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# Clinical Guide - Inferior Vena Cava Filters (Reviewed 2006)

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## Background

The treatment of choice for deep venous thrombosis (DVT) and pulmonary embolism (PE) is anticoagulant therapy. Inferior vena cava (IVC) filters have been developed to prevent PE in patients with venous thromboembolism who have a contraindication to anticoagulation or in patients considered to be at very high for PE. Several recent reviews are recommended.[1-5]

Percutaneous IVC filters are either **permanent** or **retrievable**. The latter are also called **optional** filters, because they can be retrieved when no longer needed, or they can be left in place as permanent devices. The indications for IVC filter placement, the selection of a filter type, and the management after filter insertion are all very controversial issues because there is little prospectively derived data[6] and only a single randomized clinical trial has been conducted in this area.[7]

## Proven and Unproven Effects of IVC Filters

- Reduces, but does not eliminate, the risk of symptomatic PE in patients with proximal DVT in the short-term[7]
- Does not prevent small PE
- Not proven to reduce PE in the long-term. Large venous collaterals develop around an occluded IVC. Patients have had PE (and fatal PE) after IVC filters (< 5%).
- Insertion site thrombosis (up to 40% with femoral approach)
- No pressure gradient across the filter (unless > 60% of IVC occluded by clot)
- Little or no thrombogenic potential
- High rate of long-term patency (> 95%)
- No evidence of a decrease in fatal PE
- No all-cause mortality reduction
- Increase in symptomatic DVT in patients with filters

Therefore, limited evidence suggests that IVC filters temporarily prevent PE in patients destined to have PE. However, unlike anticoagulant therapy, IVC filters have no effect on the prevention of DVT, nor do they prevent extension of existing DVT, recurrence of DVT, and postphlebitic syndrome.[6]

## Indications for an IVC Filter

The indication to use an IVC filter should be carefully evaluated in each individual case, based on a clear understanding of the objectives of filter insertion and consideration of alternatives. IVC filters are often inserted for unproven and inappropriate reasons.

**A. Generally Accepted Indication**

**The only generally accepted indication for IVC filter insertion is the presence of a recent proximal DVT plus an absolute contraindication to therapeutic anticoagulation.**

- Contraindications to therapeutic anticoagulation might include:
- Current or recent active major bleeding that cannot be treated acutely
- Frank intracranial bleeding in the past 5 days
- Need for a major surgical procedure in the next 2 weeks
- Severe, prolonged thrombocytopenia

**B. Controversial Uses**

For the uses below, there is no evidence that an IVC filter is necessary. Therefore, we do not recommend lacement of an IVC filter for these indications.With greater experience in IVC filter placement and the introduction of retrievable filters, there is the temptation to expand the indications for filter use without evaluation of the benefit of this expensive, invasive practice.

| Controversial Uses | Comments |
|---|---|
| PE (without current proximal DVT) with absolute contraindication for full-dose anticoagulation | If there is no proximal DVT, such patients do not require therapeutic anticoagulation now – they can be given prophylactic doses of anticoagulants that should prevent recurrent proximal DVT and, therefore, recurrent PE until therapeutic anticoagulation can be initiated once the high bleeding risk resolves. If the clinical situation warrants, the possibility of a pelvic vein thrombus should be considered. Large pelvic vein thrombi may be detectable using a high resolution contrast-enhanced CT scan. |
| DVT/PE in patients with a high risk for bleeding (but not currently bleeding) | Most patients at high risk of bleeding, do not develop major or life-threatening bleeding when they are anticoagulated. |
| PE within a few days of the start of full anticoagulation for DVT | A small proportion of patients with DVT will develop PE in the first few days of treatment, related to mechanical break-off of some of the thrombus. This does not represent anticoagulation failure. Continued therepeutic anticoagulation is required in these patients and an IVC filter is not necessary. |
| Progression of DVT despite full anticoagulation | This does represent anticoagulant 'failure' and should be managed by increasing the intensity of the anticoagulation or switching to another anticoagulant. An IVC filter will not control the uncontrolled thrombosis, and is, therefore, not necessary. |
| Recurrent thromboembolic disease despite full anticoagulation | This situation is very uncommon. If recurrent thromboembolism despite full anticoagulation is proven, this does represent anticoagulation failure, and should be managed by increasing the intensity of the anticoagulation or switching to another anticoagulant. An IVC filter will not control the uncontrolled thrombosis, and is therefore, not necessary. |
| Massive PE with residual DVT (recurrent PE could be fatal) | Recurrent PE is uncommon once anticoagulation is started. |

| | |
|---|---|
| Extensive proximal DVT or DVT with a free-floating proximal end | There is no increase in PE with conventional anticoagulation if DVT is free-floating.[8] |
| Large proximal DVT in a patient undergoing thrombolysis | Very few of such patients experience symptomatic PE. |
| Proximal DVT or PE in a patient with poor cardio-respiratory reserve | There is no agreement on a definition of poor cardio-respiratory reserve. |
| DVT in the setting of heparin-induced thrombocytopenia | These patients require anticoagulation with a heparin-safe anticoagulant. |
| DVT or PE in patients with cancer | These patients need to receive an anticoagulant that suppresses the thrombotic process or else they will continue to clot, with or without an IVC filter. |
| During or after pulmonary embolectomy | There is no evidence supporting this indication. |
| Before pulmonary thromboendarterectomy in chronic thromboembolic pulmonary hypertension | There is no evidence for this indication. |
| Primary prophylaxis in selected high risk patients e.g. major trauma, spinal cord injury, arthroplasty, neurosurgery | There is no evidence of the benefit of IVC filters for this indication. We are unable to predict which patients might benefit, and the use of an IVC filter may delay effective prophylaxis. Very costly. Evidence-based thromboprophylaxis is indicated. |

**Contraindications to IVC Filter Insertion**

1. Uncorrectable, severe coagulopathy

2. Extensive IVC thrombosis such that placement of a filter above the thrombus is not possible

3. Bacteremia

**IVC Filter Insertion Procedure**

Angiographic imaging of the IVC should be obtained prior to filter placement to characterise IVC anatomy and to exclude the presence of IVC thrombus. Filter insertion can be performed via a femoral vein or a jugular vein approach. Placement of the filter is performed under fluoroscopic guidance. If possible, filters should be placed in the IVC below the level of the renal veins (unless there is infrarenal IVC thrombus or the recipient is a woman of child-bearing potential or is pregnant). For retrievable filters, a cavogram should also be performed prior to removal to rule-out the presence of thrombus trapped in the filter itself.

In experienced hands, the technical success rate for percutaneous IVC filter placement should be 97% or better.

**Types of IVC Filters:**[5]

**A. Permanent Filters**

| Device | Size of introducer* | Insertion site (jugular/femoral) | Comments |
|---|---|---|---|
| Bird's Nest | 14 Fr | Either (separate kits) | Can be used in IVC up to 40 mm; requires 5-8 cm of IVC to insert; not MRI compatible |
| Greenfield (stainless steel) | 14 Fr | Either (separate kits) | Less insertion control (all-or-none release); not MRI compatible |
| Simon Nitinol | 9 Fr | Either (separate kits) | Thermal-mechanical memory; max IVC diameter 28 mm; MRI compatible |
| TrapEase | 8 Fr | Either (1 kit for both) | Little data; maximum IVC up to 30 mm; MRI compatible |

| Device | Size of introducer* | Insertion site (jugular/femoral) | Comments |
|---|---|---|---|
| VenaTech | 14.6 Fr | Either (one kit) | MRI-compatible |

* Outer diameter

**B. Optional Filters (temporary retrievable or permanent)**

| Device | Size oF introducer* | Insertion site(jugular/ femoral) | Comments |
|---|---|---|---|
| Gunther Tulip | 12 Fr | Either (separate kits) | Maximum IVC up to 30 mm; MRI compatible |
| OptEase | 8 Fr | Either | Little data; maximum IVC up to 30 mm; MRI compatible |
| Recovery Filter | 9 Fr | Femoral | Retrievable up to several weeks or months after implantation using a 12 Fr retrieval catheter; MRI compatible |

* Outer diameter

**Complications Associated with IVC Filter Use** [4,9]

In experienced hands, the process of IVC filter insertion is associated with a low rate of complications.Furthermore, with proper selection of filter indications and appropriate management of patients who have IVC filters, the risk of long-term complications is also low.

**A. Short-Term Complications**

- Contrast reaction
- Arrhythmia
- Air embolism (especially with jugular insertion)
- Pneumothorax/hemothorax
- Extravascular penetration of guidewire
- Premature opening - iliac vein
  - SVC, heart, proximal IVC
- Incomplete opening
- Tilting/angulation
- Misplacement – iliac vein, renal vein, etc
  - proximal to renal veins when this was not planned
  - often requires placement of a second filter
- Guide wire entrapment
- Filter migration (3-69%)
- Embolization of the filter (2-5%) – to heart, pulmonary artery
- Filter fracture
- Insertion site bleeding/hematoma – this will interfere with subsequent anticoagulation
- Infection at insertion site
- Contrast-induced renal dysfunction
- A-V fistula
- *Failure or delay in anticoagulation, which may lead to progressive DVT, phlegmasia cerulea dolens, or venous gangrene
- *Insertion site thrombosis (2-35%) appears to be greater with femoral route
- Recurrent PE (0.5%-6%)
- Fatal PE – rare (<1%)
- Death – very rare (3/2,557)

**B. Long-Term Complications**

- *Increased risk of subsequent DVT [7,10]
- *Physician assumption of long-term protection à failure to prophylax
- Migration: proximal or distal
- Penetration of the vein wall/perforation – retroperitoneal, aorta, ureter, bowel
  - common, generally no adverse consequences
- Filter fracture
- IVC occlusion (2-28%) with resultant chronic leg edema, hyperpigmentation and ulceration
- Venacaval syndrome
- Risks associated with subsequent Rt heart/PA catheterization from femoral vein including temporary pacemakers
- Lumbar pain from nerve impingement
  - Pyophlebitis (very rare)

**Anticoagulation in Patients with IVC Filters**

As a general rule, the use of an IVC filter does not change the need for or duration of anticoagulation. Since most (or all) patients who have IVC filters inserted have a proximal DVT, therapeutic anticoagulation should be instituted as soon as it is considered safe to do so (usually within a few days after insertion). While IVC filters may reduce the risk of PE in patients with DVT, they do not prevent extension of DVT, including extension through the filter. The duration of anticoagulation is the duration of anticoagulation for patients with DVT without a filter.

**Permanent versus Retrievable Filters** [11]

Although the contraindication to anticoagulation (and therefore the indication for an IVC filter) is generally temporary, there are few long-term complications associated with the presence of a filter and there are some disadvantages of retrievable filters, including the need for two central venous procedures, less experience with their use, and perhaps these filters are less effective or associated with more complications than permanent filters.

**Selection of a Filter**

The choice of which filter is inserted is largely dictated by local experience and availability. For patients with large diameter IVCs, the bird's nest filter is recommended. The most commonly used retrievable filters are the Gunther tulip and the Recovery nitinol filters.

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