

Multiple variations of the nerves arising from the lumbar plexus

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ABSTRACT

Multiple variations of the nerves arising from the lumbar plexus were found on the right side of a 35-year-old female cadaver. These were the accessory lateral femoral cutaneous nerve (aLFCN) arising from the femoral nerve, double ilioinguinal nerves and an accessory nerve branch joining to the genital branch of the genitofemoral nerve. The possible clinical problems related to the variations of these nerves were discussed. *Neuroanatomy; 2006; 5: 37–39.*

Key words [nerve variation] [lumbar plexus] [femoral nerve] [ilioinguinal nerve] [genitofemoral nerve]

Introduction

The lumbar plexus is formed within the psoas major muscle by the union of all the ventral rami of the first 3 lumbar, most of the ventral ramus of the 4th lumbar and the slender branch coming mostly from the 12th thoracic nerves. The first lumbar nerve usually receives a branch from the 12th thoracic and divides into two: an upper and larger part which forms the iliohypogastric and the ilioinguinal nerves and the lower part which is united with the branch coming from L2 to form the genitofemoral nerve. Each of the dorsal rami of L2 and L3 gives rise to several small and big branches of which the smaller ones unite to form the lateral femoral cutaneous nerve (LFCN). The bigger ones unite with the dorsal ramus of the L4 to form the femoral nerve. In the present case, we observed multiple variations of the lumbar plexus and discussed their possible clinical significance [1].

Case Report

Four variations of the lumbar plexus were found on the right side of a 35-year-old female cadaver during the routine dissection. These were; 1) the paired ilioinguinal nerve, 2) the aLFCN, 3) the branch from the LFCN to the femoral nerve, and 4) the additional branch from L2 joining the genital ramus of the genitofemoral nerve (Figures 1, 2, and 3).

The iliohypogastric and the paired ilioinguinal nerves were originated from the common root which was formed by the ventral ramus of L1. The paired ilioinguinal

nerves were coursing parallel to each other as separate nerves beginning from their origin. Both were found anterior to the quadratus lumborum and iliacus muscles and were piercing the transverse abdominal muscle 5 cm and 6 cm medial to the anterior superior iliac spine (SIAS), respectively. They were united within the internal oblique abdominal muscle just after piercing the transverse abdominal muscle. Later, they were dividing again to give the muscular and cutaneous branches. One of the cutaneous branches was extending till the midline superior to the inguinal ligament (IL) while the other was entering the deep inguinal ring to scatter in the labium majus.

The LFCN which was formed by the union of the dorsal rami of L2 and L3 spinal nerves, was passing posterolateral to the psoas major muscle to course on the iliacus. It was passing 0.4 cm medial to SIAS and supplying the anterolateral region of the thigh. aLFCN was arising 6.5 cm distal and posterolateral to the origin of the femoral nerve. Later, it was coursing laterally on the iliacus muscle. It was passing under the IL 4 cm medial to SIAS and 3.6 cm medial to the LFCN and supplying the supero-anterior region of the thigh. Further dissection of the epineurium of the femoral nerve revealed that the aLFCN was originated from the dorsal rami of L2 and L3 spinal nerves.

The femoral nerve was formed by the union of the posterior divisions of L2–4 spinal nerves. 5.2 cm after

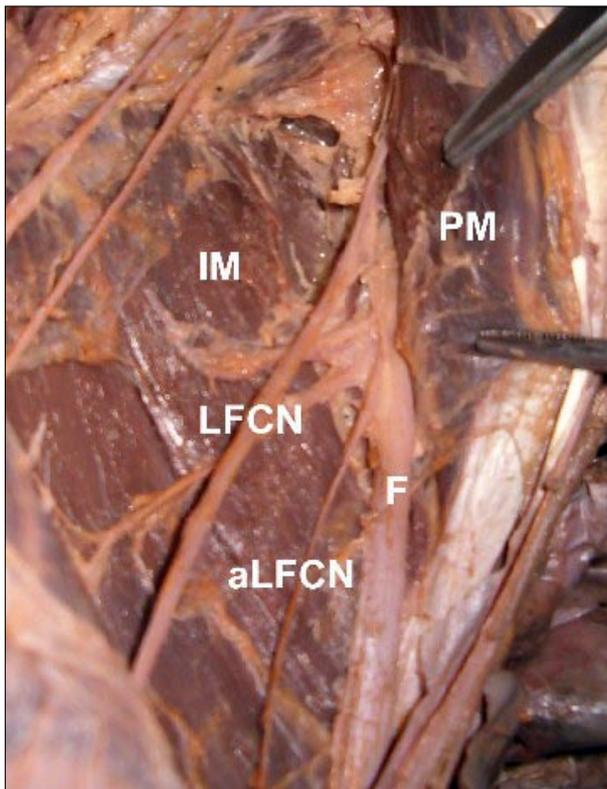


Figure 1. Shows the emergence of the aLFCN from the femoral nerve. Color version of figure is available online. (*IM*: iliac muscle; *PM*: psoas major muscle; *LFCN*: lateral femoral cutaneous nerve; *aLFCN*: accessory lateral femoral cutaneous nerve; *F*: femoral nerve)

its formation, it was receiving a slender branch from the LFCN. Further course of this nerve was normal.

The genitofemoral nerve was originating from the ventral ramus of L2. A second branch which was also originated from the ventral ramus of L2 was coursing parallel to this nerve. This second branch was joining to the genital ramus 5.5 cm distal to the bifurcation of the genitofemoral nerve to the femoral and genital rami. The genital ramus was entering the deep inguinal ring and scattering in the labium majus. The femoral ramus on the other hand, was passing under the IL medial to the aLFCN and was supplying the superomedial region of the thigh.

Discussion

The variations defined in the present case were comprising some of the branches of the lumbar plexus which may be injured during certain surgical procedures, particularly in the lower abdominal region (appendectomy, inguinal hernia repair, iliac crest bone graft harvesting and gynecologic procedures through transverse incision) [2-7, 9, 10]. After such operations, several clinical conditions may be encountered such as meralgia paresthetica, groin pain and testicular pain in which the LFCN, ilioinguinal and the genitofemoral nerves are mostly involved [2, 4, 7, 9, 10]. Thus, a better knowledge of the regional anatomy and its variations is essential for preventing from the lesions of the branches of the lumbar plexus.

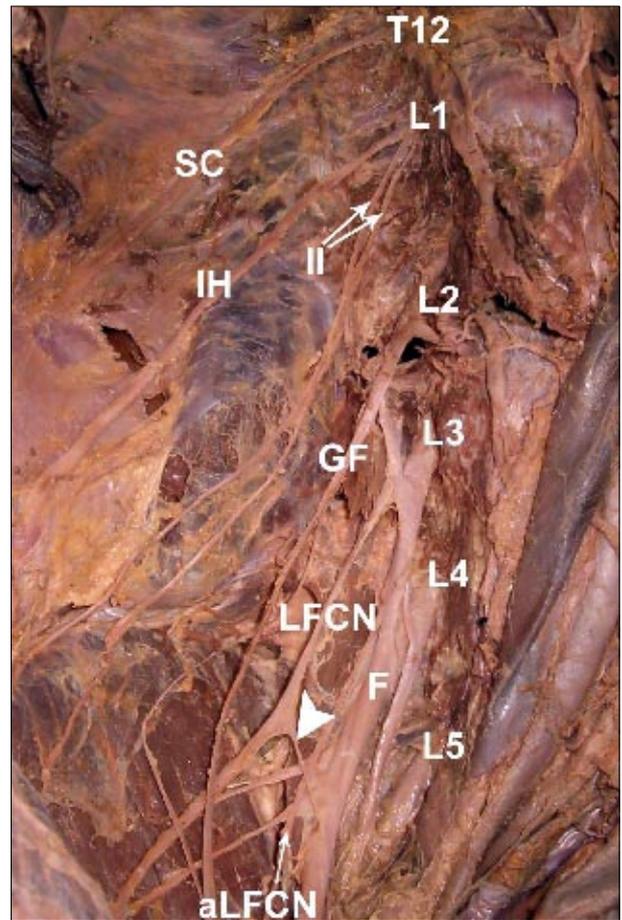


Figure 2. Shows the lumbar plexus and its branches on the right side after removal of the right psoas major muscle. The epineurium of the femoral nerve was removed. Color version of figure is available online. (*SC*: subcostal nerve; *IH*: iliohypogastric nerve; *II*: ilioinguinal nerve; *GF*: genitofemoral nerve; *LFCN*: lateral femoral cutaneous nerve; *aLFCN*: accessory lateral femoral cutaneous nerve; *F*: femoral nerve; *arrow head*: the slender branch arising from the LFCN and joining to the femoral nerve)

Meralgia paresthetica, is a pain and/or disesthesia syndrome caused by the impingement, injury or the neurinoma of the LFCN [2]. Aszmann claimed that the anatomical variations in the course and localization of LFCN may lead to have more mechanical traumas of this nerve [3]. Dias Filho reported 15 (30%) aLFCN in their bilateral dissection in 26 cadavers [4]. In their series, 3 of the aLFCN were arising from the genitofemoral nerve, one of them was arising from the ventral ramus of L1 and L2, another one was arising from the ventral ramus of L2 and L3 and the rest was arising from the ventral ramus of L2. They also reported that in one case the LFCN was arising from the femoral nerve inferior to the inguinal ligament. Erbil reported 2 unilateral aLFCN in a series of 28 cadavers [5]. In one of these two cases, there were two LCFNs arising from a common root which was formed by the union of the ventral rami of L1 and L2, while in the other there were 3 LFCNs arising from the dorsal divisions of the ventral rami of L2 and L3. Different from all the previous cases, we observed an aLFCN which was arising from the femoral nerve above the level of the IL.

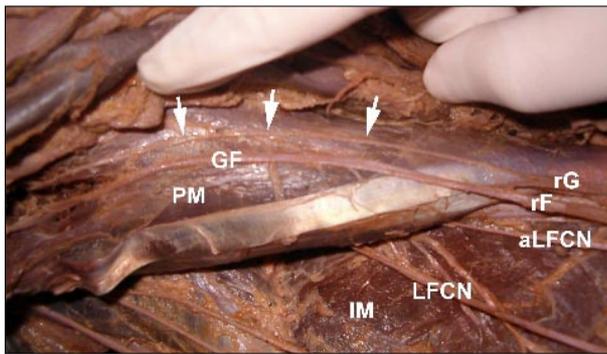


Figure 3. The accessory branch accompanying to the genitofemoral nerve. Color version of figure is available online. (*GF*: genitofemoral nerve; *rG*: ramus genitalis; *rF*: ramus femoralis; *IM*: iliac muscle; *PM*: psoas major muscle; *LFCN*: lateral femoral cutaneous nerve; *aLFCN*: accessory lateral femoral cutaneous nerve; *arrows*: the course of the accessory branch)

Injury to the ilioinguinal and iliohypogastric nerves is likely during the lower abdominal surgical procedures or anterior abdominal wall sections lower to the SIAS. Bergmann reported 10 different types of formation of the ilioinguinal nerve [6]. According to the classification of Bergman, the ilioinguinal nerve arises from a common root with a ratio of 86.5% (mostly from L1, rarely from

L2), while 11% arises from two different segments (T12 and L1, L1 and L2, or L2 and L3). The ilioinguinal nerve in our case was not consistent with any type of Bergmann classification.

The separation of the psoas muscle during retroperitoneal endoscopic surgery, injury of the lumbar plexus is a potential risk, particularly for the genitofemoral nerve which courses on the muscle. In their study on 32 cadavers, Rab stated that the genitofemoral nerve pierced the psoas major muscle as a single root and after 7 ± 3.5 cm it divided into the genital and femoral rami in 58% of the cases while in the rest (42%) it was divided into two rami within the psoas major muscle and never united again [7]. However, according to Bergman this nerve arises as a single root in 80% and as a double root in 20%, of the cases. He also claimed that these roots may originate from L1 and L2, or L2 and L3 [8]. In the present case the genitofemoral nerve was originated from L2 as a single root. Moreover, there was an extra branch arising from L2 and was accompanying the genitofemoral nerve and then joining to its genital ramus.

As a result, in this case multiple variations which would separately lead to certain clinical conditions were observed in the same cadaver. Awareness of the possibility of encountering multiple variations at once may prevent from having postoperational complications.

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