

Vascular and Ureteric Anomalies Associated with an Abdominal Ectopic Kidney: a Case Study

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ABSTRACT

Introduction: Renal ectopia is an uncommon congenital condition, where kidney is misplaced and malrotated.

Results: In the present study, it was found that the right kidney had a lower position (at the level of L2 to L5) than usual. The hilum of the right kidney was facing anterolaterally and had two renal pelvises. The right kidney was supplied by five renal arteries and the left one by two renal arteries.

Discussion: Renal ectopia occurs due to abnormal ascent and rotation of the kidney. The majority of ectopia cases were reported in the pelvic region, but in the present study it was found in the abdominal region.

Conclusion: Ectopic kidney may occur due to abnormal ascent and rotation of kidney. It may be associated with vascular and ureteric anomalies.

Keywords: renal ectopia, malrotation of kidney, abnormal vasculature of kidney.

INTRODUCTION

There is long list of urinary tract variation and most of them are congenital. These anomalies can lead to various pathological conditions. Variations in the renal system may be due to altered position, shape, rotation and size of the kidney. Renal ectopia is a congenital condition, where the kidney is misplaced and malrotated.

In the present study, we report a case of unilateral ectopic kidney with associated renal vas-

culature anomalies. These observations were made on one of the cadavers during routine abdominal dissection, in the department of Anatomy, Swami Vivekanand Subharti Medical College, Meerut, India.

RESULTS

On first look during dissection it was seen that the right kidney had a much lower position than usual (Figure 1). On further examination, it was found that the right kidney was located at

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the level of L2 to L5, while the left kidney had a normal position (T12 to L2). The lower pole of the kidney lied 3.8 cm above the pelvic brim on the right side and 8.8 cm above the pelvic brim on the left side.

In the present study, the left kidney was normally located in the abdomen, with normally positioned hilum (facing medially), and had a single pelvis originating from a hilum of 4.1 cm length. Contrary to this, the right kidney, which had a

lower position in the abdomen, presented an anterolateral facing hilum. There were two renal pelvises originating from the right hilum; one of them originated from the upper part of the hilum and had 3.4 cm in length, while the other originated from the lower part of the hilum and had 1.3 cm in length. Both united to form common pelvis, which was 3.8 cm long (length from the fusion point to the lower pole of the kidney). The length of ureter (from the lower pole of the kidney to the opening in the urinary bladder) on the right and left sides was 12.6 cm and 19.9 cm, respectively.

The right kidney had five renal arteries originating from the abdominal aorta and the right and left common iliac artery (Figure 2). The left kidney was supplied by a single renal artery originating from the lateral aspect of abdominal aorta, 0.3 cm distal to the origin of the superior mesenteric artery.

The left renal artery bifurcated 1.1 cm distal to its origin from the abdominal aorta. One artery passed anterior to the left renal vein and another, posterior to it. The length of the anterior and posterior branches was 3.5 cm and 4.3 cm, respectively. A single 5.6 cm long left renal vein opened into the inferior vena cava (IVC).

There was a total of five right renal arteries which originated from the abdominal aorta and common iliac artery of both sides. These arteries were numbered according to their site of origin

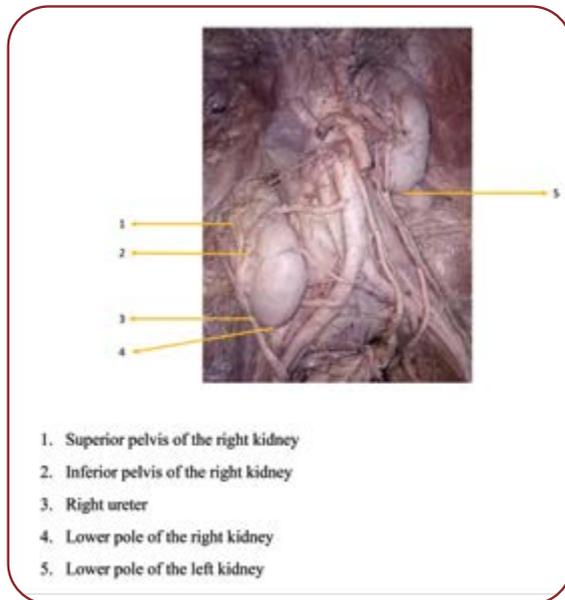


FIGURE 1. Abnormal position of lower pole and hilum the right kidney with duplication of renal pelvis

	Right kidney	Left kidney
Position	L 2 – L5	T12 – L2
Distance from the lower pole to the pelvic brim	3.8 cm	8.8 cm
Position of hilum	Anterolateral	Medial
Length of renal pelvis	Superior pelvis: 3.4 cm Inferior pelvis: 1.3 cm Common pelvis: 3.8 cm	Single pelvis: 4.1 cm
Length of ureter	12.6 cm	19.9 cm
Renal arteries	First artery: 7.3 cm Second artery: 4.1 cm Third artery: 5.1 cm Fourth artery: 8.8 cm Fifth artery: 4.6 cm	Common renal artery 1.1 cm, divided into: - anterior artery: 3.5 cm - posterior artery: 4.3 cm
Renal vein	4.8 cm	5.6 cm
Dimension of kidney	11.2×5.7×3.2 cm	10.7×5.6×4.5 cm

TABLE 1. Comparison between the right and left kidney

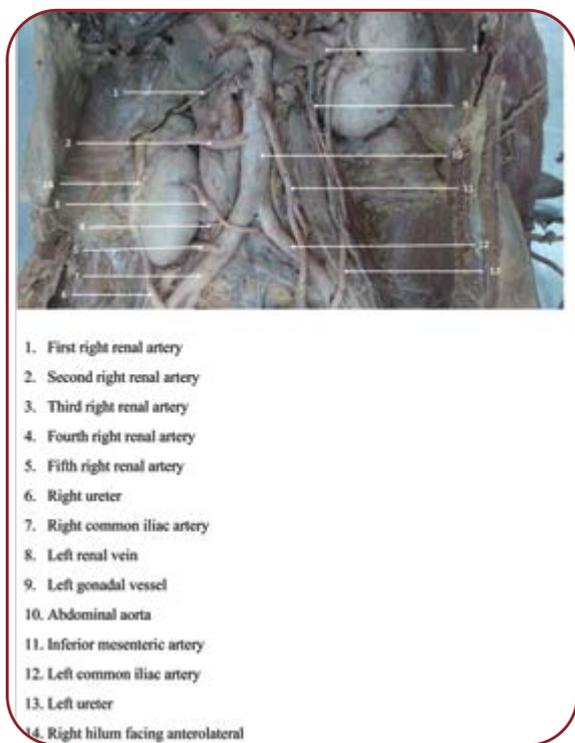


FIGURE 2. Abnormal right renal arteries

TABLE 2. Number of renal arteries observed in previous case reports of ectopic kidney

	Previous case reports	Number of renal arteries
1.	Luke, 2003 (13)	2
2.	Grogan, 2004 (14)	1
3.	Boughey, 2004 (15)	3
4.	Li, 2006 (16)	3
5.	Goldsmith, 2009 (17)	3
6.	He, 2012 (18)	2
7.	Krishnaveni, 2013 (12)	Right: five; left: two
8.	Yaich, 2014 (19)	3
9.	Siemens 2015 (20)	2
10	Minne, 2017 (11)	1
11	Present study	5

cranio-caudally. The first right renal artery originated from the anterior aspect of the abdominal aorta 0.4 cm distal to the origin of the superior mesenteric artery; it was 7.3 cm long and passed posterior to the IVC and the right renal vein and opened into the hilum of the right kidney.

The second right renal artery also originated from the anterior aspect of the abdominal aorta 4.7 cm distal to the origin of the superior mesenteric artery; it was 4.1 cm long and passed ante-

rior to IVC and eventually entered into hilum of right kidney.

The third right renal artery originated from the posterior aspect of the left common iliac artery, 0.5 cm distal to the bifurcation of aorta. It passed anterior to the right common iliac artery and entered into the right kidney along the lower part of the medial border. This artery was 5.1 cm long.

The fourth right renal artery originated from the anterior aspect of right common iliac artery, 1.6 cm distal to the bifurcation of the abdominal aorta. It passed behind the right kidney and entered it 5.7 cm above the lower pole along its lateral border. This artery was 8.8 cm long.

The right fifth renal artery originated from the anterior aspect of the right common iliac artery 2.7 cm distal to the bifurcation of the abdominal aorta. It opened into the posterior surface of the right kidney, just above the lower pole. The length of this artery was 4.6 cm.

There was a single right renal vein originating from the hilum of the right kidney, passing anterior to the right kidney and eventually opening into the IVC. The length of the right renal vein was 4.8 cm. The dimensions of the right and left kidneys were 11.2×5.7×3.2 cm and 10.7×5.6×4.5 cm, respectively.

Embryology

The kidney initially grows in the pelvic region and later ascends into the abdominal region. Ascent occurs due to growth in lumber and sacral regions, which decreases the body curvature. In the pelvic region, the embryonic kidney (metanephros) receives its blood supply from the pelvic branch of aorta. During ascent, renal arteries continuously originate from a higher level and lower arteries may remain, but usually degenerate. If these arteries remain, they are called accessory renal arteries (1).

DISCUSSION

Simple renal ectopia is defined as misplaced and malrotated kidney, with inferior misplacement being the most commonly encountered anomaly, though superior misplacement in thorax has also been reported by many authors (2). According to some reports, the incidence of renal ectopia ranges from 1:900 to 1:12 000 (3-5), but it is difficult to assume the exact range be-

cause the majority of ectopia cases are asymptomatic and require no intervention. If symptom develops, it may be due to vesicoureteral reflex, renal calculi, urinary tract infection and hydro-nephrosis (6, 7). Thompson *et al* (8) reviewed 97 ectopic kidneys and observed that 61 were located in the pelvic region, 28 in the abdominal region and eight in the iliac region (false pelvis).

Renal rotation anomalies are associated with renal ectopia. According to Braasch and Weyrauch (9, 10), there are four major types of rotation anomalies: non-rotation, incomplete rotation, reverse rotation and excessive rotation. In case of non-rotation, renal pelvis is present ventrally and in case of incomplete rotation, ventromedially. Reverse rotation and excessive rotation are rare anomalies, in which the renal pelvis can assume any position (ventrally in reverse rotation, and posteriorly in excessive rotation).

In the present case, the renal pelvis is present antero-laterally and out of five renal arteries, three are present anteriorly, while two passes posterior to the right kidney. The present case scenario cannot be explained by the previously described rotational anomalies.

The majority of ectopic kidney cases reported till now have an abnormal number of renal arteries. Minee *et al* (11) reviewed 12 case reports of renal transplants where ectopic kidneys were used as

conduits; they noticed a discrepancy in the number of renal arteries in three out of 12 cases in CT angiographic and operative findings.

In the present study, we found five renal arteries through careful dissection. It is very likely that some renal arteries may be missed in CT angiography if the radiologist is not experienced enough.

Krishnaveni *et al* (12) published a case report about the right ectopic kidney located lower in the abdomen with an anterolateral hilum; authors had also observed an abnormal vasculature with five renal arteries on the right side and three on the left side.

CONCLUSION

Renal ectopia is an uncommon anomaly. It occurs due to an abnormal ascent of the kidney. It is also associated with rotation anomaly. Renal ectopia may be asymptomatic, but it can be associated with hypertension, vesicoureteral reflux and renal insufficiency. Ectopic kidney can also be used in renal transplant and therefore, a detailed study of ectopic kidney with adequate sample size is needed. □

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