



# Bilateral extrarenal calyces, renal pelvis and associated variations of renal vessels — A rare variation of the renal collecting system

Published online October 26th, 2012 © <http://www.ijav.org>

Suresh RAO<sup>1</sup> +

Ovchinnikov NIKOLAI<sup>1</sup>

Jagessar AVINASH<sup>1</sup>

Ramesh Rao TANTRADI<sup>2</sup>

Department of Preclinical Sciences, Faculty of Medical Sciences, University of the West Indies, St. Augustine, Trinidad and Tobago, WEST INDIES (1), KMCIC, Manipal University, Manipal, Karnataka, INDIA (2).



+ Dr. Suresh Rao  
Head, Anatomy Unit  
Associate Dean Students Affairs  
Department of Preclinical Sciences  
Faculty of Medical Sciences  
UWI, St. Augustine  
TRINIDAD and TOBAGO.  
☎ +1 (868) 7491104  
✉ [s4chavan@yahoo.co.in](mailto:s4chavan@yahoo.co.in)

Received February 3rd, 2012; accepted June 10th, 2012

## Abstract

The presence of extrarenal calyces is a rare anomaly, which may develop due to a disparity resulting from slow development of the metanephric tissue or to a relatively rapid development of the ureteric bud. Bilateral extrarenal calyces, which are characterized by calyces and renal pelvis that lie outside the renal parenchyma, associated with variations of renal vessels is one of the rare anomalies of the collecting system. Patients with such variations may be asymptomatic in some cases; in others, they can develop hydronephrosis. During routine dissection we found a rare case of bilateral extrarenal calyces and renal pelvis with multiple variations in the renal vessels.

© *Int J Anat Var (IJAV)*. 2012; 5: 62–64.

**Key words** [extrarenal calyces] [renal pelvis] [variation]

## Introduction

Bilateral extrarenal calyces, which are characterized by calyces and renal pelvis that lie outside the renal parenchyma, associated with variations of renal vessels is one of the rare anomalies of the collecting system. This variant may be associated with other variations of the urogenital system, like bifid kidney, ectopic kidney, horseshoe kidney and renal dysplasia. This could be caused by embryological factors. Patients with such variations may be asymptomatic in some cases; in others, they can develop hydronephrosis. Awareness about details and topographic anatomy of various variations of the urogenital system may serve as a useful guide for both radiologists and vascular surgeons. It can help to prevent diagnostic errors, influence surgical and interventional procedures and avoid surgical complications. We present a case of bilateral extrarenal calyces and renal pelvis with multiple variations in the renal vessels that were present in a 55-year-old African male cadaver.

## Case Report

Using conventional dissecting techniques, the posterior abdominal wall contents was dissected in a 55-year-old, well built, embalmed African male cadaver, with a purpose

of preparation of the teaching and museum anatomical specimens. The history of this cadaver was not available and there were no signs of any other disease, pathological conditions, trauma, surgery or wound scars in the abdominal region. Laparotomy was performed using a midline anterior abdominal incision. The skin of the anterior abdominal wall, the superficial fascia, and the anterior abdominal wall muscles were removed systematically on both sides. The contents of the abdominal cavity were also removed thus providing free access to the kidneys. Special attention was given to the course of extrarenal calyx, renal pelvis, renal vessels and testicular veins. Following the fine dissection, the posterior abdomino-pelvic wall was photographed.

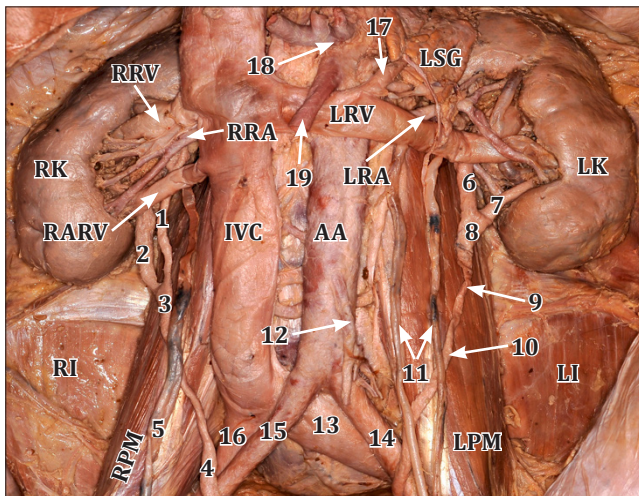
This 55-year-old, well-built, African male cadaver showed a pronounced bilateral variation of extrarenal calyces, renal pelvis, and variation in the branching pattern of renal vessels. Duplicated external calyces on the right side were measuring about 4.5 cm and on the left side it was 4.0 cm outside the renal parenchyma. These two extrarenal calyces joined to form the renal pelvis and later showed usual course of ureter on both the sides. The most interesting finding on the right side was the presence of superior and inferior renal veins. On the left side only one renal vein was present. There were two

separate testicular veins draining separately to the left renal vein. On the right side only one testicular vein was present and it was draining into the inferior renal vein. Renal artery on the right side showed five segmental branches before entering the renal parenchyma.

## Discussion

The variations of the renal collecting system represent a complex and often confusing subset of urological variations. They manifest in many ways and often make preoperative diagnosis difficult. Extrarenal calyces are one of the rare variants of the collecting system, which may be associated with other variations of the urogenital system. The urogenital system for some reason is more likely than any other to have birth defects. Their anomalies occur in many varieties and manifestations. Approximately 30% of the children born with congenital anomalies tend to have urogenital abnormalities.

There is considerable variation in the number of renal calyces and the shape of the renal pelvis, but there is also a marked variation in the position of the pelvis. Thus a pelvis may lie almost entirely within the sinus, an intrarenal pelvis, or its



**Figure 1.** Anterior view of the right and left kidneys with their elongated extrarenal/extrahilar parts of major calyces, extrarenal/extrahilar pelvises and right and left ureters on the dissected posterior abdominal wall of an adult male. (1: extrarenal part of superior major calyx of right kidney; 2: extrarenal part of inferior major calyx of right kidney; 3: right extrarenal/extrahilar pelvis; 4: right abdominal ureter; 5: right testicular vein; 6: extrarenal part of superior major calyx of left kidney; 7: extrarenal part of inferior major calyx of left kidney; 8: right extrarenal/extrahilar pelvis; 9: pelviureteric region; 10: left abdominal ureter; 11: left testicular veins; 12: inferior mesenteric artery; 13: common iliac vein; 14: left common iliac artery; 15: right common iliac artery; 16: right common iliac vein; 17: left suprarenal vein; 18: celiac trunk; 19: superior mesenteric artery; AA: abdominal aorta; IVC: inferior vena cava; LI: left iliacus; LK: left kidney; LPM: left psoas major; LRA: left renal artery; LRV: left renal vein; LSG: left suprarenal gland; RARV: right accessory renal vein; RI: right iliacus; RK: right kidney; RPM: right psoas major; RRA: right renal artery; RRV: right renal vein)

main portion may be a dilated sac and lie outside the kidney proper, an extrarenal pelvis [1].

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 [2].

The renal veins show less variation than do the renal arteries. One study found multiple renal veins to be rare on the left side and common on the right side. The venous drainage of each kidney is normally through one renal vein, which drains the blood from the kidney into the inferior vena cava. The left renal vein also receives the left suprarenal and left testicular veins in addition to that coming from the left kidney. The right renal vein however drains only the right kidney. Both testicular veins were found draining into a left renal vein. The gonadal vein may be represented by several vessels or may form a plexus [2].

Horseshoe kidney with extrarenal calyces was observed in a female cadaver. Two small caliber renal arteries supplied the upper segment of the organ on either side. A single accessory artery originated from the right side of the aorta and branched to supply the right and left middle segments as well as the well developed connecting bridge. The entire major and few minor calyces were extrarenal on both sides. The condition could be due to a disparity resulting from slow development of the metanephric tissue or to a relatively rapid development of the ureteric bud [3].

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 or due to the persistence of blood supply from lower level than normal. All the accessory renal arteries in the present case reached the kidney anterior to the inferior vena cava. This is because of the developmental reasons of the inferior vena cava. The right post-cardinal vein contributed mainly to form the post-renal segment of the inferior vena cava. Accessory renal veins were the persistent mesonephric veins draining into the right subcardinal vein. It is not very uncommon to find accessory renal artery (or arteries) or double ureter and a number of such cases have been reported. However, multiple variations in a single subject is very rare, in one of the male cadaver the kidney presented a number of variations. It was found that the right kidney had four (accessory) renal arteries and three renal veins. The hilum extended on to the anterior surface and presented double ureter. In pyelostomy the incision to the renal pelvis should be made from posterior surface to avoid numerous branches of the renal arteries. Presence of accessory renal artery can be either a direct cause or an aggravating factor in the production of hydronephrosis. Double ureter is more liable to infections, calculus or hydronephrosis. Position of the ureter or ureters is important in case of hysterectomy [4].

In 1925 the presence of extrarenal calyces was described first and so far only total number of twenty cases has been reported. The exact cause for extrarenal calyces is not known. But the condition could be due to a disparity resulting from slow development of the metanephric tissue or to a relatively rapid development of the ureteric bud. If the ureteric bud has rapid or precocious development, the calyceal system could well develop prior to its coalescence with the nephrogenic mass. Conversely, lag in the growth of the nephrogenic mass could delay its attachment to the collecting system, permitting extrarenal development of the first or second order of the collecting system. Horseshoe kidney with extrarenal calyces observed in a female cadaver. Association of extrarenal calyces and horseshoe kidney seems to have not been documented in the available literature [5].

During exploration Taha et al found 3 major calyces (extrarenal calyces) which were unusually long. They were all grouped

within a single sheath, and were initially mistaken with the proximal ureter. Despite the rare incidence of extrarenal calyces, it is important to bear this condition in mind when operating on a kidney with distorted calyceal appearance in preoperative imaging studies. This would safeguard against inadvertent injury of the calyces when operating on a well functioning kidney. Abnormalities of the lower urinary tract as ureterocele, ectopic ureters or vesico-ureteral reflux are common in children with renal dysplasia. Kidney with extrarenal calyces is usually associated with other manifestations like bifid kidney, renal ectopia, horseshoe kidney and renal dysplasia [6].

Deviations of embryonic development of blood vessels from the most common patterns are frequently encountered and widely recognized.

---

## References

- |   |  |
|---|--|
| <p>11] Anson BJ, Morris' Human Anatomy. 12th Ed., New York, Mc Graw-Hill Book Company. 1966; 1464.</p> <p>12] Bergman RA, Thomson SA, Afifi AK, Saadeh FA. Compendium of Human Anatomic Variation. Baltimore, Urban &amp; Schwarzenberg. 1988; 81–92, 171–172.</p> <p>13] Mohanty C, Ray B, Samaratunga U, Singh G. Horseshoe kidney with extrarenal calyces — a case report. <i>J Anat Soc India</i>. 2002; 51: 57–58.</p> | <p>14] Madhyastha S, Suresh R, Rao R. Multiple variations of renal vessels and ureter. <i>Indian J Urol</i>. 2001; 17: 164–165.</p> <p>15] Nataraju G, Nandeesh BN, Gayathri MN. External calyces: A rare anomaly of the renal collecting system. <i>Indian J Pathol Microbiol</i>. 2009; 52: 368–369.</p> <p>16] Taha SA, Hashish MH, Eldarawany HM, Barakat AE, Al-Zahrani AA. Renal dysplasia with extrarenal calyces. <i>Saudi Med J</i>. 2006; 27: 392–394.</p> |
|---|--|