

THE CLINICAL SIGNIFICANCE OF THE OBTURATOR ARTERY IN ORIGIN VARIABILITY

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ABSTRACT

The obturator artery is standard branch of anterior division of the internal iliac artery. It runs on the lateral wall of pelvis to enter into thigh region through obturator foremen. Based on previous research studies, it found to be extremely variable in origin and course. It may arise from internal or external iliac artery. The current study includes 60 dissected cadavers to examine the obturator artery origin and the clinical significance. In 70%, the obturator artery arises from the internal iliac artery. It arises either from its anterior or posterior division of the internal iliac artery in 45% or 25% correspondingly. In 30%, the obturator artery arises from the external iliac artery. Therefore, the variability of the obturator artery may carry a high risk of surgical complication. For instance, it carries a high risk of insufficient of vascular supply for demand structures such as proximal adductors attachment and hip joint in case of aneurysmectomy of posterior division. Consequently, vascular surgeons have to pay attention to the posterior division being an origin of the obturator artery beside its usual three classical branches: superior gluteal, iliolumbar and lateral sacral arteries. Further, the obturator artery arising from the external iliac system is in great dangerous of laceration in case of anterior pelvic fracture. Therefore, it may lead to hemorrhagic shock threatening life.

KEYWORDS : Obturator Artery, Anterior Division, Posterior Division, Superior Gluteal Artery, Iliolumbar Artery, Lateral Sacral Artery

The obturator artery is a direct branch of the anterior division of the internal iliac artery. The obturator artery passes on the lateral wall of pelvis inferior to the brim to enter the obturator foramen near to its superior edge. The artery is medial to the obturator fascia, lateral to the ureter, ductus deferens, and peritoneum and inferior to the obturator nerve. As the obturator artery passes through the pelvis, it gives several muscular and vesical branches. The muscular branches supply iliacus. Before leaving the pelvic cavity, it gives a pubic branch as a collateral circulation with the external iliac system via the inferior epigastric artery. The obturator artery then passes from the pelvic cavity to the medial compartment of the thigh via the obturator canal. On leaving the pelvic cavity through obturator foramen, the obturator artery divides into two branches, the anterior and posterior branches that anastomose with the internal circumflex artery. The anterior branch supplies obturator externus, pectineus, the adductors and gracilis and terminates by anastomosing with the posterior branch of the obturator and medial circumflex femoral arteries. The posterior branch gives twigs, which supply the muscles

attaching to the ischial tuberosity, and anastomoses with the inferior gluteal artery (Standring, 2005).

MATERIALS AND METHODS

The present study includes 120 dissected hemipelvises to study the variable origins of the obturator artery. The entire cadavers were dissected in institution of anatomy, college of life sciences, University of Dundee. Photo has been taken under the rule and regulation of University of Dundee research. The data collection and analysis have been done by using Statistical Package for the Social Sciences (SPSS). The missing data has been excluded to get the accurate incidence of each variation. This study a dissection based study and was conducted on cadavers used for undergraduate teaching. Once students had finished dissecting the anterior abdominal wall, foregut and hindgut, a transverse section through or above L4 or L5 was made followed by sagittal section of the pelvis. After dividing the pelvis, the peritoneum was identified prior to starting dissection. The peritoneum was cut 1cm superior to the bladder roof. At the pubic bone, the peritoneum is

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attached to the superior pubic ramus and has to be released to identify the possibility of an accessory (aberrant) obturator artery and its anastomosis with branches of the obturator artery passing through a defect in the pelvic fascia. Moreover, the obliterated segment (distal part) of the umbilical artery has to be preserved. In females, the vesicouterine pouch was carefully removed to reveal deep structures. Clarification of the broad ligament was done as well as identification of the uterine tube, and the ovary with its ligament. These structures were released and reflected from the lateral pelvic wall. In males, the vas deferens was reflected superoanteriorly or removed. At the level of the sacral promontory, the sigmoid colon was sectioned from the rectum at the rectosigmoidal junction. Waldeyer's fascia was incised and the rectum released from the pelvic wall. After reflection of the pelvic viscera, the pelvic fascia was divided and removed from the pelvic wall. Sometimes, it was difficult to remove if it was dry, therefore as soon as it has been identified and exposed, it had to be removed. Subsequent to removal of the endopelvic fascia, the iliac system (venous and artery) was exposed. The internal iliac veins and their tributaries veins were removed by incision at the level of common iliac vein formation. The small veins accompanying the anterior and posterior branches of the internal iliac artery were removed with extreme caution to avoid damaging the arteries.

The common iliac artery bifurcates into external and internal iliac arteries between L3 and L5. The external iliac artery was inspected and its branches identified, being careful not to miss the obturator artery from the internal iliac system or the accessory branch in relation to their communication with the inferior epigastric artery. The internal iliac artery bifurcates into anterior and posterior division anterior to the lumbosacral articulation at level (L5/S1). The anterior division gives the umbilical artery as its the most superior branch running to the superior surface of the bladder giving several branches including the superior vesical artery. At the level of the internal iliac artery bifurcation, the ureter and gonadal artery were reflected at the level of the obturator artery to give a clear view of any arteries arising from this site. The obturator artery usually arises either on the lateral or dorsolateral surface of the

anterior division: it may also arise from the anterior division below the origin of the umbilical artery. Occasionally, the superior vesical artery arises from the anterior division between the umbilical and obturator arteries. However, the obturator artery may arise from an indirect branch of the anterior or posterior divisions. Unable to identify the obturator artery as the internal iliac artery, the possibility of it arising from the external iliac artery is considered in relation to the inferior epigastric artery and its collateral circulation. To see the obturator artery easily, the obturator nerve was identified passing between the internal iliac artery bifurcation, then tracing the obturator artery just inferior to the nerve to its origin and termination. In cases of no artery running on the lateral wall of the pelvis, the possibility of origin is the external iliac artery.

RESULTS

The present study includes 120 specimens to investigate the origin of the obturator artery. The obturator artery arose from the internal iliac artery in 70% whereas it arose from the external iliac artery in 30%. The obturator artery arose from the anterior division and posterior division of the internal iliac artery in 45% and 25% respectively.

DISCUSSION

According to Anson group the occurrence of a variation of the obturator artery is 48% (Bergman et al., 1988), in which case it may arise from the common iliac, external iliac or from branch of the internal iliac in both males or females (Parsons and Keith, 1897, Pick et al., 1942, Braithwaite, 1952, Bergman et al., 1988). The obturator artery usually arises from the anterior division of the internal iliac artery ranging between 21% and 83% (Parsons and Keith, 1897, Pick et al., 1942, Braithwaite, 1952, Naguib et al., 2008, Biswas et al., 2010, Sañudo et al., 2011). In present study, it arises from anterior division of the internal iliac artery in 45% (Figure 1).

According to the incidence review of obturator artery origin, which arises from posterior division in different Populations, it occurred in 3.3% of Western population (Pick et al., 1942). It has been estimated in 9.4% of American population (Lipshutz, 1918). Further, the

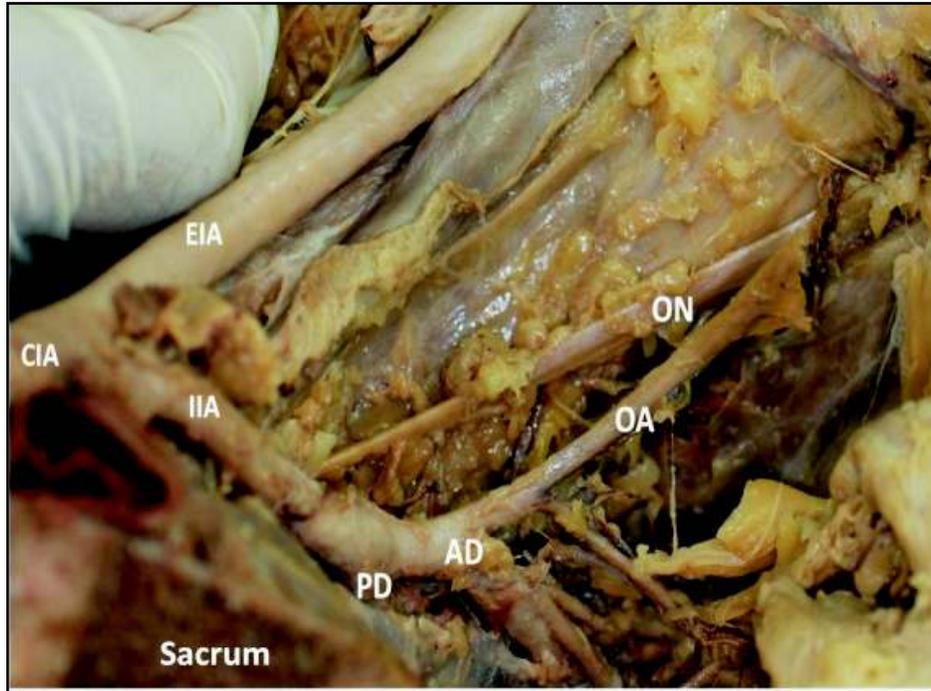


Figure 1: The Obturator Artery Arising From Anterior Division The Internal Iliac Artery. CIA. Commn Iliac Artery, EIA. External Iliac Artery, IIA. Internal Iliac Artery, AD. Anterior Division, PD. Posterior Division, OA. Obturator Artery, ON. Obturator Nerve



Figure 2: The Obturator Artery Arising From Posterior Division The Internal Iliac Artery. EIA. External Iliac Artery, IIA. Internal Iliac Artery, AD. Anterior Division. PD. Posterior Division, UMA. Umbilical Artery, OA. Obturator Artery, ON. Obturator Nerve, IPA Internal Pudendal Artery, UTA. Uterine Artery, VGA. Vaginal Artery, SA. Sciatic Artery, ILA. Iliolumbar Artery, LSA. Lateral Sacral Artery

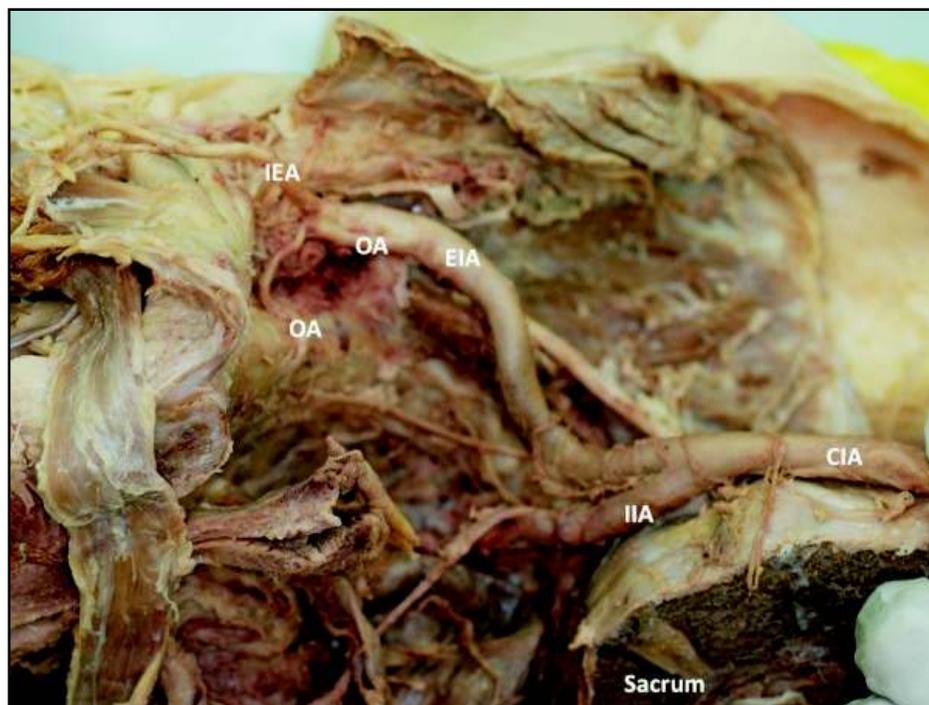


Figure 3: The Obturator Artery Arising From The External Iliac Artery. CIA. Common Iliac Artery, EIA. External Iliac Artery, IIA. Internal Iliac Artery, OA. Obturator Artery. IEA. Inferior Epigastric Artery

obturator artery arising from posterior division in United Kingdom found to be 14.5% in previous (Parsons and Keith, 1897] or 8.2% in recent studies (Sañudo et al., 2011). In series research study, the obturator artery arises from posterior division of internal iliac artery in 0.5% (Dinesh et al., 2007), 11.11% (Pai et al., 2009), 12.5% (Biswas et al., 2010), 18% (Pavan et al., 2014) or in 10% (Rajive and Pillay, 2015) in India. It occurred in 19% (Kiray et al., 2010) in Turkey population whereas it occurred in 4.0% in Germany population (Naguib et al., 2008). In present study, it occurred in 25% of United Kingdom population (Figure 2). Based on embryological theory, the obturator artery arising from the posterior division has been explained by Al Talalwah and Soames (2014) in which the coexistence of primitive obturator artery from primitive posterior division due to a delay of primitive anterior division development.

In addition, the obturator artery may arise from the external iliac artery instead of internal iliac artery. According to series studies, the obturator artery arises from the external iliac artery ranging between 1.3% and 25% (Naguib et al., 2008; Pavan et al., Lau & Lee; 2003, Biswas

et al., 2010; Sañudo et al., 2011) whereas it occurred in 30% in current study (Figure 3).

Generally, variations in the origin of the obturator artery are due to unusual embryological selections of channels from the primary capillary plexus, which develop while some disappear. According to the current obturator artery variations, the reason why the obturator artery originates from the posterior division of internal iliac artery is persistence of vascular channels of the posterior division, which become the obturator artery while the vascular channels of the anterior division of the internal iliac artery disappear. However, the origin of the obturator artery from external iliac artery is due to a delay in embryologic development.

CONCLUSION

The variability of obturator artery in origin has to be expected by clinician prior to any pelvic procedure in case of the gluteal aneurysm or hernia repair to decrease the iatrogenic faults. Knowing the variability of obturator artery origin may modify the surgical procedures to

minimize the postsurgical complication. Obturator obturator artery crosses the superior pubic ramus and is susceptible to injuries during dissection of the Bogros space and stapling of the mesh onto Cooper's ligament (Lau and Lee, 2003). Therefore, existence of this artery from either the external iliac or femoral arteries requires great awareness from surgeons during herniorrhaphy and hernioplasty. In addition, gynaecologists and obstetricians have to be aware of variations in the origin, course and branches to avoid postsurgical complications in cases of hysterectomy, as well as in orthopaedics in cases of pelvic fracture.

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