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CASE STUDY

MORPHOLOGICAL STUDY OF HORSE SHOE KIDNEY

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ABSTRACT

We report the morphological findings of a case of horse shoe kidney and analyze the size and position, renal hilum, vascular and calycealsystems of the kidney. The horse shoe kidney of our case fuses lower pole below inferior mesenteric artery with parenchymal tissue. Larger area of left hilum than right both face anteriorly. They consist of extra renal calyxes. The kidney was supplied by six arteries and drained by three veins. We discussed morphologic and embryonic importance of the anomaly.

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INTRODUCTION

The horse shoe kidney is one of the most common renal malformations. Incident of this occurs 0.25% in general population. It is more frequent in men (2:1) than women. The lower poles of kidney get fused by connecting fibrous tissue or parenchymal tissue. During ascent of kidney, they fuse below at the level of inferior mesenteric artery with regards to isthmus. Both ureters pass in front of the isthmus causing compression of the ureter causing to hydronephrosis, stone formation. They occur mostly in pelvis of the ureter. The anomaly was encountered during routine dissection in the department of anatomy, UCMS, Bhairahwa. It was observed in an approximately 50 yrs male cadaver and the cause of death was ascertained.

CASE REPORT

1.Size and Position

The kidneys were connected via connecting bridge called isthmus from lower poles of their kidneys. The width of the upper pole of right kidney was 52 mm at the level of L1 vertebra. The distance of the pole from midline was 52mm. The width of upper pole of left kidney was 49mm at the level of L1 vertebra (slightly higher than the right kidney). The distance of upper pole of the left kidney from midline was 70 mm. The distance between the upper poles of both kidneys was 65mm. The isthmus lied 11mm below the inferior mesenteric artery, 88mm above the sacral promontory occupying between L3-L4 vertebrae. The width of isthmus was 37mm. The maximum width was observed 43 mm towards left lateral end

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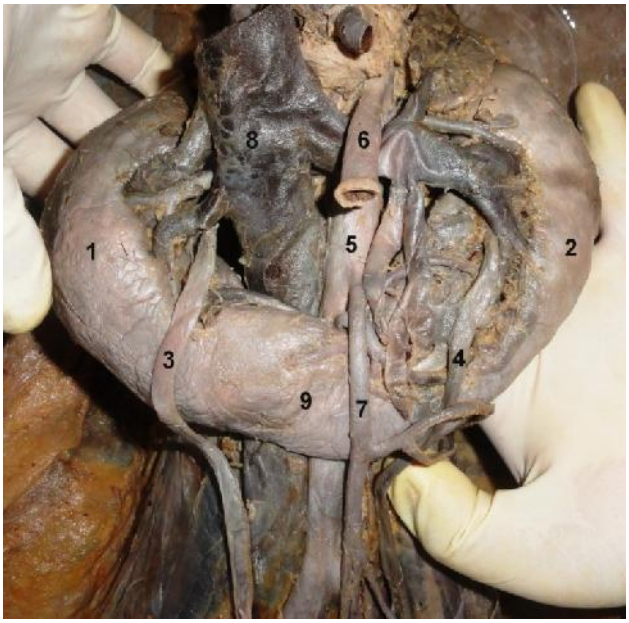

Figure 1. Paranomic view of horse shoe kidney; 1 right kidney, 2 left kidney, 3 right ureter , 4 left ureter, 5 abdominal aorta , 6 superior mesenteric artery, 7 inferior mesenteric artery, 8 inferior venacava, 9 isthmus

2.Renal Hilum

The hilum presents in the right kidney at antero-medial and left kidney at anteriorly. The left hilum was longer and wider than the right hilum. Right hilum measured 44mm in vertical length and 19mm in maximal width. Right pelvis contained three major calyces. Left hilum measured 72 mm in vertical length and 29mm in maximal width. The hilum of both kidney

contains renal vein, renal artery and ureter respectively before backwards. Left hilum contained six major calyces.

Table 1. Dimension of kidneys and isthmus

S.No.	parameter	Right kidney	Left kidney	isthmus
1.	Vertical diameter(mm)	74	85	37
2.	Transversediameter(mm)	44	49	80
	A At upper pole(mm)			
	B At middle(mm)	52	49	
	C At lower pole(mm)	56	34	
3.	Thickness(mm)	31	35	20
	A At upper pole(mm)			
	B At middle(mm)	44	40	
	C At lower pole(mm)	48	33	

Table 2. Dimension of hilum

S.No.	Parameter	Right hilum	Left hilum
1.	Vertical diameter(mm)	44	59
2.	Transverse diameter(mm)	15	13
3. A	Upper end(mm)		
B	Middle(mm)	19	29
C	Lower end(mm)	10	22

3.Vascular system

There were observed six renal arteries supplying to the horse shoe kidney. Right superior renal artery measured 4mm thick, arised 5mm below superior mesenteric artery from lateral surface of abdominal aorta. It gave two branches after its8 mm long course. It supplied to right supra renal gland and upper pole of the kidney. No segmental braches was observed. Right inferior renal artery measured 6mm thick, arised 14mm below superior mesenteric artery from lateral surface of abdominal aorta. It gave three branches after its 53 mm long course. It supplied to right upper half of the kidney.

It gave four segmental branches. Left superior renal artery measured 4mm thick, arised at level of superior mesenteric artery from lateral surface of abdominal aorta. It gave two branches after its 23 mm long course. It supplied to left suprarenal gland and left upper pole of the kidney. It gave two segmental branches on pole of the left kidney. Left superior renal artery measured 6mm thick, arised below 9cm below the superior mesenteric artery from lateral surface of abdominal aorta. It gave two branches 23 mm after its course. It supplied to left upper half of the kidney. It gave two segmental branches. Right isthmal artery measured 4mm thick, arised 11mm below the inferior mesenteric artery from anterior surface of abdominal aorta. It gave two branches after its 23 mm long course. It supplied to right end of isthmus and lower end of the kidney. It gave two segmental branches. Right isthmal artery measured 5mm thick, arised 10mm below the inferior mesenteric artery from anterior surface of abdominal aorta. It gave two branches after its6 mm long course. It supplied to right half isthmus of the kidney. It gave eleven segmental branches.

4.Calyceal System

The calyceal system of the kidney is bilaterally extra renal. Renal pelvis, minor and major calyxes present outside the renal parenchyma. It was observed right kidney contained three major calyxes and left kidney contained six major calyxes.

DISCUSSION

This is the first caseobserved during routine dissection in the department of anatomy during the period of 1998-2013. Two theory are proposed about embryogenesis of the horse she kidney. The classical theory of mechanical fusion proposes that during embrogenesis, the lower pole of the kidney comes incontact and fuse in midline, a horse shoe kidney with fibrous isthmus is formed. More recently, it has been proposed that the

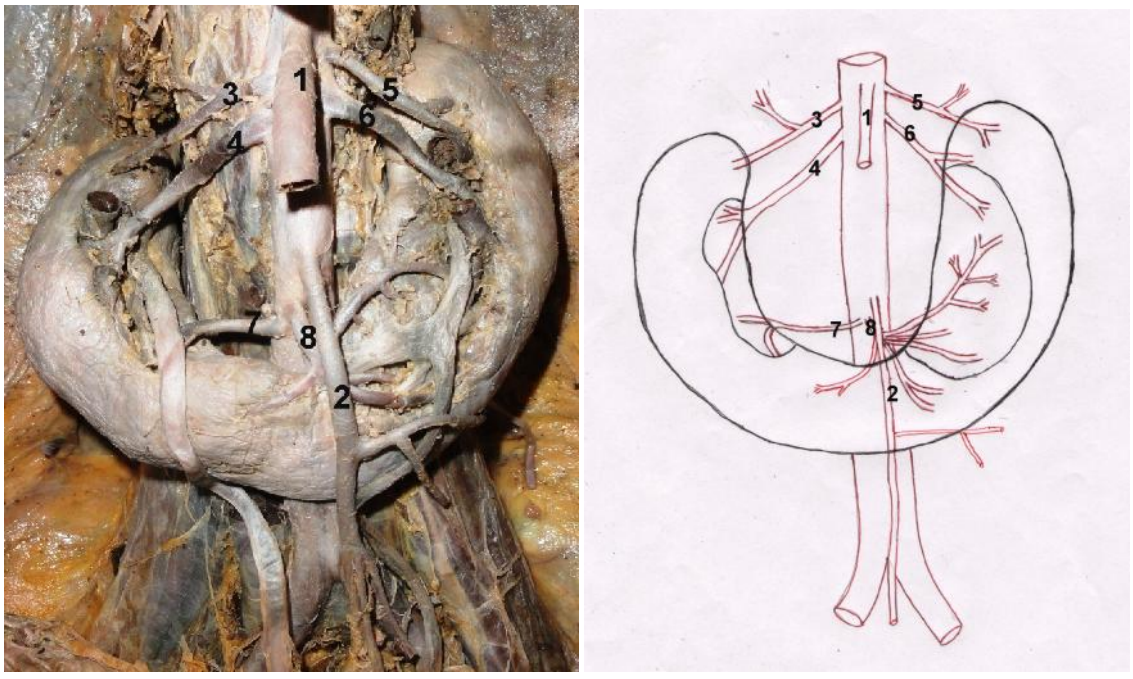

Figure 2. Horse shoe kdney showing arteries; 1 superior mesenteric artery , 2 inferior mesenteric artery, 3 right superior renal artery, 4 right inferior renal artery, 5 left superior ranal artery, 6left inferior artery, 7 right isthmal artery & 8 left isthmal artery

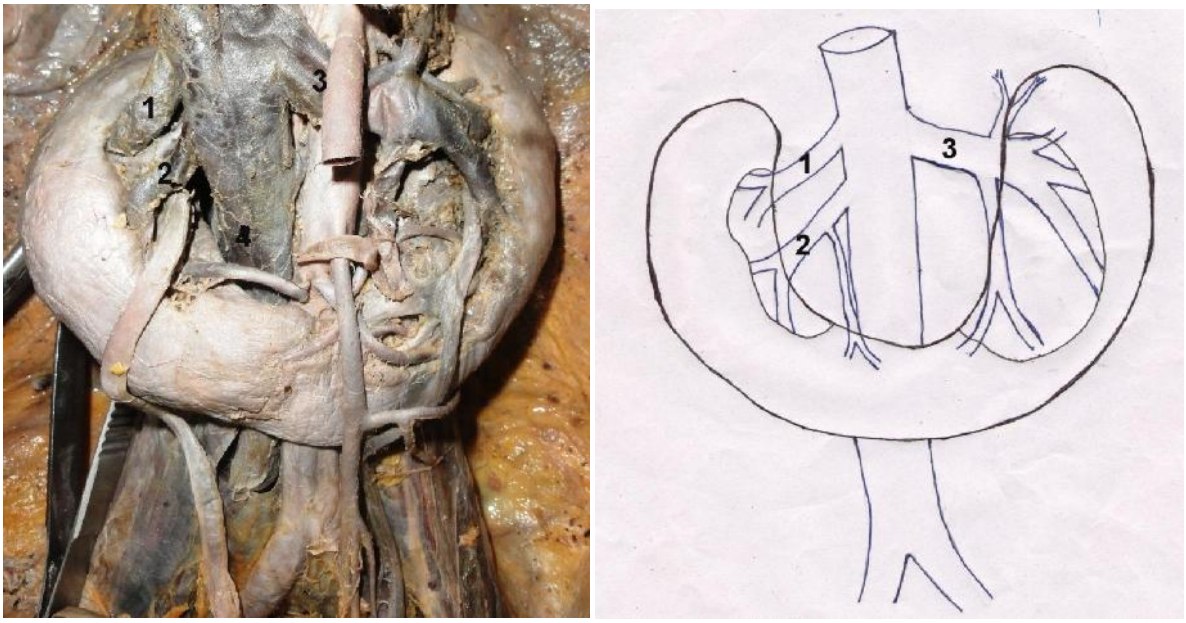

Figure 3. Horse Shoe Kidney showing viens; 1 right superior renal vein, 2 right inferior renal veins, 3 left renal vein

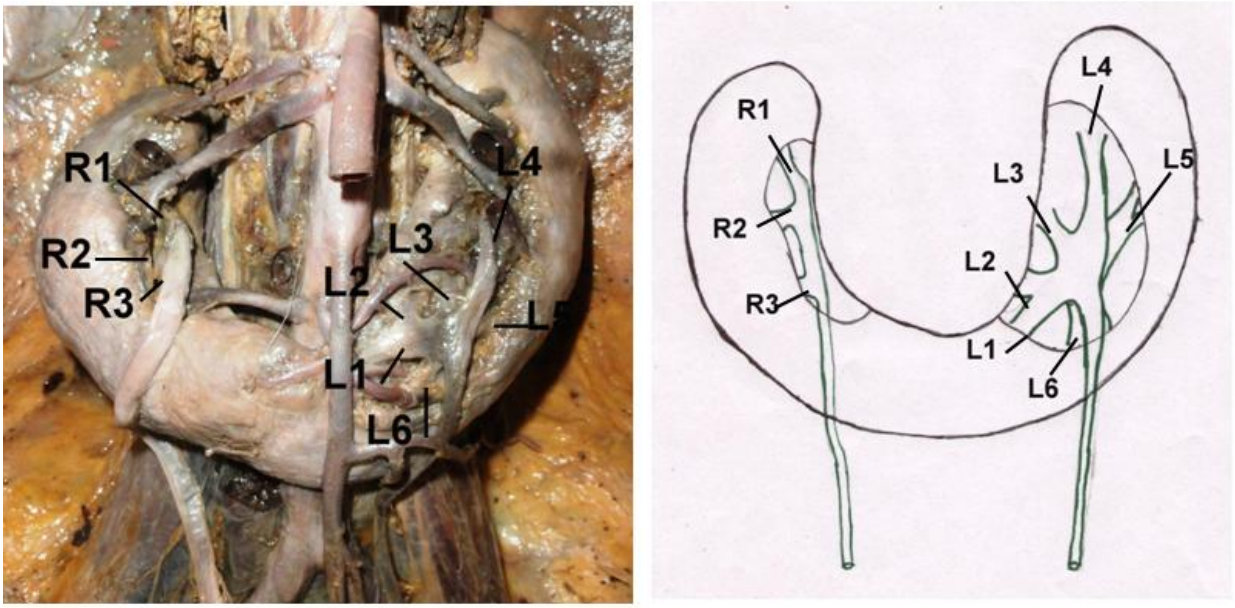

Figure 3. Horse shoe kidney showing major calyx, R1, R2 & R3 are three major calyxes of right kidney , L1, L2, L3, L4, L5 & L6 are six major calyxes of left kidney

horse shoe kidney is formed by teratogenic event that abnormal migration of cells that forms parenchymal isthmus. The location of the horseshoe kidney can vary (Tijerina, *et al.*, 2009) along the ascending trajectory of the kidneys and is found as usual location, as in our report, below the origin of inferior mesenteric artery. Hence, ascent of the kidney is limited by inferior mesenteric artery. As they ascend, the fusion the kidney prevents the normal rotation towards anteromedial and each hilum of the kidney remains anterior to it. In our case report, hilumof right kidneyfaced anterio-medially and hilum of the kidney faced anteriorly. The right kidney has two hilum, right upper medially face and lower anteriorly faced, and left lower anteriorly (Madhumita Mukharjee *et al.*,, 2013). The calyceal system in our case extra renal on both side with calyces are six in number on left side. The two extrarenal calyces joined to form the renal pelvis and later showed usual course of ureter on both the sides (Suresh Rao *et al.*, 2012). It could be due to a result from slow development of the metanephric tissue or to a relatively rapid development of uteric bud. It would well develope prior to its coalescence with nephrogenic mass. The nephrogenic mass could delay its attachment of first or second order of the collecting system (Malamnet *et al.*, 1961). The measurements of the kidney is found small variation but were expected within limits. There are wide variation in kidney vascular system, renal arteries can originate from aorta but consist of many aberrant renal arteries. This horseshoe kidney had eight arteries, which included six surplus arteries (Hirokazu Narita, *et al.*, 2012). In our report, the two arteries for each kidney originate lateral surface of aorta at and below the level of superior mesenteric artery. Two renal arteries originate from anterior surface of abdominal aorta below inferior mesenteric

artery. Both kidney including isthmus, there were three renal veins draining independently into inferior venacava. In our report, ureter crossed infront isthmus and joined independently into bladder.

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