

## “Obturator Artery Variations, Associated Bilateral Polycystic Kidney”

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### Abstract

**Introduction:** The knowledge of the origin, course and variations of the obturator artery(OBA) is the key success factor of the pelvic and inguinal surgeries.

**Materials and methods:** 57 pelvices were utilized to study the various origins of the obturator artery namely from anterior division of internal iliac artery, posterior division of internal iliac artery, external iliac artery, inferior epigastric artery and double origin from anterior division of internal iliac artery as well as external iliac artery. The observations were digital photographed and data were tabulated for analysis.

**Results:** Most common pattern of origin was recorded in fortyone(41) hemi pelvices; from the anterior division of internal iliac artery. In eight (8) pelvices the origin of obturator artery is from the posterior division of internal iliac artery. In two (2) pelvices the obturator artery was originating from external iliac artery, where as in two(2) pelvices the obturator artery emerged from inferior epigastric artery. Bimodal origin of the obturator artery was observed in four(4) pelvices. In one of the female pelvices with right sided obturator artery originating from inferior epigastric artery was associated with bilateral polycystic kidney.

**Conclusion:** the variation of the obturator artery was on par with the previous authors' observations except for the origin of OBA from anterior division of the IIA was on the higher side. There was associated bilateral polycystic kidney with right OBA from inferior epigastric artery.

**Keywords:** obturator artery – variations – bilateral polycystic kidney - female.

### I. Introduction

Obturator artery (OBA) runs antero inferiorly from the anterior trunk on the lateral pelvic wall to the upper part of the obturator foramen. In the pelvis it is related laterally to the fascia over obturator internus and is crossed on its medial side 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. Occasionally the obturator artery is replaced by an enlarged pubic branch of the inferior epigastric artery descending almost vertically to the obturator foramen. This vessel sometimes curves along the edge of the lacunar part of the inguinal ligament, encircling the neck of the hernial sac, and may be inadvertently cut during enlargement of the femoral ring in reducing a femoral hernia.<sup>1</sup> Injury to the obturator artery not only results in deprived blood supply to the femoral head, iliac bone, iliac fossa, obturator muscles and the muscles of the adductor compartment, intractable extra peritoneal bleeding behind the pubic symphysis in case of corona mortis<sup>2,3,4</sup>.

Variations of the obturator artery provides more curiosity to study the distributions of branching pattern of internal iliac as well as external iliac arterial systems. Surgical fields like orthopaedics, obstetrics and gynaecology, general surgery and urology need to know the variations of the origins of the obturator artery in detail before venturing into the operating procedures to avoid inadvertent bleeding and further complications of the surgical procedures. This study emphasizes the origins of obturator artery with respect to arteries such as internal iliac artery, external iliac artery, inferior epigastric artery, from both external iliac artery and anterior division of internal iliac artery.

### II. Materials and methods

This study was conducted in 1.Rajah Muthiah Medical College, Annamalai Nagar Chidambaram, 2.Sri Sathya Sai Medical College, Ammapettai Village, Chennai, 3. Sri Balaji Medical College, Chrompet, Chennai over a period of three years. Fifty seven (57) pelvices were utilized for this study. Among this seven(7) were hemi-pelvices and twenty five(25)were whole pelvices. Twenty seven (27)were left sided, thirty (30) were right sided. Fortyfour (44) belonged to male and thirteen (13) belonged to female. Routine dissection instruments were used to dissect the pelvis to find the origin of the obturator artery and traced till the obturator foramen. Both internal iliac artery and external iliac artery were dissected to study the origin of obturator artery. All the dissected specimens were digital photographed and the results were tabulated for analysis(Table-1,2,3).

### III. Results

Most common pattern of origin was recorded in fortyone(41) hemi pelvices; from the anterior division of internal iliac artery(fig-1). In eight(8) pelvices the origin of obturator artery was from the posterior division of internal iliac artery(fig-2). In two (2) pelvices the obturator artery was originating from external iliac artery(fig-3), whereas in two (2) pelvices the obturator artery emerged from inferior epigastric artery(fig-4). Bimodal origin of the obturator artery was observed in four (4) pelvices(fig-5). In one of the female pelvices with right sided obturator artery originating from inferior epigastric artery was associated with bilateral polycystic kidney(fig-6).

#### IV. Discussion

The embryological accounting for the variations of obturator artery is given as vascular anomalies are due to the unusual selection of channels from the primary capillaries<sup>5</sup>. The most appropriate channels from primary capillaries enlarge but others retract and disappear thereby establishing the final arterial pattern<sup>6</sup>. The obturator artery arises comparatively late in development as a supply to a plexus which in turn is joined by the axial artery of the lower limb that accompanies the sciatic nerve<sup>7</sup>.

According to Pick et al<sup>8</sup>. the documented incidence of obturator artery originating from the posterior trunk of the internal iliac artery was 3.28% in western population. The observation of the present study about the origin of obturator artery from the posterior trunk of internal iliac artery was 14% , more common in males on their right side. It was more or less the same finding of Braithwaite<sup>9</sup> (1952) 13.5% and the meta analysis by Sanudo et al<sup>7</sup>(2011) 12.1%, slightly higher incidence in males(8.7%) when compared to females(5.26%).

Comparison of studies based on the origin of Obturator Artery(Table-1)

Studies	Braithwaite (1952) %	Roberts et al (1967)%	Biswas et al (2010)%	Sanudo et al (2011)%	Meta analysis Sanudo et al (2011)%	Present study %	
Single Origin	93.5	100	100	96.55	-	92.98	
Type a	AT of IIA	59.9	53.2	44.6	52.68	35.5	71.92
Type b	IEGA	19.5	25.3	23.2	29.02	22.5	3.5
Type c	PT of IIA	13.5	16.5	28.5	8.48	12.1	14.03
Type d	IIA ↑Div	-	3.7	-	8.04	16.7	-
Type e	EIA	1.1	1.3	3.5	1.79	1.7	3.5
Type f	FA	-	-	-	-	-	-
Double origin		6.5	-	-	3.02	-	7.01
Triple origin		-	-	-	0.43	-	-

Comparison of studies based on the Sytem of origin of Obturator Artery(Table-2)

Author	From IIA%	From EIA%
Gray (1901)	66.7	33.3
Pearsol(1930)	70	30
Pick(1941)	71	29
Braithwait(1952)	73	27
Schaeffer(1953)	63	37
Roberts(1957)	73.5	26.5
Bergman(2006)	71.6	28.4
Rusu(2009)	68.8	31.2
Mahato(2009)	78	22
Biswas(2010)	71.3	28.7
Sanudo(2011)	69.2	30.8
Present study(2016)	85.95	14.01

Comparison of OBA branches based on Origin,Side,Sex percentage(Table-3)

Obturator artery Origin	Right	Left	Male	Female
Ant division IIA	31.57	40.35	77.19	22.80
Post. division IIA	8.77	5.26	8.77	5.26
EIA	1.75	1.75	1.75	1.75
IEA	3.5	-	1.75	1.75
Ant.div. IIA+IEA	7	-	7	-

Missakanov et al<sup>10</sup> found that in 44% of cases the obturator artery was originating from inferior epigastric artery. This finding was higher than the observations by Sanudo et al<sup>7</sup> 29.02%, Roberts et al<sup>11</sup> 25.3, Biswas et al<sup>12</sup> 23.2, Braithwaite<sup>9</sup> 19.5%.,Mahato<sup>13</sup> 9%. But Berberoglu et al<sup>14</sup> observed only 4% of such origin

which closely matches the present study, which was 3.5%, more on the right side and the incidence was equal among both sex as per this study (1.75%).

Origin of obturator artery directly from external iliac artery noted as per the present study was 3.5% which was same as the finding by Biswas et al (3.5%), differ from Sanudo et al 1.79%, Roberts et al (1.3%), Braithwait (1.1%). The surgical significance of obturator artery highlighted by Rusu et al<sup>17</sup> because of the intimate relationship with the superior pubic ramus and femoral ring. In case of repair of the obstructed, strangulated femoral hernias' repair the femoral canal has to be made roomy by cutting of the medial boundary, the lacunar ligament rather than disturbing the inguinal ligament anterior and superior pubic ramus posterior to the femoral ring (Rusu et al 2010).

Regarding double origin of the obturator artery both from the anterior division of the internal iliac artery and the external iliac artery the finding of Pai et al<sup>15</sup> was 47% in males and 26% in females, Braithwaite<sup>9</sup> reported 6.5% which is almost the same finding of the present study i.e 7.01%, where as Sanudo et al<sup>7</sup> reported 3.02% and Jakubowicz and Czarniawska Grzesinska<sup>16</sup> reported the incidence in only 2.6% of cases, which was most common in males(7%) as per present study.

The most common factor of the origin of obturator artery by many authors, from the anterior division of the internal iliac artery's incidence in this study was slightly in the higher side(71.92%) when compared to the inferences by the following authors namely Braithwaite<sup>9</sup> 59.5, Roberts et al 53.2%, Sanudo et al<sup>7</sup> 52.68%, Biswas et al<sup>12</sup> 44.6%. This type of occurrence was more common in males (77.19%) when compared to females(22.80%).

## V. Conclusion

This study is trying to facilitate the practicing surgeons, anatomists and other faculties of medicine to understand the prevailing concepts of obturator artery and its origin from various sources like the external iliac artery, internal iliac and inferior epigastric artery. Most of the findings of the previous authors were reconfirmed by the present study in terms of their origin, distribution among the sex and sides of the body except for the OBA from anterior division of the internal iliac artery. In one cadaver of a female, the obturator artery originating from inferior epigastric artery on the right side and from anterior division of internal iliac artery on the left side was associated with bilateral polycystic kidney.

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