Routine Use of IVC Filters in Venous Thrombolysis

Navigating the criteria for placement.

BY GERARD O'SULLIVAN, MD

The placement of inferior vena cava (IVC) filters is a highly debated topic, and for good reason. At conferences, I have heard people say they "never" use IVC filters during venous thrombolysis, while others insist on using them in every case. With such diversity of opinion, it's challenging to decide on the best methodology. Is there any evidence at all about the proper indications for filter placement?

LIMITED DATA

Until recently, there were no randomized trials addressing the role of IVC filter usage before percutaneous endovascular intervention (PEVI) for deep vein thrombosis (DVT). The recently published FILTER-PEVI (Filter Implantation To Lower Thromboembolic Risk in Percutaneous Endovascular Intervention) trial[1] by the Arizona Heart and Vascular Institute randomized 141 patients undergoing PEVI for acute massive DVT to receive a prophylactic IVC filter (filter group, 70 patients) or to receive no filter (control group, 71 patients). The baseline clinical characteristics, anticoagulation, and PEVI regimen (Table 1) were similar between the two groups. Follow-up was obtained at 15 ± 2 months.

Patients developing symptoms suggestive of pulmonary embolism (PE) during or within 24 hours of PEVI underwent objective testing for PE. From the 70 patients in the filter group, 14 underwent testing, and 22 of the 71 patients in the control group underwent testing. New PE was detected in one filter patient and eight control group patients (1.4% vs 11.3% of the total population; $P = .048$). It is important to note that all PEs were in the groups undergoing pharmacomechanical techniques, which have been shown to be associated with PE.[2]

There was, therefore, an eightfold increase in symptomatic iatrogenic PE in those not receiving a filter. However, no increased mortality was noted in patients without a filter. Profound hypotension and bradycardia requiring resuscitation occurred in three patients (4.2%) of the control group during PEVI as a result of iatrogenic PE. These were transient events, and the patients recovered without any sequelae. There was no incidence of hypotension or bradycardia in the filter group. The 11.3% rate of iatrogenic PE in the control was in keeping with the 8.6% of venographic evidence of entrapped thrombus by the filter in the filter group. No PE developed in patients undergoing catheter-directed thrombolysis alone.

There are obvious limitations in this trial, but it is certainly a step in the right direction. The biggest single criticism I have is that no preoperative imaging of the pulmonary arteries was obtained. In a poster presentation from our unit, it was found that nearly 80% of patients with pelvic vein DVT were positive for PE on a computed tomography pulmonary angiogram (CTPA); 67% of iliofemoral DVT patients also had a positive CTPA reading.

PREOPERATIVE IMAGING

Why do we perform CTPAs in all patients being considered for venous thrombolysis? Because I have had two deaths in this group within 24 hours. Bad luck or bad technique? One patient had pharmacomechanical thrombectomy; the other underwent catheter-directed thrombolysis. It transpires that both of these patients had massively dilated right ventricles on their preoperative CTPA. Both patients also had enlarged pulmonary arteries. At the time, no one commented on this. Although one patient had a positive CTPA, the other's scan was of no diagnostic use because the patient's creatinine level was elevated, so it was performed without intravenous contrast. However, the dilated pulmonary artery and right ventricle were still visible.

TABLE 1. INTERVENTIONAL APPROACHES USED IN FILTER-PEVI

	Filter (n = 70)	Control Group (n = 71)
Trellis device (Covidien, Mansfield, MA)	34	36
AngioJet (Bayer, Indianola, PA)	8	9
Thrombolytic therapy via infusion catheter	32	35
Balloon venoplasty	56	54
Stent	18	16

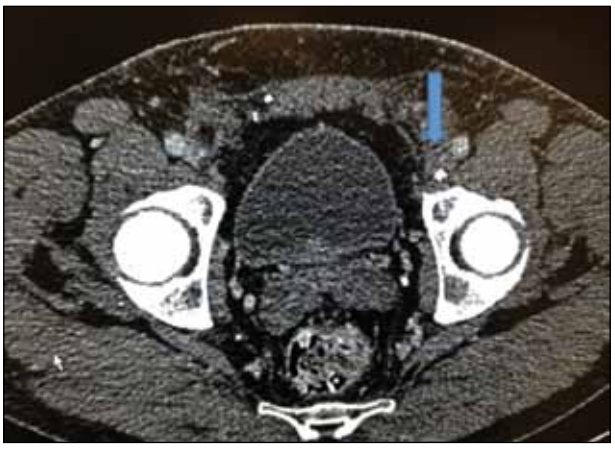

Figure 1. Note the clip on the left femoral vein.

Now, in all patients with acute DVT in whom we are considering aggressive therapy, we routinely obtain a CTPA and carry on to perform a CT venogram (CTV). If there is doubt about the RV/LV ratio or the size of the pulmonary arteries, an echocardiogram is obtained to measure the pulmonary arterial pressure (PAP). If this is elevated, we treat the patient as an acute PE case with Ekos ultrasound-assisted pulmonary arterial thrombolysis (Ekos Corporation, Bothell, WA) over 15 hours. We have not had a single fatality since we started to use this method. If the patient's PAP is normal after a few days, we then address the legs with a variety of methods.

This recommended protocol also applies to patients with no symptoms of PE. If the CTPA does not show any evidence of PE, but there is a dilated RV and PA, we use an echocardiogram to measure PAP and then go down the elevated PA pathway. As an alternative to using Ekos lysis, an IVC filter could be placed before catheter-directed thrombolysis in the legs to ensure that DVT therapy is not delayed by a week. However, the focus should be on the elevated PAP and dilated right heart, which is what tends to harm the patient. The lytic given in the leg and subsequent anticoagulation would also constitute therapy for asymptomatic PE, if present, but generally those patients will not have a dilated RV or PA.

Although it is fair to say that PEVI for acute massive DVT is generally safe, patients are harmed by the lack of recognition of underlying RV strain.

FILTER PLACEMENT CRITERIA

Clearly not all patients should receive IVC filters, but some do benefit. When PE is fatal, it is usually not solely because of the size or volume of the thrombus, but also because of the patient's underlying condition. A thrombus that might kill one patient might barely cause another to cough.

Figure 2. A prone view of the occlusive thrombus in the left common femoral vein and femoral vein of the thigh.

Figure 3. Close-up prone view of the left groin. Note the clips over the left femoral vein region and the occlusive thrombus below, extending into the profunda femoris vein.

Stein et al[3] concluded that IVC filters should be considered in patients with PE who are receiving thrombolytic therapy and in unstable patients who may not be candidates for thrombolytic therapy. The group used data from the Nationwide Inpatient Sample to review over 2 million patients from more than 1,000 acute care hospitals from 1999 to 2008.

We place IVC filters during PEVI for acute DVT if:

- The right ventricle is dilated,
- there is large-volume pulmonary embolus,
- or if there is IVC thrombus.

CASE REPORT

Recently, a fit 45-year-old triathlete presented with a left iliofemoral DVT. He had a femoral hernia repair 3 days before; clearly the vein had been damaged. His left thigh was tense and purple. The preoperative CTPA (Figure 1) was clear, and his CTV showed thrombus from the midfemoral vein of the thigh up to the left common iliac vein (Figure 2). There was a clip across the common femoral vein (Figure 3). The IVC was clear.

Perhaps because of the clip across the vein, I placed a retrievable filter in a standard infrarenal position. I used the Trellis device's 30-cm infusion length from a popliteal venous approach with the cephalad balloon in

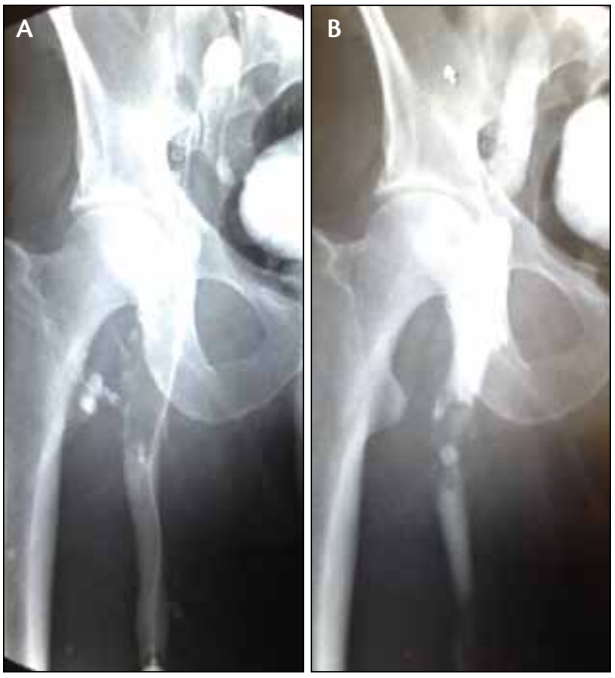

Figure 4. The Trellis device 80/30 in position across the thrombosed segment (A). Prone view of the left leg venogram after treatment with the Trellis device. Little thrombus remained, but flow appeared to be slow (B).

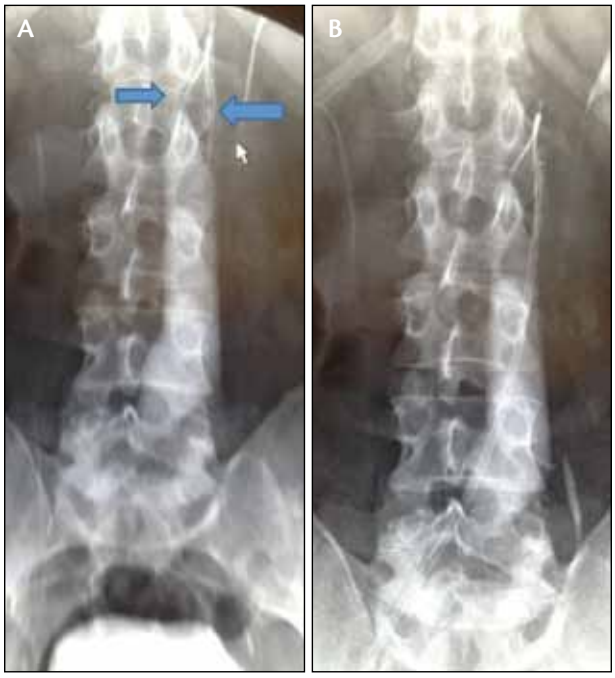

Figure 5. A large volume of thrombus was occluding the IVC (A). Prone view of the emergency aspiration of thrombus from within the IVC filter (B).

the left common iliac vein and the distal balloon in the left femoral vein, and ran 10 mg of tPA over 12 minutes (Figure 4A and 4B). I aspirated the slurry and gently obtained a venogram with 8 mL of contrast.

Immediately the patient's oxygen saturation fell to the mid 80% range. He coughed a few times, and it was fairly clear he had sustained a PE. The contrast column remained stagnant in the iliac vein, and when we screened up to the filter, it was completely occluded with thrombus (Figure 5A). I immediately aspirated this (Figure 5B) and performed repeat venography. All was clear.

Figure 6. Thrombus yield from immediate aspiration from within the IVC filter.

The volume of thrombus was worrying (Figure 6). Would this patient have survived without a filter? It is tough to say.

CONCLUSION

If you are starting a PEVI program for patients with acute DVT,[4] at least consider the use of filters. The sicker the patients, the more they need them. Measure the PAP and right ventricle using whatever method you choose. If it is elevated, treat the PE, forget about the legs for a few days, and take the filter out at 6 weeks.

This approach may not be based on rigorous scientific studies, but it is practical and will protect you and your patients—and that is what it is all about! ■

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