

A Rare Variation in Branching Pattern of the Internal Iliac Artery: A Case Report

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Article info:

Received: 15 Nov. 2013

Accepted: 25 Feb. 2014

Key Words:

Variation, Internal iliac, Artery, Case report

ABSTRACT

Internal iliac artery (IIA) shows frequent variations in its branching pattern. We saw variations in the branching pattern of right IIA in a male cadaver. The IIA divided into anterior and posterior divisions. The branches of the anterior division included umbilical artery, inferior vesical artery, obturator artery. The other branches arose from posterior trunk such as iliolumbar, lateral sacral, internal pudendal, superior and inferior gluteal arteries. Knowledge of these variations might be useful for the radiologists and surgeons.

1. Introduction

The Internal Iliac Artery originates from the common iliac artery at the level of sacroiliac joint, descends around the upper border of greater sciatic foramen, and divides into anterior and posterior divisions.

The branches of the anterior division include umbilical, superior vesical, inferior vesical, middle rectal, vaginal, obturator (OA), internal pudendal, and the inferior gluteal arteries. [1, 2]. The posterior division has three branches such as iliolumbar, lateral sacral, and the superior gluteal arteries. In general, the IIA supplies the pelvic viscera, the pelvic walls, the perineum, and the gluteal region [3,4]. The variations in the origination and branching pattern of IIA are said to be due to the developmental reasons. Developmentally, the IIA is

derived from the umbilical artery [5]. Various authors have attempted to classify the anatomic variations of the branching pattern of IIA, based on the cadaveric studies [6-8].

2. Case Report

During the dissection classes for medical students, we observed concurrent variations of the IIA. The variations were found on the right side of the pelvic of a male cadaver. The distance of bifurcation of the common iliac artery into internal and external iliac from the sacral ala was 5.3 cm. The origin of the IIA was at the level of L5-S1. The length of the common iliac artery was 60 mm and the IIA was 40mm. The IIA divided into anterior and posterior divisions in 3cm above the greater sciatic foramen. The distance of the origin of the anterior division and posterior division of IIA from the bifurcation

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of common iliac artery were 5cm and 4cm respectively. The branches of the anterior division included umbilical artery, inferior vesical artery, obturator artery. The other branches arose from posterior trunk, such as the lumbar branch of iliolumbar artery that arose from the main stem and ileal branch of iliolumbar artery that arose from posterior trunk of IIA. Also the lateral sacral, middle rectal and superior gluteal arteries arose independently from the posterior trunk, and inferior gluteal and internal pudendal arose from a common trunk of posterior trunk.

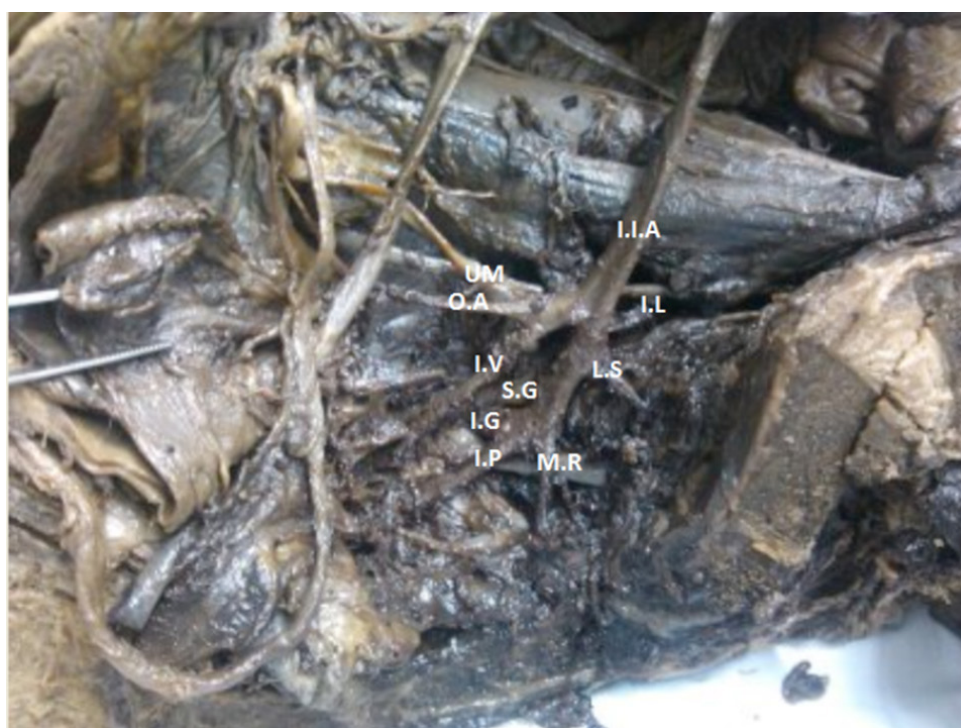
3. Discussion

The IIA is known to show some variations in its branching pattern and the knowledge of these variations is of utmost importance for the surgeons performing obstetric and gynecological surgeries. Knowledge of the branching pattern of this artery is pivotal in pelvic surgeries because erroneous interpretation and ligation of its branches are the sources of unexpected bleeding during the surgery. The percentage of successful ligation of its branches varies from 42–75% [9,10]. Unilateral or bilateral ligation of the IIA can be lifesaving in patients with massive postpartum hemorrhage, after vaginal and abdominal hysterectomy; in massive broad

ligament hematoma, cervical carcinoma, and retroperitoneal bleeding after pelvic fracture, bilateral IIA ligation is done[11,12].

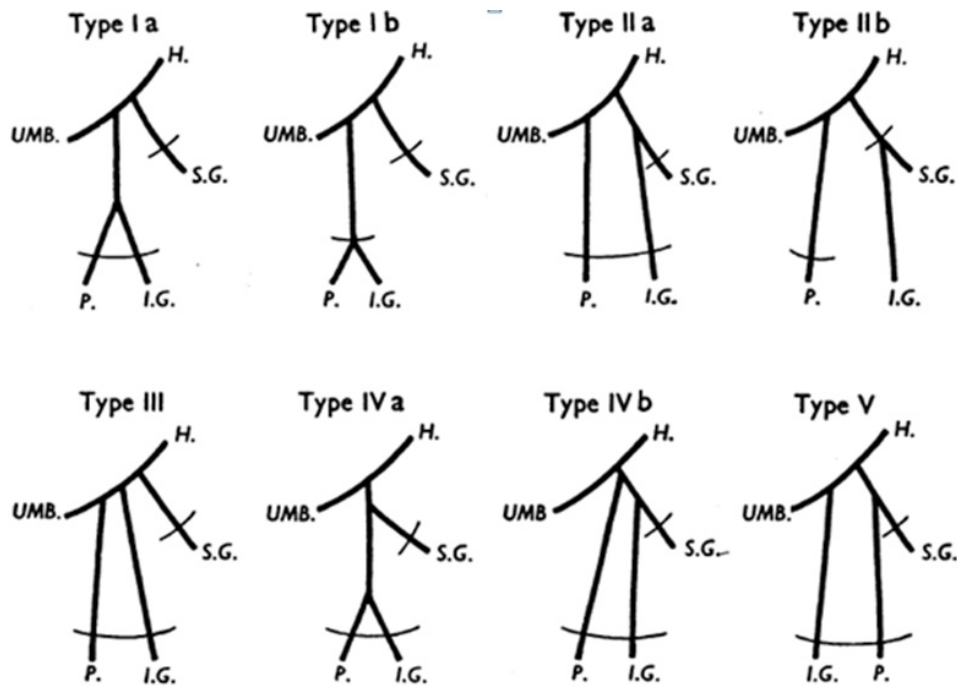
According to Williams et al. and Naveen et al., the IIA arises at the level of the L5-S1 and divides into anterior and posterior divisions at the level of superior edge of greater sciatic notch[1,11]. According to the study of Mamatha et al which was done on 50 human cadaveric, the origin of the IIA at the level of L5-S1 was seen in 72 %, at the level of S1 in 24 %, and at the level of L5 in 4 %. The distance of the level of division of the IIA in respect to greater sciatic foramen is 3 cm above in 18 %, 2 cm above in 28 %, 2.5 cm above in 36%, 3.5 cm above in 16%, and 1 cm below the greater sciatic notch in 2%[13].

Jastschinski was the first person that grouped the variations of parietal branches of the IIA in the Polish population. He classified the vessels into four definite types [14]. After this, Adachi et al [6] classified the branching pattern of IIA into five types with 8 groups in a study on Japanese subjects. In type I, the superior gluteal artery arises separately from the IIA, and the inferior gluteal and internal pudendal vessels are given off by a common trunk. If the latter divides within the pelvis it is



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Figure 1. IIA: internal iliac artery, IL: ilio lumbar, LS: lateral sacral, MR: middle rectal, IP: internal pudendal, IG: inferior gluteal, SG:superior gluteal, UM:umbilical, OA: obturator artery,IV: inferior vesical.



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Figure 2. Figure 2: Adachi's Type. H: internal iliac artery, IG: inferior gluteal, P: internal pudendal, SG: superior gluteal, UMB: umbilical artery.

considered to be type Ia, whereas if the bifurcation occurs below the pelvic floor it is classified as type Ib. In type II, the superior and inferior gluteal arteries arise by a common trunk and the internal pudendal vessel separately. In this category, as previous one, two subtypes are described. Type IIa includes those specimens in which the common trunk to the two gluteal arteries divides within the pelvis and Type IIb those in which the division occurs outside the pelvis. In Type III, the three branches arise separately from the IIA. In type IVa, the three arteries arise by a common trunk. The subtyping in this group is based on the sites of origination of the superior gluteal and the internal pudendal arteries from the parent stem. In type IVa, first gives rise to the superior gluteal artery before bifurcating into the other two branches; in type IVb the internal pudendal is the first vessel to separate from the common trunk, which then divides into superior and inferior gluteal arteries. In type V, the internal pudendal and the superior gluteal arteries arise from a common trunk, and the inferior gluteal has a separate origin (figure 2).

According to Braithwaite, a total of 169 pelvic halves have been studied, arranging according to Type I, the most frequent finding, accounting for 5-58% of all specimens. Type II is found in 3-15%; and a Type III arrangement in 5-22%. The pattern conforming to Type

IV is comparatively rare, being present in only 3-6% of specimens. A Type V arrangement is not found in this series. In 4-41% of instances, the obturator artery is most frequently a direct branch of the anterior division of the internal iliac artery. In 5-19% of instances, it arises from the inferior epigastric artery.

There is a similarity of incidence of origin (10% of cases) of the obturator artery from the superior gluteal and inferior gluteal-internal pudendal arteries. In 5-6% of instances, the obturator artery arises from a bifid root, one from an internal iliac source (3.8%) and the other from the external iliac artery (1.1%). The obturator artery exhibits a similar origin on both sides in only 23% [15]. Interestingly, the inferior vesical artery has also been reported to originate from the OA [3]. Yamaki conducted a study on 645 pelvic halves of Japanese cadavers, and proposed a modified Adachi classification. He divided the branching pattern of IIA into 5 types and 19 groups [17].

Ashley and Anson in their study on 130 specimens observed that inferior and superior gluteal arteries were arising from one common stem in 58% of the cases, the internal pudendal and umbilical arteries were arising from other common stem in 17% of the cases, the inferior and superior gluteal arteries from one common

stem, the internal pudendal and umbilical arteries from other common stem in 8% of the cases, the umbilical and internal pudendal arteries arose separately above the common stem for gluteal artery [18]. In a study which was done by Mamatha on 100 pelvic halves, the OA branching originated from the posterior division of the IIA (14%), abnormal OA branching from inferior epigastric artery (12%), iliolumbar direct branch from the trunk of the IIA (6%), OA branching with inferior vesical artery (8%). In the present case, we observed the Adachi's type IVa (2.4%). In addition middle rectal artery arose from posterior division.

4. Conclusions

Knowledge of variations of the branches of IIA is essential for the surgeons dealing with a femoral hernia, repair of pelvic floor, surgery of genital organs, rectum and anal canal, and for successful ligation of IIA during acute hemorrhage. This will guide the interventional radiologist in the intra-arterial procedures during arterial embolization for hemorrhage, control of pelvic fractures, and embolization of the pelvic tumors.

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