Challenges of vena cava filter

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## Faculty Disclosure

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Honoraria/Expenses</th>
<th>Consulting/Advisory Board</th>
<th>Funded Research</th>
<th>Royalties/Patent</th>
<th>Stock Options</th>
<th>Ownership/Equity Position</th>
<th>Employee</th>
<th>Other (please specify)</th>
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<tr>
<td>Example: company XYZ</td>
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x No, nothing to disclose

Yes, please specify:
Challenges in cancer associated thrombosis

- Varying thrombogenicity
- Intermittant thrombocytopenia
- Hypercoaguizable despite adequate anticoagulation
- Increased bleeding risk
Kazi Mobin-Uddin: 1969

- IVC thrombosis 60%
- Filter migration 0.4%

Lazar Greenfield: 1973

## Guidelines vary in recommendations

<table>
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<tbody>
<tr>
<td>Acute proximal DVT or PE and contraindication for anticoagulation</td>
<td>Recommended (Grade 1C)</td>
<td>Recommended (Absolute indication)</td>
<td>Recommended (Class I)</td>
<td>Recommended</td>
<td>Recommended (Class IIa)</td>
</tr>
<tr>
<td>Failure of anticoagulation</td>
<td>–</td>
<td>–</td>
<td>Suggested (Class IIa)</td>
<td>Consider</td>
<td>Recommended (Class IIa)</td>
</tr>
<tr>
<td>Massive PE with residual DVT</td>
<td>–</td>
<td>–</td>
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<tr>
<td>Iliocaval or large free-floating proximal DVT</td>
<td>–</td>
<td>Recommended (relative indication)</td>
<td>Not recommended (Class III)</td>
<td>Not recommended</td>
<td>Not recommended</td>
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<tr>
<td>Severe cardiopulmonary disease and DVT</td>
<td>–</td>
<td>Recommended (relative indication)</td>
<td>–</td>
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<td>–</td>
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<tr>
<td>Prior to thromboendarterectomy for CTEPH</td>
<td>Suggested (Grade 2C)</td>
<td>Recommended (relative indication)</td>
<td>–</td>
<td>–</td>
<td>Not recommended</td>
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<tr>
<td>Prior to thrombolysis</td>
<td>–</td>
<td>Recommended (relative indication)</td>
<td>–</td>
<td>Not recommended</td>
<td>Not recommended</td>
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<tr>
<td>Prophylaxis in trauma patients</td>
<td>–</td>
<td>Recommended (relative indication)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Prophylaxis in bariatric surgery patients</td>
<td>–</td>
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</tbody>
</table>

DVT, deep vein thrombosis; PE, pulmonary embolism; IVC, inferior vena cava; CTEPH, chronic thromboembolic pulmonary hypertension; ACCP, American College of Chest Physicians; SIR, Society of International Radiology; AHA, American Heart Association; BCSH, British Committee for Standards in Hematology; ESC, European Society of Cardiology; ERS, European Respiratory Society.
Twenty-one-Year Trends in the Use of Inferior Vena Cava Filters

• 29% of patients with IVC filters suffer complications.
  • improper anatomic placement of the filter (7%),
  • migration (2%-3%),
  • angulation of the filter (2%),
  • caval stenosis or filter narrowing (2%),
  • caval occlusion (2%-9%),
  • air embolism (1%),
  • penetration of the caval wall (1%),
  • lower extremity edema (13%-26%)
  • sequelae of venous stasis (27%)

US Food and Drug Administration (FDA) 2010
Initial Communication: Risk of Adverse Events with Long Term Use

• Past 5 years 921 device adverse events with IVC filters

<table>
<thead>
<tr>
<th>Adverse event</th>
<th>number</th>
<th>%</th>
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</thead>
<tbody>
<tr>
<td>Device migration</td>
<td>328</td>
<td>35.5%</td>
</tr>
<tr>
<td>Embolization</td>
<td>146</td>
<td>16%</td>
</tr>
<tr>
<td>Perforation of IVC</td>
<td>70</td>
<td>7.5%</td>
</tr>
<tr>
<td>Filter fracture</td>
<td>56</td>
<td>6%</td>
</tr>
<tr>
<td>Other</td>
<td>321</td>
<td>34%</td>
</tr>
</tbody>
</table>
U.S. FDA Manufacturer and User Facility Device Experience (MAUDE) database.

- Database review January 1, 2009, to December 31, 2012
- 1606 adverse events (AE) involving 1057 IVC filters
- 1394 (86.8%) retrievable
  - Most common AE was fracture
- 212 (13.2%) permanent
  - Most common AE was placement malfunction

Andreoli et al. JVIR 2014 25 (8) 1181-1185
Indications for IVC Filter

• Absolute
  • contraindication to anticoagulation
  • complication of anticoagulation
  • inability to achieve or maintain therapeutic anticoagulation
  • recurrent VTE while on adequate anticoagulation

• Relative
  • massive pulmonary embolism
  • limited cardiopulmonary reserve
  • free-floating IVC thrombus
  • poor compliance with anticoagulation therapy
Retrievable IVC Filter Failure Modes

Filter Fracturing
Sending pieces of metal into the abdomen, lungs, liver, kidneys and even the heart and other organs. Surgeons often have to leave the fractured portion of an IVC filter embedded into an organ, because trying to take it out would be too dangerous.

Filter Shifting or Tilting
The filter has shifted or tilted to another area of the body, making it almost impossible to remove. Leads to loss of efficiency, fracture and tissue perforation leading to formation of scar tissue.

Migration
Caudal (Downward)
Cephalad (Upward directly towards the heart)

Perforation
Causing stress that leads to fracture. Fractured components can become embedded in the tissue. Including organs and may not be removable.

*Studies show 1 out of 4 IVC filters fracture, potentially causing death.*

900+ Adverse Events

328 Adverse Events Involving Device Migration

Numerous Lawsuits Already Underway

* Source Medscape from WebMD | Article: FDA Warns of Adverse Events With Inferior Vena Cava Filters
Filter tilting

- 2.3 – 41%
- Reduced ability to trap clots
- Difficulty to remove
Filter tilting

Notes: further details here (or delete)
Source: details here (or delete)
Filter fracture

- One cohort study:
- Strut fracture in 16% patients
- End organ embolisation 11%
Chest CT scan with arrow delineating a linear foreign body in the left anterior pericardial space.
My practice

1. Avoid wherever possible
2. Use retrievable filters
3. Remove at earliest opportunity