

Bilateral branching variants of internal and external iliac arteries - cadaveric study

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SUMMARY

During a routine female cadaveric dissection, we found an unusual bilateral pelvic branching pattern of the internal and external iliac arteries. The vaginal and middle rectal arteries had a common origin from the right internal pudendal artery. An aberrant obturator artery arises from both external iliac arteries. A right aberrant obturator artery gives a small branch to the back of the pubic bone. The left inferior epigastric artery arises from the common trunk of the external iliac artery with the aberrant obturator artery. Knowledge of arterial variations helps to reduce the internal hemorrhage during abdominal and pelvic surgeries.

Keywords: Aberrant obturator artery – External iliac artery – Internal iliac artery – Middle rectal artery – Vaginal artery

INTRODUCTION

The internal iliac artery is the main artery of the pelvis; it divides into anterior and posterior divisions. The anterior division gives rise to the superior vesical, inferior vesical, obturator, middle rectal, internal pudendal and the inferior gluteal arteries. In females, the inferior vesical artery may be replaced by the vaginal artery and an additional branch, the uterine artery (Williams et al., 1995). The branches of the posterior division are the ili-

olumbar, lateral sacral and the superior gluteal arteries (Williams et al., 1995). The internal iliac arteries have multiple variations in the origin of its branches. Arterial branching pattern variation may be due to developmental anomalies, hemodynamic forces, genetic predisposition and intrauterine position of the fetus (Kumari and Gowda, 2016).

The external iliac artery usually gives two main branches, namely the deep circumflex iliac and the inferior epigastric arteries, and also gives small branches to the psoas major muscle and the neighboring lymph nodes (Nayak, 2008).

CASE REPORT

We have observed bilateral variations in the internal and external iliac arteries of a female cadaver of unknown age during a routine dissection in the Anatomy Department of King Khalid University, Abha, Saudi Arabia. This study was approved by the Research Ethics Committee (REC# 2019-01-22) of the King Khalid University. Both iliac arteries were carefully dissected to identify all its branches, and finally the arteries were painted in red color and photographed.

The anterior division of the right internal iliac artery (RIIA) divides into three common trunks (CT). First, CT gives three branches; among these branches, the first branch is an umbilical artery, the second branch gives off three vesical arteries and a muscular branch. Finally, the third branch divides into three vesical and uterine arteries. The internal pudendal artery originates from the second CT; this artery gives vaginal and middle rectal ar-

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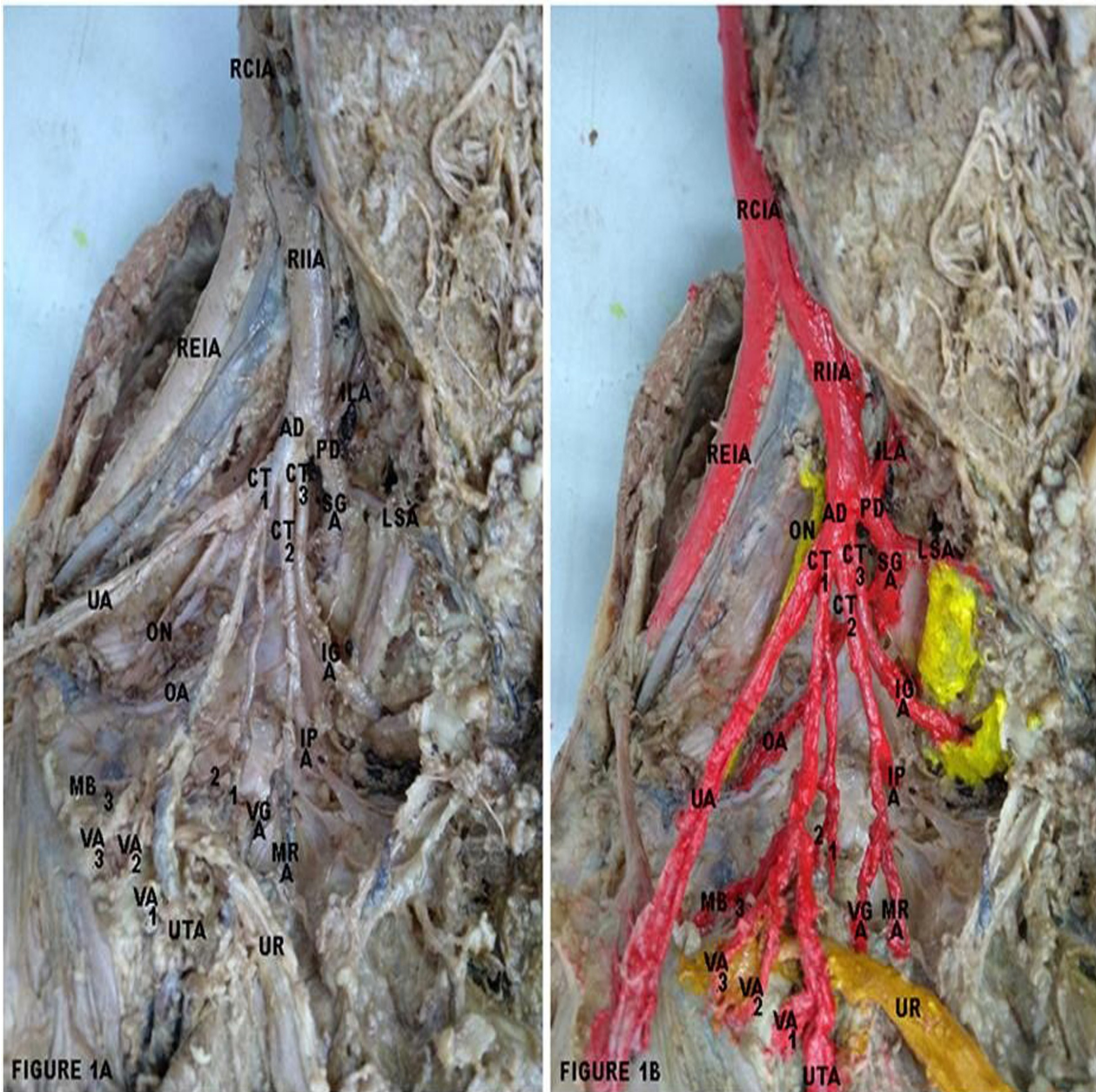


Fig 1. A: Before painting, **B:** After painting. RCIA- Right Common Iliac Artery, REIA- Right External Iliac Artery, RIIA- Right Internal Iliac Artery, AD- Anterior Division, PD- Posterior Division, CT 1- First Common Trunk, CT 2- Second Common Trunk, CT 3- Third Common Trunk, UA- Umbilical Artery, 1, 2, and 3- Three Vesical arteries from CT 1 second branch, MB- Muscular Branch from CT 1 second branch, UTA- Uterine Artery, VA 1, VA 2 and VA 3- Three Vesical Arteries from CT 1 third branch, OA- Obturator Artery from SGA- Superior Gluteal Artery, ON- Obturator Nerve, IPA- Internal Pudendal Artery, VGA- Vaginal Artery, MRA- Middle Rectal Artery, IGA- Inferior Gluteal Artery, ILA- Iliolumbar Artery, LSA- Lateral Sacral Artery, UR- Ureter.

teries. Third CT continues as an inferior gluteal artery (Fig. 1A and B). Branches from the posterior division were normal, but the obturator artery originated from the superior gluteal artery (Fig. 1A and B). Four branches originate from anterior division the Left internal iliac artery (LIIA): the first branch is an umbilical artery; the second branch gives off vesical and uterine arteries; the third branch gives vesical and vaginal arteries, and the fourth branch continues as an internal pudendal artery. The middle rectal artery was absent on LIIA (Fig. 2A and B). A posterior division of LIIA gives inferior and

superior gluteal arteries; the obturator artery is also originated from the superior gluteal artery (Fig. 2A and B). The iliolumbar and lateral sacral arteries originated as a common trunk from LIIA before its division, and the iliolumbar artery further gives two branches (Fig. 2A and B).

The right external iliac artery (REIA) gives deep circumflex iliac and inferior epigastric arteries from its lateral side but from medial side give aberrant obturator artery. A right aberrant obturator artery gives off a small branch to the back of the pubic bone (Fig. 3). Common trunk (CT) arises from the



Fig 2. A: Before painting, **B:** After painting. LCIA- Left Common Iliac Artery, LEIA- Left External Iliac Artery, LIIA- Left Internal Iliac Artery, AD- Anterior Division, PD- Posterior Division, UA- Umbilical Artery, UTA- Uterine Artery, VA- Vesical Arteries from second and third branches, OA- Obturator Artery from SGA- Superior Gluteal Artery, OAT- Obturator Artery twig to external iliac artery, ON- Obturator Nerve, IPA- Internal Pudendal Artery, VGA- Vaginal Artery, IGA - Inferior Gluteal Artery, ILA- Iliolumbar Artery, 1 and 2- branches of iliolumbar artery, LSA- Lateral Sacral Artery, UR- Ureter.

medial side of the left external iliac artery (LEIA). This CT crosses the external iliac artery from medial to the lateral side, on the lateral side; it divides into inferior epigastric and aberrant obturator arteries. A left aberrant obturator artery crosses the external iliac artery from lateral to the medial side. The left deep circumflex iliac artery originates from the lateral side of the external iliac artery (Fig. 4).

COMMENTS

On the basis of embryology, the internal iliac ar-

tery derived from the umbilical artery; usually its proximal part persists, and its distal part gets obliterate. The most appropriate channels enlarge with others disappear or retract, which result in a final arterial pattern. An unusual selection of channels from primary capillaries leads to the origin of the anomalous arterial pattern (Sadler, 2012).

In this present case, the origin of the internal pudendal, and the inferior and superior gluteal arteries were compared to Adachi (1928) classification: the type III pattern was observed on the right internal iliac artery, but the type IIa pattern was found

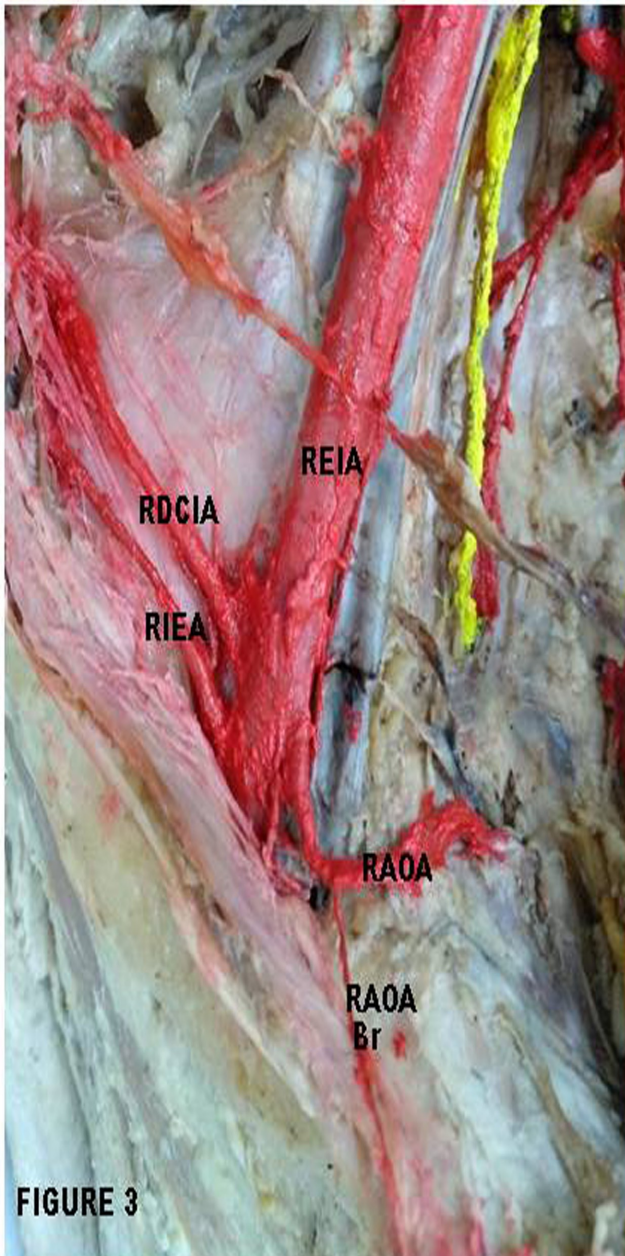


FIGURE 3
Fig 3. REIA- Right External Iliac Artery, RDCIA- Right Deep Circumflex Iliac Artery, RIEA- Right Inferior Epigastric Artery, RAOA- Right Aberrant Obturator Artery, and RAOA Br- Pubic branch of the Right Aberrant Obturator Artery.



FIGURE 4
Fig 4. LEIA- Left External Iliac Artery, LDCIA- Left Deep Circumflex Iliac Artery, LIEA- Left Inferior Epigastric Artery, LAOA- Left Aberrant Obturator Artery and CT- Common Trunk.

on the left internal iliac artery.

The middle rectal and vaginal arteries were of common origin from the right internal pudendal artery (Lipshutz, 1918; Dubreuil-Chambardel, 1925; Piersol, 1930; Roberts and Krishingner, 1967).

Havaldar et al. (2014) reported that the middle rectal artery was absent in 16% of cases; the same finding was observed on the left internal iliac artery.

Based on the Gomez-Jorge et al. (2003) classification of uterine artery origin, the right uterine artery is type 3 classification of origin, but the left

uterine artery is type 2 classification. On both sides, the uterine and vesical arteries had their origin in the common trunk; the same finding was observed in previous studies (Pelage et al., 1999; Saraiya et al., 2002). Knowledge of anatomical variant of uterine artery is essential while performing uterine artery embolization and surgical interventions (Wagner et al., 2017).

Normally the obturator artery takes origin from the anterior division of the internal iliac artery. Most frequent variations were observed in the origin of the obturator artery (Jusoh et al., 2010; Maneesha et al., 2012). Only in 5% or 4% of cases (Yuvaraj

et al., 2018; Narayana and Padmini, 2015), the obturator artery originates from the superior gluteal artery. These observations correlate with both internal iliac arteries at the present case: the obturator artery originates from the superior gluteal artery, and the aberrant obturator artery from the external iliac artery. The left obturator artery gives a small twig that passes along with the external iliac artery. Awareness of anomalous origin of the obturator artery from the posterior division may be beneficial to vascular surgeons during ligating the internal iliac artery (Sonje and Vatsalaswamy, 2016).

The iliolumbar artery may originate from the main trunk in 6% or 6.9% of cases (Mamatha et al., 2015; Sakthivelavan et al., 2014). But the present case report revealed that the iliolumbar and lateral sacral arteries originated from the main trunk of the left internal iliac artery. The iliolumbar artery further divides into iliac and lumbar branches (Yuvaraj et al., 2018), but these branches were seen only on the left internal iliac artery.

The external iliac developed from the umbilical artery. Variations in the branching pattern of the external iliac artery are usually rare (Ranganath and Gayathri, 2013). In the present case, the right external iliac artery gives deep circumflex iliac and inferior epigastric arteries from its lateral side. In 83.6% of cases, the inferior epigastric artery is a direct branch from the external iliac artery (Al-Talalwah, 2017). A right aberrant obturator artery arises from the medial side of the external iliac artery and it gives a small branch to the back of the pubic bone. But on the left external iliac artery, a common trunk arises from its medial side. This common trunk crosses the external iliac artery from medial to the lateral side, on the lateral side; it divides into inferior epigastric and aberrant obturator arteries. In 15.1% or 1.3% of cases, the inferior epigastric artery arises from the common trunk of the external iliac artery with the aberrant obturator artery (Al-Talalwah, 2017). The left aberrant obturator artery crosses the external iliac artery from lateral to the medial side. In the current case, the left deep circumflex iliac artery originates from the lateral side of the external iliac artery.

Conclusion

Knowledge of vasculature variation is essential to avoid accidental hemorrhage in surgeries.

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