Morphometry of the internal iliac artery in different ethnic groups

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**Summary**
The internal iliac artery supplies the pelvic organs, as well as the osseous and muscular components of pelvic walls. The goal of our study is a statistical analysis of the internal iliac artery and its branches compared to the data recorded in the literature. A total of 100 internal iliac arteries were dissected, 60 arteries from male and 40 from female individuals. The results point out differences in length and caliber between males and females. Comparative analysis of our data with similar studies shows differences in the length of the internal iliac artery in Romanian patients compared to English and Japanese people. In conclusion, our results suggest a vascular variability in different ethnic groups.

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**Introduction**

From an embryologic point of view the internal iliac artery derives from the umbilical artery that obliterates postnatally in its distal part and remains permanent in its proximal part. This permanent part is then termed ‘internal iliac artery’ (Sadler, 1990). The internal iliac artery is the medial branch of the common iliac artery. Its visceral branches supply the urinary bladder, rectum, prostate, seminal vesicles and ejaculatory ducts in males, and also the gonads, uterus, vagina, urinary bladder and urethra in females (Testut, 1948; Williams, 1995). The vascularization of the gluteal region, posterior and antero-medial regions of the thigh and the hip joint (Fredet, 1899; Rouviere, 1967) is achieved by the extrapelvic branches of the internal iliac artery.

Numerous authors have studied the internal iliac artery because of its large territory of distribution,
its role in the embryo-fetal circulation, as well as the possibility of practicing its atrophic ligature in non-surgical malignancies (Fatu et al. 1996; Jauregui et al. 2002; Salvat et al. 2002; Gotta et al. 2003; Terek et al. 2004; Iliopoulos et al., 1989).

Pelvic tumors, especially in the female genital tract, are supplied by vasculature that evolve from branches of the internal iliac artery. To avoid hemorrhages during the Wertheim extended colpohysterectomy the internal iliac arteries are frequently ligated.

The objective of the study has been a comparative analysis over various ethnical groups by (i) studying the emergence of the internal iliac artery and the ending type of the internal iliac artery and (ii) determining morphometrically the length and calibre of the internal iliac artery.

Materials and methods

We have analyzed 100 internal iliac arteries, 50 on the right side and 50 on the left side from 50 Romanian bodies, 30 males and 20 females. The bodies were fixed in formalin in the Laboratory of the Institute of Anatomy in Iasi.

By means of the classical method of anatomic dissection, we determined the origin, path, and ending type of the internal iliac artery.

The origin of the artery was determined according to

a. The relationship with the osteoarticular elements in its proximity.

b. The distance to the midsagittal plane represented by the line connecting the middle of the symphysis pubis with the middle of the lumbosacral promontorium.

The length of the internal iliac artery was measured from its origin to the emergence of its terminal branch, the gluteal artery. The calibre was determined in the middle segment of the artery using a micrometer.

The ending variants of the internal iliac artery were classified in five subtypes according to Adachi (1928).

In order to have more accurate results, these measurements were made by two different persons independently. The results were compared to those of some similar studies employing other ethnic groups, i.e. English and Japanese individuals (Quain, 1908; Adachi, 1928).

Results

The origin of internal iliac artery

In all 100 cases studied the internal iliac artery comes from the common iliac artery (Fig. 1).

a. When related to the osteoarticular elements in its proximity, the origin of the internal iliac artery is at the level of the sacro-iliac joint with insignificant differences to the right or left. However, in males the origin is internal to the sacro-iliac joint, while in females it is at the same level.

b. The distance from the midsagittal plane to the origin of the internal iliac artery ranged between 29 and 36 mm on the right side and between 40 and 50 mm on the left side, with variations between sexes (Table 1, Fig. 2a). Our results do not differ from the results of other studies (Quenu and Duvall, 1898). A greater distance from the midsagittal plane to the origin in females has not been reported before. This is probably an adaptative mechanism of the vascularization of the female pelvis.

The length of the internal iliac artery

The length of the internal iliac artery is variable according to the ending type of the internal iliac artery. In our studies we used the Adachi’s classification where the internal iliac artery ends at the emergence of the gluteal artery (Adachi, 1928). According to our measurements the values ranged between 20 and 90 mm, mean value 49 mm, without major differences between the two sexes or between left and right (Table 2, Fig. 2b).
The caliber of the internal iliac artery investigated in this study ranged between 4 and 11 mm (Fig. 2c). The calibers were thus larger than those reported in previous studies with values ranging between 5 and 8 mm (Adachi, 1928; Pacini et al., 1981, Table 3).
Variants of endings of the internal iliac artery

In the literature there are numerous concepts for classifying the ending types of the internal iliac artery (Kosinski, 1929; Villemin et al. 1952a, b; Ishigaki et al. 1970; Terek et al. 2004). In our study we used Adachi’s classification, which distinguishes five types (Adachi, 1928).

In 60 out of 100 cases we found ending type I with the internal iliac artery dividing into an anterior ischio-pudendal trunk and a posterior branch, the gluteal artery (Fig. 1). This ending type was found in 45 males and in 15 females (Fig. 3a). Ending type II was found in 20 cases, 10 males and 10 females. This type is characterized by a posterior ischio-gluteal trunk and an anterior branch, the internal pudendal trunk (Fig. 3b). Ending type III was found in 20 cases, 10 males and 10 females. This type is characterized by a posterior ischio-gluteal trunk and an anterior branch, the internal pudendal trunk (Fig. 3b). Ending type IV, characterized by the detachment from the internal iliac artery of a unique trunk, that, after a short distance divided into a posterior gluteal artery and two anterior branches, ischiatic and internal pudendal branches, was found in one male (Fig. 3d). Type V was found in 18 cases and only in females. This ending type is characterized by the pudendo-gluteal trunk and a separate branch, named the ischiatic artery (Fig. 3e).

One of our cases could not be included in Adachi’s classification. In this case, four arteries leave the internal iliac artery: a gluteal artery running backwards, an internal pudendal artery anteriorly and two ischiatic branches, similar in length and volume, which supply the same territory.

We compared our data with similar studies in the literature on different ethnic groups (English, Japanese) (Table 4). Our data shows minor differences in the length of the internal iliac artery in Romanian patients (49 ± 3.34 mm) compared to the Japanese persons (44.3 ± 1.32 mm) (Adachi, 1928), and significant differences compared to the English persons (36.8 ± 0.6 mm) (Quain, 1908).

Discussion

The aim of our study was to confirm the variabilities in length, caliber and termination of the internal iliac artery in different ethnic groups. Our results show length, caliber and ending type of the internal iliac artery as it has been estimated in 100 Romanians. Compared to other ethnical groups, in Romanian persons the length, caliber and the ending type of the internal iliac artery are similar to the Japanese persons and are significantly different compared to the English people (Adachi, 1928; Quain, 1908; Cabanie and Gouaze, 1952; Braitwaite, 1952; Dylevsky and Ticha, 1987; Iwasaki et al., 1987; Yamaki et al., 1998; Okamoto et al., 2005).

Among those who studied the internal iliac arteries, mention should be made of the following researchers: Quain (1908), Kosinski (1929), Testut (1948), Testut and Latarjet, (1947), Adachi (1928) and Roberts and Krishinger (1967). Their studies deal with both the morphometry of the artery in the origin countries, and the way in which it terminates.

There is a variation in the distance of the internal iliac artery to the midsagittal plane in relation to gender: In females distances are larger from the midline, both on the left and the right. This reflects in particular the postpuberal development of the female pelvis (Kamina, 1981). In Villemin et al. (1952a,b), a case is reported, where the right internal iliac artery was missing. Instead there were three arteries from the common iliac artery: gluteal, ischiatic and internal pudendal arteries. The left internal iliac artery was very short. No such case was observed in our study.

Table 2. Length of the internal iliac artery (mm)

<table>
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<tr>
<th>Nr. crt.</th>
<th>Length of internal iliac artery (mm)</th>
<th>M</th>
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Table 3. Caliber of the internal iliac artery (mm)

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<th>Caliber (mm)</th>
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<td>1</td>
<td>3</td>
<td>11</td>
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Our study revealed intersexual differences in the caliber of the internal iliac arteries. We assume that the increased diameter observed in females exists to accommodate the demands of the pelvic excavation of the female genital organs.

The classification into ending types of the internal iliac arteries shows the predominance of type I in males and of type V in females in Romanians. The other types are equally distributed among both sexes. Our data with 60% type I endings are similar to those reported in other studies of other ethnic groups (Adachi, 1928; Kosinski, 1929). While in a study on Polish people by Kosinski, 79% type I endings were reported, 51.2% type I endings were observed in Japanese cases studied by Adachi (1928).
Out of the 60% type I endings determined in our study, 75% existed in males and 25% in females. Our study revealed the predominance of type I in males, while type V is predominant in females. Thus, branching types clearly differ between the sexes.

Taking into account the variability in length, caliber and ending of the internal iliac artery, as well as their major degree of anastomoses with other vascular systems, it is important for surgeons to apply the internal iliac ligature to stop hemorrhages of different etiologies.

Because of the capillary network which derives from the abundant anastomoses of the gluteal muscular mass, we recommend that the ligature of the internal iliac artery be made behind the emergence of the gluteal artery.

References


