"OVIDIUS" UNIVERSITY CONSTANTA
FACULTY OF MEDICINE
DEPARTMENT OF ANATOMY

MORPHOLOGY OF THE ILIAC VESSELS

- ABSTRACT -

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Constanta
2012

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INTRODUCTION

The iliac vessels supplies arterial and venous blood to a significant area of the lower body whence their importance in the context of circulatory disorders that may occur in this sector. It is therefore essential to identify their morphology and morphometry (caliber, length), their anatomic relations with other pelvic structures or the variations of their branches. Medical-surgical pathology of these vessels is quite complex, including stenoses, atherosclerosis and aneurysms.

Brunkwall, Sacks, Sekkal, Ferreira have described the aneurysmal transformation of the arteries whose diameter was superior to 1.7 cm in males or to 1.5 cm in females for common iliac artery or to 0.8 cm, for internal iliac artery. Iliac artery's stenosis should be periodically evaluated by CT or magnetic resonance, even if the entity appears to be a simple (Levi, Mc Cready).

The common iliac arteries aneurysms could be associated in 10-20% of the cases with abdominal aortic aneurysms (Armon) and the incidence increases with age, peaking in the 7^{th} and 8^{th} decade. Isolated iliac artery aneurysms are less frequent (2% of the abdominal aneurysms). The common iliac artery is most involved (70%), followed by the internal iliac artery (25%). The external iliac aneurysms are extremely rare. (Dix)

The most common cause of iliac aneurysms is atherosclerosis, but they can occur following traumatisms, infections (Woodrum), excessive athletic effort or fibro-muscular fibrosis (Atsuta). The natural course of an iliac artery aneurysm consists of progressive expansion with eventual rupture, with high perioperative mortality rate (7% to 11% in elective procedures and 50% in emergency surgery). In this situation it is imperative to be aware of the morphometric aspects of the iliac vessels. The imaging studies especially CT and MRI, allow an accurate diagnosis of aneurysms. An imaging classification system, based on anatomic features, permits a good selection of appropriate candidates for endovascular or surgical therapy.

Endovascular treatment is now an alternative to surgery for the treatment of iliac artery aneurysms. A variety of minimally

invasive therapeutic options are available and choosing an appropriate option is essential for achieving excellent long-term results and reducing potential complications (Razawi, Mori, Van Sambeek).

This thesis is organized into two parts: general aspects and a personal research.

In the first part of this thesis I included a review of some embryology studies (Chevrel, Langman and Netter), for a better understanding of the wide spectrum of anatomical variation and anomalies of iliac vessels.

In order to present accurate information on the anatomy of the iliac vessels (common, internal and external iliac arteries) I cited some of the most complex and influential anatomy textbooks: Paturet, Testut, Rouvière, Gray, Chevrel, Kamina, but also updated articles from recent medical journals.

In the personal research part I described the material and methods, with all the steps in the process and the results of the study. I summarized the information on middle (median) sacral artery and on normal iliac vessels morphology and I compared it with similar studies published in international medical journals. In distinctive chapters I mentioned a few rare cases of renal arteries arose from common iliac arteries, associated with ectopic pelvic kidneys. Another chapter is dedicated to histological structure of iliac vessels and to some related physiological aspects: the arterial resistivity index, blood pressure and pulsatility index.

Partial results of this study, included in articles, presentation and posters were communicated to national and international congresses and published in acknowledged medical journals.

In the last chapter I briefly present a number of issues that I find interesting and less addressed in the medical literature.

The bibliography comprises over 100 titles, but the information on common iliac vessels available in medical books and journals or on the internet is relatively poor. For that reason, the comparison of the results of my research with the existing ones was not made on a large number of authors.

I want to express my appreciation to my colleagues from the Department of Anatomy: Dr. Popa Marius, Dr. Cambrea Marius, Dr.Stanca Răzvan, Dr. Corici Paul şi Dr. Bulbuc Ionuţ, for helping me with my work. I would also like to thank Dr. Radu Baz and Dr. Bardas, from the Department of Radiology, where the CT studies

were carried out and Dr. Gheorghe Ema who helped me to accomplish the histological study.

I owe my deepest gratitude to my coordinator, Professor Bordei Petru, for his valuable advice, guidance and support during the period of preparation of this thesis.

PERSONAL RESEARCH

MATERIAL AND METHODS

My study comprises the analyze of 232 iliac arteries (52 dissections on human cadavers (adults and fetuses), fixed in formalin and fresh, 28 vascular corrosion casts, 12 Doppler ultrasound studies, 44 angiographies, 95 2D and 3D CT angiograms) and 72 iliac veins (38 dissections, 12 Doppler ultrasound studies, 18 cavographies, 14 CT angiograms).

Iliac veins have been investigated on a smaller number of cases than arteries: 38 dissections on human cadavers, 12 Doppler ultrasound studies, 18 cavographies, 14 CT angiograms.

To these I added 4 pairs of iliac vessels (artery and vein) harvested on fresh corpses, in which I have studied the structure of the vascular wall.

No.	METHOD	CASES	FOTO
1.	Dissection	52	
2.	Vascular corrosion casts	28	
3.	Ultrasound	12	

4.	Angiography	44	
5.	CT angiogram	96	
		232	

TABLE 1 – studies of iliac arteries

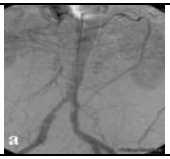
Nr.	METHOD	CASES	FOTO
1.	Dissection	38	
2.	Ultrasound	12	
3.	Cavography	18	
4.	CT angiogram	14	
	Total	72	

TABLE 2 – studies of iliac veins

Have analyzed the microscopic structure of the vascular wall, the morphometric aspects of the common, internal and external iliac arteries and veins (length, caliber), the aortic bifurcation angle, aorto-iliac angle, aorto-iliac take-off angle, the path and the arterial branches abnormally arose from the common iliac artery. All the data was classified according to the side of the body (left and right), gender and age.

The dissection was performed on adult human bodies, fixed in formalin in the laboratory of the Department of Anatomy and on fresh or fixed fetuses. The injection-corrosion technique was applied to unfixed human fetuses. The aorta was infused with liquid Technovit 7143 and the corrosion was realized using sodium hydroxide at temperatures of $80\text{-}90^0$.

All the Doppler ultrasound studies were performed by Dr. Stanca Razvan, on healthy young subjects (students of "Ovidius" University), at "Euromaterna" Hospital, using a GE Voluson E8 Expert ultrasound system.

The angiographies and cavographies are included in the imaging collection of the Department of Anatomy of Ovidius University.

The CT angiograms analyzed for this study were performed at Pozimed Diagnostic Center by dr. Radu Baz, using a GE LightSpeed VCT64 Slice CT and at Medimar by dr. Mariana Bardas, using a GE LightSpeed 16 Slice CT.

RESULTS

MEDIAN SACRAL ARTERY

I have analyzed 22 median sacral arteries (4 dissections and 18 CT angiograms). All of them arose from the posterior aspect of the aorta, from 5 to 18 mm above bifurcation.

Its origin on the posterior side of the aorta is usually on the left side and rarely on the midline or on the right side.

If the aorta bifurcates above the origin of vena cava, the median sacral artery descends between the two common iliac arteries, on the midline (40.91%) or closer to the right branch (27.27%) or to the left one (31.22%).

Fig. 17 - Median sacral artery originate on the posterior aspect, 9mm above bifurcation of the aorta

Fig. 18 – The path of median sacral artery in relation to iliac veins

The caliber of the 16 median sacral arteries investigated in this study ranges between 1.8 and 6.2 mm. However in males the caliber is larger (5.2-6.2 mm).

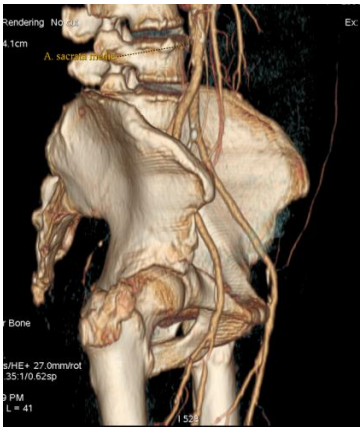


Fig. 19 - Median sacral artery originate on the posterior side of the aorta, at the level of fifth lumbar vertebra, above the bifurcation

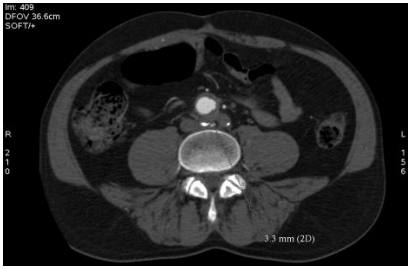


Fig. 20 – A 3,3 mm caliber medial sacral artery in female, originated on the left side of the aorta.

ORIGIN OF THE COMMON ILIAC ARTERY

The origin of common iliac artery was determined according to its relations to the spine, to the midsagittal plane, to gender, to the origin of vena cava and aortic bifurcation angles.

ORIGIN OF THE COMMON ILIAC ARTERY IN RELATION TO THE SPINE

The origin of 96 common iliac arteries (69 in males – 71.88% of the cases and 27 in females – 28.12%) was studied in relation to

the spine. It was located between the middle third of L3 and the inferior third of L5 vertebrae.

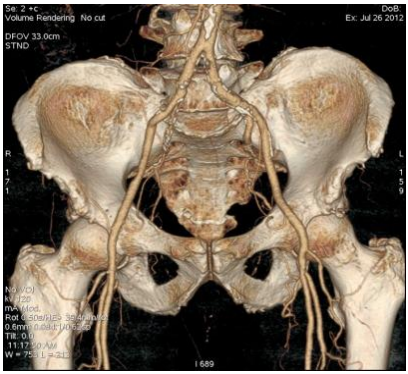


Fig. 21 – Origin of common iliac arteries on the inferior third of L4 vertebra, on the midline

The results are summarized below:

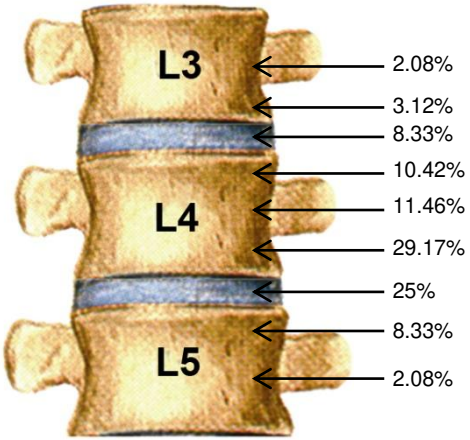


Fig. 25 - the origin of the common iliac artery in relation to the spine

I haven't noticed any sex related differences according to the origin of the artery. For the most part of the cases (92.71%) the arteries arose between the L3-L4 disc and the superior third of L5 whereby 54.17% originated at the level of the inferior third of L4. I have accounted 13 cases (13.54%) of high origin (above the fourth lumbar vertebra) and 10 cases of low origin (below the L4-L5 disc).

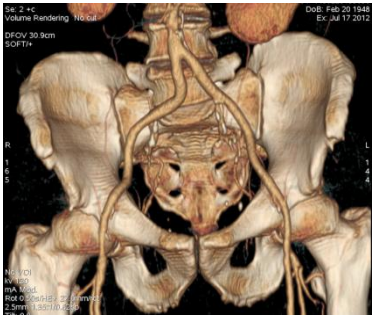


Fig. 22 - Origin of common iliac arteries on L4-L5 disc, to the right of the midline.

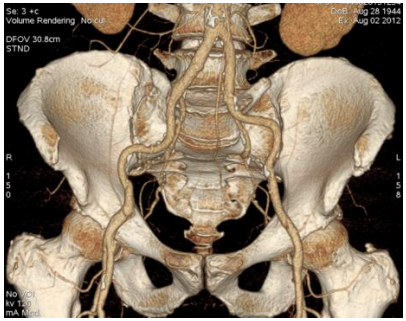


Fig. 23 - Origin of common iliac arteries on L4-L5 disc, to the left of the midline..

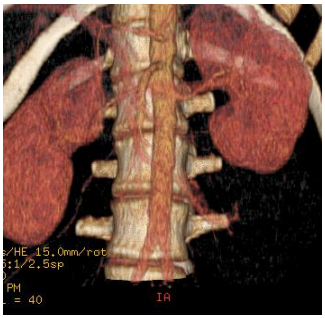


Fig. 26 – High origin of common iliac arteries (inferior third of L3), to the left of the midline

Reviewing the results of other similar studies I noticed a completely different level of the bifurcation of the aorta in relation to the spine.

AUTHOR	ORIGIN OF THE COMMON ILIAC ARTERY
Paturet	Lower edge of L4 (70%)
Testut	Lower edge of L4
Rouvière	Lower edge of L4
Gray	L4
Moore	L4-L5 disc
Krause	L4
Chiriac	L4-L5 disc

TABLE 3 – LEVEL OF THE BIFURCATION OF THE AORTA IN RELATION TO THE SPINE

Studying the bifurcation of the aorta in relation with the origin of the inferior vena cava on 38 specimens I detected that for 71.04% cases it was 2-45 mm above, for 18.42% below and for 10.53% on the same level.

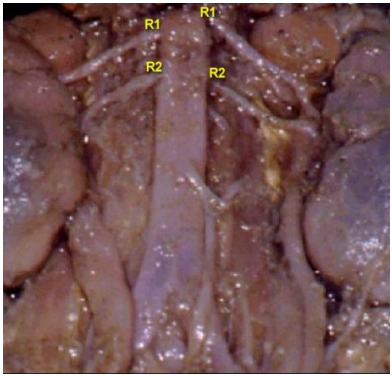


Fig. 30 – Bifurcation of the aorta located below the origin of the inferior vena cava

AORTIC BIFURCATION ANGLE

For 48 cases (38 males, 10 females) I have measured the aortic bifurcation angle, ranging from 19.8 to 75.9°, with a significant sex related difference. In males the angle varies from 21.4 to 75.9°:

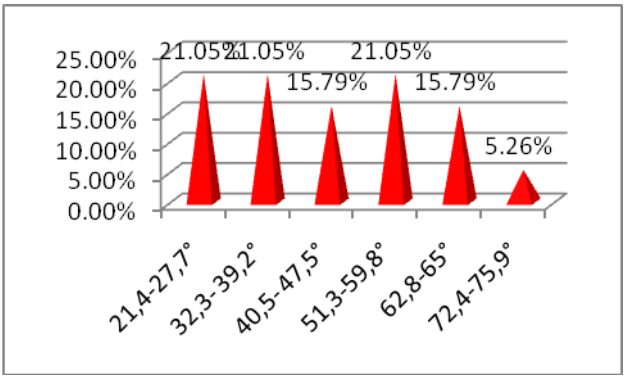


CHART 6 – BIFURCATION ANGLE IN MALES

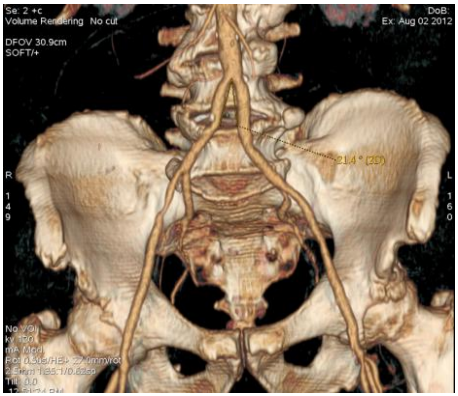


Fig. 40 – bifurcation angle< 21,4° in male.

In females the bifuration angle ranges from 19,8 to 47,4°:

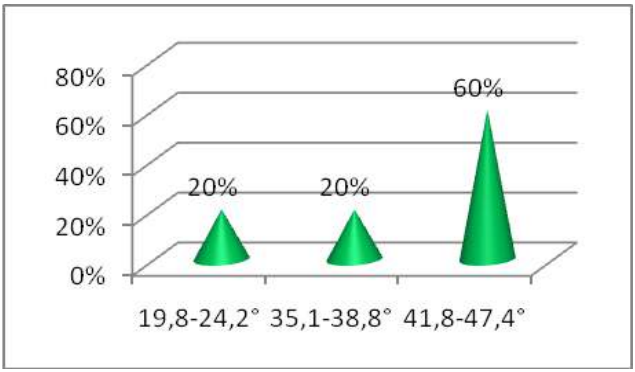


CHART. 7 - BIFURCATION ANGLE IN MALES

In males, the angle is wider than in female, with difference of 1.6° between the minimum values and of 28.5°between the maximum values.

AUTHOR	Bifurcation angle
Paturet	60-70°
Testut	60-80°
Chevrel	60-70°
Krause	65° (male); 75° (female)
Chiriac	60°
Personal study	21,4-75,9° (male);19,8-47,4° (female)

TABLE 5 – ILIAC BIFURCATION ANGLE

Other authors haven't described values below 60^0, or significant sex related differences, except for Krause's. In my study I have found not only lower values of the angel in female (below 47.4°), but also higher values in males, over 70°.

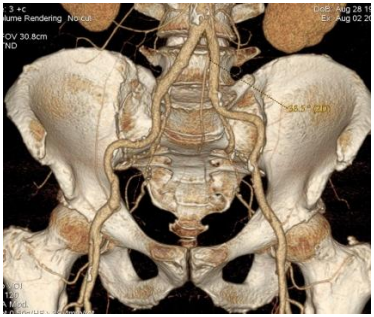


Fig. 44 - A 38,5° bifurcation angle in male

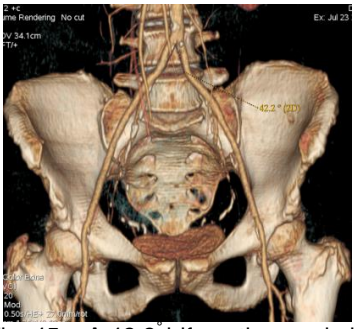


Fig. 45 – A 42,2° bifurcation angle in female

CALIBER OF COMMONE ILIAC ARTERY AT ITS ORIGIN

I studied the caliber of 48 pairs of common iliac arteries, right and left at their origin and I classified the result based on gender. The diameter ranges between 7.7 and 14.8 mm, with a slightly difference between the right (8.4–11.7mm) and the left side (7.7–14.7mm). A noticeable sex related difference was found.

Right common iliac artery's caliber: 8,4-14,8 mm in males
8,5-11,7 mm in females.

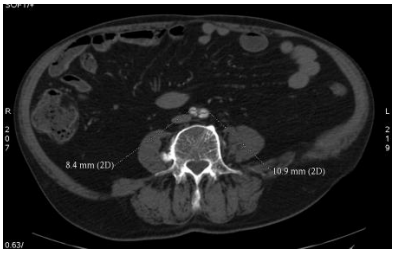


Fig. 60 –Caliber of the common iliac artery in male: 8,4 mm on the right and10,9 mm on the left

Fig. 62 - Caliber of the common iliac artery in female: 8,5mm on the right and7,7 mm on the left

Left common iliac artery's caliber: 7,9-14,7 mm in males,
7,7-11,3 mm in females.

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Fig. 64 - Caliber of the common iliac artery in male: 9,1 mm on the right and 7,9 mm on the left

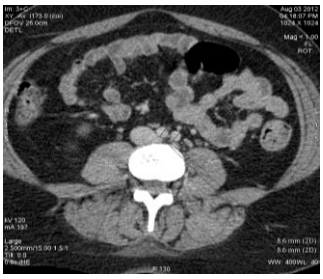

Fig. 66 - Caliber of the common iliac artery in female: 8,6 mm on both sides

In other studies the data is not classified according to the side (right and left) and sex. The largest diameter is reported by Paturet (12 mm), lesser that my findings and the smallest by Gray (3,5mm). The values communicated by Chevrel and Kamina are closed to those I have found.

AUTHOR	CALIBRE
Paturet	11 mm (8-12 mm)
Gray	3,5-7,5 mm
Chevrel	8-12 mm
Kamina	10 mm (+/- 2 mm)
Chiriac	4,5-7 mm
Personal study	male: right 8,4-14,8 mm left 7,9-14,7 mm female: right 8,5-11,7 mm left 7,7-11,3 mm

TABLE 6– CALIBER OF COMMON ILIAC ARTERIES IN OTHER STUDIES

LENGHT OF THE COMMON ILIAC ARTERY

The length of the common iliac artery was measured on 89 specimens: 42 right arteries (47,19%) and 47 left arteries (52,81%), in males and females. According to my measurement the length ranges from 16,5 to 84,8mm:

Right common iliac artery - 17-73,8 mm.

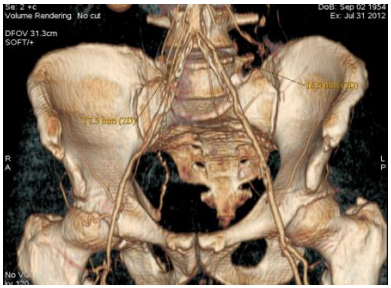

Fig. 75 –Male patient
right iliac artery 17,5 mm,
left iliac artery 16,5 mm

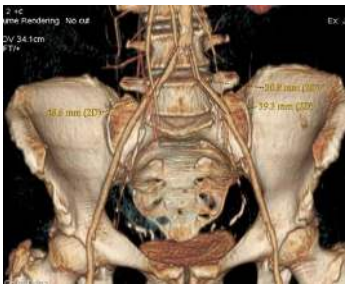

Fig. 77 - Female patient;
right iliac artery 48,6 mm,
left iliac artery 72,2mm

Left common iliac artery-16,5-84,8mm.

In other studies the length of the artery is not classified according to the side (right and left) and sex.

AUTHOR	LENGHT
Paturet	60 mm
Testut	60 mm
Gray	50 mm right iliac artery 40 mm left iliac artery.
Chevrel	60 mm
Kamina	50 mm right iliac artery 40 mm left iliac artery
Bergman	37-75 mm (în 72%)
Wikipedia	40 mm
Chiriac	40 (50)-70 mm
Personal study	***right: M=17,5-73,8 mm*** ***F= 48,6-74,9 mm*** ***left: M=16,5-84,4 mm*** ***F=57,2-74,9 mm***

TABLE 7 – LENGHT OF THE COMMON ILIAC ARTERY

According to other authors, the mean length was 60mm (Paturet, Testut and Chevrel). Gray and Kamina noted a 10 mm difference between the right and the left side. Bergman reported a wider range of length: 37-75 mm, for both sides.

My measurements of the length of the common iliac artery: 30 mm - 7 cases (7,86%), 40 mm - 21 cases (23,60%), 50 mm - 30 cases (33,71%), 60 mm -11 cases (12,36%), 70 mm - 8 cases (8,99%).

VARIATION OF ENDINGS OF THE COMMON ILIAC ARTERY

My study on ending of the common iliac vessels was done on 76 specimens, 58 males (76,32%) and 18 females (23,68%). The location of the ending was determined according to its relationship with the spine and the sacrum.

Fig. 85 – The ending of the right iliac artery on the upper border of the sacrum; the ending of the left iliac artery on the upper ½ ofL5 (high ending).

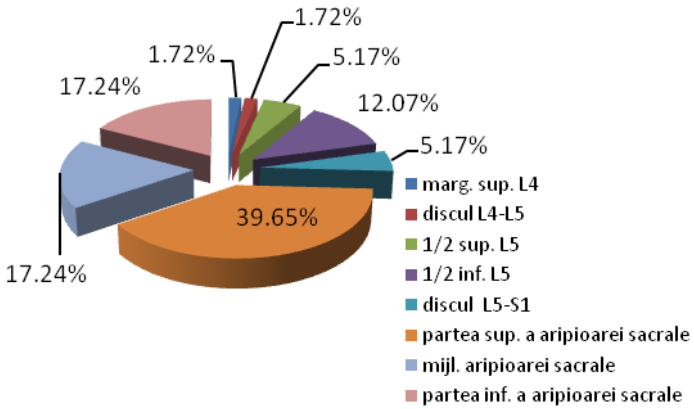

CHART 37 - VARIANTS OF ENDING OF THE RIGHT COMMON ILIAC ARTERIES IN MALES

In males the point of division of the ***right common iliac artery*** was between the upper edge of L5 and the lower border of the sacral ala. (Chart 37)

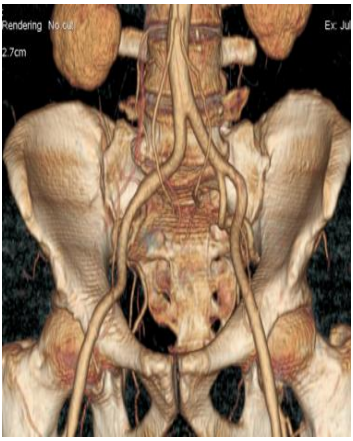

Fig. 86 - The ending of the right iliac artery on the lower border of the sacral ala; The ending of the left iliac artery on the upper border of the sacrum

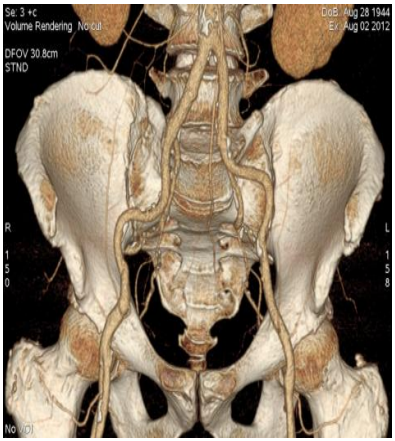

Fig. 87 - The ending of the right iliac artery on the L4-L5 disc; The ending of the left iliac artery on the upper ½ ofL5 (high ending).

I considered low endings of the right artery the division points situated on the inferior border of the sacral ala (10 cases- 17,24% of males). The high endings of the artery, above the sacral ala, were found in 15 cases (25,86% of males) whereby 1 case on the upper margin of L4 and 1 case on L4-L5 disc.

In females, the division point of the ***right common iliac artery*** is positioned between the superior margin of the fifth lumbar vertebra and the inferior border of the sacral wing (chart 38). Four cases (22,22%) of high ending and 6 cases (33,33%) of low ending were found.

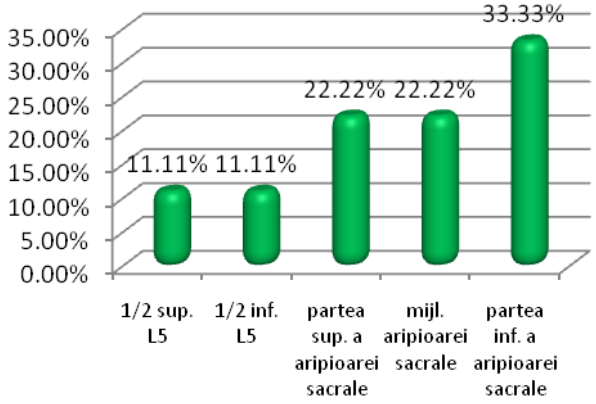

CHART 38 - THE ENDING OF THE RIGHT COMMON ILIAC ARTERY IN FEMALES

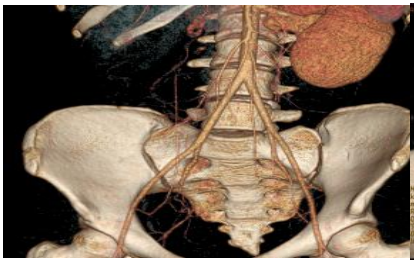

Fig. 88 – Female patient. The bifurcation of the right iliac artery on the superior half of the sacral ala. The bifurcation of the left iliac artery above the upper border of the sacral ala (high ending)

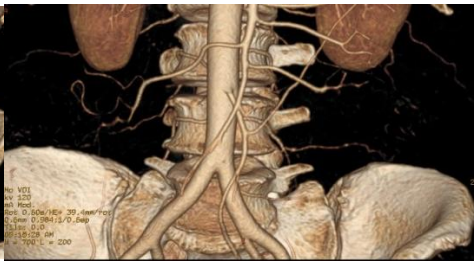

Fig. 89 - Female patient. The bifurcation of the right iliac artery on the inferior border of the sacral ala. The bifurcation of the left iliac artery on the L5-S1 disc

The point of division of the ***left common iliac artery***, studied on 78 cases (whereby 57 males) was located on the upper margin of L4 and the anterior surface of the sacrum in both males and females. In ***males,*** in 44 cases (77,19%) the ending point was found on the sacral wing (chart 39).

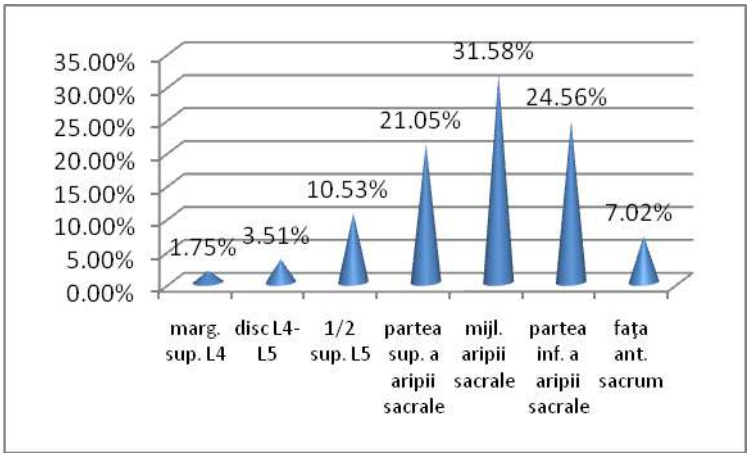

CHART 39 **–** DIVISION POINT OF THE LEFT COMMON ILIAC ARTERIES IN MALES

The high endings were found in 9 cases (15,79% of males) and low endings in 18 cases (31,58% of males).

In females, from 18 left arteries included in the study, 17 (94,44%) ended on the sacral wing (chart 40)

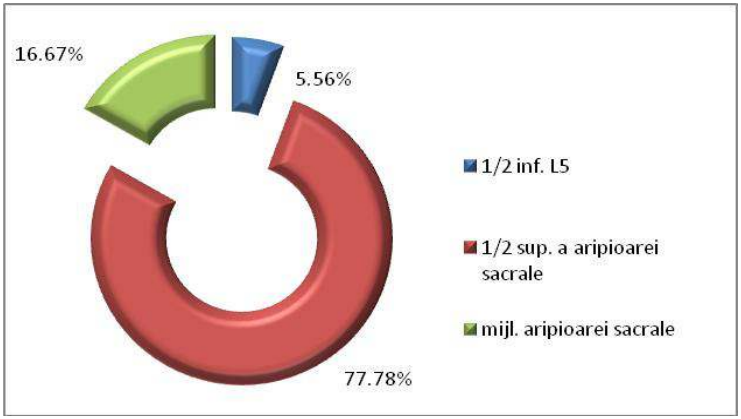

CHART 40 - DIVISION POINT OF THE LEFT COMMON ILIAC ARTERIES IN FEMALES

DIVISION POINT OF THE COMMON ILIAC ARTERIES – COMPARISON OF RIGHT VERSUS LEFT SIDE

In my study I have compared the division point of the right versus left common iliac artery in 92 cases, but only 78 cases (84,78%) were classified according to sex.

For 44 cases (47,83%) the right common iliac artery divided on a higher position than the left, and for 42 cases (45,65%) the left common iliac artery divided on a higher point than the right. For 6 cases (6,52%) the ending point was on the same level.

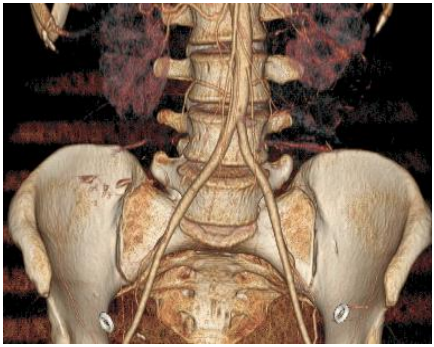

Fig. 91 - The left common iliac artery divides lower down more frequently than the righ in males.

Reviewing the results of other similar studies I summarized their data in the table below.

Paturet, Gray and Bergman reported a high division point (80%), above the sacral ala. In my study, the percentage is lower - 41,65% of all cases (27,78% in females). Rouvière's results were similar, except for those regarding the ending on L4 and L4-L5 disc.

AUTHOR	ENDING POINT
Paturet	Above the sacral ala, on the L5-S1 disc, 4,5 cm away from the midline;
Rouvière	Medial to the sacro-iliac joint, lateral to the promontory; inf. margin of L5; post-inf. Margin of the sacral ala; 3 cm to the righr ; 4 cm to the left;
Gray	L5-S1 disc; lower to the left;
Chevrel	Medial to the sacro-iliac joint, in relation to the post. Margin of the sacral ala; 4 cm to the left, 3 cm to the right;

Testut	sacro-iliac joint;
Bergman	68%: L5- S1; 12%: above L5; 17% : below the superior border of the sacrum; More distal division on the left.
Personal study	Upper margin of L4-lower sacral wing.

TABLE 8 – DIVISION POINT OF THE COMMON ILIAC ARTERIES

Testut described a low division point of the common iliac artery, confirmed by my research for 35,84% of the cases in males and 33,33% in females, but only on the right. Most of the studies, mine included, reported the ending point medial to the sacro-iliac joint. Gray and Bergman described a lower ending point of the left artery.

RELATIONS OF THE URETERS WITH THE ILIAC VESSELS

The left ureter crossed the common iliac artery above bifurcation for 5 cases (25%), below bifurcation for 11 cases (55,56%) and at the level of bifurcation for 4 cases (22,22%)

Fig. 112 – ureter crossing the right iliac artery below bifurcation. The left iliac artery is crossed above bifurcation

Fig. 114 – ureter crossing the right iliac artery at the level o bifurcation.-.

The right ureter crossed the common iliac artery above bifurcation for 14 cases (58,33%), below bifurcation for 6 cases (25%) and at the point of bifurcation for 4 cases (16,67%)

ILIAC VEINS

Iliac veins (common, external and internal) have been studied on 18 specimens, 6 males (33,33%) and 12 females (66,67%). Given the low number of cases I haven't classified the data according to gender.

THE ORIGIN OF VENA CAVA IN RELATION WITH THE SPINE

In all 18 cases the union of the two iliac veins occurred between the middle third of fifth lumbar vertebra and L3-L4 intervertebral disc. (chart 59)

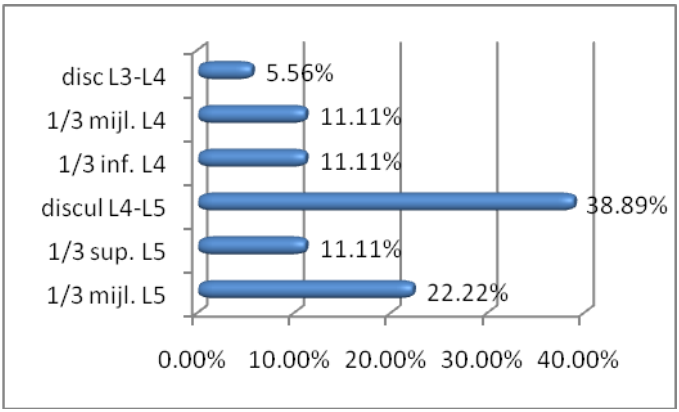

CHART 59 - THE ORIGIN OF VENA CAVA IN RELATION WITH THE SPINE

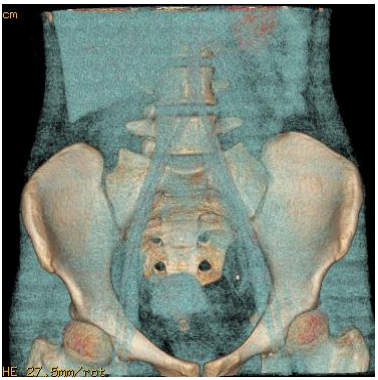

Fig. 126 – origin of vena cava in female, in relation to the middle 1/3 of L5.

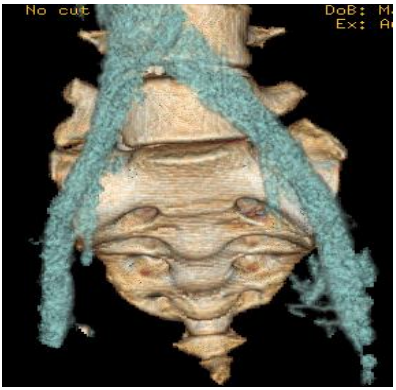

Fig. 127 – origin of vena cava in female, on L4-L5 disc

INTERILIAC ANGLE

The angle measured between the two common iliac arteries, at the origin of vena cava (interiliac angle) ranged from 23,4-78,7°.

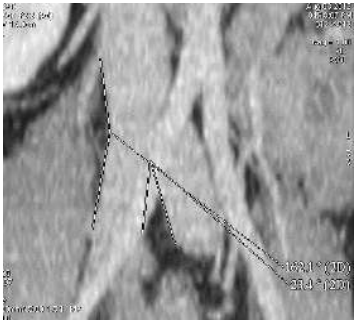

Fig. 129 – 23,4° interiliac anglle in female

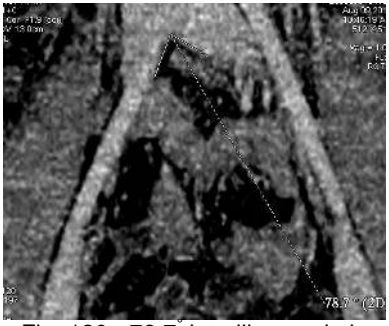

Fig. 130 - 78,7° interiliac angle in femal

DIAMETER OF VENA CAVA AT ITS ORIGIN

The caliber of iliac veins at their origin varied between 11 and 17 mm.

Comparing the caliber of common iliac veins on both sides, for 10 cases (55,56%) the left vein was larger in caliber (0,8-3,7 mm) and for 8 cases (44,44%) it was smaller (0,3-1,3mm).

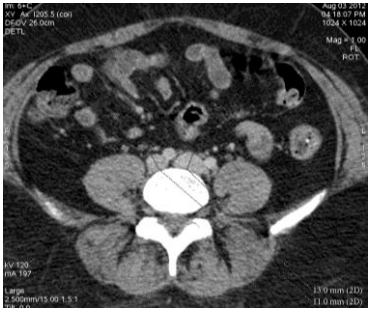

Fig. 142 - The caliber of the iliac vein in female: 13 mm to the left, 11 mm to the right..

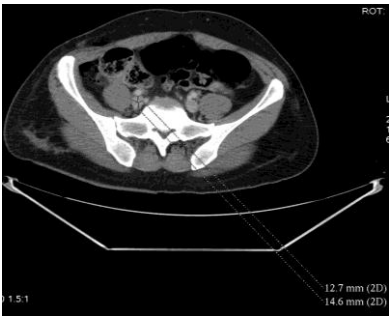

Fig. 143 - The caliber of the iliac vein in female: 12,7 mm to the left, 14,6 mm to the right.

Fig. 146 – The caliber of the iliac vein in male: 12,9 mm to the left, 13,9 mm to the right.

LENGTH OF COMMON ILIAC VEINS

My measurements on the ***common iliac veins*** showed a variation of length between 32,2-70,7 mm.

Comparing the common iliac veins, right versus left, for all the 18 cases the left was up to 24,9 mm longer.

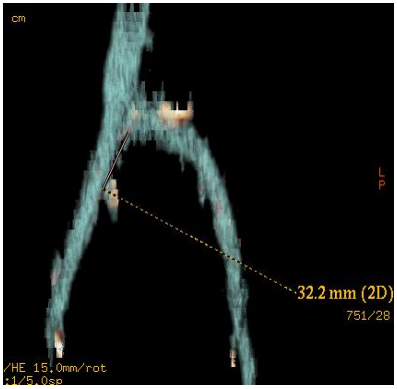

Fig. 149 - A 32,2 mm lonf right iliac vein in female

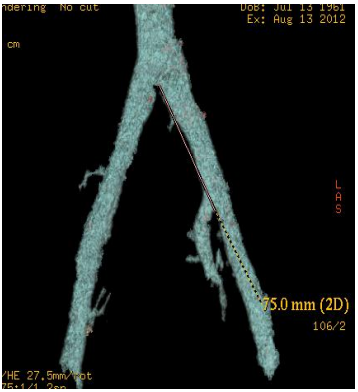

Fig. 152 - A 75 mm lonf left iliac vein in female.

CONCLUSIONS

Iliac vessels supplies blood for a large part of the body, whence their importance in the context of circulatory disorders that may occur in this sector. Therefore, any morphological disturbance can lead to functional perturbations, requiring prompt medical intervention. Considering the high frequency of vascular pathology (atherosclerosis, aneurysms, stenosis, thrombosis), it is absolutely necessary to know the normal anatomy.

The information on common iliac vessels available in medical books and journals or on the internet is relatively poor. For that reason, the comparison of the results of my research with the existing ones was not made on a large number of authors. Some of the data obtained as a result of this study have not been reported by others. On the other hand I have not encountered some situation described in the medical literature, for example the absence of the common iliac artery or “marsupial cava”

Since the middle sacral artery originates on the posterior aspect of the aorta, above bifurcation, I consider it is more accurate to assume that the aorta ends by division in two terminal branches.

There is not a pattern of the relationship between the common iliac vessels. The vein can be found in various positions to the artery, with significant differences between left and right. There are situation when the two vessels are in contact, which may lead to severe venous hemorrhage, difficult to control during surgical dissection. The iliac vein compression syndrome or May-Thurner syndrome implies the compression of the left common iliac vein by the right common iliac artery. This compression increases the risk of deep venous thrombosis (DVT), with the formation of blood clots which may block the blood flow through the vein.

The data regarding the relationship of the iliac vessels with the ureter contradicts the classic opinion. The results overlap for only 22,22% of the cases on the left and for 25% on the right.

Although authors like Paturet and Rouvière argue that the common iliac artery bifurcates at the level of L5-S1 disc, I have confirmed it in 17% of cases.

Frequently, the bifurcation angle of the aorta is larger than the interiliac angle and the origin of vena cava is located below the aortic bifurcation.

Tortuous arteries are more common after the 5th decade of life, but the most accurate term should be “curved arteries” since they are quite wide and S shaped. Veins are always straight.

It is also important to remind the importance of the iliac vessels for transplant surgery and for minimally invasive treatment of abdominal aortic aneurysms.

In medical literature there are cited examples of abnormal branches of common iliac artery, vessels which normally arise from other arteries (renal, middle colic, umbilical, obturatory, iliac circumflex, inferior mesenteric artery). In my study I have described 2 cases of renal arteries arose from common iliac artery associated with ectopic pelvic kidneys.

In my research I have also studied some physiological aspects (that I have not found in other studies): the arterial resistivity index, systolic and diastolic blood pressure and pulsatility index, measured on healthy specimens.

In the study, I used the international anatomical terminology.

Most authors explain statistical differences through the variation of the geographical area of the study. It is perfectly true that there are morphological differences based on race and ethnicity, but also the variations are dependent on age and sex and on the working methods used (dissection, corrosion casts, and measurements on imaging studies).

I am aware that my study does not follow all aspects of the normal morphology of iliac vessels and I have not exhausted the subject, but I consider that its results are useful not only for the anatomists, but also for surgeons.

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