Applying post-processing techniques of computed tomography imaging in diagnosing aortic dissection

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Abstract. Post-processing techniques of computed tomography imaging are playing a dominant and critical role in evaluation of AD. It is vivid for showing the whole contour of aorta, from different view. Post-processing techniques not only provide information of location, but also provide information of invading range. It is referred as preferred investigative modality for the diagnosis of aortic dissection, and has been widely used in clinic. Recently, it has become the first choice for clinical to diagnose AD, then it could provide important information for clinical selection of AD of surgical methods.

1. Introduction
Aortic dissection (AD) is serious cardiovascular emergency, which refers to the blood in the aortic cavity enters the aortic intima, leading to the intima and media separated, then forming the true and false lumen. The crisis and rapid progress of AD are common in the middle-age and male patients. Some studies have demonstrated that 65%~70% of patient with AD died in arrhythmia in acute stage, so it is more significant for the patients of prognosis to accurate diagnosis early and treatment timely [1-4]. Currently, the diagnosis of aortic dissection has different techniques of examination, such as ultrasound (US), digital subtraction angiography (DSA), magnetic resonance imaging (MRI), computed tomography angiography (CTA). US examination is affected by lung gas, and the accuracy of examination is low. DSA examination is invasive. MRI scanning time is long, severe patients should not do it. However, CT is most common technique, conventional scan cannot diagnose AD, with application of contrast, CT angiography can make accurate diagnosis. Axial imaging of CTA is not vivid for showing the whole contour of aorta [5-6]. Thus, post-processing techniques of computed tomography imaging were regarded as effective method to evaluate more information of AD. Post-processing techniques not only provide information of location, but also provide information of invading range [7]. With above information, post-processing techniques of CTA can make classification easily, which are divided into three types including DeBaKey TypeⅠ, DeBaKey TypeⅡ, DeBaKey Type III [8].

The purpose of this research was to evaluate the feasibility of post-processing techniques of computed tomography imaging in differentiation diseases of AD with acute chest pain. Post-processing technique are valid methods to estimate aorta artery CT imaging.

2. Materials and methods

2.1 Patient characteristics
2.2 Computed tomography protocol
Computed tomography images of aortic dissection were conducted on Brilliance iCT, which possessed scanning time quickly and radiation dose lowly. The tube voltage of 120 kVp, tube current of 800 mAs, slice thickness of 0.9 mm, the pitch of 0.2 mm, and the FOV of 250 mm are applied in CT detections. Horizontal axis scanning was adopted in scanning examination. Scanning range was from the inlet of thorax to the symphysis pubis. The automated bolus tracking technique was applied in the CT examination to acquire the data of the patients.

2.3 Post-processing technique
All of the volume data were transferred to the Extended Brilliance Workspace (EWD) for further post processing. Multi-planar reconstruction was applied for evaluating aortic dissection, which included performed multiplanar reconstruction (MPR), volume rendering (VR), maximum intensity projection (MIP), curved-planar reconstruction (CPR), and shaded surface display (SSD). Among them, MPR, VR, MIP, CPR are the most widely used post-processing techniques of computed tomography imaging. MPR can show the internal and external lumen of blood vessels clearly. VR can provide more clear images and rotate from many angles, which showed the vascular disease comprehensively. MIP is suitable for the observation of blood vessels of less overlapping. CPR is applied in diagnosis of Circuitous vascular disease. Hence, the two-dimensional and three-dimensional images of the aortic artery and its main branches were reconstructed respectively. Post-processing techniques of computed tomography imaging can not only diagnose aortic dissection rapidly, but also provide valuable information for clinical treatment schedule.

3. Results and Discussions

3.1 Patient characteristics
We have enrolled into 209 patients of AD, which consisted of 55 females and 154 males in the group.

3.2 DeBaKey Type I
The location of rupture is in the ascending aorta, extending through the aortic to the descending aortic. As shown in Fig.1a, showed aortic dissecting rupture was observed in the initial segment of aorta (white arrow). Fig.1b showed the information of invading range, from the ascending aorta to the left ilium artery. Fig.1c showed the location of rupture and the true or false lumen (white arrow). Fig.1d showed 3D reformatted image of aortic dissection.

Fig.1 CTA features of DeBaKey Type I. (a) Axial section images of the location of rupture (white arrow). (b) The invading range of AD. (c) Sagittal images of the rupture (white arrow). (d) VR of aorta.
3.3 DeBaKey Type II
The rupture of aortic dissection is located in the ascending aortic artery and ends in the aortic arch, which does not involve the descending aortic artery. As shown in Fig. 2a, showed aortic dissecting rupture was observed in the initial segment of aorta (white arrow). Fig. 2b showed the location of rupture in sagittal, whether or not it invaded the aortic arch. Fig. 2c showed the end of AD is limited to ascending aorta. Fig. 2d showed 3D reformatted image of aortic dissection.

![Fig. 2 CTA features of DeBaKey Type II.](image1)

3.4 DeBaKey Type III
Type III originates from the descending of the aortic arch and prolonging to the abdominal aortic artery without involving the ascending aortic artery. As shown in Fig. 3a, showed aortic dissecting rupture was observed in the distal end of the opening of the left subclavian artery (white arrow). Fig. 3b showed the location of rupture in sagittal. Fig. 3c showed the AD of invading range from the distal end of the opening of the left subclavian artery to the right ilium artery Fig. 3d showed 3D reformatted image of aortic dissection.

![Fig. 3 CTA features of DeBaKey Type III.](image2)

4. Conclusion
Post-processing techniques of computed tomography imaging can diagnose aortic dissection accurately. It is the preferred investigative modality for the diagnosis of aortic dissection. CTA has become the gold standard for the diagnosis of aortic dissection at this stage. It has the characteristics of safety, reliability and non-invasive. It is widely used in clinic. The post-processing techniques of computed tomography imaging can provide valuable information for physician to treat aortic dissection. It showed the position, size, invading range of aortic dissection from different angles of view.
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