

Coexisting anatomical variation of the lateral femoral cutaneous nerve and genitofemoral nerve: A case report

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ABSTRACT

Introduction: Anatomical variations of the nerves derived from the lumbar plexus are common and clinically valid. Therefore, this report aims to present the coexisting anatomical variations of the lateral femoral cutaneous and genitofemoral nerves.

Case description: During routine dissection of an isolated male left lower limb (fixed in 10 % formalin solution), atypical arrangements of the lateral femoral cutaneous and genitofemoral nerves were found. The lateral femoral cutaneous nerve division level into anterior and posterior branches was high, above the inguinal ligament. Both branches passed beneath the inguinal ligament at the midpoint of the distance between the anterior superior iliac spine and the femoral artery. The anterior branch of the lateral femoral cutaneous nerve was better developed and had a greater diameter than the posterior branch. The femoral branch of the genitofemoral nerve was absent and partially replaced by the most medial branch derived from the anterior division of the lateral femoral cutaneous nerve.

Conclusions: The lateral femoral cutaneous and genitofemoral nerves can show anatomic variability, which should be remembered during clinical assessments of nerve lesions and while performing surgical interventions.

1. Introduction

The lateral femoral cutaneous nerve (alternatively, lateral cutaneous nerve of the thigh; Latin *nervus cutaneus femoris lateralis*) originates from the lumbar plexus. It primarily consists of fibers derived from the L2 and L3 spinal nerves. After originating in the lumbar plexus, the nerve runs obliquely through the iliac fossa. Then, it passes under or through the inguinal ligament, typically medially to the anterior superior iliac spine (although the relationship of the nerve to this landmark is highly variable). Subsequently, the nerve divides into its terminal (anterior and posterior) branches and provides sensory innervation from the anterior and lateral sides of the thigh [1–5].

Genitofemoral nerve (Latin *nervus genitofemoralis*) - is also a nerve originating from the lumbar plexus. It consists of fibers from the L1 and L2 spinal nerves. This nerve passes through the psoas major muscle and, after leaving it, typically divides into two branches: genital (which passes through the inguinal canal) and femoral (also called lumboinguinal nerve, which passes through the vascular lacuna and runs on the anterior surface of the femoral artery) [1–3].

Anatomical variations of the nerves derived from the lumbar plexus

are common and clinically valid [4–8]. Therefore, this report aims to present the coexisting anatomical variations of the lateral femoral cutaneous and genitofemoral nerves.

2. Case presentation

During routine dissection of an isolated male left lower limb (fixed in 10 % formalin solution), atypical arrangements of the lateral femoral cutaneous and genitofemoral nerves were found. The lateral femoral cutaneous nerve division level into anterior and posterior branches was high, above the inguinal ligament. Both branches occupied a medial position to the anterior superior iliac spine while emerging from under the inguinal ligament. Both branches passed beneath the inguinal ligament at the midpoint of the distance between the anterior superior iliac spine and the femoral artery. The distance between the posterior branch and the anterior superior iliac spine was 47 mm. The distance between the anterior branch and the femoral artery was 36 mm (and the distance of this branch to the pubic tubercle was 65 mm). The anterior branch of the lateral femoral cutaneous nerve was better developed and had a greater diameter (2.57 mm) than the posterior branch (1.39 mm

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diameter). The femoral branch of the genitofemoral nerve was absent and partially replaced by the most medial branch derived from the anterior division of the lateral femoral cutaneous nerve. Thus, the territory of the lateral femoral cutaneous nerve anterior branch covered a greater extent than typical, while the territory of the nerve's posterior branch was typical. Anatomical relationships in the femoral triangle and anterolateral thigh in the dissected specimen are presented in Fig. 1. The genital branch of the genitofemoral nerve occupied a normal position. The remaining nerves of the lumbar plexus were normal. The typical innervation territory of the lateral femoral cutaneous nerve and femoral branch of the genitofemoral nerve is shown for comparison in Fig. 2.

3. Discussion

Anatomical variations of nerves result from deviations in axonal migration during nerve development [2]. From an anatomical point of

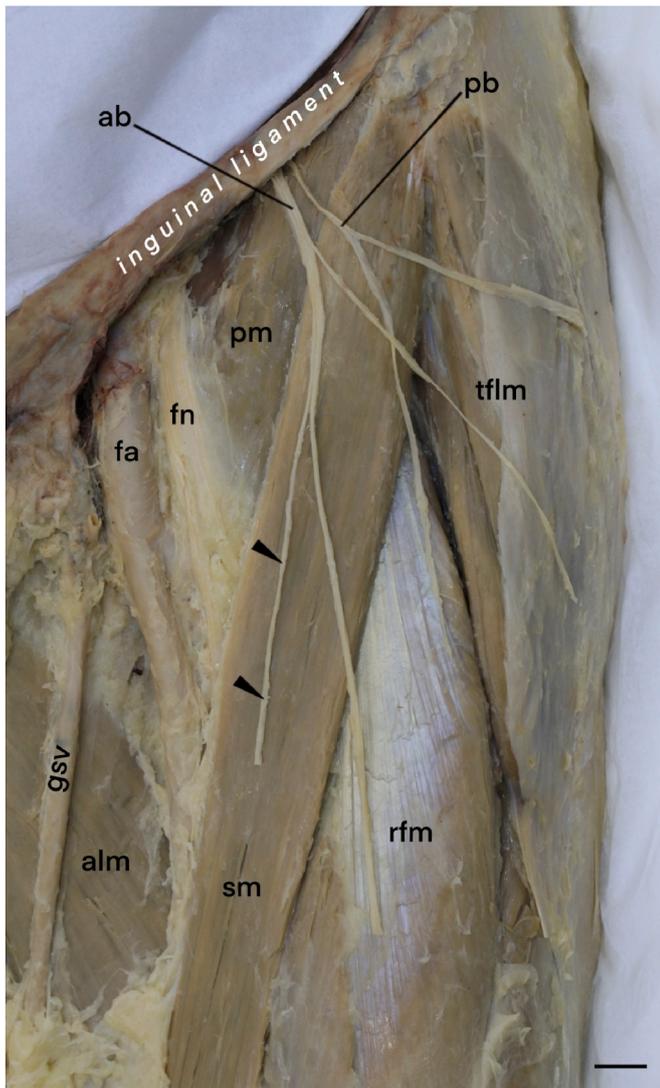


Fig. 1. Anatomical relationships in the femoral triangle and anterolateral thigh in the dissected specimen. The lateral femoral cutaneous nerve occupies a medial position emerging from under the inguinal ligament. The nerve is divided into anterior (an) and posterior (pb) branches above the inguinal ligament. The femoral branch of the genitofemoral nerve is absent and partially replaced by the most medial branch (marked by black arrowheads) of the lateral femoral cutaneous nerve (the branch was moved slightly laterally during the dissection). alm – abductor longus muscle; fa – femoral artery; fn – femoral nerve; gsv – greater saphenous vein; pm – pectineus muscle; rfm – rectus femoris muscle; sm – sartorius muscle; tflm – tensor fasciae latae muscle.

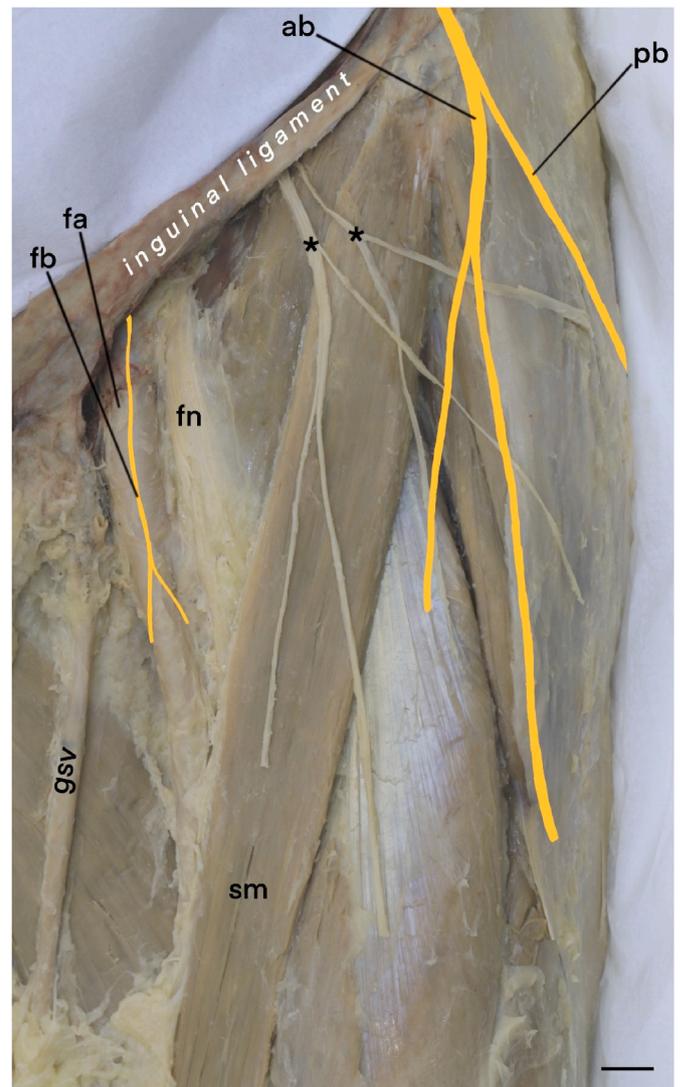


Fig. 2. Comparison of normal anatomy and anatomical variation described in our report. The lateral femoral cutaneous nerve with its anterior (ab) and posterior (pb) branches and the femoral branch of the genitofemoral nerve (fb) of typical location were drawn in yellow. Black asterisks indicate lateral femoral cutaneous nerve variation described in this report. Note differences between the expected and atypical nerves' relations. fa – femoral artery; gsv – greater saphenous vein; sm – sartorius muscle. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

view, both the lateral femoral cutaneous nerve and the genitofemoral nerve are characterized by high variability in their course and territory. Bergman et al. [3] suggest that the genitofemoral nerve "is considered by some authors as the most variable nerve of the lumbar plexus." As Bergman et al. [3] sum up, the genitofemoral or each of its terminal branches may be absent. In those cases, the genital branch is most commonly replaced by the ilioinguinal nerve [3]. In contrast, the lateral femoral cutaneous nerve can replace the femoral branch, as in the specimen presented in our report [2,3]. The lateral femoral cutaneous nerve can also show an unusual course or branching pattern. As stressed by Bergman et al. [3] and similar to our case, the nerve can course beneath the inguinal ligament at midlength between the anterior superior iliac spine and the femoral artery (even the posterior branch of the nerve can emerge from beneath the inguinal ligament about 5 cm medial to the anterior superior iliac spine) [3]. The nerve may also be divided into terminal branches above the inguinal ligament [2].

As stressed by Lee et al. [9], the lateral femoral cutaneous nerve's location makes it prone to trauma, external compression, and iatrogenic injury. The lateral femoral cutaneous nerve damage may be caused by nerve compression or traumatic or iatrogenic injury. Long-term pressure leads to nerve dysfunction and damage. The lateral cutaneous nerve of the thigh is responsible for innervating the skin on the anterolateral surface of the thigh, and its compression causes characteristic symptoms in this area, referred to as meralgia paresthetica. Meralgia paresthetica is the compression neuropathy resulting from chronic pressure exerted on the nerve. Meralgia paresthetica can result from irritation of the lateral femoral cutaneous nerve in the area of the inguinal ligament or around the nerve's course near the anterior superior iliac spine. Factors predisposing to nerve compression in this area include swelling, obesity, pregnancy, diabetes, tumors, enlarged lymph nodes, and injuries (including surgical procedures around the anterior superior iliac spine) [4,6,9–12]. As mentioned earlier, meralgia paresthetica is a condition characterized by tingling, numbness, and burning pain in the outer part of the thigh. With atypical innervation territory, these symptoms may vary. In the case we describe, damage of the lateral femoral cutaneous nerve could result in paresthesias both in the outer part of the thigh and the skin covering the femoral triangle area (i.e., much more medially than usual). Taking into account that the genitofemoral nerve typically originates from L1-L2 levels, and the lateral femoral cutaneous nerve arises from L2-L3 levels, anatomical variations in which one nerve partially takes over the skin innervation of the other nerve may cause difficulties in the interpretation of clinical symptoms [2].

The relationship of the lateral femoral cutaneous nerve to the anterior superior iliac spine is crucial. In the study by Lee et al. [10], the mean distance between the nerve and the anterior superior iliac spine was 8.8 mm. According to those authors, in approximately 90 % of cases, the lateral cutaneous femoral nerve was localized <2 cm from the medial tip of the anterior superior iliac spine, whereas, in 76 % of cases, it was <1 cm away [10]. In the case presented in our report, the nerve was located much more medially, approximately halfway along the inguinal ligament. Additionally, the nerve was divided into terminal branches above the inguinal ligament, and its anterior branch partially replaced the femoral branch of the genitofemoral nerve. The unusual location of the lateral femoral cutaneous nerve should also be considered during the nerve's ultrasound visualization attempts [9]. The anatomical variations in the location of the lateral femoral cutaneous nerve and genitofemoral nerve should also be considered to avoid damage during hernia surgical repair [13].

4. Conclusions

The lateral femoral cutaneous and genitofemoral nerves can show anatomic variability, which should be remembered during clinical assessments of nerve lesions and while performing surgical interventions. In atypical innervation territory, clinical symptoms may vary. In the case we describe, the lateral femoral cutaneous nerve injury could result in paresthesias both in the outer part of the thigh and the skin covering the femoral triangle area (i.e., much more medially than usual).

Ethical statement

The authors state that every effort was made to follow all local and international ethical guidelines and laws that pertain to the use of human cadaveric donors in anatomical research [14].

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Robert Haladaj: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. **Ivan Varga:** Conceptualization, Formal analysis, Project administration, Supervision, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None declared.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tria.2023.100276>.

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