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Magnetic Resonance Characteristics of the LGM Vena Cava Filter: Technical Note

Paul M. Kiproff, Ziad L. Deeb, Farhad M. Contractor, and Maroon B. Khoury

Department of Diagnostic Radiology, Allegheny General Hospital and The Medical College of Pennsylvania, Allegheny Campus, Pittsburgh, Pennsylvania, USA

Abstract. The LGM (Vena Tech) IVC filter is a recently introduced device for caval interruption. The magnetic resonance imaging safety and imaging characteristics of this filter were evaluated. The filter was proven to lack ferromagnetic properties. It was imaged with minimal artifact and no detectable motion in the magnetic field.

Key words: LGM filter–Magnetic resonance imaging

The LGM (Vena Tech) IVC filter is a recently introduced percutaneous device for caval interruption that is inserted via a 12F sheath (3.6 mm diameter). Pulmonary emboli recurrence has been reported at 2% and inferior vena cava occlusion has been reported at 7.1% of patients followed for 1 year [1]. These low complication rates, along with the user-friendliness of the LGM filter, has made it the inferior vena cava filter of choice for many [2]. To date, the magnetic resonance (MR) characteristics of the LGM filter have not been reported. The MR imaging safety and artifacts of the LGM (Vena Tech) filter were evaluated.

Materials, Methods, and Results

The LGM (Vena Tech) IVC filter is made from an alloy called Phynox (42% cobalt, 21.5% chrome, 18% nickel, 7.5% molybdinum, 2% manganese, 8.849% iron, 0.15% carbon, 0.001% beryllium). The ferromagnetism of the device was measured by a method previously described by New et al. [3]. As described, the device was suspended on a string at the portal of the MR unit, and the angle of deflection from the vertical was determined. The magnitude of deflection indicates the magnitude of the ferromagnetism of the device.

Address reprint requests to: Paul M. Kiproff, M.D., Department of Diagnostic Radiology, Allegheny General Hospital, 320 East North Avenue, Pittsburgh, PA 15212-9986, USA

In a 1.5 Tesla field, the ferromagnetic force (Dynes $\times$ 10^2) for the filter was 0.0, indicating the absence of ferromagnetism.

Device Migration

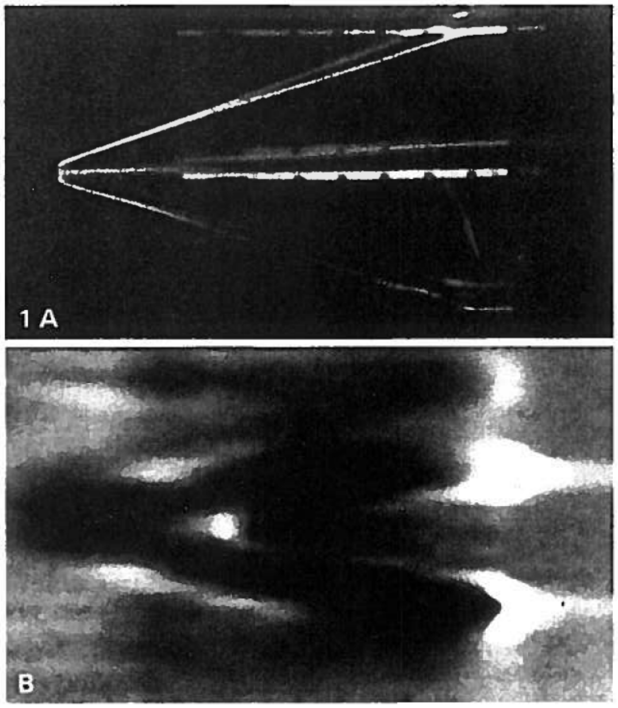
The device was invested in gelatin. Plain films were obtained in both the AP and lateral projections pre- and post-MR imaging. Superimposition of the images demonstrated no detectable movement. Plain films of the invested filter (Fig. 1A) and MR images of the invested filter (Fig. 1B) are presented.

Patient Imaging

Five patients were then chosen at random and scanned with a 1 Tesla unit between 3 and 21 days postfilter placement. The image characteristics of the filter were essentially identical in all patients. In the axial projection an appearance similar to that of a sand dollar was observed in all patients (Fig. 2). Cranial images also had a characteristic appearance, as seen in Figure 3. As demonstrated, only minimal artifacts are noted when imaged at 1.0 Tesla. The characteristic appearance with minimal artifact allows exact identification of this filter without interfering with the diagnostic MR evaluation of the abdomen.

Discussion

Risk of MR imaging in patients with ferromagnetic implants is mainly related to movement or dislodgement of the object. With the increased usage of MR imaging, the MR compatibility of newly introduced implantable devices must be considered. Teitelbaum et al. [4] have evaluated artifacts and torques of intravascular devices, including 9 IVC filters. Four of the nine filters were judged to have no or mild artifact. The remaining five filters demonstrated moderate-to-severe black hole artifact. Shellock [5] has compiled this data along with 13 other published articles to formulate an MR compatibility list of 127 metallic implants and materials. As new devices become available, their MR compatibility must be included to make a fair assessment and comparison with other similar devices.



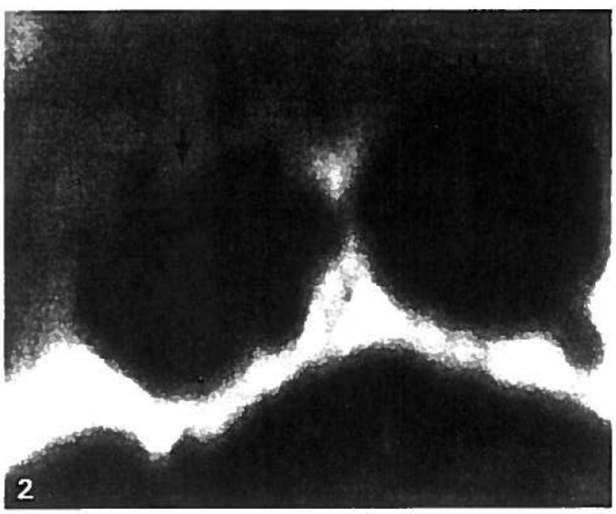


Fig. 1. A AP image of invested filter 2 ma at 46 kVp (above). **B** Coronal MR image of invested filter [TR 60, TE 15].

Fig. 2. Axial MR image demonstrating characteristic "sand dollar" appearance (closed arrow); (aorta = open arrow); [TR 60, TE 15].

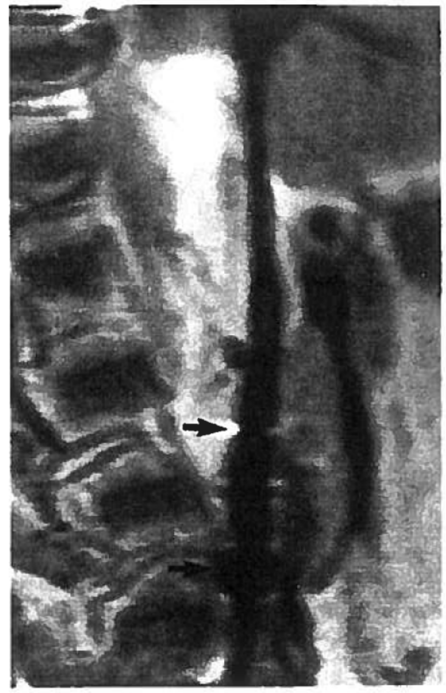


Fig. 3. Sagittal MR image demonstrating characteristic appearance with minimal artifact (arrows indicate upper and lower extents of filter).

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