Topographical anatomy of the profunda femoris artery and the femoral nerve: normal and abnormal relationships


Department of Anatomy, Universiti Kebangsaan Malaysia Medical Centre, 50300, Kuala Lumpur, Malaysia

Abstract

Background and Objective. Femoral nerve (FN) is the largest branch of lumbar plexus. It lies lateral to femoral artery (FA) and it is located outside the femoral sheath. Profunda femoris artery (PFA) is a branch of the FA. The present study aimed to observe the topographical anatomy and relationship of the PFA and the FN.

Materials and Methods. A total of 12 embalmed cadaveric lower limbs (7 left and 5 right) were taken and the thighs were dissected in detail. The relationship of PFA and FN were observed. Appropriate measurements were taken and the specimens were photographed.

Results. The PFA originated from the FA in all the 12 specimens (100%). In 10 specimens (83.3%), the PFA was found to originate lateral to the FA while in 2 specimens, the origin of PFA was posterior to the FA (16.7%). The PFA originated from the FA at a distance of 6.5 ± 1.5 cm with regard to the midinguinal point. All FN were found to lie outside the femoral sheaths. Out of the 12 specimens, only 2 specimens (16.7%) exhibited the FN to lie posterior to the PFA, while in 10 specimens (83.3%), the FN was found to lie anterior to the PFA.

Conclusion. Prior anatomical knowledge of structures in the anterior compartment of thigh may be helpful for surgeons performing nerve block, cannulation and catheterization. Knowledge of abnormal anatomy of the FN and PFA is important in order to prevent any inadvertent injury to the PFA or FN. Clin Ter 2013; 164(1):17-19. doi: 10.7417/CT.2013.1504

Key words: anatomy, artery, profunda femoris, femoral, nerve, relation

Introduction

The femoral nerve (FN), being the largest branch of the lumbar plexus arises from the dorsal branches of the L 2, 3, 4 ventral rami (1). The FN traverses a course on the lateral border of the psoas major muscle as it descends and thereby passes between psoas major and iliacus deep to the iliac fascia, running posteriorly to the inguinal ligament to reach the thigh (1). Upon reaching the thigh, the FN divides into several branches which innervates the anterior muscles of the thigh (2). It gives off branches such as nerve to pectineus, medial cutaneous nerve of the thigh, intermediate cutaneous nerve of the thigh, nerve to sartorius, saphenous nerve, muscular branches to quadriceps femoris, vascular branches to FA and articular branches to the hip and knee joints (1).

Standard textbook of anatomy describes the PFA to originate laterally or posteriorly from the FA in the femoral triangle (1). The PFA gives off perforating arteries that encircles the posterior aspect of femur. These perforating arteries supply blood to all the muscles of the three fascial compartments of the thigh (1).

The present study aimed to look into the relationship of the PFA to the FA and FN. Proper understanding of the topographical anatomy of the PFA and FN may be beneficial for the surgeons in performing femoral nerve blocks and ligation of blood vessels (3).
lateralis). The PFA originated from the FA at a distance of $6.5 \pm 1.5$ cm with regard to the midinguinal point (Fig. 2). The FN was found outside the femoral sheath in all the cases. The FN was observed to lie posterior to PFA in 2 cases (16.7%), while in 10 cases (83.3%), the FN was found anterior to the PFA. No other abnormality was observed.

Discussion

Standard textbook of anatomy describes the fact that PFA may originate either laterally or posteriorly from the FA (1). In the present study, majority of the specimens showed that PFA originate laterally from the FA. We speculate that any increase in the pressure in the FA, may compress the PFA if the latter lies posterior to the FA.

According to past research studies conducted in the West, the PFA originates at a median distance of 4.4 cm from the inguinal ligament (4). In the present study, we observed that the PFA originated at a distance of $6.5 \pm 1.5$ cm from the midinguinal point.

Other researchers documented the median distance of PFA from the FA was 4.2 cm distal to the midpoint of inguinal ligament in the Indian population (5). The same study showed that 29 out of 64 (45.3%) specimens, showed that the PFA originated in the proximal third, whereas in 25 out of 64 (39.4%) extremities, the PFA originated in the middle third while 10 out of 64 (15.1%) specimens, showed the origin of the PFA distal to the third of a distance from the midpoint of the inguinal ligament to the apex of the femoral triangle (5). The PFA has been reported to originate from the external iliac artery, 2 cm above the inguinal ligament, run a parallel course with the superficial FA and located between the branches of the FN (6). In the present study, the PFA was never found to lie in between the branches of the FN in all the specimens.

The PFA has been reported to originate from the anterior aspect of the FA while some of the arteries such as the inferior epigastric and the external pudendal arteries have been reported to originate from the PFA (7). A variant PFA was observed to pass anterior to the femoral vein in a male newborn cadaver (8). In the same study, a duplicated case of the PFA was observed in the right lower limb of the male newborn cadaver (8). These variations were explained on the basis of the abnormal development of the lower limb arteries (8).

Rarely, the PFA originates from the medial aspect of the FA and courses anterior to the femoral vein. This rare anomaly was observed on the left side of the thigh in a 55-year-old male cadaver (9). The same case reported complication of arteriovenous fistula in the region of the groin due to percutaneous angioplasty or cardiac catheterization of the femoral vessels (9).

<table>
<thead>
<tr>
<th>Cadaver</th>
<th>Measurement of origin of the profunda artery from midinguinal point (cm)</th>
<th>Position of femoral nerve in relation to profunda femoris artery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
<td>Cadaver 1</td>
<td>-</td>
<td>4.75</td>
</tr>
<tr>
<td>Cadaver 2</td>
<td>9.75</td>
<td>-</td>
</tr>
<tr>
<td>Cadaver 3</td>
<td>7.50</td>
<td>-</td>
</tr>
<tr>
<td>Cadaver 4</td>
<td>4.75</td>
<td>-</td>
</tr>
<tr>
<td>Cadaver 5</td>
<td>-</td>
<td>6.25</td>
</tr>
<tr>
<td>Cadaver 6</td>
<td>5.00</td>
<td>-</td>
</tr>
<tr>
<td>Cadaver 7</td>
<td>-</td>
<td>7.50</td>
</tr>
<tr>
<td>Cadaver 8</td>
<td>-</td>
<td>6.25</td>
</tr>
<tr>
<td>Cadaver 9</td>
<td>6.25</td>
<td>-</td>
</tr>
<tr>
<td>Cadaver 10</td>
<td>6.25</td>
<td>-</td>
</tr>
<tr>
<td>Cadaver 11</td>
<td>5.00</td>
<td>-</td>
</tr>
<tr>
<td>Cadaver 12</td>
<td>7.50</td>
<td>-</td>
</tr>
</tbody>
</table>
The FN is known to be anatomically present lateral to the FA. The FN innervates the anterior compartment muscles of the thigh. During Orthopaedic surgery, FN block is performed. For successful FN block, the FA serves as an important anatomical landmark. The needle is ideally inserted lateral to the FA (10). In case where the FN lies posterior to the PFA, as seen in two specimens in the present study, there might be failure of FN block and there are chances of even puncturing the PFA.

There are instances, where successful FN blockade may not occur because of abnormal position of FN or its branches. Researchers have discussed in detail the episodes of needle puncturing lateral circumflex femoral artery while FN blockade was performed (2). There are reports of local anaesthetic toxicity following FN block, in which blood was aspirated lateral to the FA even though the needle was injected with normal anatomical knowledge (11). The vascular relationship varies from person to person. Hence, pre-operative investigations may be beneficial.

In conclusion, knowledge of the normal and abnormal anatomy of the PFA and FN is important for surgeons performing nerve block, cannulation and catheterization. We suggest pre-operative investigations to check any inadvertent injury to the vessels and nerves. The present study was a humble attempt to describe the anomalous relationship of the FN and PFA. Further studies on larger sample size are advocated.

Acknowledgements

The Authors wish to acknowledge the kind help received from the supporting staff of the dissection hall namely, Mr. Ma’amor Salleh, Mr. Daud Hamid & Mr. Zainuddin.

References

2. Moore KL, Dalley AF. Clinical Oriented Anatomy, 5th edn, Lippincott Williams & Wilkins, 2006; 603