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THE GREEN PARK PENDİK HOTEL - İSTANBUL

Vena Cava Filter

Who and when?

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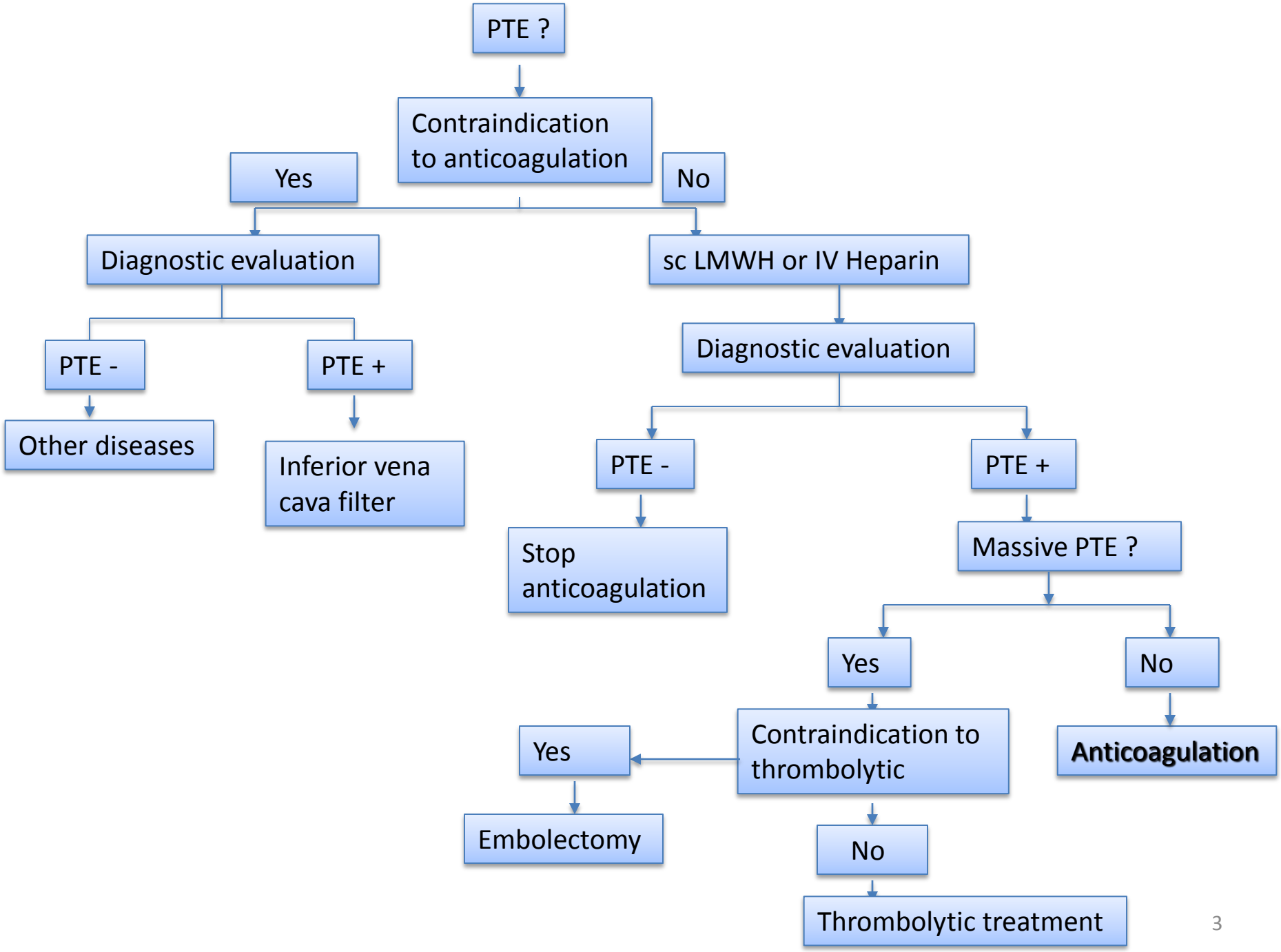
Venous thromboembolism (VTE) and Pulmonary thromboembolism (PTE)

- 2 points on the spectrum of a single disease process
- VTE →
  - Common, reported incidence 422/100000
  - If left untreated → 40% pulmonary embolism
- PTE →
  - Mortality without treatment : 30%
  - Most of the deaths within first hours
  - Mortality with treatment : 2 – 8 %
- First – line treatment → anticoagulation
  - Treatment failure
  - Contraindication to anticoagulation


PTE ?
Contraindication to anticoagulation
Yes
No
Diagnostic evaluation
sc LMWH or IV Heparin
PTE -
PTE +
Other diseases
Inferior vena cava filter
Diagnostic evaluation
PTE -
PTE +
Stop anticoagulation
Massive PTE ?
Yes
No
Yes
Contraindication to thrombolytic
Anticoagulation
Embolectomy
No
Thrombolytic treatment

Indications

- Controversies among guidelines
- Common consensus →
  - Acute VTE and
    - contraindication to anticoagulation
      - 38-77% of patients undergoing IVC filter placement.
    - complication or failure in anticoagulation therapy

Contraindications to anticoagulation

- Hemorrhagic stroke
- Recent neurosurgical procedures or other major surgery
- Major or multiple trauma
- Active internal bleeding (eg, upper or lower gastrointestinal bleeding, hematuria, hemobilia)
- Intracranial neoplasm
- Bleeding diathesis (eg, secondary thrombocytopenia, idiopathic thrombocytopenic purpura, hemophilia)
- Pregnancy
- Unsteady gait or tendency to fall (as seen in patients with previous stroke, Parkinson disease)
- Poor patient compliance with medications

Table 1. Societal Guidelines for IVC Use

ACCP (9)	SIR (10,12)	Appropriateness Criteria (13)	AHA (11)*
Primary Therapy for Acute VTE is Pharmacologic			
Absolute Indications/Evidence Level I or Level IIa or High Appropriateness			
Acute VTE and contraindication to anticoagulation	VTE and contraindication to anticoagulation	Chronic symptomatic PE	Adult patients with any confirmed VTE with contraindications to anticoagulation or with active bleeding complication
	Failure of anticoagulation in patients with VTE including recurrent VTE, complication of anticoagulation, and inability to achieve or maintain therapeutic anticoagulation		Recurrent acute PE despite therapeutic anticoagulation, it is reasonable to place an IVC filter
Relative Indications/Evidence Level IIb or Mid-Level Appropriateness			
Unstable patients with PE may benefit from IVCF in conjunction with anticoagulation therapy	VTE with limited cardiopulmonary reserve	Acute PE and/or iliofemoral DVT*	Patients with acute PE and very poor cardiopulmonary reserve, including those with massive PE
	Large, free-floating proximal DVT	Free-floating iliofemoral DVT	
Massive PE treated with thrombolysis/ thrombectomy or chronic PE treated with thromboendarterectomy	Massive PE treated with thrombolysis/ thrombectomy or chronic PE treated with thromboendarterectomy		
	Thrombolysis for iliocaval DVT	rIVCF for phlegmasia cerulea dolens undergoing endovascular treatment	
	Iliocaval DVT		
	Recurrent PE with a filter in place		
	Difficulty achieving anticoagulation or poor compliance to anticoagulation treatment		
	High risk of complications of anticoagulation (e.g., fall risk)		
	Prophylaxis for patients with severe trauma, closed head injury, spinal cord injury, multiple long bone injuries, prolonged immobilization	rIVCF as prophylaxis in high-risk patients	
Not Indicated/Not Appropriate			
Prophylaxis		Calf vein thrombosis and upper extremity DVT	Routinely as an adjuvant to anticoagulation and systemic fibrinolysis in the treatment of acute PE
In addition to anticoagulation for the treatment of VTE			

Relative Indications

- represents patients who could benefit from an IVC filter, but may be just fine without one as well.
- **Proven VTE**: High risk of contraindication or complication to arise during anticoagulation therapy
- **Large, free-floating proximal DVT's**
- **Poor Compliance**: INR levels are not stable, not taking medicine as directed
- **Thrombolysis**: Iliocaval DVT's, which are emboli in the Illiac region

a few relative contraindications

- those receiving therapeutic anticoagulants,
- those with thrombus between the venous access site and expected deployment site, and
- patients expected to undergo magnetic resonance imaging (MRI) after filter placement.

Permanent or Retrievable

- **Short Term Risk of PE/Short Term contraindication of anticoagulation**: Usually merits a retrievable filter
- **Uncertain Risk of PE and/or lack of control for anticoagulation**: Usually results in permanent filters for long term management
- **Long Term Risk of PE/Recurrent PE/Recurrent DVT**: Permanent Filter

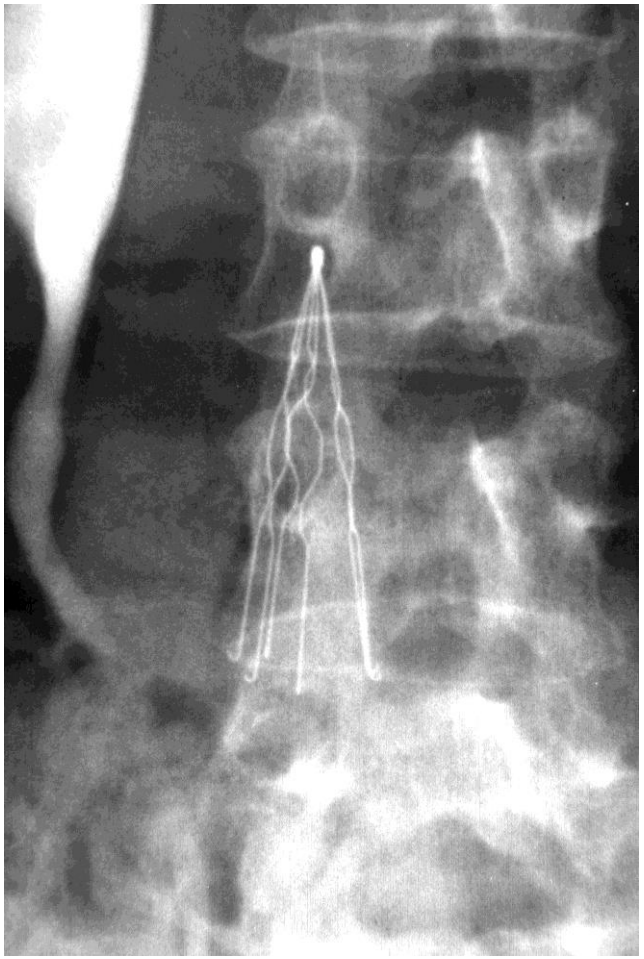
Filter	Size	Access site	IVC diameter	MR-comp
1. Bird's Nest	14 F	Femoral / Juguler	≤40 mm	Yes (?)
2. Greenfield (Stainless-steel)	29.5 F	Femoral / Juguler	≤28 mm	No
3. Greenfield (Titanium)	14.3 F	Femoral / Juguler	≤28 mm	Yes
4. Greenfield (Stainless-steel over-the-wire)	15 F	Femoral / Juguler	≤28 mm	Yes
5. VenaTech (-LGM)	14.6 F	Femoral / Juguler	≤28 mm	Yes
6. Simon Nitinol	9 F	Femoral / Juguler	≤28 mm	Yes
7. TrapEase	8 F	Femoral / Juguler	≤30 mm	Yes
8. Günther Tulip	12 F	Femoral / Juguler	≤30 mm	Yes

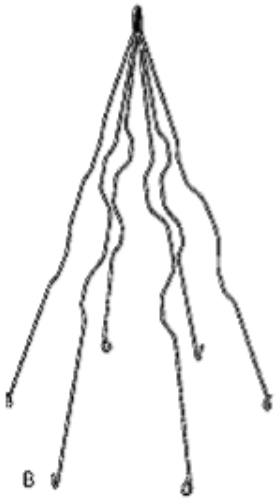
Table 2. FDA Approved rIVCF Main Characteristics

Filter	Recommended Time-to-Retrieval	Introducer Size	Comments
Celect (Cook Medical, Bloomington, Indiana)	Retrieval was 97% at 179 days and reported up to 466 days (50)	7-F	Can be used up to a maximal IVC size of 30 mm
Gunther Tulip (Cook Medical, Bloomington, Indiana)	Retrieval success rate was 94% at 12 weeks and reported up to 494 days (51)	11-F	Can be used up to a maximal IVC size of 30 mm
G2 (Bard Peripheral Vascular, Tempe, Arizona)	Retrieval was 86.9% at 131 days and reported up to 602 days (52)	7-F	Can be used up to a maximal IVC size of 28 mm. High rates of tilting that precludes retrieval, fracture, and migration have been reported
Optease (Cordis, Miami Lakes, Florida)	23 days		Can be used up to a maximal IVC size of 30 mm
ALN Filter (ALN Implants Chirurgicaux, Ghisonaccia, France)	"Unlimited"	6-F	Approved for IVC up to 28 mm in the United States and 32 mm in Europe
SafeFlo (Rafael Medical Technologies, Caesarea, Israel)	N/A	6-F	Available for IVC 16–25 mm
Option (Rex Medical, distributed by Argon Medical Devices, Plano, Texas)	175 days	5-F	Can be used up to a maximal IVC size of 32 mm
Crux (Crux Biomedical, Menlo Park, California)	In a multinational study, 98% of filters were retrieved within 84 ± 57 days	6-F	Can be retrieved from the jugular or the femoral approach. Two sizes offer protection for IVC sizes 17–28 mm

FDA = U.S. Food and Drug Administration; N/A = not available; other abbreviations as in Table 1.

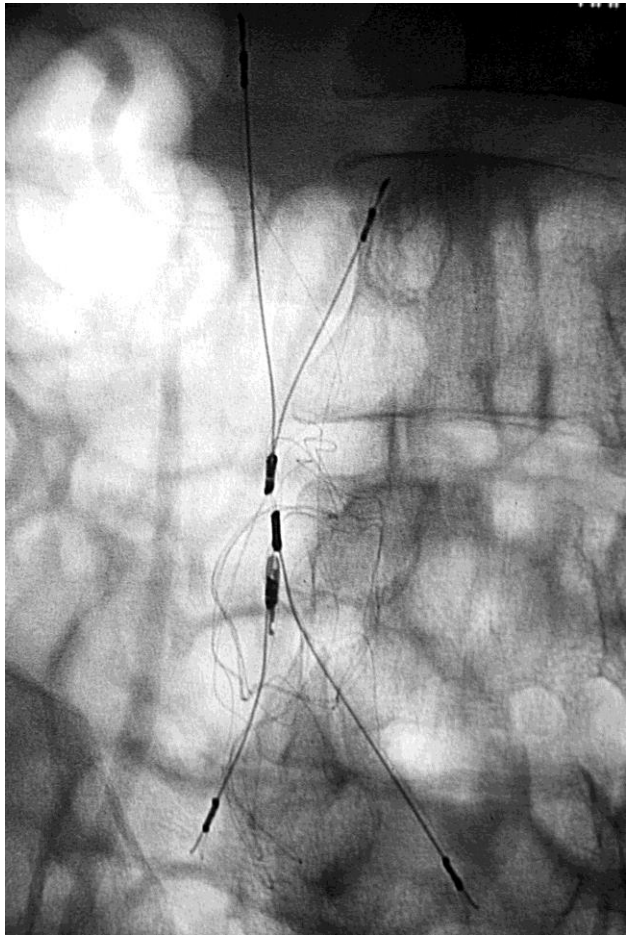
Greenfield Filter





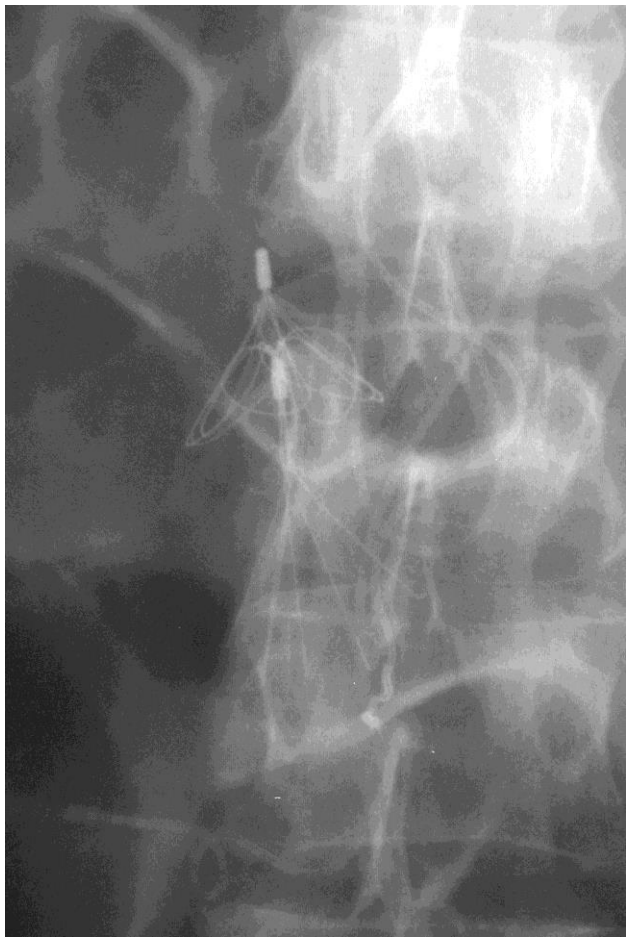
- First commercially available filter

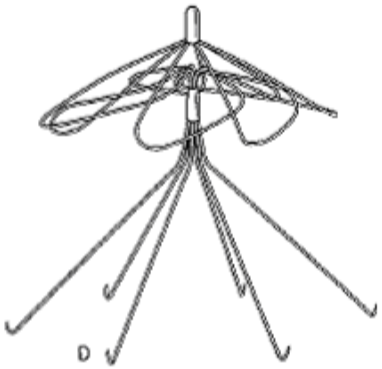
Bird's Nest Filter



- In patients with large IVC.
- Compatible with tortuos venous anatomy

Simon Nitinol Filter



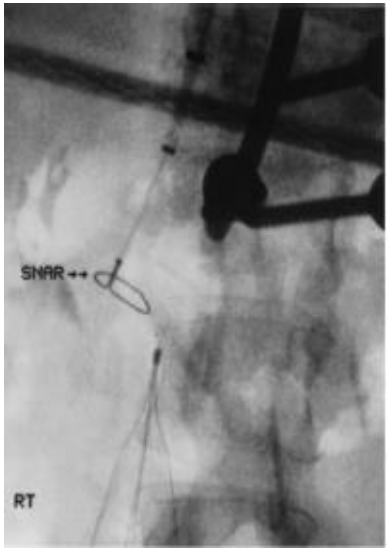


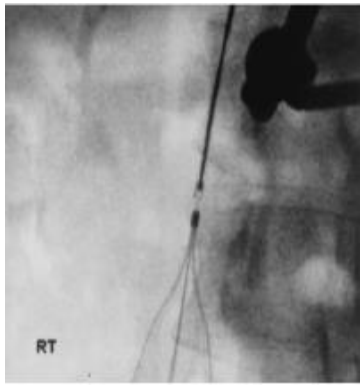
- <27°C straight and flexibl,
- 37°C, designed shape

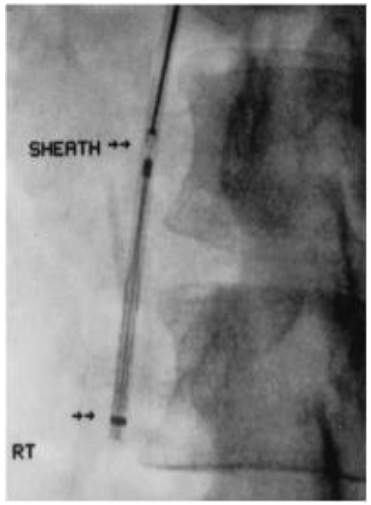
Trap Ease Filter

- Small guide catheter

Günther Tulip Filter







- Suitable for prophylactic usage
- retrievable

Safe?

- Complications of access site
  - Pneumothorax (incidence very low with ultrasonographic guidance)
  - Access site thrombosis (2%)
  - Persistent bleeding from insertion site
  - Pulmonary embolism (PE) (if passage was through a thrombosed vein)

Complications related to filter

- IVC trauma / thrombosis / obstruction
- Penetration of the caval wall by the filter legs (may rarely lead to retroperitoneal hematoma or bowel injury)
- Filter migration (< 1%; may be caused by trapped guidewires)
- Filter fracture (< 1%)
- Filter infection (< 1%)
- Caval thrombosis (5%)
- Death (30-d mortality, < 1%)

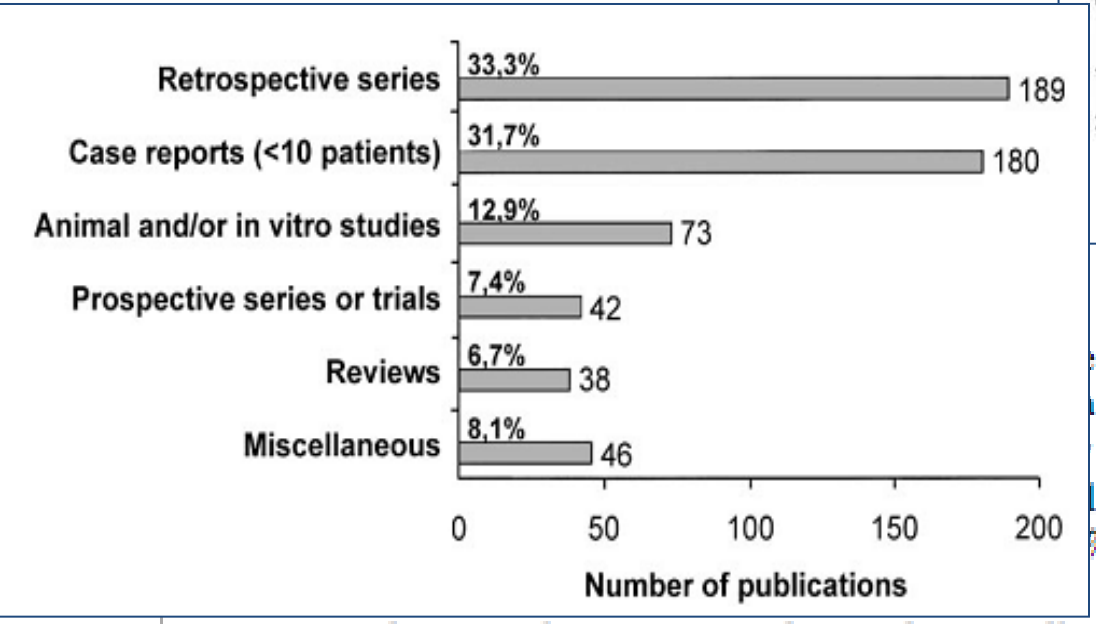
Anticoagulation after placement?

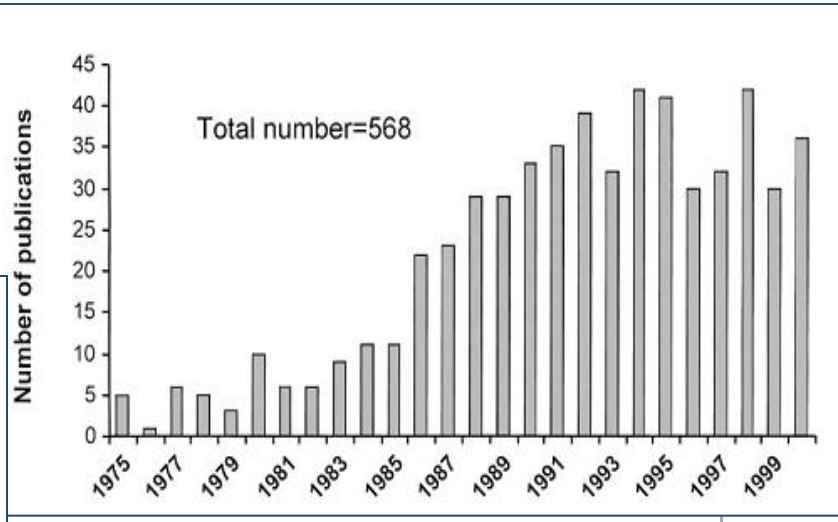
- Should anticoagulant therapy be utilized after filter placement?
- Protects pulmonary bed
- Thrombotic predisposition is not decreased
- Small thrombi
- IVC thrombosis / insert site thrombosis

Medical Literature and Vena Cava Filters*

So Far So Weak

Philippe Girard, MD, FCCP; Jean-Baptiste Stern, MD; and



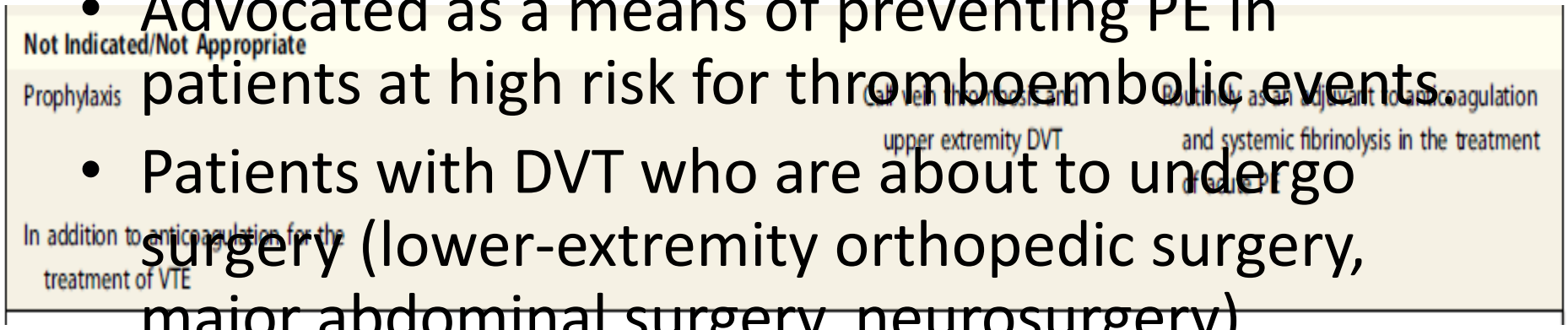


earch about vena cava filters produced a
nd 2000 inclusively. Each reference was
two thirds (65.0%) of these publications
1.7%, respectively), 12.9% were animal or
% were reviews, and 8.1% reported on
studies, only 16 studies included ≥ 100 patients, only 1 study was a randomized controlled trial (0.02% of 568 references), and heterogeneity among series precluded any relevant comparison. In a similar search about heparin and venous thromboembolism, 47.4% of 531 references were randomized controlled trials.

Conclusions: Until more relevant data become available, literature reviews about vena cava filters will remain narrative, and many if not most indications for filter placement will remain a matter of opinion.

(CHEST 2002; 122:963–967)

PTE Prophylaxis



- Advocated as a means of preventing PE in patients at high risk for thromboembolic events.
- Patients with DVT who are about to undergo surgery (lower-extremity orthopedic surgery, major abdominal surgery, neurosurgery)
- Patients with chronic pulmonary hypertension and a marginal cardiopulmonary reserve
- Patients with cancer
- Some major trauma patients
- Temporary filters with pharmocologic and pharmocomechanical thromblysis of DVT

Surgical pulmonary embolectomy

Case Fatality Rate with Pulmonary Embolectomy for Acute Pulmonary Embolism

Paul D. Stein, MD, Fadi Matta, MD

Department of Research, St. Mary Mercy Hospital, Livonia, Mich; and Department of Osteopathic Medical Specialities, Michigan State University College of Osteopathic Medicine, East Lansing.

ABSTRACT

BACKGROUND: There are insufficient data to assess the potential role of pulmonary embolectomy in patients with acute pulmonary embolism.

METHODS: In-hospital all-cause case fatality rate with pulmonary embolectomy was assessed from the Nationwide Inpatient Sample from 1999 through 2008.

RESULTS: Among unstable patients (in shock or ventilator-dependent), case fatality rate with embolectomy was 380 of 950 (40%). Among stable patients, case fatality rate was lower: 690 of 2820 (24%) ($P < .0001$). Case fatality rate in unstable patients was 39% in 1999-2003 and 40% in 2004-2008 (not significant), and in stable patients it was 27% in 1999-2003 and 23% in 2004-2008 ($P = .01$). Case fatality rates were lower in patients with a primary diagnosis of pulmonary embolism and even lower in patients with a primary diagnosis who had none of the comorbid conditions listed in the Charlson Index. Within each stratified group, patients with vena cava filters had a lower case fatality rate.

CONCLUSIONS: Case fatality rate in unstable patients who underwent pulmonary embolectomy remained at 39%-40% from 1999-2003 to 2004-2008, and in stable patients it decreased only from 27% to 23%. Case fatality rates were lower in those with fewer comorbid conditions and in those who received a vena cava filter. Our data reflect average outcome in the US. It may be that experienced surgeons and an aggressive multidisciplinary team could obtain a lower case fatality rate.

 • The American Journal of Medicine (2012) 125, 471-477

Free-floating DVT

Arch Surg. 1985 Jul;120(7):806-8.

Free-floating iliofemoral thrombus. A risk of pulmonary embolism.

Norris CS, Greenfield LJ, Herrmann JB.

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Arch Intern Med. 1997 Feb 10;157(3):305-8.

Free-floating thrombus and embolic risk in patients with angiographically confirmed proximal deep venous thrombosis. A prospective study.

Pacouret G, Alison D, Pottier JM, Bertrand P, Charbonnier B.

Cardiology D and Coronary Care Unit, Trousseau University Hospital, Tours, France.

Abstract

BACKGROUND: A free-floating thrombus (FFT) is often considered to be a risk factor for pulmonary embolism (PE), despite adequate anticoagulation therapy, in patients with proximal deep venous thrombosis.

METHODS: Ninety-five patients underwent prospective assessment according to the presence (FFT group [n = 62]) or absence (occlusive thrombus group [n = 28]) of an FFT. On day 1, color venous duplex scanning, venography (reference method), perfusion lung scanning, and, if results of the lung scan were abnormal, pulmonary angiography were performed. On day 10 (range, days 9-11), the lung scan was repeated, as well as pulmonary angiography if the lung scan demonstrated impairment. A 3-month clinical follow-up visit was scheduled. Five patients were retrospectively excluded from analysis for uncertain diagnosis of FFT. Patients were treated with intravenous unfractionated heparin sodium adjusted for activated partial thromboplastin time (n = 1) or subcutaneous low-molecular-weight heparin (n = 89) (nadroparin calcium, 225 Institut Choay factor Xa inhibitory units per kilogram for 12 hours). Warfarin sodium therapy was initiated on day 3 (range, days 2-4).

RESULTS: Both groups were well-matched according to age, sex, risk factors, and delay from onset of symptoms to treatment. Positive and negative predictive values of color venous duplex scanning for the diagnosis of an FFT were 91% and 55%, respectively. On admission, PE prevalence was 64% in the FFT group (40 of 62 patients) and 50% in the occlusive thrombus group (14 of 28 patients) (P = .19). Two patients were excluded on follow-up analysis (range, days 9-11) for preventive vena cava filtering (due to major bleeding in 1 and cholecystectomy in the other); the recurrent rate of PE was 3.3% in the FFT group (2 of 61 patients) and 3.7% in the occlusive thrombus group (1 of 27 patients). No symptomatic recurrent PE occurred between day 10 (range, days 9-11) and 3 months. Four patients died of evolutive neoplasm after hospital discharge.

CONCLUSIONS: No higher risk for PE was observed in patients with free-floating proximal deep venous thrombosis; anticoagulant therapy should prevent recurrent PE in such patients.

Trauma patients

Randomized trial

Randomized clinical trial of intermittent pneumatic compression and low molecular weight heparin in trauma

E. Ginzburg, S. M. Cohn, J. Lopez, J. Jackowski, M. Brown and S. M. Hameed for the Miami Deep Vein Thrombosis Study Group

The Journal of TRAUMA® *Injury, Infection, and Critical Care*

Prevention of Venous Thromboembolism after Injury: An Evidence-Based Report—Part I: Analysis of Risk Factors and Evaluation of the Role of Vena Caval Filters

George C. Velmahos, MD, PhD, Jack Kern, PharmD, Linda S. Chan, PhD, Danila Oder, BA, James A. Murray, MD, and Paul Shekelle, MD

extremity fractures

Spine surgery

SPINE Volume 35, Number 20, pp 1893–1896

Efficacy of Prophylactic Placement of Inferior *Vena Cava* Filter in Patients Undergoing Spinal Surgery

Cagatay Ozturk, MD, Kursat Ganiyusufoglu, MD, Ahmet Alanay, MD, Mehmet Aydogan, MD, Levent Onat, MD, and Azmi Hamzaoglu, MD

Ann Vasc Surg. 2005 May;19(3):442-7.

The prophylactic use of inferior vena cava filters in patients undergoing high-risk spinal surgery.

Leon L, Rodriquez H, Tawk RG, Ondra SL, Labropoulos N, Morasch MD.

Department of Surgery, Loyola University Medical Center, Maywood, IL, USA.

Cancer patients

- Caval thrombosis risk ↑
- Bleeding risk ↑
- Not cost-effective

Take home message

- Increased used of filters is not supported by high-quality evidence.
- In venous thromboembolic disease when a patient is not a candidate for anticoagulant therapy or has failed anticoagulation
- Prophylactic filter replacement is an option for selected patients at high risk for venous tromboembolism


Thank you for
your attention