

QISS MR Peripheral Angiography: Image Quality And Diagnostic Performance Of Non-Contrast Enhanced QISS MR Angiography Compared To Contrast Enhanced FLASH MR Angiography



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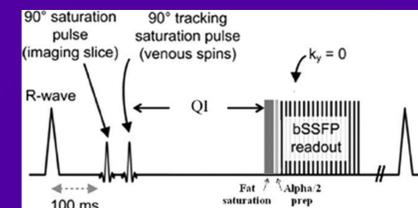
Introduction

Magnetic Resonance Angiography (MRA) is used in the assessment of peripheral arterial disease (PAD) and has relied on the use of gadolinium-based agents for contrast enhancement. However, recent concerns regarding gadolinium in patients with renal dysfunction [1,2] have necessitated the development of sequences which obviate the need for contrast enhancement.

Quiescent-Interval Single-Shot (QISS) MRA was recently developed by Edelman et al [3] as a means of evaluating PAD without using gadolinium-based agents. Using an initial group of ten symptomatic patients in our centre, we compare the image quality and diagnostic performance of QISS MRA of the lower limbs against contrast-enhanced FLASH (Fast Low Angle SHot) MRA (CE MRA).

What is QISS?

QISS is a rapidly acquired, unenhanced MRA sequence which minimises flow and motion artefact. Using ECG gating, data is acquired using a modified two-dimensional balanced steady-state, free precession pulse sequence with fat suppression. A quiescent interval is incorporated to optimise enhancement of inflowing blood. The pulse sequence is demonstrated in this diagram (by Edelman et al [3])



Methodology and technical parameters

Ten patients underwent standard CE MRA with additional ECG-gated QISS sequences on a 1.5 Tesla scanner using 2 body matrix, spine array and peripheral angiography coils - providing coverage from the aortic arch down to the toes. Parameters were adopted from those used by Edelman et al [3]: TR/echo time/QI/flip angle = 3.4ms/1.4ms/350ms/90°; QISS time delay (from R-wave to first excitation pulse) = 100ms; field of view = 34-40cm; effective slice thickness = 2.4mm (3.0mm with 0.6mm overlap), axial orientation, 48 slices. Parallel imaging (GRAPPA) acceleration factor 2 was also implemented. Each QISS acquisition block (of 48 slices) took approximately 50 seconds to complete, and nine blocks were acquired from toes upwards to the level of the renal arteries – resulting in an additional scan time of about 10-15 minutes relative to normal CE-MRA.

Comparisons were made between CE MRA (20ml Dotarem) and QISS MRA data. Case examples are shown.

Results - Case 1

83 year old male with near critical ischaemia in the left leg but no rest pain.

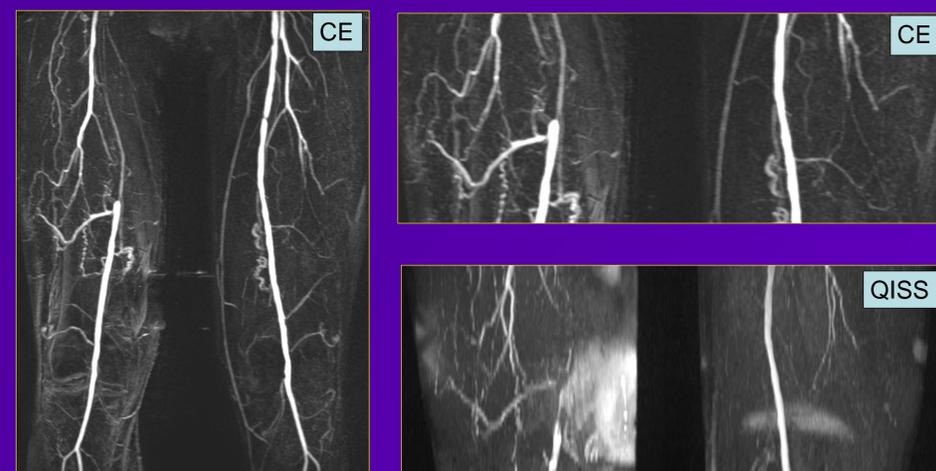
CE MRA demonstrates short segment left SFA occlusion with contralateral right SFA stenosis. Both are also well demonstrated on QISS imaging.



Results - Case 2

59 year old male. Duplex scanning had identified a right SFA obstruction.

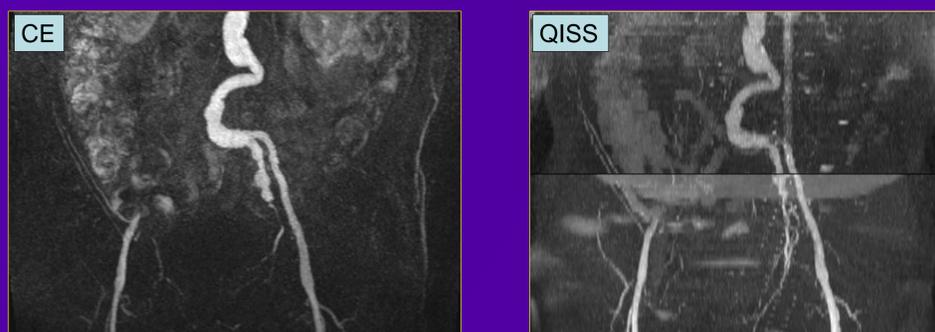
CE MRA confirms that the right SFA has occluded at its origin, reforming distally from collaterals. This is also appreciable on QISS.



Results - Case 3

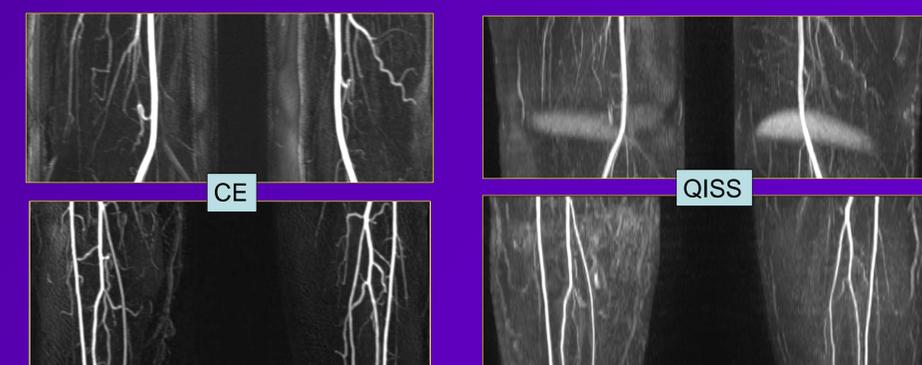
70 year old male with previous AAA repair who presented with intermittent claudication in the right thigh. The right femoral pulse was absent on examination.

CE MRA demonstrates occlusion of the right iliac segment, also seen on QISS. The extreme tortuosity of the aorta is clearly evident on both sequences.



Results - Case 4

24 year old female. No significant abnormality identified on CE MRA or QISS, which demonstrate comparable arterial opacification, with good run-off opacification



Conclusion

Within our study group of symptomatic patients, non-contrast QISS MRA has been shown to be technically comparable to CE MRA. QISS provides good early results for the detection of significant peripheral arterial stenotic disease. Accordingly, QISS MRA may prove valuable in patients with renal dysfunction by avoiding the use of gadolinium-based contrast agents in peripheral MRA.

Lay summary

QISS is a new sequence in MRA which has been suggested as a means of avoiding the use of gadolinium-based contrast agents in the assessment of peripheral arterial disease. These contrast agents have been linked to the development of nephrogenic systemic fibrosis in patients with poor renal function.

In this exhibit, we have presented a selection of findings from symptomatic patients in our centre which demonstrate that imaging using QISS is broadly comparable to imaging using contrast agents. Accordingly, QISS may be a feasible alternative to contrast-enhanced MRA in patients with poor renal function.

References:

- 1) Broome DR. Nephrogenic systemic fibrosis associated with gadolinium based contrast agents: A summary of the medical literature reporting. Eur J Radiol. 2008;66:230-4
- 2) Martin DR. Nephrogenic systemic fibrosis: A radiologist's practical perspective. Eur J Radiol. 2008;66:220-4
- 3) Edelman RR, Sheehan JJ, Dunkle E et al. Quiescent-interval single-shot unenhanced Magnetic Resonance Angiography of peripheral vascular disease: Technical considerations and clinical feasibility. Magn Reson Med. 2010;63:951-8