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An MRI examination for evaluation of aortic dissection using a blood pool agent

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Introduction

In aortic dissection the formation of thrombus in the false lumen is associated with improved survival. [1]. Current imaging using contrast-enhanced computed tomography (CT) assumes the presence of thrombus by the absence of contrast but due to altered flow this finding may not be accurate.

Purpose

The aims of this study were to i) investigate the use of direct thrombus MRI together with 3D MRA using a blood pool agent to quantify false lumen thrombus volume in patients with Type B aortic dissection, and ii) compare the volumes to those obtained by clinical CT.

Methods

Ten patients with Type B aortic dissection underwent MRI at 3.0 T (Philips Healthcare) with a 6-element cardiac coil. After an initial survey and reference scan, direct thrombus imaging was performed by an inversion recovery (IR) ECG-triggered respiratory-navigated 3D TFE sequence (FOV: 300 × 255 × 60 mm^3 with 2 × 2 × 2.5 mm^3 resolution, TI = 490 ms, TFE-factor = 36, TR/TE = 3.2/1 ms). A blood-pool agent (Gadofosveset) (dose 0.12 ml/kg at 4 ml/s) was injected and first-pass imaging performed by 3D CE MRA (FOV = 420 × 280 × 135 mm^3, resolution = 1.8 mm^3, FA = 35°, TR/TE = 6.0/1.8 ms), breathhold, without cardiac gating. Two-dimensional flow analyses were performed at 4 aortic levels (FOV = 2 × 2 × 10 mm^3, FA = 10°, TR/TE = 5.0/2.7 ms, 25 cardiac-phases, VENC = 250 cm/s). For blood-pool imaging, a respiratory-navigated ECG-triggered IR-3D SSFP sequence was used (FOV = 400 × 253 × 156 mm^3, resolution = 1.5 mm^3, FA = 20°, TI = 350 ms, TR/TE = 4.0/1.3 ms, TFE-factor = 22). The volume of thrombus was extracted from the different datasets (first pass MRA, blood pool MRI and first pass CT) by an expert using manual segmentation (ViewForum, Philips Healthcare). Areas of low signal on blood pool images were correlated with direct thrombus images Figure 1.

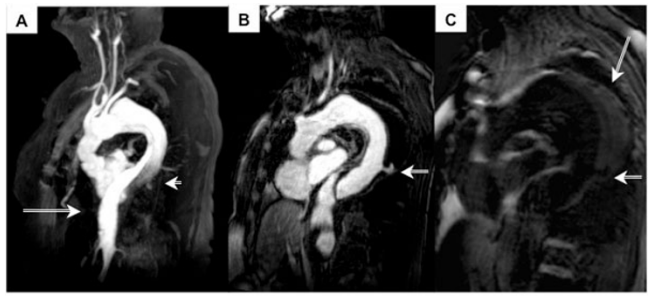

Figure 1
A. First pass CR MRA (MIP) with Gadofosveset, demonstrating food true lumen perfusion (long arrow) and poor false lumen perfusion (short arrow). B: 3D Inversion Recovery SSFP blood pool imaging with visible distal entry tear (arrow). C: Direct thrombus (IR 3D-TFE sequence) imaging highlightng false lumen thrombus (long arrow) and distal entry tear (short arrow).

Results

Analysis was feasible in all ten patients. Flow evaluation in the true and false lumen showed altered and regurgitant flow. The thrombus volumes derived from first pass 3D CE MRA and CT were significantly greater than those obtained with blood pool imaging. The mean difference between first pass 3D CE MRA and blood pool imaging was 114.4 cm^3 ((95%CI 60.04-168.7), p = 0.001), and between CT and blood pool imaging was 69.97 cm^3 ((95%CI 14.33-125.60), p = 0.019). Thrombus location and morphology was confirmed by direct thrombus MRI in all patients.

Conclusion

Blood pool imaging together with direct thrombus MRI allows assessment of aortic anatomy and quantification of false lumen thrombosis. Current clinical trials using false lumen thrombosis as a primary endpoint should consider multi-parametric MRI as the preferred diagnostic tool.

References

1. Bernard Y, *et al.*: *Am J Cardiol* 2001, **87(12):**1378-82.