

ANATOMICAL VARIATIONS OF ACCESSORY OBTURATOR NERVE: A CADAVERIC STUDY WITH PROPOSED CLINICAL IMPLICATIONS

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ABSTRACT

Background: The accessory obturator nerve arises from the ventral branches of the third and fourth lumbar ventral rami. It is occasionally present in 10% of population. It descends along the medial border of psoas major, crosses the superior pubic ramus and divides into branches supplying the hip joint and pectineus. There is a high degree of variability in its formation. It may arise from the ventral rami of second and third lumbar nerves or second, third and fourth lumbar nerves or from third lumbar nerve alone. Sometimes the accessory obturator nerve is very small and supplies only pectineus. Any branch may be absent. Knowledge of these variations is important for surgeries of hip joint and in evaluation of groin pain.

Aim: The aim of this study was to evaluate the incidence and variation in the formation of accessory obturator nerve and to analyse the variability of the frequency of this nerve, reported in the literature and to discuss its clinical implications.

Materials and Methods: The study was conducted on 25(50 sides) adult human cadavers in Department of Anatomy, Sri Siddhartha Medical College, Tumkur, Karnataka, India by dissection method. The accessory obturator nerve was looked for, bilaterally, and its formation studied. The specimens were numbered and photographed.

Results: The incidence of accessory obturator nerve in this study was 8%. The nerve was seen arising from ventral rami of third and fourth lumbar nerves in 3 cases (6%) and from ventral rami of second and third lumbar nerves in 1 case (2%). Accessory obturator nerve was observed on the right side in 2 cases (4%) and on the left side in 2 cases (4%). The nerve was found in 2% males and 2% females.

Conclusion: The knowledge of anatomy of accessory obturator nerve is important for orthopaedicians to plan an effective hip surgery to relieve coxalgia. Compression of the nerve as it courses over the superior pubic ramus and subsequent neuropathy is a differential diagnostic option in groin pain. High variability in the incidence and formation of this nerve, highlights the importance of a detailed anatomical knowledge of accessory obturator nerve.

KEY WORDS: Accessory Obturator Nerve, Lumbar Ventral Rami, Pectineus, Coxalgia, Hip Joint, Groin Pain.

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INTRODUCTION

The accessory obturator nerve (AON) is small and forms a part of the lumbar plexus, the nerve plexus of the lower limb. Lumbar plexus through its branches innervates the muscles and skin on the anterior and medial sides of the thigh and the skin on the medial side of the leg and foot. The lumbar plexus lies within the substance of the posterior part of psoas major, anterior to the transverse processes of the lumbar vertebrae. It is formed by the first (L1) second (L2) third (L3), and most of the fourth lumbar (L4) ventral rami. Accessory obturator nerve, when it exists, arises from the ventral branches of the third and fourth lumbar ventral rami. It is occasionally present in 10% of population [1]. AON has also been reported to arise from anterior primary divisions of L3 L4 alone or from the trunk of obturator nerve [2]. Past studies have reported the incidence of AON in 19-29% cases [3].

AON descends along the medial border of psoas major, crosses the superior pubic ramus behind pectineus and divides into three branches, which are also variable. One enters the deep surface of pectineus, another supplies the hip joint and a third connects with the anterior branch of the obturator nerve, to supply the adductor muscles. Sometimes the accessory obturator nerve is very small and supplies only pectineus. Any branch may be absent and others may occur, one sometimes supplying adductor longus [1]. The terminal branches may individually replace the femoral branch to the pectineus, or form a significant supply to hip joint. They may, however, only supply the pectineus muscle or make a significant contribution to the innervation of the adductor muscles [4].

A sound anatomical knowledge of the morphology of AON is of paramount importance, due to its high variability in the incidence and formation. The knowledge of these variations is important in regional hip joint surgeries to relieve coxalgia and in differential diagnosis of groin pain.

MATERIALS AND METHODS

This study was conducted on 25 (50 sides) apparently normal human adult cadavers of known age and sex in the dissection laboratory,

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Cadavers in which anterior abdominal wall and abdominal viscera had been studied and removed with undisturbed posterior abdominal wall structures were selected for the study. Cadavers with intact twelfth thoracic, 5 lumbar vertebrae, sacrum, psoas major, quadratus lumborum, transversus abdominis, iliacus muscle were included in the study. Specimens with any abnormality or pathology in this region disturbing the nerve anatomy were excluded from the study. Specimens were numbered from 1 to 50 using plastic number plates and photographed after dissection.

Dissection of lumbar plexus in 25 cadavers was done on both sides by following standard method [5]. The posterior abdominal wall was visualised and the structures namely 12th rib, Psoas Major, Quadratus Lumborum, Transversus Abdominis, Iliacus muscles and their covering fascia were identified. The muscles were exposed by removing their fascial covering. Injury to the nerves related to the muscles was avoided. The Psoas Major muscle was traced through its whole length in the abdomen. The branches of the lumbar plexus emerging from the borders and surfaces of psoas major muscle were noted. The specimens were numbered and photographed documenting the emergence of nerves from the Psoas muscle. The Psoas muscle was then removed by piecemeal from the transverse processes of the lumbar vertebrae and intervertebral discs, disentangling the ventral rami of the lumbar nerves from its substance, thus exposing the plexus and its branches. The vertebrae were identified by articulation of 12th rib with 12th thoracic vertebra and also by identification of lumbosacral joint between 5th lumbar vertebra and sacrum. Roots were identified emerging from corresponding intervertebral foramina. Formation of lumbar plexus was observed. The presence or absence of accessory obturator nerve was noted. Its formation from the lumbar roots was documented. Each specimen was photographed individually after dissection.

RESULTS

In our study the incidence of AON was observed

to be 8%. It was observed to be present on right side in 4% cases and on the left side in 4% cases. AON was observed to be arising from ventral rami of L3 L4 in 6% cases (Fig. 1) and from L2 L3 in 2% cases (Fig. 2), (Table 1). AON was found in 2% males and 2% females.

Table 1: Observations on AON.

Specimen no	Sex	Side	Root of origin
21	Male	Right	Ventral rami of L2 L3
22	Male	Left	Ventral rami of L3 L4
39	Female	Right	Ventral rami of L3 L4
40	Female	Left	Ventral rami of L3 L4

Graph 1: Comparison of incidence of AON in various studies.

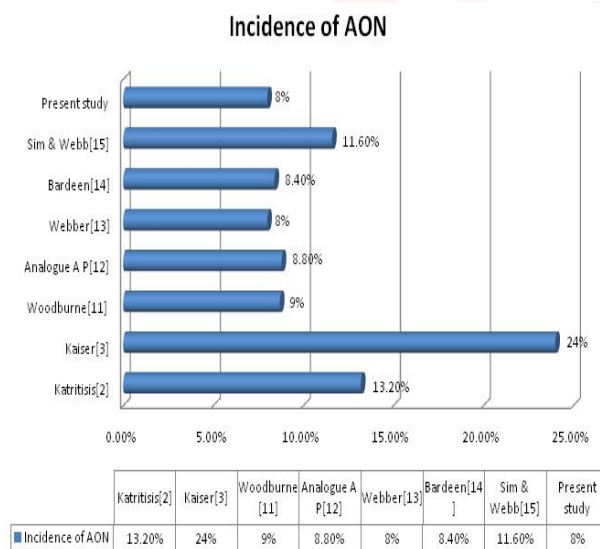


Fig. 1: Origin of accessory obturator nerve from ventral rami of L3 L4.

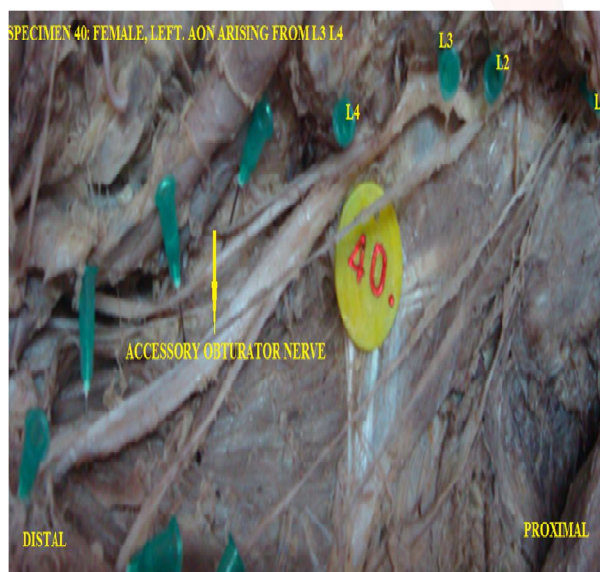
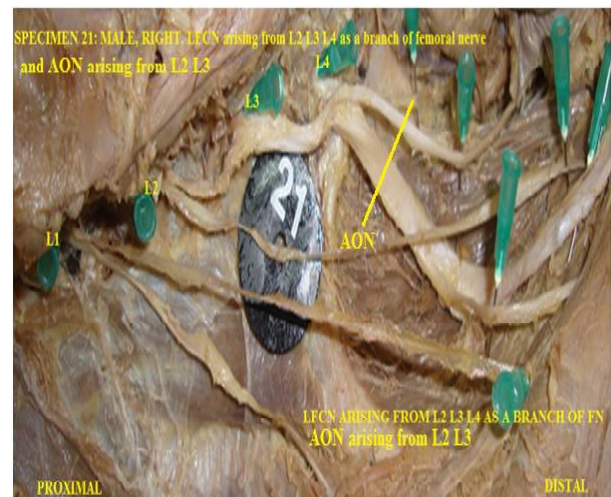


Fig. 2: Origin of accessory obturator nerve from ventral rami of L2 L3.



DISCUSSION

AON is small and arises from ventral branches of L3 L4. It is occasionally present in 10% population, emerging from medial border of psoas major [1,6-10]. Katritsis E, Anagnostopoulou S and Papadopoulos N in 1980 conducted a study on 1000 specimens to observe formation and distribution of AON. They reported that the frequency of this nerve was found to be 13.2% [2]. Incidence of AON was reported by Eisler (29%), De Sousa (8.3%), Akkaya (12.5%) and Polacek (16.6%)[11-13]. Incidence of AON varies from 8-29% and it has been reported in previous studies [3,11-15](Graph 1). In the present study incidence of AON was observed to be 8%.

AON when it exists, arises from ventral rami of L3 L4 [1]. Katritsis E, Anagnostopoulou S, Papadopoulos N conducted a study in a series of 500 adult human embalmed cadavers, in which the AON was looked for bilaterally and its formation and distribution studied. They reported that the nerve was formed by roots from the anterior primary divisions of L3 L4 (63.6%) or L2 L3 L4 (10.6%) or L2 L3 (7.6%) or L3 (6.1%) or from the trunk of ON (12.1%) [2]. Bergman RA et al have stated that the formation of AON varies. It arises from the ventral rami of third or more commonly from the third or fourth lumbar nerves between the roots of femoral nerve and obturator nerve. The AON may also arise from ventral rami of L2 L3 L4, L2 L3, L3 or it may arise directly from the obturator nerve [4]. In the present study, AON was originating from ventral

rami of L3 L4 in 6 % cases and L2 L3 in 2% cases. Katritsis E, Anagnostopoulou S and Papadopoulos N reported that the frequency of this nerve was found to be 13.3% in males and 12.9% in females. They also noted a predominance on the left side of the body (15.2:11.2) [2]. In the present study AON was found in 2% males and 2% females. The AON was found bilaterally in 2 cadavers. Tubbs SR, Sheetz J, Salter G and Oaks JW in 2003 reported a case of presence of AON bilaterally in an adult female cadaver. Both the nerves were associated with pseudoganglia [16].

AON can be selectively compressed as it courses over the superior pubic ramus. Compression and subsequent neuropathy is a differential diagnostic option in groin pain due to its innervations of hip joint [12].

CONCLUSION

A profound knowledge of the anatomic characteristics and variations in the formation of AON is of important value, due to the high variability in the incidence and formation of this nerve. Knowledge about the morphology of accessory obturator nerve is important for orthopaedicians to plan an effective hip surgery due to its innervation of pubofemoral ligament of hip joint. Compression of the nerve as it courses over the superior pubic ramus and subsequent neuropathy is a differential diagnostic option in groin pain. Therefore detailed anatomical knowledge of the accessory obturator nerve is of utmost importance, to increase the success of regional surgery.

ABBREVIATION

ON – Obturator Nerve
AON– Accessory Obturator Nerve
L1 – First Lumbar Nerve
L2 – Second Lumbar Nerve
L3 – Third Lumbar Nerve
L4 – Fourth Lumbar Nerve

Conflicts of Interests: None

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