Value of three-dimensional contrasted-enhanced MR angiography in diagnosis and treatment of aortic dissection

Q. Liu[1], P. J. Lu[1], F. Wang[1], and L. Wang[1]

[1]Radiology, Changhai Hospital, Second Military Medical University, Shanghai, China, People's Republic of

Background

Aortic dissection is a catastrophic aortic disorder with high morbidity and mortality rates. Patients with different types of aortic dissection require different treatment. Timely diagnosis and appropriate treatment are crucial for saving the lives of these patients. Thus, proper imaging is critical for clinical treatment, with delineation of these features being an important part of the diagnostic work-up.

Objective

To assess the value of three-dimensional contrast-enhanced MR angiography (3D CE-MRA) and its 3D reconstruction in diagnosis and treatment for aortic dissection.

Methods

Two hundred and four patients with aortic dissection underwent 3D CE-MRA combined with other sequences. 3D CE-MRA was performed in the coronal plane with a 3D fast low-angle shot sequence（TR/TE/FA = 2.96/1.15ms/25degrees, matrix=256×512, eff. Slice=1mm, FOV=30~40cm×48cm, acquisition time=20s）after injection of 0.2mmol Gd-DTPA per kg b.w. The source images were subtracted from mask images and transferred to computer workstation subsequently post-processed using volume rendering (VR), maximum intensity projection (MIP), virtual endoscopy (VE) and multiplaner reformation (MPR).

Results

1) Double lumen could be shown in all of 204 patients. There were 41 DeBakey type□ dissections, 4 type □ dissections and 159 type Ⅲ dissections. Among them, thirty-two had undergone surgery; sixty-five, DSA; and the others, more than two methods of ultrasound, CT, MRI and CTA. The diagnostic accuracy of 3D CE-MRA was 100%, the classified diagnosis 96%. 2) Initial entry sites were defined in 157 cases and not seen in the 47 (23%) cases with intramural hematoma (Fig.1). The 104 entry sites in 79 patients were confirmed with surgery or angiography, and 93 were depicted at 3D CE-MRA. The depiction of 3D CE-MRA was 99.5% for initial entry sites and 89.4% for multi entry sites. Depiction of the initial entry sites was significantly better with MPR images. The shape and relationship between arterial orifice and initial entry sites were clearly demonstrated with three-dimension on VR images (Fig.2), which was very helpful for surgery and endovascular graft exclusion. 3) The orifice of anonymous artery involved in type□ dissections was 37 percent, and the orifice of left subclavian artery involved in type □ dissections, 10.3 percent. In 200 patients with type □and type □ dissections, the kidney arterial orifice was involved in 40.3 percent; the celiac arterial orifice, 14.9 percent; and the super mesenteric arterial orifice, 4.5 percent. Single artery involved was about 32.1 percent, and multi arteries, 12.7 percent (Fig.3). 4) The false lumen with large amounts of thrombi was found in 53(25.9%).

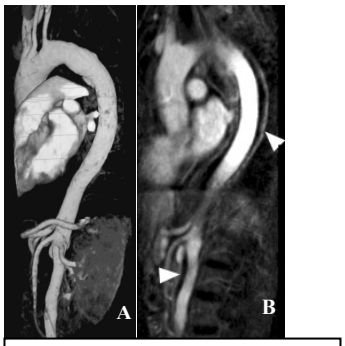

Fig.1 Intramural hematoma. **(A)** On a clipped sagittal VR image, the aorta appears to be normal. **(B)** Sagittal MPR images clearly delineate an unenhanced hematoma (arrowheads) in the medial layer of the descending aorta.

Fig.2 Initial entry in a DeBakey type Ⅲ aortic dissection. Clipped oblique sagittal VR images clearly depict the morphologic features of the initial entry (black arrowhead) and its relationship with the left subclavian artery (white arrow)

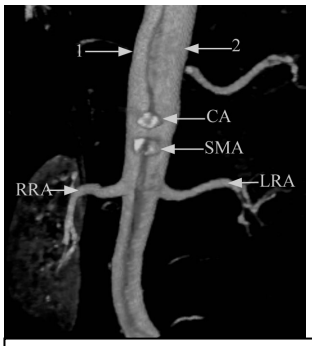

Fig.3 Involvement of the abdominal aortic branches. Clipped coronal VR image shows that the celiac artery *(CA)* and the superior mesenteric artery *(SMA)* originate from both the true *(1)* and false *(2)* lumina, the left renal artery *(LRA)* originates from the false lumen, and right renal artery *(RRA)* originate from the true lumen.

Conclusion

3D CE-MRA with postprocessing is a non-invasive, fast and effective technique for the diagnosis and classification of aortic dissection. It does not involve nephrotoxic contrast agent or ionizing radiation, and offers greater ease and speed of postprocessing. In clinical practice, 3D CE-MRA can provide highquality imaging data suitable for 3D reconstructions, making it valuable for the diagnosis and classification of aortic dissection and in providing information that is helpful for surgical and endovascular treatment.