Fresh Blood Imaging versus Contrast Enhanced MRA with DSA as the Reference Standard

R. K. Puni[1], M. J. Henderson[1], L. Morus[1], C. Green[1], F. Admiraa-Behloul[2], and S. Roy-Choudhury[1]
[1]Heart of England NHS Foundation Trust, Birmingham, United Kingdom, [2]MR-BU, Toshiba Meidcal Systems Europe, Zoetermeer, Netherlands

INTRODUCTION: With Nephrogenic systemic fibrosis (NSF) receiving considerable attention [1], non-contrast enhanced (NCE) MRA appears to be a feasible alternative to contrast enhanced (CE) MRA. Fresh Blood Imaging (FBI) is a NCE technique that was introduced in late 90s by M Miyazaki and co-workers, and has gained popularity only very recently [2] after the NSF-Gadolinium link has been reported in patients with impaired renal function. The purpose of this pilot study was to compare FBI technique to CE-MRA using DSA as the reference standard.

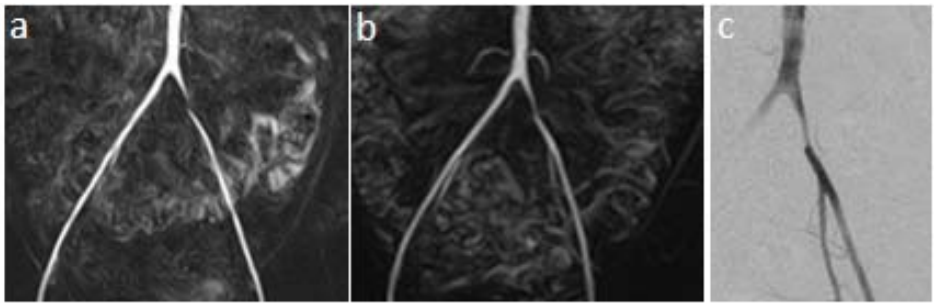

Fig. 1: good agreement between FBI (a) CE-MRA(b) and DSA (c)

MATERIALS AND METHODS: We included 15 patients with suspected vascular disease. The examinations were carried using a Toshiba 1.5 T MRI scanner with the Atlas coil-system. For both techniques the patients were scanned feet first with 3 stations using 2 Atlas Phase-array surface body coils (16 elements each), a 32-elements Atlas Spine coil, and a 14 elements Atlas head coil (used for pedal area), having a total coverage of about 120 to 130 cm. The patients had both the FBI and CE-MRA examinations carried out on the same hospital visit. The FBI technique was carried out first. The CE MRA was acquired with a bolus of 30 ml of Gadolinium (Gadobenate dimeglumine; Multihance 0.5M) infused over 1.5 minutes and the following parameters: TR 3.7 X TE 1.3 =x FOV (430X480) Matrix (460X512) slice thickness= 3.5MM, FA20, Fat Sat ON.FBI images were obtained with flow-spoiled gradients pulses ECG-triggered and a 3D half-Fourier FSE imaging. An ECG-prep scan was first performed to determine the appropriate diastolic and systolic delay times. The image subtraction of the diastolic bright blood arteries from the systolic black blood arteries allowed the visualization of the arteries alone . FBI scan parameters were as follows: TR: 2733, TI: 130, TE: 80, FA: 90, NEX: 1, FOV: 450mm, in plane resolution: 1.8mm, slice thickness: 3.8mm, number of slices: 46, Fat sat on, examination time each station: 3.11 minutes.

RESULTS: The FBI and CE-MRA techniques were well tolerated by all the patients. In 13 out of 15 patients the FBI identified lesions seen on CE-MRA and DSA (example in Fig 1). In one patient with cardiac myopathy, there was poor arterial and venous vessel differentiation in FBI image most probably due to small differences between systolic and diastolic flow velocities. In one case the FBI showed similar findings to the DSA which demonstrated attenuation of flow in the left tibial arteries, whereas the CE-MRA study in this patient demonstrated apparent good flow with normal caliber of the tibial vessels which was at odds with the FBI /DSA findings.

CONCLUSION: Our initial findings show that the FBI technique demonstrates good depiction of the peripheral vessels and therefore has the potential to be a very valuable diagnostic tool especially in patients with renal impairment . A larger study group involving quantitative analysis of the vessels bilaterally is being organized out with accuracy, sensitivity and specificity scoring tables. Further investigations are required to asses whether the use of CE-MRA in peripheral vascular tree using an injector pump makes a significant difference haemodynamically to alter the MRI appearances of small vessels (as seen in one case) compared to the FBI technique which depends upon natural flow within the vessels.

REFERENCES: 1. Shellock FG *et al*, AJR 2008:191 2. Miyazaki M, Lee VS, Radiol 2008;248