

Previously Unreported Variation in the Innervation of the Psoas Major Muscle

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Abstract

Injury to the nerves of the lumbar plexus can result in significant disability. Therefore, the clinician should be knowledgeable of both the normal and variant anatomy of these branches. We report what we believe to be the first description of the accessory obturator nerve providing a branch to the psoas major muscle. Such a variant innervation to the psoas major muscle should be kept in mind by those who examine patients or operate near the lumbar plexus.

Keywords: Posterior Abdominal Wall; Lumbar Plexus; Variation and Anatomy

Introduction

The psoas major is a large, long muscle that lies on either side of the lumbar vertebral column [1]. Its primary function is flexion of the hip joint [2,3]. Within the abdominal and pelvic cavities, the muscle is surrounded by many important structures. Most notably, the lumbar plexus is embedded posteriorly in the substance of the psoas major [1]. The psoas major is innervated by the ventral rami of the lumbar spinal nerves L1-L3 with some contribution from L4 [1,4]. In this case report we review the anatomy and innervation of the psoas major and lumbar plexus, paying specific attention to the accessory obturator nerve (AON) of the lumbar plexus, present in 10% to 30% of patients [5]. We report a case involving the anomalous innervation of the psoas major by the AON, discovered during cadaveric dissection and believed to be previously unreported in the literature.

Case Report

During the routine dissection of the right lumbar plexus in a male cadaver aged 78 years old at death, an AON was identified. This nerve traveled between the iliac vessels medially and the psoas major muscle laterally. Distally, the AON crossed the pubis and terminated by innervating the deep surface of the pectineus at its origin on the pubis. As the psoas major was retracted laterally, the AON was noted to give off a small branch to the medial surface of the psoas major muscle (Figure 1). This branch arose from the AON just below the level of the highest point of the iliac crest and was approximately 2.5 cm in length. After giving off this branch, the AON continued anterior to the pubic bone to innervate the pectineus muscle. The AON in our specimen arose from L3 and L4 spinal levels. No other anatomical variations were noted in this cadaveric specimen who had died of pneumonia. The left side of this same cadaver was not found to have an AON.



Figure 1: Right-sided dissection of the obturator (black arrow) and accessory obturator nerves (upper white arrows). The obturator nerve is seen traveling deeply toward the obturator foramen and the accessory obturator nerve is shown coursing anterior to the pubis. Note the small branch (small white arrows) from the accessory obturator nerve innervating the psoas major muscle (retracted laterally). For reference, the base of the black arrow is positioned over the right iliolumbar ligament.

Discussion

To our knowledge, this is the first description of the AON innervating the psoas major muscle. The branches of the lumbar plexus and its association with the psoas major muscle is important to understand, especially during surgery in that region or when performing anesthetic blocks. Variations of the plexus and their associated clinical implications have been documented in the literature [6].

In addition to its primary role in the flexion of the hip joint, the psoas major serves several important functions such as balancing the

trunk while sitting, lateral rotation of the hip joint, and maintaining an upright vertebral column [1,3,7]. The proximal attachments of the psoas major involve the transverse processes of all the lumbar vertebrae and the vertebral bodies of T12-L5 [1-3]. The muscle descends along the pelvic brim, continuing posterior to the inguinal ligament and anterior to the capsule of the hip joint. It then joins with the iliacus muscle, forming the iliopsoas muscle, which finally inserts onto the lesser trochanter of the femur [1,3].

As stated before, the psoas major muscle is in close relationship with the lumbar plexus. The lumbar plexus is formed by the ventral rami of L1-L4, with contributions from T12 [1,8]. The majority of branches from the lumbar plexus cross the psoas major muscle proximally [9]. As these nerves transverse the muscle, motor branches from the anterior rami of (L1-L4) are given off to innervate the psoas major [6]. The AON mainly arises from the anterior branches of the third and fourth lumbar ventral rami, but can also have contributions from L1 and L2 [1,5,10]. Other nerves formed by the plexus are: iliohypogastric (L1), ilioinguinal (L1), genitofemoral (L1-L2), lateral femoral cutaneous (L2-L3), obturator (L2-L4), and femoral (L2-L4) nerves [1,8].

The AON descends along the medial border of the psoas major muscle, crosses the superior pubic ramus behind the pectineus, and divides into three branches. One branch enters the deep surface of the pectineus muscle, one supplies the hip joint, and the last connects with the anterior branch of the obturator nerve [1]. Terminal branch variations of the AON are well documented in the literature, however, as mentioned before, we believe this to be the first reported case involving AON innervation of the psoas major muscle.

In a study of 1,000 plexuses, done by Katritsis et al. [3] the presence of the AON was reported in around 13% of cases [10]. Other studies have stated the prevalence to be between 10% to 30% [5]. The AON originates most often from the L3 and L4 ventral rami, but some variations reported by Katritsis et al. have observed the AON arising from the trunk of the obturator nerve [10].

Variations in the lumbar plexus may lead to a verity of clinical pathologies. For example, the AON can be selectively compressed as it travels over the superior pubic ramus, leading to neuropathy of that nerve [6]. Depending on the specific innervation of the AON, patients may present with diverse symptomology. Due to its innervation of the hip joint, a differential diagnosis for groin pain could be compression of the AON [6]. If there is variation in the of the AON, as in the

presently reported case, it could lead to weakness in flexion of the hip due to the innervation of the psoas major by the AON.

Conclusion

Even though the AON is not found in every person, awareness of this nerve and the possible variations in innervation can be clinically significant and is important for clinicians to understand. With the psoas major having such a substantial role in movement of the hip, variations in its innervation can have considerable effects on the patient. Surgeons accessing this area should have knowledge of variations in the AON so as not to partially denervate the psoas major muscle.

Conflict of Interest

The authors declare that they have no conflict of interest.

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