

Variability in the Origin of the Obturator Artery: A Descriptive Cross-Sectional Cadaveric Study

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Abstract

Background: Surgeons must be conscious of unexpected sources of hemorrhage, such as an aberrant obturator artery or vein, and unexpected iliopubic vessels and take appropriate precautions to avoid injury to these structures.

Objective: Evaluating the incidence of normal and aberrant origin of the obturator artery and vein.

Materials and Methods: A total of 72 human hemi-pelvises were taken including both the fresh cadavers arrived in mortuary with preserved pelvises in Department of Anatomy at Netaji Subhash Chandra Bose Medical College, Jabalpur. Laparotomy done with midline anterior incision up to the pubic symphysis and dissection carried out in the pelvic and retropubic region to expose the branches of the common iliac artery.

Results: Obturator artery common originates from the anterior trunk of the internal iliac artery and less frequently from other branches of internal or external iliac artery. Abnormal communication found in 45.8% of hemi-pelvises which are mostly venous.

Conclusion: Obturator artery the most common originates from anterior trunk of internal iliac artery. Abnormal venous communications (venous corona mortis) are a very common and knowledge of abnormal communications of obturator vessels is crucial for the different surgeries at pelvic region.

Keywords: Obturator artery, External iliac artery, Inferior epigastric artery, Internal iliac artery, Variations

INTRODUCTION

A severe and potentially lethal complication in the 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.¹ A sound knowledge of retropubic vascular anatomy is important for successful performance of open/endoscopic inguinal hernioplasty, as well as for herniorrhaphy.² The ideal reconstruction of the floor of the inguinal canal during the herniorrhaphy involves good anatomic dissection and exposure,³ which can only be accomplished by entering the subinguinal space of Bogros.

There is an adequate anecdotal experience to indicate that the relationships of structures near the internal ring are not generally well-known and this may predispose them to injury during surgery.⁴ Among all of the above arteries, the obturator artery is more prone to injury during hernia or pelvic surgeries. Surgeons must be conscious of unexpected sources of hemorrhage, such as an aberrant obturator artery or vein, and unexpected iliopubic vessels and take appropriate precautions to avoid injury to these structures. Regarding the variability in the origin of the obturator artery, Bergman *et al.*⁵ documented that it may arise from the common iliac or anterior division of the internal iliac in 41.4% of cases, from the inferior epigastric in 25% of cases, from the superior gluteal in 10% of cases, from the inferior gluteal/internal pudendal trunk in 10% of cases, from the inferior gluteal in 4.7% of cases and from the internal pudendal in 3.8% of cases. Knowledge of variations in origin of obturator artery is useful not only in cases of hernia surgery but also important in other surgeries, like Orthopedic surgeons planning an anterior approach to the acetabulum such as the ilioinguinal or

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the intrapelvic approach (Modified Stoppa), must be cautious when dissecting near the superior pubic ramus or pubic rami fractures for fixation and plating. During pelvic surgeries, obstetric and gynecological surgeries and vascular surgeries for various branches of internal and external iliac vessels, there is a need of thorough understanding of anatomy of obturator artery and related vessels. The human cadaver is probably an ideal model to explore the surgical anatomy. The “corona mortis” is an anatomical variant, an anastomosis between the obturator and the external iliac or inferior epigastric arteries or veins, located on the superior pubic ramus. It is also known as crown of death (Tornetta *et al.*, 1996).⁶ Corona mortis is composed of aberrant obturator artery and/or vein. During endoscopic procedures, the consequence of injuring the vein could be more serious than that of arterial injury (Avisse *et al.*, 2000).⁷ Bleeding from an aberrant obturator artery can be easily recognized and controlled during endoscopic procedure. In contrast, bleeding from a damaged vein might be inconspicuous as the pressure of insufflated carbon dioxide within the preperitoneal space might temporarily seal it off. Post-operative oozing from the injured vein could then lead to hematoma formation. In open surgeries for hernia, surgeon can escape from injury to these vessels because of better delineation of vessels. In patients who have the injury to this artery may need conversion from laparoscopic hernia repair to open surgery to stop bleeding. From the recent studies, incidence of corona mortis was 10-43%.^{2,8-10} Potentially fatal bleeding from these injured vessels might occur following the pelvic fracture or pelvic surgery. This study was conducted with the objective of evaluating the incidence of normal and aberrant origin of the obturator artery and vein and to describe their relevance in surgical practice.

MATERIALS AND METHODS

A descriptive cross-sectional cadaveric study conducted in the Department of Surgery, Anatomy, and Forensic Medicine, Netaji Subhash Chandra Bose Medical College and Hospital, Jabalpur, Madhya Pradesh, during the period of September 2011 to August 2012. Inclusion criterions were all fresh cadavers received in mortuary and all preserved cadavers in Department of Anatomy, Netaji Subhash Chandra Bose Medical College, Jabalpur, Madhya Pradesh. Exclusion criterion being (a) Age <18 years, (b) Blunt trauma abdomen or pelvis, (c) Burn, (d) Pregnant woman, and (e) Pelvic malignancy. After the ethical committee approval, 72 human hemi-pelvises were taken including both the fresh cadavers arrived in mortuary with preserved pelvises in Department of Anatomy at Netaji Subhash Chandra Bose Medical College, Jabalpur. Laparotomy done with midline anterior incision up to the pubic symphysis and dissection carried out in the pelvic and retropubic region to expose the branches of the common iliac artery. The internal iliac

artery along with its anterior and posterior divisions and their further subdivisions were carefully delineated by separating it from the surrounding structures. The obturator artery was identified and traced from its origin to its exit at the obturator foramen along with the obturator nerve and obturator vein. The normal and abnormal obturator vessels were carefully dissected, to study its origin, its branches and their communications. Photographs were taken for documentation. The data were entered and analyzed in Microsoft office excel 2007. Qualitative data was summarized as percentage and proportions.

RESULTS

We dissected total 72 hemi-pelvises both preserved ones in Department of Anatomy and freshly arrived cadaver in mortuary through midline laparotomy. Among 72 hemi-pelvises dissected, 54 were male pelvises and 18 were female. Out of 54 male pelvises 32 belongs to right side and 22 to left side and total 18 female pelvises 8 of the right side and 10 were left sided. Among total 72 cases, obturator artery originated from internal iliac artery in 67 (93%) cases in which 50 in males and 17 in female pelvises. External iliac gave origin to obturator artery in 05(07%) cases in which 4 were males and 1 female. Table 1 Frequency of origin of obturator artery from various branches. Out of 72 dissected hemi-pelvises abnormal communication found in 33/72 (45.8%) in which in males 25/54 (46.3%), in females 08/18 (44.4%). Abnormal communication was absent in 39/72 cases that were 54.2%. Table 2 shows the incidence of a type of the abnormal communication.

Table 1: Frequency of origin of obturator artery from various branches

Artery	Male	Female	Total
Int ili art			
Ant trunk			
Direct	14	09	23
Cmn G+IP*	17	04	21
Cmn A+IV#	06	00	06
Post trunk			
Direct	06	03	09
Sup glut art	07	01	08
Ext ili art			
Inf epi art	04	01	05
Total	54	18	72

*Common trunk of IP/IG, #Common trunk of OA/IV

Table 2: Incidence of type of abnormal communication

Type of communication	Male (%)	Female (%)	Total (%)
Venous	21 (84)	07 (87.5)	28 (84.8)
Arterial	01 (04)	00	01 (03)
Combined arterial+venous	03 (12)	01 (12.5)	04 (12.1)
Total	25	08	33

DISCUSSION

The most common source of origin of the obturator artery is as a single branch arising from the anterior division of the internal iliac artery. However, the literature contains many articles that report variable origins. Interesting variations in the origin and course of the principal arteries have long attracted the attention of surgeons and anatomists. In our study, the most common origin of obturator artery in both the sex was from the internal iliac artery, more often from the anterior division than the posterior division and in a few cases from the inferior epigastric artery.

In our study, we found obturator artery originate from internal iliac artery in 93% of hemi-pelvises (67/72), while Malivalaya *et al.*¹¹ found in 77.5%, and 79% by Pai.¹² This is the most common source of origin of obturator artery in literature and in all previous study. As we go further in specification, in our study obturator artery originate from anterior trunk of internal iliac artery in 75% (50/67) of hemi-pelvises in which as a direct branch in 46% (23/50), from common trunk of inferior gluteal and internal pudendal artery in 42% (21/50) and from common trunk of obturator artery and inferior vesical artery in 12% (06/50). To compare our results Bergman *et al.*⁵ documented that it may arise from the common iliac or anterior division of the internal iliac in 41.4% of cases, from the inferior gluteal/internal pudendal trunk in 10% of cases, from the inferior gluteal in 4.7% of cases and from the internal pudendal in 3.8% of cases and remaining 22.5% from others. Pai¹² quoted that obturator artery arises from anterior trunk in 76% of cases. We found the origin of obturator artery from posterior trunk in 25% (17/67) of hemi-pelvises where in 53% (09/17) as a direct branch and 47% (08/17) from superior gluteal artery. These data are comparable with Pai¹² who quoted 23% from posterior trunk, in which as a direct branch in 39%, from superior gluteal artery in 56% and in 5% from iliolumbar artery. Regarding origin of obturator artery from posterior trunk, Jusoh¹³ reported 5.8%, Pick *et al.*¹⁴ 3.28%, Kumar and Rath¹⁵ 0.5%.

We observed that in 7% (5/72) of hemi-pelvises, obturator artery originate from inferior epigastric artery and none of them as a direct branch of external iliac artery. Mahato¹⁶ reported it as 8% from inferior epigastric artery and from the external iliac artery in 10%. Jakubowicz and Czarniawska-Grzesinska¹⁷ (1996) recorded the frequency of the origin of this artery from the external iliac artery 1.3% and 2% from inferior epigastric artery. Berberoglu *et al.*⁸ (2001) placed this incidence at 7.1% and 4% from external iliac artery and inferior epigastric artery, respectively. There is wide range of variability found in origin of obturator artery in different studies and our

observations are comparable to others. Our study revealed that the abnormal obturator communication was in 45.8% (33/72) which comprises 46.3% in males (25/54) and 44.4% in females (08/18) while Lau *et al.*² found the incidence of overall corona mortis 40%, Malivalaya *et al.*¹¹ 17.2%, Ocku¹⁰ 61% and Pungpapong¹⁸ 77.3%. In our study, we observed that 84.4% (28/33) were venous among all abnormal communication. Berberoglu *et al.*⁸ reported incidence of venous corona mortis was 96% of pelvic halves, Malivalaya *et al.*¹¹ 70.6%, Ocku¹⁰ 52%, Tornetta *et al.*⁶ 70%, and Pungpapong¹⁸ 77.3%. As of previous studies, we also found abnormal venous communications quite frequently. In classical anatomy textbooks and most of other studies, a description of the veins that form corona mortis is found less often than descriptions of the arteries. We found the most common source of abnormal venous communication is inferior epigastric vein but in few cases obturator vein drain directly to external iliac vein or it drain into a communication between internal and external iliac vein. More than one site of abnormal communication may also present in a hemi-pelvis. In our study, we found arterial abnormal communications in 3% (1/33) which are comparable to Berberoglu *et al.*⁸ 8.3%. Pungpapong¹⁸ 13.6%, Malivalaya *et al.*¹¹ 22.5%, Lau² 22.2% and Pick *et al.*¹⁴ 29%. As such we also found combined arterial and venous abnormal communication in 12% (4/33) of hemi-pelvises which are also comparable to Malivalaya *et al.*¹¹ 17.2%, Ocku¹⁰ 19%, Lau² 09%, and Tornetta *et al.*⁶ 20%. Our study confirms that the incidence of venous corona mortis is greater than that of arterial corona mortis even though the frequency was variable when compared with other studies. As venous connection is more probable than an arterial one, its importance must be appreciated by surgeons to avoid venous bleeding. All abnormal communications present at the inner surface of superior pubic ramus and they are straight in course. Abnormal communication may found in both halves of pelvis and they may differ in their type. Origin of these abnormalities may be due to embryological or specific selection of vessels. Pathological either venocclusive or arterial thromboembolic phenomenon and trauma or surgery in the pelvic area may also give rise to these abnormal vessels later in life. We should keep all these variations in mind during different pelvic surgeries to avoid hemorrhage.

CONCLUSION

Obturator artery most common originates from anterior trunk of internal iliac artery. Abnormal venous communications (venous corona mortis) are very common, and knowledge of abnormal communications of obturator vessels is crucial for the different surgeries at pelvic region.

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