

VARIABILITY OF ORIGIN OF OBTURATOR ARTERY AND ITS CLINICAL SIGNIFICANCE

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ABSTRACT

Background: Obturator artery is a branch of anterior division of internal iliac artery. It normally runs anteroinferiorly on the lateral wall of pelvis to the upper part of the obturator foramen and leaves the pelvis by passing through the obturator canal. On its course, the artery is accompanied by the obturator nerve and vein. It supplies the muscles of the medial compartment of the thigh. A severe and potentially lethal complication in pelvic injuries is arterial bleeding commonly involving the branches of the internal iliac artery, namely the lateral sacral, iliolumbar, obturator, vesical and inferior gluteal arteries. A sound knowledge of retro-pubic pelvic vascular anatomy is pivotal for successful performance of endoscopic procedures such as total extra-peritoneal inguinal hernioplasty or laparoscopic herniorrhaphy.

The context and purpose of the study: This study is an attempt to analyse the origin, course, distribution of obturator artery in pelvis and their clinical implication.

Result: out of 60 formalin fixed pelvic halves 36.6% of the specimens, (26.67% in males and 10% in females) the origin of obturator artery was found to be normal from anterior division of internal iliac artery. About 63.63% from various other sources.

Conclusion: This knowledge of variation in the origin of obturator artery is important while doing pelvic and groin surgeries requiring appropriate ligation. Such aberrant origins may be a significant source for persistent bleeding in the setting of acute trauma. Knowledge regarding the variations of obturator artery is useful during surgeries of fracture and direct or indirect inguinal, femoral and obturator hernias.

KEY WORDS: Internal Iliac Artery, Obturator Artery, Superior Gluteal Artery, Iliolumbar Artery, External Iliac Artery, Inferior Epigastric Artery.

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INTRODUCTION

Obturator artery, a branch from the anterior division of internal iliac artery, supplies hip joint and muscles of adductor compartment of thigh. Within the pelvis it gives branches to urinary bladder & twigs to ilium and pubis. The obturator artery passes downwards along the pelvic wall, crossed medially by the ureter and the ductus

deferens in male. In the obturator foramen it divides into anterior and posterior branches. It is accompanied by the obturator nerve above and vein below. In pelvis, it gives branches to urinary bladder, nutrient branch to ilium and pubis. Behind the pubis it anastomoses with inferior epigastric artery.

Origin of obturator artery from other arterial

source have been reported in some studied [1, 2, 3]. The presence of vital organs and other anatomical structures within the closely packed confines of the pelvis makes the study of vascular patterns and their variations significant [4]. Due to the rapid development of surgical procedures and investigatory techniques involved in obstetric procedures or urogenital interventions, it is essential to understand the vascular tree in the abdomen especially in the pelvis [5].

MATERIALS AND METHODS

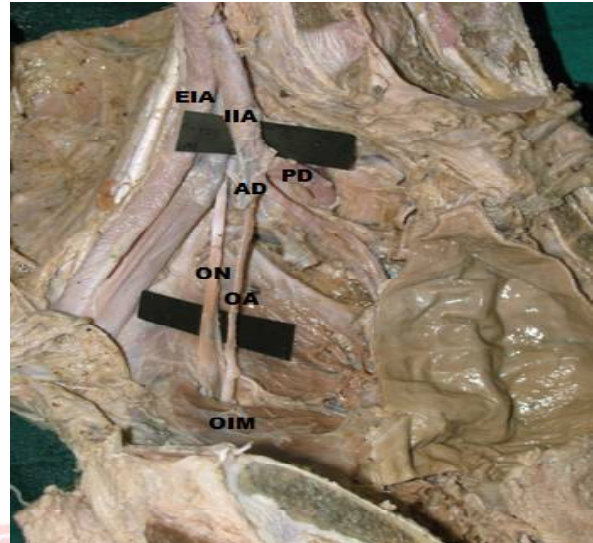
The study was conducted on sixty adult pelvic halves of known sex which were being used for dissection purposes for teaching medical student in the department of Anatomy, Chettinad hospital and research institute, TN, India. Dissection was carried out according to the dissection steps given in Cunningham's manual of practical anatomy [6].

In each half of the pelvis the common iliac arteries was first located. Then the internal iliac branch of the common iliac artery and its anterior division was identified in the pelvic cavity. The obturator artery was traced from its origin till obturator foramen. The origin of the obturator artery relationship of the artery to its adjacent structures and branching pattern was recorded and adequately photographed.

RESULTS

The source of origin of obturator artery was studied in 60 formalin fixed pelvic halves. In 36.67% of the specimens, (26.67% in males and 10% in females) the obturator artery arises from anterior division of internal iliac artery pass antero-inferiorly on the lateral wall to the upper part of obturator foramen in the pelvis (Figure 1). It was related laterally to obturator fascia separating it from obturator internus with obturator nerve above and obturator vein below. In 63.63% of specimens the origin of obturator artery was from various sources i.e., posterior division of internal iliac artery, superior gluteal artery, combined with iliolumbar artery and direct branch from external iliac or inferior epigastric artery. A detailed description regarding the variations in the origin of obturator artery is described as follows.

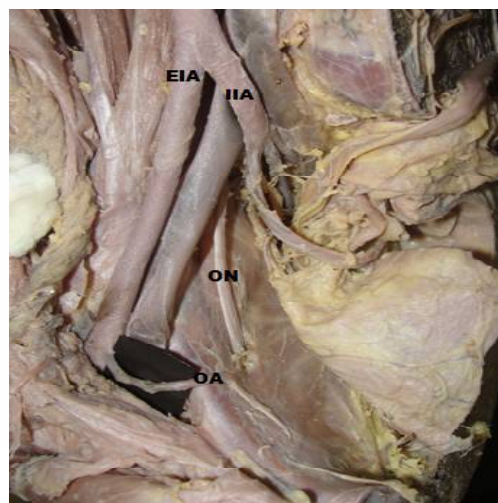
Fig.1: Dissected specimen of right pelvic region of a male cadaver.



external iliac artery (EIA) anteriorly and posteriorly internal iliac artery (IIA) along with its anterior division (AD) posterior division (PD), the obturator artery (OA) arises from the anterior division and runs anteroinferiorly just below the obturator nerve (ON) towards obturator foramen disappears by passing undercover of obturator internus muscle (IM)

Variation 1: The origin of obturator artery from the trunk of external iliac artery was found in a total of 5 specimens (male 4 and female 1). The obturator artery passed anteriorly over the superior ramus of pubis and turned inwards to enter into the obturator canal (Fig. 2). In the present study, the incidence of obturator artery from direct branch of external iliac artery was found to be 8.33%.

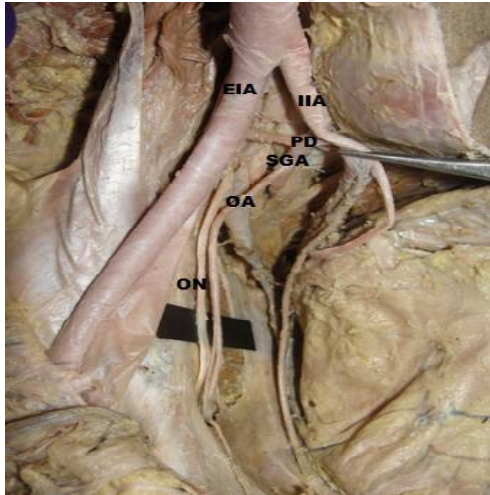
Fig. 2: Dissected specimen of right pelvic region of a male cadaver.



External iliac artery (EIA) anteriorly and posteriorly internal iliac artery (IIA), external iliac artery (EIA) give rise to obturator artery (OA) it makes a curve runs posterior then pass through the obturator foramen (OF) along with obturator nerve (ON)

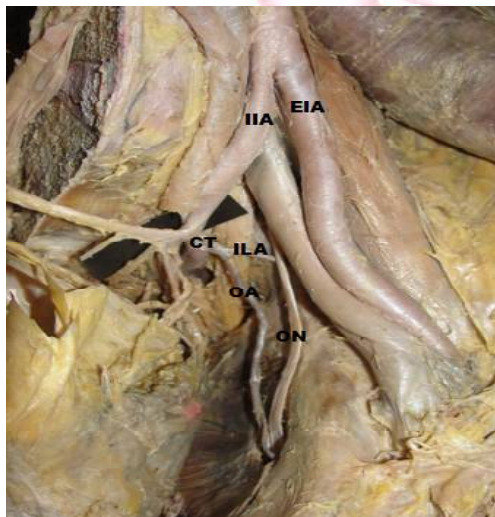
Variation 2: In this type of variation the obturator artery from posterior division of internal iliac artery (Fig.3) instead of the usual anterior division of internal iliac artery. The incidence percentage of this particular type of variation in the present study was found to be 11.67%.

Fig. 3: Dissected specimen of right pelvic region of a male cadaver.



Internal iliac artery (IIA) and external iliac artery (EIA) from common iliac artery (CIA), Obturator artery (OA) arising from posterior division (PD) of internal iliac artery (IIA). Here obturator artery runs anteroinferiorly along with obturator nerve (ON) towards obturator foramen (OF).

Fig. 4: A dissected specimen of left pelvic region of a male cadaver.



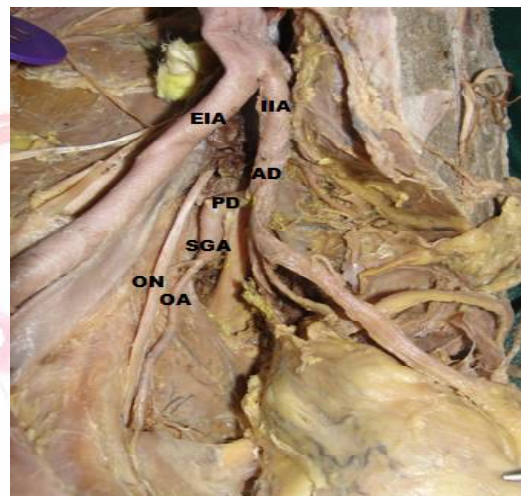
Internal iliac artery (IIA) and external iliac artery (EIA) from common iliac artery (CIA), here Obturator artery (OA) arising from trunk of posterior division (PD) of internal iliac artery (IIA) has a common trunk (CT) along with ilio-lumbar artery (ILA) runs anteroinferior toward obturator foramen (OF) below the obturator artery (OA).

Variation 3: A rather uncommon type of variation where the obturator artery along with Ilio-lumbar artery was found to arise as a

common trunk from posterior division of internal iliac artery (Fig. 4). This type of variation was observed in 2 specimens.

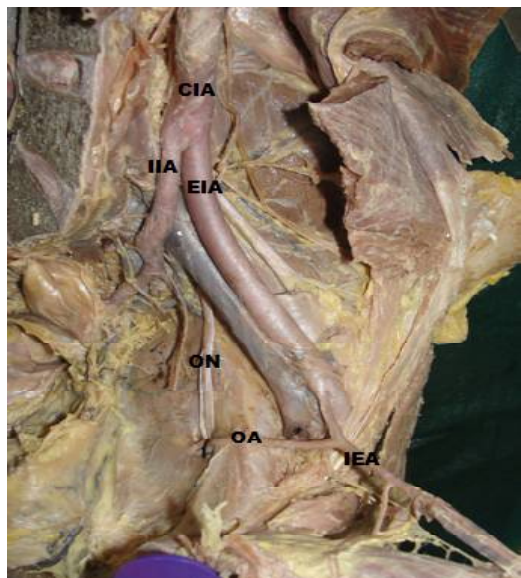
Variation 4: The origin of obturator artery from the superior gluteal artery was observed in a total of 9 specimens (male 7 and female 2). The artery from its origin was found to pass beneath the branches of anterior division to enter the obturator foramen (Fig. 5). The artery was related to obturator nerve above.

Fig. 5: Dissected specimen of left pelvic region of a male cadaver.



Internal iliac artery (IIA) and external iliac artery (EIA) from common iliac artery (CIA), here Obturator artery (OA) arises from Superior gluteal artery (SGA) that is a branch from internal iliac artery (IIA).

Fig. 6: Dissected specimen of left pelvic region of a male cadaver.



Internal iliac artery (IIA) and external iliac artery (EIA) from common iliac artery (CIA), Obturator artery (OA) arising from inferior epigastric artery (IEA) which in turn branch from external iliac artery (EIA).

Table 1: Incidence of origin of obturator artery from various branches of internal and external iliac arteries.

	Origin	Male	Female	Total	Incidence %
Internal iliac artery n=40	Anterior division (Normal)	16	6	22	36.67
	Superior gluteal artery	7	2	9	15
	Posterior division	5	2	7	11.67
	With ilio-lumbar artery	2	0	2	3.33
External iliac artery n=20	Directly from external Iliac artery	4	1	5	8.33
	Inferior epigastric artery	12	3	15	25

As a whole the incidence percentage of usual origin of obturator artery was found to be 36.67% and variable origin of the obturator artery was found to be 63.33%.

DISCUSSION

The obturator artery runs anteroinferiorly from the anterior trunk of internal iliac artery on the lateral pelvic wall to the upper part of the obturator foramen. It leaves the pelvic via the obturator canal and divides into anterior and posterior division. In the pelvic it is related laterally to the fascia over obturator internus and is crossed on its medial aspect by the ureter and, in the male, by the vas deferens. In the nulliparous female the ovary lies medial to it. The obturator nerve is above the artery, the obturator vein below it [7].

The anatomical knowledge pertaining to diverse variations about the origin of obturator artery from internal and external iliac artery or from its branches. Obturator artery courses in pelvic and leave it by passing through obturator foramen alone with obturator nerve is of utmost importance during numerous surgical manipulation. Accidental hemorrhage is common during erroneous interpretation of anomalous blood vessels. Alarmingly, hemorrhage has been considered the leading cause of obstetrical mortality in the United States of America and the leading cause of maternal deaths in all the developing countries [8]. Thus, a thorough knowledge of the normal and the abnormal anatomy of the branches of the internal iliac artery are essential for obstetric surgeons.

Origin of obturator artery has been reported by various author's out of which Mangala M Pai [10] and SharmistaBiswas [11] study has been compared in below table.

Table 2: Incidence percentages of various origin of obturator artery. Present study Vs Mangala M Pai and SharmistaBis was study.

Mode of Origin	Present study (2013)	Mangala M Pai (2009) [10]	Sharmista Biswas 2010 [11]
Anterior division of Internal iliac artery	36.67%	60.20%	44.60%
Posterior division of Internal iliac artery	11.67%	7.20%	12.50%
With ilio-lumbar artery	3.33%	1%	0%
Superior gluteal artery	15%	10.20%	16%
External iliac artery(Direct)	8.33%	5.20%	-
Inferior epigastric artery	25%	14.30%	3.50%
Dual origin from internal & external iliac artery's.	-	2.20%	-
Inferior gluteal artery	-	-	-
Internal pudendalartery	-	-	-
Common trunk of inferior gluteal & internal pudendal	-	-	-

Obturator artery from anterior division of Internal iliac artery (Fig.1):

Origin of obturator artery from internal iliac artery is three times more frequent than those arising from inferior epigastric or external iliac artery Bergman [9]. The most common source of origin of the obturator artery is a single branch arising from the anterior division of the internal iliac artery. This type of variation was more frequently observed by Mangala M Pai [10] (60%) and SharmistaBiswas [11] (40.2%) as compared to that of present study (36.67%) [Table 2]. Whereas Pick [2] reported only a 21% incidence in this type of variation

Obturator artery from posterior division of Internal iliac artery and its branches (Fig. 3):

The origin of obturator artery arising from the posterior division of internal iliac artery is considered as a rare observation in Indian population. Therefore an attempt has been made to highlight its clinical implications in relation to the anomalous origin from the internal iliac artery [12]. The obturator artery may originate directly from posterior division or in combination with ilio-lumbar and superior gluteal artery.

Our resultsshowed an incidence of 11.6% [Table 2] for this type of variation which was in coincidence with SharmistaBis was [11] (12.5%). A lower incidence (3%) was reported [2, 8].

Origin of Obturator artery in combination with ilio-lumbar artery (Fig. 4): The origin of obturator artery along with ilio-lumbar artery was found in 3.33% of specimens in the present study. This type of variation is rarely reported (1%) by Mangala M Pai [10] [Table2].

Obturator artery from superior gluteal artery (Fig. 5): Our results showed an incidence of 15% for this type of variation (Table 2) coincidence (16%)[11] and lower incidence rate (10%)[9].

Origin of obturator artery from external iliac artery (Fig. 2)

This type of variation was more frequently observed by Missankov [13] (25%) and Mangala M Pai [10] (5.2%) as compared to that of present study (8.33%), whereas Braithwaite [16] reported only 1.1% and Jakubowicz et.al., [14] reported only 1.3% incidence in this type of variation.

Obturator artery from inferior epigastric artery (Fig. 6): The common origin of inferior epigastric and obturator arteries is a relatively frequent variation that occurs in 20–30% of cases [9]. The first to report about origin of obturator from inferior epigastric artery [15]. Our results showed an incidence of 25% for this type of variation which was similar to Poynter [15], Bergman [9], and lower incidence of 14.3% [10]. The origin of obturator artery from inferior gluteal, internal pudendal, common trunk for inferior gluteal and internal pudendal arteries or from the lumbar artery was not observed in any of the specimens in the present study. This was in contrast to previous studies [9, 16]. In the same way, dual origin of the obturator artery from both internal iliac and external iliac arteries was not observed in the present study. Such variation were maximally reported by Braithwaite [16], who found in 6.5%, Bergman [9] found in 1% and Mangala M Pai [10] found in 2.2%.

Obturator artery in retropubic fat may obscure visualization of these small vessels during ilioinguinal incision, making them prone to iatrogenic injury during operations such as inguinal hernioplasty and prostatectomy [17]. The obturator veins are also prone to injury. In addition to iatrogenic injury, the proximity of these vessels to the superior pubic ramus may

result in persistent hemorrhage associated with pelvic fractures.

Aberrant anatomy of the obturator artery can increase the risk of iatrogenic or traumatic injury. The obturator artery may have an anomalous origin from the inferior epigastric artery, the posterior trunk of the internal iliac artery, or the superior or inferior gluteal arteries. Branches of the obturator and inferior epigastric vessels lie in close proximity, on opposite sides of the superior pubic ramus. Occasional anastomoses crossing the top of the superior pubic ramus to connect these two vascular distributions was termed “corona mortis” by Letournel [18] because it forms a vascular “crown” prone to life-threatening hemorrhage when injured.

CONCLUSION

In the present study various source of origin of obturator artery were observed. The most common type of origin observed in the present study is from anterior division of obturator artery. Among the variable source of origin, there is an increased incidence percentage of the artery arising from inferior epigastric artery. Origin of obturator artery in combination with ilio-lumbar artery is a rare type of origin reported in the present study. During surgical repair of hernia and fracture of superior ramus of pubis, the obturator artery may be injured due to anomalous origin from the external iliac artery which might lead to profuse bleeding. Surgeons must be conscious of unexpected sources of hemorrhage, such as an aberrant obturator artery or vein, and unexpected ilio-pubic vessels and take appropriate precautions to avoid injury to these structures. The human cadaver is probably an ideal model to explore the nuances of pelvic surgeries.

LIST OF ABBREVIATIONS

EIA - External Iliac Artery
IIA - Internal Iliac Artery
AD - Anterior Division
PD - Posterior Division
OA - Obturator Artery
ON - Obturator Nerve
IM - Obturator Internus Muscle
OF - Obturator Foramen
CIA - Common Iliac Artery
CT - Common Trunk
IIA - Ilio-Lumbar Artery
IEA - Inferior Epigastric Artery

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Conflicts of Interests: None

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