

Case Report

Horseshoe kidney with high bifurcation of abdominal aorta: a rare imaging finding

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ABSTRACT

Vascular variations of the bifurcation of the abdominal aorta (BAA) are rare, and they are usually discovered incidentally. We report a unique clinically and surgically significant case of variations of the abdominal aorta as related to the location and type of bifurcation. A high-positioned bifurcation of the abdominal aorta upon a horseshoe kidney at the level of upper L2 vertebral body was detected during contrast-enhanced abdominal computed tomography scan. Due to the halted ascent in horseshoe kidney, abdominal vascular anomalies are common: usually, multiple renal arteries arise from the distal aorta or iliac arteries; this is important when these patients undergo any procedure, particularly abdominal angiogram. The awareness of the variations of the abdominal aorta is of great importance during surgery and interventional radiological procedures to reduce complications during abdominal and spinal interventions, as well as for radiologists for precise interpretation of angiograms.

Keywords: Abdominal aorta, Horseshoe kidney, Variation, Computed tomography

INTRODUCTION

Anomalies of the aortoiliac arteries are exceedingly rare, with few case reports in the literature. Usually, it is recognized that the abdominal aorta (AA) usually bifurcates into two common iliac arteries (CIA) at the level of L4 vertebral body.¹ Sometimes the AA bifurcation can be at an elevated level of L3 vertebral body. Here we report a case of horseshoe kidney with AA bifurcation occurring at the L1 vertebrae with an unusual tortuous course of the right common

iliac arteries (R-CIA). In the general population, these conditions are exceedingly rare. Only a few cases of high AA bifurcation have been reported, and horseshoe kidney is known to affect 0.025% of the general population.^{2,3} In more than 90% of cases of horseshoe kidney, the fusion is at the lower pole. The location of the isthmus is usually

between AA and inferior mesenteric artery (IMA) and rarely posterior to the aorta. The root of IMA impedes ascending of the fused kidney and the isthmus hinders the normal rotation of kidneys. Herein, we have reported a unique case of a patient with a horseshoe kidney and AA bifurcation anomalies with no associated variation of other abdominal arteries during contrast-enhanced computed tomography (CT) examination of the abdomen.

CASE REPORT

The case was a 57-year-old male who presented with chronic lower abdominal pain for over 6 months. He had no urinary or gastrointestinal symptoms. There was no history of prior trauma or instrumentation of the lower extremity vessels. Other physical examinations were unremarkable. In the lower extremities, there were no delayed capillary refills, no pallor, or varicosities.

Arterial pulsations at the femoral, popliteal, and dorsalis pedis arteries were normal. All routine laboratory values and blood counts including urine routine microscopy and kidney function tests were within normal limits. Abdominal and pelvic ultrasonography for the evaluation of abdominal pain revealed horseshoe kidney with an abnormal tortuous course of the aorta and right common iliac artery. For confirmation of USG findings and further evaluation, CT was performed with a MDCT scanner, including sagittal and coronal reconstructed images. The patient received non-ionic intravenous (IV) contrast media. An automated tracking system with a density of 100 hounsfield units (HU) in the ascending aorta was used to initiate scanning. The 3D volume-rendered (VR) images were obtained from axial MDCT images at a workstation to display vascular and osseous structures. MDCT images showed U shaped horseshoe kidney with AA bifurcation at the upper segment of the second lumbar vertebral body (L2), approximately 1 cm distal to the origin of the bilateral renal arteries (Figure 1 and 2). After bifurcating, the right CIA is seen running anterior to the horseshoe kidney isthmus and continued laterally along the anterior aspect of the right kidney (Figure 3). The non-branching right common iliac artery coursed in a circuitous route through the right retroperitoneum and ultimately bifurcated at the level of the superior acetabular rim. The diameter of the right common iliac artery was considerably larger than that of the left one. The left common iliac artery coursed straight into the pelvis, bifurcating at the pelvic brim (Figure 4 and 5). The IMA appears slightly narrow in caliber (Figure 1). The parenchyma isthmus was inferior to aorta bifurcation in midline clamped by the two extended CIAs. The lower pole of the horseshoe kidney was at the level of L3 intervertebral disk.

Renal veins are seen parallel to renal arteries coursing normally ultimately draining into IVC. There were no other associated anomalies of the abdominal vasculature, pelvis and spine detected on CT.

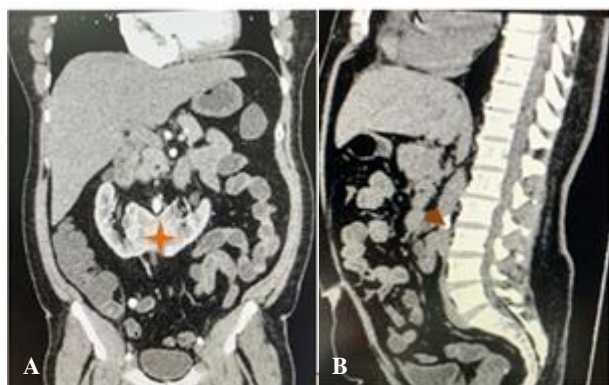


Figure 1: (A) Post-contrast coronal image showing U-shaped kidney. (B) Non-contrast sagittal image of abdomen showing high bifurcation of the AA at the level of L2 with calcification at the origin of iliac arteries.

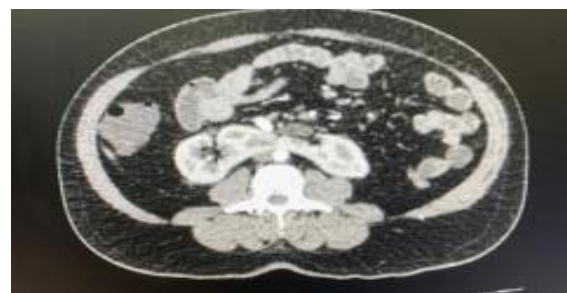


Figure 2: Axial post contrast images of abdomen showing right CIA continues anterior to the horseshoe kidney isthmus.

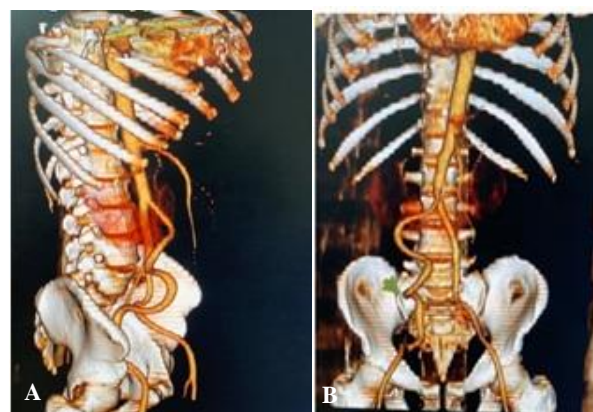


Figure 3 (A and B): Three-dimensional reconstructed images showing diameter of the right common iliac artery is larger than the left and the both common iliac artery coursed straight into the pelvis, bifurcating at the pelvic brim (green arrows).

DISCUSSION

Usually, the AA bifurcation occurs at the L4 level in two-thirds of adults and between L3 and the L5/S1 junction in the remaining third.⁴ There are two kinds of variation of AA bifurcation: structure or location anomaly. High-positioned bifurcation in the present case consists of location variation and structure anomalies altogether. A few cases have described high AA bifurcation, but this is a rare finding in conjunction with a horseshoe kidney. Though the normal length of CIA is about 4 cm (left) and 5 cm (right), in this case, the two CIAs were longer than normal. Arterial variations of the present case may be related to horseshoe kidney for over two-thirds of horseshoe kidney patients have anomalous abdominal vasculature.⁵

In a review, Boatman described 15 types of artery supply of horseshoe kidneys.⁶ Furthermore, in another one, Bietz reviewed 34 kinds of artery supply in horseshoe kidneys with aneurysm.⁷ But none of those variations is seen in the present case. Hager et al reported a very similar case with high AA bifurcation and an atypical course and branching pattern of the right and left CIA.³ In that case, there were no associated genitourinary anomalies.

In general, IMA is upon the isthmus preventing the ascending of horseshoe kidney, and the isthmus hinders normal rotation of kidneys at an embryonic phase which is seen in the present case and the right CIA was pushed forward by the fused segment of the isthmus. This malformation may be on account of abnormal vasculature during the embryonic development period.⁸ In addition to vascular anomalies, horseshoe kidney can also associate with other congenital anomalies including anomalies of the urogenital, gastrointestinal, neurologic, and skeletal systems, as well as some chromosomal abnormalities. This patient had luckily none of these anomalies. Multi-detector computed tomography (MDCT) can acquire high-resolution images of the body rapidly. MDCT can obtain isotropic sub-millimeter spatial resolution which is excellent for abdominal CT angiography (CTA). With the volumetric acquisition of 3D data and post-process techniques such as multiplanar reconstruction (MPR), maximum intensity projection (MIP), and volume rendering (VR), MDCT angiography can provide patient's arterial anatomy precisely. It is useful to clearly delineate normal or abnormal artery structure preoperatively instead of cadaver study. MDCT scan especially CTA is valuable to make a correct preoperative diagnosis and guide operative procedure precisely.^{9,10} Long-term follow-up is suggested given the possibility of aneurysm formation.

CONCLUSION

We reported on a unique clinically and surgically significant case of variations of the abdominal aorta as related to the location and type of bifurcation. MDCT with 3D-image reconstruction can provide valuable information including clinical significances of abdominal aorta abnormalities. The awareness of the variations of the abdominal aorta is of great importance for surgeons in order to reduce complications during abdominal and spinal interventions, as well as for radiologists for precise interpretation of angiograms.

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REFERENCES

1. Lee CH, Seo BK, Choi YC, Shin HJ, Park JH, Jeon HJ, et al. Using MRI to Evaluate Anatomic Significance of Aortic Bifurcation, Right Renal Artery, and Conus Medullaris When Locating Lumbar Vertebral Segments. *American Journal of Roentgenology*. 2004;182:1295-300.
2. Hager E, Isenberg G, Gonsalves C, Moudgill N, Dong S, DiMuzio P. A new anatomic variant of the aorta: a case report. *J Vasc Surg*. 2008;48:213-5.
3. Huang W, Ge G, Meng J, Xu Y. High bifurcation of abdominal aorta upon horseshoe kidney at the level of upper L2 vertebral body: a rare case report. *Surg Radiol Anat*. 2010;32:605-8.
4. Chithriki M, Jaibaji M, Steele R. The anatomical relationship of the aortic bifurcation to the lumbar vertebrae: a MRI study. *Surgical and Radiologic Anatomy*. 2002;24:308-12.
5. Glenn JF. Analysis of 51 patients with horseshoe kidney. *N Engl J Med*. 1959;261:684-7.
6. Boatman DL, Cornell SH, Kölln CP. The arterial supply of horseshoe kidneys. *Am J Roentgenology*. 1971;113: 447-51.
7. Bietz DS, Merendino KA. Abdominal aneurysm and horseshoe kidney: a review. *Ann Surg*. 1975;181(3):333-41.
8. Pirro N, Ciampi D, Champsaur P, Di Marino V. The anatomical relationship of the ilio-cava junction to the lumbosacral spine and the aortic bifurcation. *Surg Radiol Anat*. 2005;27(2):137-41.
9. Kara E, Yildiz A, Oztürk NC, Oztürk H. An extremely rare bifurcation pattern of the caudal abdominal aorta: case report demonstrated by angiography. *Surg Radiol Anat*. 2008;30(8):689-91.
10. Atalar MH, Salk I, Bozbiyik N, Cetin A. Diagnosis of High Bifurcation of the Abdominal Aorta with Associated Vascular Variations: Case Report with Multidetector Computed Tomography. *Pol J Radiol*. 2015;80:523-5.

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