



“Unilateral Double Renal Pelvis, Proximal Bifid Ureter and Associated with Variations of Renal Vessels in a single cadaver” A rare variation of the renal collecting system

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ABSTRACT

The development of the renal vessels account for the fact of the complicate development of the kidney. During routine dissection in the Department of Anatomy found the presence of Unilateral Double Renal Pelvis and Proximal Bifid Ureter is a rare anomaly were observed on the left side of a 58 years old male cadaver, which may develop due to delayed development of the metanephric tissue or a relatively rapid development of the ureteric bud. The anatomical variations of the renal collecting system associated with renal vessels are of great importance for surgical approaches radiology other evaluative methods like cystoscopy and retrograde pyelography and renal transplantation.

KEYWORDS : Kidney- Double Renal pelvis - Bifid Ureter - Renal Arteries - Renal Veins, Hilar structures variations

Introduction:

Kidneys and ureters are situated retro-peritoneal in the posterior abdominal wall. The development of the collecting ducts of the permanent kidney begins with the formation of the ureteric bud. It penetrates the metanephric blastema, which as a cap is moulded over its distal end. This end subsequently dilates to forming the primitive pelvis, simultaneously splits into cranial and caudal portion, further major calyces. Classically, the topographic arrangement of the hilar structures is referred to in the antero -posterior sense, as its vein-artery-pelvis. Unilateral double renal pelvis, bifid ureter associated with variations of renal vessels, and disposition of hilar structures is one of the rare anomalies of the collecting system. This variant may be associated with other variations like bifid kidney, ectopic kidney, horseshoe kidney and renal dysplasia. This could be caused by embryological factors and they can develop hydronephrosis. Awareness about these variations may serve as a useful guide for the radiologists, Urologists and vascular surgeons. It can help to prevent diagnostic errors, and avoid surgical complications.

Case Report:

During routine cadaveric dissection for the undergraduate students in the Department of Anatomy, Heritage Institute of Medical Sciences, Varanasi, U.P, India on the left side of a 58 years old male cadaver, we encountered the following variations.

Unilateral double pelvis and proximal bifid ureter associated with the renal vascular variations were observed on the left side of a posterior abdominal wall.

1: With conventional dissecting techniques, the posterior abdominal wall contents were well dissected. For making free access to the kidneys the abdominal cavity contents were removed. Following the fine dissection, Special care was given to the course of bifid ureter, and renal vessels, photographs were taken. This cadaver showed a pronounced unilateral double renal pelvis and variation in the branching pattern and disposition of renal vessels. In the left kidney these two major calyces joined to form the double renal pelvis bifid ureter at the hilum, and descend as a separate renal pelvis and fuses with each other at the lower pole of the kidney later showed its usual course of ureter on the left side.[fig 1, Fig2(a) & Fig2(b)].

Fig 1

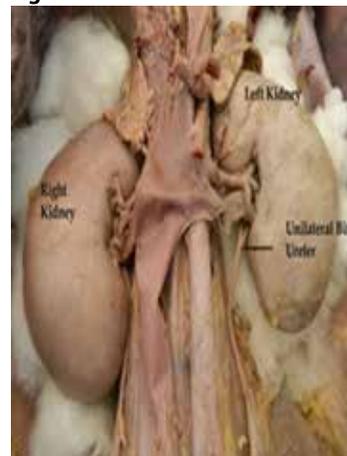


Fig 2(a)



Fig 2(b)



Fig 4(b)

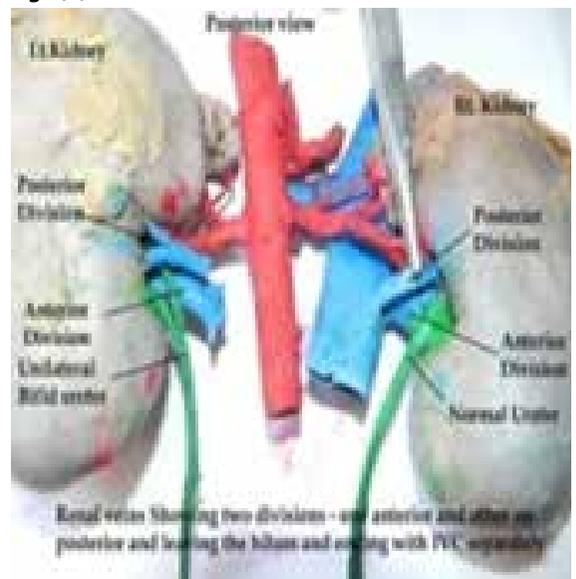


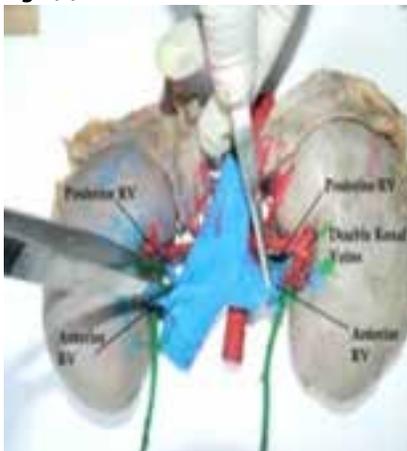
Fig 3



Fig 5



Fig 4(a)



2: Other interesting findings in left kidney were the Accessory renal artery-(upper polar artery) arising just at the beginning of left renal artery, entering at the upper pole of the kidney. Interestingly this branch also gave origin to inferior supra renal artery to left suprarenal gland. Whereas the on the right side the right renal artery was arising directly from the abdominal aorta at the level of L2 as normal pattern, but it gives two branches to the right suprarenal gland, supplying supra renal gland instead of one. Bilateral Renal arteries were showed three segmental branches before entering the renal parenchyma.(Fig 3)

3: The renal veins in both kidneys were formed into two divided into two divisions one anterior and other on posterior and leaving the hilum and ending with IVC separately. [fig4(a) & Fig 4(b)]

4: The disposition of hilar structures, On the right side, the arrangement of the hilar structures from anterior to posterior were renal artery above, anterior division of renal vein below, middle the posterior division of renal vein, and posteriorly renal pelvis. This was seen as the A-V-V-P type of arrangement. We also noted the renal pelvis was entrapped between the renal vessels, on the left kidney. The arrangement is A-V-P-V from anterior to posterior was renal artery anteriorly, anterior branch of renal vein, double renal pelvis and posteriorly posterior branch of renal vein. Thus, the normal arrangement was not seen on both the sides. (fig 5)

Discussion:

Bifid ureter were usually unilateral it shows approximately in 25% individuals.¹ It is due to premature division of the ureteric bud near its terminations. In terms of their development the kidney and the ureter develop from intermediate mesoderm. 4th week of intrauterine life metanephric kidney began to develop and consists of two parts- collecting and secretory. The collecting part includes ureter, major and minor calyces. 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. Bifid ureter in this case was due to the longitudinal splitting of single normal ureteric bud.²

Variations in the major calices and pelvis are more marked. The major calices may pass downward for some distance beyond the hilum, and end by joining to form the ureter without undergoing any obvious expansion. In such cases, the pelvis is absent; if the calices dilate, one or two pelvis may be present.³

1- Siomou E et al,⁴ and Inamoto K et al⁵ reported the duplex collecting system, whereas bifid ureter and its relations to the surrounding structures noted in this case make this case more unique. Such anomalies may be associated with congenital genitourinary tract anomalies like ectopic ureter or increased risk of developing urinary tract infection, pain, hydronephrosis and stone formation.

The results of the previous studies which were done on the patterns of the hilar structures were compared with those of the present study, as shown. In the study which was conducted by Joao et al.,⁶ they observed that the main trunk of the renal artery had divided into 3 segmental branches before it entered the renal tissue. Similarly, Arora et al., observed 2 segmental arteries on the right side.⁷ However, in this study the main trunk of the right renal artery had divided 4 segmental branches, and left renal artery the main trunk had divided into 3 segmental branches before entering the renal tissue. Such variations in the varied pattern of the divisions of the renal artery in the hilar region are generally associated with renal malformations in the embryo.⁸

In 2008 by Kaneko et al., presented 25% multiple renal arteries which included the polar or accessory renal arteries. However, some authors^{9,10} believe that this aspect may be a misinterpreting factor for the true number of renal arterial divisions.

Accessory renal arteries are common in 40% of individuals, usually arising from the aorta above or below the main renal artery. The variation in the number of arteries is because of persistence of lateral splanchnic arteries^{11,12} or due to the persistence of blood supply from lower level than normal during the ascent of kidney from pelvic to the lumbar region. When the kidneys are situated in the pelvic cavity, they are supplied by the branches of common iliac arteries. While the kidneys ascend to lumbar region, their arterial supply also shifts from common iliac artery to abdominal aorta. It is important to be aware that accessory renal arteries are end arteries; therefore if an accessory is damaged, the part of kidney supplied by it is likely to become ischaemic.¹³

The inferior supra renal artery in left kidney arising from accessory renal artery, and in right kidney the middle and inferior supra renal arteries are arises from right renal artery directly it is a rare variation. So far there is no such variations are documented.

Considering the distribution of the extra-parenchymal renal vein, Joao A et al., observed that 2.6% of the kidneys had more than one renal vein and that 7% had bifurcated renal veins. In this study, we observed 2 divisions of the renal veins one in front and behind the hilum of the kidney, coincided with the findings of the study which was conducted by Satyapal¹⁴ in South Africa. In this study there was a common observation in the both kidneys that; the incidence of the variant patterns of the renal veins was more common on the both kidneys.

The additional renal veins are not as common as arteries and very few cases of additional renal veins have been reported. This might be due to the embryological basis. Even though has not been cited in the

recent medical literature, such renal veins variations may influence technical feasibility of the operation.¹⁵

The deviant development of the venous channels, which is attributed to the formation of the renal veins, may change the interrelationship between the renal hilar structures.¹⁶

Conventional textbooks of anatomy define the relation of renal vein, renal artery and pelvis antero-posteriorly and above downwards at the hilum of each kidney. The incidence in classical position of the renal vein anterior to the renal artery has been reported to be 65%, while the position of artery, anterior to the vein has been reported to be 35% of cases, respectively. Variations in the configuration of renal calices, pelvis and ureter have been reported. Classical studies reported three different types in the configuration of the renal calices, pelvis and ureter. Type III b has been defined as one where the pelvis is split in two distant portions that leave the kidney in the form of one ureter. The present case has been reported with an incidence of 1%. Hence in the present case, the normal anatomical relationship of the renal vein, renal artery and the ureter from anterior to posterior was not observed.¹⁷

Conclusion:

Knowledge about anatomical variations such as Unilateral double pelvis and proximal bifid ureter associated with multiple renal vascular variations and disposition of hilar structures against the classical normal pattern. The presence of bifid ureter, and variations in renal artery and vein makes the hilar structures deviating from the anatomy, is of great importance for surgical approaches and radiologic and other evaluative methods, like cystoscopy and retrograde pyelography. These anatomical variations serve as guidance for therapeutic and surgical interventions to avoid complications.

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