

A HUMAN CADAVERIC STUDY ON THE VARIATION IN FORMATION OF OBTURATOR NERVE AND STUDY THE PRESENCE OF ACCESSORY OBTURATOR NERVE

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Abstract:

Background: The lumbar plexus is a network of nerves which comprises of the ventral primary rami of the first, second, third and fourth lumbar spinal nerves (L1 - L4). Awareness of the possibility of encountering multiple variations may prevent post-operative complications. This would also be useful information for Anatomists, Anaesthesiologists, Gynaecologists, Orthopedicians and Surgeons. **Aim-:** The aim of this study was to evaluate the incidence and variation in the formation of obturator nerve and accessory obturator nerve. **Material and method-:** The study was carried out on a total of 60 lumbar plexuses taken from 30 cadavers in the department of anatomy index medical college (MP), and govt medical college, Doda (J&K). For the purpose of providing a more transparent depiction of the observed variation, each item has been photographed with a digital camera. **Result-:** The normal origin of ON is from the root segments of the ventral divisions L2, L3, and L4 was found in 81.66% cadavers. ON was absent in 8 out of 60 plexuses (which is a percentage of 13.3%). There was no any exceptional branching pattern found in any of the plexuses. The accessory obturator nerve was found in 12 different lumbar plexuses and had a normal origin from the ventral division of the L2-L3 roots. **Conclusion-:** 81.66% of cadavers were having obturator nerve arising from ventral division of L2, L3, L4 and Only 12 of the 60 plexuses have the Accessory Obturator Nerve present. As it travels along the superior pubic ramus, it has the potential to undergo selective compression. Groin discomfort is a symptom that can have a variety of causes, one of which is the compression and consequent neuropathy of the accessory obturator nerve. This is because the accessory obturator nerve innervates the hip joint.

Key words – Obturator nerve (ON), Iliohypogastric nerve (IHN), Ilio- inguinal nerve (IIN), Genitofemoral nerve (GFN), Lateral femoral cutaneous nerve (LFCN), Femoral nerve (FN), Accessory obturator nerve (AON)

Introduction-

The lumbar plexus is a network of nerves which comprises of the ventral primary rami of the first, second, third and fourth lumbar spinal nerves (L1 - L4). The first lumbar nerve also receives a branch from the last thoracic nerve.

The Lumbar Plexus lies within the posterior part of the psoas major muscle in front of the transverse processes of the lumbar vertebrae. The lumbar plexus formation as described in the standard treatise (Gray's Anatomy) is as follows: The first lumbar nerve (L1), supplemented by a twig from the last thoracic, and splits into upper and lower branches. The upper larger branch divides into the iliohypogastric (IHN) and ilio-inguinal nerves (IIN). The lower, the smaller branch unite with second lumbar nerve (L2) to form the genitofemoral nerve (GFN). The remainder of the L2, L3, and the part of L4 joins the plexus, and divides into ventral and dorsal branches. The ventral branch of the L2 unites with the ventral branches of the L3 and L4 nerves to form the obturator nerve (ON).

The dorsal branches of L2 and L3 nerves each divide into a smaller and a larger part; the smaller parts unite to form the lateral femoral cutaneous nerve (LFCN), and the larger parts join with the dorsal branch of the L4 to form the femoral nerve (FN). Sometimes, the accessory obturator nerve (AON) also present, when it exists, arises from the ventral branches of the L3 and L4 Spinal nerves. The iliacus muscle supplied by the Muscular branches arising from the L2 and L3 spinal nerves.

Obturator nerve (ventral division of L2,L3,L4):-

Obturator nerve emerges out from the medial border of the psoas major beneath the common iliac vessels, this nerve travels along the lateral wall of the lesser pelvis and enters into obturator foramen. After entering in thigh, it bifurcates into an anterior and posterior branch. Anterior branch runs anterior to the obturator externus muscle, deep to pectinius and adductor longus muscle and superficial to adductor brevis muscle. It gives off the muscular branches to the adductor longus, gracialis & adductor brevis muscles. The posterior branch of the obturator nerve leaves through the anterior aspect of the obturator externus, runs beneath the adductor brevis & anterior to adductor magnus, and then gives off muscular branches to obturator externus, adductor magnus, and the adductor brevis.

Accessory Obturator Nerve (Ventral division of L3,L4):-

Accessory Obturator nerve is occasionally present. It arises from the ventral division of the ventral primary rami of the L3 and L4 nerves. It descends along the medial border of the Psoas major muscle, crosses the superior ramus of the pubis behind the pectineus, and divides into branches.

This study aims to add to the anatomical data on variations in the formation of obturator nerve and to detect the presence of accessory obturator nerve. Awareness of the possibility of encountering multiple variations may prevent post-operative complications. This would also be useful information for Anatomists, Anaesthesiologists, Gynaecologists, Orthopedicians and Surgeons.

Material & Methods –

The research was carried out on a total of 60 lumbar plexuses taken from 30 adult human cadavers, with 30 taken from the right side and 30 taken from the left. The lumbar plexus was exposed bilaterally in respect to the psoas major muscle after it was dissected on both sides using an anterior approach.

The psoas major muscle was left intact and in its original position after all of the viscera that were located in front of the peritoneum were removed in order to expose the posterior abdominal cavity via the anterior approach. We looked into the connection between the psoas

major muscle and the lumbar plexus. After that, the muscle was meticulously dissected and cut into pieces so that the branching pattern of the nerves could be observed.

Results –

Table 1: Obturator Nerve (ON)

Origin	Rt		Lt		Absent		Unusual Branchig	
	N	%	N	%	N	%	N	%
T12,L1,L2,L3,L4	2	2.5	1	3.33				
L2,L3,L4	25	83.3	24	80	8	13.3	-	-

The normal origin of ON is from the root segments of the ventral divisions L2, L3, and L4(Figure 1).ON was lacking in 8 out of 60 plexuses (which is a percentage of 13.3%)(Figure 2).There was not an exceptional branching pattern found in any of the plexuses.

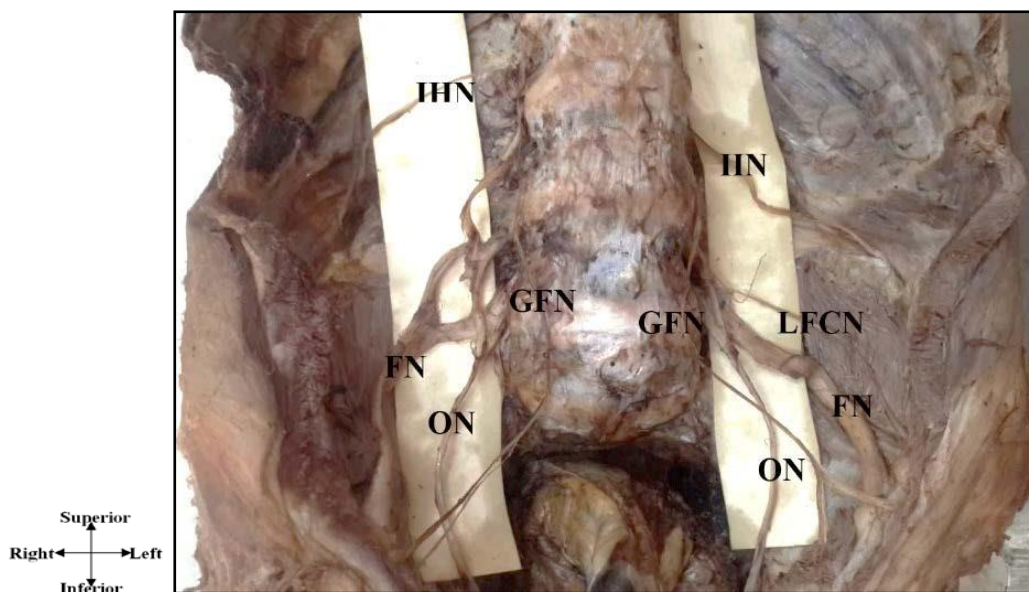


Figure 1: Showing the normal origin of ON from ventral division of L2, L3, L4 Roots

Table 13: Accessory Obturator Nerve (AON)

Side	N	%
Right	5	12.5
Left	7	17.5

The nerve was found in 12 different lumbar plexuses and had a normal origin from the ventral division of the L2-L3 roots. (Figure 2)



Figure 2: Showing the absence of ON and presence of AON from ventral division of L3, L4 roots

Discussion –

Author	Total No. of Lumbar Plexuses	Nerve Derived from (Origin)	N	%	Absent	
					N	%
Horwitz et. al. (1939)	228	L1, L2, L3, L4	2	0.87	-	-
		L2, L3, L4	23	10.08		
		L3, L4	175	76.75		
		L3, L4, L5	10	4.38		
		L3	3	1.31		
		L4	12	5.36		
		L4, L5	3	1.31		
Hollinshead (1982)	228	L2-L3-L4	53	23.24	-	-
		L3-L4	175	76.7		
Erbil et al.	2	L1, L2, L3	1	50	-	-

(1999)						
Yusuf et al. (2005)	20	-	-	-	-	-
Anagnostopoulous et.al. (2013)	88	L1, L2, L3, L4	5	5.64		
		L2, L3, L4	56	63.6	-	-
		L2, L3, L4, L5	13	14.72		
		L3, L4	14	15.9		
Arora et al. (2014)	60	L2, L3, L4	20	33.3	-	-
		T12, L1, L2, L3	1	1.67		
P. Nontasaen et al.(2016)	31	L2-L3-L4	131	100	-	-
Arora et al. (2016)	60	T12, L1, L2, L3	2	3.33		
		L1, L2, L3	7	11.66	-	-
		L1, L2, L3, L4	16	26.66		
		L2, L3	3	5		
		L2, L3, L4	32	53.33		
Present study	60	T12, L1, L2, L3, L4	3	5	8	13.3

- ✧ It was reported by Arora et al. (2014, 2016) that the origin from T12, L1, L2, or L3 occurred in fewer than 5% of instances. The current investigation did not uncover any evidence of such a source.
- ✧ "In the current investigation, it was observed that ON took origin from the ventral division of T12, L1, L2, L3, and L4 in 5% of cases." A variant origin that encompasses such a large range (T12, L1, L2, L3, L4) has not been described in the previous research.
- ✧ Horwitz et al. (1939), Anagnostopoulous et al. (2013), and Arora et al. have all reported that the origin of ON may be traced back to L1, L2, L3, and L4 (2016). In this particular investigation, such a source was unable to be located.
- ✧ whereas Erbil et al. (1999) observed genesis from L1, L2, and L3 in a single case, Arora et al. (2016) claim that it occurs in 11.66% of cases. The current investigation did not uncover any evidence of such a source.
- ✧ It has been observed that the nerve originates from the L2 and L3 levels alone by Arora et al. (2016) in 5% of their cases. The current investigation did not uncover any such point of origin.

- ✧ P. Nontasean et al. (2016) found that the typical text book origin from was seen in all 100 cases, while the present investigation found it in 81.66% of the cases. In two different studies, Arora et al. (2014, 2016) found that the origin of the cases ranged from L2, L3, and L4 between 33–55 percent of the time.
- ✧ Anagnostopoulous et al. (2013) report an incidence of 63.6%, although Horwitz et al. (1939) and Hollinshead (1982) report a low percentage (10-25%) of such observation.
- ✧ Horwitz et al. (1939) are the only ones who have recorded the nerve's origin coming from either the L3 (1.31%) or the L4 (5.36%) vertebrae.
- ✧ whereas Anagnostopoulous et al. (2013) report in only 15.9% of origin of the nerves from L3, L4, Horwitz (1939) and Hollinshead claim a high proportion (76.75%) of origin of the nerves from L3, L4.
- ✧ Only Horwitz et al. (1939) have reported that the aetiology can be traced back to L3, L4, or L5 in 4.38% of instances.
- ✧ According to Anagnostopoulous et al. (2013), the aetiology of ON was solely reported to come from L2, L3, L4, or L5 in 14.72 percent of cases.
- ✧ Horwitz et al. (1939) are the only ones who have recorded the genesis from L4, L5, and they did it in 1.31% of their instances. In 15% of the cases, the nerve was nowhere to be found. In their research, not a single source mentions the presence of nerve deficiencies.
- ✧ There was no remarkable branching pattern found in any of the plexuses that were examined by either us or any other

ACCESSORY OBTURATOR NERVE-:

Author	N	Present in plexuses	Present (Percentage of lexuses %)
R H Webber (1961)	50	4	8
Sim and Webb (2004)	60	7	11.6
Akkaya et al. (2008)	24	3	12.5
Anloague et al. (2009)	34	3	8.8
P. Nontasaen et al. (2016)	131	12	9.2
Present study	60	12	20

- ✧ Researchers R. H. Webber (1961), Anloague et al. (2009), and P. Nontasaen et al. (2016) found the presence of AON in 8–10% of cases.

- ✧ "Sim and Webb (2004) and Akkaya et al. (2008) reported the presence of AON in more than 10% of patients, which was comparable to our finding in the present study .
- ✧ When compared to the other researchers, we found the highest incidence of AON.

Conclusion –

In this study 81.66% of cadavers were having obturator nerve arising from ventral division of L2, L3, L4 and Only 12 of the 60 plexuses have the Accessory Obturator Nerve present. As it travels along the superior pubic ramus, it has the potential to undergo selective compression. Groin discomfort is a symptom that can have a variety of causes, one of which is the compression and consequent neuropathy of the accessory obturator nerve. This is because the accessory obturator nerve innervates the hip joint.

Only 8 of the 60 plexuses have the Accessory Obturator Nerve present. As it travels along the superior pubic ramus, it has the potential to undergo selective compression. Groin discomfort is a symptom that can have a variety of causes, one of which is the compression and consequent neuropathy of the accessory obturator nerve. This is because the accessory obturator nerve innervates the hip joint.

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