

Bilateral variation of iliacus muscle and splitting of femoral nerve

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ABSTRACT

Awareness in the variations of psoas major muscle and iliacus muscle is useful guide for both in studies of human anatomy and in clinical practice today. It is of significant practical importance for the surgeons and radiologist, to know the form, degree of severity and range of such changes. Images of posterior abdominopelvic wall with such variations may lead to confusion in interpretation. The knowledge of relations of this variation with neighboring nerves, blood vessels and other structures are important for an accurate diagnosis and to prevent further surgical complications during routine surgery. In our routine dissections with the purpose of preparation of the teaching and museum specimens, it was observed that in one of the elderly Indian male cadaver showed bilateral variant slip of iliacus muscle having two bellies; in addition the femoral nerve also showed variation in its course. © *Neuroanatomy*. 2008; 7: 72–75.

Key words [iliacus muscle] [psoas major muscle] [femoral nerve]

Introduction

The iliopsoas muscle has extensive and clinically important relations to the kidney, ureter, caecum, appendix, sigmoid colon, pancreas, lumbar lymph nodes and nerves of the posterior abdominal wall. When any of these structures is diseased, movement of the iliopsoas muscle usually causes pain. Aberrant slips of iliacus muscle, however, have occasionally been reported to cover or split the femoral nerve. Several reports on the variations of iliacus muscle and psoas major muscle are documented. The knowledge of these variations might be useful and important for the interpretation of magnetic resonance imaging and ultrasonography, because they may influence surgical and interventional procedure.

Iliacus is a triangular sheet of muscle that arises from the superior two-thirds of the concavity of the iliac fossa, the inner lip of the iliac crest, the ventral sacro-iliac and ilio-lumbar ligaments, the upper surface of the lateral part of sacrum and capsule of the hip joint. From its origin it runs down along with psoas major muscle to get inserted to the lesser trochanter of the femur and to the femur just below and in front of the lesser trochanter. Its nerve supply is by the branches of the femoral nerve. Iliacus and psoas major acting from above, flexes the thigh upon the pelvis [1,2].

In the present case, we report a 60 year-old Indian male cadaver without any visible medical disorder, showing bilateral variant accessory slips of iliacus muscle

combined with variations in the trunk of femoral nerve, during its course in the iliac fossa.

Case Report

Using conventional dissecting techniques, the posterior abdominal wall was dissected in a 60 year-old embalmed male cadaver, with a purpose of preparation of the teaching and museum anatomical specimens. There was no sign of trauma, surgery or wound scars in the abdominal region. Laparotomy was performed using a midline anterior abdominal incision. The skin of the anterior abdominal wall, the superficial fascia, and the anterior abdominal wall muscles were removed systematically on both sides. The contents of the abdominal cavity were also removed thus providing free access to the muscles and nerves of the posterior abdominal wall and related structures were carefully dissected. Special attention was given to the course of the femoral nerve, iliacus and psoas major muscles. Following the fine dissection, the posterior abdominopelvic wall was photographed.

This 60-year-old, well-built, Indian male cadaver showed a pronounced bilateral variation in the origin of iliacus muscle, the history of this cadaver was not available. We did not notice any signs of other diseases or pathological conditions during the anatomical dissection of this cadaver.

The most interesting finding on the left side was the presence of two well-defined variant muscles –iliacus minimus muscle and accessory slip of iliacus muscle–

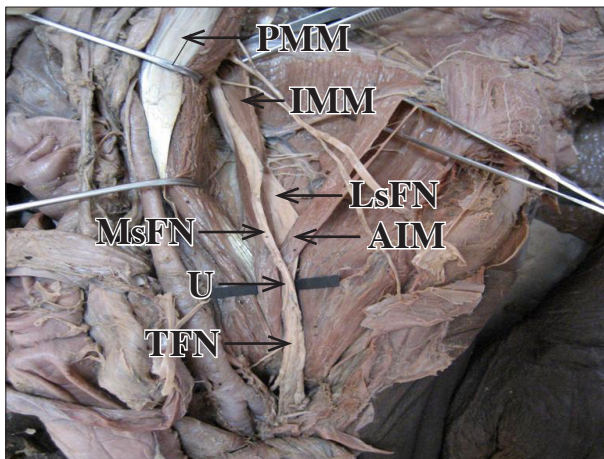


Figure 1. Iliacus minimus muscle and accessory slip of iliacus muscle, left side. Color version of figure is available online. (*PMM*: psoas major muscle; *IMM*: iliacus minimus muscle; *MsFN*: medial slip of femoral nerve; *LsFN*: lateral slip of femoral nerve; *AIM*: accessory iliacus muscle; *U*: union of variant slips; *TFN*: trunk of femoral nerve)

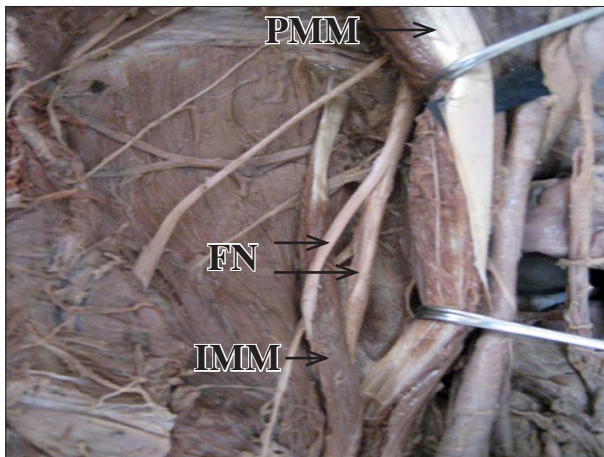


Figure 2. Additional slip of the iliacus muscle, right side. Color version of figure is available online. (*PMM*: psoas major muscle; *IMM*: iliacus minimus muscle; *FN*: femoral nerve)

which were covered by iliac fascia and separated from the femoral nerve and iliacus muscle by loose connective tissue (Figure 1). These two variant muscles were innervated by lateral part of femoral nerve. The variant muscular slips were directed inferiorly, in front of iliolumbar vessels and lying anterior and completely separated from the main iliacus muscle and finally attached to the lesser trochanter of the femur along with iliopsoas tendon. During careful observation in the course of the femoral nerve, we found that femoral nerve appeared, too small in its thickness and after retracting the psoas major muscle; we noticed that the femoral nerve splitted in order to enclose both the variant slips of the iliacus muscle. The larger portion of the femoral nerve was present lateral to the variant slips of the iliacus muscle and the smaller portion was lying medial to them. The femoral nerve after enclosing these additional

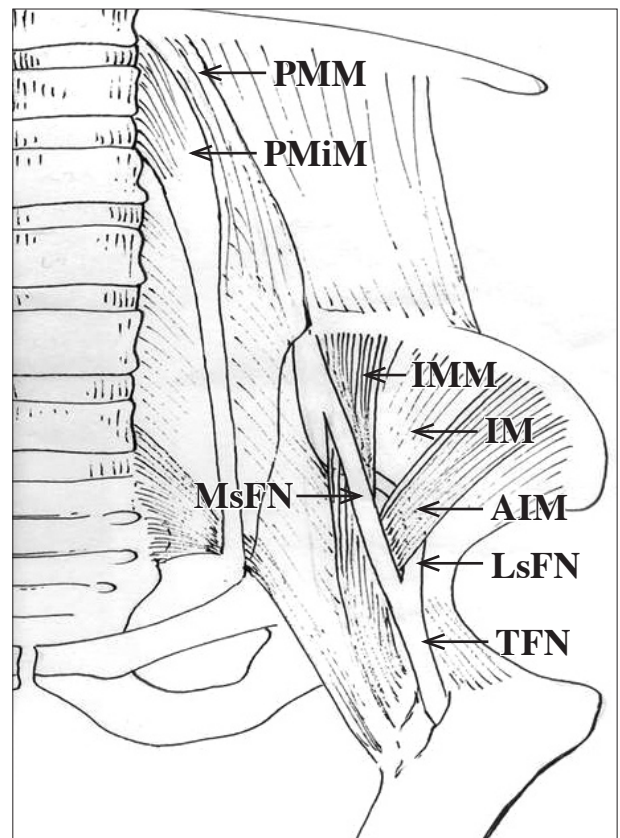


Figure 3. Schematic drawing of Figure 1. (*PMM*: psoas major muscle; *PMiM*: psoas minor muscle; *IMM*: iliacus minimus muscle; *IM*: iliacus muscle; *MsFN*: medial slip of femoral nerve; *LsFN*: lateral slip of femoral nerve; *AIM*: accessory iliacus muscle; *TFN*: trunk of femoral nerve)

slips of iliacus muscle, fused to form a single trunk and descended with normal course.

However, on the right side the iliacus muscle showed only one additional slip (Figure 2). This additional slip was directed downwards, anterior to the iliolumbar vessels and the main iliacus muscle. Distally this additional slip fused with the iliopsoas tendon and attached to the lesser trochanter of the femur. As on the left side, the femoral nerve on the right side also showed the splitting in order to enclose the additional slip of iliacus muscle. After enclosing the additional slip both the branches of femoral nerve fused to form a single trunk to descend with normal course.

Discussion

In spite of the detailed description of the iliopsoas muscle complex, interesting variations of its main parts – the psoas major and the iliacus muscles can still be encountered. These variations may clarify some aspects of the embryological development of the iliopsoas muscle and have certain clinical importance because of the frequent co-existence with an unusual femoral nerve by its formation and course.

The psoas and iliacus muscles are occasionally completely independent muscles. The psoas may be divided longitudinally into fascicles. An accessory slip

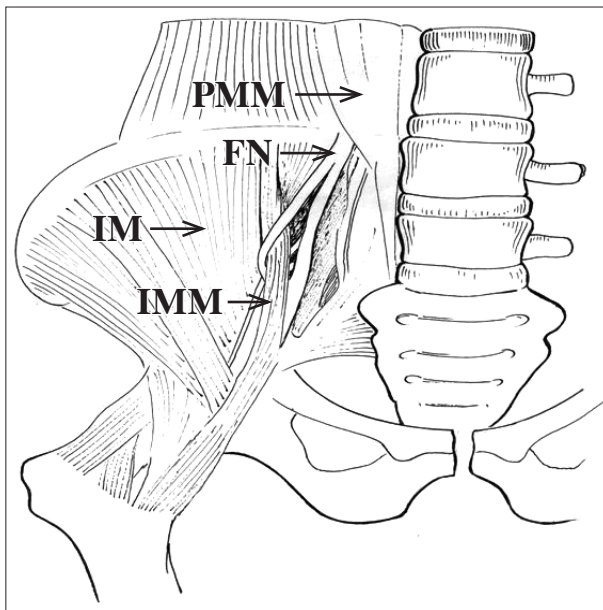


Figure 4. Schematic drawing of Figure 2. (*PMM*: psaos major muscle; *IMM*: iliacus minimus muscle; *IM*: iliacus muscle; *FN*: femoral nerve)

has been described lateral to the muscle and separated from it by the femoral nerve. The psaos minor muscle is not constant in humans. Iliacus muscle may be pierced by the femoral nerve. The iliacus minor muscle or iliocapsularis muscle, a small-detached portion of the iliacus muscle, is frequently present [3].

Compression of the femoral nerve in the iliac fossa has been reported as a consequence of several pathologies, but never as a result of muscular compression. Aberrant slips of iliacus muscle, however, have occasionally been reported to cover or split the femoral nerve. Each disposition may be a potential risk for nerve entrapment [4]. The main trunk of the femoral nerve is not subject to an entrapment neuropathy, but may be compressed by retroperitoneal tumors or retroperitoneal hemorrhage in patients on anticoagulants or with a bleeding diathesis. A localized lesion of the femoral nerve may occur in diabetes mellitus. The striking feature of femoral neuropathy is wasting and weakness of quadriceps femoris muscle, which result in considerable difficulty in walking, with a tendency for the leg to collapse. Pain and paraesthesia may occur on the anterior and medial aspect of the thigh, extending down the medial aspect of the leg in the distribution of the saphenous branch of the femoral nerve [5].

Jelev et al. presented a case of bilateral variations of the psaos major and the iliacus muscles combined with variations of the left and the right femoral nerves [6]. The most remarkable finding was noted on the left side, where an undescribed variant muscle –accessory iliopsoas muscle– was observed. The accessory iliopsoas muscle was formed by the connection of two accessory muscles: accessory psaos major muscle and accessory iliacus muscle.

The cause for the variations of the iliopsoas muscle, described in the text, might be an unknown disturbance in the embryonic muscular blastema and its interaction with the aggressive ingrowths of the femoral nerve through the developing iliopsoas muscle complex. The muscular variations, such as those mentioned above, most probably do not cause any considerable disturbance in the lower limb movements [6].

The accessory muscles may be seen as interesting findings in patients during laparotomy and enrich the possibilities in the differential diagnosis on CT imaging of the iliopsoas compartment. Mainly because of the frequent co-existence with an unusual course and formation (splitting) of the femoral nerve, these muscular variations are of a great importance to clinical practice. A variant muscular slip, belonging to the psaos major muscle or iliacus muscle, or even an accessory muscle may cause tension of the femoral nerve and therefore should be suspected in patients with referred pain to the hip and knee joints and to the lumbar dermatomes. In case of femoral nerve neuropathy caused by iliac hematoma after anticoagulant treatment or trauma or vessel catheterization the existence of some variant muscles, which may increase the nerve compression, must be born in mind. The detailed knowledge of the possible variations of the iliopsoas muscle complex and the femoral nerve variations, connected with them, may also give surgeons confidence during iliacus compartment fasciotomy in the treatment of iliacus hematoma [6].

Tubbs and Salter observed the presence of an anomalous muscle (iliacus minimus muscle) bilaterally, which originated from the iliolumbar ligament [7]. This anomalous muscle traveled anterior to the iliacus muscle, lateral to the psaos major muscle, and pierced the femoral nerve to fuse distally into the muscle fibers of the iliopsoas muscle at the level of the inguinal ligament. The femoral nerve supplied this muscle prior to it piercing this nerve. No apparent atrophy of the anterior thigh muscles was observed in the face of potential femoral nerve compression by this anomalous muscle.

Spratt et al., found four examples of unilateral variant slips of iliacus muscle and psaos major muscle in 68 cadavers they dissected [8]. In three of them the femoral nerve was pierced by the variant slip. Such anomalies might cause tension on the femoral nerve resulting in referred pain to the hip and knee joints and to the lumbar dermatomes L2, 3 and 4.

Conclusion

The bilateral variation of the iliacus muscle and splitting of the femoral nerve presented in our case have clearly demonstrated some morphological details, which could not be obtained during clinical examination of patients involving modern imaging techniques. Examination of obtained images in cases of unusual and complicated variations of iliacus muscle and femoral nerve may be associated with misinterpretation of the data. Information about details and topographic anatomy of reported and other variations of the iliopsoas muscle complex and the femoral nerve may serve as a useful guide for both radiologists and surgeons. These variations may be

asymptomatic, so an extra care must be undertaken even during routine surgical interventions. It can help to prevent diagnostic errors, influence surgical and interventional procedures and avoid surgical complications during routine surgeries. The detailed knowledge of the possible

variations of the iliopsoas muscle complex and the femoral nerve variations connected with them, may also give surgeons confidence during iliacus compartment fasciotomy in the treatment of iliacus hematoma and during drainage of intramuscular abscess.

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