Surgical Removal of IVC Filters for Perforation or Infiltration

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Timothy K. Liem financial disclosures:

- None

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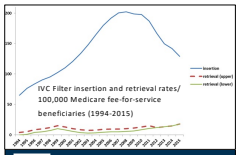
Background

- IVC filter usage: Rapid increase and decline over past 30 yrs
  - No evidence of mortality benefit
  - Reports of filter-related complications
  - Reports of low retrieval rates (15-30%)
  - FDA warning August 9, 2010 Morris, J Am Coll Radiol 2018
- 921 reports of IVC filter complications (FDA 2005-2010)
  - Migration 328/921
  - Filter fracture 146/921
  - IVC perforation 70/921
- Perforation defined: strut/anchor >3mm outside IVC wall
  - Most are asymptomatic
  - More likely with hookless filters

Ayad, J Vasc Surg: Venous and Lym Dis 2019
https://wayback.archive-it.org/7993/20161022180008/http://www.fda.gov/MedicalDevices/Safety/AlertsandNotices/ucm221676.htm



FDA 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.

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Caval Penetration by Inferior Vena Cava Filters
A Systematic Literature Review of Clinical Significance and Management

Zhongzhi Jia, MD; Alex Wu, MD; Mathew Tam, MD; James Spain, MD, PhD; J. Mark McKinney, MD; Weiping Wang, MD

Medline search (1970-2014) finding 88 clinical studies and 112 case reports, 9002 pts

- IVC filter wall penetration (1699/9002) 19%

Organ/ structure involved (322/1699) 19%	
- Duodenum	123
- Lumbar vertebrae	63
- Aorta	62
- Psoas muscle	8
- Lumbar artery	6

Interventions Performed	
- Surgical removal	63
- Endovascular stent/ embolize	11
- Endovascular retrieval	4
- Nephrostomy/ ureter stent	3

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Jia, Circulation 2015

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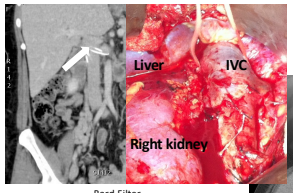
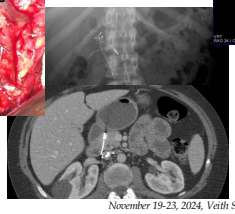
IVC Filter Perforation or Infiltration?



Bard Filter

Cook Bird's Nest Filter



Cordis Optease Filter

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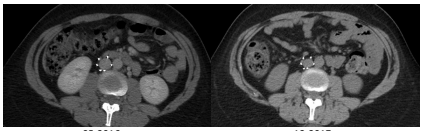
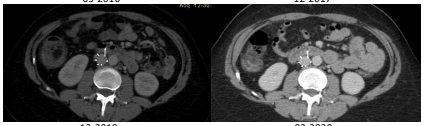
IVC Filter Perforation or Infiltration?



05-2016 12-2017



12-2019 03-2020

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IVC Filter Perforation or Infiltration?

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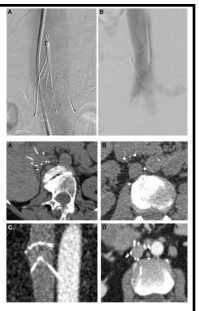
From the Society for Clinical Vascular Surgery

Factors predicting failure of retrieval of inferior vena cava filters

Katherine L. Morrow, MS,[a] James Bena, MS,[b] Sean P. Lyden, MD,[b] Ezequiel Parodi, MD,[b] and Christopher J. Smolock, MD,[b] *Cleveland, Ohio*

- **295 IVC-filter retrieval attempts at Cleveland Clinic** (2011-2018). Success in 249 (84.4%) w/o IVC ruptures, morbidity or mortality.
  - IVC-filter tine penetration in 98.6%
  - Hook/apex (HA) embedded/ penetrated 10.5%
  - Hook/apex/collar (HA+C) embedded/ penetrated 11.2%
- Factors predicting failure of retrieval:
  - Longer dwell time (375d vs 196d, P=.004)
  - Permanent filters (61.5% vs 85.5%, P=.02)



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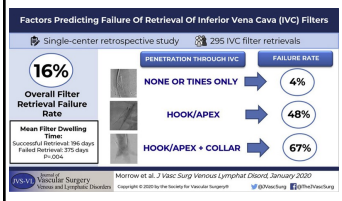

Conclusions: Retrieval should be attempted for all IVC filters, irrespective of the chronicity and complexity, given the procedural safety.

Limitations:

- No description of filter type
- All conical filters
- Low number of permanent filters (4%)
- No caval ruptures

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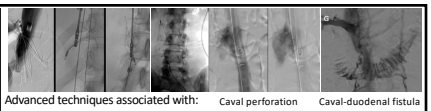
Procedural complications of inferior vena cava filter retrieval, an illustrated review

Quencer, CVIR Endovascular 2020



Advanced techniques associated with: Caval perforation Caval-duodenal fistula

- 4-fold increased complications (5% vs 20%)
- 13-fold increased major complications
- 5.4x more fluoro time

>2500 advanced IVC-F retrievals attempted (2010-2018)

- **500 pt** subset failed retrieval with after 3X standard retrieval force (6-7 lb force)
- Laser-assisted retrieval success 99.4%

10 Complications:

- IVC hemorrhage
- Delayed IVC thrombus
- Renal AV fistula
- Renal infarction
- Artery injury
- Bowel injury/ sepsis

Kuo, JAHA 2020

Journal of the American Heart Association

ORIGINAL RESEARCH

Laser-Assisted Removal of Embedded Vena Cava Filters: A First-In-Human Escalation Trial in 500 Patients Refractory to High-Force Retrieval

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Clinical Series of Open IVCF Removal

Open surgical removal of retained and dislodged inferior vena cava filters

Rana, JVSVL 2015: **6 patients**

- open cavotomy 2
- stab venotomy 3
- strut removal 1

Charlton-Ouw, Ann Vasc Surg 2018: **7 patients**

- All failed percutaneous retrieval
- 1 with 2 IVCF/ 2 with 3 IVCF

Indications and Outcomes of Open Inferior Vena Cava Filter Removal

Various Approaches to Open Removal of Inferior Vena Cava Filters

Qato, Ann Vasc Surg 2020: **6 patients**

- open cavotomy/primary repair 3
- open cavotomy/patch repair 1
- strut removal 1
- stab venotomy/snare 1

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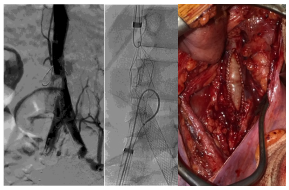
OHSU Series of Open IVC Filter Retrievals

11 Open IVC filter retrievals (2007-2022)

- Prior VTE in 8 (73%)/ 3 prophylactic filters: poly-trauma and ICH
- Prior percutaneous attempts at IVC filter retrieval in 4 pts (range in # attempts 1 – 4)
- Symptomatic 9 (82%)
  - Duodenal perforation (4)
  - Aortic perforation (3)
  - Pancreas (1)
  - Left renal v. (1)
- Technique:
  - Perforating strut excision (2 pts)
  - Open snare/sheath (2 pts)
  - IVC venotomy (6 pts)



Outcomes

- 30-dMortality 0%
- Median LOS 5d
- Complications: aortic pseudoaneurysm, incisional hernia

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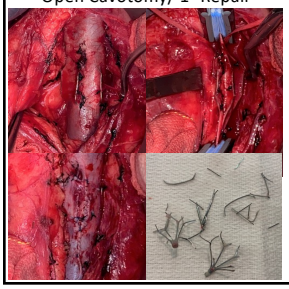
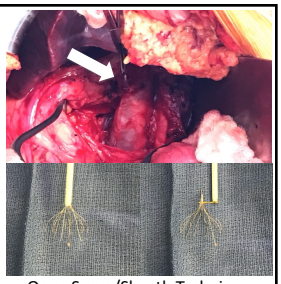
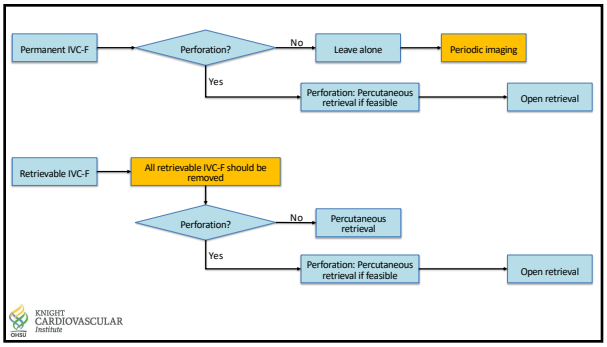
Open Cavotomy/ 1° Repair





Open Snare/Sheath Technique



Summary

- IVC filter-associated perforation is an under-recognized complication (19%-34%). 19% of penetrations show organ/structure impalement.
- IVC filters with symptomatic perforation/ asymptomatic severe perforation should be removed.
- Open retrieval is a viable option for patients with IVC filter-associated complications who are not candidates for, or who have failed, percutaneous retrieval

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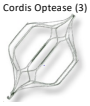
Results: Demographics - Filter Types

Cordis Optease (3)



Cook Celect (1)

Bard Simon-Nitinol (1)

Greenfield (1)

Cook Günther Tulip (2)

Cook Bird's Nest (1)

Bard Eclipse (1)

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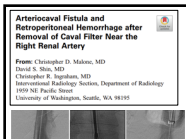
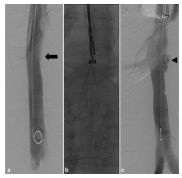


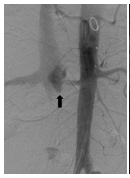
Arteriocaval Fistula and Retroperitoneal Hemorrhage after Removal of Caval Filter Near the Right Renal Artery

From: Christopher D. Malone, MD
David S. Shin, MD
Christopher R. Ingraham, MD
Interventional Radiology Section, Department of Radiology
1959 NE Pacific Street
University of Washington, Seattle, WA 98195

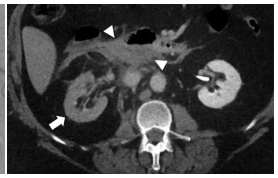
Case reports post IVC-filter endoretrieval:

- Caval rupture
- AV fistula formation
- Renal artery thrombosis
- Aortic pseudoaneurysms





AV fistula



Retroperitoneal hematoma

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Malone, JVIR 2018