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## Diagnosis of High Bifurcation of the Abdominal Aorta with Associated Vascular Variations: Case Report with Multidetector Computed Tomography

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### Summary

#### Background:

Variations of the branches and bifurcation of the abdominal aorta and their relations with other abdominal structures and organs are important concerning abdominal and spinal surgery.

#### Case Report:

In this report, authors present a high -positioned bifurcation of the abdominal aorta at the level of the L3 vertebral body and its associations with multiple variations of other abdominal arteries during contrast-enhanced multi-detector computed tomography (MDCT) examination of the abdomen.

#### Conclusions:

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. 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.

#### MeSH Keywords:

Anatomic Variation • Aorta, Abdominal • Multidetector Computed Tomography

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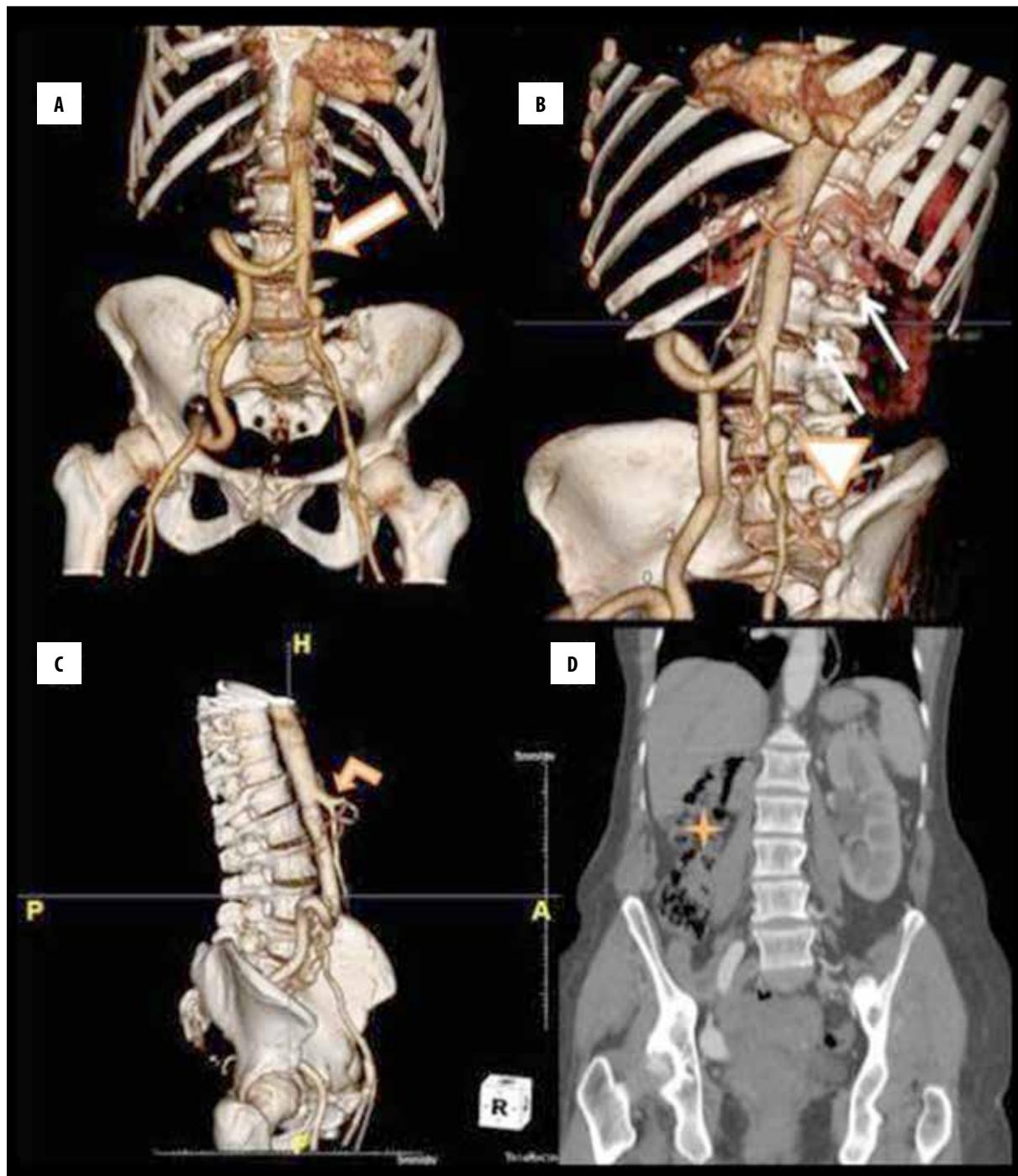
### Background

Vascular variations of the bifurcation of the abdominal aorta (BAA) are rare, and they are usually discovered incidentally by manifestations of chronic lower limb ischemia. The most common site of BAA was at the L4 vertebra (67–83%) [1,2]. The BAA can be at an elevated level of the L3 vertebral body in rare cases [1–3]. Available imaging modalities for the evaluation of abnormalities of abdominal and pelvic arteries are composed of conventional or digital subtraction angiography and computed tomography angiography with three-dimensional (3D) reconstruction [4]. In this report, we present a high- positioned BAA at the level of the L3 vertebral body and its associations with multiple variations of other abdominal arteries during a contrast-enhanced multi-detector computed tomography (MDCT) examination of the abdomen.

### Case Report

A 58-year-old man with no significant previous medical history 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 were within normal limits. Pelvic ultrasonography for the evaluation of abdominal pain was unremarkable. For the differential diagnosis of abdominal pain, CT was performed with a 16-row MDCT (Brilliance 16, Philips Medical Systems, Amsterdam, Holland) 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 separate workstation to display vascular and osseous structures. MDCT images showed BAA at the level of the upper segment of the third lumbar vertebral body. The nonbranching right common iliac artery coursed in a circuitous route through



**Figure 1.** (A–C) 3D-multi-detector CT and (D) coronal reformatted images show an elevated bifurcation of the abdominal aorta and accompanying other findings (white thick arrow: high aortic bifurcation, white thin arrows: multiple left renal arteries, arrowhead: aneurysmatic dilatation, curved arrow: common celiacomesenteric trunk, star: right renal agenesis).

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 fifth lumbar vertebra. In addition, it had atherosclerotic changes and aneurysmatic dilatation. Associated findings on MDCT images included a common celiacomesenteric trunk, right renal agenesis and two left renal arteries (Figure 1A–1D).

## Discussion

The abdominal aorta (AA) begins at the aortic hiatus of the diaphragm, anteriorly to the inferior border of the 12<sup>th</sup> thoracic vertebra. It descends anteriorly to the lumbar vertebrae to end at the lower border of the fourth lumbar vertebra, by dividing into two common iliac arteries [5]. There are two types of variation of BAA, i.e. structural or locational anomaly. In this case, both types of variation were

present [6–8]. Besides the presence of BAA at the level of the third lumbar vertebra, the diameter of the right common iliac artery was higher than that of the left one, and the route of the right common artery was considerably different from the left one.

Pirró et al. [3] assessed the relationship with the lumbosacral spine and BAA. They found that BAA was situated between L3 and S1, most frequently at the L5 level (50%). The level of BAA was determined in an MRI study of Lee et al. [1]. They found that BAA was at the upper half of the L4 vertebral body in 45% of patients, at the lower half of L4 in 38% of patients, at the L3-L4 intervertebral disk space in 10% of patients, at the L4-L5 intervertebral disk space of the level in 4% of patients, and at the lower half of L3 in 2% of patients. Chithriki et al. [2] assessed the level of BAA in relation to the lumbar spine using MRI. They noted that BAA was found at the L4 vertebral body in 67% of patients, at the L3/L4 vertebral bodies in 13% of patients, and at the L3 vertebral body in 9% of patients.

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## Conclusions

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.

## Conflicts of interest statement

The authors declare that there is no conflict of interest with regard to the publication of this manuscript.