

Bilateral Common Origin of Obturator and Inferior epigastric Arteries from the External Iliac Arteries, Accompanied by Venous Corona Mortis Duplicated on the Left Hemi-Pelvis

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ABSTRACT

During the dissection of the pelvis of a 93-year-old female donor, aberrant obturator artery and inferior epigastric artery were found to arise by a common trunk from the external iliac arteries bilaterally. Both right and left AOAs descended into the lesser pelvis with a venous corona mortis and entered the obturator canal on its anterolateral wall where each artery is joined by two (superior and inferior) obturator veins (OVs) and the obturator nerve on the respective side. The bilateral venous corona mortis connected the superior obturator veins with inferior epigastric veins, while on left hemipelvis, a second venous corona mortis additionally connected the inferior obturator vein with external iliac vein. These variant pelvic vessels are prone to injuries by trauma during accidents, iatrogenic injuries during inguinal and femoral hernia operations, and other orthopedic, gynecologic and urologic procedures. Such injuries have high morbidity and mortality rate due to hemorrhagic shock, therefore, caution must be exercised to avoid excessive hemorrhage and other complications.

Keywords: External iliac artery; External iliac vein; Inferior epigastric artery; Inferior epigastric vein; Aberrant obturator artery; Obturator vein; Venous corona mortis

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INTRODUCTION

The obturator artery (OA) is one of the branches of the anterior division of the internal iliac artery (IIA) that runs on the lateral wall of the pelvis frequently between the obturator nerve (ON) (above it) and obturator vein (OV) (below it), and the ureter [1,2] and vas deferens in males [3] medial to it. Then it passes through the obturator canal to mainly supply the medial thigh compartment, the head of femur and the knee [2,3]. It provides iliac, vesical and pubic branches in the pelvis and divides into anterior and posterior

branches in the medial thigh [4]. In addition to anastomosis between them, the anterior branch also anastomoses with the medial circumflex femoral artery and supplies the adductors of thigh, while its posterior branch anastomoses with the inferior gluteal artery and supplies muscles attached to the ischial tuberosity. The OA also provides an acetabular branch to the hip joint [4]. This anastomotic connection of the OA plays an important role in the collateral circulation of blood to the gluteal and perineal regions, as well as

to the medial thigh compartment during a unilateral or bilateral interruption of IIA, such as during endovascular aortic aneurysm repair [5]. Though mostly described as a branch of the anterior division of the IIA, different studies have noted different percentages of variability of the OA showing that it is the most varied of all the branches of the IIA. It can originate from the common iliac, posterior division of IIA, from external iliac artery (EIA) or from any of the branches of the IIA and inferior epigastric artery (IEA) [6]. Systematic review and meta-analytic studies have also demonstrated that there is an extensive and inconstant variability of the OA [7,8]. Sanudo et al. [9] in their study of the origin and course of the OA in 119 human cadavers showed that this artery can have variable origins by variable number of roots from the IIA-system or from the EIA system. There were specific studies on the variability of the origin of the OA that noted its origin from the anterior division of IIA in about 79% of the case [10]. However, another study revealed that its branches from the anterior division of IIA only in 36.67% but takes variable origins in 63.63% of the cases including a unilateral or bilateral origin from various branches of the iliac arterial tree and even from the femoral artery [11]. According to some authors OA originating from the IEA is the second common variation of origin with a prevalence of 20-33.30% [11-14]. Cerda et al. [15] described a bilateral aberrant OA (AOA) originating from the IEA, which is consistent with those previous findings.

The variable obturator vessels are prone to traumatic and iatrogenic injuries causing life threatening hemorrhages [16-24]. It is well known that the OA is the most frequently involved in high-energy blunt pelvic ring injury [25] and other injuries involving OA can also occur during transurethral bladder surgery

and prostatic arterial embolization [26-28]. Such traumatic or iatrogenic pelvic vascular injuries have high morbidity and mortality rates due to shock as a result of bleeding [29,30]. The obturator vascular variation including the OV's, where the veins drained into the EIV or IEV was also well documented [31-33]. These variant veins, similar to the arteries, are also prone to traumatic or iatrogenic injuries.

This case report presents a 93-year-old female donor with bilateral AOAs and aberrant obturator veins (AOVs) with unusual origin, number, course and communications. This could be of tremendous importance for surgeons, orthopedists, obstetricians, gynecologists and urologists to exercise caution and avoid iatrogenic injuries causing excessive hemorrhage that can result in consequent, but preventable, morbidity and mortality.

MATERIAL AND METHODS

During the dissection of the pelvis for the branches of the internal iliac vessels, the AOA was found to arise from the EIAs bilaterally via a common trunk with IEA. The AOA on each side was accompanied by the venous corona mortis (VCM) in its course down to the lesser pelvis. After observing this in the whole pelvis, the pelvis was bisected into right and left halves for an easier approach of its lateral wall. The vessels on each hemi-section were carefully dissected farther and cleaned to reveal their origins and courses. This dissection additionally revealed two OV's accompanying each ON. Then, the arteries and veins were painted red and blue respectively for the purpose of differentiation and photographs were taken for illustration. The OV's were designated as superior and inferior based of their relationship to the ON at and near the obturator canal.

CASE REPORT

The dissection of the branches of the internal iliac vessels in a 93-year-old female donor, who consented for research and publication, revealed the bilateral absence of the OAs as branches of the IIAs, (Figure 1 and Figure 2). Further dissection of the anterolateral pelvic wall and the external iliac vessels showed an arterial trunks that ascended into the lower anterior abdominal wall by crossing over the EIV (Figure 1 and Figure 2). Immediately after crossing over the EIV, the common trunks bifurcated into ascending and descending branches of comparable size. The ascending branches became IEAs, while the descending branch that became AOAs looped around the IEVs and then ran across the superior pubic rami, the pelvic brim, lateral walls of the lesser pelvis and entered the obturator canals of the respective side. Each AOA provided a pubic branch just before entering the obturator canal (Figure 2). As the AOAs coursed down to the obturator canal, they were accompanied by VCM (Figure 1 and Figure 2). Two OV's (superior and inferior) accompanied the ONs, entered the pelvis through the obturator canals and merged to form a single OV on each side just before their terminations in the IIVs (Figure 2). Short after the OV's entered the pelvis the superior OV's were joined by the VCM that connected them to IEVs (Figure 2). On the left hemi-pelvis, the inferior OV was connected by a second VCM to the left EIV (Figure 2).

DISCUSSION

The variation of obturator vessels is well-studied; many previous studies and case reports have illustrated numerous possibilities of variations of these vessels and reached a conclusion that they are the most varied vessels related to the internal iliac system. These variations included the presence of arterial corona mortis, aberrant and accessory obturator artery [1]. The

variations, therefore, can be variations of origin, communication, course and distribution. As related to communications a computed tomograph angiographic study done on 300 arteries of 150 patients found 90 arterial corona mortis (30% of the cases), where 40 of them were on the right side and 50 were on the left side [2]. There are also so many case reports that noted the variable origins of OA that included its origin from the external iliac artery and its course with double OV's with the ureter and ductus deferens descending medial to it [3]. The OA can also be formed by an enlarged pubic branch of the IEA [4]. Despite the fact that most sources agree that the OA is a branch from the anterior division of the IIA, it is the most varied branch with different percentages of variability. Three previous studies found three different percentage of variability of the origin of the OA: 63.63% [6], 31.41% [7] and 38.4% [8]. According to a study conducted on 119 cadavers, the majority (69.20%) of the OAs arose with a single root from the IIA-system and 30.80% were from the EIA-system, which were classified into categories a-f, where the type A (52.68%) were from the anterior division of the IIA, type B were from the IEA and the rest were from different branches of the two system [9]. In another specific and detailed study of the OA by Pai et al. [10] on 98 hemi-pelvises, the obturator artery was found to be a branch of the internal iliac artery in 79% (77/98) of the cases; arising either from anterior or posterior division of IIA independently or with other named branches, while in 19% (19/98) of the cases it originated from the external iliac artery (EIA) as a separate branch or together with the IEA. Out of those that branched from the IIA, 76.62% (59/77) were from the anterior division.

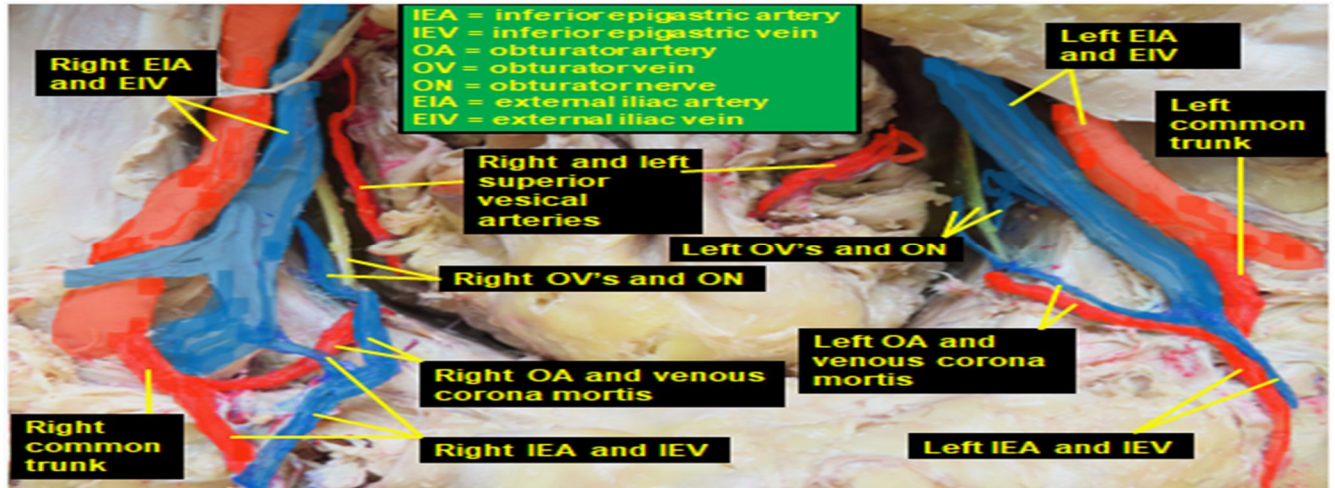


Figure 1: Superior view of the pelvis illustrating the origins of the common arterial trunks from the external iliac arteries (EIAs) and their bifurcation into ascending and descending branches that formed the AOAs and IEAs respectively. It also shows the bilateral VCM accompanying the AOAs in their course to the obturator canal.

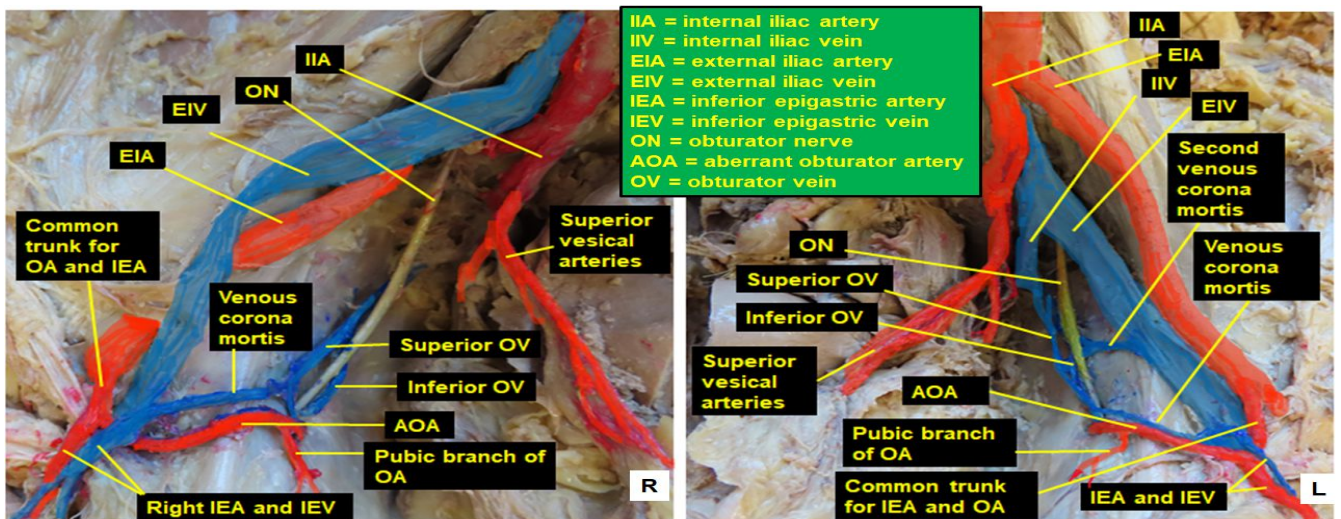


Figure 2: Photograph of the medial aspect of the right (R) and left (L) hemi-pelvises. It illustrates the bifurcations of the common trunks into AOAs and IEAs, the course of the AOAs as they cross over the EIVs, loop around the IEVs, provide pubic branches and enter the obturator canals. The superior and inferior OV's emerging through the obturator canal, their course with the ONs, their fusion to form single OV on each side and the communication of the superior OV's with IEV's via the VCM are shown. The connection of the left inferior OV by a second VCM to EIV is also shown.

On the contrary, the study of Sakthivel et al. [11] showed that the OA arose from the anterior division of the IIA only in 36.67% of the 60 hemi-pelvises they investigated. Moreover, many studies have also noted that the second common origin of OA next to the anterior division of the IIA is the IEA with a prevalence of 20-33.30% [11-14]. A previous case report described six cases of AOA, (one bilateral, four

left unilateral and one right unilateral), where the bilateral and the four left unilateral AOAs were branches from the deep inferior epigastric artery (DIEA) of the respective side, while one was from the right external iliac artery (EIA) [14]. AOAs with bilateral origins from the IEA, were also reported by Cerda et al. [15]. These two case reports described the AOAs as branches of IEA, whereas, the finding in

present case report, shows a significant bilateral arterial trunk (common trunk) that arose from the external iliac artery (EIA) and ascended into the lower anterior abdominal wall before bifurcating into the two branches (AOA and IEA) of comparable size. Therefore, the AOA and IEA are considered as sharing a common trunk arising from the external iliac artery (EIA). Both AOAs are accompanied by VCM and gave off pubic branches.

The OV's also vary in their drainage pattern, relations to skeletal landmarks, numbers and communications. Such variations are identified significantly more often than the arterial variations [16]. The most frequent variation in the drainage of these veins is their termination in the EIV or IEV [16]. According to a study of variations of OV's and their surgical implications conducted on 106 patients who had bilateral pelvic lymph node dissection, it was found that the OV's drained bilaterally symmetrically either into IIV or EIV [17]. To which of these two veins they drain can also vary between the two sides. Another study on the variability of the retropubic space in 15 female cadavers found that, the OV was the closest of the obturator neurovascular structures to the ischial spine [18].

The finding of bilateral combination of variations including the common arterial trunks bifurcating into AOA and IEA, VCM duplicated on the left side and the bilateral double OV's, makes the current report different from the others before.

Due to the close proximity to pelvic organs and the pelvic wall and their unpredictable variability, the obturator vessels are commonly injured during various procedures in the pelvic cavity and its wall causing life threatening hemorrhages. These can be caused by trauma during pelvic and acetabular fractures [19-23] or can be a result of iatrogenic involvement during

procedures like ischial or pubic osteotomy associated with acetabular or periacetabular osteotomy and screw fixation and pelvic lymph node dissection [24-27]. A study on the incidence rate and topography of intra-pelvic arterial lesions associated with high-energy blunt pelvic ring injury showed that the OA is the most frequently involved [28]. Other procedures like ON block for transurethral bladder surgery [29] and prostatic arterial embolization [30,31] can also be complicated by obturator vascular injury. Such pelvic vascular injuries have a high mortality rate due to shock as a result of bleeding [32,33]. To avoid such injuries, particularly the iatrogenic injuries, and the associated morbidity and mortality, most authors recommend safe sites of approach in the respective procedures to minimize complications and for better clinical outcome.

CONCLUSION

The co-existence of bilateral arterial and venous variations in origin, course, number, communication and termination patterns, such as in this case report, can increase the possibility of potential vascular injury and mortality. Therefore, pre-, intra-, and post-procedural cautions must be practiced to avoid excessive hemorrhage and other complications during inguinal and femoral hernia operations and other orthopedic, gynecologic and urologic procedures.

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CONFLICT OF INTEREST

None

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