The number of complications between guidewires and inferior vena cava filters is unknown and most likely underreported. Since 1993, at least 17 cases of central venous catheter guidewires entangled in inferior vena cava filters have been reported. The placement of both devices in the intensive care setting has increased the number of incidents in which a guidewire from a central venous catheter becomes entrapped in an inferior vena cava filter.

The authors report a case in which entrapment of a guidewire occurred without causing displacement of the filter. In addition, a review of simple but useful recommendations to prevent and manage these complications is presented.

Central venous catheterization is a safe, commonly performed procedure in the intensive care setting. It is performed at the bedside without fluoroscopy, often with a J-tip guidewire. Central venous catheterization provides vascular access to administer drugs, parenteral nutrition, fluids, and blood products. Common complications include pneumothorax, bleeding, and catheter sepsis. We report a case of a J-tip entrapment by a previously placed inferior vena cava filter (IVCF). In addition, we discuss guidelines to avoid these types of complications.

Report of Case
An 81-year-old woman was admitted to the surgical intensive care unit after emergent colon surgery. Her postoperative course was complicated by a thrombus in her left deep femoral vein. Anticoagulation was contraindicated at this time because of upper gastrointestinal bleeding. It was decided to place a 12F stainless steel Greenfield filter (Medi-Tech, Watertown, Mass) while the patient was in the radiology suite. The filter was deployed in the infrarenal position via the right internal jugular vein.

One week later, the patient underwent an attempt to place a triple lumen intravenous catheter via the left subclavian vein. A 0.038-inch, 3-J-tip spring guidewire was passed easily into the cannulated vein and advanced approximately 50 cm, and the catheter was passed over the guidewire without difficulty. However, attempts to withdraw the guidewire met with significant resistance. Further attempts resulted in breaking the inner mandrel and unraveling the wire beneath the clavicle. A chest and abdominal film revealed that the J-tip had become entrapped in the IVCF (Figure 1). The position of the filter appeared to be unchanged.

The patient was brought to the angiography suite, where there was concern about safely passing a catheter over the unraveled wire, so access was gained from the right side in an attempt to ensnare the wire. This demonstrated that the wire was under tension between the filter and the clavicle and could not be retrieved safely. The interventional radiologist passed a second wire along the unraveled wire and then buttressed the two together. A catheter was then passed down both wires to the J-tip that was opened, and the wire disengaged (Figure 2). Films taken after removal of the wire indicated no migration or malposition of the filter.

Discussion
In the intensive care setting, central venous catheterization is a commonly performed procedure often used for intravenous or central access or pulmonary artery catheter placement. The Swedish radiologist Sven Ivar Seldinger first described the Seldinger technique in 1953 as an arterial catheterization method for performing arteriography in which a guidewire is initially placed into the vessel and a catheter is placed over the guidewire. It is a safe and effective technique that avoids the use of cutdowns to gain access to a vessel. Although bedside placement of central venous catheters is routine, complications can occur, including infection, bleeding, pneumothorax, thrombosis, air embolism, and vascular perforation.1

In conjunction with the widespread use of central venous access, inferior vena cava filters have gained widespread accep-
tance as a means of preventing pulmonary thromboembolism. Absolute indications for their use are contraindication to anticoagulation, recurrent pulmonary embolism despite anticoagulation, free-floating iliofemoral thrombus, and pulmonary embolectomy. In addition, physicians in trauma centers with a high number of patients with traumatic brain injury, spinal cord injury, and complex pelvic fractures often place prophylactic IVCFs to prevent or decrease pulmonary embolic complications. Complications of these devices, such as misplacement, migration, mechanical disruption, caval thrombosis, recurrent pulmonary embolization, and penetration of adjacent structures, have been described.

There are two types of guidewires commonly available for central venous catheterization: straight and J-tip guidewires. An in vitro study showed that J-tip guidewires engaged 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 12F stainless steel Greenfield filters when the J-tip was 3 mm or less in radius. In addition, there were no incidents of entrapment or engagement with the straight guidewires. Since 1993, at least 17 cases of central catheter guidewires entangled in IVCFs have been reported.

The advancement of interventional radiology has permitted the development of several techniques for removing entrapped guidewires. These techniques take into consideration the risks of filter malposition and fragmentation, as well as a potentially free-floating guidewire once it is freed. The risks in attempting to remove a filter via the femoral approach include embolization of clots past the filter. There have been reports of IVCF strut fracture, as well as fracture with embolization after manipulation of the filter. Morgan and Sussman have described the monorail technique, which involves passing a wire over the existing guidewire to open the J-tip. This is similar to what was done in our patient, though the unraveling of the wire complicated matters. Cope describes a technique in which the wire is extended by making an eyelet at the stiff end of the wire, and then used as an exchange wire.

Based on our experience with this case and the literature review, a few recommendations can be delineated and include the following:

- Be aware of the presence of an IVCF before inserting a new central venous catheter or exchanging a central venous catheter over a guidewire.
Avoid the use of femoral vein access if an IVCF is present.
If available, use a straight guidewire to avoid engagement or entrapment with the IVCF.
Guidewire lengths should be noted and only introduced up to 15 to 20 cm (depth of the superior vena cava). The length can be estimated if the guidewire is layered over the thorax from the insertion site to the angle of the manubrium.
As in all vascular intervention, resistance to guidewire or catheter movement is always of concern. Should resistance to removal of the guidewire be encountered, the operator must not use excessive or additional force.
Further attempts or manipulation should be performed under fluoroscopic guidance. This approach should be originally considered in patients who have an inferior vena cava filter.

References