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Variation in the Arterial Branching Pattern of Internal Iliac Artery In human cadavers (South Indian Population)

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Abstract
Internal iliac Artery [IIA] is one of the terminal Branches of the common iliac artery and is the artery of the pelvis. It supplies most of the Blood to the pelvicviscera, gluteal region, medial thigh region and perineum. The Internal iliac artery is known to show frequent variations starting from its origin up to termination. So it has attracted attention of Anatomists, pelvic surgeon, and interventional Radiologists. A, severe lethal complication during pelvic surgery is Arterial Bleeding. So the knowledge of variability of iliac artery is essential for surgeon. The present study was conducted to study of variation of arterial branching pattern of internal iliac artery.
Methods: *50 Adult human halves were procured from embalmed cadavers of raja muthiah medical college, Chidambaram, Tamilnadu. India for the study.*
Results: *The classification of Branching pattern internal iliac artery was based on modified Adachi classification. Out of 50 specimen studied*
Type IA was found in 56% of the specimen
Type Ib was found in 12 %of The specimen
Type IIa was found in8% of The specimen
Type III was found in 20%of The specimen
Type IV a was found in4% ofThe specimen
Type IVb and Type V was not found in any of the specimens.
Conclusion: *The Internal iliac artery shows Multiple morphological variations , So the knowledge is very helpful during pelvic surgeries.*
Keywords: *Internal iliac artery South indian population, Branching pattern.Variation.*

Introduction

Internal iliac artery is known to show multiple variations of great Importance to surgeons since many years ago. Even in 18th century, ligation of hypogastric artery was performed for various reasons. Any obstetrician who attends and experiences a case of severe postpartum haemorrhage.[1] When the conservative treatment fails unilateral or bilateral internal iliac artery ligation should be considered[2,3]. The Internal iliac artery is the principle artery of the pelvis supplying blood to most of the pelvic viscera and some to musculoskeletal parts of the pelvis. However it also supplies branches to the gluteal regions, Medial thigh regions and the perineum[4]. Each internal iliac artery, about 4cm long begins

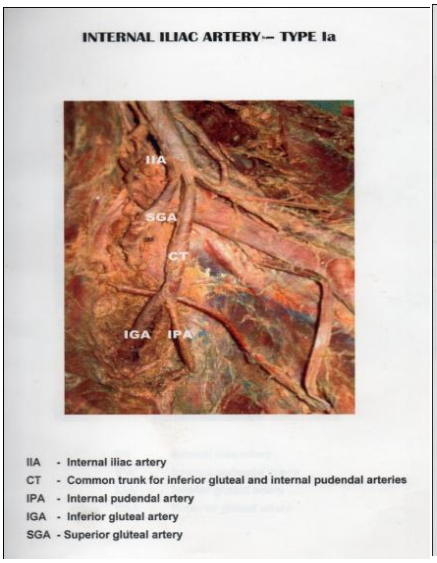
at the the common iliac bifurcation level with the Lumbosacral intervertebral disc and anterior to sacro iliac joint. It descends posteriorly to the superior margin of greater sciatic foramen where it divides into an anterior trunk, which continues in the same line towards the ischialspine and a posterior trunk, which passes back to the greater sciatic foramen. The branches of the posterior division, ilio lumbar, lateral sacral and superior gluteal arteries leave the internal iliac from its lateral surface to provide some of the blood supply to the pelvic wall and gluteal muscles. The Anterior division has both parietal and visceral branches. The parietal branches, obturator, Internal pudendal, Inferior gluteal arteries primarily supplies muscles where as The visceral branches –uterine, superior vesical ,Inferior vesical or vaginal and middle rectal arteries supply the pelvic organs.[5] The basic law of Anatomy is the an artery and its constant variability. Unlike the External iliac artery, which is constant and relatively simple In its morphology. The branching pattern of internal iliac artery is extremely variable. Even in the same individual, Branching pattern is identical in only 50% of Instances. There is no constant order in which the Branches as especially the parietal branches divide from the parent vessel some may arise as common trunks or may spring from other branches rather than from internal iliac artery. Striking variations in the Branching pattern of Internal iliac artery have long received attention of Anatomists surgeons and always been a subject of controversy.[6] The first attempt to group the variations in the origin of the parietal branches of the internal iliac artery into definite pattern was undertaken by jastschinski grouped into four types[7] and later modified by Adachy into five types.[8]

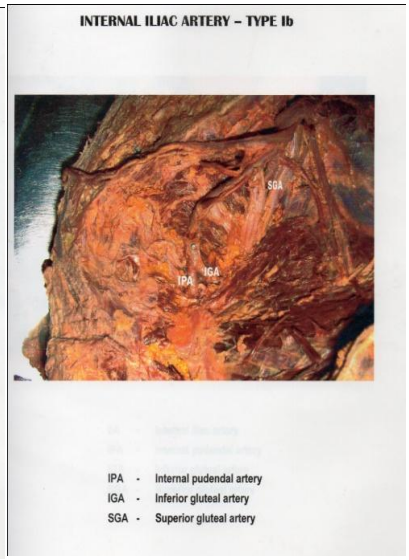
The first reported case of Ligation of hypogastric artery was performed for the treatment of an aneurysm of gluteal artery in 1812 by Stephens. The role of ligation of internal iliac artery in controlling severe pelvic hemorrhage is well established. It is important to identity and ligate the anterior division distal to the posterior parietal branches to achieve adequate homeostasis.[9] Trauma, Iatrogenic Injuries and Aneurysms can involve the trunk of the Internal iliac, superior gluteal or Inferior gluteal arteries. For longtime, the internal iliac artery was a Neglected vessel with few procedures being performed by Interventional radiologists, Except for a limited number of Angioplasties done for significant claudication or erectile dysfunction.[10] Fibroids are currently treated by uterine artery embolisation pudendal Arteriography and iliac angioplasty are being performed for evaluation and Management of Impotency. Preoperative Internal iliac artery coil embolisation is done for stent graft or operative repair of Abdominal aortic and iliac artery aneurysms to prevent collateral endoleaks.[11] Internal iliac artery embolisation is also employed to arrest hemorrhage following parturition., Intractable hemorrhage from bladder during surgery for bladder Maligancy, Rectal or prostatic malignancy and before hysterectomy for placenta Accreta.

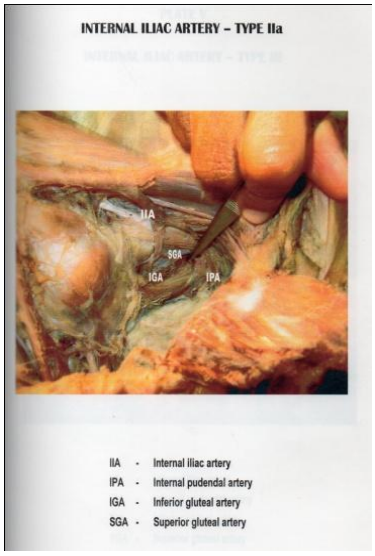
Intra arterial chemotherapy in 90th recently used for pain control in patients with Recurrent Rectal cancer.

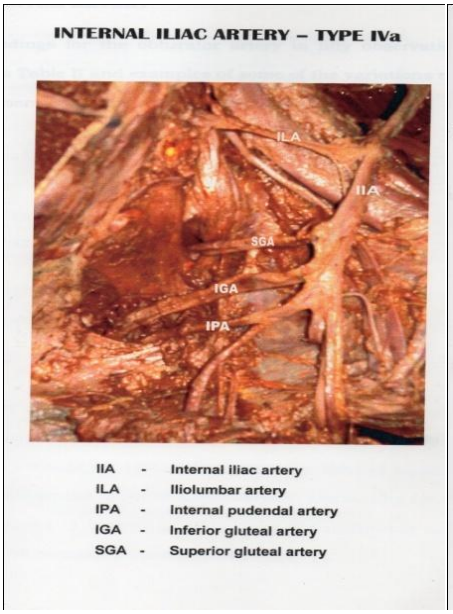
Flaps based on superior and Inferior gluteal arteries are routinely used in plastic and reconstructive surgery.[12]

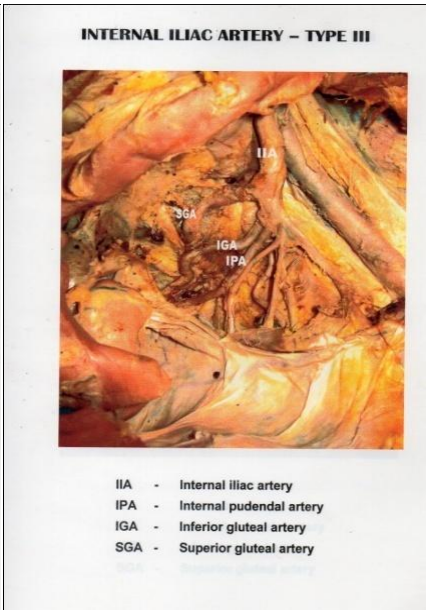
The Pelvic surgeon must be prepared for deviations from textbook arterial patterns, to avoid any complications, An Accurate knowledge of this major arterial conduit in relation to its variable Branching pattern is of considerable practical significance.

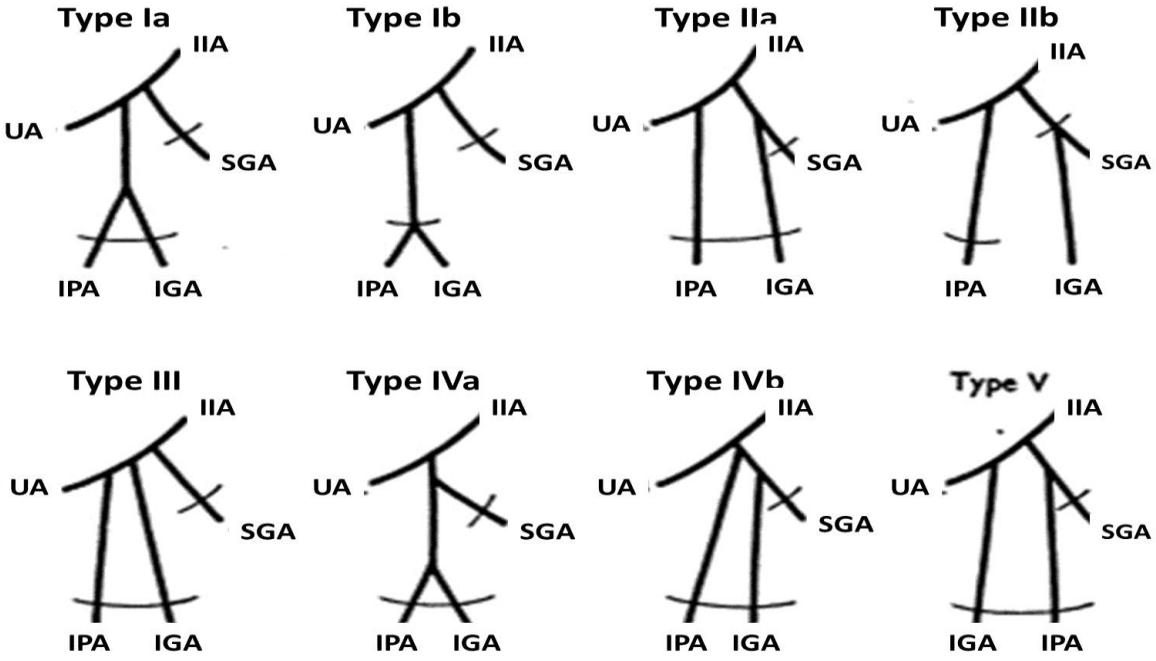

INTERNAL ILIAC ARTERY – TYPE Ia
IIA
SGA
CT
IGA
IPA
IIA - Internal iliac artery
CT - Common trunk for inferior gluteal and internal pudendal arteries
IPA - Internal pudendal artery
IGA - Inferior gluteal artery
SGA - Superior gluteal artery


INTERNAL ILIAC ARTERY – TYPE Ib
SGA
IPA
IGA
IPA - Internal pudendal artery
IGA - Inferior gluteal artery
SGA - Superior gluteal artery


INTERNAL ILIAC ARTERY – TYPE IIa
IIA
SGA
IGA
IPA
IIA - Internal iliac artery
IPA - Internal pudendal artery
IGA - Inferior gluteal artery
SGA - Superior gluteal artery


INTERNAL ILIAC ARTERY – TYPE IVa
ILA
IIA
SGA
IGA
IPA
IIA - Internal iliac artery
ILA - Iliolumbar artery
IPA - Internal pudendal artery
IGA - Inferior gluteal artery
SGA - Superior gluteal artery


INTERNAL ILIAC ARTERY – TYPE III
IIA
SGA
IGA
IPA
IIA - Internal iliac artery
IPA - Internal pudendal artery
IGA - Inferior gluteal artery
SGA - Superior gluteal artery


Type Ia
IIA
UA
SGA
IPA
IGA
Type Ib
IIA
UA
SGA
IPA
IGA
Type IIa
IIA
UA
SGA
IPA
IGA
Type IIb
IIA
UA
SGA
IPA
IGA
Type III
IIA
UA
SGA
IPA
IGA
Type IVa
IIA
UA
SGA
IPA
IGA
Type IVb
IIA
UA
SGA
IPA
IGA
Type V
IIA
UA
SGA
IGA
IPA

Adachi Types

Type: I- The superior gluteal artery arises separately from the Internal iliac artery and Inferior gluteal and Internal pudendal vessels are given off by a common trunk. The latter divides within the pelvis it is considered as Type Ia, where as the bifurcation occurs below the pelvic floor it is classified as type Ib.

Type II: The superior and the Inferior gluteal arteries arise by a common trunk and the Internal pudendal vessels separately.

Type II a: In which the trunk common to the two gluteal arteries divides within the pelvis and Type IIb in which the division occurs outside the pelvis.

Type III: The Three branches arise separately from Internal iliac artery.

Type IV: Three arteries arise by a common **trunk. Type IV a** The trunk first gives rise to the superior gluteal artery before bifurcating in to the other two branches.

Type IV b The Internal pudendal is the first vessel to spring the common trunk. Then divides into superior and Inferior gluteal arteries.

Type V: The Internal pudendal and superior gluteal arteries arise from a common trunk and the Inferior gluteal has a separate origin.

Material and methods

This is a pilot study of the descriptive type, carried out in cadaver specimens belonging to a south indian population. The material consisted of adult subjects between the ages of 38 and 78 from the dissection halls of department of Anatomy Raja muthiah medical college, Chidambaram, Tamil Nadu. A total of fifty pelvic halves were studied completely. Out of available fifty specimens these ten were female and forty were male pelvic specimens. The pelvic viscere were pulled away from the pelvic walls to expose the internal iliac artery and its tributaries were removed in some cases to get a clear exposure of the arteries.

The Internal iliac artery and its branches were studied carefully.

The larger parietal branches of The Internal iliac artery, Namely superior gluteal artery, Inferior gluteal artery, Internal pudendal artery and obturator artery were studied in relation.

1.The sites of origin from the parent trunk.

2. Their destination or structures supplied by them

3.Any abnormalities

The observation regarding the four arteries were recorded carefully photographed and drawing were made after displaying the trunk and the branches of the Internal iliac artery.

Observations

Table: 1 Variation in branching of internal iliac artery.

Types	MALE		FEMALE		TOTAL	
	No	%	No	%	No	%
Ia	24	60%	4	40%	28	56%
Ib	4	10%	2	20%	6	12%
IIa	3	7.5%	1	10%	4	8%
IIb	-	-	-	-	-	-
III	7	17.5%	3	30%	10	20%
IVA	2	5%	-	-	-	4%
V	-	-	-	-	-	-

The common stem for the Inferior gluteal and Internal pudendal arteries proximal to pelvic floor (Type Ia) in 56% of Instances, while in 12% of The division occurs out of the pelvic floor (Type Ib). Type Ia arrangement is observed in 60% of male specimen, where as a similar pattern is observed in 40% of female specimens. Among Type Ib variations is seen in10%of the male specimens and 20%of the female specimens

Type III is the Next predominant pattern accounting for 20% of which male specimen contributed 17.5% of thespecimenand30% of female specimen contributed Type III.

Type IIa variations seen in 8% of the total specimens. Out of which male specimen shown7.5%and10%female of the specimens

Type IVA This pattern is observed in 4% of pelvis specimen and not seen in female specimen.

Type V arrangement not seen

Discussion

In the present series The mode of origin superior gluteal, Inferior gluteal and Internal pudendal arteries conforms to one of Adachi four type viz Type I, II,III and IV

worker	year	Frequency of Internal iliac Type in%				
		I	II	III	IV	V
Jastschinski	1891	38	22.8	32.5	7.3	1.2
Adachi	1928	59	16.2	22.7	1.2	0.5
Ashleyand Anson	1941	56.2	13.5	23.2	4.4	0.4
Braithwite	1952	58.5	15.3	22.5	3.6	-
yamaki	1998	595	14.2	21.3	4.2	0.5
sumathilatha	2014	63.2	15.8	21	-	-
Shivakumar	2014	89	11	0	0	
Pavan p Havaldar	2014	52	2	34		2
Present study	2017	68%	8%	20%	4%	0

The frequency of the Internal iliac types as reported by various workers the mode of origin of the three large parietal branches conforms to one of four types in the present series. type I arrangement in which the superior gluteal artery arises proximal to the common trunk for the inferior gluteal and internal pudendal arteries is the predominant pattern observed (68%) .This finding is in agreement with Adachi (1928)[8], Ashely and Anson (1941)[13], Braithwite (1952)[14], and yamaki (1998).[15]. It was also correlated with the south Indian study of sumathilatha et al (2014).[16] pavan p havaldar et al (2014),[17] shivakumar et al,[18] HoweverJastichihski (1891),[7]noted a Type I pattern in 38% of their specimens.

Type II arrangement is observed in only 8% of the specimens, which is less than the Incidence reported for this type by other workers. This may be possibly because of the fewer number of specimens used in the present study. Only a Type IIa pattern in which the two gluteal arteries arise by a common trunk and this trunk bifurcates within the pelvis was noted in the present series.

A Type III Arrangement in which the superior gluteal, Inferior gluteal and Internal pudendal arteries arise as separate branches from the parent vessel is noted in a significant number of cases (20%), This finding is correlate with Adachi (1921), Ashley and Anson (1941), Braithwaite (1953), and yamaki (1998). This study also in agreement with south Indian study sumathilatha (2014). This result is contrary to the study of Jastschinski (1891) 32.5% and pavan Havalder (2014) (34 %).

The Incidence of the relatively rare Type IV arrangement (4%) in the series tallies with the observations of Ashley and Anson(1941), Braithwaite (1953)and yamaki (1998) while Jastschinski (1891) notes a relatively higher incidence (7%)

The still rare variation in which the superior gluteal and Internal pudendal artery arises by a common stem and Inferior gluteal artery arises separately has not been found in this south Indian population. This finding is in agreement with Braithwaite (1952) who failed to observe this Type V pattern in his extensive study although others have reported this very rare variant in meager proportions. This study correlate with other south Indian study sumathilatha et al shivakumar etal and also failed to Identify Type V pattern.

The present Investigation undertaken in a limited number of cadavers belonging to a south Indian population. The following finding observed in our study.

1) Type I as the predominant arrangement

2) High Incidence of Type Ia pattern
3) Next common pattern Type III
4) Absence of Type V Arrangement.

Conclusion

The Branching pattern of Internal iliac artery was classified as per modified Adachi classification. Type Ia arrangement was found in 56%, Type Ib12% Type IIa 8% Type III in 20% and Type IVa was seen in 4% of the specimens., Type V was not found in any of the specimens. The order of frequency in south Indian population was Type I > Type III > Type II It correlates with other south Indian studies. Understanding Internal iliac arteryanatomical variation is essential to minimize Intraoperative blood loss and other complications.

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