Rapid MR evaluation of the lower extremity veins: Technique and clinical findings of DVT in 520 subjects referred for peripheral MRA

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INTRODUCTION: Contrast-enhanced MRA of the arterial system has emerged as a rapid, effective way to evaluate patients with suspected arterial occlusions of the lower extremities. Some of these patients, however, may have deep venous thrombosis as the primary cause of lower extremity pain and swelling, and we have developed a protocol for comprehensive evaluation of the arterial and venous system in a single setting. The objectives of this research are to describe a protocol for rapid evaluation of the lower extremity for venous thrombosis, and to determine the incidence of deep venous thrombosis in patients referred for evaluation of suspected arterial occlusion.

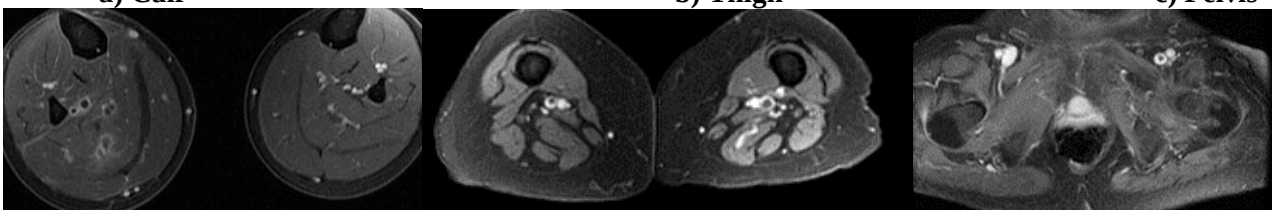
METHODS: We developed a protocol for rapid, comprehensive examination of the lower extremity venous and arterial system. All studies were performed on a 1.5 Tesla scanner (GE-SIGNA EXCITE, GE Healthcare, Waukesha, WI) using a 3-station arterial phase contrast-enhanced MRA during the intravenous infusion of 50 cc Omniscan contrast agent (GE Healthcare). Subsequently, venous imaging was performed using a delayed, post-contrast, T1 weighted fast spoiled recalled gradient echo acquisition with fat saturation. Parameters for the acquisition included: TR/TE/FLIP = 110/1.3/60°, Matrix 256 x 192, 8 mm thick slice, axial plane. The MR venography images were obtained at four locations including the calf, thigh, pelvis, and abdomen. Each acquisition required one minute , for a total MR venography examination time of approximately 4 minutes.

The records from 520 consecutive patients imaged between April 2001 to November 2004 were retrospectively reviewed for the presence of venous thrombosis diagnosed by the MRV exam. The medical records of the patients with DVT were reviewed to determine the course of treatment. This review was approved by our institutional IRB.

RESULTS: The rapid MR venography technique provides a fast, relatively artifact-free image of the deep venous system. Combination of high FLIP angle and fat suppression highlights the image contrast between the deep venous thrombosis and surrounding contrast-enhanced blood and perivascular tissues. Venous thrombosis was clearly demonstrated as a filling defect within the deep venous system, as demonstrated by low signal intensity hemosiderin within the clots (Figure 1). Compared to time-of-flight imaging, the technique is more rapid (approximately $1/5^{th}$ of the time) and does not suffer from artifacts due to slow flow. In addition, the delayed post-contrast images provided exquisite images of complications associated with venous or arterial insufficiency, including ulcerations, myonecrosis, and cellulitis.

A total of 18 of 520 patients had deep venous thrombosis, giving a prevalence of 3.46 %. Of the positive studies, 17 went on to further treatment, including Intravenous / Oral anticoagulation and IVC filter placement

Figure 1.



CONCLUSION: We describe a protocol for rapid evaluation of the deep venous system that may be combined with an MRA of the lower extremity arteries. While the prevalence of unsuspected deep venous thrombosis in this patient population is low, 17/18 of those individuals with deep venous thrombosis were treated. Therefore, we suggest that this additional evaluation should be added to existing MRA protocols, and the technique should be considered as a rapid diagnostic technique for detection of deep venous thrombosis in the symptomatic population.