Vena Cava Interruption

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- Vena cava filter • Pulmonary embolus • Deep vein thrombosis
- Critical care • Anticoagulation

During the last decade, awareness over venous thromboembolic disease has risen markedly among health care professionals and the general public. The Surgical Care Improvement Project (SCIP) includes institution of venous thromboembolic prophylaxis within 24 hours of anesthesia end time as a core measure.[1] In 2008, the Joint Commission, National Quality Forum, and Centers for Medicare & Medicaid Services approved six inpatient quality measures. VTE-2 assesses the use of venous thromboembolic prophylaxis in intensive care unit patients and requires that prophylaxis is initiated or rationale to withhold prophylaxis is documented within 24 hours of ICU admission.[2] In addition, venous thromboembolism (VTE) was added as a "never event" following certain orthopaedic surgeries in 2008, and many fear this will be expanded to a larger patient population soon.[3]

Whether due to increased surveillance, increased risk, or both, prevalence of VTE increased 33% from 2002 to 2006, from 317 to 422 per 100,000 patients. Based on these data, the number of Americans with VTE is expected to increase to 1.82 million in 2050.[4] Systemic anticoagulation is the first line for prevention and treatment of VTE. However, there are many patient populations in whom this is contraindicated or fails.

The technique of vena caval interruption is not new. However, since the original Greenfield filter was introduced in 1973, technologic improvements have broadened the use of vena cava filters (VCFs). The filter evolved from a cutdown to a percutaneous technique and subsequently from permanent to retrievable. The current generation of optional filters, which can be retrieved when the indication for a VCF has subsided or left in place permanently if needed, has greatly expanded the use of VCFs.

Worldwide insertions of VCFs have increased exponentially, from 2000 in 1979 to 49,000 in 1999 and 140,000 in 2003.[5,6] With this increase in placement have come conflicting recommendations on the appropriate use of the VCF. Organizations such as the American College of Chest Physicians (ACCP), Eastern Association for the Surgery of Trauma (EAST), Society of Interventional Radiologists (SIR), Brain Trauma

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Foundation (BTF), and the Consortium for Spinal Cord Medicine have all published guidelines and recommendations.[7–11] Importantly, many guidelines do not address specific patient factors, such as traumatic brain injury and comorbidities. Therefore, the indications for VCF insertion continue to vary between institutions and specialists.

INDICATIONS FOR INSERTION OF A VENA CAVA FILTER

The standard of care for treatment of venous thromboembolic disease is systemic anticoagulation. Patients diagnosed with deep venous thrombus (DVT) or pulmonary embolus (PE) are initially anticoagulated in the acute setting with therapeutic subcutaneous low molecular weight heparin or intravenous heparin drip. They are then transitioned to warfarin to undergo a minimum of 3 months of anticoagulation with a target international normalized ratio (INR) of 2.0 to 3.0. Patients at a high risk for recurrence are treated indefinitely. Risk factors for recurrence include male gender, advanced age, malignancy, and unprovoked PE. Even patients receiving a VCF for the indications discussed later should receive a course of anticoagulant therapy whenever possible (eg, when the previous contraindication is eliminated).[12]

The conventional indication for insertion of a VCF is a patient with documented VTE in whom anticoagulation is contraindicated or has failed. Level II and level III data have been used to add relative indications such as free-floating thrombus and severely reduced cardiopulmonary reserve. With advances in technology regarding insertion as well as retrieval of VCFs, the "prophylactic" insertion of optional filters skyrocketed. Despite this common nomenclature, all VCFs should be considered prophylactic, as they do not prevent or treat VTE; rather, they prevent, or prophylax against, an embolus traveling to the lungs. In the literature, however, most define a prophylactic VCF as one placed in a patient with no known active thromboembolic disease.

In 1998, Decousus and colleagues published the initial results of the PREPIC study, a randomized trial of "prophylactic" filter insertion. Four hundred patients at high risk for PE (195 of whom had established PE at inclusion) were randomized in a two-by-two design to VCF insertion or none as well as to receive enoxaparin or unfractionated heparin. At 12 days, the filter group demonstrated a significantly lower incidence of PE. However, at 2 years, there was no difference in symptomatic PE occurrence, although the filter group had significantly more recurrent DVT (20.8% vs 11.6%). There was no difference in mortality or major bleeding.[13] An 8-year follow-up of the same group showed a decrease in PE in the filter group. The incidence of DVT remained higher in this group, with no difference in post-thrombotic syndrome or mortality.[14] This lack of impact on mortality is often referenced by those opposing VCF insertion. However, given the low incidence of PE, an adequately powered trial to show mortality impact is essentially impossible.

Although, to our knowledge, the PREPIC trial is the only randomized controlled trial to date, the randomization of patients *already receiving anticoagulation* did not make it applicable to the majority of patients receiving prophylactic VCFs, and a mortality benefit would not be expected. In addition, this study was performed before widespread use of modern, optional devices. Therefore, the absolute indications for insertion of a VCF in patients without known VTE and unable to receive anticoagulation remain undefined.

As there has not been a randomized controlled trial to define high-risk patients who should receive a VCF, many groups have published recommendations. The American College of Chest Physicians (ACCP) recommends VCF insertion in patients with proximal vein thrombosis and an absolute contraindication to, or complication of, anticoagulation.[9] Similarly, the SIR produced a consensus document in 2005, summarized in the **Box 1**, stating absolute, relative, and prophylactic indications for VCFs.[10]