The Role Of Ultrasound In Abdominal Aortic Pathology In Children

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Learning objectives

- Radiologists should be aware of pathology of abdominal aorta in children too.
- Since ultrasound (US) examination is the first imaging method in children, abdominal aorta should be also evaluated.
- US findings should be the basis for other imaging modalities.
Background

Acquired aortic disease is uncommon in children. Trauma, infections, inflammatory and connective tissue diseases can affect the aorta. They can cause aortic dissection, aortic aneurism or aortic stenosis. These three diagnostic entities directly determine mortality and morbidity.

The first imaging method for evaluation of aorta was catheter-based angiography. Technological advancements in computed tomography (CT) and magnetic resonance imaging (MRI) produced efficient three-dimensional angiographic techniques. Although spatial resolution of MR angiography (MRA) is less than CT angiography (CTA), MRA benefits with lack of ionizing radiation and the ability to quantify flow.

Generally, first imaging method in children is US and aorta should be evaluated in every child with arterial hypertension, claudication, fatigue, arthralgias, myalgias or weight loss. On the basis of US further imaging methods are indicated.
We present imaging findings in three cases of aortic pathology in children.

**CASE 1 - 3 year-old girl with mid-aortic syndrome:**

A girl was admitted to our hospital because of proteinuria, hemoglobinuria and a high blood pressure (>200/100 mm Hg). An abdominal bruit was heard during physical examination. Doppler-US exam of kidneys and renal arteries showed slightly hyperechoic renal parenchyma, tardus parvus wave in both kidneys and narrowed abdominal aorta at the level of the origin of visceral and renal arteries without changes of aortic wall (Fig.1). Digital subtraction angiography (DSA) of abdominal aorta confirmed narrowing of middle part of abdominal aorta with occlusion of right renal artery and stenosis of left renal artery, celiac trunk and mesenteric superior artery, collateral circulation was abundant (Fig.2). To exclude the vasculitis and localize the pathology of arteries the MRI and MRA of the whole body were done. Isolated abdominal aorta pathology was confirmed with visceral and renal arteries involvement (Fig.3). No contrast enhancement in slightly thickened aortic wall was noted, laboratory tests for vasculitis were normal. Hypertrophy of left ventricle with diastolic dysfunction was found on US exam.

Arterial hypertension was refractory to medical treatment. The percutaneous transluminal angioplasty was performed first. However, the stenosis of the aorta and left renal artery were resistant to dilatation due to the elastic recoil of narrowed parts of the affected vessels and only resulted in a minimal angiographic improvement. Therefore the subdiaphragmal aorto-aortic by-pass with mobilization, resection and neoimplantation of both renal arteries was done.

Now her blood pressure is within normal range with only one antihypertensive drug, her heart involvement subsided completely.

**CASE 2 - 13 year-old boy with Takayasu aortitis:**

13 year-old boy was admitted to the hospital because of claudication. He had pain in both lower extremities, especially in dorsal part of thigh for about six months. He felt pain only at sports activities like playing football or climbing. At rest and normal daily activities he had no problems. He didn't have fever or other signs of infection. During physical examination systolic bruit was heard in the abdomen. Femoral and peripheral artery pulses were symmetrically decreased, radial artery pulses were normal. Of all laboratory tests only slight elevated erythrocyte sedimentation rate (ESR) was found (17 mm/h). MRA of the abdominal aorta showed contrast enhancement of thickened walls of infrarenal abdominal aorta, both iliac arteries and mesenteric superior artery, lumen of arteries was narrowed (Fig.4). On US exam of the abdominal aorta which was made.
before starting the medical treatment with corticosteroids, the wall of the infrarenal part of abdominal aorta was thickened and hypoechoic, lumen was narrowed (Fig.5). There was no hyperemia in the aortic wall. After 2 weeks of therapy control US exam showed only slightly aortic wall thickening and a bit aortic lumen narrowing (Fig.6), ESR was normal (2 mm/h).

CASE 3 - 14 year-old girl with infrarenal occlusion of aorta:

A 12-year-old girl was admitted to our hospital in January 2009 because of repeated colic abdominal pain lasted for several years. She had pain in every time of the day, even through the night, without vomiting, diarrhea, blood in the stool or weight loss. The physical examination and laboratory tests were normal. US exam of abdomen was in normal range (aorta was not evaluated), on endoscopic gastroduodenoscopy (EGDS) chronic nodular gastritis was found.

2 years later in March 2011 she returned with headache, dizziness, palpitations and chest pain. Her blood pressure was 150/100 mm Hg, the rest physical exam was normal. There were no abnormalities in laboratory tests. US of the heart showed hypertrophy of left ventricle with diastolic dysfunction. On Doppler-US exam of kidneys and renal arteries stenosis of right renal artery was suspected, morphologically the kidneys were normal. Again aorta was not properly evaluated. DSA of the abdominal aorta showed infrarenal occlusion of aorta with a lot of collaterals from distal part of aorta, lumbal and inferior costal arteries. Stenosis of renal arteries was not found, but lower polls of kidneys had tiny polar collaterals and they could be the reason for arterial hypertension. MRA of abdominal aorta confirmed findings on aortography (Fig.7). CT and MRA of the head were performed because of the severe headache and were normal.

Today girl doesn't have claudications or headache, her blood pressure is in normal range on medical therapy. US of the heart is normal. The aortoiliorenal by-pass is planned when the symptoms reappear.
Fig. 1: US image shows narrowing of the abdominal aorta and ostial stenosis of the celiac trunc (TC) and the superior mesenteric artery (AMS).

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Fig. 2: Narrowing of the aorta, stenosis of left renal artery and occlusion of right renal artery is seen on DSA.
Fig. 3: MRA of the abdominal aorta and its branches confirms the diagnosis of mid-aortic syndrome.

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**Fig. 4:** MRA shows narrowed lumen of the infrarenal abdominal aorta, both iliac arteries and superior mesenteric artery. Walls of arteries are thickened, contrast enhanced walls are seen.

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Fig. 5: US exam shows changes of the aorta and its branches described on MRA.

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Fig. 6: Diminished US changes of aorta and its branches after 2 weeks of therapy.
Fig. 7: DSA (A, B, C) and MRA (D) of the abdominal aorta show infrarenal occlusion of the aorta with abundant collaterals.
Conclusion

US is well known first imaging modality in children. Pathology of abdominal aorta is rare in childhood and should be found on US examination of the abdomen as an accident finding or in connection with underlying clinical entities like arterial hypertension resistant to medical therapy or claudication. The pathologic changes found on US could be the base for further, more invasive imaging methods like aortography, MRA or CTA.
References


