

Clinical Application of Non-Contrast Enhanced MRA at 1.5T to Peripheral Arteries in Patients with Obstructive Vascular Disease

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PURPOSE

Nephrogenic Systemic Fibrosis is a fibrosing condition that occurs in patients with renal insufficiency [1,2]. Many directives have recently been given to radiologists advising a careful use of Contrast-Enhanced (CE) MRI. In patients with renal malfunction the only safe alternative is to use a non-contrast enhanced technique. Fresh Blood Imaging (FBI) [3,4] is a non-contrast enhanced MR Angiography (MRA) available on any 1.5 T MR scanner of Toshiba Medical Systems. The purpose of this study was to investigate the reliability of this new commercially available technique in a clinical setting for the benefit of patients with obstructive vascular disease and renal insufficiency.

MATERIAL AND METHODS

Fifteen patients (9 man, mean age 66 range 43 to 85) with obstructive vascular disease of the lower extremity were explored to obtain pre-treatment evaluation, prior to endovascular or surgical revascularisation. All patients were imaged by at least one reference technique: CTA and/or CE-MRA. Three patients had both CTA and CE-MRA, 9 had CTA only and 3 had CE-MRA only. CTA was performed on a VCT 64 General Electric, and MR Angiographies were obtained on a 1.5T MRI system (Vantage, TOSHIBA, Tokyo).

CE-MRA images were acquired using the following parameters: TR=3.7 TE1.3 SI 3mmMC40 FOV45 Matrix192X256 FA20 Fat Sat ON.

FBI images were obtained with flow-spoiled gradients pulses in ECG-triggered 3D half-Fourier FSE imaging. An ECG-prep scan was first performed to determine the appropriate diastolic and systolic ECG-triggering delay times for the vessels of interest. The image subtraction of the diastolic bright blood arteries from the systolic black blood arteries allowed the visualization of the arteries alone by canceling the background and the veins, which are always depicted as bright blood throughout the cardiac cycle. Three-dimensional FBI images were then obtained with TR=3000, TI=130, TE=30, FA=90, NEX=1, FOV= 40, matrix=256X256, slice thickness= 2 to 4, slice number= 40 to 50, Fat Sat on, and acquisition time = 5 mm.

We used 3 to 4 step exploration and the all stages were analyzed separately with MIP image reconstruction in multiple planes.

The image quality was visually assessed by an experienced radiologist and scored as: bad quality non-interpretatable, moderate quality but interpretatable and good quality.

The FBI images were compared to the reference examination, for the assessment of all vascular lesions, calcified or non-calcified plaques, assessment of the degree of stenosis and their repercussions on the flow below and visibility of the whole vascular axe.

RESULTS

All 15 examinations were interpretable, 4 were scored as moderate quality and 11 as good quality. The precise evaluation of atherosclerosis disease, by non-contrast enhanced MRA was almost comparable to CTA and contrast enhanced MRA.

The assessment of the infra-renal aorta and the iliac arteries was most of the time slightly better in CTA and CE-MRA because of bowel motion and oblique angle of iliac axes. However, calf arteries were better seen in distality with FBI, without any venous contamination.



Fig. 1: A 59 year old man with pain in his legs. We performed CTA (a) and FBI (b). The results are scored as good. On the CTA, we can see many calcifications of the arterial wall, on the infra-renal Aorta and the iliac arteries. There are also many non-calcified plaques. Calcified and non-calcified plaques are well depicted with FBI MRA. There is no significant stenosis, but the atherosclerosis wall plaques are more extended on the superficial femoral artery and there is a collateral artery from the deep femoral artery to the distality of the superficial femoral artery. There is also a more important plaque on the left popliteal artery, opposite a calcification better evaluated with FBI MRA.

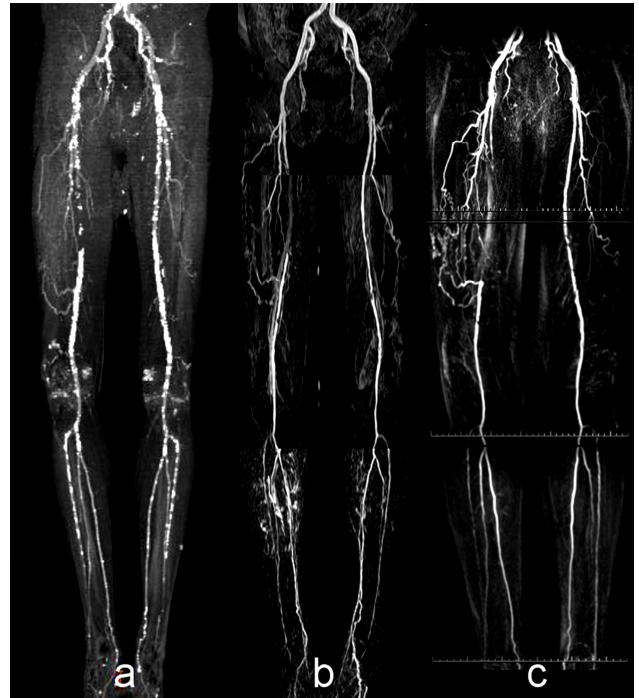


Fig. 2: An 82 year old man, explored for a pre-occlusive stenosis of the right superficial femoral artery, with CTA (a), CE-MRA (b) and FBI (c). The images are scored as good for CTA and FBI but only mid for CE-MRA because of venous and background contamination. The stenosis is well depicted in all 3 techniques. There is an artifact on the left iliac artery due to the oblique angle of the vessel and there are many calcifications which obstruct the visibility of the lumen on CTA. There are many wall plaques with a low flow in calf arteries, particularly in the right anterior tibial artery and the left peroneal artery.

CONCLUSION

The non-contrast enhanced MR Angiography technique FBI, for the examination of the lower extremity arteries is reliable enough to be used as pre-treatment imaging for obstructive vascular disease, when patients have moderate or serious renal dysfunction.

REFERENCES

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