

## Congenital Unilateral Double Renal Pelvis and Double Ureters Associated with Triple Renal veins and Left Retro Aortic Renal Vein

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**Abstract:** The urinary system includes the kidneys, ureter, the bladder and the urethra and their anatomical variations of the renal collecting system and renal vesicles is of great importance for surgical approaches and radiologic and other evaluative methods, like cystoscopy and retrograde pyelography. During routine dissection in the Department of Anatomy, unilateral double pelvis and double ureters were observed on the right side of a middle aged female cadaver. In addition, we also detected in the same cadaver right triple renal veins and left retro aortic renal vein. Urologists, technicians and clinicians should keep in mind such anatomical variations as guidance for therapeutic and surgical interventions to avoid complications. Hence their early detection may be helpful in better management and increased survival rates.

**Keywords:** Kidney, Mesonephric Duct, Renal Pelvis, Renal Vein, Ureteric Bud, Ureters.

### Introduction

The kidneys are pair of essential excretory organs, situated retro-peritoneally in the posterior abdominal wall. The ureters are the pair of muscular tubes which convey the urine from the kidneys to the urinary bladder. It descends from the renal pelvis (a funnel-shaped expanded upper end of the ureter) along the posterior abdominal wall, behind the parietal peritoneum, and enters the urinary bladder on the posterior inferior surface. Anatomical variations of ureters and their relationship to surrounding structures are therefore essential in surgeries involving renal transplant, radiological examinations and treatment to preserve renal functions.

Each kidney drains in to inferior vena cava by corresponding renal vein. Knowledge of the vascular variations [1] particularly renal vessels is essential during operative, diagnostic and endovascular procedures in the abdomen and pelvis.

### Case Report

During routine cadaveric dissection for the undergraduate students in the Department of Anatomy, Santhiram Medical College, Nandyal, of a middle - aged female cadaver, we encountered the following variations.

Unilateral double pelvis and double ureters were observed on the right side of a posterior abdominal wall.

- The duplicated ureter joined at the middle part of ureter in a Y-shaped manner and finally entered the urinary bladder on the posterior inferior surface [Figure 1 and 2].
- Double ureters descended from the separate renal pelvis (double pelvis) originated from the upper and lower renal poles of the right kidney [Figure 3].
- In addition, triple right renal (one main renal vein and two lower polar renal veins) veins were noted in the present case have unique relations with the renal artery and renal pelvis of the double ureters near the hilum of the kidney.
- Main right renal vein noted in this case was formed by the union of upper vein draining the upper pole of kidney and middle vein draining the middle portion of kidney (Figure 2).
- Lower anterior and posterior polar accessory renal veins, draining the lower pole of right kidney joined the inferior vena cava at a distance of 3.4 cm below the main renal vein (Figure 2 and 4).

Addition to this left retro aortic renal vein was also noted (Figure 2).

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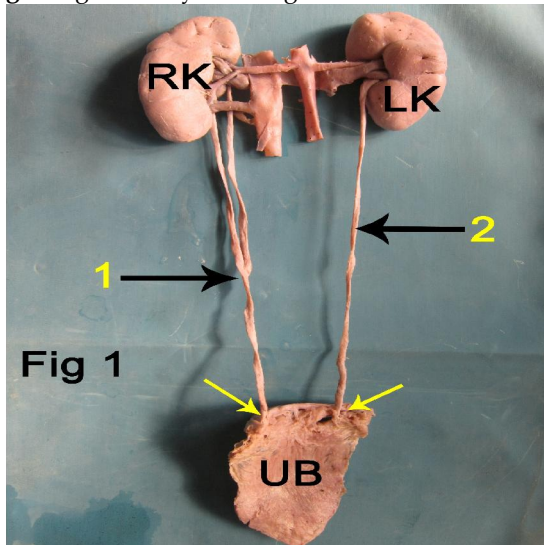
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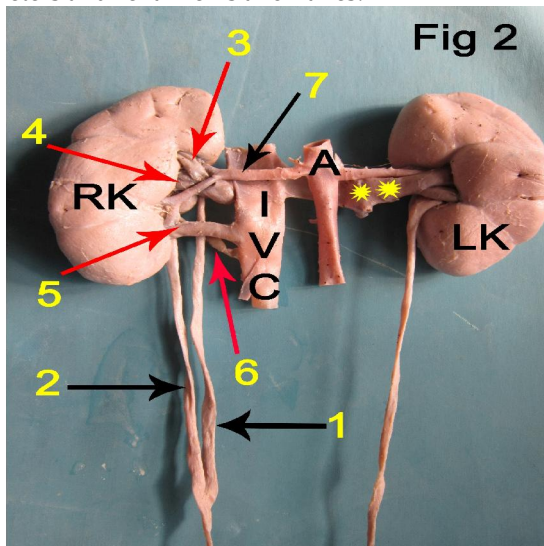
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**Fig.1:** Right kidney showing double ureters.



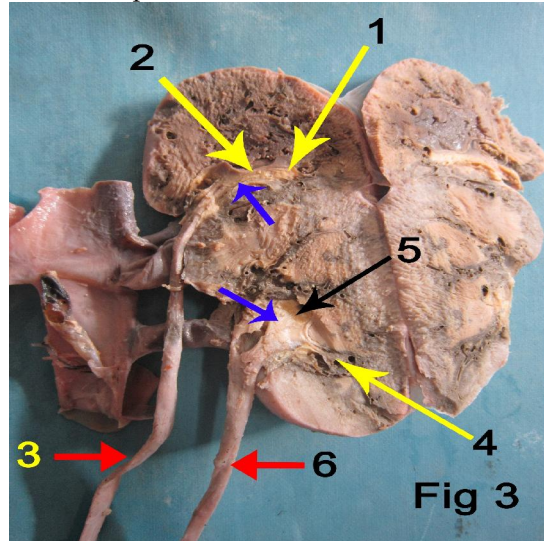
1- Double right ureters joined at the middle part of ureter in a Y-shaped manner; 2- Single left ureter; RK-Right Kidney; LK-Left Kidney; UB- Urinary Bladder; Yellow arrows- Ureters entered the urinary bladder on the postero inferior surface.

**Fig.2:** Anterior view of kidneys showing double ureters and renal veins anomalies.



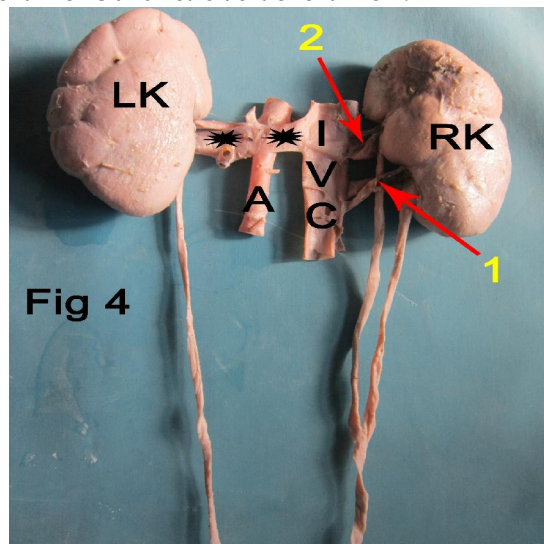
1 and 2- Double right ureters; 3 and 4- upper vein and middle vein unite to form main right renal vein; 5- Lower right anterior polar vein; 6- Lower right posterior polar vein; 7- Right renal artery; RK-Right Kidney; LK-Left Kidney; IVC-Inferior Vena Cava; A- Abdominal aorta; Yellow stars- Left retro aortic renal vein;

**Fig.3:** Coronal section through right kidney showing double renal pelvis.



1 and 2- Minor and major calices; Blue stars- Double right renal pelvis; 3- ureter descending from the renal pelvis of upper pole of kidney; 4 and 5- Minor and major calices; 6- ureter descending from the renal pelvis of lower pole of kidney;

**Fig.4:** Posterior view of kidneys showing accessory renal veins and retro aortic renal vein.



1- Posterior lower right polar renal vein; RK-Right Kidney; 2- Main right renal vein; LK-Left Kidney; IVC-Inferior Vena Cava; A- Abdominal aorta; Black stars- Left retro aortic renal vein.

### Discussion

The urinary system includes the kidneys, ureter, the bladder and the urethra, knowledge of anatomical variations of the urinary system is of great importance for not only urological conditions but also in surgeries involving renal transplant and radiological examinations interpretation. In terms of their development the kidney and the ureter develop from intermediate mesoderm. Metanephric kidney began to develop in the 4<sup>th</sup> week of intrauterine life and consists of two parts- collecting

and secretory. The collecting part includes ureter, major and minor calyces.

The ureters normally arise in the fourth to fifth week as a ureteric bud (metanephrogenic diverticulum) of the mesonephric ducts. The cranial end of the ureteric bud extends into the intermediate mesoderm, where it divides many times and it will eventually give rise to the pelvis of the kidney, the major and minor calyces of the kidney and the collecting tubules.

The incomplete double ureter and subsequent double pelvis present in the case are probably due to twin ureteral buds arising from the lower end of the mesonephric duct. Such variations are more liable to become infected or to be the seat of calculus formation than a normal ureter. The Y-shaped ureter noted in this case may be the result of doubling of a single ureteral bud somewhere distal to its origin. Siomou E et al, [2] and Inamoto K et al [3] reported the duplex collecting system, whereas the duplication of the renal pelvis and ureter and its relations to the surrounding structures noted in this case make this case more unique. Duplicated ureter is a congenital renal abnormality, occurring in approximately 1% of the population. Such abnormalities may be associated with congenital genitourinary tract abnormalities like ectopic ureter or increased risk of developing urinary tract infection, pain, hydronephrosis and stone formation. [4, 5] Hence, their early detection may be helpful in better management and increased survival rates.

Knowledge about the anatomical variations of the renal collecting system is of great importance for surgical approaches and radiologic and other evaluative methods, like cystoscopy and retrograde pyelography. Urologists, technicians and clinicians should keep in mind these anatomical variations as guidance for therapeutic and surgical interventions to avoid complications.

The additional renal veins are not as common as arteries and very few cases of additional renal veins have been reported. [6] The incidents of the variations of right renal veins are more common than the left renal veins. [7, 8] Even though the right triple renal veins noted in this case, has not been cited in the recent medical literature, such renal veins variations may influence technical feasibility of the operation. [9]

Right accessory renal veins noted in the present case have unique relations with the renal artery and renal pelvis of the ureters near the hilum of the kidney. Main right renal vein was formed 2.25

cm away from the hilum of the right kidney, by the union of upper vein draining the upper pole of kidney and middle vein draining the middle portion of kidney. It was sandwiched between the right renal artery in front and right pelvis of the ureter behind. Such variant renal vein running posterior to the renal artery or anterior to the pelvis of the ureter may be compressed by it or it may compress the ureter. Retro aortic left renal vein found in this case may be compressed and leads to retrograde venous return, which results in increases the pressure of gonadal veins leading to varicosity of veins and nutcracker syndrome. Such retro aortic left renal vein noted in this case may have an increased risk of developing haematuria, pain, thrombosis, left renal vein hypertension. [10]

Double ureter noted in this case were sandwiched between the lower anterior and posterior polar accessory renal veins, such rare variant relations may compress the ureters which results in narrowing of the ureteral lumen, causing functional obstruction of ureters.

The anterior and posterior polar veins entered the IVC at a distance of 3.8cm below the main right renal vein. The knowledge of such accessory renal veins entry into the inferior vena cava and their variations is essential during catheterization and planning porto-renal shunt procedures. [11]

## Conclusion

Knowledge of double ureters and double pelvis of ureters noted in this case is of great importance for not only urological conditions but also in surgeries involving renal transplant and radiological examinations interpretation, as this may reduce unnecessary complications. Addition to this accessory right renal veins and its level of entry into the IVC, as well as the left retro aortic renal vein noted in the present case are of considerable importance in planning porto-renal shunt procedures, kidney transplant, laparoscopic surgery, radiological interventions and penetrating injuries to abdomen. [12,13]

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