

Anatomical Variations in the Branching Pattern of Internal Iliac Artery in Human Cadavers

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Variations in the anatomical branching pattern of Internal Iliac Artery have been observed in humans. In clinical practice it carries immense significance, and has an impact on various procedures or operations that are performed in this area. We studied the existence of these variations in human cadavers available in the department of Anatomy King Edward Medical College, Lahore over a period of 4 years. A total of 50 cadavers were studied for the presence of variations / anomalies in the branching pattern of Internal Iliac Artery. Anatomical variations observed were, 1) absence of anterior & posterior main divisions in 12 bodies (24%) on left side and in 15 bodies (30%) on right side. 2) short main trunks (<1cm), observed in 9 bodies (18%), 3) high level of emergence of branches was noted in 6 bodies (12%) on left side & 8 bodies (16%) on right side. 4) Bilaterally asymmetric branching pattern was seen in 2 bodies (4%). We conclude that the variations in the branching pattern of Internal Iliac Artery are not uncommon and this information should be used in undertaking clinical procedures and operations performed in this region to avoid complications and improve success rates.

Key words: Internal Iliac Artery, Anatomical variations

Variations in the anatomical branching pattern of Internal Iliac Artery have been observed in humans. In this era of modern clinical practice, many operations and invasive procedures are performed in the area of distribution of blood supplied by the internal iliac artery. Background knowledge of these variations is not only essential but also has a major impact on various procedures or operations that are performed in today's clinical practice. It helps the surgeon or the radiologist in carrying out these procedures without developing complications and improves success rate.

Internal iliac artery about 4 cm long, one of the terminal branches of common iliac artery, begins medial to psoas major and anterior to sacroiliac joint, at the level of lumbosacral intervertebral disc. It passes posteriorly into the lesser pelvis medial to the external iliac vein and the obturator nerve. It lies between the ureter inferiorly and the internal iliac vein superiorly and usually ends in anterior and posterior divisions at the upper margin of greater sciatic notch.¹

The branches are as follows²

Posterior division

Superior gluteal artery
Iliolumbar artery
Lateral sacral arteries

Anterior division

Inferior gluteal artery
Obturator artery
Internal pudendal artery
Umbilical artery (Sup. Vesical A)
Inf. vesical artery (Vaginal A)
Uterine artery
Middle rectal artery

This pattern is not always seen and branching pattern may be erratic and it is better to describe them under the

headings of somatic, visceral, and branches to limb & perineum³

In the adult Internal Iliac artery is smaller of the two branches of common iliac artery, though it is larger in fetus as it transmits blood to placenta through the umbilical artery. After degeneration of umbilical artery soon after birth it gradually attains its normal caliber²

Methods

Dissection of internal iliac artery & its branches was performed to explore and study its branching pattern on 50 cadavers available for routine dissection in Anatomy department of King Edward Medical College, Lahore.

All the pelvic viscera were identified, exploring their relations & peritoneal reflections. All the pelvic viscera were then pulled away from the pelvic walls to get a clear view of iliac blood vessels. Branches of iliac blood vessels were followed & dissected by clearing their fascial sheaths. Small tributaries of veins were removed to get a clear view of the arteries.

Following points were noted.

1. Length of internal iliac artery
2. Division patterns of internal iliac artery into its main anterior & posterior trunks or direct branching.
3. Length of main trunks.
4. Level of branching into main trunks.

The dissected areas were soaked in 20% formaline overnight by cotton packing. Blood vessels were painted the next morning using oil based paints, & photographed subsequently

Findings were recorded in a tabulated form in the Performa.

Results

Basically two patterns of divisions of Internal Iliac Artery were noted.

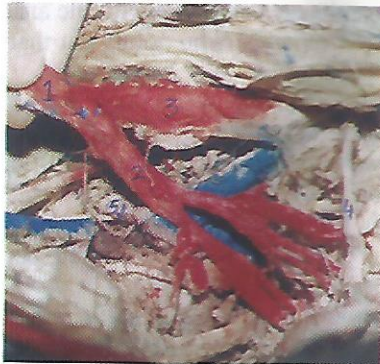
1. Internal iliac artery divided into anterior & posterior trunks in 35 bodies on the right side (70%) and 38 bodies on the left side (76%), See Table 1. The branches of trunks were as following the usual pattern given in various anatomical descriptions. (Fig. 1).

2) There was no division into anterior & posterior main trunks in 15 bodies on right side (30%) and 12 bodies on left side (24%). The artery in these cases divided abruptly into a bunch of blood vessels (Fig 2). In most of these cases the level of emergence of branches was higher, being 1 to 1.5 cm above the upper margin of greater sciatic notch. High level of emergence of branches was noted in 6 bodies (12%) on left side & 8 bodies (16%) on right side

In 2 out of 50 (4%) cadavers branching pattern was different on two sides. Main trunks were seen on left side while on right side pattern no.2 was observed. In one out of these two bodies accessory obturator artery was also seen & the renal vein was passing anterior to abdominal aorta to drain into inferior vena cava.

Length of main divisions (when present) was quite variable ranging from 0.5 to 1.5 cm before giving off the first branch. (Fig 3)

Figure 1 Photograph showing division of Internal iliac artery into anterior & posterior trunks



1. Common iliac artery
2. Internal iliac artery
3. External, iliac artery
4. Ureter
5. Obturator Nerve

Figure 2 Photograph showing direct branching of Internal Iliac artery in a cadaver



1. Common iliac artery
2. Internal iliac artery
3. External, iliac artery
4. Ureter
5. Obturator Nerve

Figure 3 Photograph showing very short trunks of internal iliac artery.



1. Common iliac artery,
2. Internal iliac artery
3. External, iliac artery
4. Ureter
5. Obturator Nerve

Average length of internal iliac artery was 3.99 ± 0.22 cm on right side and 3.88 ± 0.27 cm on left side. Difference on the two sides was found to be statistically significant ($p=0.026$)(Table 2). Mean length of main trunks was quite variable, as detailed in Table 3

Table: 1 Pattern of division of Internal Iliac Artery (n=50)

Pattern of division	Right	Percent	Left	Percent
Anterior / Posterior	35	70%	38	76%
Direct branching	15	30%	12	24%
Total	50	100%	50	100%

Table: 2 Length of Internal Iliac Artery (n=50)

Parameter Observed	Right side Mean(cm)	Left side Mean(cm)	p value
Length of Int iliac A	3.99 ± 0.22	3.88 ± 0.27	0.026

Table 3 Length of main trunks of Internal Iliac Artery

Length of main trunks (cm)	Right	Left
Anterior	1.9 ± 0.23	2.2 ± 0.21
Posterior	1.2 ± 0.26	1.0 ± 0.27

Discussion

Internal Iliac Artery because of its strategic location, vast and important area of blood supply holds specific clinical importance in human body. This artery supplies most of the gluteal region and pelvis. It is utilized for various gynecological, Obstetrical and surgical procedures and is vulnerable to injuries during these procedures.

Gynecology and Obstetrics

Intractable uterine hemorrhage unresponsive to medical therapy or curettage, has been traditionally treated by hysterectomy and / or internal iliac ligation^{4,5}

Internal Iliac Artery Ligation

Internal iliac artery ligation may be performed in lower

segment caesarian section after uterine artery ligation, uterine perforation or slipped uterine artery ligature after hysterectomy⁶ It is a life saving procedure in such cases⁷. When medical management fails to control the post partial hemorrhage, surgical management is indicated. Hysterectomy may be avoided by using methods such as Uterine Artery Ligation, Hypogastric artery ligation, or ovarian artery ligation. Uterine artery ligation controls bleeding from uterus and not from vagina Internal artery ligation will control bleeding from both the sites. However it has been stated that this procedure succeeds in 40 % cases probably because of difficulty in performing it accurately at the appropriate site. Another important reason is the presence of anatomical variations in its branching pattern Twenty five patients of severe and persistent bleeding in obstetrics and gynecology were treated by this procedure but it failed in 3 cases⁸

In internal iliac artery ligation this artery is dissected free for approximately 5 cm to avoid ligature above the posterior branch as if the flow to posterior branch is interrupted, it can result in compromised flow to the gluteal muscles and buttocks⁹.

It has been observed that it is quite a common feature that internal iliac artery does not divide into anterior and posterior trunks, but straight away into its branches. In such a case level of ligation has to be ascertained with great care in order to achieve the objective of this procedure

Although it is an easy procedure but undertaken with reluctance, because of circumstances in which it is indicated. The patient is often compromised and there may be edema or hematoma complicating the anatomy. It is advised that if the operator is not well familiar with the retropelvic anatomy it may be more prudent to proceed with hysterectomy⁹. Laparoscopic ligation of internal iliac artery appears to be an alternate procedure to abdominal or extra-peritoneal ligation¹⁰

Pre-sacral neurectomy for the treatment of chronic pelvic pain due to dysmenorrhoea, adenomyosis or endometriosis is a valuable procedure. Injury to internal iliac artery is a major risk and may require further surgery¹¹.

Embolization of uterine fibroids is a technique performed by an interventional radiologist to block the blood supply feeding uterine fibroids. Uncomfortable symptoms of heavy bleeding and pelvic pain are diminished. Starvation of fibroids results in decreased size & in some cases expulsion of the fibroid mass from the body. A catheter is inserted into femoral artery, then manipulated into internal iliac artery to the origin of uterine artery from it¹²

Surgery

In advanced carcinoma of urinary bladder, arterial infusion chemotherapy is an alternative treatment to surgery and

radiotherapy. It provides a favorable survival and improved quality of life with preservation of bladder function. Chemo-therapeutic agent is introduced via embolisation of internal iliac artery^{13,14} It is an effective treatment for advanced rectal carcinoma. Efficacy of this treatment is limited to area to which the drug is delivered. Thus it is important that the method and location of catheter are determined adequately for each case¹⁵

Aneurysms

Aneurysms of internal artery are rare and difficult to diagnose when isolated.^{16,17} Aortic aneurysms which are relatively common, may be accompanied by aneurysms and / or occlusion of internal iliac artery where necessary surgical modifications of pelvic arterial anatomy has to be performed.¹⁸

In an attempt to define the relationship of fracture pattern to arterial injury O' Neill et al¹⁹ concluded that bleeding from internal iliac artery or its posterior branches was statistically more common in patients with posterior pelvic fracture.

Branching pattern of internal iliac artery is traditionally described to divide into two main trunks before giving off its branches² but in the present study this pattern was not found in 24-30% cases. In this respect our results are consistent with the anatomical description given by Romanes¹ who points out that the branching pattern of this artery is quite erratic.

Bilateral asymmetry of branching pattern has not been described in various textbooks of Anatomy. A case was reported in which internal Iliac artery arose from aorta on left side whereas on right side the origin was normal²⁰ In present study abnormality in origin of internal iliac was not observed but its branching pattern was different on two sides in 4% cases.

Ronald²⁰ reported that in few cases common iliac arteries may be absent, the external & internal iliac arteries then arise in common from the distal end of aorta The absence of common iliac artery was noted on the left side of a dissected body. Aorta in that case divided into three branches, a right common iliac, a left external, and a left internal iliac artery.²⁰ No such finding was observed in present study.

Conclusion

We conclude that the variations in the branching pattern of Internal Iliac Artery are not uncommon and this information should be used in undertaking clinical procedures and operations performed in this region to avoid complications and improve success rates.

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