Hilar Arteriovenous Pattern in a Case of Horseshoe Kidney

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Abstract

Horseshoe kidney is a poor congenital formation that results in the union of the lower poles of the kidneys through the fibrous isthmus that crosses the median line, with a prevalence of 0.25% (1 in 400 births), a higher rate in males (2:1 or 3:1), and an important variation in the arrangement of arteries and veins in the hilum. The present study aims to describe the arteriovenous pattern in the renal hilum in a case of horseshoe kidney. A conventional retroperitoneal dissection was performed in a 64-year-old female corpse of brown skin color, legally belonging to the Anatomy Laboratory of Unicastelo, Fernandópolis, state of São Paulo, Brazil, with causa mortis associated with uterine cancer. The dissection revealed a horseshoe kidney, with the right kidney measuring 5.69 cm, the left kidney measuring 11.65 cm, and the isthmus measuring 6.40 cm, and with the presence of a single right superior polar segmental artery (originated in the posterior aspect of the renal artery), of a double left superior polar segmental artery (originated in the renal artery, with one for each renal aspect), of one renal isthmus artery (originated in the posterior aspect of the abdominal aorta), and of one renal isthmus vein (left common iliac vein). Horseshoe kidney is a congenital abnormality whose arteries may originate from branches of the renal artery, of the inferior mesenteric artery, or of the iliac artery. Its veins drain into the renal vein, into the inferior vena cava, or into the iliac vein. It may be associated with hydronephrosis and nephroblastoma. However, no reports in the literature are found regarding the correlation with uterine cancer, highlighting the relevance of the hilar vascular pattern of the reported case.

Keywords

- horseshoe kidney
- anomaly
- artery
- vein
- anatomy

Introduction

Kidneys are oval-shaped organs that are situated in the retroperitoneum, on the posterior abdominal wall, one on each side of the vertebral column, at the level of the T12-L3 vertebrae. They have a reddish-brown color and are ~ 10 cm long, 5 cm wide, and 2.5 cm thick. The right kidney is located ~ 2.5 cm lower than the left kidney, probably because of the liver. The lower pole of the right kidney is approximately one finger width above the iliac crest.[1]

Horseshoe kidney is the most common congenital malformation of the urinary system, and it combines three anatomical variations: ectopia, poor rotation, and vascular change.[2] In most of the cases, the fusion occurs through the lower renal poles with the formation of an isthmus of fibrous tissue that crosses the median line, which prevents the kidney from ascending from the pelvis to the abdominal cavity due to the presence of the inferior mesenteric artery, at the level of the third to the fifth lumbar vertebrae. Due to

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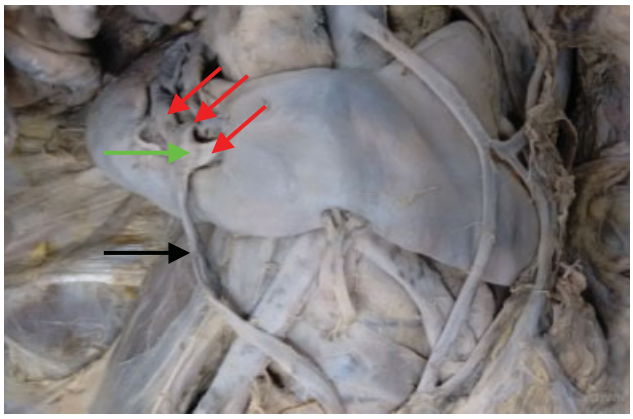

Fig. 1 Right anterior aspect of the horseshoe kidney (green arrow: renal pelvis; red arrows: larger renal calyces; black arrow: abdominal part of the ureter).

this fact, they do not rotate 90° anteriorly, which damages the arteriovenous formation, giving rise to numerous accessory vessels.[2–4]

This malformation has a prevalence of 0.25% (1 in 400 births) and a higher rate in males (2:1 or 3:1). The arrangement of the arteries and veins in the renal hilum varies considerably, which can compress the ureters and cause urinary lithiasis in up to 41% of the cases.[5,6] The anomalous anatomical position predisposes to a greater risk of blunt injuries.[3] In addition, the horseshoe kidney has also been related to a greater propensity to neoplasias, such as Wilms tumor, and to systemic malformations, such as Turner syndrome.[7]

The blood supply to the horseshoe kidney is varied, with the arteries originating from branches of the aorta, from the inferior mesenteric artery, or from the iliac artery.[8] The identification of the anatomical variations of the renal arteries is of extreme importance for the performance of surgical procedures involving the renal arteries in order to prevent reckless lesions during surgery. This study cooperate especially in surgical interventions, as well as in renal transplants and radiological studies.[9–11]

The objective of the present study is to report the arteriovenous pattern found in the renal hilum in a case of horseshoe kidney.

Materials and Methods

A conventional retroperitoneal dissection was performed in a corpse, fixed for 2 years in formalin, of a 64-year-old adult female, brown skin color, legally belonging to the Anatomy Laboratory of Unicastelo, Fernandópolis, state of São Paulo, Brazil, with causa mortis related to uterine cancer.

Results

Horseshoe kidney (►**Fig. 1**) was detected, with a union pattern at the lower extremities formed by an isthmus with a concavity facing upwards. The right kidney was 5.69 cm long, 3.62 cm wide, and had an average thickness of 2.68 cm. The left kidney was 11.65 cm long, 5.02 cm wide, and had an average thickness of 2.82 cm. The distance between the 2 upper poles was 9 cm, with a convex margin of 37 cm, and a concave margin of 19.5 cm. The ureters originated from an anomalous and extruded renal pelvis; however, with a normal path and topography (►**Fig. 1**).

In a comparison with the usual pattern of renal arterial supply (►**Fig. 2**), the following variations could be observed (►**Figs. 3** to **6**): single right superior polar segmental artery with right posterior artery; double left superior polar segmental arteries originating from the renal artery (one in each renal face); renal isthmus artery originating from the posterior aspect of the abdominal aorta; and a vein from the renal isthmus opening into the left common iliac vein.

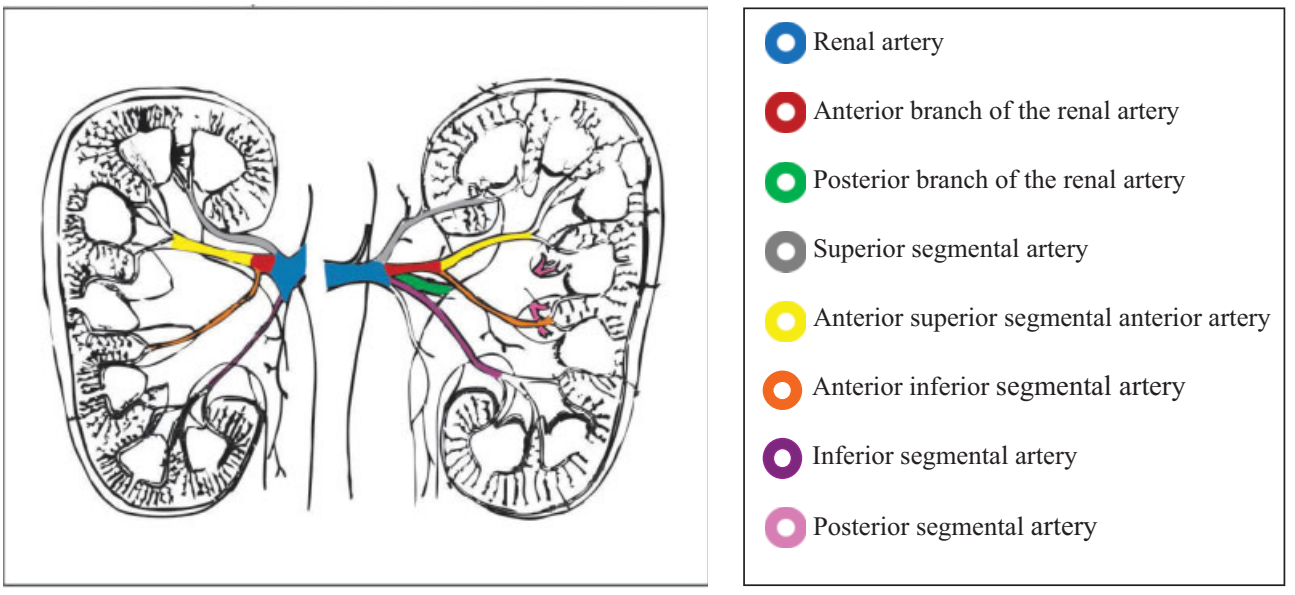

Fig. 2 Renal arterial pattern.

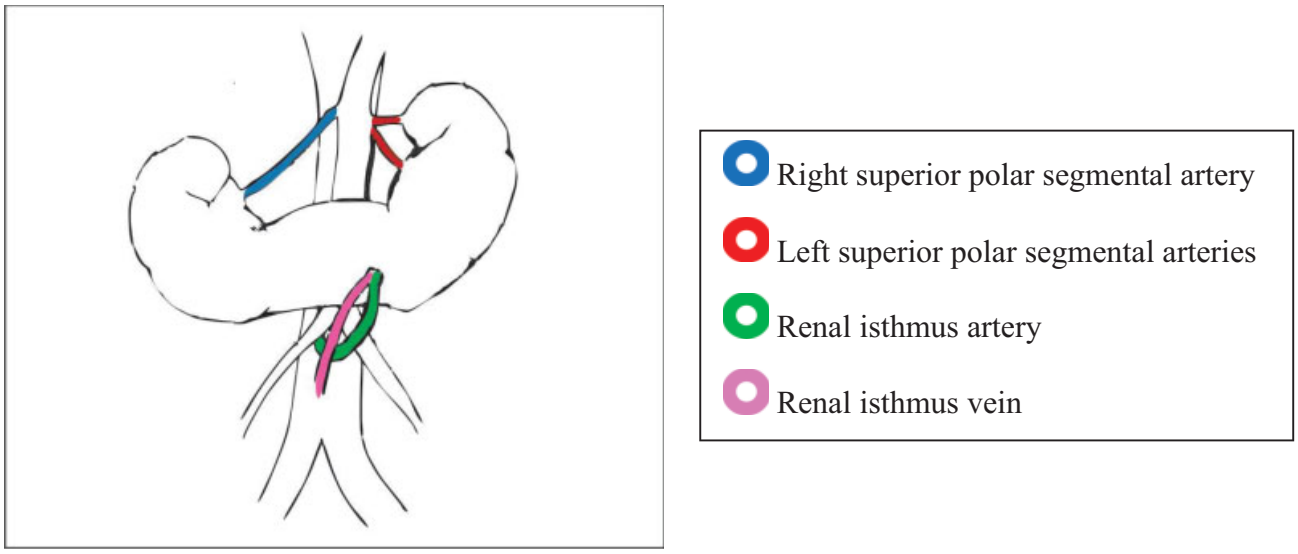

Fig. 3 Blood supply found in a case of horseshoe kidney.

Fig. 4 Presence of right superior polar segmental artery (red arrow) in posterior view, after the dislocation of the horseshoe kidney.

Fig. 5 Presence of two left superior polar segmental arteries (red arrows) in horseshoe kidney.

Discussion

Horseshoe kidneys are asymptomatic and are usually detected at random. However, they are subject to a series of complications as a result of poor drainage, which may lead to clinical symptoms.[3,12] These complications include hydronephrosis secondary to obstruction of the ureteral junction, infection and renal calculi, increased incidence of malignancy (especially Wilms tumor and transitional cell carcinoma), and increased susceptibility to trauma.[3,12,13] Glomerulonephritis is another complication, with immunoglobulin A nephropathy being the most common in horseshoe kidneys.[13]

The most probable explanation for the formal genesis of the anomaly of the present case is the fusion of the two caudal poles during a period in which two renal sketches were very close, mainly at the lower poles. As a result, the mesodermal tissue among the methanephrons disappears or does not carry out its normal development. For reasons that are not yet determined, the lower poles of the kidneys are close to merge. This merge explains the successive stop of rotation along the longitudinal axis.[7,12]

The blood supply is, in most cases, anomalous, being composed of several accessory vessels.[3] This variation was classified in different ways and is important for surgical programming.[14]

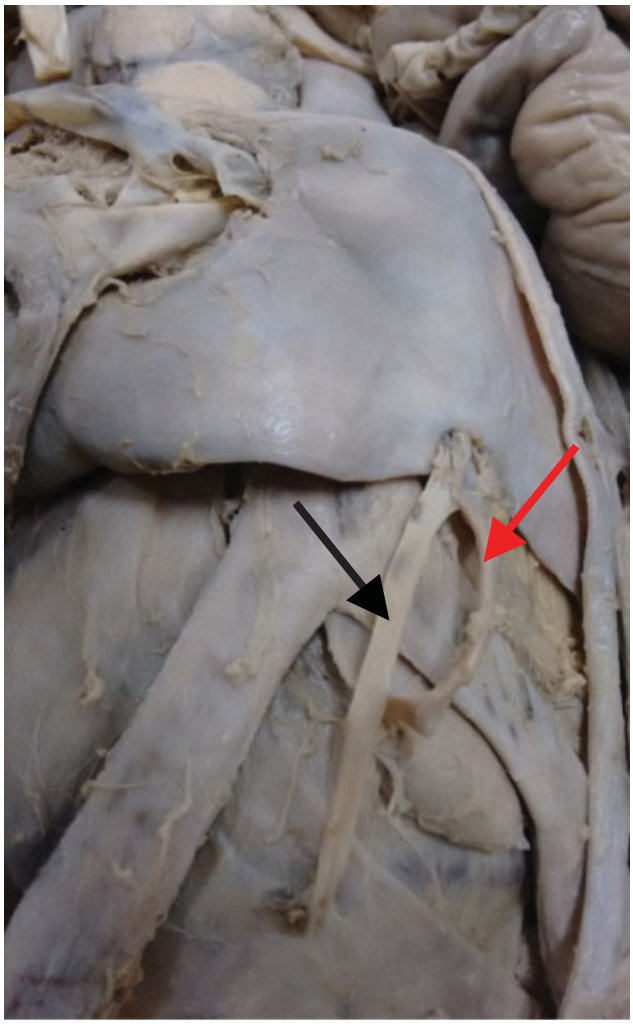

Fig. 6 Detection of the artery (red arrow) and of the vein (black arrow) of the renal isthmus in a case of horseshoe kidney.

Conclusion

Horseshoe kidney is a congenital anomaly whose arteries can originate from branches of the aorta, from the inferior mesenteric artery, or from the iliac artery. Its veins drain into the renal vein, into the inferior vena cava, or into the iliac veins. Although it may be associated with hydronephrosis and nephroblastoma, no reports were found in the literature regarding the correlation between horseshoe kidney and uterine cancer, which highlights the importance of the hilar vascular pattern of the reported case.

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