

Asymptomatic aortic and supra-aortic complicated plaque identified by Magnetic Resonance Direct Thrombus Imaging in patients investigated for carotid disease

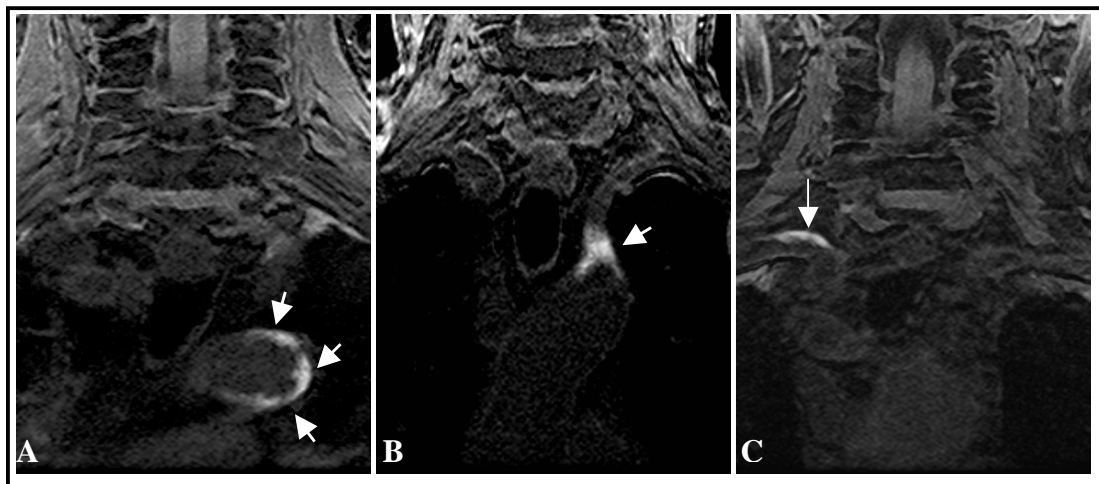
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Introduction: Atherosclerosis is a systemic disease that leads to raised plaques within the vessel wall of arteries such as the aorta, coronaries and carotids. Non-invasive imaging of the arterial vessel wall is becoming increasingly important, as the plaques that lead to morbidity and mortality are usually modestly stenotic, often not seen by angiography. Intraplaque hemorrhage/thrombosis is one of the markers of complicated plaque formation that defines the plaque as being at increased risk of causing adverse events (e.g. stroke, ischemia). We have successfully developed techniques that, by exploiting the T1 shortening effects of methemoglobin, directly visualize hemorrhage/thrombus in the arterial circulation (1, 2). The purpose of this study was to evaluate the incidence and location of asymptomatic aortic and supra-aortic complicated plaque in patients referred for evaluation of carotid artery disease.

Methods: Two hundred consecutive patients (128 male, 72 female, mean age 67.4 years [22-95 years]) were scanned using a 1.5T GE Twin Speed clinical MR scanner (GE Medical systems, USA) using an 8-channel neurovascular phased-array coil (USA Instruments, USA). All patients were being investigated for carotid artery disease. The sequence used to image the arterial vessel wall was a 3D T1W fat-suppressed spoiled gradient echo (TR/TE/ α 6.7ms/1.7ms/Fr, 15⁰), with 3mm thickness, FOV 300mm², matrix size 320², and effective pixel size 0.94mm x 0.94 mm x 1.5mm (interpolated), 3NEX. Fat suppression was performed using the Special (Spectral Inversion At Lipids) GE proprietary technique. Scan time was 04:13 minutes. Because of our large FOV, we were able to image the upper thoracic aorta (ascending/arch/upper descending portions) and supra-aortic arterial system (including the brachiocephalic and subclavian arteries). The location of the complicated plaque was categorized as: thoracic aorta, brachiocephalic, and subclavian (right and/or left).

Results: Of the initial 200 patients, the upper thoracic aorta was not imaged in 7. These patients were removed from the final analysis. Forty-five of the remaining 193 patients (23.3%) were found to have complicated plaque in the carotids, while 25 of 193 patients (13%) were found to have aortic and/or supra-aortic complicated atherosclerotic disease (16 male, 9 female, mean age 78.3 years [64-89years]). These 25 patients were being investigated for the following: transient ischemic attacks/amaurosis fugax (52%, 13 of 25 patients), acute stroke (12%, 3 of 25 patients), remote stroke (8%, 2 of 25 patients), and asymptomatic carotid stenosis (28%, 7 of 22 patients). Complicated carotid plaque was seen in 14 of the 25 (56%),



while the remaining 11 of 25 (44%) did not have carotid complicated plaque. Aortic and/or supra-aortic complicated plaque was more commonly seen in males than females (17 males [68%] vs. 8 females [32%]). The thoracic aorta was involved in 19 patients (76%) (Figure 1A), the left subclavian in 5 patients (20%) (Figure 1B), and the right subclavian in 1 patient (4%) (Figure 1C). No complicated plaque was seen in the brachiocephalic arteries.

Figure 1. Magnetic Resonance Direct Thrombus Imaging of aortic and supra-aortic arteries. Complicated plaque is seen in the aortic arch (A, arrows), the origin of the left subclavian artery (B, arrow) and right subclavian artery (C, arrow).

Conclusion: Asymptomatic aortic and supra-aortic complicated plaque was identified in 13% of our patient population. Males were found to have more asymptomatic complicated plaque than females, and the upper thoracic aorta was the most commonly site involved.

References:

1. Moody AR *et al.* *Circulation* 2003; 107:3047
2. Murphy RE *et al.* *Circulation* 2003; 107:3053