

Corona Mortis: the Abnormal Obturator Vessels in Filipino Cadavers

Imelda A. Luna

Department of Anatomy, College of Medicine, University of the Philippines Manila

ABSTRACT

Objectives. This is a descriptive study to determine the origin of abnormal obturator arteries, the drainage of abnormal obturator veins, and if any anastomoses exist between these abnormal vessels in Filipino cadavers.

Methods. A total of 54 cadaver halves, 50 dissected by UP medical students and 4 by UP Dentistry students were included in this survey.

Results. Results showed the abnormal obturator arteries arising from the inferior epigastric arteries in 7 halves (12.96%) and the abnormal communicating veins draining into the inferior epigastric or external iliac veins in 16 (29.62%). There were also arterial anastomoses in 5 (9.25%) with the inferior epigastric artery, and venous anastomoses in 16 (29.62%) with the inferior epigastric or external iliac veins. Bilateral abnormalities were noted in a total 6 cadavers, 3 with both arterial and venous, and the remaining 3 with only venous anastomoses.

Conclusion. It is important to be aware of the presence of these abnormalities that if found during surgery, must first be ligated to avoid intraoperative bleeding complications.

Key Words: obturator vessels, abnormal, corona mortis

INTRODUCTION

The main artery to the pelvic region is the internal iliac artery (IIA) with two exceptions: the ovarian/testicular artery arises directly from the aorta and the superior rectal artery from the inferior mesenteric artery (IMA). The internal iliac or hypogastric artery is one of the most variable arterial systems of the human body, its parietal branches, particularly the obturator artery (OBA) accounts for most of its variability.

The origin of the obturator artery is variable. It usually arises close to the origin of the umbilical artery (from the anterior division) where it is crossed by the ureter, runs anteroinferiorly along the obturator fascia on the lateral pelvic wall and gives off its 3rd or pubic branch just before it enters the obturator foramen between the obturator vein and nerve (after giving off an iliac branch to the iliac fossa, and a vesical branch to the bladder). The pubic branch *ascends upon the back of the pubic bone* to anastomose with the pubic branch of the inferior epigastric artery (IEA).

In a common variation (20%), an aberrant or accessory OBA arises from the IEA and *descends* into the pelvis along the usual route of the pubic branch.¹

The pubic branch of the inferior epigastric anastomoses with the pubic branch of the obturator. Although usually small, the anastomosis may be considerably enlarged as

Corresponding author: Imelda A. Luna, MD
Department of Anatomy
College of Medicine
University of the Philippines Manila
547 Pedro Gil St. Ermita, Manila 1000, Philippines
Telephone: +632 5264194
Email: ialuna200711@gmail.com

an accessory obturator artery and is sometimes known as the abnormal obturator artery.² To differentiate, it is called accessory if it arises from the IEA or the external iliac artery (EIA), either of extrapelvic origin and there is *also* a normal obturator artery from the IIA. It is anomalous/aberrant/abnormal if it arises from the IEA or EIA and it is the *only* obturator artery.

Corona mortis (crown of death) refers to the anastomosis between the pubic rami of the IE and the obturator arteries. "It is generally considered to be an arterial connection by classical and orthopedic textbooks, and less information is available regarding the incidence and location of venous anastomoses."³

In a series by Berberoglu et al., venous anastomoses on the superior pubic ramus were found in 96% of cases whereas accessory branches of the obturator artery in only 8% of dissected cadavers (7) and patients (28). They called the connection at the inferior border of the superior pubic ramus between a vein from the inferior epigastric or external iliac vein (IEV/EIV) and the obturator vein "**communicating vein.**" The anastomosis forms the corona mortis. "In classical anatomy textbooks, a description of

the veins that form corona mortis is found less often than descriptions of the arteries. Since a venous connection is more probable than an arterial one, its importance must be appreciated by surgeons dealing with all kind of hernias in order to avoid venous bleeding."⁴ Both arterial and venous anastomoses may be seen in the same subject but no data has been found on the frequency of mixed anomalies. All of the above variants may contribute to the formation of corona mortis.

MATERIALS AND METHODS

This study was done in the University of the Philippines (UP) Manila Campus. A total of 54 cadaver halves, 50 dissected by UP medical students (AY 2009-10) and 4 dissected by UP dentistry students (AY 2010-11) were included in this study. The students were instructed to identify the origin of the obturator artery (OBA), where the obturator vein drains, and the presence, if any, of arterial or venous anastomoses between the obturator and inferior epigastric or external iliac vessels. For uniformity, findings were recorded using a form as shown in the Appendix.

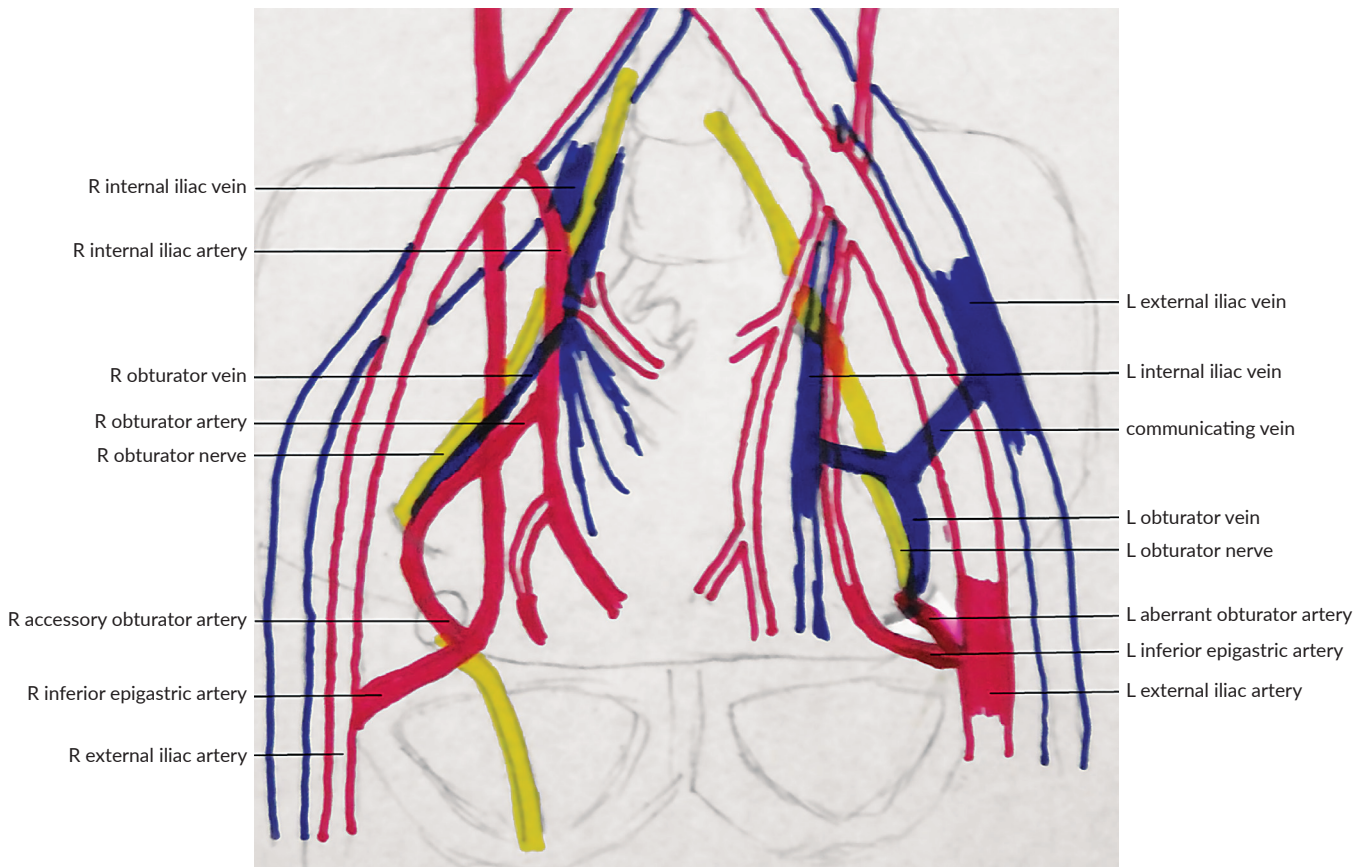


Figure 1. Right: accessory from IEA, Left: aberrant from IEA + communicating vein with EIV.

RESULTS

Normal obturator arteries

Normal obturator arteries (94.44%) were found in 25 out of 26 right halves and in 26 out of 28 left halves. Majority of the normal obturator arteries (27 in 51 or 52.94%) originated from the anterior division, taking off after the umbilical artery (UA). The rest were given off after the other branches of the anterior and posterior divisions at different frequencies.

Abnormal obturator arteries

There were 4 accessory arteries and 1 aberrant artery from the right IEAs while one of each was found from the left IEAs. In total, there were 9.25% accessory obturator arteries and 3.70% aberrant obturator arteries from the IEAs.

Normal obturator vein

In all 27 right and 27 left halves, the normal obturator veins drained into the internal iliac veins (IIVs).

Abnormal obturator veins

Communicating veins were found in 29.62% (9 with EIVs and 7 with IEVs).

Arterial and venous anastomoses

Five (9.25%) arterial anastomoses were found, all of which were with IEAs, while there were 16 (29.62%) venous anastomoses with EIVs and IEVs. Both arterial and venous anastomoses were found in 3 cadavers (Figure 1) while bilateral venous anastomoses were found in another 3 cadavers (Figure 2).

DISCUSSION

The origin of the obturator artery is very variable as illustrated in Figure 3, which is based on a study on 169 bodies (61 females and 108 males) redrawn from J.L. Braithwaite, 1952. Number 1 shows the usual origin from the anterior division of the IIA, after the OUA (41%). This is also the most frequent (52.94%) origin in this present study.

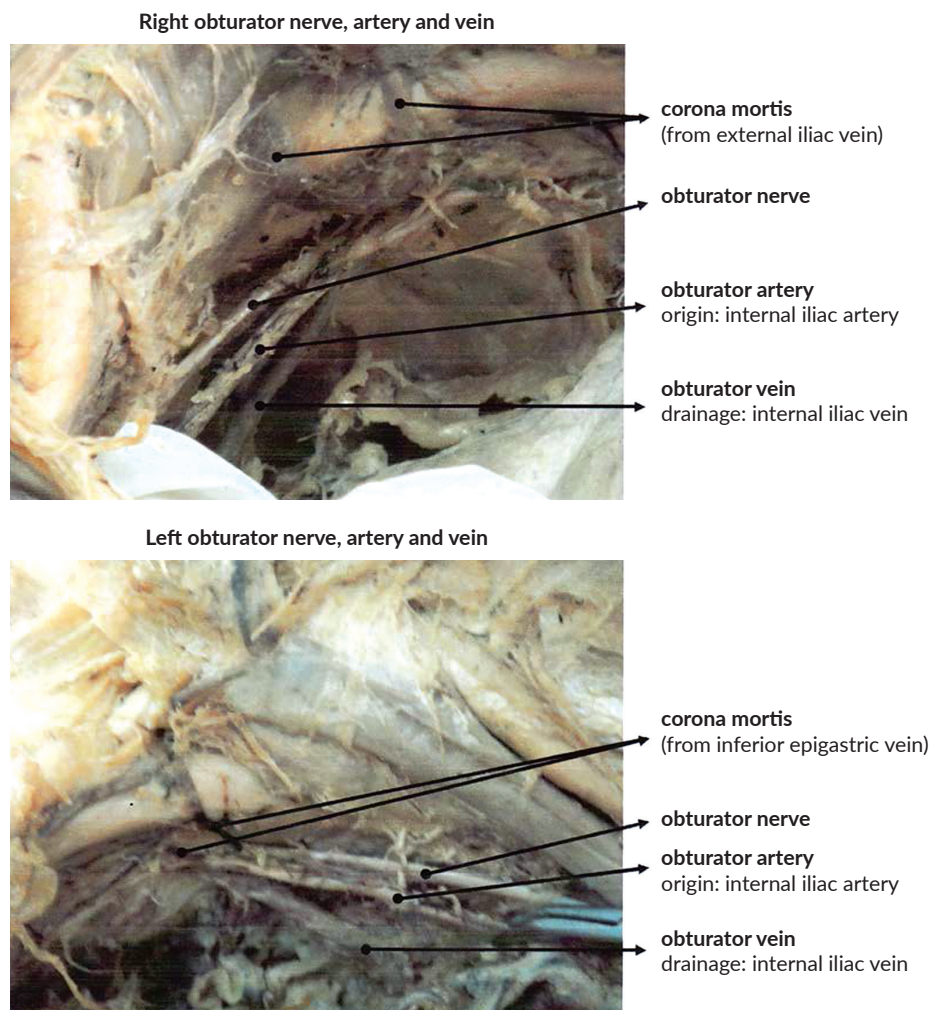


Figure 2. Communicating veins: Right with EIV (2), and Left with IEV smaller than on the right.

However, variability is noted for origination from numbers 2-7 as follows: 2, from the inferior epigastric artery (19.5% vs. 9.25% accessory and 3.70% aberrant from the IEA in this present study); 3, from superior gluteal artery (10.0%); 4, from inferior gluteal-pudendal trunk (10.0%); 5, from inferior gluteal artery (4.7%); 6, from internal pudendal artery (3.8%); and 7, from external iliac artery (1.1% vs. 0% in this present study).⁵

Origin of Obturator Artery

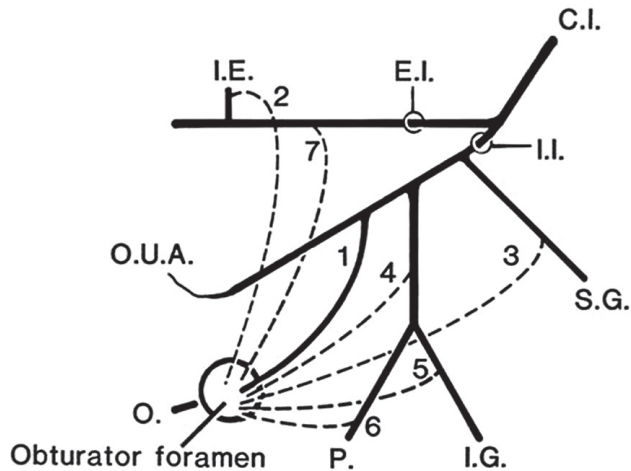


Figure 3. Variability of the origin of the obturator artery redrawn from JL Braithwaite, 1952. 1 anterior division of the internal iliac (II) artery, 2 from the inferior epigastric (IE), 3 from the superior gluteal (SG), 4 from the common trunk giving rise to the inferior gluteal (IG) and pudendal (P), 5 from the inferior gluteal (IG), 6 from the pudendal (P) and 7 from the external iliac (EI).

In another large series by Pick et al., the OBA arises from the IIA (2 in 3 cases), from the inferior epigastric artery (2 in 7 cases), by two roots from both vessels (1 in 72 cases). It arises in about the same proportion from the EIA.

The origin from the inferior epigastric is not commonly found on both sides of the same body. In the present study, the origin from the IEA is *bilateral* (*R* accessory and *L* aberrant) in one body, which also had left communicating veins with the EIV. The other bilateral abnormalities in another five bodies are truly not the same on both sides – two having arterial abnormalities on the right and venous on the left, and three having only venous abnormalities, which were not exactly the same on both sides. Thus, there were either bilateral arterial and/or venous anastomoses or both venous anastomoses found in a total of six bodies.

Variability is also observed in the course of the obturator artery when arising from the IEA as shown in Figure 4. In Figure 4A, it descends almost vertically to the upper part of the obturator foramen where it usually lies in contact with the EIV and on the outer side of the femoral ring;

therefore, is not in danger during femoral herniorrhaphies. Occasionally, as in Figure 4B, it curves along the free margin of Gimbernat's ligament (lacunar ligament) and thus, would almost completely encircle the neck of a hernial sac and puts it in danger if ever an herniorrhaphy is done.⁶

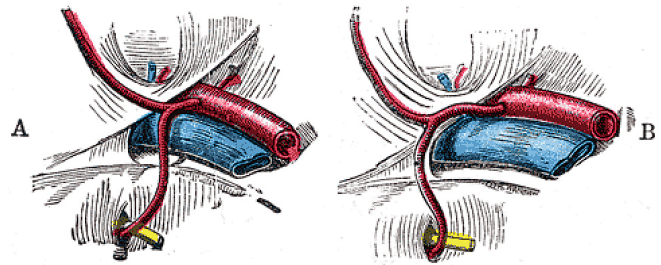


Figure 4. Variability in the course of the obturator artery when arising from the inferior epigastric (IE) artery. Source: Henry Gray's Anatomy of the Human Body, 1918.

The most common type of variation is the anastomosis between OBA of internal iliac origin and inferior epigastric of external iliac origin. Out of these, only in 30% of cases does this anastomosis opens up to become accessory obturator artery, replacing the normal branch from the internal iliac artery.⁷

Several series show different percentages and different combinations of anomalies. In a total of 54 halves, the obturator artery originated from IEA in 8 (14.81%) halves while in the remaining 46 halves the following were noted: 11 (20.37%) venous corona mortis and the rest had no arterial corona mortis nor any anastomosis.³

In a smaller series by Jakubowicz and Czerniawska-Grzesinska, findings were a common trunk for the inferior epigastric and obturator arteries in 4%, an obturator artery originated from the IEA in 2.6% and from the EIA in 1.3%.⁸

Missankov et al. found that the arterial pubic anastomoses were replaced in 44% by an obturator artery arising from the IEA and 25% by an obturator artery arising from the EIA.⁹

Origination of the OBA from the EIA (and IEA from the femoral artery) may be caused by an *unusual selection of channels* ie. the most appropriate channels enlarge while the others contract and disappear, thereby establishing the final pattern during the embryologic development of the vascular plexus of the lower limb. Before the pelvic and femoral arteries appear as independent blood vessels from the *rete pelvicum* and *rete femoralis*, respectively, the blood flow destined for this territory makes an unexpected choice of channels thus giving rise to embryologic abnormalities of the arterial network of the lower limb.¹⁰

The OBA arises comparatively late in development as a supply to a plexus which in turn is joined by the axial artery of lower limb that and accompanies the sciatic nerve.¹¹ As of this writing this is still the accepted explanation of "the anomalies that affect the arterial patterns of the

limbs are based on an unusual selection of channels from primary capillaries.”¹²

Clinically, awareness of the existence of the above variations at the superior border of the iliopubic ramus is of considerable importance to various surgical subspecialists “as it serves as an anchoring site for inguinal and femoral hernia repairs, radical cystectomies and others.”¹⁰ Therefore every surgeon dealing with hernias (direct, indirect, femoral or obturator) and fractures (superior pubic rami, acetabular) need to be aware of these anastomoses (arterial, venous or both). If corona mortis presents, it should be ligated to prevent bleeding which is difficult to control if it retracts into the pelvis.³

CONCLUSION

Corona mortis is an anatomic variation that is observed in Filipinos. Recognition and knowledge on how to properly manage this is of utmost importance in pelvic surgeries to prevent intraoperative bleeding complications.

Statement of Authorship

Sole author approved the final version submitted.

Author Disclosure

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APPENDIX

Survey Form

RESULTS:				
VESSEL	RIGHT		LEFT	
Obturator Artery	Normal <input checked="" type="checkbox"/>	Abnormal <input type="checkbox"/>	Normal <input checked="" type="checkbox"/>	Abnormal <input type="checkbox"/>
	Origin <u>anterior branch</u>		Origin <u>anterior branch of</u>	
	<i>before 1st cross internal iliac A</i>		<i>1st cross internal iliac A</i>	
Obturator Vein	Normal <input checked="" type="checkbox"/>	Abnormal <input type="checkbox"/>	Normal <input checked="" type="checkbox"/>	Abnormal <input type="checkbox"/>
	Drainage <u>internal iliac V</u>		Drainage <u>internal iliac V</u>	
Anastomosis between Obturator & Inferior Epigastric:				
Artery	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Vein	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>