IVC FILTER
the great debate...

- Dr Raphael Blöchle
- Vascular & Endovascular Surgery
- General & Trauma surgery
- Director of The Center for Wound Care and Hyperbaric Medicine @ ECMC
Statistics

• 600,000-800,000 cases of DVT annually
• 70% of VTE are hospital acquired
• 29% of DVT patients develop chronic venous insufficiency
• Economic burden $250 million (2001), >1 billion (2006)
• 25% of DVT will progress to PE
Statistics

- Over 100,000 estimated deaths annually from PE
- PE is the most preventable cause of death in the US
- 1/3 of all “sudden deaths” are due to PE
- Most patients who die of PE do so within 30 minutes
- <50% survive one year after recognized PE
- 1% develop Chronic Pulmonary Hypertension
- 30% incidence of recurrent PE
- 5% die of recurrent PE
**Risk of DVT in Hospitalized Patients**

If no prophylaxis is given and routine screening is performed

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>DVT Prevalence, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Patients</td>
<td>10-20</td>
</tr>
<tr>
<td>General Surgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Major Gynecologic Surgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Major Urologic Surgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Stroke</td>
<td>20-40</td>
</tr>
<tr>
<td>Hip, knee arthroplasty, hip fracture</td>
<td>40-60</td>
</tr>
<tr>
<td>Spinal Cord Injury</td>
<td>60-80</td>
</tr>
</tbody>
</table>

*Geerts – Chest June, 2008*
History

- Surgical interruption of the IVC to prevent fatal pulmonary embolism was suggested as far back as 1868 by Trousseau
- Initially performed via ligation or plication of the inferior vena cava via clips that were externally placed on the IVC below the renal vein
Interruption of IVC

Fig. 13-5 The vena cava is accessible through a right flank approach.
Endovascular Era

- This initially required venous cutdown, and local or regional anesthesia.
- The idea first originated in 1967 in Buffalo, NY in a paper by Eichlter and Shenk with the title: a New Experimental Approach to Prophylaxis of Pulmonary Embolism.
- The first device was deployed in 1967, called the Mobin-Uddin filter, was delivered via a jugular cutdown + 27 French delivery system.
Examples of current devices

- Simon Nitinol - 7Fr
- Venatech - 7Fr
- Greenfield - 12Fr
- Trapease - 6Fr
- Bird’s Nest - 12Fr
- Option - 7Fr
- G2X - 7Fr
- Gunther-Tulip - 8Fr
- Celect - 5Fr
- Optease - 6Fr
- Safeflo - 7Fr
Technique

• Decide location
• Choose access vein
• ID renal veins
• Measure diameter IVC
• Evaluate patency
• Over 90% of PE’s originate from DVT’s of the iliac and lower extremities but steps must be taken to ensure that the DVT/PE is not originating from the renal veins or upper extremity veins, prior to placing an IVC filter
Follow-up

- While some clinicians have no patient follow-up at all unless clinical symptoms develop, others employ routine clinical and objective radiological follow-up, in the attempt to reduce complications associated with the post-thrombotic syndrome.
Indications for Filter Placement

- Recommended use according to evidence-based guidelines
  - Proven VTE with contraindication for anticoagulation
  - Proven VTE with complications of anticoagulation treatment
  - Recurrent VTE despite anticoagulation treatment (failure of anticoagulation)
• Expanded use (not guideline recommended)
  – Recurrent PE complicated pulmonary hypertension
  – Patients with DVT and limited cardiopulmonary reserve or COPD
  – Patients with large, free-floating iliofemoral thrombus
  – Following thrombectomy, embolectomy, or thrombolysis of DVT
  – High-risk trauma patients (head injury, spinal cord injury, pelvic or lower extremity fracture) with a contraindication to anticoagulation
  – High-risk surgical patients with a contraindication for anticoagulation
  – Patients with DVT who have cancer, burns or are pregnant
Contraindications?

- Bacteremia
- Uncorrectable severe coagulopathy
- Extensive IVC thrombus such that filter placement would be hazardous.
Permanent Filters

400 patients with confirmed DVT on LMWH or unfractionated heparin

<table>
<thead>
<tr>
<th></th>
<th>IVC Filter Placement N= 200</th>
<th>No Filter Placement N= 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE at 12 days</td>
<td>1.1%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Recurrent DVT at 2 yrs</td>
<td>20.8%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Recurrent DVT at 8 yrs</td>
<td>32.1%</td>
<td>27.3%</td>
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</tbody>
</table>

## Complications of IVC Filters

<table>
<thead>
<tr>
<th>Filter Type</th>
<th>Patients</th>
<th>Follow up (months)</th>
<th>PE (Fatal)</th>
<th>DVT</th>
<th>IVC Thrombosis</th>
<th>Post-Phlebitic syndrome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stainless GFF</td>
<td>3,184</td>
<td>18 (1-60)</td>
<td>2.6% (0.9)</td>
<td>5.9</td>
<td>3.6</td>
<td>19</td>
</tr>
<tr>
<td>Titanium GFF</td>
<td>511</td>
<td>5.8</td>
<td>3.1 (1.7)</td>
<td>22.7</td>
<td>6.5</td>
<td>14.4</td>
</tr>
<tr>
<td>Birds Nest</td>
<td>1,426</td>
<td>14.2</td>
<td>2.9 (0.9)</td>
<td>6</td>
<td>3.9</td>
<td>14</td>
</tr>
<tr>
<td>Simon Nitinol</td>
<td>319</td>
<td>16.9</td>
<td>3.8 (1.9)</td>
<td>8.9</td>
<td>7.7</td>
<td>12.9</td>
</tr>
<tr>
<td>Vena Tech</td>
<td>1,050</td>
<td>12</td>
<td>3.4 (0.3)</td>
<td>32</td>
<td>11.2</td>
<td>41</td>
</tr>
</tbody>
</table>

Trends in Placement

- 25 fold increase in filter placement
  - 1979: 2,000
  - 1992: 30,000
  - 1999: 49,000
  - 2007: 213,000

***Estimated growth rate of 16% per annum

- Indications for filter placement:
  - Absolute indication reduced from 67.1% in 1995 to 56.8% in 2005
  - Greater percentage being placed for relative and prophylactic indications
• Inferior vena cava filter (IVCF) use continues to increase in the United States (US) despite questionable clinical benefit and increasing concerns over long-term complications. Searches of MEDLINE and Cochrane databases were conducted for randomized prospective IVCF studies. Only three randomized prospective studies for IVCFs were identified. Commonly cited IVCF guidelines were reviewed with attention to their evolution over time.

• No evidence has shown a survival benefit with IVCF use.

• Despite this, continued rising utilization, especially for primary prophylactic indications, is concerning, given increasing evidence of long-term filter-related complications. This is particularly noted in the US where IVCF placements for 2012 are projected to be 25 times that of an equivalent population in Europe (224,700 versus 9,070).

There are now >100,000 IVC filters deployed annually in the USA, with projected future growth at a rate of 16% per year. Peterson L. Inferior Vena Cava Filters. Trends Med. 2003.

In 1999, a retrospective study demonstrated that use of IVC filters increased sharply from <1% in 1980 to 11% in 1999 per 100 PE’s. Stein PD, Kayali F, Olson RE. Twenty-one-year trends in the use of inferior vena cava filters. Arch Intern Med. 2004;164:1541-5.

Single institution fivefold increase in the number of vena cava filter implantation procedures over a 26-year period despite a stable number of hospital admissions. Athanasoulis C, Kaufman J, Halpern E. Inferior Vena Cava Filters: review of a 26 year single center clinical experience.
Survival benefit?

- In one population based study among geriatric patients who underwent IVC filter placement, 16% died during the same hospitalization and 48% by two years.

PREPIC study

After 8 years of follow-up the filter group had fewer PE’s (6.2% vs 15.1%), but with a higher incidence of DVT (36.7% vs 27.5%), and no difference in mortality (48.1% vs 51%). Therefore the PREPIC study failed to show that filters reduce mortality due to PE in anticoagulated patients.

Bariatric Patient

Morbidly obese pose a greater risk for DVT and PE.
More complicated PE’s due to their decreased pulmonary reserve.
Up to 80% of bariatric deaths were found to have had silent PE’s despite prophylaxis.
Incidence seems to be higher with less invasive laparoscopic surgeries.
Without prophylaxis, patients that have major trauma have a risk of DVT up to 50%, with PE being the third most common cause of death in those surviving beyond the first day.


Even with the use of prophylactic anticoagulation the prevalence of a DVT was 27% in trauma patients who underwent weekly Doppler ultrasound, and PE has been shown to occur in approximately 10% of the high risk trauma patients despite prophylaxis.

Retrieval rate

- In a large 21 trauma center trial coordinated through the American Association for the Surgery of Trauma, 79% of all filters placed today are retrievable.

- However, almost 80% of retrievable filters were not removed simply due to patients being lost to follow-up.

- They found a 6-fold increase in loss to follow-up when the physician placing the device was not primarily responsible for the patients’ care.

Malignancy

- The American College of Chest Physicians Consensus Committee on Pulmonary Embolism report states that routine use of filters is not recommended in patients with cancer and DVT or PE.

- Patients with malignancy have an increased risk of thrombosis, often without a triggering event.
In one study the one year survival of cancer patients with VTE event was only 24%, regardless of their treatment modality for VTE, and death was rarely due to the thromboembolic event.

Patients requiring an IVC filter rather than anticoagulation as initial therapy once VTE is diagnosed face a two-fold increase in risk of death.

There is wide variability of incidence of filter deployment across regions of a same country or in comparison to other countries, despite similar rates of DVT/PE ratios.

The indications to use a filter should be carefully evaluated on a patient by patient basis. IVC filters can be important adjuncts to patient care, but are often inserted for unproven and inappropriate reasons.

Filters do not prevent DVT’s
As Dr. Greenfield himself said “given the choice, I suspect ... most patients would prefer deep venous thrombosis to pulmonary embolism”.