Appropriate Use of Vena Cava Filters

David Green, PhD, MD

Emeritus Professor of Medicine, and Member, Hematology/Oncology Division, Department of Medicine, Feinberg School of Medicine, Northwestern University

Abstract

Vena cava filters are potentially life-saving devices that are used to prevent embolization of thrombi that develop in the veins of the lower extremities and pelvis. Temporary filters are indicated for at-risk patients with contraindications to anticoagulation and to prevent pulmonary emboli from occurring during thrombolytic therapy for lower-extremity or pelvic deep vein thrombosis (DVT). Permanent filters are placed in those patients with a continuing risk for embolization not able to receive, or who have failed, anticoagulant therapy. While a randomized, controlled trial showed that filters decreased the frequency of new emboli in cancer patients with DVT, their use was associated with an increase in new DVT, and there was no survival benefit. Successful filter placement requires expertise, is not always effective, and is expensive. In conclusion, filters are indicated in acute conditions when the risk for major hemorrhage obviates the use of full-dose anticoagulation. However, filters should be removed and anticoagulation initiated as soon as the risk for serious bleeding has subsided.

Keywords

Vena cava filters, pulmonary emboli, deep vein thrombosis, anticoagulation, hemorrhage

Disclosure: The authors have no conflicts of interest to declare.
Received: December 1, 2008 **Accepted:** June 8, 2009 *DOI: 10.17925/OHR.2009.02.0.28*
Correspondence: David Green, PhD, MD, 676 N St Clair Street—Suite 850, Chicago, IL 60611. E: d-green@northwestern.edu

Vena cava filters are potentially life-saving devices that are used to prevent thrombi in the veins of the lower extremities and pelvis from accessing the lungs. They are usually inserted percutaneously into the inferior vena cava (IVC) below the renal veins. Both permanent and temporary filters are available. Filter insertion is recommended when anticoagulant therapy is contraindicated for patients with acute deep vein thrombosis (DVT) or pulmonary emboli (PE).[1] Filters are also needed if PE recur despite adequate anticoagulant treatment, or to prevent embolization of clot material if there is an attempt to lyze thrombi in proximal leg and pelvic veins using invasive thrombolytic procedures. Although filters may be effective in blocking thrombi from reaching the lungs, they have no effect on thrombi in the legs, and may increase the risk for DVT recurrence.

The use of IVC filters has dramatically escalated over the past two decades, from two to more than 10 per 100 patients with PE.[2] In addition, many more filter models are available. The indications for filter use have also broadened to include patients at high risk for death from PE due to severe existing pulmonary disease or cancer and primary prevention in high-risk situations such as trauma or complex surgical procedures;[3] however, much of this use is not evidence-based. In one of the few randomized, controlled clinical trials, 400 patients with proximal DVT-complicating cancer were randomized to filter or no-filter groups.[4] All received standard anticoagulant therapy. There was a statistically significant decrease in PE in the filter group during the first 12 days of the trial (two versus nine), but the recurrence rate for DVT at two years was significantly increased in the filter group (37 versus 21) and there was no difference in mortality (43 versus 40). On eight-year follow-up, the differences in rates of PE (favoring the filter group, hazard ratio 0.37) and DVT (favoring the no-filter group, hazard ratio 1.52) persisted, and there was no difference in survival.[5] A retrospective review confirmed that the use of filters in addition to standard therapeutic anticoagulation failed to lower the incidence of subsequent venous thrombotic events.[6] A population-based study of patients with discharge diagnoses of venous thromboembolism showed that the DVT recurrence rate was increased (relative risk 1.8) following filter placement.[7] Furthermore, those with filters did not have a significant reduction in subsequent re-hospitalizations for PE, and DVT recurrence rates were higher in those with filters initially placed because of PE (hazard ratio 2.6).[8]

The studies listed above have tempered enthusiasm for filter placement. Problems with the use of IVC filters include device failure, characterized by recurrent PE despite the presence of the filter. This may be due to tilting or too small a filter for the diameter of the vena cava, development of collateral circulation around the filter, and formation of thrombi above the filter. Other hazards of filter placement are vena cava thrombosis or perforation,[9] thrombosis at the venous access site, and embolization of the filter to the heart or lungs. Inexperienced operators may also place the filter in an ectopic position, even in the abdominal aorta. Additionally, the costs associated with filter placement are not insignificant.

The current recommendations of the American College of Chest Physicians Evidence-Based Clinical Practice Guidelines are that filters should be placed in patients with acute proximal DVT if anticoagulant therapy is not possible because of the risk for bleeding, but they should not be used routinely in addition to anticoagulants.[10] Furthermore, they recommend that if a filter is placed, patients should receive a conventional course of anticoagulant therapy as soon as their risk for bleeding resolves. Failure to initiate anticoagulants, especially in those whose risk factors for thrombosis persist (for example patients with cancer), may result in extensive thrombosis of the veins of the legs, pelvis, or vena cava itself.

Temporary vena cava filters are indicated in patients with contra-indications to anticoagulation, usually a major risk for bleeding, and for protection from PE during thrombolytic therapy for lower-extremity or pelvic DVT. These filters are usually removed within three weeks of placement, but there are reports of retrieval from 30 to 300 days after implantation.[11] Some trauma surgeons also recommend the placement of a temporary filter in patients with major trauma who are thought to be at high risk for development of venous thrombo- embolism.[12] Unfortunately, randomized trials are few, and retrospective reviews of experience with such patients suggest no difference in the incidence of PE[13,14] or death.[15]

In fact, the current Consensus Conference of the American College of Chest Physicians specifically recommends against the use of an IVC filter for thromboprophylaxis.[16] The authors reason that there is a lack of any direct evidence of efficacy, uncertainty about which patients might benefit, and the procedure is high-cost. They note that most temporary filters are placed about six days after injury, at a time when it is generally safe to administer prophylactic doses of anticoagulants that would provide adequate protection against thrombosis. They also note that a second procedure, entailing radiation exposure and instrumentation, is required to remove the filter. They emphasize that until there is convincing evidence to the contrary, filters should be placed only in patients with proven proximal DVT and either an absolute contraindication to full-dose anticoagulation or a need for urgent major surgery.

The following case studies from the author's files demonstrate the use of filters and some of the complications associated with their placement.

A 78-year-old man had a mesenteric venous thrombosis at 56 years of age and was found to have protein S deficiency. Shortly thereafter, his nephew presented with recurrent DVT and was also found to have protein S deficiency. The propositus was treated with warfarin and was fully compliant with therapy, and the international normalized ratios were consistently within the therapeutic range.[2–3] However, he began having bilateral leg swelling, became short of breath, and a right pleural effusion was discovered. Further evaluation revealed pulmonary hypertension, presumably secondary to silent PE. An IVC filter was placed and he was continued on warfarin. The indication for filter placement in this patient was failure of therapeutic oral anticoagulation to prevent recurrent PE.

A 46-year-old man with hereditary hemorrhagic telangiectasia and recurrent bleeding from the nose and gastrointestinal (GI) tract developed a left popliteal vein thrombosis when hospitalized for bleeding. A heparin infusion was started, but he had severe epistaxis and the anticoagulant was discontinued. An IVC filter was placed. Subsequently, he had a right common femoral vein thrombosis and continues to have nose and GI bleeding. The precipitating factor for the left leg DVT was probably bed-rest, but the inciting factor for the right leg DVT might have been the IVC filter.

A 56-year-old man fell from a ladder, sustaining a laceration of the right kidney, right rib fractures, and a fractured right radius. A cast was placed and he was discharged, but returned two weeks later with left-sided chest pain, found to be due to a PE. Due to fears that he might bleed from his lacerated kidney, an IVC filter was placed and anticoagulation was not prescribed. Six weeks later, while bending, he experienced severe lower abdominal pain and then swelling in his scrotum and both legs. He was found to have completely occluding thrombi in the proximal veins of both legs, which involved the vena cava and extended through the filter. Catheter-directed thrombolysis was performed and a stent was placed through the filter. Despite initiation of low-molecular-weight heparin, there was persistent clot in the femoral and popliteal veins of both legs. This case shows that failure to administer therapeutic anticoagulation after filter placement can lead to progressive venous thrombosis.

In conclusion, filters may be life-saving in acute conditions when the risk for major hemorrhage obviates the use of full-dose anticoagulation. However, filters do not prevent or treat DVT and might in fact predispose to thrombosis. Anticoagulation should be initiated when the risk for serious bleeding has subsided. Following filter placement, patients probably need to receive anticoagulants for at least one to two years because of the risk for recurrent DVT. Temporary filters are available for the prevention of venous thromboembolism under certain circumstances, but whether they are beneficial for trauma patients has not been established. Rather, these patients should be fitted with antithrombotic compression devices and receive anticoagulant prophylaxis as soon as the risk for major bleeding has subsided. ■

David Green, PhD, MD, is a member of the Hematology/Oncology Division of the Department of Medicine and an Emeritus Professor of Medicine at the Feinberg School of Medicine of Northwestern University in Chicago. His articles and book chapters have appeared in many peer-reviewed journals and publications. He has served on numerous committees for societies including the American Society of Hematology (ASH), the American Red Cross, the International Society of Thrombosis and Hemostasis (ISTH), the American Heart Association (AHA), the National Hemophilia Foundation, and the American Thrombosis and Hemostasis Network (ATHN), and is Co-Chair of the Thrombosis Committee of the Hemophilia and Thrombosis Research Society (HTRS).

1. Streiff MB, *Blood*, 2000;95:3669–77.
2. Stein PD, et al., *Arch Intern Med*, 2004;164:1541–5.
3. Girard P, et al., *Ann Rev Med*, 2000;51:1–15.
4. Decousus H, et al., *N Engl J Med*, 1998;338:409–15.
5 The PREPIC Study Group, *Circulation*, 2005;112:416–22.
6. Billett HH, *J Thromb Haemost*, 2007;5:1848–53.
7. Murin S, et al.,*Thromb Haemost*, 2002;88:407–14.
8. White RH, et al., *Arch Intern Med*, 2000;160:2033–41.
9. Morris CS, Cushman M, *J Thromb Haemost*, 2008;6: 1835–6.
10. Kearon C, et al., *Chest*, 2008;133:454S–545S.
11. Imberti D, et al., *J Thromb Haemost*, 2005;3: 1370–75.
12. Rogers FB, et al., *J Trauma*, 2002;53:142–64.
13. McMurtry AL, et al., *J Am Coll Surg*, 1999;189: 314–20.
14. Velmahos GC, et al., *J Trauma*, 2000;49:140–44.
15. Spain DA, et al., *J Trauma*, 1997;42:463–9.
16. Geerts WH, et al., *Chest*, 2008;133:381S–453S.