Time Resolved MRA for the Classification of Endoleaks after Endovascular Aneurysm Repair

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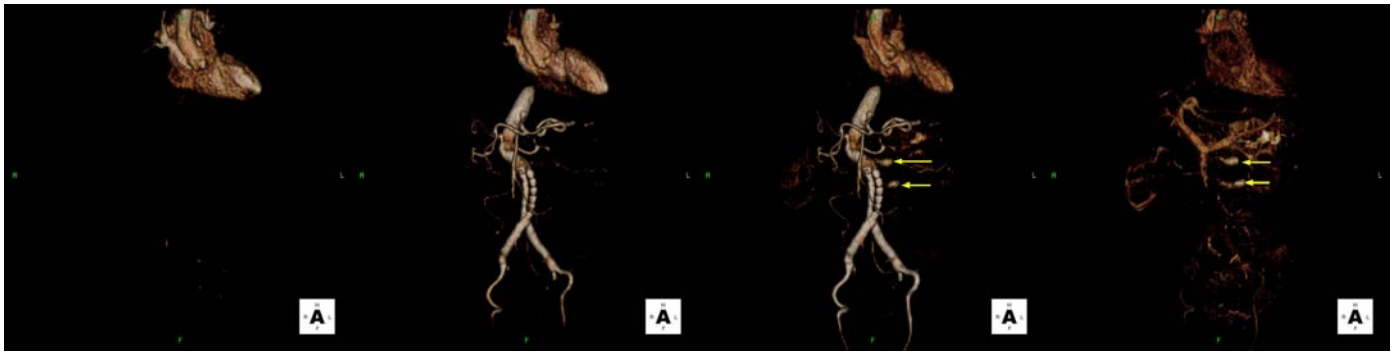
Background:

Endovascular treatment of abdominal aortic aneurysms (EVAR) has emerged as an alternative to open surgery.[1] However, the development of post-procedure endoleak remains a significant challenge. Classification of endoleaks (Type 1-4) can be an important factor in determining the appropriate management.[2] It has been previously demonstrated that endoleak results in increased pressure in the aneurysm sac, which can lead to enlargement or rupture.[3] Additionally, MRI has been shown to be significantly superior to biphasic computed tomography (CT) for detection and sizing of endoleaks, and can detect a significant number of endoleaks in cases when CT findings were negative.[4] Dynamic contrast enhanced magnetic resonance angiography (MRA) has also been shown to be effective in endoleak classification.[5] In this study, we demonstrate the effectiveness of time resolved MRA (TR-MRA) in the classification of endoleaks.

Materials and Methods:

TR-MRA images were obtained from 30 patients following EVAR between October 2002 and October 2005. These images were reviewed by a radiologist who was blinded to the angiographic results and classified the endoleak if one was present.

TR-MRA was performed with a 3d spoiled gradient sequence with Time Resolved Imaging of Contrast Kinetics (TRICKS) on a Siemens Sonata 1.5 T scanner with the following parameters: TR=2.3, TE=0.77, Slice thickness of 4mm (slice resolution 64%, interpolated), Phase partial Fourier = 6/8, Matrix = 179 x 256, Bandwidth = 700, GRAPPA (IPAT=3, 24 reference lines). 8-10 ml of Magnevist (Berlex, Wayne, NJ) was administered and 35 measurements were obtained. The temporal resolution varied between 2-3 seconds depending on patient anatomy and size.



Four images from a TR-MRA sequence demonstrating lumbar type 2 endoleaks which appear subsequent to the opacification of the iliac arteries, and remain opacified on the later images.

Results:

Endoleaks were present in 28 out of 30 patients. TR-MRA correctly characterized the presence and type of endoleak in 27 cases (90%). There were a total of six type 1 endoleaks and 22 type 2 endoleaks. The misdiagnosed cases included one case of type 1 proximal posterior endoleak which was misclassified as a type 2 endoleak, one case of type 2 endoleak misclassified as a type 3 due to a lack of visualization of the small feeding lumbar vessel, and one case of type 2 endoleak which was classified as no endoleak due to the poor visualization of the small leak.

Conclusion:

TR-MRA is highly effective in detecting and characterizing different types of endoleaks following EVAR, and should be considered as a first line diagnostic tool in the classification of endoleaks. The study is limited in detecting the presence or absence of endoleaks by the protocol for patient monitoring at our institution, as post-EVAR patients are typically followed with CT angiography. MR examination (including TR-MRA) is obtained when an endoleak needs further characterization and/or is not visualized. A few cases are directly referred to MR imaging due to elevated serum creatinine or CT contrast allergy, but not all patients in this category receive TR-MRA. The study also is limited for detecting type 3 endoleaks which were not part of the cohort.

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