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Research Article

Anatomical Variations of Lateral Femoral Cutaneous Nerve and Its Clinical Significance

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ABSTRACT

A study in 30 cadavers revealed significant variations in the Lateral Femoral Cutaneous Nerve (LFCN), with 8.3% absent, 10% having accessory nerves, 3.3% splitting, 8.3% originating from L2, and 51.66% from L3. These formation and branching variations, noted in 40% of cases, are clinically important for surgeons and clinicians to prevent injuries and plan appropriate treatments, such as for meralgia paresthetica. Clinicians need to understand these variations to accurately diagnose the level of injury and plan effective treatments, including surgical decompression if necessary. Awareness of LFCN variations is crucial for surgeons performing procedures like hip or groin surgeries, as anatomical anomalies can increase the risk of nerve injury.

Keywords: *LFCN*

INTRODUCTION

The Lateral cutaneous nerve is the branch of lumbar plexus , it emerges from psoas above the iliac crest. It passes obliquely across iliacus towards the anterior superior iliac spine, and enters the thigh posterior to the lateral end of the inguinal ligament[1,2].

Orgin

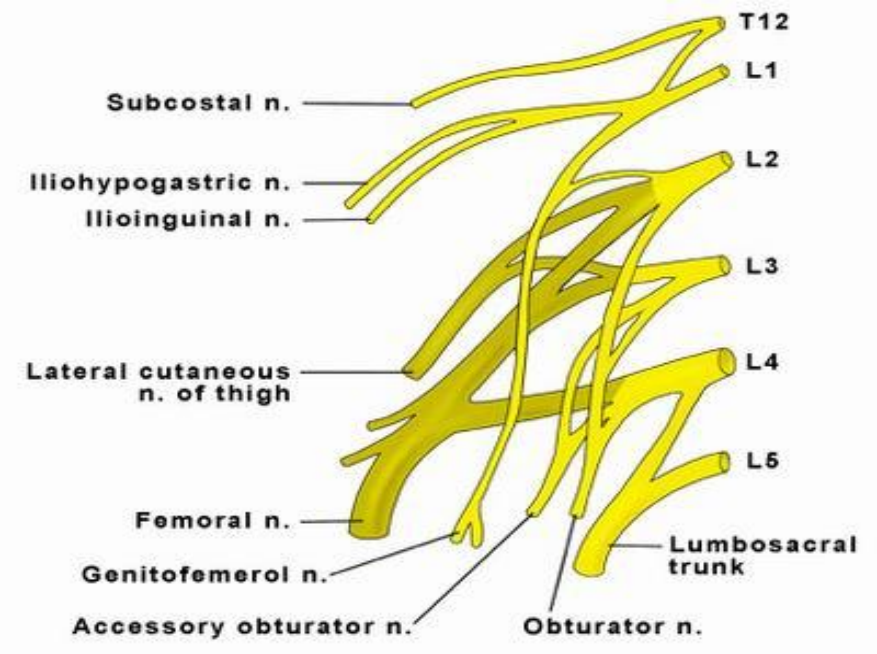
It is derived from the dorsal branches of the ventral rami of second and third lumbar nerves (L_2,L_3).

Course and relations

It passes downwards and laterally across the iliac fossa in front of the iliacus muscle and lies under cover of the fascia iliaca. The nerve enters the thigh beneath the inguinal ligament through a notch between the anterior superior and anterior inferior iliac spines.

Branches and Distribution

In the iliac fossa the nerve provides branches to the parietal peritoneum; it passes behind the caecum on the right side , and behind the iliac part of descending colon on the left side. In the thigh the lateral cutaneous nerve passes downward in front of or through the sartorius muscle, and divides into anterior and posterior branches



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AIM OF THE STUDY

To understand the variations in the anatomy of the Lateral femoral cutaneous nerves.

OBJECTIVES

1) To identify the variations in the formation lateral femoral cutaneous nerves
2) To identify variations in the branching pattern of lateral femoral cutaneous nerves

MATERIALS AND METHODS

The study was carried out after due ethical clearance from the institution.

1) **Study design:** Cross sectional study
2) **Sample size :** 60 specimens
3) **Inclusion criteria:** Adult human cadavers from the department of Anatomy with no evidence of surgical intervention on the abdomen and pelvic cavity.
4) **Exclusion criteria:** Those specimens with evidence of surgical intervention on the abdomen or pelvis were excluded from the study.
5) **Methodology:**

Dissection method:

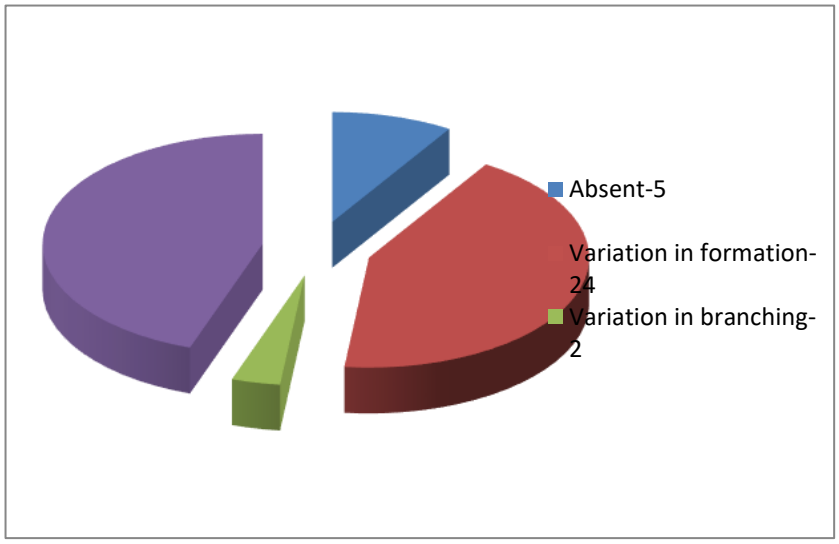
The lumbar plexus were dissected by the method described in Cunninghams manual of practical anatomy, 15 th edition.

RESULTS

VARIATIONS IN THE LATERAL FEMORAL CUTANEOUS NERVE (Pie chart. , Bar diagram.)

- LFCN was absent in 5 (8.3%) lumbar plexus.
- Accessory LFCN was noticed in 6 (10%) lumbar plexus.
- In 2 plexus (3.3%) the nerve was split in the middle of the course in the pelvic cavity.
- In 5 plexus it was formed from L_2 (8.3%).
- In 19 out of 60 it was formed from L_3 (51.66%).
- Variations in the formation were noticed in 24 plexus (40%).
- Variations in the branching pattern were noticed in 2 specimen (3.3%).

Pie chart. Observations in lateral femoral cutaneous nerve



Bar diagram. 4 Differentorigin of lateral femoral cutaneous nerve

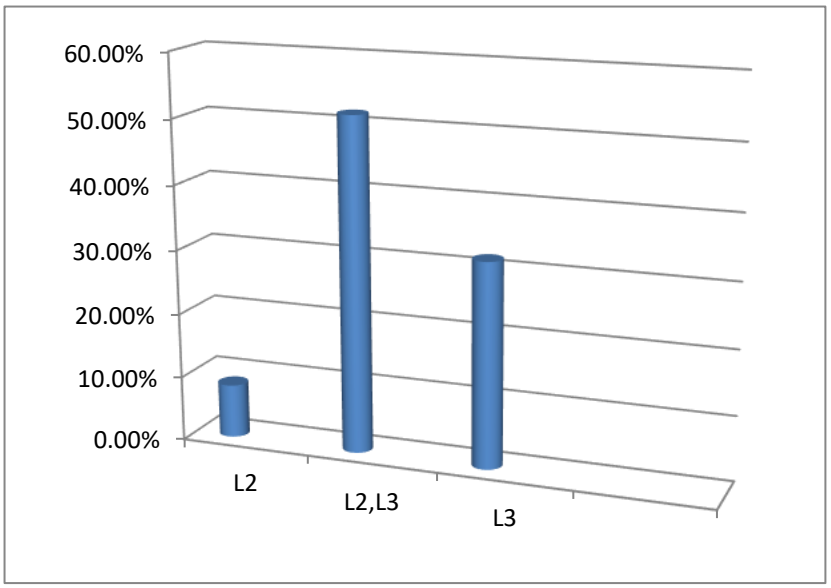


Table. 2 Observations on anatomy of lumbar plexus in a study of 60 LFCN

Nerve	Formation		Absent Number	Branching variations	Total variations in the formation	Total variations in the branching
	Root value	No				
Lateral femoral cutaneous nerve	L_2 L_2,L_3 L_3	5 31 19	5	Accessory nerve-6 Split during course-2	24	2

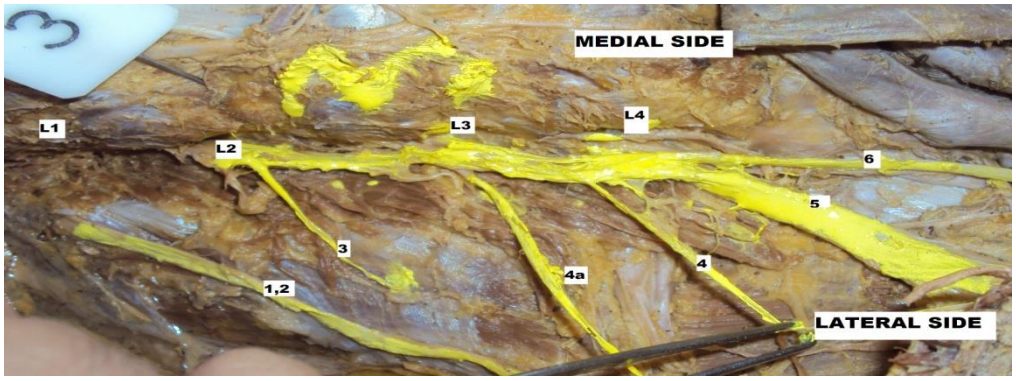


Figure. 5 Differentorigin of nerves of lumbar plexus

L_1,L_2,L_3,L_4-Lumbarnerve roots, 1-Iliohypogastric nerve, 2-Ilioinguinal nerve, 3-Genitofemoralnerve , 4-Lateralfemoral cutaneous nerve, 4a-Accessory LFCN, 5- Femoral nerve, 6- Obturator nerve. Genitofemoral nerve originate from L_2, Lateral femoral cutaneous nerve from L_3, Accessory lateral femoral cutaneous nerve from L_3-L_4.

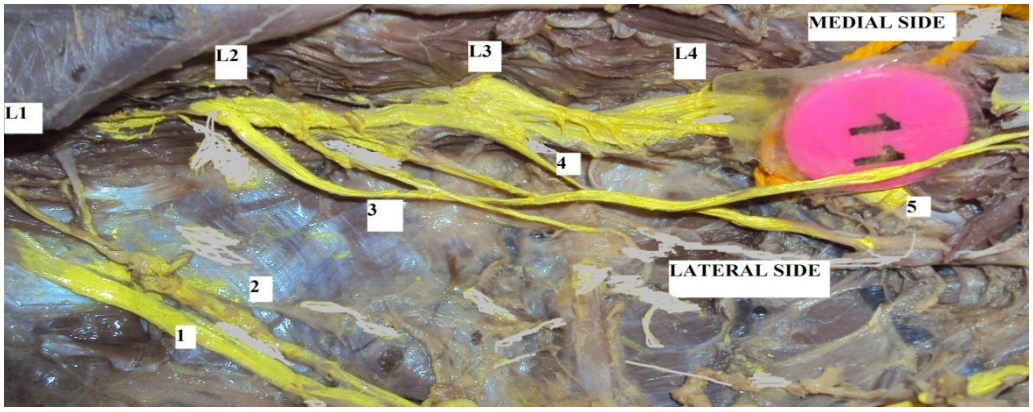


Figure.7 Accessory lateral femoral cutaneous nerve originating from L_2-L_3

L_1,L_2,L_3,L_4-Lumbar nerve roots,1-Iliohypogastric nerve, 2-Ilioinguinal nerve, 3-Genitofemoral nerve , 4-Lateral femoral cutaneous nerve, Accessory lateral femoral nerve present in between 3 and 4, 5- Femoral nerve, 6- Obturator nerve.

REVIEW OF LITERATURE
LITERATURE

In 22 (36.7%) of 60 plexus, the lateral femoral cutaneous nerve arose from the first two lumbar nerves. In one plexus (1.7%) the nerve arose from second lumbar ventral ramus and and in 6 plexus (10%), it was derived from the femoral nerve, total variation being 48.3%.[3]

Lateral cutaneous nerve of thigh arose directly from the femoral nerve in 6 plexuses (10%) in one study.[3]

The lateral femoral cutaneous nerve of the thigh was formed by the union of the anterior rami of the L_1 and L_2 lumbar spinal nerves.[4]

Origin of lateral femoral cutaneous nerve of thigh from the femoral nerve was also reported in another case.[5]
In 27.6% of the 29 cadavers, the lateral femoral cutaneous nerve bifurcated into additional branches before crossing the inguinal ligament.[6]

Injuries to this nerve can cause decreased sensation and neuropathic pain around the anterolateral thigh. Meralgia paresthetica, is a pain and/or disesthesia syndrome caused by the impingement, injury or the neurinoma of the lateral femoral cutaneous nerve .[7]Anatomical variations in the course and localization of the lateral femoral cutaneous nerve may lead to have more mechanical traumas of this nerve.[8]

15 (30%) accessory lateral femoral cutaneous nerve were reported in the bilateral dissection in 26 cadavers [9].
There was origin of lateral cutaneous nerve of thigh from the femoral nerve inferior to the inguinal ligament in one case in a study.[9]

Inbilateral dissection in 26 cadavers 3 of the accessory lateral femoral cutaneous nerves were arising from the genitofemoral nerve, one of them was arising from the ventral ramus of L_1 and L_2, another one arising from the ventral

ramus of L_2 and L_3 and the rest were arising from the ventral ramus of L_2. In one case the lateral femoral cutaneous nerve was arising from the femoral nerve.[9]

There are variations of the lateral femoral cutaneous nerve related to the anterior superior iliac spine and iliac crest that the nerve can be damaged during surgical intervention such as applying the external fixator of the pelvis. After operations such as appendectomy, inguinal hernia repair, iliac crest bone graft harvesting and gynaecological procedures through transverse incision several clinical conditions may be encountered such as meralgia paresthetica, groin pain and testicular pain in which the the lateral femoral cutaneous nerve, ilioinguinal and the genitofemoral nerves are mostly involved.[10,11]

Multiple variations of the nerves arising from the lumbar plexus on the right side of a 35 year old female cadaver were found. These were the accessory lateral femoral cutaneous nerve arising from the femoral nerve, double ilioinguinal nerves and an accessory nerve joining with the genital branch of the genitofemoral nerve. The lateral femoral cutaneous nerve which was formed by the union of the dorsal rami of L_2 and L_3 spinal nerves, was observed passing posterolateral to the psoas major muscle to course on the iliacus.[12]

It was reported that the accessory lateral cutaneous nerve of thigh originated from the femoral nerve above the inguinal ligament in 4 plexuses in one study.[13]

In another study in 6 of the 34 plexus (17.6%) variations were demonstrated in lateral femoral cutaneus nerve. In 4 lumbar plexus lateral femoral cutaneous nerve arose from the L_1 and L_2 nerve roots and in one plexus it had its origin solely from the L_2 nerve (2.9%).[13] Another noted eight distinct patterns of nerves.[14]

Another study reported that in 24 of 200 cadavers the lateral femoral cutaneous nerve arose from L_1 and L_2 and even solely from the L_2 or L_3 nerves.[15]

In 23% the lateral femoral cutaneous nerve gaverise to two branches.[16]

Two unilateral accessory lateral femoral cutaneous nerve were reported in a series of 28 cadavers. In one of these 2 cases there were 2 lateral femoral cutaneous nerves arising from a common root which was formed by the union of the ventral rami of L_1 and L_2 ,while in the other there were 3 lateral femoral cutaneous nerves arising from the dorsal divisions of the ventral rami of L_2 and L_3.[17]

Variations in lateral femoral cutaneous nerves were reported in 2 cadavers out of 28 cadavers in another study. On the right side of one cadaver, the ventral rami of the first and second lumbar spinal nerves were united and then this nerve was divided into 4 branches. From medial to lateral these branches were the obturator nerve,the femoral nerve the medially located lateral femoral cutaneous nerve. On the left side of another cadaver there were 3 lateral femoral cutaneous nerve.[17]

Early lateral femoral cutaneous nerve bifurcation have been reported. It has also been noted that the lateral femoral cutaneous nerve was wholly absent in 13 (8.8%) of 148 patients who received surgical intervention in one study.[18]

In another report a variant lateral femoral cutaneous nerve where two lateral femoral cutaneous nerve branches were encountered arising from the lumbar plexus was noted. In specific, the anterior lateral femoral cutaneous nerve branch originated from the femoral nerve, where as at the level of inguinal ligament four nerve branches were present.[19]

A study reported the chance of nerve injury in 10% during harvesting bone graft. Injuries to this nerve can cause decreased sensation and neuropathic pain around the anterolateral thigh.[20]

Several studies have demonstrated injury to the nerve in harvesting bone graft from iliac crest.[21,22]

DISCUSSION

In current study lateral femoral cutaneous nerve was absent in 5 (8.3%) lumbar plexus. And accessory lateral femoral cutaneous nerve was noticed in 6 (10%) lumbar plexus. In 2 plexus (3.3%) the nerve was split in the middle of the course in the pelvic cavity. In 5 plexus it was formed from L_2 (8.3%), in 31 plexus it arose from L_2-L_3(51.66%). In 19 out of 60 it was formed from L_3 (31.66%). Total variations in the formation were 24(40%) and total variation in the branching pattern were 2 (3.3%). Accessory lateral femoral cutaneous nerve was found in 4 plexuses

In another study it was foundthat rightlateral femoral cutaneous nerve was derived from the anterior divisions of the first and second lumbar nerve roots[5]. In another study it was found that right lateral femoral cutaneous nerve derived from the anterior divisions of the first and second lumbar nerve roots[3]

Lateral femoral cutaneous nerve bifurcated into additional branches before crossing the inguinal ligament.(27.6% of the 29 cadavers).[5]

Out of 34 (2.9%) specimens one lumbar plexus was found to have lateral femoral cutaneous nerve arising from L_2.[13]

Normally lateral femoral cutaneous nerve arises from posterior division of the L_2 and L_3 nerve roots. Variation in the formation of lateral femoral cutaneous nerve has been reported in previous studies in varying percentages as 17.6%,[13] 25% ,[15] 48.3%.[23] Out of 148 specimens 13 (8.8%) lumbar plexuses were found to have absence of lateral femoral cutaneous nerve in a study.[18]In a study 27.6% of the 29 cadavers had the lateral femoral cutaneous nerve bifurcating into additional branches before crossing the inguinal ligament[6] and in other study 23% of the lateral cutaneous nerve gave rise to two branches.. The present study showed many variations in the formation and branching pattern of lateral femoral cutaneous nerve[16].

CONCLUSION

- Lateral femoral cutaneous nerve (LFCN) absentin 5 (8.3%)
- Accessory lateral femoral cutaneous nerve in 6 (10%)
- LFCN splits during its course in 2 (3.3%)
- LFCN arises from L_2 in 5 (8.3%)
- LFCN arises from L_2,L_3 in 31 (51.66%)
- LFCN arises from L_3 in 19 (31.66%)
- Variation in the formation in 24 (40%)
- Variation in the branching pattern in 2 (3.3%)
- 29 plexus originate from L_2,L_3. Out of 31 normal formation, 6 plexus show variation in branching. So total variations of genitofemoral nerve are 35 (58.33%)
-

A key to carry out therapeutic and diagnostic procedures successfully on lateral cutaneous nerve depends on the knowledge of the possible variations of nerves. Such neurological variations are not only more prone to iatrogenic injuries but they interfere in the correct interpretation of clinical conditions as well. A proper understanding of the anatomy of this nerve is elementary for improving the results of operative treatment.

SUMMARY

The knowledge of variations and their branching pattern is important for the clinicians in investigating the level of injury and to plan appropriate treatment. The present study was conducted to know the variations of the origin and branching pattern of lateral femoral cutaneous nerve. As, many variations were seen, If these are unrecognized, there is a risk of iatrogenic injury to the involved structures leading to unfavourable surgical outcomes.

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