

Inferior Vena Cava Filters: Appropriate Use and Management



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Both authors have no conflicts of interest to declare.



Learning Objectives

1. To review current evidence on the use of inferior vena cava (IVC) filters.
2. To review the indications and contraindications for the use of retrievable IVC filters as well as appropriate duration of IVC filter placement.
3. To review the indications and contraindications for the use of non-retrievable IVC filters.
4. To review potential IVC filter complications and appropriate management strategies.



Introduction

- IVC filters are placed with the primary goal of reducing the risk of pulmonary embolism(PE) in specific high risk patient populations.
- Percutaneously placed via the jugular or femoral veins under fluoroscopic or ultrasound guidance.
- Usually positioned in the infrarenal IVC.
- Two broad categories of IVC filter:
 - Permanent
 - Retrievable



IVC Filters: The Evidence

- Despite having been in use since the 1960's, evidence behind IVC filters remains limited to primarily observational studies.
- Few randomized controlled trials (RCTs) have been performed to assess outcomes with IVC filters.

IVC Filters: The Evidence

- A Cochrane systematic review identified only two RCTs assessing examining the effectiveness of IVC filters in preventing PE:
 - 1. Fullen et al. 1973
 - 2. PREPIC Trial 1998/2005
- ***Both trials used only permanent filters.***

IVC Filters: The Evidence

- Fullen et al. looked at 129 patients with traumatic hip fractures . Followup was for 34 days and demonstrated a reduction in PE in favour of the IVC filter group (0% vs 20%, $p < 0.05$). There was no significant difference in mortality.

IVC Filters: The Evidence

- The PREPIC trial looked at 400 patients with DVT or PE randomized to receive either an IVC filter or no filter. All patients received simultaneous anticoagulation and were followed over an 8 year period.
- At 8 years, a significant reduction in PE incidence occurred in the IVC filter group (6.2% vs 15.1% p=0.008).
- However, DVT occurred more frequently in the IVC filter group (35.7% vs 27.5%). No difference in mortality was detected.
- PREPIC has been criticized for being statistically underpowered, for using solely permanent filters, and for having a primarily elderly population limiting generalizability around mortality outcomes.

IVC Filters: The Evidence

- Cochrane review conclusion:

“There is a paucity of vena cava filter outcome evidence when used within currently approved indications and a lack of trials on retrievable filters. Further trials are needed to assess vena caval filter safety and effectiveness.”



Guideline Summary: Indications

- Significant variation in recommendations between different guidelines.
- Commonly agreed upon indications for IVC filters include:
 - Absolute or relative contraindication to anticoagulation in patients with proven DVT
 - Recurrent PE despite adequate anticoagulation therapy

Guideline Summary: Indications

Therapeutic Indications for IVC Filter Use	SIR	ACCP	EAST	BSH
Absolute or relative contraindication to anticoagulation with proven DVT	R	R	R	R
Complications resulting from anticoagulation with proven DVT	R	-	-	-
Failure of anticoagulation with proven DVT	R	-	-	-
Recurrent PE in patients with adequate anticoagulation with proven DVT	R	-	-	R
Inability to achieve or maintain adequate anticoagulation with proven DVT	R	-	-	-
Progression, advancement or propagation of DVT while therapeutically anticoagulated	R	-	-	R
Massive PE with residual DVT at risk for further PE	R	-	-	-

SIR-Society of Interventional Radiology, ACCP-American College of Chest Physicians, EAST- Eastern Association for the Surgery of Trauma, BSH- British Society of Haematology
 “R”- Recommended, “NR”-Not Recommended, “-” - No Statement

Table adapted from: Milovanovic L, Kennedy SA, Midia M. Procedural and Indwelling Complications with Inferior Vena Cava Filters: Frequency, Etiology, and Management. Semin Intervent Radiol. 2015 Mar;32(1):34-41.

Guideline Summary: Indications

Therapeutic Indications for IVC Filter Use	SIR	ACCP	EAST	BSH
Free-floating iliofemoral or IVC thrombus	R	-	-	-
Severe cardiopulmonary disease and DVT	R	-	-	-
Filter use in addition to effective anticoagulation with proven DVT	-	NR	-	NR
Pregnant patients with contraindication to anticoagulation and develop VTE <2 weeks before delivery	-	-	-	R
Patients with PE undergoing thrombolysis	-	-	-	NR
Preoperative patients requiring anticoagulation interruption with recent VTE (<1 mo)	-	-	-	R
Patients with chronic thromboembolic pulmonary hypertension undergoing pulmonary endarterectomy	-	-	-	R

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Guideline Summary: Indications

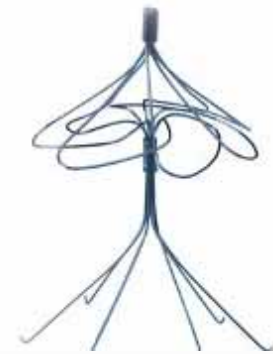
Prophylactic Indications for IVC Filter Use	SIR	ACCP	EAST	BSH
Primary DVT prevention in patients undergoing surgery	-	NR	-	-
Patients undergoing orthopedic surgery receiving IVC filter over no prophylaxis	-	NR	-	-
Severe trauma without documented PE or DVT	R	NR	R	-
Closed head or spinal cord injury	R	-	R	-
Multiple long-bone or pelvic fractures	R	-	R	-
High-risk patients (ie, immobilized, intensive care patients)	R	-	R	-
Free-floating thrombus	-	-	-	NR

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Permanent IVC Filter Types

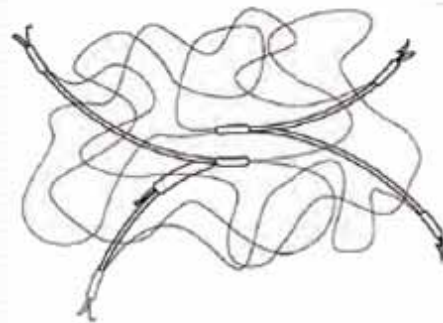
- Examples include:
 - Gianturco-Roehm Bird's Nest (Cook)
 - TrapEase (Cordis)
 - Simon Nitinol Filter (Bard)
 - Vena Tech LP (B. Braun Medical)
 - Titanium Greenfield (Boston Scientific)



Simon Nitinol™



Titanium Greenfield™



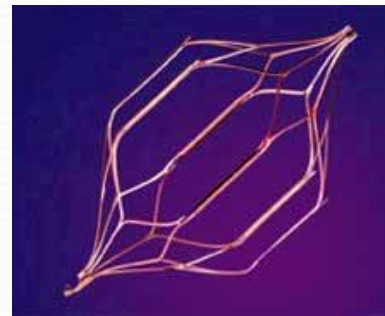
Bird's Nest™



Vena Tech LP™

Retrievable IVC Filter Types

- Examples include:
 - DENALI (Bard)
 - OptEase (Cordis)
 - Crux (Volcano Corporation)
 - Gunther Tulip (Cook)
 - Cook Celect (Cook)
 - Option (Argon Medical)



OptEase™




Crux™



Günther Tulip™



Celect™



Retrievable vs Permanent IVC Filter Specific Uses

- Generally, a retrievable filter can be used in almost all circumstances.
- The sole exception where a permanent filter is the only option for insertion is placement in mega cavas (IVC diameter greater than 28 mm). The Bird's Nest permanent filter is the only one that can accommodate such a large diameter.

Complications

- Despite being “retrievable”, compliance is extremely poor with a systematic review demonstrating only 34% of IVC filters were retrieved.
- IVC filters can be left permanently in patients who have a sustained high risk of pulmonary embolism, a life expectancy <6 months or if the filter cannot be safely removed. Otherwise, they should be removed as soon as possible in order to reduce the risk of complications.

Angel LF, Tapson V, Galgon RE, et al. Systematic review of the use of retrievable inferior vena cava filters. *J Vasc Interv Radiol.* 2011 Nov;22(11):1522-1530.e3.

Kaufman JA, Kinney TB, Streiff M et al. Guidelines for the use of retrievable and convertible vena cava filters: report from the Society of Interventional Radiology multidisciplinary consensus conference. *J Vasc Interv Radiol.* 2006 Mar;17(3):449-59.

Complications

Complication	Rate (%)
Caval wall erosion	0-41
Caval thrombosis	2-30
Access site thrombosis	0-25
Filter migration	0-18
Filter fracture	2-10
IVC filter deployment outside of target region	1-9
Filter embolization	<1
Death	0.12
Recurrent DVT	35.7% after 8 years of permanent filter in place

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Caplin DM, Nikolic B, Kalva SP, et al. Quality Improvement Guidelines for the Performance of Inferior Vena Cava Filter Placement for the Prevention of Pulmonary Embolism. *J Vasc Interv Radiol.* 2011 Nov;22(11):1499-506.

Complications

- Caval wall erosion occurs when a portion of the filter breaks through the IVC wall. Though common, it is often clinically insignificant. In extremely rare cases, wall erosion could theoretically cause massive bleeding.
- Caval wall thrombosis occurs primarily due to the pro-thrombotic local effects of the filter itself and accumulation of embolic material. Caval wall thrombosis is often asymptomatic. In rare cases it can cause significant lower extremity edema and occlusion of the renal veins. In such circumstances, catheter-directed thrombolysis can be considered.

Complications

- Minimal caudal IVC filter migration is common and of no clinical significance. Rarely, IVC filters can migrate large distances as far as the heart and great vessels. In such circumstances, endovascular snare retrieval or failing this surgical removal can be considered depending on location and risk.
- Similarly, filter fracture occurs frequently. However, embolization is less common. IVC filters should be carefully inspected once they are removed for missing or damaged parts. On identifying embolized components, retrieval can be attempted using endovascular snares or rigid endobronchial forceps depending on location and risk.

2010 FDA Alert

- ***“FDA (Food and Drug Administration) recommends that implanting physicians and clinicians responsible for the ongoing care of patients with retrievable IVC filters consider removing the filter as soon as protection from PE is no longer needed.”***
- Concern in regards to risk of device migration, embolization and IVC perforation.

Future Trials

- In light of FDA warning, the PRESERVE randomized controlled trial was organized.
- Will compare various different filters for safety and efficacy.
- Five year long study.
- Expected to start enrollment in spring 2015.
- Aims to enroll 2100 patients.

Society of Interventional Radiology. Large-scale study on vein filter use launches. http://www.sirweb.org/news/newsPDF/Release_PRESERVE_final111214.pdf . 2014 Nov 12.



Conclusion

- IVC filters may be beneficial in preventing PE in carefully selected patient populations.
- IVC filters do carry significant risks. They are not a substitute for adequate anticoagulation and should be in place for the shortest duration possible.
- Unfortunately, there remains a continued lack of high quality, large randomized controlled trials to help optimize IVC filter utilization.