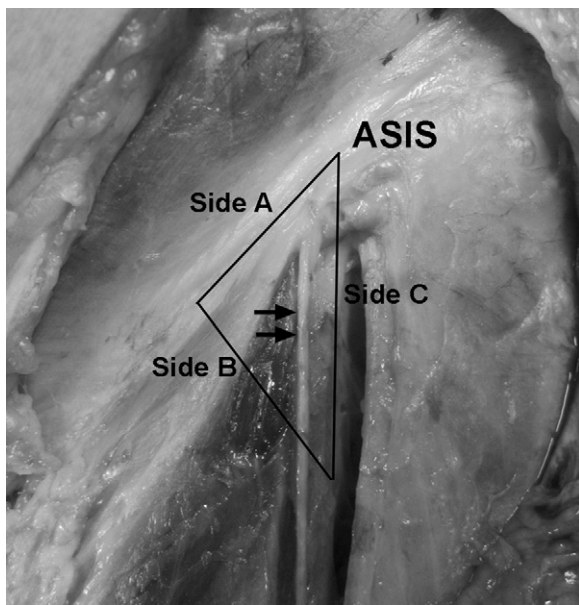


Fig. 1. Dissection of the inguinal region on the left side. A triangle used as a reference to find the lateral cutaneous nerve of the thigh (arrows) was drawn using the anterior superior iliac spine (ASIS), the inguinal ligament and the direction of tendinous insertions of the tensor of fascia lata muscle as anatomical landmarks.

is LCN anatomical variability [6–11]. The aim of the present study is to compare bilaterally the main anatomical parameters related to the course of the LCN nerve in the inguinal region and to provide anatomically relevant information to localize the LCN in the inguinal region during surgery.

2. Materials and methods

The study was approved by the local ethical commission. Dissections were conducted in the dissection rooms at the Serviço de Verificação de Óbitos da Capital, São Paulo University School of Medicine, São Paulo, Brazil.

The inguinal regions of 60 adult non-fixed cadavers were assessed bilaterally during a five year period, emphasizing the anatomical variations using the infrainguinal approach. Cadavers presenting scars or previous procedures in the inguinal region have been excluded from the study. An incision was made parallel to the inguinal ligament, starting at the anterior superior iliac spine (ASIS) and extending 3 cm medially. Appropriate retraction provides an inferior exposure with a triangle shape. If necessary the exposure was extended towards the pubic symphysis or laterally to the ASIS. The subcutaneous fat of the region was partially removed and the ASIS and the inguinal ligament were then identified. The fascia covering the sartorius muscle was divided and the LCN was identified at the subfascial plane. The disposition of LCN related to the inguinal ligament was observed after tracing the nerve proximally. Contributions to the LCN, when present, were registered as well as the number of nerves exiting the inguinal ligament and their position relative to the ASIS, medial or lateral. The inguinal ligament was opened to confirm the number of nerves and its relationship with the ligament. Measurements were then performed using a portable pachymeter for the distance between the inferior border of the ASIS and the LCN or its first branch (DAL). The internal angle between the LCN and the inguinal ligament (IA) was also defined.

Based on the findings of the dissections and the relationship between DAL and IA we define a triangle to facilitate the dissection of the LCN. This triangle was designed using the inguinal ligament, the ASIS and the direction of tendinous insertions of the tensor of fascia lata muscle as parameters. One side was started at the ASIS

Table 1

Values of distance between ASIS and the LCN (DAL) or its first branch, internal angle between the LCN and the inguinal ligament (IA) and correlation analysis.

	DAL	IA	Correlation
Right side	1.31 cm (0–5 cm)	66.08° (40–120°)	$r=0.73, p<0.0001$
Left side	1.22 cm (0–5 cm)	69.92° (40–130°)	$r=0.66, p<0.0001$

ASIS: anterior superior iliac spine; cm: centimeters; LCN: lateral cutaneous nerve of the thigh.

and followed the inguinal ligament 2.5 cm medially (side A), the length of which was defined based on results from the literature [12,13]. At the end of this delineation, a second straight line was drawn directed inferiorly with an angle of 90° to the first line (side B). The third side of the triangle was represented by a line also originating at the lateral end of the ASIS that follows the fibers of the tendinous insertions of the tensor of fascia lata muscle, intersecting the second line (side C) (Fig. 1). The nerve location inside the triangle was evaluated after the dissections for each side of all cadavers.

Statistical analyses were performed using the SPSS version 14.0 for Windows (SPSS Inc.). The following measurements were compared bilaterally: number of nerves exiting the inguinal ligament, the DAL and the IA. Data from the two sides were evaluated for normal distribution and equal variances and then compared. Numerical and categorical variables were compared by independent unpaired *t* test and by the Chi-square test, respectively. In order to evaluate the relationship between the DAL and the IA, a linear correlation was performed using the Pearson's correlation test. We hypothesize that there would be a positive correlation between those parameters, enabling the use of the anatomical triangle positioned in the lateral portion of the inguinal region. A *p* value of less than 0.05 was considered significant.

3. Results

The LCN was identified in every specimen. There were 51 men and 9 women with ages ranging from 18 to 86 years (average age, 54.2 years). The mean height was 172.8 cm, and ranged from 160 to 190 cm; the mean weight was 67 kg and ranged from 50 to 84 kg. In most of the 120 dissections (80%, $n=96$), the nerve (s) passed under the inguinal ligament, and this relationship was identified in both sides in 50 cadavers. In 16 dissections (13.3%), 7 of them on the right side, the nerve passes through a split in the lateral end of the inguinal ligament. We did not find any pseudoneuroma related to the point where the nerve crossed the inguinal ligament. No significant difference was observed between the right and the left sides with respect to relationship between the nerve and the inguinal ligament (Chi-square test, $p=0.83$). The nerve crossed lateral to the ASIS in only three dissections (2.5%), in one case bilaterally, and in the other two cases on the left side.

Table 1 summarizes the results of the distance between LCN and the ASIS (DAL) and the internal angle between the LCN and the inguinal ligament (IA) in centimeters (cm). A great variability was observed for the values of DAL (Fig. 2) and IA. DAL ranged from 0 (immediately medial to the ASIS) to 5 cm bilaterally, with a mean value of 1.28 cm for both sides, and mean values of 1.31 and 1.22 cm for the right and left side, respectively. The mean value of DAL was 1.22 cm in male and 1.51 cm in female. No significant gender difference was found for DAL measurement. IA values varied from 40° to 120° on the right side, with a mean of 66.08°, and from 40° to 130° with a mean of 69.92° on the left side. The mean value of IA was 67.16° in male and 72.78° in female. No significant gender difference was identified for IA measurement. The values were symmetric only in 27 specimens (45%) for DAL and in 28 specimens

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