"OVIDIUS" UNIVERSITY CONSTANŢA
DOCTORAL SCHOOL OF THE FACULTY OF MEDICINE

DESCRIPTIVE AND CLINICAL ANATOMY OF THE URETER

ABSTRACT OF THE DOCTORAL THESIS

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VARGAU DIONISIE-MARIAN

CONTENTS

Preamble

As an organ with vital function in the body, the kidney was the object of study from ancient times, but the method of study of the urinary system varied from one epoch to another. One can't set the urinary pathology, regardless its nature, without knowing its morphophysiology and dynamics.

Macroscopic human anatomy remained true anatomy, is a real and accurate anatomy and "even the most skeptical spirit can't refuse the anatomy to be the starting point of the art of healing" (Bouissou), given its contribution both to explain the emergence of diseases and for their treatment.

In our century, the very complex pathology of the urinary system, imposed forcefully as precise and accurate knowledge of the morphological aspects of its components, an important role resting with the pielocaliceal and ureter system.

The urinary system surgery has had an impressive development in recent years, from partial nephrectomy to organ transplants, and the search of advanced operators techniques required to conduct further anatomical-surgical studies for the development of resection techniques on anatomical bases, which led to the resumption of the study of urinary system components and its vascular branches distribution and topography.

Ureters variants and anomalies are common, presenting particular importance in urologic surgery, given the complexity of their pathology.

The first case of partial doubling of the ureter was described in 1913 by the Romanian Juvara (after Mondet), he also describes *partial ureteral duplicity in inverted Y or caudal bifida*, which is a rare anomaly of the ureter, represented by the existence of a duplicative ureter at a variable level before it reaches the bladder, the doubling is called confluence. Bifid ureter is a disease with female predominance, the percentage being 1.6 after (Klauberg, Beasley, Moslem, Suzuki) and Caller (quoted by Mondet). It is frequently associated with the presence of gallstones (Noah, Suzuki). Burych

describes 18 cases of double kidney ureter using as methods of study corrosion and pielography.

Cussenot found bifida cases of ureteral duplicity or a ureteral bifid blind branch, which are very rare. Ureteral branch "blind" occurs due to the division early ureteric bud and one of its two branches can't reach the metanephrogenic blastema and form a "blind" branch (Perlmutter, quoted Cussenot).

All these considerations led me to conduct an anatomical study of the ureter, study which besides the systematization and schematization of the knowledge scattered in various specialty papers, brings some personal observations, less reported or unreported in the literature.

The paper, which begins with the history of the study of the urinary system, continues with the current state of knowledge, drawn from the literature that I had the opportunity to consult. In order to explain the morphological variants and renal pelvis and ureter abnormalities, I presented further embryological development of the urinary system, this subject being made in light of the most recent acquisitions in this area.

It is presented the morphology the upper urinary system (kidney pelvis and ureter), based on the classic treaties anatomy: Testut, Rouvière, Gray, Sobotta, and treaties and recent atlases (Chevrel, Kamina, Putz, Moore, Netter, Schunk) and specialty articles published in medical journals the country and abroad, some of them very timely.

The personal part of the thesis begins with the working method and material, showing the morphological aspects pursued, the techniques used to study the upper urinary system, and some difficulties met.

Next, there are approached proper problems of the upper urinary system study, starting with personal results drawn from the study of over 200 cases in which I worked, each anatomical profile being followed on a specific number of cases because on an anatomical piece I could not follow all morphological aspects pursued.

There were studied: the formation of the renal pelvis, its shape and relationship with the ureter, pursuing the path, its relationships and his way of termination in the bladder. There were determined the dimensions (length, caliber), the distance between the two ureters at different levels of morphological characteristics of

ureteral orifices bladder, the most accurate results are obtained using CT urography.

I insisted more on particular aspects of the pelvis and ureter, issues concerning the variations and anomalies on the number, size, shape and arrangement of these elements.

During discussions, comparisons are made between personal results and data in the literature, comparisons which are illustrated by suggestive tables, graphs and conclusive personal images to support the claims made and which don't give room for interpretation. Finally I make some highlights of the survey results, which concern, both from the point of view of the systematic data in the literature, and especially of concrete findings, also the anatomist and the radiologist, surgeon, urologist and even the internist.

When treating a subject is impossible to definitely exhausted it and therefore one can surely add many aspects presented, particularly on structural features and also the most diverse variants and anomalies.

Finally I want to thank my scientific coordinator, PhD. Professor Bordei Petre and the anatomy discipline team of the Constanta Faculty of Medicine, for all your help given, team of which I was part for some time.

WORK MATERIAL AND METHODS

Setting the morphological characteristics of the renal pelvis and of the ureter was performed on a total of 311 cases of mine, of which 108 cases by dissection, 69 cases of plastic injection, 14 cases by injection of contrast agent, 56 simple urographies and 64 CT scan urographies.

Plastic injection (Technovit 7143) was performed only on freshly collected kidneys, of a total of 69 cases, in 24 cases injecting the urinary system, the artery and the vein, in 22 cases there were injected the urinary system and the artery, in 14 cases only was injected the urinary system, in 9 cases injecting the urinary system and the renal vein. I did the corrosion from the beginning with sodium hydroxide.

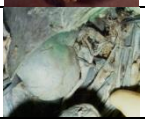
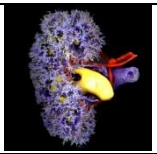
Simple urographies investigated for this study came from the collection of the Anatomy Laboratory of the Faculty of Medicine of Constanta and in the archive of the Radiology Laboratory of the County Constanta Emergency Hospital.

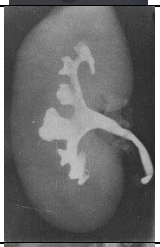
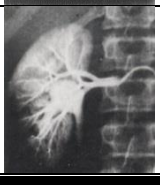
The CT scan urographies which I've studied came from Medimar exam center of Constanta Emergency Hospital, being performed on a GE LightSpeed 16 Slice CT CT scanner, and from the Pozimed diagnostic center of Constanta, being performed on a GE LightSpeed VCT64 Slice CT CT scanner. The simple or CT scan urographies bring information especially on the origin and situation of the urinifer tube segments relative to the spine, on their size, direction and path, and also on their way of confluence and continuity. The images of the cases studied were processed and stored in a Pentium computer, so we currently have a database with all the cases we studied.

To renal pelvis was described the shape and the dimensions, its situation in relation to the kidney sinus, the number of large calyces ending at its base and it way and place of continuity with the ureter. There were also described its relations with renal arterial and venous branches. The ureter has been studied in terms of its morphometry (length, caliber), of the track and its relations with

neighboring anatomical elements: renal arterial and venous branches, single or multiple, inferior vena cava, gonadal arteries, iliac vessels; there were studied the variations and anomalies which may present, and the distance between the two ureters, originally, at the iliac crossing level, super bladder level and ending in the bladder (the ureter meats).

TABLE No. 1.WORK MATERIAL AND METHODS USED

NR.	METHOD	NO. CASES	PHOTO
1.	**dissection**	**108**	
1a.	isolated pelvis ureter calyx Pieces	28	
1b.	eviscerated kidney dissections	38	
1c.	Body dissections	42 (11 adult + 31 fetal)	
2.	**plastic injection**	**69**	
2a.	urinary tract +artery + vein	24	

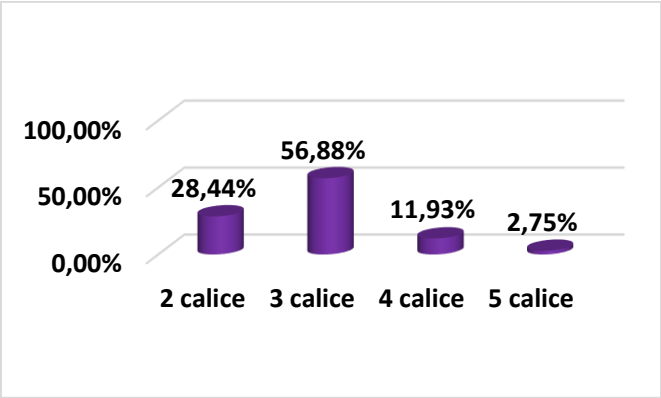
2b.	urinary tract + artery	22	
2c.	only upper urinary system	14	
2d.	urinary tract +vein	9	
3.	**contrast agent injection**	**14**	
4	**Simple urography**	**56**	

5.	**CT scan urography**	**64**	
	Total	**311**	

PERSONAL RESULTS AND DISCUSSION

RENAL PELVIS

The origin of the ureter is closely related to morphological characteristics of the renal pelvis: the number of large calyces opening at the base of the pelvis, the level of its formation by reference to the kidney and spine, its shape and appearance (single or bifid) or even its absence.



GRAPH NO. 1 – Number of large calyces ending in kidney pelvis.

Fig. 19. 2 large left calyces ending in an oval pelvis with the big shaft oriented oblique inferior-medial (rear view).

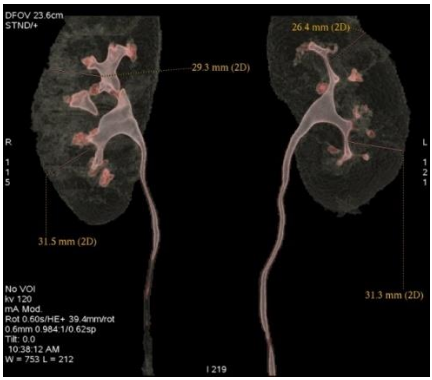


Fig. 20. Oval right pelvis, with the big shaft oriented oblique superior-medial, receives 2 large calyces, and the left pelvis, triangular, receives 3 large calyces.

I have studied on a number of 83 cases ***the situation of the renal pelvis with respect to kidney sinus,*** finding three cases of renal pelvis:

- in 45 cases (54,22% of cases), the renal pelvis had a part located intrarenal, the other part being located extrarenal;
- in 27 cases (32,53% of cases) the pelvises were completely located in the renal sinus, intrarenal pelvises;
- in 11 cases (13,25% of cases) the pelvises were completely located outside the renal sinus, extratrarenal pelvises***.***

Fig. 29. Intrarenal Pelvis.

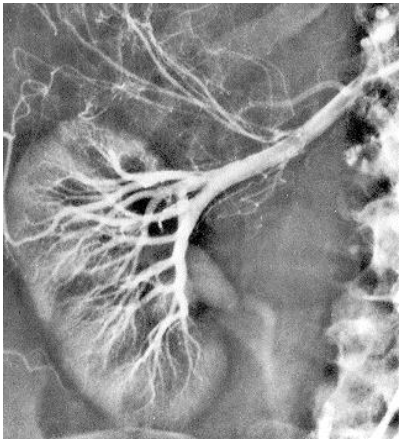


Fig. 30. Extrarenal Pelvis.

I've studied the ***shape of the renal pelvis*** on a number of 104 cases, in 3 cases (2,88% of cases) the renal pelvis being absent.

Fig. 34. Absence of left renal pelvis.

In 56 cases (53,85% of cases) we've found ***the ampullar shape*** of the renal pelvis, and in 45 cases (43,27% of cases) I found ***the branched shape*** of the renal pelvis.

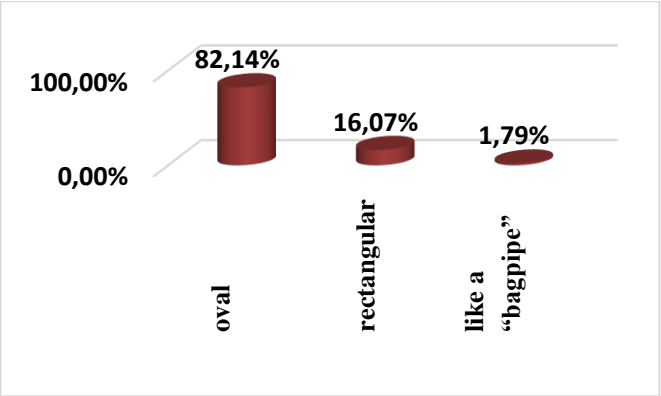


CHART No. 11 Variants of ampullary renal pelvis.

TABLE No. 3. SHAPES OF RENAL PELVISES.

AUTHOR	AMPULLARY PELVIS	RAMIFIED PELVIS	ABSENT
Papin	-	more frequent	-
Juskiewenski	-	more frequent	-
Burych	6%	94%	-
Papilian	-	more frequent	-
Glodeanu	62.33%	36.30%	1.37%
Pers. cases	***53.85%***	***43.27%***	***2.88%***

In relation to the spine, the renal pelvis situation has been studied on 22 cases.

TABLE No. 6. THE RENAL PELVISES SITUATION IN RELATION TO THE SPINE.

No.	SEX	RIGHT/ LEFT	POSITION
1	M	RIGHT	middle of costiform process L1 – i.v. disc L1-L2;
2	M	RIGHT	middle of costiform process L2 – under the upper edge L3;

3	M	RIGHT	middle L2;
4	M	RIGHT	lower side L1 – upper side L2;
5	M	RIGHT	lower side L2 - upper side L3;
6	M	RIGHT	½ lower L2;
7	M	RIGHT	½ upper L2;
8	M	RIGHT	disc L2-L3 – lower edge of the costiform process L3;
9	M	LEFT	costiform process L2;
10	M	LEFT	costiform process L2 – lower edge of the body L2;
11	M	LEFT	lower edge of the costiform process L1 – upper edge L2;
12	M	LEFT	lower costiform edge L2 – upper costiform edge L3;
13	M	LEFT	½ lower L2 – i.v. disc L2-L3;
14	M	LEFT	½ lower body L1;
15	M	LEFT	middle L2;
16	F	RIGHT	under the upper edge L2 – middle costiform L2;
17	F	RIGHT	under costiform L2 – lower costiform edge L3;
18	F	RIGHT	under costiform L2 – lower costiform edge L3;
19	F	LEFT	L2-L3 i.v. disc;
20	F	LEFT	lower edge L2 – upper edge L3;
21	F	LEFT	between the costiform process L1 – L2;
22	F	LEFT	L2-L3 i.v. disc.

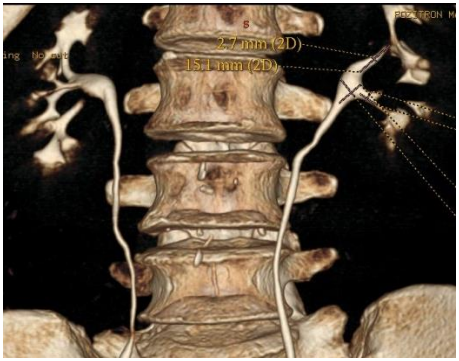


Fig. 56. Right pelvis at the upper ½ L2 vertebral body level and up to the middle of the respective costiform process, left pelvis is located at the level of the same interval (in women).

THE URETER

In relation to the spine, the origin of the ureter is between the L1 costiform process and the middle of L3 vertebra (L3 costiform process), and I have pursued this aspect in 36 cases.

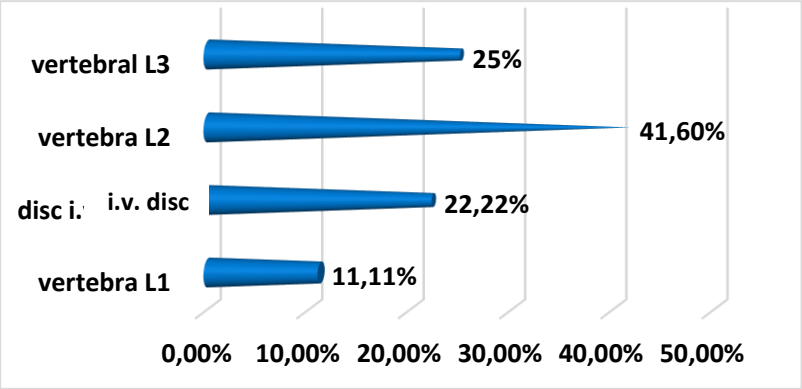


CHART No. 17. The origin of the ureter in relation to the spine.

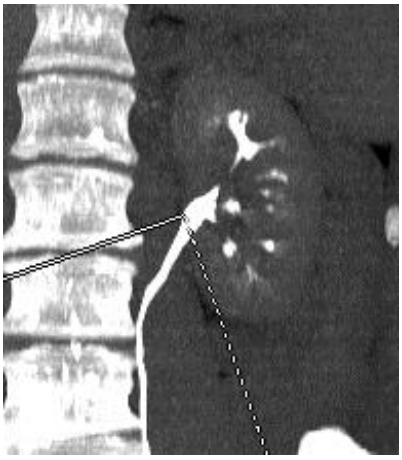


Fig. 61. The origin of the left ureter at

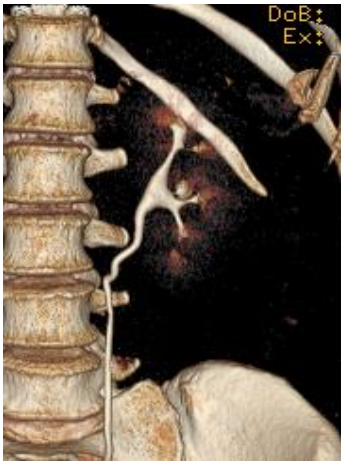


Fig. 62. The origin of the left

the levelof the lower edge of the L1 vertebra.

ureter at the level of the i.v. disc of L1 - L2.

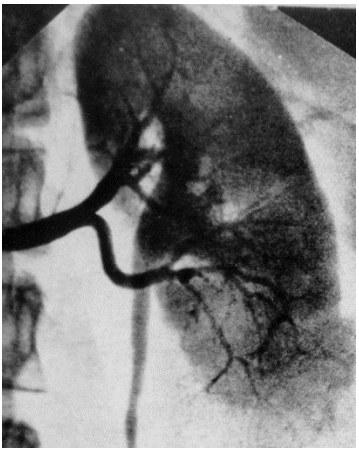


Fig. 63. The origin of the left ureter at the level of the upper edge of the L2 vertebra.

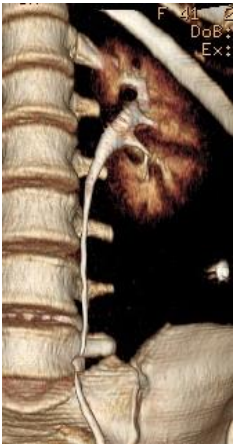


Fig. 64. The origin of the left ureter at the level of the L2 costiform process.

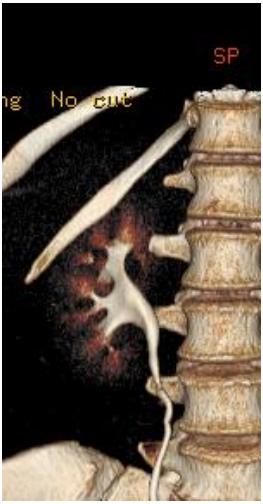


Fig. 65. The origin of the right ureter at the level of the L3 costiform process.

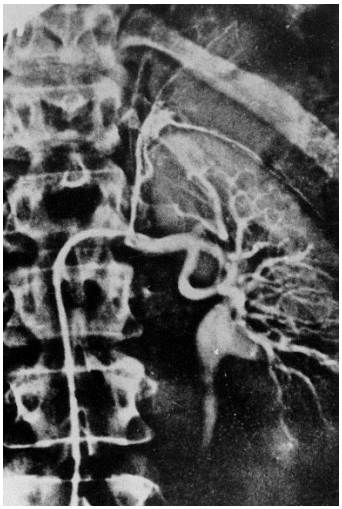


Fig. 66. The origin of the right ureter at the upper edge of the L3 vertebra.

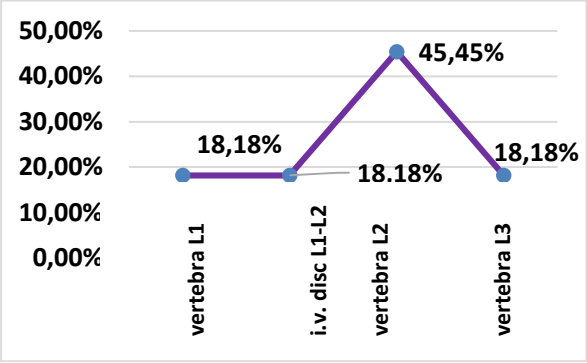


CHART No. 18. The origin of the ureter in relation to the spine in males.

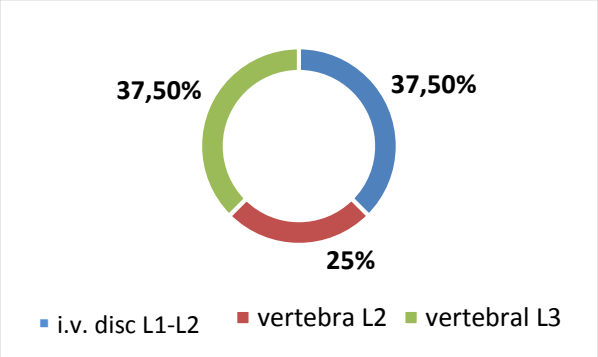


CHART No. 19. The origin of the ureter in relation to the spine in women.

TRAJECTORY AND RELATIONS OF URETERS

I have studied the relations of ureters on the two sides of the body considering the sex of the person with the i.v. disc dney and renal vessels, the inferior cava vena, gonadal vessels and iliac vessels.

In relation to the spine, on a total of 38 cases, I have found that in 5 cases (13.16% of cases) the ureter touched the tip of the L2 costiform process, in 2 cases (5.26% of cases), the ureter, in relation

to the spine, was at the tip of L3 costiform process, in other 2 cases the ureter, in relation to the spine, was at the tip of L4 costiform process, in other 2 cases the ureter, in relation to the spine, was on the anterior side of the L2 costiform process, in 16 cases (5.26% of cases), the ureter, in relation to the spine, was on the anterior side of the L3 costiform process, in 6 cases (15.79% of cases), the ureter, in relation to the spine, was on the anterior side of the L4 costiform process and in one case, on the left side, (2.63% of all cases and 5.56% of the left cases), the ureter, in relation to the spine, was on the anterior side of L5 costiform process.

Fig. 69. Left ureter, in relation to the spine, is at the level of L2 costiform process.

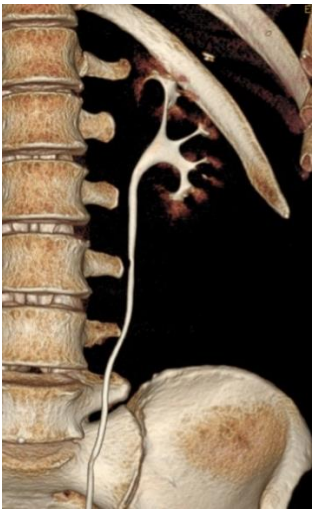


Fig. 71. Left ureter, in relation to the spine, is at the level of L4 costiform process.

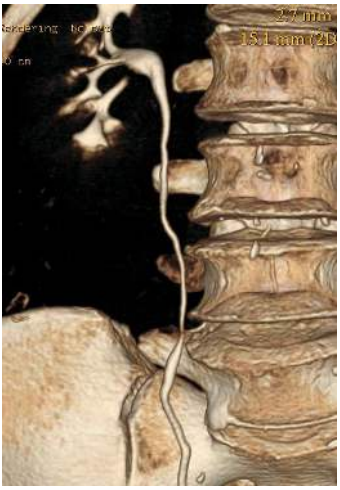


Fig. 73. Right ureter, in relation to the spine, is at the level of the anterior side of L3 costiform process.

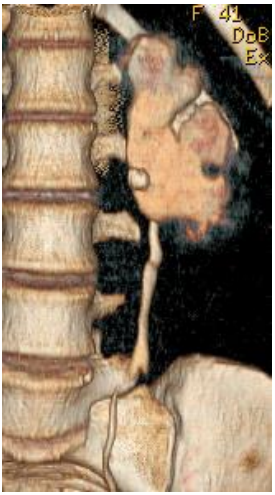


Fig. 75. Right ureter, in relation to the spine, is at the level of the anterior side of L5 costiform process.

In 3 cases (10.53% of cases), the ureter did not come in relation to the lumbar spine and it passed anteriorly the sacral wing, or it did not come in relation to the lumbar costiform, being located on their side, passing anteriorly the L5 vertebral body.

Fig. 76. The right ureter is not in relation to the spine, and it has a lateral direction from the costiform processes and goes down the anterior side of the sacral wing.

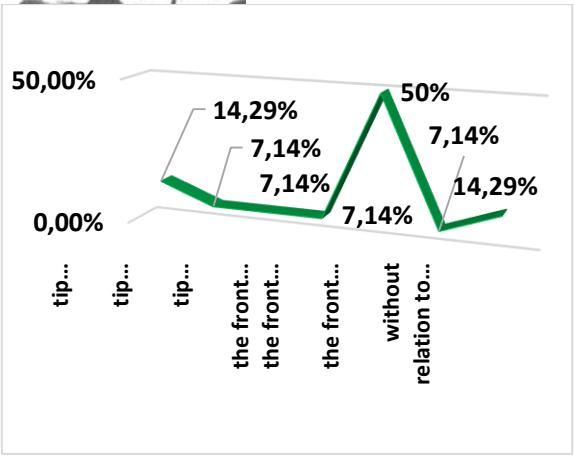


CHART No. 23. The level of ureters' relations of the spine in males.

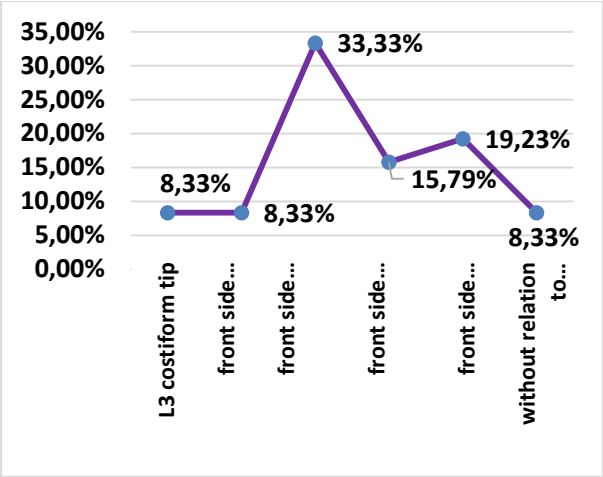


CHART No. 24. The level of ureters' relations with the spine in females.

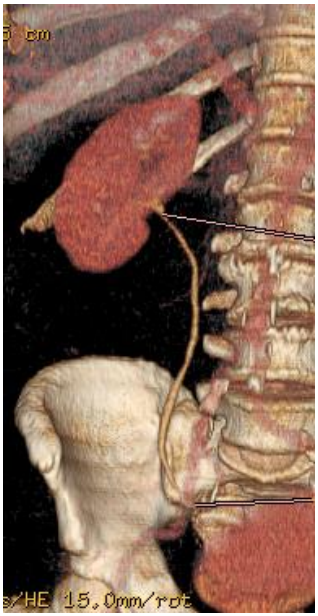


Fig. 84. The left ureter goes on the lateral side of the lumbar spine outside the costiform processes, it continues its way on the lateral side of the sacral wing, and it touches only its upper-lateral edge and a small portion of the lower-lateral edge, just above the lower edge of the wing.

In 28 cases, I have observed ***the trajectory of ureters from the pieloureteral junction to the bladder***, the most frequently from the pieloureteral junction of both parts of the body, the ureters go firstly in an oblique lower-medial direction, on a variable distance, to the spine. More rarely, the ureter, from its origin, can have a nearly vertical trajectory, going thereafter to the spine to which it comes in contact or stays parallel with it, sometimes up above the bladder, and this level describes the frequent supravesical curve with the medial concavity.

A characteristic of ureters is the presence of the inferior supravesical curve which I found in 24 cases (85.71% of cases), and this curve, with the same sizes or different sizes, is absent only in 4 cases (14.29% of cases).

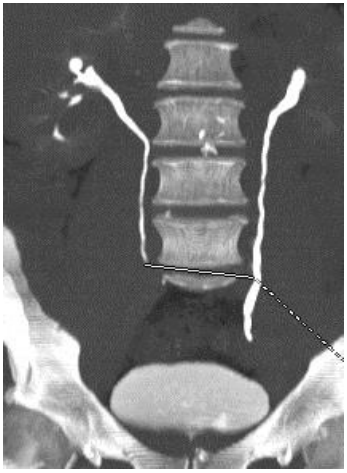


Fig. 85. Posterior view. Left ureter with vertical trajectory, parallel to the spine up to the supravesical level. The right ureter has the same trajectory.

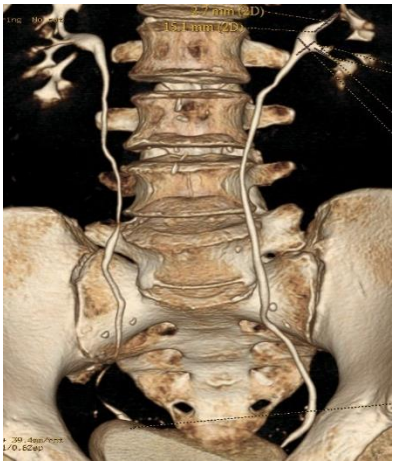


Fig. 86. Both ureters have the supravesical curve with medial concavity, the right curve is broader than the left one.

Throughout its trajectory, the ureter has two curves, the upper one is bigger with lateral concavity and the lower one (supravesical) is smaller with medial concavity, or it may have three upper superimposed curves with medial concavity formed with its

initial oblique infero-medial segment, the second is medium, with lateral concavity and the third is lower, supravesical, with medial concavity.

Frequently, throughout its trajectory, the ureter may present 4-5 overlapping curves, the latter is supravesical, the curves have their concavity facing the opposite direction of those placed over and underlying concavities.

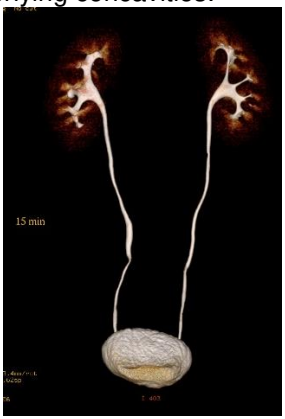


Fig. 87. The right ureter shows the supravesical curve with medial concavity, the left ureter has a vertical supravesical trajectory.

Fig. 88. The left ureter showing a large superior curve with lateral concavity and an inferior smaller supravesical curve with medial concavity.

Fig. 90. The right ureter shows three superimposed curves, the upper one with medial concavity, the middle one with lateral concavity and the lower one is supravesical with medial concavity.

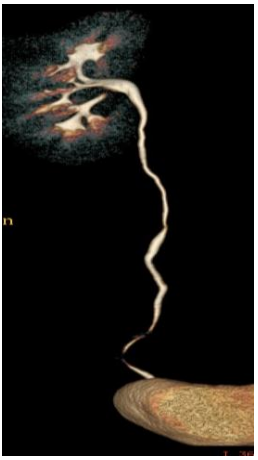


Fig. 91. The right ureter shows a number of 5 superimposed curves: the first one with medial concavity, the second one with lateralconcavity, the third one with medial concavity, the fourth one with lateral concavity and the last one, supravesical one, with medial concavity.

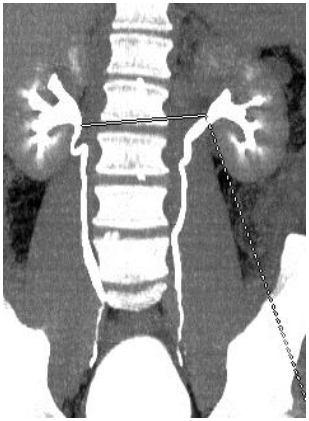


Fig. 92. After an initial vertical trajectory, the right ureter shows a "close" curve with the superior concavity, after which the ureter becomes vertical. The left ureter, after an initial oblique inferior-medial trajectory, has a curve with the medial concavity.

THE MORPHOMETRY OF URETERS

The ureter has, between the pieloureteral junction and the opening in the bladder, a ***total length*** of 17.34 to 25.73 cm, the lumbar ureter has a length ranging from 7.34 to 12.51 cm, the iliac ureter has a legth of 5.71 to 8.88 cm and the pelvic ureter has a length ranging from 3 to 4.38 cm.

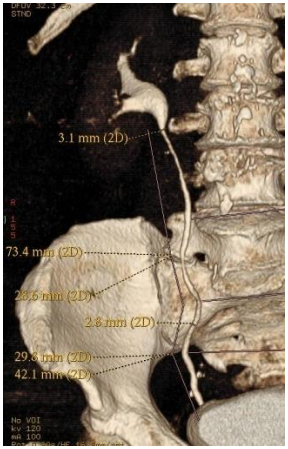


Fig. 96. The right ureter has a total length of 17.34 cm, the segments have the following dimensions: lumbar 7.34 cm, iliac 5.79 cm and pelvic 4.21 cm.

I have found differences in length between the two ureters, the right ureter has a length ranging from 17.34 to 18.80 cm, and the left ureter has a length ranging from 18.61 to 25.73 cm. It is noted that the left ureter is longer with 1.27 cm than the right one for the minimum value and 6.93 cm the maximum length.

The caliber of the ureter is also variable depending on the region and its measurement moment: during the contractile wave or during rest. It measures between 1.5-7.2 mm. At its origin, the ureter has a diameter of 2.4 mm to 7.2 mm, at its iliac level a diameter of 2.9 to 4.6 mm, at its supravesical level 1.7 mm to 5 mm, at its retrovesical level 2.1 mm to 2.9 mm and at its bladder level 1.5 mm to 1.8 mm.

TABLE No. 8. THE MORPHOMETRY OF THE URETER.

AUTHOR	LENGTH/cm	CALIBER/mm
Rouvière	25	3-5
Juskiewenski	25-30	4
Lacombe	25	-
Kent	25	-
Shunke	26-29	
Beauthier	25-30	-
Kamina	25-30	3-5
Moore	25-30	-
Gray	25-30	3-5
Romanes	25	5
O'Rahilli	25-30	-
Lahlaidi	25-30	6-10
Papilian	25-30	5-10
Nubert	25-30	-
Iancu	25-30	-
Chiriac	25-30	-
Frasin	25-30	-
Albu	-	3-5
Ulmeanu	30-35	1.5-5
Glodeanu	19.5-27.8	3-3.5
Personal cases	***17.34-25.73***	***1.7-7.2***

TABLE No. 9. THE LENGTH OF THE ANATOMICAL SEGMENTS OF THE URETER.

AUTHOR	LUMBAR URETER	ILIAC URETER	PELVIC URETER	INTRAMURAL
Papilian	9-11 cm	3.4 cm	13-14 cm	1.5 cm
Ulmeanu	12-13 cm	3-4 cm	14-16 cm	1-1.5 cm
Personal cases	***7.34-8.71 cm***	***5.71-5.79 cm***	***4.21-4.38 cm***	***1-1.5 cm***

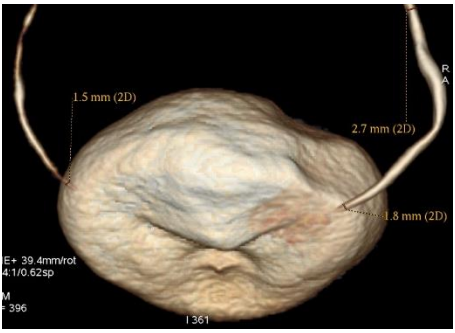


Fig. 10+. The right ureter has a caliber of 1.5 mm near the bladder. It ends on the lateral side of the bladder. The left ureter has a caliber of 1.8 mm near the bladder. It easily ends posterolaterally in the bladder.

The distances between the two ureters that I have examined on the CT, could be compared with the data described by Papilian and Ulmeanu.

TABLE No. 10. THE DISTANCE BETWEEN THE ANATOMICAL SEGMENTS OF THE URETER.

AUTHOR	DISTANCE TO ORIGIN	INTERILIAC DISTANCE	PELVIC DISTANCE	BLADDER DISTANCE
Papilian	8-10 cm	5-7 cm	9-10 cm	2-3 cm
Ulmeanu	8-9 cm	-	-	4-5 cm
Personal cases	***7.2-12.53 cm***	***2.26-7.36***	***3.04-6.84***	***2.13-4.5***

MORPHOLOGICAL ABNORMALITIES OF THE RENAL PELVIS AND URETER

During my study I have met the following renal pelvis and ureter abnormalities: duplicity of the pyelocaliceal system, bifid or double pelvis and bifid or double ureter. I have encountered renal pelvic abnormalities in 19 cases (6.11% of all studied cases) out of which in 12 cases (63.16% of abnormal renal pelvis) I have dealt with double pelvises and in 7 cases (35.83% of abnormal renal pelvis), with bifid pelvises.

Fig. 111. Double renal pelvis, each continued with its own ureter, the two ureters joining in the lower pole of the kidney.

Fig. 112. Bifid right renal pelvis, left renal pelvis is morphologically normal (posterior view).

I have found only two cases of double pelvis on both sides of the body (10.53% of the cases).

Of the 23 cases with pieloureteral abnormalities, I have found 15 cases with ureteral abnormalities (65.22% of all abnormalities), 11 cases were on the right side (73.33% of cases) and 4 cases on the left side (26.67% of cases).

In 9 cases the ureters were double (39.13% of total abnormalities and 60% of ureteral abnormalities), 8 cases were on the right side (34.78% of total abnormalities, 53.33% of ureteral abnormalities) and 1 case on the left side (4.35% of all abnormalities, 6.67% of ureteral abnormalities).

Fig. 115. Double right ureter. The superior ureter continues the superior calyceal, the renal pelvis is absent. It crosses twice the inferior ureter, the superior crossing is at the mid-point of the lower pole of the kidney and the bladder is posterior to the inferior ureter and the lower supravesical crossing passes above the inferior ureter.

Fig. 116. The superior ureter passes over the bladder medial to inferior ureter going down on its posterior side, entering the median line above the lower pole thereof, above the inferior ureter, more voluminous, which penetrates the bladder on its side of the former.

In 4 cases with double ureters (26.67% of double ureters), there were no double renal pelvises, one of these was missing, in 3 cases the superior pelvis was missing and in one case the inferior pelvis was missing.

The two ureters end on the back side of the bladder, the ureter often passes supravesical medial to the inferior ureter going down on its posterior face of the bladder in which the median line enters the top of the lower pole thereof, above the inferior ureter, more voluminous, which penetrates the bladder on its lateral side of the former.

Most commonly, in the case of double ureters, which are adjacent to each other, but have a corrugated trajectory with two or more junctions, the latter may be crossed retrovesical prior to their penetration into the bladder wall. The diameter of the double ureters

is variable, the most common is different and more rare and can have the same diameter in the different parts thereof.

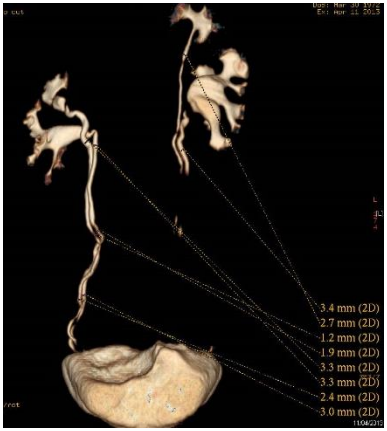


Fig. 119. Bilateral double right ureter, both ureters have a wavy trajectory and present multiple crossings. It is noted that the different diameters of ureters at different levels, but only the right ureters stem from the same diameter (3.3 mm).

I have found one case where there were bilateral double ureters.

In 6 cases there were bifid ureters (26.09% of all abnormalities and 40% of ureteral abnormalities). The confluence of the two ureters is most common at the half distance between the lower pole of the kidney and the bladder, but it can also be done higher in the kidney or in the renal hilum level, but also lower half distance between kidney-bladder, the lumbar spine or L5-S1 intervertebral disc. I have encountered one case of bilateral bifid ureter, bifid left ureter with crossed trajectory showing the confluence of the two ureters closer to the bladder.

Fig. 120. Left kidney. Bifid ureter, ureters' confluence is approximately half distance the kidney-bladder. The two ureters, extrarenal, have "gun barrel" trajectory.

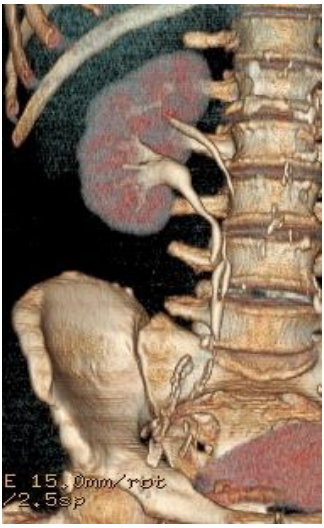


Fig. 121. Bifid right ureter, the superior one originating intrasinusal, their confluence is at the upper edge of the L5 vertebral body.

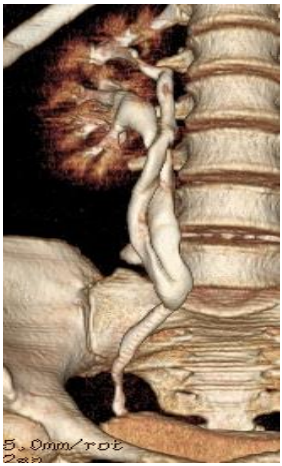


Fig. 122. Right bifid ureter, the confluence of the two ureters is made at L5-S1 intervertebral disc level.

Fig. 123. Bilateral bifid ureter. Left bifid ureter with crossed trajectory, the confluence of the two ureters is made closer to the bladder. On the right side the superior ureter goes to the front side of the inferior ureter, their confluence is made closer to the kidney, at the level of the renal inferior pole.

TABLE No. 11. THE FREQUENCY OF URETERAL ABNORMALITIES: BIFID AND DOUBLE URETERS.

AUTORUL	NR. CAZURI	PROCENTAJ
Poirier	300	2-3%
Weigert	-	10%
Bostrom	-	3%
Krause	-	<1-2%
Brewer	150	4.67%
Gatti	-	1%
Campbell	-	0.65%
Privet	-	1.8%
Glodeanu	258	3.49%
Personal cases	***311***	***7,40%***

CONCLUSIONS

It is noted the big variability as traject, relationships, morphometry and even in the number of pelvises and ureters, noting the existence of an asymmetry between morphological characteristics of the pieloureteral elements of the right and left kidney, the proof being the statistics established in the performed study. Although the existing information material in the speciality literature is abundant, ambiguities and contradictions still exist on urinary components. A very important issue is the pieloureteral junction wall structure. After Santos, in the level of pieloureteral junction the circular muscle fibers are the first to appear, featuring a complete and incomplete initial ring. The longitudinal muscle fiber appears in a greater numbers after the first week. Given the constrictive intermittent property of the circular fibers, they can be considered the high obstructive uropathies due an infants and children. Kaneto noted that the pieloureteric junction architecture is represented by a network of fibers arranged in multiple directions, and that it would develop at birth from a circular structure, to a network structure, via oblique. Tanagho observed a topographic variation of a circular muscle layer in the uretero bladder junction, finding that its disappearance was replaced with a obliquely layer, which some consider plexiform. Although the function of the urinary system starts from the 10-12 weeks of intrauterine life,the reduced amount of nerve fibers could be explained by the immaturity of the nervous system (Bossy). After Mann and Weiss, the contraction waves in the proximal portion of the ureter are generated by the induction of a electrical activity, that would have the source in the proximal portion of the urinary tract. **After Shafik, Bossy, Kamina the origin of the ureteral peristalsis is essential myogenic and not neurogenic .** So, the kidney innervation is not necessary for the renal function impairment, as well as the extrinsic innervation of the heart. It involved the existence of a "**center**", probably located in the kidney, which would be the inductor and the coil of the peristaltic waves. A proper functioning of the urinary system requires on the one hand the pieloureteral muscular wall integrity (the presence of the muscle layers with different orientations) and second the

electrical integrity of the induction mechanism that gives rise to waves of peristaltic contraction.

After Moore, the acute pieloureteral obstruction usually occurs as a result of a ureteral stone,the symptoms and the severity depends on the location, type and size of the stone, but also on his appearance, smooth or sharp. Given the fact that it is produced as a result of a ureter hiperperstaltism overlayed of theo obstruction level, the calculus computing pain is felt as a colic (Nefret colic)-like a intestinal colic. A uretral stone can cause a complete or a intermittent obstruction of the urinary flow, the obstruction can be localized along the whole length of the ureter traject, the most common is being located at the level of the narrowing of the ureter: pieloureteral junction, at crossing level of the ureter with the iliac vessels and the upper opening of the basin and in his intraparietal ,when crossing the bladder wall.

The morphometric data of an organ are important not only for the anatomist, but also for the clinician, allowing them to make a comparison with the normal dimensions and to discover a misconducts, that could favor a diagnosis, that gives information about the etiology of the disease and enable the appropriate treatment .

The pyelouretral system components involved in the very diverse renal pathology , present a big dimensional variability in the literature of speciality .At their level meet particular morphological features not only from one individual to another, but also between the two parts of the organism, so that symmetries are rarely encountered.

The ureter dimensions are characteristic for each segment, its caliber is gradually decreasing from 0.3 to 0.35 cm in the lumbar ureter level up to 0.11 to 0.18 cm at the entrance into the bladder.

The morphometric differences between different authors, sometimes quite significant, not only due to the different number of cases that they worked and the period in which the study was conducted, and especially the used working methods, the obtained results by dissection and especially by injection plastics are less accurate, the most accurate results are obtained by urography, especially by CT urography.

The anatomical variability and the upper abnormalities of the urinary tract have a particular importance for the surgery, and also for the execution of kidney transplantation (in particular for the cases

of duplicate) as well for the pielotomy, in this case the disposal of the terminal branches of the renal artery is essential.

The ureters relationships are particularly important in abdominopelvic surgery. Thus, after Moore, given the close relationship with the internal genitals organs, the ureters may be injured during the gynecologic surgery, such as for example during the radical hysterectomy. There are two main levels that can produce the injuries: the crossing of the ureter with the ovarian vessels, at the upper opening of the pelvis and the crossing of the ureter with the uterine artery near the cervix. Therefore, before these interventions, an important preventive measure is to identify the ureter throughout its pelvic traject. The ureter injury may consist in the section, breaking, pleating, ligation or in a vascular deficit at the vascular plexus level.

Since Papin is considered that the double or bifid ureters may upset the clinical picture of the renal disease and may lead to diagnostic errors. The separation of the kidney in two secondary kidneys each having with his excretory organ, may allow a conservatory surgery.Papin adds that one of the two ureters may have a abnormal termination, bladder or extra bladder. Bistran states that there is exist a variable distribution related to the gender or age of the ureteral abnormalities, which are rare and often went unnoticed, were discovered by accident, often can be discovered postmortem (after dissection).

I not agree that there are not exists variations of the pieloureteral morphological characteristics system related to sex, evidenced by the statistics described in the content of the work.

The detailed knowledge of normal anatomical variants, and also of pieloureteral malformations is essential for a properly diagnosis, the new imagistic methods CT urography, MRI and scintigraphy bringing improvements to the correct formulation of diagnosis.

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