



## SECOND PANCREAS SIGN – A SONOGRAPHIC SIGN TO IDENTIFY HORSE SHOE KIDNEY

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### ABSTRACT

**Purpose:** The purpose of the study is to establish a sonographic sign to identify horse shoe kidney. Isthmus of horse shoe kidney may be seen as a horizontal hypoechoic tissue in the midline anterior to vertebra resembling pancreas – second pancreas sign.

**Method:** The patients were examined in supine position with curvilinear probe of frequency 7 Hz. Axial images were obtained from the epigastrium to umbilicus to identify the isthmus. Complications like hydronephrosis, calculi and tumor were also looked for.

**Results:** Among the patients diagnosed sonographically with horse shoe kidney, isthmus was identified as a solid structure anterior to the aorta resembling pancreas in 84.4 % patients.

**Conclusion:** Visualization of the isthmus as ‘second pancreas’ helps in almost definite diagnosis of horse shoe kidney.

**Keywords :** second pancreas sign, horse shoe kidney, sonographic sign, renal isthmus

### INTRODUCTION

Horse shoe kidney is the most common renal anomaly. In more than 90 % of horse shoe kidneys, the inferior poles are fused. In the rest, the superior pole or both the superior and inferior poles are fused.

The isthmus is formed of functioning renal parenchyma in 85 % and of fibrous tissue in the rest. The isthmus is found at L4 / L5 vertebral level.

The incidence of horse shoe kidney is one in 400 in the general population. However, the incidence is higher in down’s syndrome, Edward syndrome, patau syndrome and Ellis- van-Crevald syndrome.

Horse shoe kidney is more common in males with a male to female ratio of 2:1.

Between 4<sup>th</sup> and 6<sup>th</sup> week of gestation, the inferior /superior poles of metanephric blastema gets fused in the midline forming the isthmus. This occurs before rotation and ascent of the kidneys. The normal ascent of the kidneys is impaired by the inferior mesenteric artery which lies superior and anterior to the isthmus<sup>1-3</sup>.

### PATIENTS AND METHODS

The purpose of the study is to establish a sonographic sign to identify horse shoe kidney. Isthmus of horse shoe kidney may be seen as a horizontal hypoechoic tissue in the midline anterior to vertebra resembling pancreas – second pancreas sign.

The study was done in the our Department from 2012 to 2015. The patients included in the study were those for whom ultrasound examination was done for indications like abdominal pain and horse shoe kidney was identified as an incidental finding.

The study included 32 patients of which 25 were males and the rest females. Mean age was 31 years (range 18 – 52 years).

Horse shoe kidney was diagnosed sonographically in 32 patients. It was confirmed by IVU (in 19 patients) and CT study (in 10 patients). All the sonographic images were obtained by using Mindray DC7 units.

The patients were examined in supine position with curvilinear probe of frequency 7 Hz. Axial images were obtained from the epigastrium to umbilicus to identify the isthmus. The patients were also examined for curved appearance of kidney , reversed longitudinal axis of kidneys, tapering of lower poles, anterior position of renal pelvis, low lying kidneys and distortion of interface between renal sinus fat and parenchyma. Complications like hydronephrosis, calculi and tumor were also looked for.

## RESULT

Among the 32 patients diagnosed sonographically with horse shoe kidney, isthmus was identified as a solid structure anterior to the aorta in 27 (84.4 %) patients. Central echogenic area similar to renal sinus was seen in 6 patients.

In addition out of the 64 kidneys, 45 (70.3 %) were found to be low lying. 37 (57.8 %) kidneys showed tapering of lower poles. Anteriorly oriented renal pelvis was found in 34 (53.1 %) kidneys.

Among the 32 patients examined, hydronephrosis was noted in 11 (17.2%) kidneys and a calculus was found in 9 (14.0%) kidneys. None of the patients had renal tumor.

## DISCUSSION

Horse shoe kidney being the most common renal fusion anomaly makes it important to be diagnosed by USG, especially due to the increased rate of associated congenital anomalies and complications like hydronephrosis, infection, calculi etc. Horse shoe kidney may be associated with other congenital anomalies mainly skeletal, cardiovascular, central nervous system and anorectal malformations<sup>4</sup>. Patients with horse shoe kidney are asymptomatic in one third of cases and symptomatic when complications like hydronephrosis, infection or calculus formation occurs. In patients with calculi and hydronephrosis percutaneous management requires individual consideration due to its abnormal location. Horse shoe kidney is also associated with increased risk of Wilms tumor, transitional cell carcinoma and renal carcinoid<sup>5,6</sup>. It is also important to identify horse shoe kidney in a renal transplant donor.

In the case of horseshoe kidney ultrasound diagnosis may be difficult unless the isthmus is definitely imaged. When ultrasound examination of the patient is done in supine position with the probe in transverse orientation starting from the epigastrium to the umbilicus, pancreas will first be imaged as a linear structure isoechoic to liver crossing the midline (fig 1) . Pancreas is seen in relation to various vascular structures like portal vein, splenic vein, superior mesenteric artery, aorta and inferior venacava (fig 2). As the probe is moved further inferiorly, the isthmus is imaged as a horizontal band of tissue isoechoic to renal cortex (fig 3), across the midline of abdomen connecting the inferior or superior poles of the kidneys giving the appearance of pancreas. This isthmus is seen anterior to aorta, inferior venacava and spine (fig 4). Thus this finding – second pancreas sign - helps to make the definite diagnosis of horse shoe kidney .

It is necessary to differentiate pancreas from isthmus. Pancreas is seen at L1 -L2 level with portal vein, splenic vein and splenic artery as its posterior relation. Isthmus is seen at L 3- L4 level with inferior vena cava and aorta as its posterior relations.



**Figure 1 : Pancreas is imaged as a linear structure isoechoic to liver crossing the midline .**



**Figure 2 : Portal vein (blue), splenic vein (red-elongated) and splenic artery (red-anterior to aorta) are seen posterior to pancreas.**



**Figure 3: The isthmus of horseshoe kidney is imaged as a horizontal band of tissue isoechoic to renal cortex, across the midline of abdomen connecting the inferior or superior poles of the kidneys giving the appearance of pancreas.**



**Figure 4 : Aorta (red) and inferior venacava (blue) are seen posterior to the isthmus.**

Causes of false positive diagnosis of isthmus are enlarged retroperitoneal lymphnodes, retroperitoneal fibrosis or tumor, collapsed bowel loop and thrombosed renal vein<sup>7,8</sup>. Normal pancreas may be mistaken for isthmus by beginners.

If the isthmus consists of fibrous tissue only, it may be difficult to visualize it. Even if functioning renal parenchyma is present in the isthmus, it may be obscured by bowel gas. Routinely the area anterior to aorta may not be examined.

## CONCLUSION

Visualization of the isthmus as ‘second pancreas’ helps in almost definite diagnosis of horse shoe kidney. Other findings like bent or curved kidneys with tapering of the lower pole or indistinct lower pole margins, anterior position of the renal pelves, low-lying kidneys are also seen in horseshoe kidneys.

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