

Vărgău M., Iliescu D.M., Ionescu C., Bordei P.

## Morphological aspects of the bifid ureter (in „Y”)

Discipline of anatomy, Department I – preclinical disciplines, Faculty of medicine, University “Ovidius” Constanța

### ABSTRACT

Our assessments on the bifid ureter resulted from the study on a number of 258 cases of renal upper pathways, using as study methods the dissection and the analysis of CT urographies. We met a total of 10 cases with bifid ureter, 4 cases on the right and 6 cases on the left, two of them showing a bilateral bifid ureter. In 8 cases the superior ureter drained only the upper part of the kidney and in 2 cases the two ureters had an equal drainage area. The superior ureteral was thinner than the lower one in 6 cases, in 2 cases the two ureters were equal in caliber and also in 2 cases the superior ureter was more voluminous than the lower one. Up to their confluence, the two ureters were linear, in one case the upper ureter was sinuous and in two cases the upper ureter describes a concave curve oriented laterally. The confluence of both ureters is most commonly on the medial margin of the kidney, under the renal hilum, an aspect we met in 7 cases. Located supero-medial to the lower ureter, the superior one showed several aspects up to the confluence with the lower one: a. passing along the medial face of the lower ureter, with a trajectory like a “gun barrel”, as seen in 2 cases; b. in 3 cases anteriorly crossed the lower ureter, with the confluence laterally; c. in 2 cases the superior ureter passed postero-medial to the lower one; d. in 2 cases the superior ureter went in front of the lower one; e. in one case the upper ureter have an

oblique infero-medial trajectory while the lower one was supero-medial, their confluence being made under an acute angle on the medial margin of the kidney, above its inferior pole.

Keywords: bifid ureter - morphology

### Introduction

The variants and the anomalies of the ureters are multiple, presenting a particular importance in urologic surgery, given the complexity of their pathology. Ureters may show an ectopic termination, congenital diverticula or may show a retro iliac trajectory.

A less common anomaly of the ureter is represented by the bifid ureter, resulted from the early division of the metanephrotic diverticulum; the duplication can be total, double ureter, or partial, bifid ureter. The same process generates the congenital diverticulum of the ureter [Caller, quoted by 1].

The first ever case of partial duplication of the ureter has been described by Juvara [2] in 1913. He also describes the partial ureteral duplicity in Y inverted or caudal bifidity, which is a rare anomaly of the ureter, as defined by the presence of a ureter which is doubled at a variable distance before reaching the urinary bladder. The doubling zone is called

Iliescu D.M.

Department of Anatomy, Faculty of medicine, University “Ovidius”  
Constanța, Romania  
Aleea Universitatii, Nr. 1, Campus B  
Constanța, Romania  
dan@anatomie.ro

confluence. The bifid ureter is a variation with female predominance of 6/1 [1,3,4,5] and Caller [quoted by 6]. It is associated with the presence of urinary stones [7]. Burych [8] described 18 cases of kidney with double ureter, using as study methods corrosion and pielography. The bifid ureter cases are more common than double ureter cases, in the literature being cited by many authors [5,7,9,10,11,12,13].

[1] present cases of ureteral bifidity or duplicity with a blind branch, which are very rare. The “blind” path occurs due to the early division of the ureteric bud and one of its two branches cannot reach the metanephrotic blastema, thus forming this blind termination [Perlmutter quoted by 1].

## Material and method

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Our samples of bifid ureter were found after a study on the pelvi-clayceal system performed on a total of 258 cases, on their upper renal tract, using as study methods the dissection and the analysis of CT urographies. The dissection was performed on pelvi-clayceal systems, on eviscerated kidneys and on dissected adult and fetal human cadavers, within the dissecting rooms of the Laboratory of Anatomy, Faculty of Medicine Constanța.

The CT urographies that we studied were provided by Medimar Explorations Center of the Emergency Hospital in Constanta, being executed on a GE LightSpeed 16 Slice CT Scanner and by Pozimed Diagnostic Center, performed on a GE LightSpeed 64 Slice VCT scanner.

## Results

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We have met a total of 10 cases with bifid ureter, 4 cases on the right side and 6 cases on the left,

two cases of them being bilateral bifid ureter. Three cases were found by dissection, the other 7 cases being discovered on CT urographies.

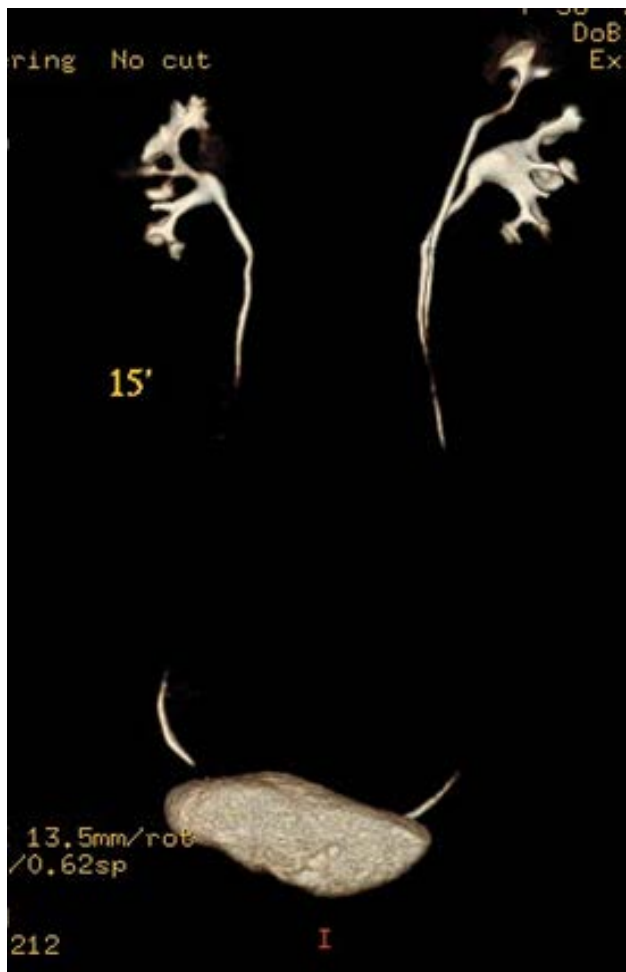
In 8 cases (5 cases on the left and 3 cases on the right), the superior ureter drained only the upper part of the kidney, and in 2 cases (one case on the right and one on the left) we had two ureters draining an equal area, each serving half of the kidney. The upper ureteral was thinner than the lower one in 6 cases (3 cases on the right and 3 cases on the left). In 2 cases the two ureters were equal in size (1 case on the right and another on the left) and also in 2 cases the superior ureter was more voluminous than the lower one, with both cases on the left side.



*Figure 1 - Left bifid ureter with parallel trajet; the confluence of the two ureters is made above the lower renal pole. Both ureters passed below the inferior renal artery, which gives off the left gonadal artery.*

If for the lower ureter we always met an evident pelvis, triangular or oval, for the upper ureter we encountered 3 cases when the pelvis was not well marked and the superior ureter continued the upper calyx, a situations where the confluence of small calyces was “in bouquet”.

Up to their confluence, the two ureters showed linear paths, in one case (on the right) finding a sinuous paths of the superior ureter and in 2 cases (one right and one left), the upper ureter described a curve concave laterally.



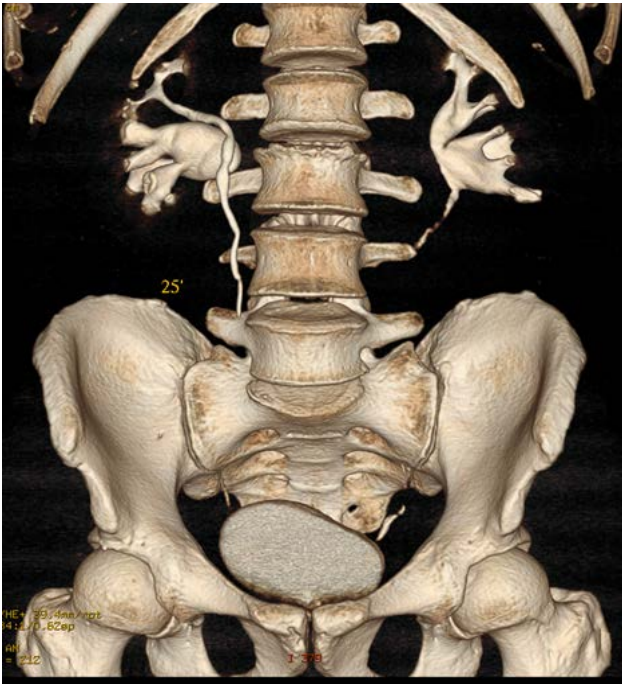
*Figure 2 - Left bifid ureter, both ureters having crossed paths, the superior one anterior the lower ureter. The upper ureter describes a curve concave laterally above the confluence. The pelvis and the inferior ureter are more voluminous*

The confluence of both ureters was, most commonly, on the medial margin of the kidney, under the renal hilum, an aspect we met in 7 cases (3 cases on the left and 4 cases on the right). In the other 3 cases (all on the left), the confluence of the two ureters is between the kidney and the urinary bladder: at the union of upper one third with middle third, halfway kidney-bladder and just above the urinary bladder.



*Figure 3 - Bilateral ureteral bifidity. Left bifid ureter with crossed trajectory, the confluence of the two ureters being closer to the urinary bladder. Right upper ureter is corrugated, with directions on the front of the lower ureter and their confluence being made closer to the lower pole of the kidney.*

At the origin the upper ureter is located supero-medial to the lower one, and then, until the confluence with the lower ureter, it may present several aspects: a. passing along the medial face of the lower ureter, with a trajectory like a “gun barrel”, as seen in 2 cases, both on the left; b. in 3 cases (2 cases on the left and one on the right) anteriorly crossed the lower ureter, with the confluence laterally; c. in 2 cases (one on each side) the superior ureter passed postero-medial to the lower one; d. in 2 cases the superior ureter went in front of the lower one; e. in one case (on the right) the upper ureter have an oblique infero-medial trajectory while the lower one was oriented supero-medially, their confluence being made under an acute angle on the medial margin of the kidney, above its inferior pole; the two ureters showed a convergent trajectory.

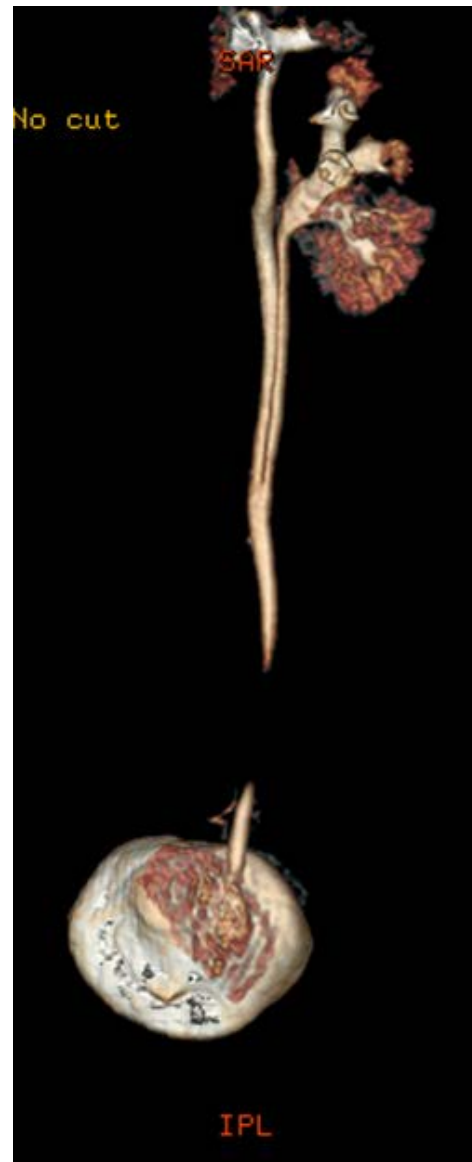


*Figure 4 - Bilateral bifid ureter. Right upper ureter describes a curve concave laterally and descends in front of the lower one. Left upper ureter descends on the posterior medial face of the lower one. The confluence of the ureters on both sides is on the medial border of the kidney.*



*Figure 5 - Right kidney. Double pyelo-calyceal system and bifid ureter: Confluated calyces in bouquet, triangular pelvises, which continues with the ureters that confluence at an acute angle, with convergent trajectory. The upper ureter is longer; but the caliber of the two ureters is equal.*

Among the 10 cases with bifid ureter, in 2 cases (one right and one left) were double renal arteries and the ureteral trajectory was retroarterial (under the lower renal artery) and in one case (on the left), from the lower renal artery arise the gonadal artery, which was unique .



*Figure 6 - Left kidney. Double pyelo-calyceal system and bifid ureter ; the ureters confluence is about halfway kidney-urinary bladder. Triangular superior pelvis is small and oval and more voluminous lower pelvis. The two ureters, have an extrarenal trajectory as a "gun barrel".*



## Discussions

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The 10 cases with bifid ureter represented 3.88% of the cases we studied, a percentage higher than the percentages given by Campbell (0.65 % of cases) and Privett (1.8 % of cases), cited by [13], which worked on a total of over 5000 cases (autopsies and urographies). The morphological abnormalities of the upper urinary system are closely interrelated, the duplicity of the pielo-calyceal system being accompanied by double or bifid ureter. The confluence of both ureters in case of bifid ureter may be extrarenal, anywhere on the path kidney - urinary bladder, but more frequently by the middle of this trajectory. The extrarenal trajet of the two ureters may be near parallel, one beside the other, like a “gun barrel” or may be slightly apart at the top, with convergent route to their confluence level. More rarely, (only 3 cases) the trajet was crossed, the upper ureter anterior the lower one over their confluence. In our study we have not found any case of ureter in “inverted Y” or ureteral duplicity with “blind” branch. Also we have not encountered any cases of ureter with ectopic termination.

## Conclusions

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A proper functioning of the urinary system requires the integrity of the upper urinary system components and especially their normal morphology. The variability of the anatomical aspects of the upper urinary system and its abnormalities show surgical particular importance, both for renal transplantation (especially cases of duplicity) and for pielotomy, in this case the normal arrangement of the components of the pielo-calyceal system being paramount.

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