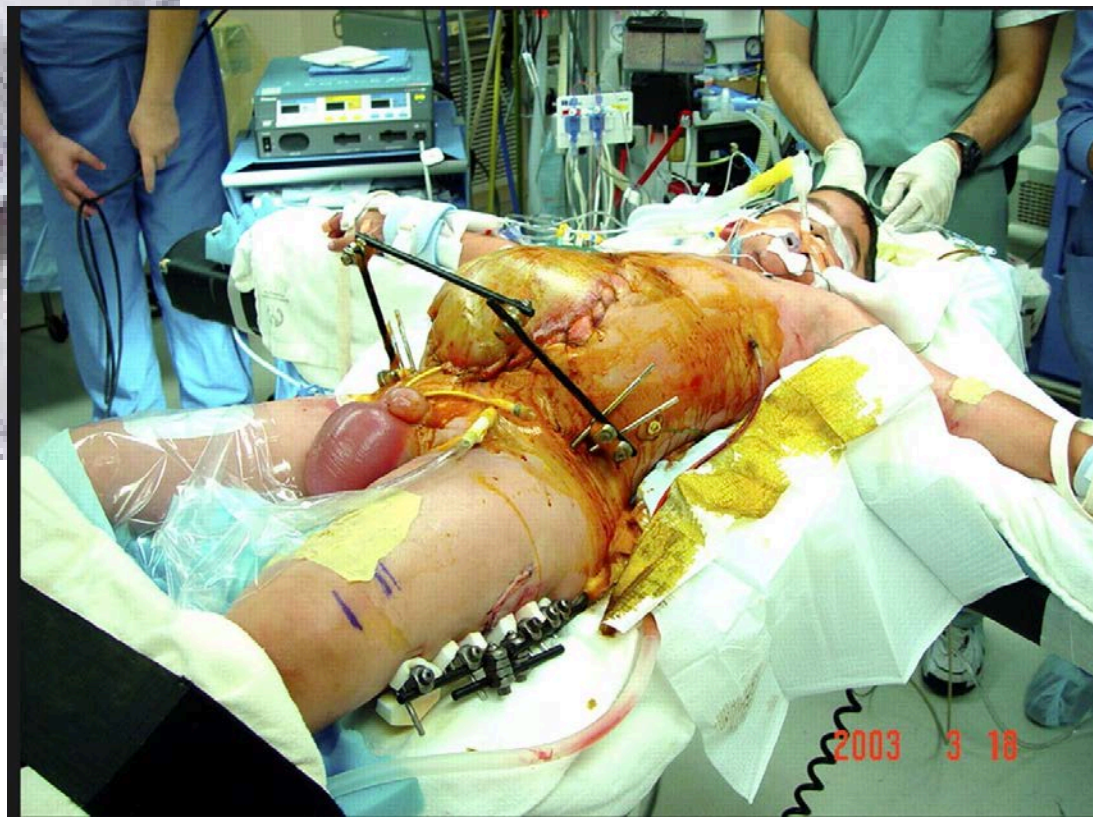
IVC filters in trauma

Sooraj Motilall
Cert Trauma Surg (SA),Cert Critical Care(SA)

Academic and Clinical Head, Trauma Surgery
Consultant in Critical Care

Steve Biko Academic Hospital
Department of General Surgery
University of Pretoria


2003 3 18

Options for prophylaxis

Options for thromboprophylaxis

- Mechanical compression devices → PCD
  → Stockings
- Chemical → LMWH
  → Low dose heparin
- IVC Filters (IVCF)

Challenges of the trauma patient

- Mechanical devices → lower limb fractures
  → Fasciotomies

- Chemical → coagulopathic

- Associated injuries → Intracranial haemorrhages
  → High grade solid organ injuries
  → Retroperitoneal haematomas
  → Packed pelvis

Options for thrombo - prophylaxis

- Mechanical compression devices → PCD
  → Stockings
- Chemical → LMWH
  → Low dose heparin
- IVC Filters (IVCF)

IVCF

- IVCFs have been used since the 1970s
- Improvements in → devices → techniques for introduction
- Estimated more **than 259 000 filters would be placed in 2012 in US** → most would be retrievable filters
- Retrievable and non retrievable filters
- Complications
- **Non - retrievable filters are recommended to undergo lifelong anticoagulation a form of morbidity in itself**

Seminars in Interventional Radiology
Thieme Medical Publishers

Permanent versus Retrievable Inferior Vena Cava Filters: Rethinking the "One-Filter-for-All" Approach to Mechanical Thromboembolic Prophylaxis

Christine E. Ghatan, MD and Robert K. Ryu, MD

Semin Intervent Radiol. 2016 Jun; 33(2): 75–78.

- Non retrievable filters less long term complication

- **Retrievable filters → low retrieval rate 2% - 50%**
  → higher complication rate
  → fracture / migration

What is the evidence for use of IVCF?

The New England Journal of Medicine

VOLUME 338 FEBRUARY 12, 1998 NUMBER 7

A CLINICAL TRIAL OF VENA CAVAL FILTERS IN THE PREVENTION OF PULMONARY EMBOLISM IN PATIENTS WITH PROXIMAL DEEP-VEIN THROMBOSIS

- Multicenter, 44, France
- 400 patients with DVT all had chemical prophylaxis
  → LMWH or unfractionated heparin
- Randomized to either IVCF (200) or no IVCF (200)
- 4 makes of **permanent filters**
- Analyzed at 12 months and 2 years
  → recurrent DVT, bleeding, death

Table 1. Base-Line Characteristics of the Study Patients.

Characteristic	Filter (N=200)	No Filter (N=200)	Low-Molecular-Weight Heparin (N=195)	Unfractionated Heparin (N=205)
Mean (±SD) age — yr	73±11	72±11.5	73±10.5	72±12
		number (percent)		
Male sex	92 (46)	98 (49)	93 (48)	97 (47)
History of venous thrombo-embolism	70 (35)	71 (36)	70 (36)	71 (35)
Chronic cardiac or respiratory insufficiency	47 (24)	39 (20)	50 (26)	36 (18)
Surgery in past 60 days	17 (8)	26 (13)	18 (9)	25 (12)
Cancer	32 (16)	24 (12)	24 (12)	32 (16)
Upper limit of deep-vein thrombosis				
Popliteal	13 (6)	10 (5)	15 (8)	8 (4)
Femoral	113 (56)	105 (52)	102 (52)	116 (57)
Iliac	70 (35)	77 (38)	74 (38)	73 (36)
Caval	4 (2)	8 (4)	4 (2)	8 (4)
Symptomatic initial pulmonary embolism	77 (38)	68 (34)	68 (35)	77 (38)
Asymptomatic initial pulmonary embolism	25 (12)	27 (14)	24 (12)	28 (14)

- Day 12, 2 pts IVCF (1.1%) vs 9 (4.8%)patients no IVCF had PE

- 2 years 37pts (20.8) IVCF vs 21 (11.6%) pts had recurent DVT

- **No significant differences in mortality or the other outcomes**

“ the initial beneficial effect of IVCF for the prevention of PE was counterbalanced by an excess of recurrent DVT, without any difference in mortality”

Original Investigation

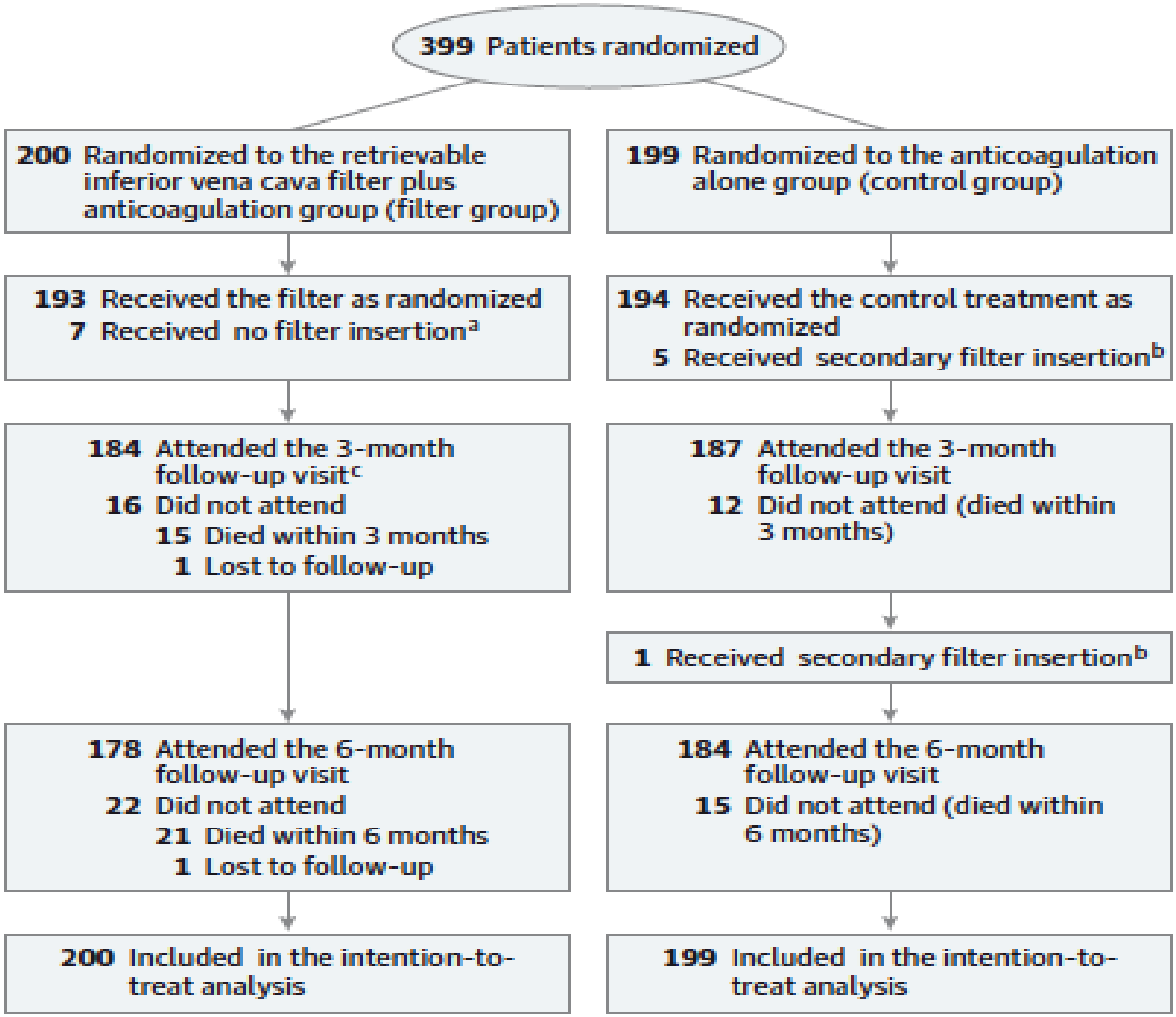
Effect of a Retrievable Inferior Vena Cava Filter Plus Anticoagulation vs Anticoagulation Alone on Risk of Recurrent Pulmonary Embolism

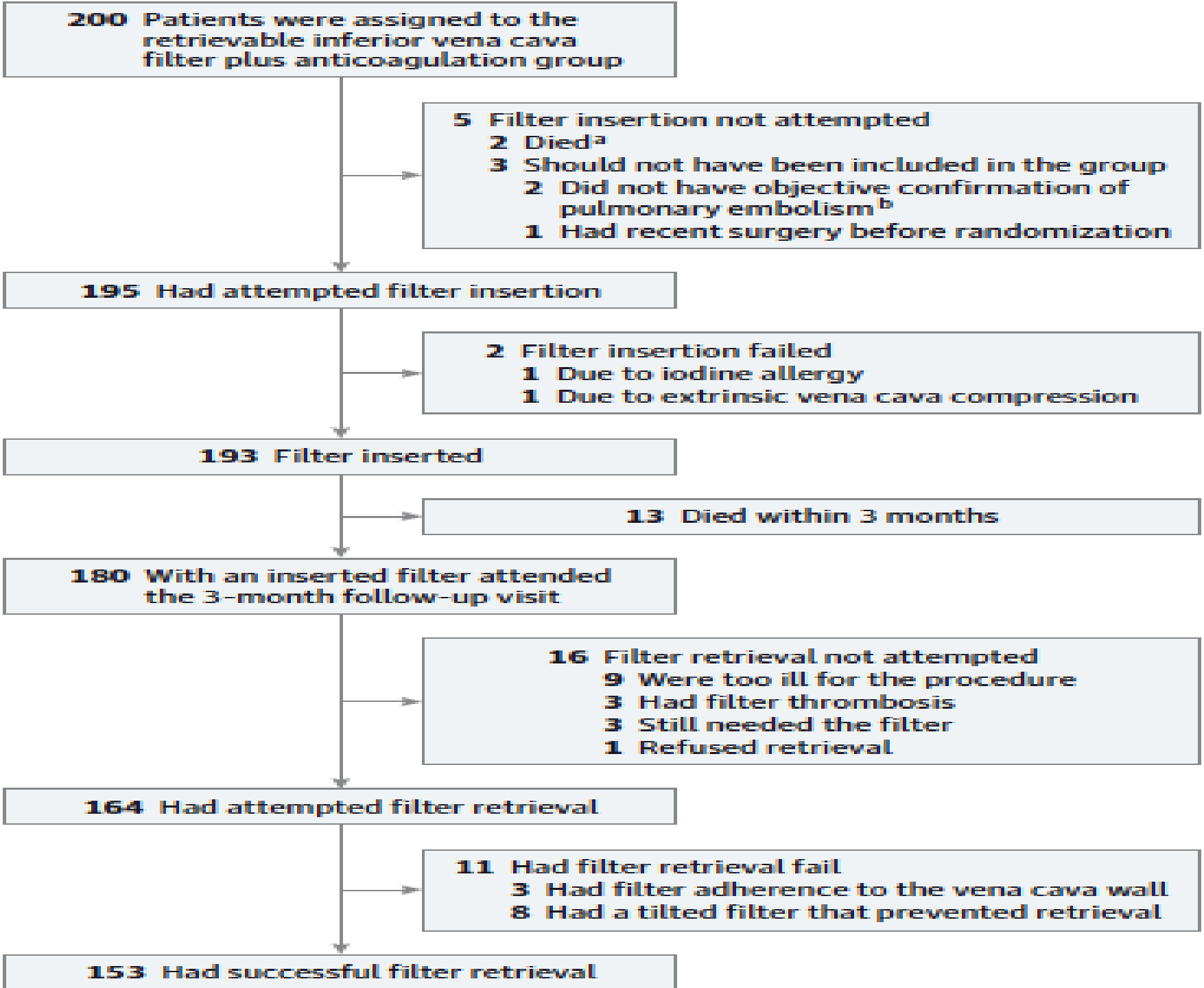
A Randomized Clinical Trial

Patrick Mismetti, MD, PhD; Silvy Laporte, MS, PhD; Olivier Pellerin, MD, MSc; Pierre-Vladimir Ennezat, MD, PhD; Francis Couturaud, MD, PhD; Antoine Elias, MD, PhD; Nicolas Falvo, MD; Nicolas Meneveau, MD, PhD; Isabelle Quere, MD, PhD; Pierre-Marie Roy, MD, PhD; Olivier Sanchez, MD, PhD; Jeannot Schmidt, MD, PhD; Christophe Seinturier, MD; Marie-Antoinette Sevestre, MD; Jean-Paul Beregi, MD, PhD; Bernard Tardy, MD, PhD; Philippe Lacroix, MD; Emilie Presles, MSc; Alain Leizorovicz, MD; Hervé Decousus, MD; Fabrice-Guy Barral, MD; Guy Meyer, MD; for the PREPIC2 Study Group

JAMA. 2015;313(16):1627-1635.

- Randomized, 6/12 follow-up – 17 centers
- August 2006 to January 2013
- Hospitalized acute, symptomatic PE associated with lower-limb vein thrombosis and at least 1 criterion for severity
- Randomized IVCF + anticoagulation (200) vs anticoagulation (199)
- Anticoagulation for 6/12
- Planned removal in 3/12
- **Retrievable vena cava filter (ALN filter, ALN Implants Chirurgicaux)**


399 Patients randomized
200 Randomized to the retrievable inferior vena cava filter plus anticoagulation group (filter group)
199 Randomized to the anticoagulation alone group (control group)
193 Received the filter as randomized
7 Received no filter insertion[a]
194 Received the control treatment as randomized
5 Received secondary filter insertion[b]
184 Attended the 3-month follow-up visit[c]
16 Did not attend
15 Died within 3 months
1 Lost to follow-up
187 Attended the 3-month follow-up visit
12 Did not attend (died within 3 months)
1 Received secondary filter insertion[b]
178 Attended the 6-month follow-up visit
22 Did not attend
21 Died within 6 months
1 Lost to follow-up
184 Attended the 6-month follow-up visit
15 Did not attend (died within 6 months)
200 Included in the intention-to-treat analysis
199 Included in the intention-to-treat analysis


200 Patients were assigned to the retrievable inferior vena cava filter plus anticoagulation group
5 Filter insertion not attempted
2 Died[a]
3 Should not have been included in the group
2 Did not have objective confirmation of pulmonary embolism[b]
1 Had recent surgery before randomization
195 Had attempted filter insertion
2 Filter insertion failed
1 Due to iodine allergy
1 Due to extrinsic vena cava compression
193 Filter inserted
13 Died within 3 months
180 With an inserted filter attended the 3-month follow-up visit
16 Filter retrieval not attempted
9 Were too ill for the procedure
3 Had filter thrombosis
3 Still needed the filter
1 Refused retrieval
164 Had attempted filter retrieval
11 Had filter retrieval fail
3 Had filter adherence to the vena cava wall
8 Had a tilted filter that prevented retrieval
153 Had successful filter retrieval

- 3/12, recurrent PE had occurred in 6 patients (3.0%; all fatal) in the filter group and in 3 patients (1.5%; 2 fatal) in the control group

- 6/12 no change in outcome

- Filter thrombosis occurred in 3 patients

“use of a retrievable IVCF plus anticoagulation vs anticoagulation alone did not reduce the risk of symptomatic recurrent PE at 3 months. Findings do not support the use of this type of filter in patients who can be treated with anticoagulation”

Complications ?

- Recurrent DVT
- Vena cava thrombosis
- Migration
- Strut fracture **up to 40% at 5.5 years**

CHEST Special Feature

Intracardiac Migration of Inferior Vena Cava Filters

Review of Published Data

Charles A. Owens, MD, FCCP; James T. Bui, MD; M-Grace Knuttinen, MD, PhD; Ron C. Gaba, MD; Tami C. Carrillo, MD; Nickoleta Hoefling, MD; and Jennifer E. Layden-Almer, MD

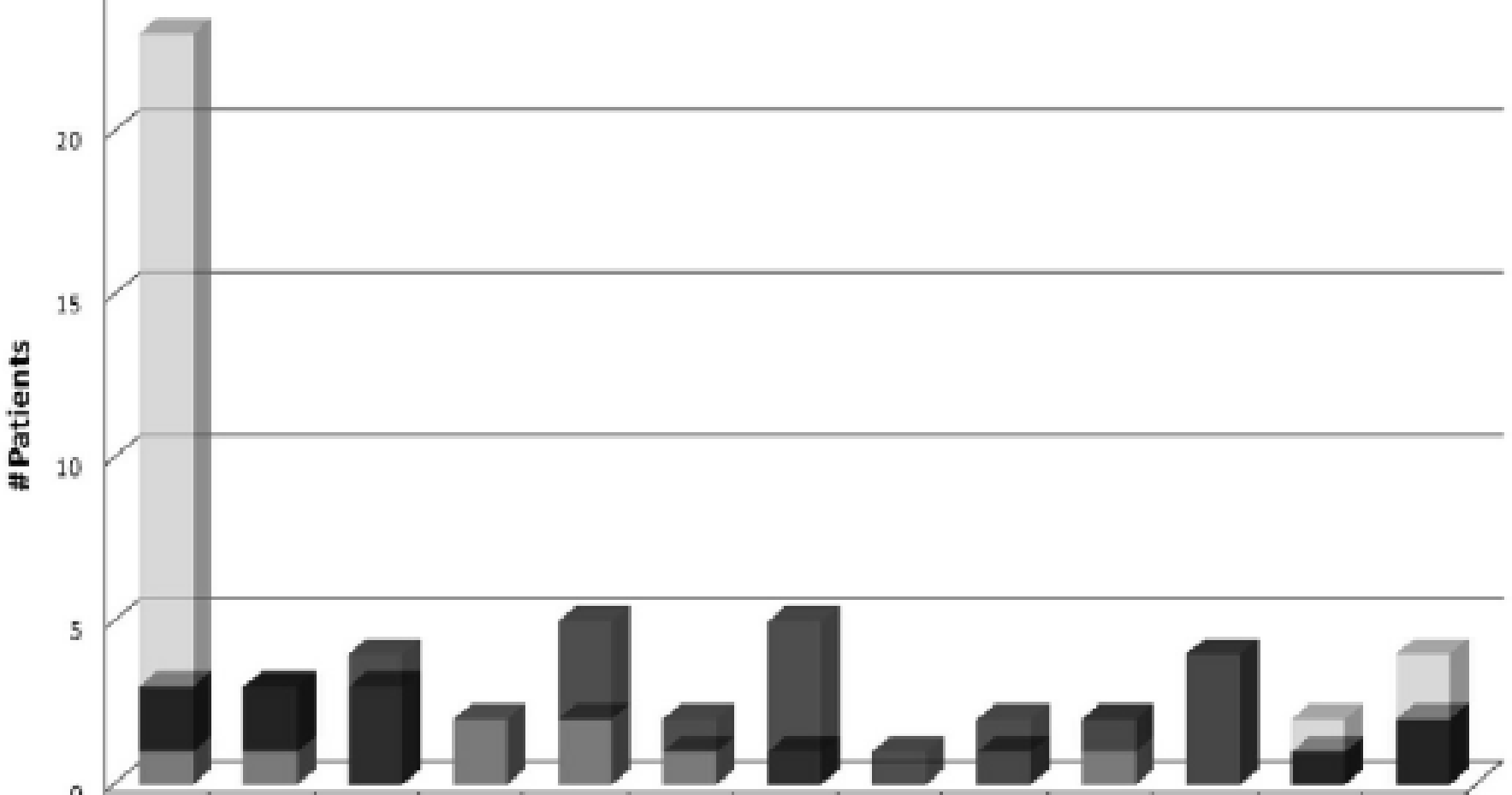
(*CHEST 2009; 136:877–887*)

- Pubmed – Medline
- 1977 and October 2008, 77 publications – (95 patients)
- 39 Kimray-Greenfield (KG) filters (Med-Tech/Boston Scientific; Watertown, MA)
- Filter migration → 20 KG filter → 14 before 1993
- Deployment of arms → 7
- Fracture of arms → 4

Table 1—*Presenting Symptom vs Filter Location*

Symptoms	Overall (n = 66)	Right Atrium (n = 22)	Tricuspid Valve (n = 16)	Right Ventricle (n = 17)	Pulmonary Artery (n = 11)
Asymptomatic	22.7%	13.6%	25.0%	17.6%	45.5%
One or more symptoms	77.3%	86.4%	75.0%	82.4%	54.5%
Cardiac arrhythmia	45.5%	40.9%	62.5%	47.1%	27.3%
	(n = 30)	(n = 9)	(n = 10)	(n = 8)	(n = 3)
Chest pain	33.3%	50.0%	25.0%	41.2%	0.0%
	(n = 22)	(n = 11)	(n = 4)	(n = 7)	(n = 0)
Dyspnea	33.3%	40.9%	18.8%	41.2%	27.3%
	(n = 22)	(n = 9)	(n = 3)	(n = 7)	(n = 3)
Hypotension	22.7%	27.3%	12.5%	29.4%	18.2%
	(n = 15)	(n = 6)	(n = 2)	(n = 5)	(n = 2)

Incidence of symptoms depending on location of filter in cardiac chamber or pulmonary artery. Many patients presented with more than one symptom.



	KG	TG	BR	TP	BM	SN	AN	TrpE	VT-LP	CBT	VT-LGM	FC	BG2
Operator Error	20											1	2
Clot Burden			1		3	1	4	1	1				
Legs Failed to Open	2	2										1	2
Wire Entrapment									1	1	4		
Mega Cava	1	1		2	2	1				1			
Filter Fracture			3				1						

FIGURE 1. Causes of filter migration reported in 58 patients: operator error (n = 23); clot burden "sail effect" (n = 12 [one filter type not reported]); legs failed to open (n = 7); wire entrapment (n = 6); mega cava (n = 8); and filter fracture (n = 4).

- 13 cases left in situ → 4 failed endovascular removal
- 34 removed → open surgery
- 31/42 removed endovascular technique
- A review of the Manufacturer and User Device Experience (MAUDE) **database between January 2001 and December 2008 uncovered an additional 80 intra cardiac filter migrations**

Heart, Lung and Circulation (2017) 26, e11–e13
1443-9506/04/$36.00
http://dx.doi.org/10.1016/j.hlc.2016.07.017

Cardiac Perforation by Migrated Fractured Strut of Inferior Vena Cava Filter Mimicking Acute Coronary Syndrome

Chris W. Piercecchi, MD [a*], Julio C. Vasquez, MD [b], Stephen J. Kaplan, MD, MPH [c], Jordan Hoffman, MD [a], John D. Puskas, MD [a], Jacob DeLaRosa, MD [b]

- 52-year-old female
- sudden chest pain
- increase tropinin
- ECG changes
- 6 years prior a BARD IVCF
- Sternotomy

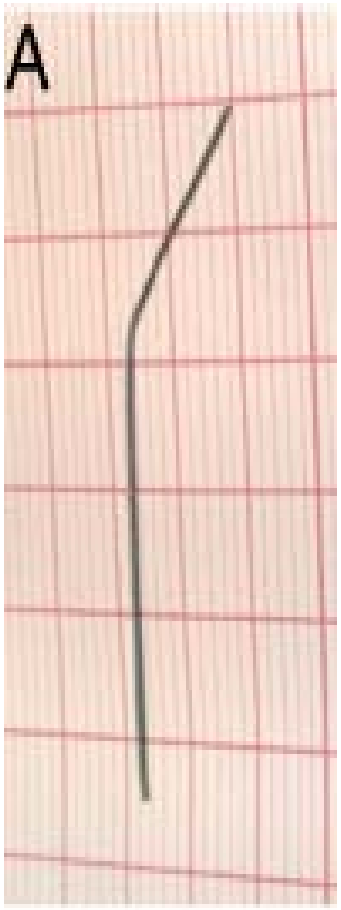
CASE REPORT

Mehanni S, *et al. BMJ Case Rep* 2016. doi:10.1136/bcr-2016-218159

Expectoration of an inferior vena cava filter strut

Stephen Mehanni,[1] Meghan Higley,[2] Ryan C Schenning[3]

- 49 yr old male
- DVT → multiple abdominal surgeries
- 8 yrs later cough for 2/52 → no hemoptysis
- coughed an IVC strut

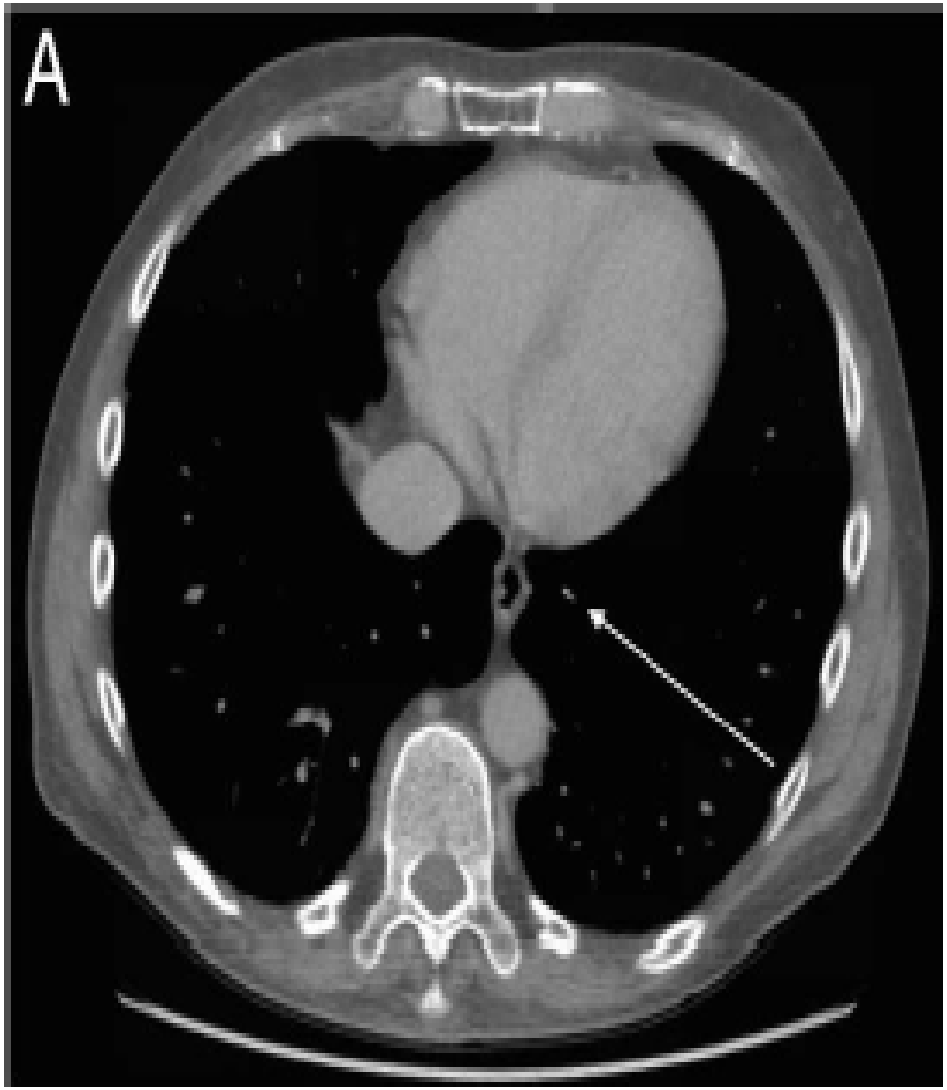


Fracture rates

- 1.9% at <180 days
- 30.8% at >3 years

- **Separate review of the Bard G2 filter estimated a 5-year fracture prevalence of 38%**

- **Risks and benefits of removal most favorable 29–54 days after implantation**



Indications for IVCF?

Appropriate Use of Inferior Vena Cava Filters

Oct 31, 2016 | Ido Weinberg, MD, MSc, FACC

Expert Analysis

Indication*	Societies that Support this Indication	Societies that Oppose this Indication	Comments
Acute VTE and inability to anticoagulate	ACCP,[7] AHA,[8] SIR,[9,10] ACR[11]	-	-
Anticoagulation failure	AHA, SIR, ACR	-	-
Hemodynamically unstable patients, as an adjunct to anticoagulation	ACCP, SIR, AHA, ACR	-	The intent is to prevent further hemodynamic decompensation
Massive PE treated with thrombolysis or thrombectomy or during thrombo-endarterectomy	ACCP, SIR, ACR	AHA	-
Prophylaxis in high-risk populations	SIR, ACR	ACCP	Examples of high-risk populations include multi-trauma and spinal cord injury
Mobile thrombus	SIR, ACR	-	-
Iliocaval DVT	SIR, ACR	-	-

* Indications are not phrased exactly the same in different societal guidelines. The indications as they appear in this table are a result of the authors' interpretation
ACCP – American College of Chest Physicians, AHA – American Heart Association, ACR – American College of Radiology Appropriateness Criteria, DVT – deep vein thrombosis, PE – pulmonary embolism, SIR – Society for Interventional Radiology, VTE – venous thromboembolism

IVCF use in trauma

- Efficacy of prophylactic IVCF must take into consideration several factors

  → ability to reduce the incidence of PE

  → complication rate related to IVCF insertion and dwell time

  → retrieval rate of removable filters

Indications for IVC filters

CLINICAL MANAGEMENT UPDATE

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

Practice Management Guidelines for the Prevention of Venous Thromboembolism in Trauma Patients: The EAST Practice Management Guidelines Work Group

Frederick B. Rogers, MD, Mark D. Cipolle, MD, PhD, George Velmahos, MD, PhD, Grace Rozycki, MD, and Fred A. Luchette, MD

J Trauma. 2002;53:142–164.

C. Level III: Insertion of a "prophylactic" VCF should be considered in very-high-risk trauma patients:

1. Who cannot receive anticoagulation because of increased bleeding risk, and

2. Have an injury patterns rendering them immobilized for a prolonged period of time, including the following:[52–69]

a. Severe closed head injury (GCS score < 8).

b. Incomplete spinal cord injury with paraplegia or quadriplegia.

c. Complex pelvic fractures with associated long bone fractures.

d. Multiple long bone fractures.

- **High risk for bleeding 5 to 10 days after injury**

  → intracranial hemorrhage
  → ocular injury with hemorrhage,
  → solid intra-abdominal organ injury
  → pelvic or retroperitoneal hematoma requiring transfusion

- **Other risk factors**

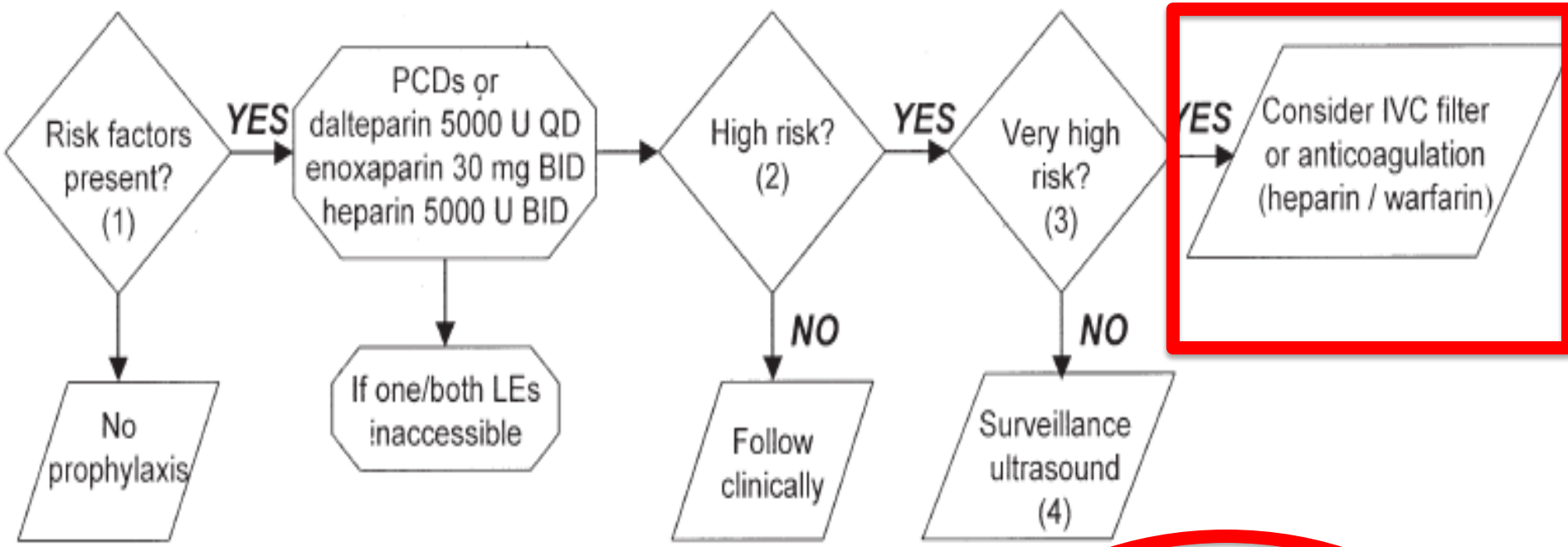
  → cirrhosis
  → active peptic ulcer disease
  → end-stage renal disease , coagulopathy
  → **age – elderly higher risk – unsure of exact age**

Early Experience with Retrievable Inferior Vena Cava Filters in High-Risk Trauma Patients

William S Hoff, MD, FACS, Brian A Hoey, MD, Gail A Wainwright, BSN, James F Reed, PhD, David S Ball, DO, FSIR, Michael Ringold, MD, Michael D Grossman, MD

J Am Coll Surg 2004;199:869–874

- St Luke's Hospital - Level I trauma center
- January 2002 - March 2003
- 35 patients had retrievable IVCF
- 26 pts (74%) sustained at least one orthopaedic injury



Risk Factors:
- Age > 40 yrs
- ISS > 9
- blood txn(s)
- surgery > 2 hrs
- LE fracture(s)
- pelvis fracture
- spinal cord injury (SCI)
- immobilization
- pregnancy
- estrogen therapy
- h/o DVT/PE
- malignancy
- hypercoaguable state
- soft tissue trauma
- CHF
- obesity

High risk factors:
- Age > 50 yrs
- ISS ≥ 16
- femoral v. CVC
- AIS ≥ 3
- GCS ≤ 8
- SCI
- pelvis fracture
- femur/tibia fracture
- venous injury

Very high risk factors:
- SCI
- AIS-head/neck ≥ 3 + long bone fracture
- severe pelvis fracture (post. Elements) + long bone fracture
- ≥ 3 long bone fractures

(4) Initial US of LE within 48 hrs, then serial US every 5-7 days

Table 1. Indications for Prophylactic IVC Filter

Weight bearing status
Nonweight bearing
Bed rest
Spinal precautions
Out of bed to chair
Partial weight bearing
Weight bearing as tolerated
Contraindications to anticoagulation
Thoracoabdominal injury(s)
Severe/multiple orthopaedic injury(s)
Head injury (intracerebral hemorrhage)
Spinal cord injury
Other
Contraindications to pneumatic compression stockings
Lower extremity external fixation device(s)
Lower extremity traction device(s)
Lower extremity splint(s)/cast(s)
Other

Results

- IVCF filters in 35 patients after blunt trauma
- 26 (74%) sustained at least one orthopaedic injury
- Enoxaparin was contraindicated in 32 patients (91%)
- Other injuries precluded the use of pneumatic compression devices in 11 (31%)
- **IVC filters were removed in 18 patients (51%)**

Do filters make a difference in Trauma patients ?

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

Prophylactic Inferior Vena Cava Filters: Do They Make a Difference in Trauma Patients?

Robert A. Cherry, MD, FACS, Pamela A. Nichols, BSN, Theresa M. Snavely, BSN, RN, Mauger T. David, PhD, and Frank C. Lynch, MD

J Trauma. 2008;65:544–548

- Prospective study 2004 to 2006.
- Modified EAST protocol
- 4,936 patients, 244 meeting inclusion criteria
- **59% retrieval rate**

Table 1 Modified EAST Guidelines

Who cannot receive anticoagulation because of increased bleeding risk, and have one or more of the following injury patterns:

a. Severe closed head injury (GCS <8)
b. Spinal cord injury with para or quadriplegia
c. Spine fractures resulting in prolonged immobility (>72 h)*
d. Complex pelvic fractures with associated long-bone fractures
e. Complex pelvic fractures without associated long-bone fractures*
e. Multiple long-bone fractures
f. High grade liver and spleen injuries managed non-operatively and unable to anticoagulate within 72 h*

High risk trauma patient

Table 2 Distribution of Injuries Among 176 Patients Meeting Traditional EAST Guidelines for PIVCF

Injuries	N
Long bone fracture	109
Pelvis fracture	99
TBI with GCS <8	93
Spine fractures	80
Spleen injury	39
Liver injury	31
SCI with paraplegia or quadriplegia	27

PIVCF indicates prophylactic inferior vena cava filter; TBI, traumatic brain injury; SCI, spinal cord injury; GCS, Glascow come scale.

Table 4 Prophylactic IVCF Implanted and Number of PEs

	2004	2005	2006	Total
Adult trauma patients	1,388	1,737	1,811	4,936
Prophylactic IVCF	29 (2.1)	88 (5.1)*	127 (7.0)*	244 (4.9)
PEs	10 (0.7)	13 (0.7)	8 (0.4)	31 (0.6)

- The results of this study contribute to the body of literature placing the effectiveness of IVC filters in doubt

.

- **Current criteria used for determining which patients will benefit are not sufficient enough to have an effect at reducing the overall rate of PE.**

ASA PAPER

Prophylactic Inferior Vena Cava Filter Placement Does Not Result in a Survival Benefit for Trauma Patients

Mark R. Hemmila, MD, Nicholas H. Osborne, MD,* Peter K. Henke, MD,* John P. Kepros, MD,†*
Sujal G. Patel, MD,‡ Anne H. Cain-Nielsen, MS, and Nancy J. Birkmeyer, PhD**

(*Ann Surg* 2015;262:577–585)

- Trauma collaborative data from 2010 to 2014
- 26 ACS Trauma Units
- Excluded → No signs of life
  → Injury Severity Score < 9
  → hospitalization <3 days
  → received IVC filter after VTE event
- Prophylactic IVCF in 803/ 39,456 pts (2%)
- **Hospitals significant variability (0.6% to 9.6%) in IVCF**

TABLE 2. Patient Outcomes

Outcome	No IVC Filter	IVC Filter	*P*
Patients, N	38,653	803	–
Mortality, % (N)	3.5 (1,369)	5.2 (42)	0.01
DVT, % (N)	1.2 (483)	6.7 (54)	<0.001
Pulmonary embolism, % (N)	0.5 (187)	1.1 (9)	0.01
VTE, % (N)	1.6 (632)	7.3 (59)	<0.001

DVT indicates deep vein thrombosis; VTE, venous thromboembolism.

- **IVCF does not reduce the risk of mortality** for trauma patients at the hospital level.

- Prophylactic IVCF is associated with an **increased risk of subsequent DVT occurrence.**

ORIGINAL INVESTIGATION

LESS IS MORE

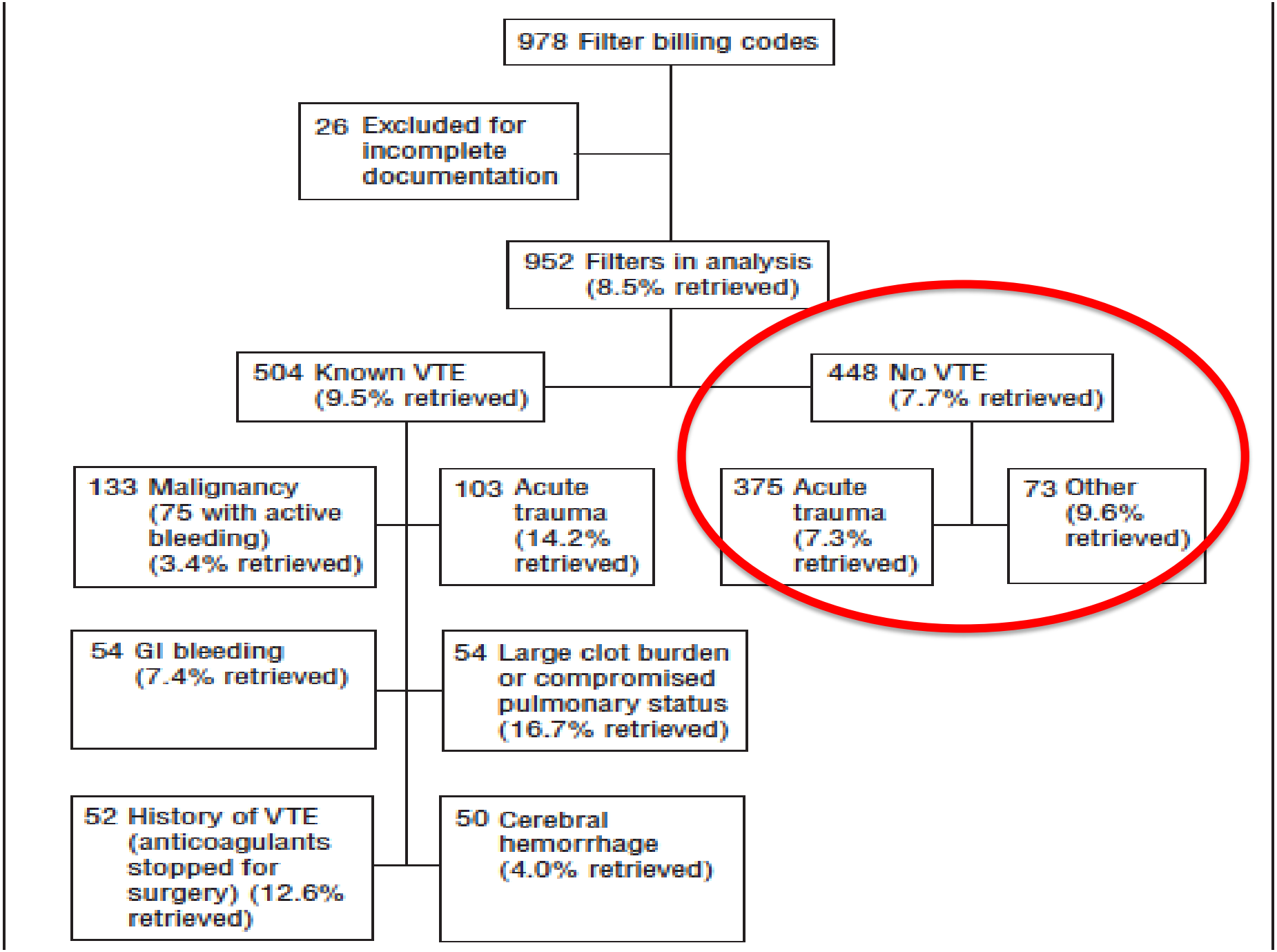
Indications, Complications, and Management of Inferior Vena Cava Filters

The Experience in 952 Patients at an Academic Hospital With a Level I Trauma Center

Shayna Sarosiek, MD; Mark Crowther, MD; J. Mark Sloan, MD

JAMA Intern Med. 2013;173(7):513-517.

- Retrospective review – Boston Medical
- August 1, 2003, and February 28, 2011
- 679/978 retrievable IVCF
- **58 (8.5%) were successfully removed.**
- **74/942 VTE (7.8%) occurred after IVCF placement , 25 PE with IVCF in place**


978 Filter billing codes
26 Excluded for incomplete documentation
952 Filters in analysis (8.5% retrieved)
504 Known VTE (9.5% retrieved)
448 No VTE (7.7% retrieved)
133 Malignancy (75 with active bleeding) (3.4% retrieved)
103 Acute trauma (14.2% retrieved)
375 Acute trauma (7.3% retrieved)
73 Other (9.6% retrieved)
54 GI bleeding (7.4% retrieved)
54 Large clot burden or compromised pulmonary status (16.7% retrieved)
52 History of VTE (anticoagulants stopped for surgery) (12.6% retrieved)
50 Cerebral hemorrhage (4.0% retrieved)

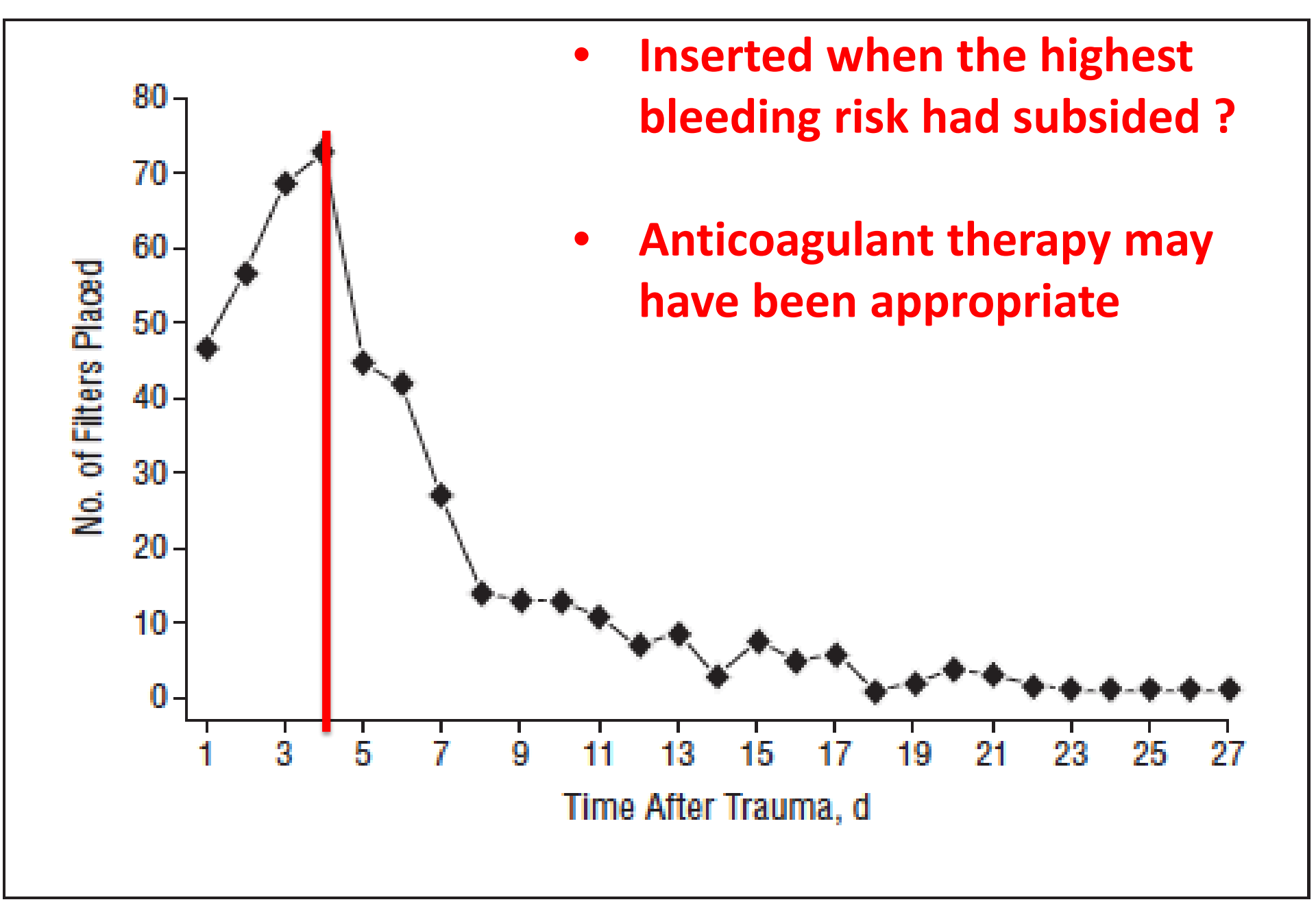


Figure 2. Number of days after trauma until inferior vena cava filter placement.

Conclusions

- IVCF decisions may be influenced by inpatient hospital reimbursement
- By modifying the diagnosis related group, the Centers for Medicare and Medicaid Services **reimbursement for a patient admitted for an acute DVT increases by almost 250% if an IVCF is placed**
- Retrieval on the same admission would not increase reimbursement
- **While outpatient retrieval is reimbursed separately**

Conclusions

- Many patients may qualify to have IVCF removed before discharge from the hospital

- 24.9% of patients who had VTE and had a filter placed received anticoagulants before leaving the hospital → **these patients could have been considered for filter removal once anticoagulant therapy was tolerated**.

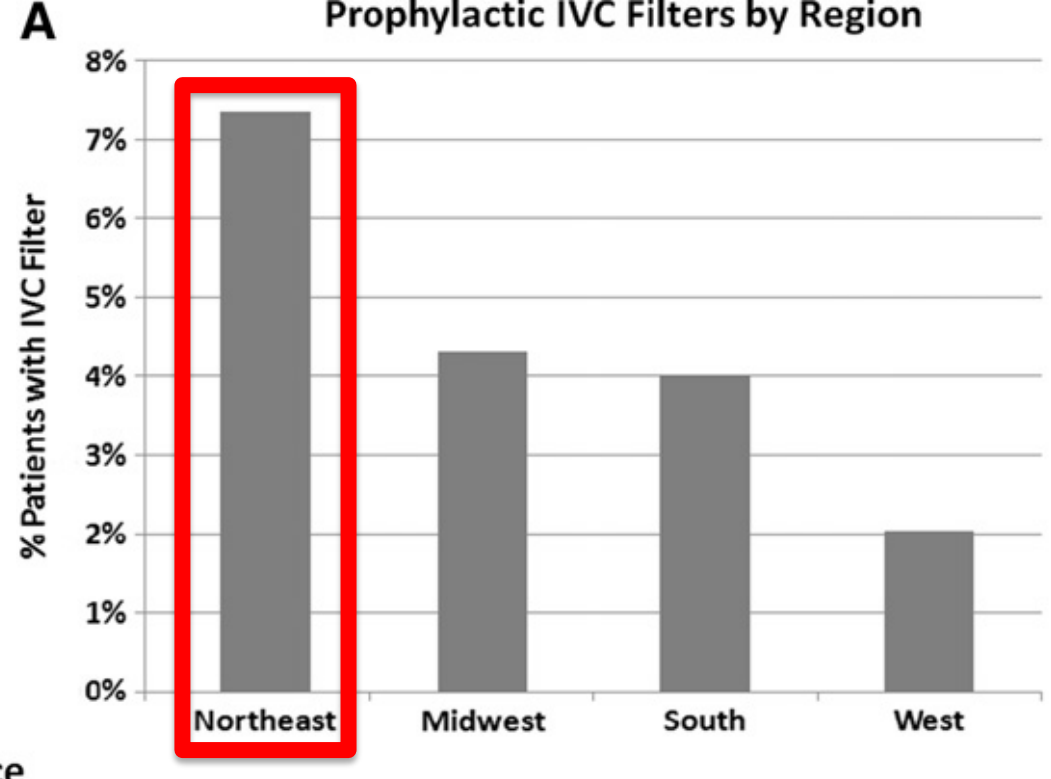
- Filters placed for prophylaxis after trauma were inserted after the period of highest bleeding risk had subsided

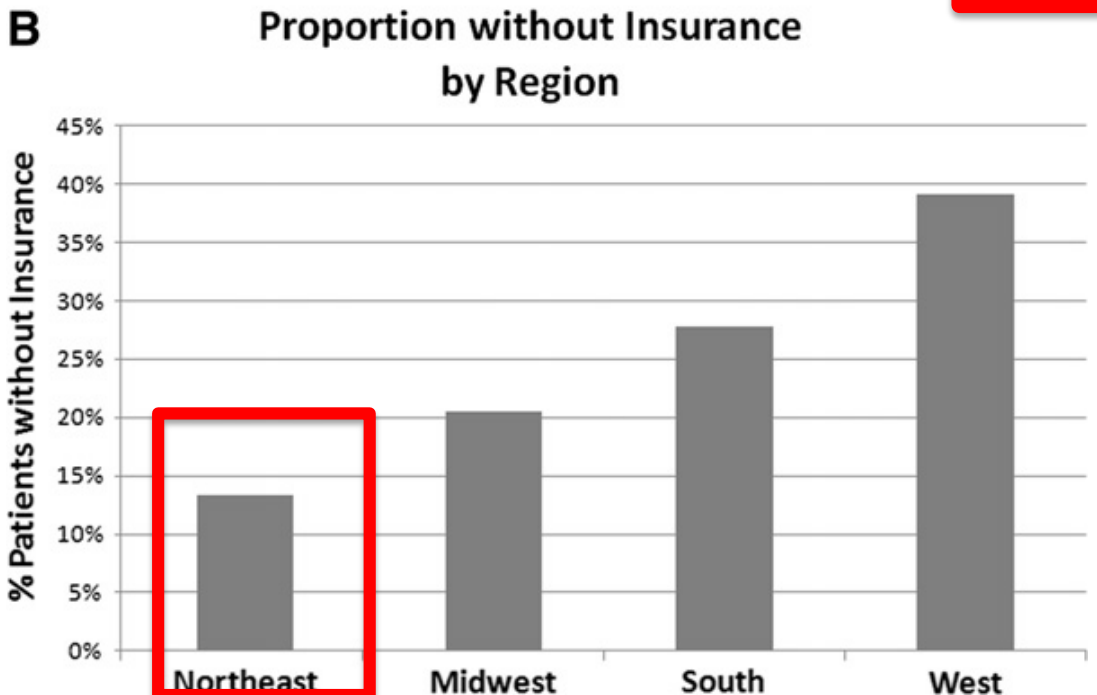
Payer status is associated with the use of prophylactic inferior vena cava filter in high-risk trauma patients

Danielle M. Pickham, MD, Rachael A. Callcut, MD, MSPH, Paul M. Maggio, MD, MBA, Matthew W. Mell, MD, David A. Spain, MD, Fritz Bech, MD, MS, *and* Kristan Staudenmayer, MD, MS, *Stanford, CA*

(Surgery 2012;152:232-7.)

- Retrospective analysis using the National Trauma Databank (2002–2007)
- Included high risk for PE (traumatic brain injury or spinal cord injury) (adults)
- Excluded patients with DVT or PE
- Prophylactic IVCF placed in 3,331/77695 (4.3%) pts


A
Prophylactic IVC Filters by Region
% Patients with IVC Filter
8%
7%
6%
5%
4%
3%
2%
1%
0%
Northeast
Midwest
South
West


B
Proportion without Insurance by Region
% Patients without Insurance
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Northeast
Midwest
South
West

- Pts without insurance had an IVC filter placed less often compared with those with any form of insurance (2.7% vs 4.9%, respectively)

- **Pts without insurance were less likely to receive a prophylactic IVC filter, (P < .001)**.

Retrievability of IVCF ?

Eur J Trauma Emerg Surg (2016) 42:459–464
DOI 10.1007/s00068-015-0553-5

ORIGINAL ARTICLE

Are retrievable vena cava filters placed in trauma patients really retrievable?

W. R. Leeper[1,5] · P. B. Murphy[1,6] · K. N. Vogt[1] · T. J. Leeper[1] · S. W. Kribs[2] · D. K. Gray[1,3] · N. G. Parry[1,3,4,5]

- London Health Sciences Centre (LHSC) South Western Ontario, Canada
- rIVCF - January 1 2000 and June 30 2014.
- N = 374 → 313 medical and 61 trauma patients
- Filter non-retrieval
    - → not attempted
    - → attempted but not technically feasible
    - → death prior to attempted filter retrieval
- **Followed up by a single trauma nurse practitioner**

	Trauma	Non-trauma	*p* value
Number	61	313	
Age, years (SD)	44 (17)	65 (15)	<0.01
Male, *n* (%)	48 (79)	136 (44)	<0.01
Dwell days, median (IQR)	27 (15–35)	21 (14–36)	0.46
Complication, *n* (%)	3 (5)	9 (3)	0.41
IVCF Retrieved, *n* (%)	53 (87)	153 (49)	<0.01

From the American Venous Forum

Journal of
Vascular Surgery
Venous and Lymphatic Disorders

Improving the retrieval rate of inferior vena cava filters with a multidisciplinary team approach

Elica Inagaki, MD,[a] Alik Farber, MD,[b] Mohammad H. Eslami, MD,[b] Jeffrey J. Siracuse, MD,[b] Denis V. Rybin, PhD,[c] Shayna Sarosiek, MD,[d] J. Mark Sloan, MD,[d] and Jeffrey Kalish, MD,[b] *Boston, Mass*

http://dx.doi.org/10.1016/j.jvsv.2015.11.002

- Retrospective September 2003 and July 2012
- Prospective August 2012, a multidisciplinary team instituted
- Retrospective group 82 / 720 (11%)
- Prospective group 40/74 (54%) **(Technical failure of 18%)**

[Original Research **Pulmonary Vascular Disease**]

Laser-Assisted Removal of Embedded Vena Cava Filters

A 5-Year First-in-Human Study

William T. Kuo, MD, FCCP; Justin I. Odegaard, MD, PhD; Jarrett K. Rosenberg, PhD; and Lawrence V. Hofmann, MD

CHEST 2017; 151(2):417-424

- 5 years pts underwent laser-assisted retrieval
- Was successful in 249 of 251 patients (99.2%)
- With a mean implantation of 979 days, range: 37-7,098 days (> 19 years)
- Retrievable-type filters (n = 211)
- Permanent-type filters (n = 40).

High risk trauma patient and IVCF

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

Prophylactic Inferior Vena Cava (IVC) Filter Placement May Increase the Relative Risk of Deep Venous Thrombosis After Acute Spinal Cord Injury

Peter H. Gorman, MD, MS, Syed F. A. Qadri, MD, and Anuradha Rao-Patel, MD

J Trauma. 2009;66:707–712.

- Retrospective chart review
- N = 114. C3 – L3 injury
- All received chemical prophylaxis
- IVCF 54 vs no IVCF 58
- **IVCF 11 (20.4%) DVT vs 3 (5.2%)**
- **1 pt PE and was in IVCF**

- **The presence of prophylactic IVC filters in acute SCI patients may actually increase the risk of DVT, which has its own associated morbidities and costs**

Summary

Injury, Int. J. Care Injured 43 (2012) 542–547

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Review

The use of prophylactic inferior vena cava filters in trauma patients: A systematic review☆

Biniam Kidane [a,b], Amin M. Madani [b], Kelly Vogt [a,b], Murray Girotti [a,b,e], Richard A. Malthaner [a,b,c,e], Neil G. Parry [a,b,d,e,*]

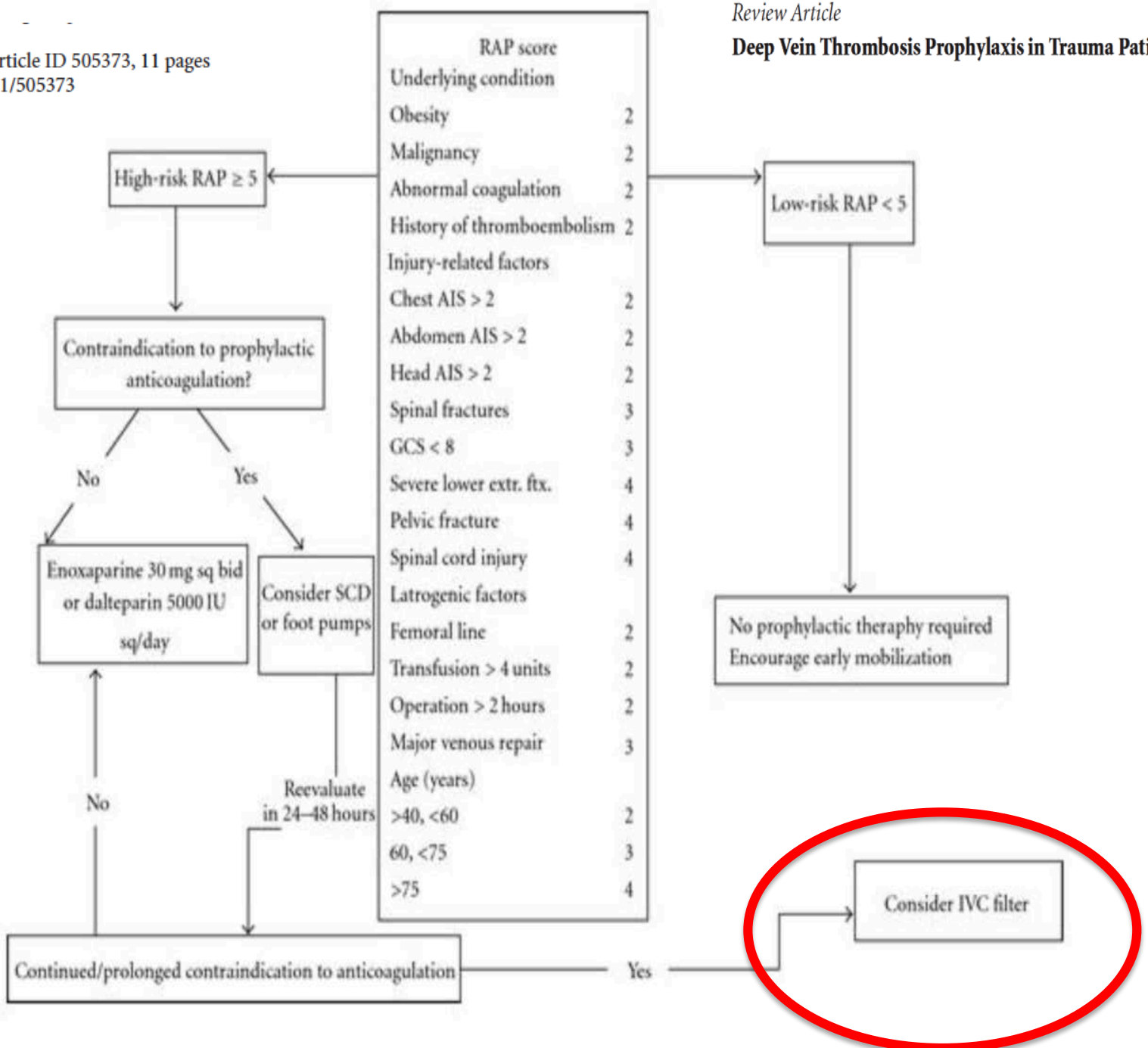
- ISS > 12 27/279 articles

- The literature is still plagued by a lack of high quality data, the true efficacy of prophylactic IVC filters for prevention of PE in trauma patients remains unclear.

- Further studies are required to determine the true role of prophylactic IVC filters in trauma patient.

Thrombosis
Volume 2011, Article ID 505373, 11 pages
doi:10.1155/2011/505373

Deep Vein Thrombosis Prophylaxis in Trauma Patients



Summary

- Judicious patient selection
- Multi-disciplinary team
- If inserted retrievable vs non retrievable
- Remove as soon as patient is anti-coagulated and the initial indication is no longer present
- Dedicated follow – up improves retrieval


ThanK
You!