antivenin should be administered as soon as possible.

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JAOA

Case report

Guidewire incidents with inferior vena cava filters

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Several authors have demonstrated that prophylactically inserted inferior vena cava filters have decreased pulmonary thromboembolic complications in selected high-risk trauma patients. Guidewire-related mishaps are potential complications of inferior vena cava filters and are likely underreported. The authors present two cases and review strategies to prevent these complications.

(Key words: inferior vena cava filter, guidewire, trauma care)

Conventional indications for inferior vena cava filter (IVCF) insertion include contraindication to anticoagulation, complication of anticoagulation, failure of anticoagulation (recurrent pulmonary embolus), free-floating iliofemoral thrombus, and having a pulmonary embolectomy. In addition, high-risk injured patients with contraindications to low-dose heparin (including low-molecular-weight heparin) and sequential compression devices may benefit from the prophylactic insertion of an IVCF. This practice is common in trauma centers.[1] Prophylactic IVCFs in this setting have been shown to decrease pulmonary embolic complications and have an acceptably low incidence of complications in selected high-risk trauma patients.[2-4] Data regarding complications of prophylactic IVCF insertion in the trauma population have been limited to insertion-site deep venous thrombosis, recurrent pulmonary embolus, caval occlusion, IVCF tilt, and migration.[2-6] We report two guidewire-related complications in injured patients.

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Report of case

Case 1

A 54-year-old man fell 30 feet and sustained a depressed skull fracture, frontal lobe contusion, multiple facial fractures, distal right radius and ulna fractures, and a thoracic spine fracture (T-3) with resultant paraplegia. His depressed skull fracture was elevated operatively and a dural laceration repaired after admission. A prophylactic IVCF was inserted on his second day after admission. The preinsertion cavagram was unremarkable, and an LGM Vena Tech filter (Braun, Evanston, Ill) was inserted via the right internal jugular vein. The filter was deployed infrarenally with the apex of the IVCF at the mid-body of the third lumbar vertebra. The thoracic spine fractures were stabilized with internal fixation on the sixth day after admission. The radius and ulna fractures were treated nonoperatively, and the brain injury was observed without sequelae.

Two days after IVCF insertion, the patient underwent a left subclavian central venous catheter exchange over a wire. The new catheter was advanced over the

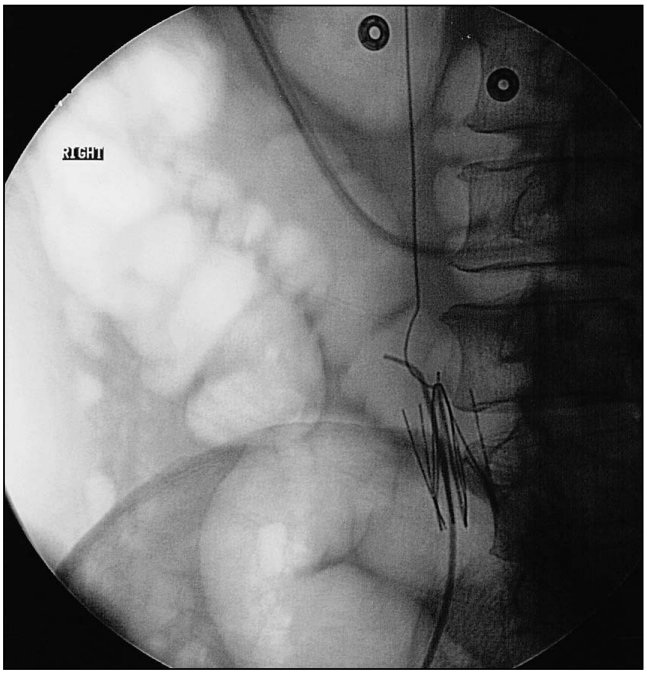

Figure 1. *Vena Tech inferior vena cava filter with entrapped J-tipped guidewire. Cobra catheter via the femoral vein used to dislodge entrapped guidewire.*

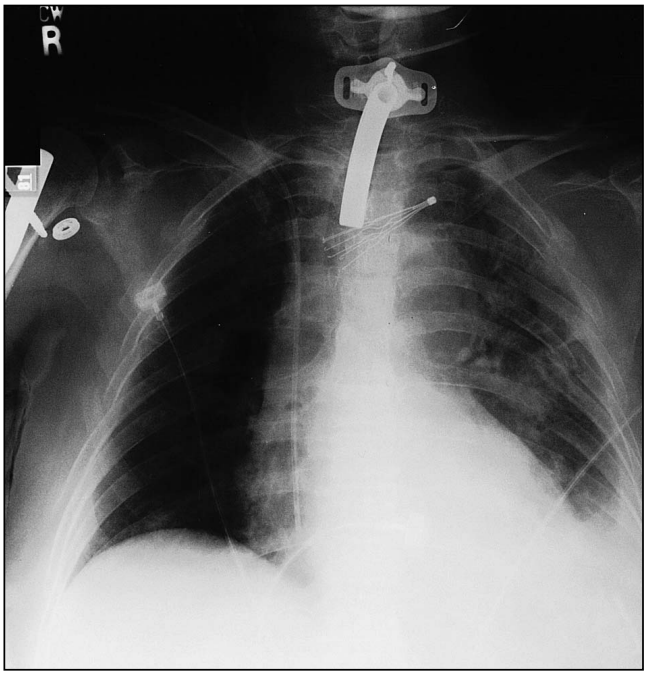

Figure 2. *Stainless steel Greenfield filter in the innominate vein.*

guidewire without difficulty; however, attempts to withdraw the guidewire met with significant resistance. A fluoroscope was brought to the bedside, and the guidewire was found to be trapped in the IVCF (*Figure 1*). Notably, the multiple manipulations had dislodged the filter, which was now located at the fourth and fifth lumbar levels. Two attempts to dislodge the guidewire under fluoroscopy were unsuccessful, and the patient was taken to interventional radiology. The guidewire was successfully dislodged using an angiographic catheter via a femorally placed introducer sheath. A Cobra catheter and tip deflector (Cook Inc, Bloomington, Ill) were used to dislodge the guidewire from the filter, allowing the guidewire to be removed via the left subclavian catheter (*Figure 1*).

Case 2

A 69-year-old female pedestrian was struck by an automobile, sustaining facial fractures, multiple rib fractures, a sacral fracture, and a right humerus fracture. The patient's condition while in the hospital was complicated by respiratory failure, which led to a tracheostomy and prolonged ventilator support. In addition, a deep venous thrombosis developed early during her hospitalization. A stainless steel Greenfield IVCF (Meditech, Watertown, Mass) was inserted because she appeared to be too high of a risk to undergo therapeutic anticoagulation. Two weeks later, she underwent a left subclavian central venous catheter exchange over a wire. The guidewire became "stuck" and was vigorously removed. A subsequent chest x-ray revealed that the IVCF had been dislodged and now resided in the innominate vein (*Figure 2*). By this time, the patient was considered safe for therapeutic anticoagulation, and she was placed on intravenous heparin. The IVCF was left in the innominate vein. The patient was discharged and placed on a course of oral warfarin for 3 months, and she remains asymptomatic 4 years after the incident.

Comments

The incidence of guidewire mishaps with IVCFs is unknown. Reports are limited to a few case reports and small case series. These incidents include guidewire entrapment, filter dislodgment, and cava perforation.[7-13] We suspect guidewire-related complications are underreported. We were able to dislodge the guidewire endovascularly in Case 1. This, however, required transport to the angiography suite and the insertion of a femoral introducer sheath. Other guidewire mishaps have required operative removal of the guidewire, the IVCF, or both.[8] At the time of the guidewire complication in Case 2, we believed the patient could be safely anticoagulated. Therefore, a second IVCF was not indicated, and the "misplaced" Greenfield filter was observed for complications. The patient remains asymptomatic at 4 years.

Injured patients undergoing prophylactic IVCF often have multiple injuries that contraindicate the use of low-molecular-weight heparin (for example, brain injuries, pulmonary contusions, and nonoperative solid-organ injuries). These patients often have prolonged stays in the intensive care unit and hospital. Such patients also require multiple central venous catheters and pulmonary artery catheters throughout their hospitalization; therefore, patients with IVCFs are at risk for this complication.

The principal IVCF type used in the

United States is the Greenfield filter (both titanium and stainless steel), which represents more than 95% of the reported prophylactic filters used in trauma patients. Incidents related to J-tipped guidewires and IVCFs have been reported in Greenfield and Vena Tech filters. To our knowledge, there are no reported guidewire incidents with either the Bird's Nest (Cook Inc, Bloomington, Ill) or the Simon Nitinol (Covington, Ga) filters.

An in vitro study showed that J-tipped guidewires engage in all the major filter types used in the United States (stainless steel Greenfield, titanium Greenfield, Vena Tech, Bird's Nest, and Simon Nitinol) but entrapment occurred only in the Vena Tech and 12 Fr stainless steel Greenfield filters.[9] Entrapment did not occur in the titanium Greenfield, Bird's Nest, or Simon Nitinol filters. Notably, there were no incidents of entrapment or engagement with straight guidewires. In our review of the literature, cases of guidewire-related mishaps with Greenfield filters did not always specify titanium or stainless steel, [8,10,11] though one report specified a stainless steel filter.[12]

Preventive measures include awareness of the presence of an IVCF prior to the insertion of a new central venous catheter or the exchange of a central venous catheter over a guidewire. Guidewire lengths should be noted and inserted only to the depth of the superior vena cava. This can be estimated by laying the guidewire over the thorax from the insertion site to the angle of the manubrium prior to insertion. Bedside fluoroscopic guidance to avoid engagement of the guidewire with an IVCF may also be considered, but this method is cumbersome and adds significant additional expense and radiation exposure. The use of straight guidewires for insertion or catheter changes is the safest and easiest method to avoid guidewire-related complications. There may be an advantage to the titanium Greenfield, Bird's Nest, and Simon Nitinol filters regarding guidewire-related complications, though this is by no means certain.

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