Utility of Lower Extremity MR Angiography for Detection of Acute Thrombotic Arterial Occlusion

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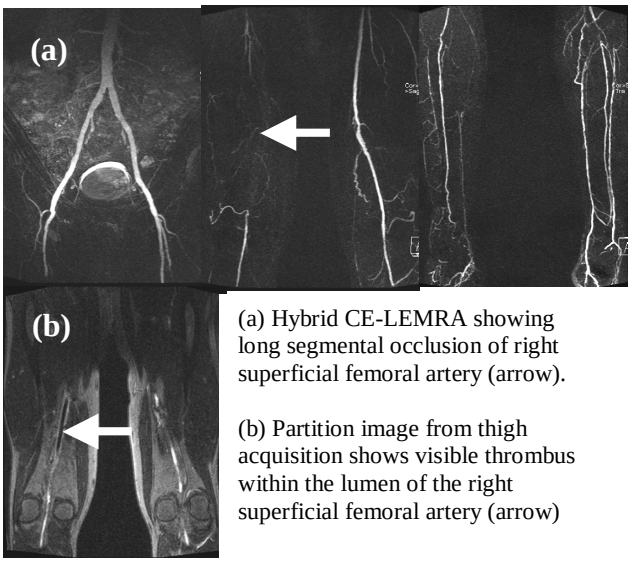
INTRODUCTION: Acute arterial occlusion secondary to intraluminal thrombosis is a potentially catastrophic condition that may result in limb loss or even death. Early diagnosis is vital as prompt treatment with intra-arterial thrombolysis may result in complete resolution of thrombus and limb salvage. Traditionally, digital subtraction angiography (DSA) has been the diagnostic investigation of choice, however DSA cannot reliably distinguish between acute and chronic arterial occlusion. Contrast-enhanced MR angiography (CEMRA) [1, 2] is now increasingly being used to evaluate the arterial system of the lower extremities. Not only can CEMRA depict the contour of the vessel, it can also directly image clot within the lumen. The ability to detect visible thrombus within the arterial lumen may act as a marker for diagnosis of acute thrombotic arterial occlusion. This subgroup of patients could therefore be treated with minimally invasive intra-arterial thrombolysis, thus avoiding unnecessary surgery.

PURPOSE: To evaluate the ability of lower extremity CEMRA (LE-CEMRA) to detect intraluminal thrombus and to correlate this with the clinical presentation of the patient.

MATERIALS AND METHODS: 108 LE-CEMRA studies were retrospectively reviewed on a PACS workstation (GE medical systems, Milwaukee, WI). All LE-CEMRA studies had been carried out on a Magnetom Quantum scanner (Siemens Medical Systems, Iselin, NJ) using a 3D gradient echo pulse sequence (TR/TE: 3.5/1.2; flip angle 25^0) and dedicated peripheral vascular coil.
The hybrid LE-CEMRA technique [3], which has previously been described at this meeting, was used in all cases. Two separate axial timing-bolus acquisitions were initially carried out, in both the calves and the pelvis. 3D CEMRA was initially carried out in the calves. 20ml Gadolinium-DTPA was injected at 2ml/sec. 1 pre-contrast and 2 post-contrast acquisitions were obtained yielding 2 subtracted 3D data sets. Following this, stepping-table LE-CEMRA was performed using 2 stations to cover both pelvis and thighs. Scanning parameters were optimized at each level giving a total acquisition time of approximately 30 seconds including table movement time. Forty ml Gadolinium-DTPA was injected as a single infusion; the first 20ml at 2ml/sec followed by the remainder at 1ml/sec.
Partitions and maximum intensity projection images were assessed by 2 observers. Segmental or complete arterial occlusions were noted in the pelvis, thigh and calf vessels for all subjects. The presence of continuous and discontinuous intraluminal thrombus was also noted for all the occluded arterial segments. All studies with arterial occlusions were correlated with the clinical presentation, by retrospective digital chart review.



(a) Hybrid CE-LEMRA showing long segmental occlusion of right superficial femoral artery (arrow).

(b) Partition image from thigh acquisition shows visible thrombus within the lumen of the right superficial femoral artery (arrow)

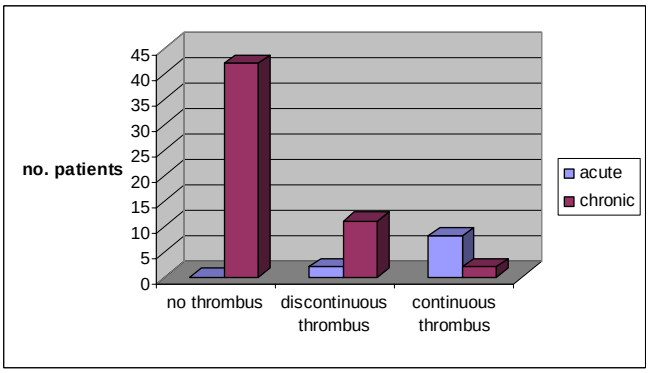


Table 1: Table demonstrates correlation of segmental arterial occlusion (n=65) with clinical presentation. 80% of those with continuous intraluminal thrombus presented acutely. The majority of those without thrombus or with discontinuous thrombus presented with chronic symptoms

RESULTS: 65 patients had arterial occlusions noted on their LE-CEMRA study. Intraluminal thrombus was identified in 23 of the 65 patients with occlusions. Of the 23 patients with thrombus, 10 (44%) had continuous thrombus and 13 (56%) had discontinuous thrombus. 8 (80%) out of 10 patients with continuous thrombus had an acute clinical presentation. 2 out of 13 patients (15%) with discontinuous thrombus had an acute presentation. All (100%) of the 42 patients with arterial occlusions, where no thrombus was identified, had chronic symptoms at presentation.

CONCLUSION: The presence of continuous intraluminal arterial thrombus identified at LE-CEMRA correlated highly with acute clinical symptomatology. This finding on LE-CEMRA may act as a marker for acute thrombotic arterial occlusion and help direct these patients towards less invasive intra-arterial thrombolysis rather than surgery.

References:

1. Prince. Radiology 1994. 191: 155-164
2. Leiner et al. J Magn Reson Imaging 2000. 11:368-377
3. Carr et al. ISMRM 2002