Removal of 16-year old Permanent Trapease IVC Filter: Presentation + Review of the Literature

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Disclosure

Speaker name: Brandon Olivieri

I have the following potential conflicts of interest to report:

☐ Consulting
☐ Employment in industry
☐ Stockholder of a healthcare company
☐ Owner of a healthcare company
☐ Other(s)

☒ I do not have any potential conflict of interest
Background: IVC Filters

- US Alone: 100,000 Filters placed /yr
- Many retrievable
- Increasing awareness of complications of filters
  - Physicians
  - Regulatory agencies
  - Public
Background: IVC Filters

Potential Complications of Long-term Filter Placement:

- Caval thrombosis
- Extension of lower extremity DVT
- Caval or adjacent vessel perforation
- Visceral perforation
- Whole or partial Migration
- Device Fracture
- Embolization
- Death
IVC Filter Retrieval

• Most filter retrievals uneventful
  • High degree of technical success

• Advanced techniques can be necessary
  • Difficult filter retrievals
  • Removing permanent filters
  • Should be used with caution
Trapease IVC Filter: Design + Specifications
Trapease IVC Filter Construction

• Released as permanent IVC filter in 2000 by Cordis (Miami Lakes, FL)

• Laser-cut from nitinol metal tube
  • No weld points

• Self-expanding maximum diameter 35mm

## Theoretical Advantages

<table>
<thead>
<tr>
<th>Structural Feature</th>
<th>Theoretical Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximal + Distal Baskets</td>
<td>✢ embolus capturing ability</td>
</tr>
<tr>
<td>6 vertical struts</td>
<td>• Reduced tilting + migration</td>
</tr>
<tr>
<td></td>
<td>• Accurate, predicable deployment</td>
</tr>
<tr>
<td>Wall fixation achieved by vertical struts + short opposing barbs</td>
<td>Limited IVC wall penetration</td>
</tr>
</tbody>
</table>

http://radipedia.com/WikiMedia/images/b/b3/TrapEasePhoto.jpg
Neointimal incorporation of TrapEase Filter struts over time in goat model
## Trapease IVC Filter: Technical Outcomes

<table>
<thead>
<tr>
<th></th>
<th># Filters</th>
<th>Mean f/u months</th>
<th>Tilt, n/N (%)</th>
<th>Migration, n/N (%)</th>
<th>Fracture, n/N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVERALL</strong></td>
<td></td>
<td></td>
<td>0 – 0.4%</td>
<td>0%</td>
<td>0– 50%</td>
</tr>
<tr>
<td>Tsui et al</td>
<td>594</td>
<td>21.2</td>
<td>0/9 (0)</td>
<td>0/9 (0)</td>
<td>17/128 (13.3)</td>
</tr>
<tr>
<td>Sano et al</td>
<td>20</td>
<td>50</td>
<td>N/A</td>
<td>N/A</td>
<td>10/20 (50)</td>
</tr>
<tr>
<td>Usoh et al</td>
<td>72</td>
<td>12</td>
<td>N/A</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Nazzal et al</td>
<td>224</td>
<td>N/A</td>
<td>1/223 (0.4)</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Kalva et al</td>
<td>751</td>
<td>9.8</td>
<td>0</td>
<td>0</td>
<td>8/270 (3.0)</td>
</tr>
<tr>
<td>Liu et al</td>
<td>42</td>
<td>15.4</td>
<td>0</td>
<td>0</td>
<td>0/42 (0)</td>
</tr>
<tr>
<td>Onat et al</td>
<td>30</td>
<td>N/A</td>
<td>N/A</td>
<td>0</td>
<td>0/30 (0)</td>
</tr>
<tr>
<td>Rosseau et al</td>
<td>65</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0/65 (0)</td>
</tr>
<tr>
<td>Schutzer et al</td>
<td>189</td>
<td>4.2</td>
<td>0</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Modified from Tsui B et al. Outcomes of the TrapEase inferior vena cava filter over 10 years at a single health care system. JVS: Venous + Lymphatic Disorders. 2018. 6; 5. 599 - 605
## Trapease IVC Filter: Clinical Outcomes

<table>
<thead>
<tr>
<th></th>
<th>PE breakthrough</th>
<th>Entrapped Clot</th>
<th>Caval thrombosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRAPEASE</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0 - 18%</td>
<td>2.4 – 25.2%</td>
<td>0.7 - 100%</td>
</tr>
<tr>
<td>Greenfield&lt;sup&gt;2,3&lt;/sup&gt;</td>
<td>3-4%</td>
<td>N/A</td>
<td>2-4%</td>
</tr>
<tr>
<td>Gunther Tulip&lt;sup&gt;4&lt;/sup&gt;</td>
<td>3.3% - 5.2%</td>
<td>N/A</td>
<td>4.1%</td>
</tr>
<tr>
<td>Cook Celect&lt;sup&gt;5,6&lt;/sup&gt;</td>
<td>2.6%</td>
<td>1.4 - 12.5%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Option&lt;sup&gt;7&lt;/sup&gt;</td>
<td>8%</td>
<td>N/A</td>
<td>3%</td>
</tr>
</tbody>
</table>

1. Tsui B et al. Outcomes of the TrapEase inferior vena cava filter over 10 years at a single health care system. JVS: Venous + Lymphatic Disorders. 2018; 6; 5. 599 – 605
Filter Design

- EFFECTIVE CAVAL FILTRATION
- THROMBOGENICITY
Partially Occluded Filter:

Upstream trapping position (closer to feet)

- Results in recirculating + stagnant flow w/ low shear stress
- Promotes intrafilter thrombosis

Case Presentation

78 y/o M w/ history of CKD, DM, + DVT s/p Trapease Permanent filter placement in 2002

• Over past 8 years developed debilitating bilateral LE edema requiring ambulation w/ walker

• Mistakenly diagnosed as “lymphedema” and treated w/ weekly outpatient lymphatic massage
Case Presentation

• Admitted to hospital for recurrent DVT w/ worsening bilateral lower extremity edema, lipodermatosclerosis, + early gaiter zone ulceration
Imaging Evaluation

• Venous duplex:
  • R popliteal, L CFV + femoral vein DVT
  • Bilateral iliac vein occlusions noted

• CT A/P (noncontrast due to CKD)

Diminutive IVC caliber

Trapease Filter
- Bilateral femoral + R IJ access obtained
- Occlusion of iliac veins and IVC extending through IVC filter to renal veins
• Dual operators

• Occlusion traversed from R IJ access + femoral access simultaneously
- RIJ wire snared from L femoral access
- R femoral wire snared via R IJ within the filter
- Wires externalized
- Through + through access
Tract created across occlusion with 10mm balloons

@SOBE_Vascular
Tract created for delivery of devices + filter removal
• 16Fr sheath from R IJ

• 18Fr sheath from L femoral access

• Glidewire passed through Reverse Curve catheter + snared from below across inferior struts of filter x 2
  • Create 2 glidewire loop snares across inferior aspect of filter
“Curl” Technique

1) Endobronchial forceps grasp filter apex from jugular access

2) Simultaneous retraction applied by:
   - 2 loops snares from below
   - Forceps from above

3) Forceps rotated to twist filter
“Curl” Technique

Elongation + decreased diameter
“Curl” Technique
Persistent Iliac + IVC stenosis s/p filter removal (also on IVUS)

Caval Reconstruction w/ 24 mm Wallstent in IVC + double barrel 18mm Wallstents in Iliac veins
• Discharged on apixaban
• LE edema much improved
• Now ambulating
• Stents patent at 6 months
Retrieval of TRAPESE and OPTEASE Inferior Vena Cava Filters with Extended Dwell Times

Daniel Scher, MD, Anthony Venbrux, MD, Kevin Okapal, MD, Gaby Gabriel, MD, Robert Dufour, MD, Albert Chun, MD, MBA, Shawn Sarin, MD, MBA, and Andrew Akman, MD, MBA

Percutaneous Retrieval of Permanent Inferior Vena Cava Filters

Anobel Tamrazi¹ · Vibhor Wadhwa¹,² · Brian Holly¹ · Nikhil Bhagat³ · Jonathan K. Marx¹ · Michael Streiff⁴ · Mark L. Lessne¹,⁵

Endovascular Technique

Endovascular Removal of a Permanent “TrapEase” Inferior Vena Cava Filter

Sasidhar Yallampalli, MD¹, Zubin Irani, MD¹, and Sanjeeva P. Kalva, MD¹

Abstract No. 513

Percutaneous removal of permanent IVC filters: tips, tricks, and TrapEases

M.L. Lessne²,¹, B. Holly¹, N. Bhagat³, A. Tamrazi¹;¹Radiology, John Hopkins University, Baltimore, MD; ²Vascular & Interventional Specialists of Charlotte Radiology, Charlotte, NC; ³Radiology, Kaiser Permanente, McLean, VA

Double Barrel In Situ Recanalization of Thrombosed Nonretrievable IVC filter

Shubhabrata Banerjee, Hiten M. Patel, Virender K. Sheorain, Tarun Grover, and Rajiv Parakh, Haryana, India

Removal of a TrapEase Inferior Vena Cava Filter for Chronic Abdominal Pain 2 Years after Implantation

From: Howard M. Richard III, MD
# Reported Trapease Filter Retrieval Techniques

<table>
<thead>
<tr>
<th>Technique</th>
<th>Number Removed</th>
<th>Dwell time (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Loop Snare</td>
<td>2</td>
<td>129; 280</td>
</tr>
<tr>
<td>Double Loop Snare Technique</td>
<td>4</td>
<td>7; 180; 270, 730</td>
</tr>
<tr>
<td>Loop Snare + Forceps</td>
<td>1</td>
<td>3,282</td>
</tr>
<tr>
<td>Dual Forceps</td>
<td>1</td>
<td>2,183</td>
</tr>
<tr>
<td>Loop Snare + Dual Forceps</td>
<td>1</td>
<td>492</td>
</tr>
<tr>
<td>Laser</td>
<td>17</td>
<td>105 - 4,340</td>
</tr>
<tr>
<td>Laser + Forceps</td>
<td>1</td>
<td>1,460</td>
</tr>
<tr>
<td>Laser + Loop Snare</td>
<td>1</td>
<td>2,920</td>
</tr>
<tr>
<td>Double Barrel Stent (filter not removed)</td>
<td>2</td>
<td>180; 2555</td>
</tr>
</tbody>
</table>
Summary

- Long-term IVC filters can result in debilitating consequences for patients
- Permanent filters can be removed
- Consider filter design + when using advanced filter retrieval techniques
- Laser is most frequently reported extraction technique for Trapease filters
- “Curl technique” may be useful for difficult Trapease permanent filter removals
Thank you!

Mount Sinai Multidisciplinary Limb Salvage Center

Don’t hesitate to call or email us with questions at: (305) 674-2071

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- Christian Koelbl, MD
  • Christian.Koelbl@msmc.com

International Physicians + Students welcome to rotate with us
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