

THROMBOEMBOLIC EVENTS AFTER IVC FILTER PLACEMENT IN TRAUMA PATIENTS



Lidie Lajoie, MD

SUNY Downstate Department of Surgery

December 20, 2012

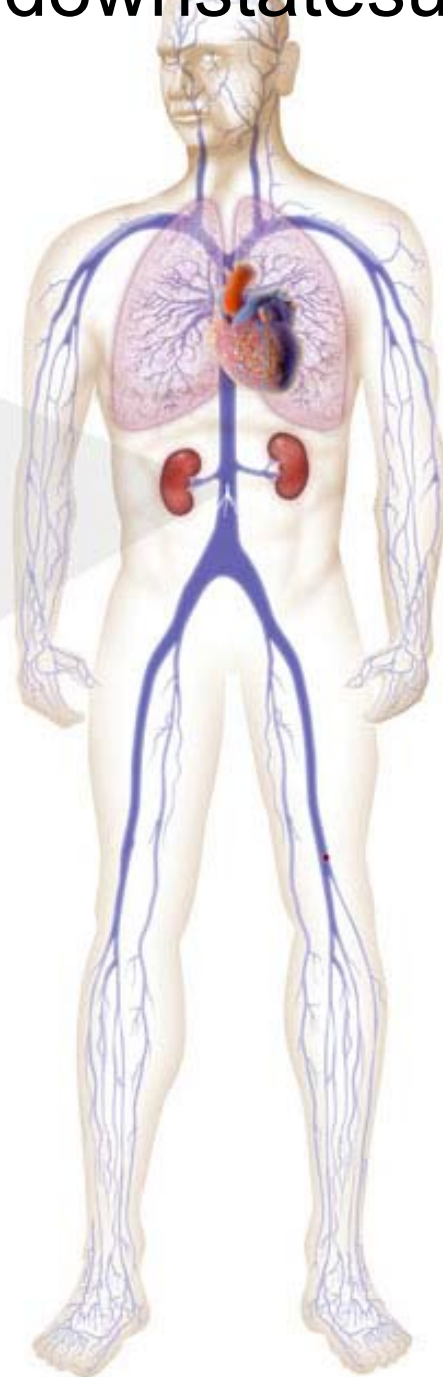
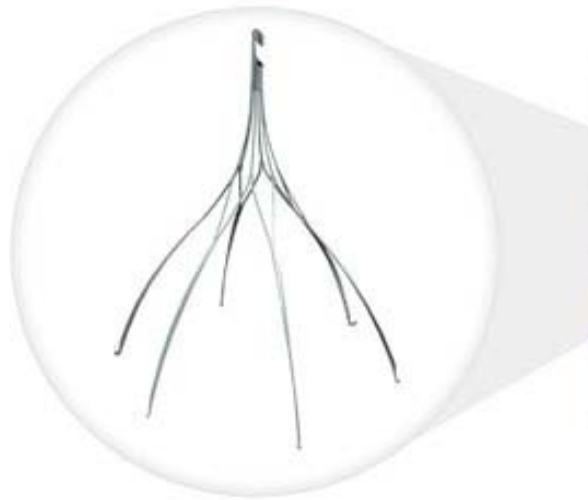
Background

Trauma Patients at High Risk for VTE

Injury	Number (% high risk)	DVT (% of group)
Closed head injury	131 (47)	5 (4)
Extremity fracture	126 (45)	2 (2)
Pelvic fracture	109 (39)	2 (2)
Spine fracture (intact)	62 (22)	2 (3)
Cord injury	43 (15)	4 (9)
Major venous injury	6 (2)	2 (33)

^a Patients with more than one major injury are included in each column.

Spain, D.A., et al., *Venous thromboembolism in the high-risk trauma patient: do risks justify aggressive screening and prophylaxis?* J Trauma, 1997. **42**(3): p. 463-7



IVC Filter
use
associated with
decreased
incidence
of PE in
high risk
trauma
patients

EAST established guidelines for filter insertion

“Prophylactic” vena caval filter insertion in very high risk trauma patients who: (Level III)

1. Cannot receive anticoagulation because of increased bleeding risk, and
2. Have one or more of the following injury patterns:
 - Severe closed head injury (GCS < 8)
 - Incomplete spinal cord injury with para or quadriplegia
 - Complex pelvic fractures with associated long-bone fractures
 - Multiple long-bone fractures

Filter Placement in Trauma Surgery has increased dramatically in the last two decades

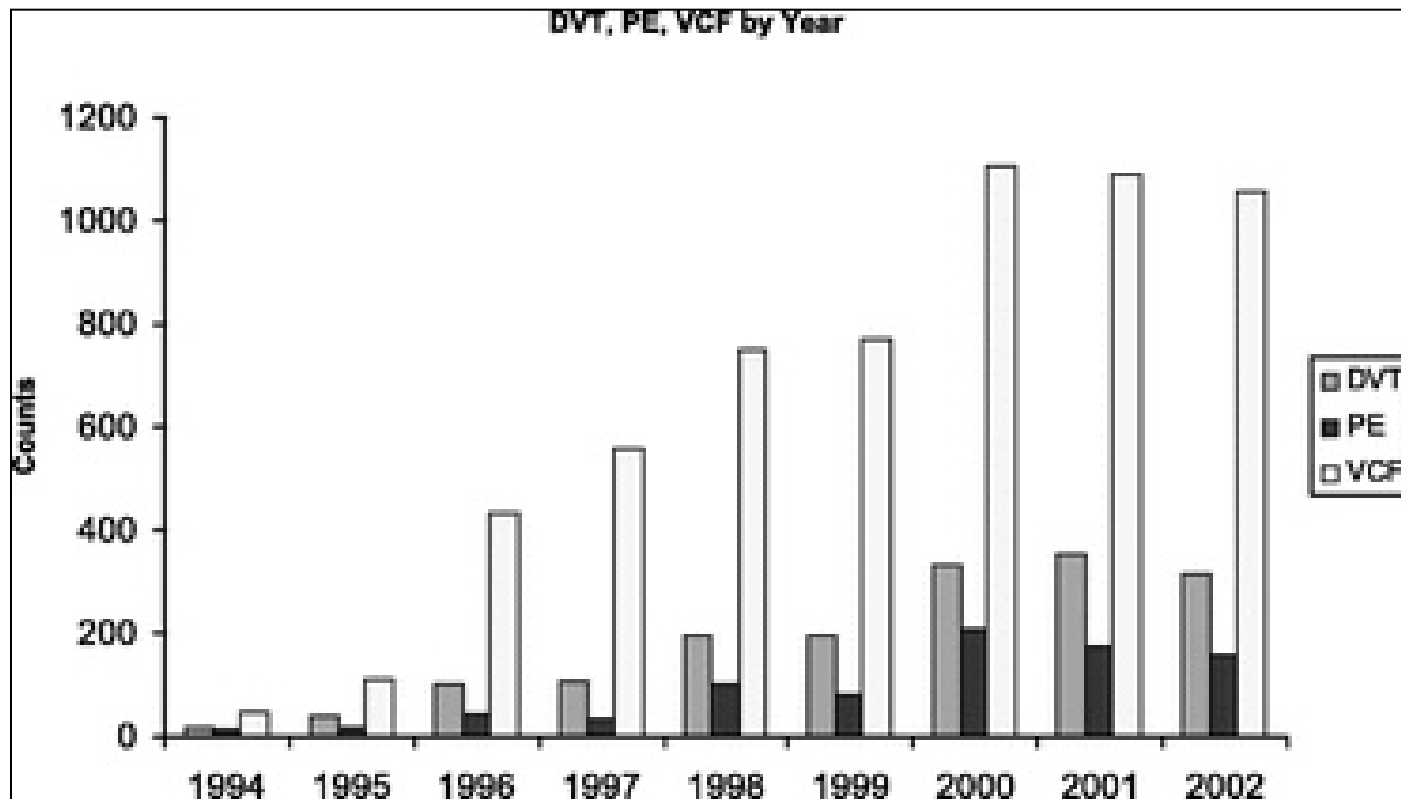


Fig. 1. Bar graph demonstrating the number of patients reported to the NTDB who had a VCF placed during the interval 1994-2002. Also shown are the number of patients reported to the NTDB who had either a DVT or a PE. When these numbers are divided by the total number of patients reported to the NTDB in each of the years shown, the number of VCF placed annually has increased 340% whereas the number of DVT or PE reported has increased 246%.

The Increasing Use of Vena Cava Filters in Adult Trauma Victims: Data From the American College of Surgeons National Trauma Data Bank.
Shackford, Steven; Cook, Alan; Rogers, Frederick; Littenberg, Benjamin; Osler, Turner

Journal of Trauma-Injury Infection & Critical Care. 63(4):764-769, October 2007.
DOI: 10.1097/01.ta.0000240444.14664.5f

**Systematic Reviews
and Meta-analyses**

**Randomized
Controlled Double
Blind Studies**



Cohort Studies

Case Control Studies

Case Series

Case Reports

Ideas, Editorials, Opinions

Animal research

In vitro ('test tube') research

Long term results of RCTs suggest IVC Filter associated with increased risk of DVT

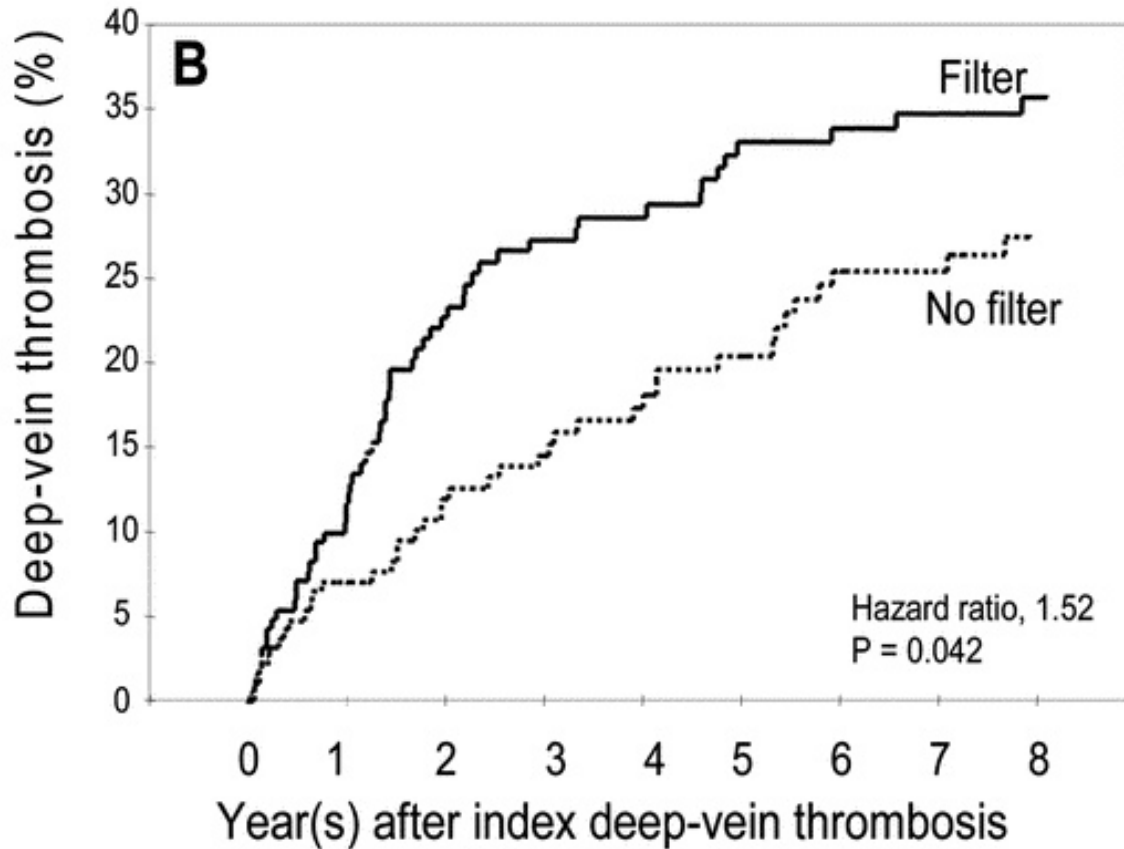


Figure 2. Kaplan-Meier analysis of time to pulmonary embolism (A; filter versus no filter: hazard ratio 0.37, 95% CI 0.17 to 0.79, $P=0.008$), deep-vein thrombosis (B; filter versus no filter: hazard ratio 1.52, 95% CI 1.02 to 2.27, $P=0.042$), and death (C; filter versus no filter: hazard ratio 0.97, 95% CI 0.74 to 1.28, $P=0.83$) over a period of 8 years after index thromboembolic event according to treatment groups.

Eight-Year Follow-Up of Patients With Permanent Vena Cava Filters in the Prevention of Pulmonary Embolism: The PREPIC (Prevention du Risque d'Embolie Pulmonaire par Interruption Cave) Randomized Study.

Circulation. 112(3):416-422, July 19, 2005.

Purpose

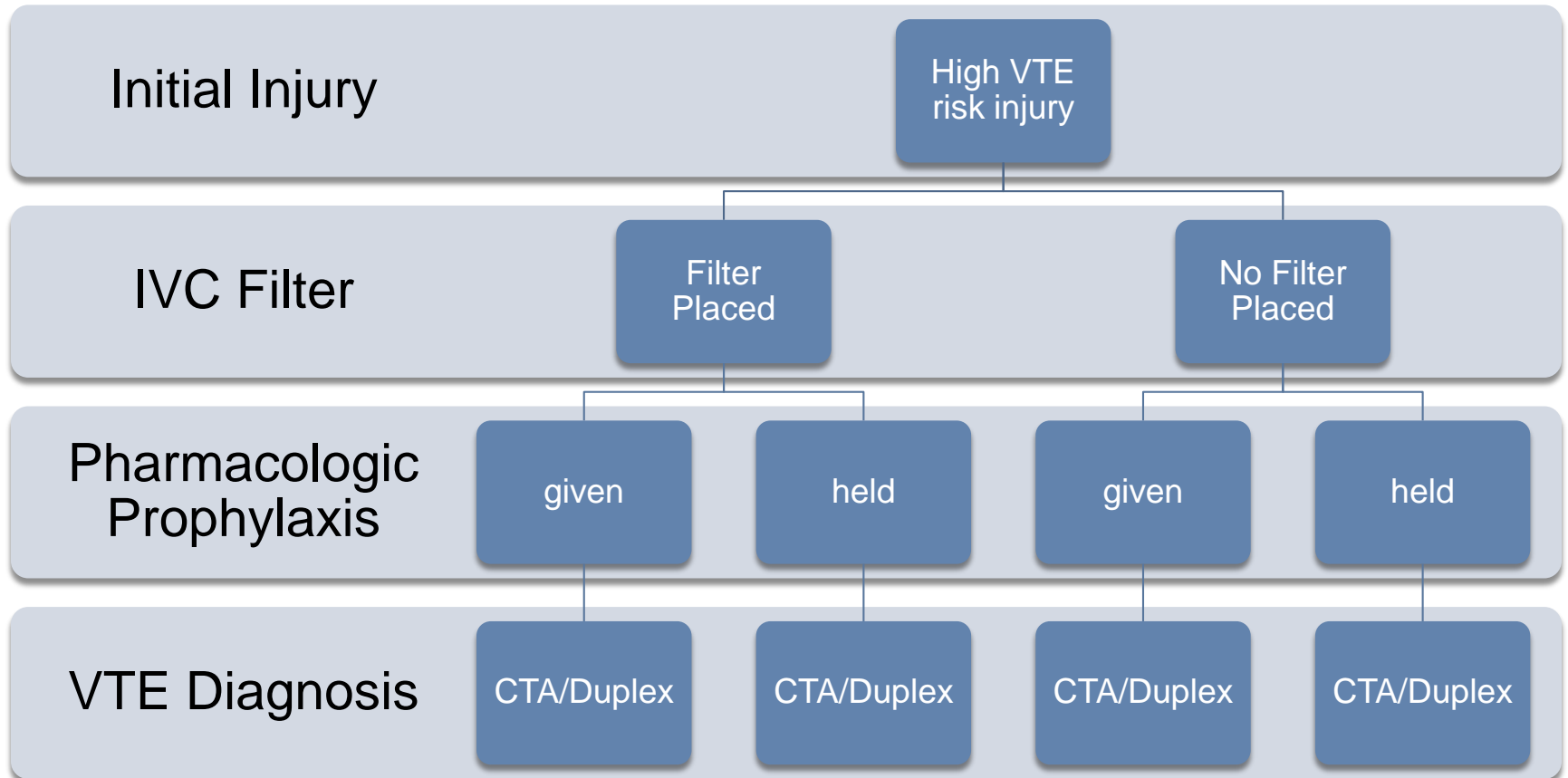
Determine if the rate of DVT found in patients after prophylactic IVC filter placement was associated with their high VTE risk injury pattern alone, or if the placement of an IVC filter itself is associated with increased risk

Study Design.

retrospective cohort

- Reviewed all admissions to KCHC during 25-month period
- Subjects: all patients with high VTE risk injury patterns
 - ▣ Severe head injury (GCS <8)
 - ▣ Spinal cord injury with paralysis
 - ▣ Concurrent pelvic and long bone fracture
 - ▣ Multiple long bone fractures
- Exclusions:
 - age <18 or >90
 - mortality or brain death within 24hrs
 - recovery of GCS within 24hrs
 - VTE before or at time of filter placement

Treatment Algorithm

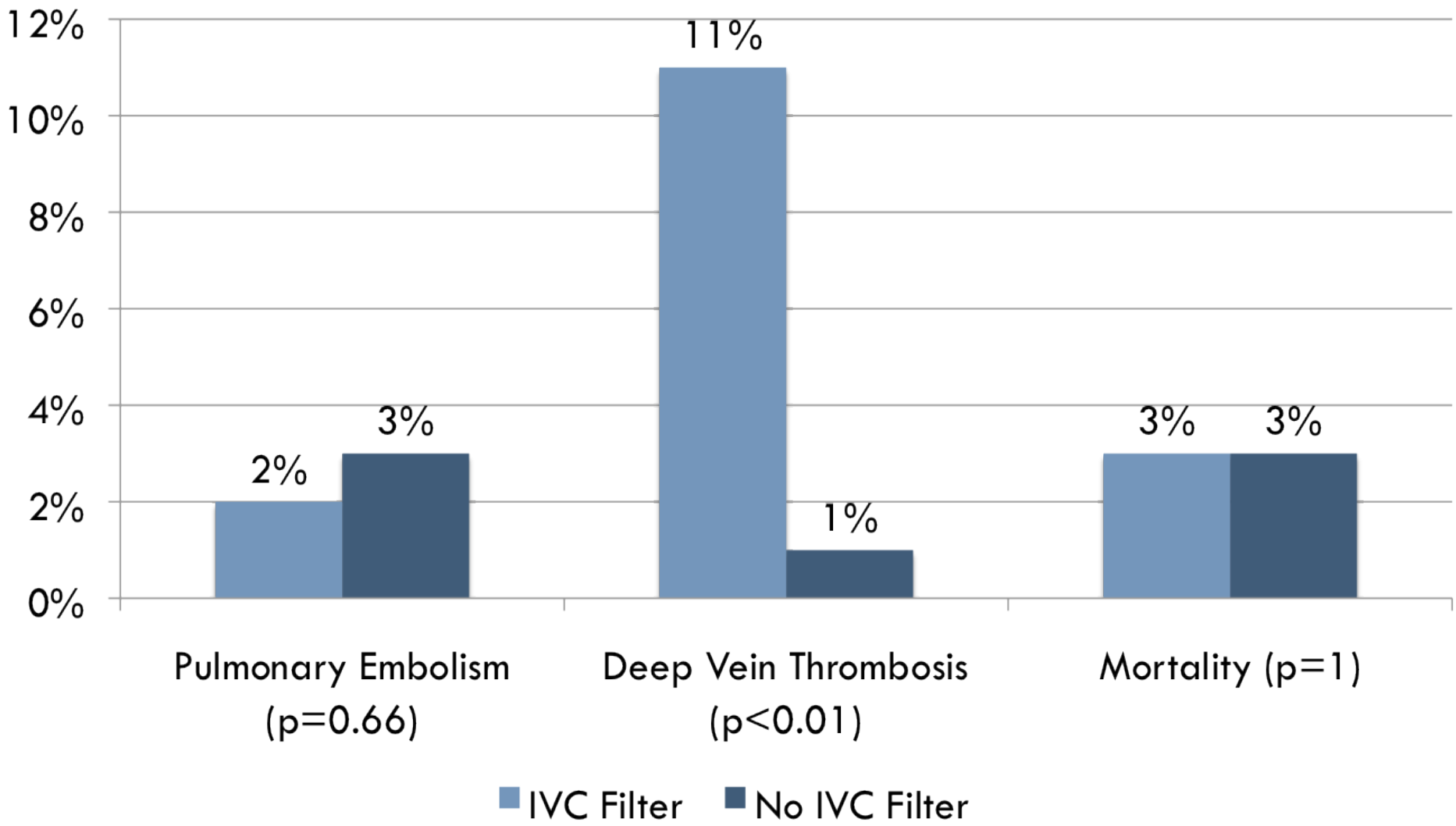


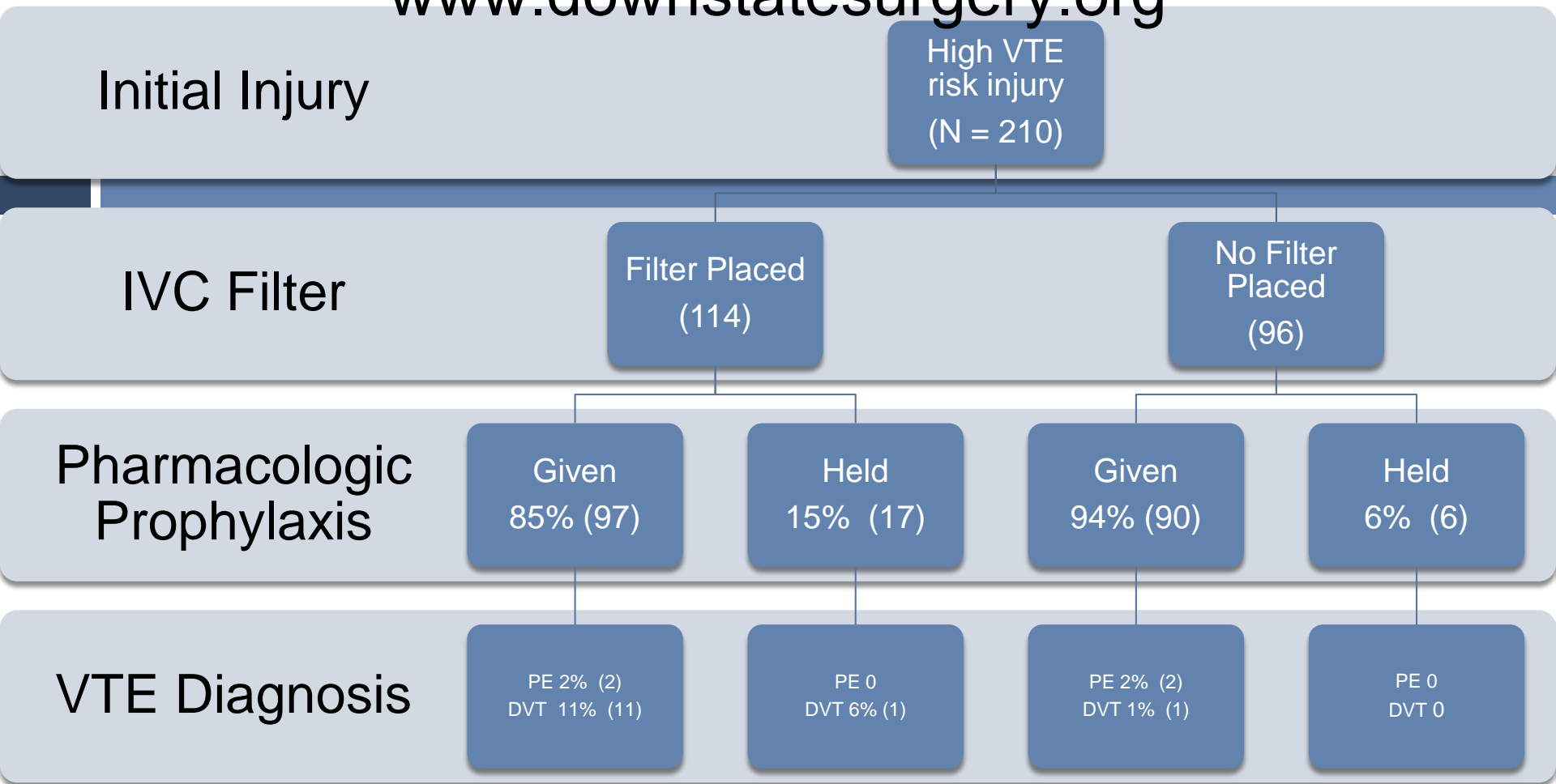
Results

www.downstatesurgery.org
**Demographic Characteristics of High VTE Risk Patients with
 and without IVC Filter**

N = 210	No Filter	Filter	P-value
Subjects	96	114	
Age (years)	44 ± 19	43 ± 19	0.71
Gender (male)	71% (68)	65% (74)	0.38
Injury Type			
Severe Head Injury	6% (6)	27% (31)	< 0.01
Cord Injury w/ Paralysis	0% (0)	22% (25)	< 0.01
Pelvic + long bone fractures	16% (15)	25% (29)	0.09
Multiple long bone fractures	78% (75)	30% (34)	< 0.01
Injury Severity Score	15 ± 8.9	27 ± 10	< 0.01
Pharmacologic prophylaxis	94% (90)	85% 97	0.05
Follow up (days)	24 ± 42	56 ± 74	< 0.01

Incidence of Thromboembolic Events in High VTE Risk Patients with and without IVC Filter



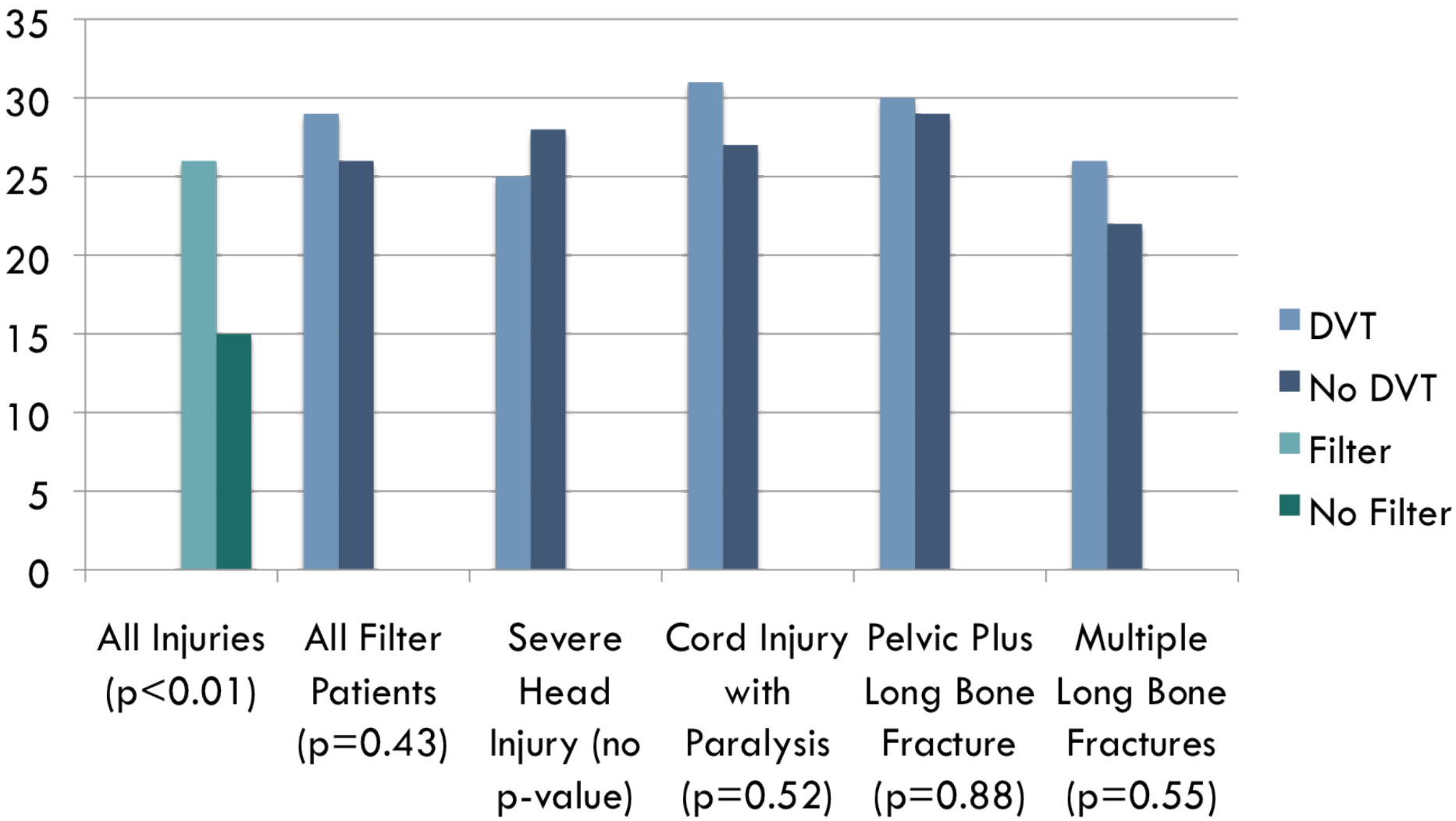


No difference in incidence of DVT after IVC filter between patient who were given pharmacologic prophylaxis and those who were not (p= 0.69).

Distribution of Patients with DVT by Injury Subgroup

	No Filter	Filter	P-value
Severe Head Injury	0/6	1/31	1
Cord Injury with Paralysis	0/0	4/25	--
Pelvic plus Long Bone Fractures	0/15	4/29	0.28
Multiple Long Bone Fractures	1/75	3/34	0.09

Injury Severity Scores for Patients with IVC Filters

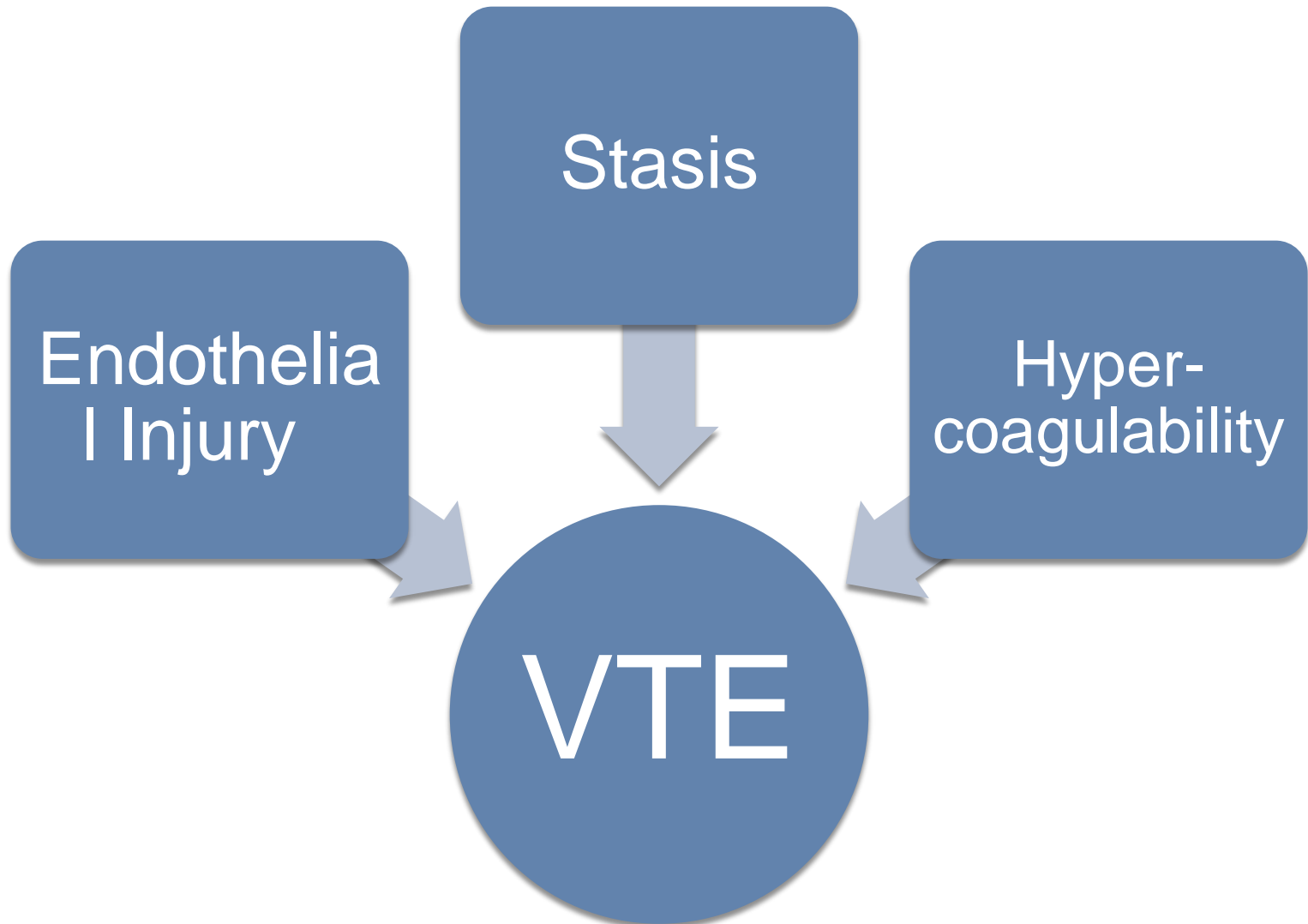


Summary

- No difference in incidence of PE between patients with IVC filters compared to those without filters
- Significantly higher incidence of DVT in patients with IVC filters
 - **For development of DVT after IVC filter**
 - **RR 1.1 (95% CI = 1.04-1.18)**
 - **OR 11.2 (95% CI 1.43-87.7)**
- Increased incidence of DVT in patients with IVC filters not correlated with ISS, use of pharmacologic prophylaxis, or specific injury

WHY?

Virchow's Triad



Purpose

Determine if technical factors of IVC filter placement, including filter model, type (permanent or retrievable) or introducer sheath size are related to subsequent incidence of VTE

Study Design.

retrospective case series

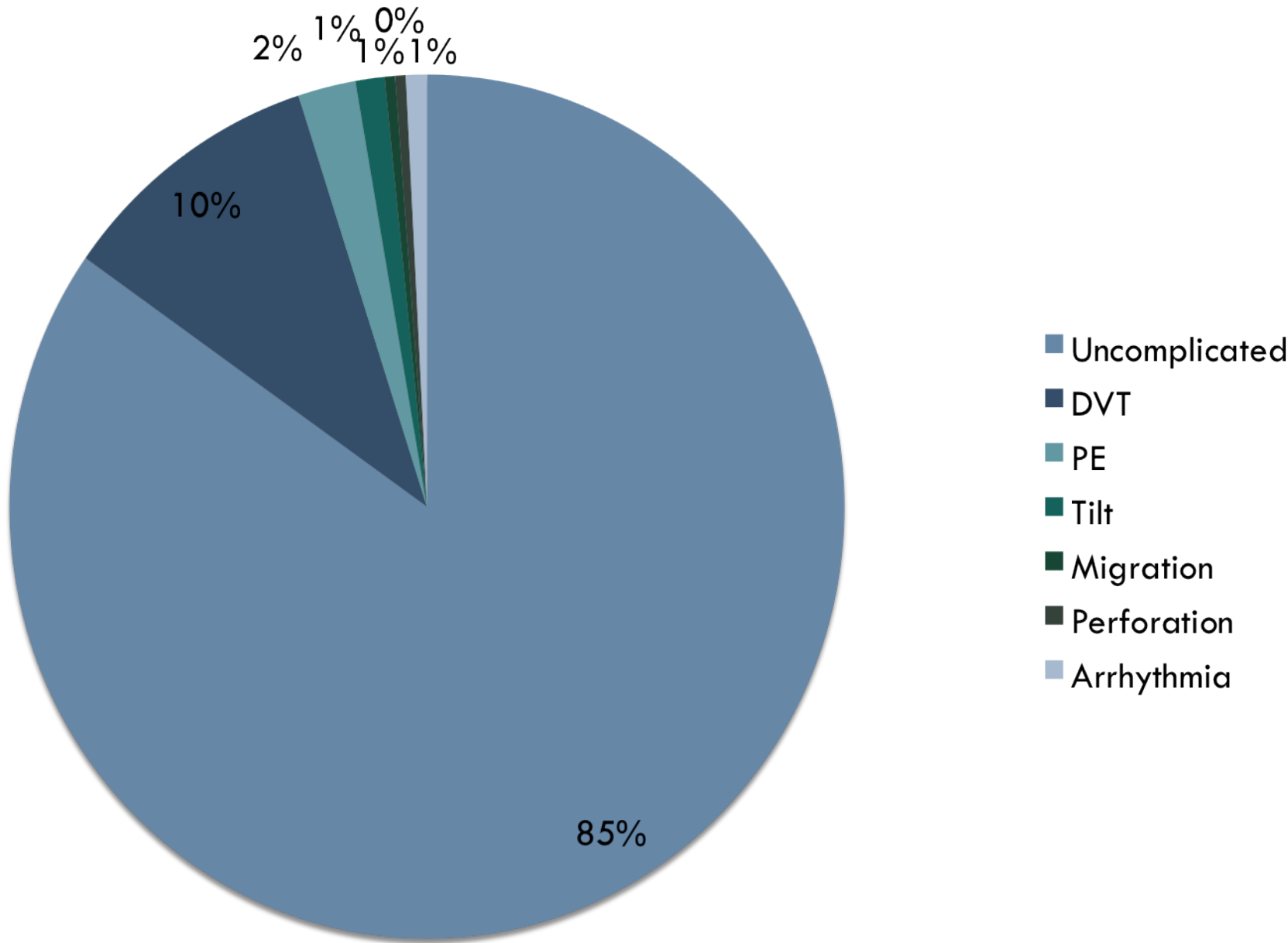
- Reviewed all trauma admissions to KCHC during 4 year period
- Subjects: all patients with IVC filters placed during trauma admission

- Exclusions:
 - age <18 or >90
 - mortality or brain death within 24hrs
 - Prior IVC filter placement

Results

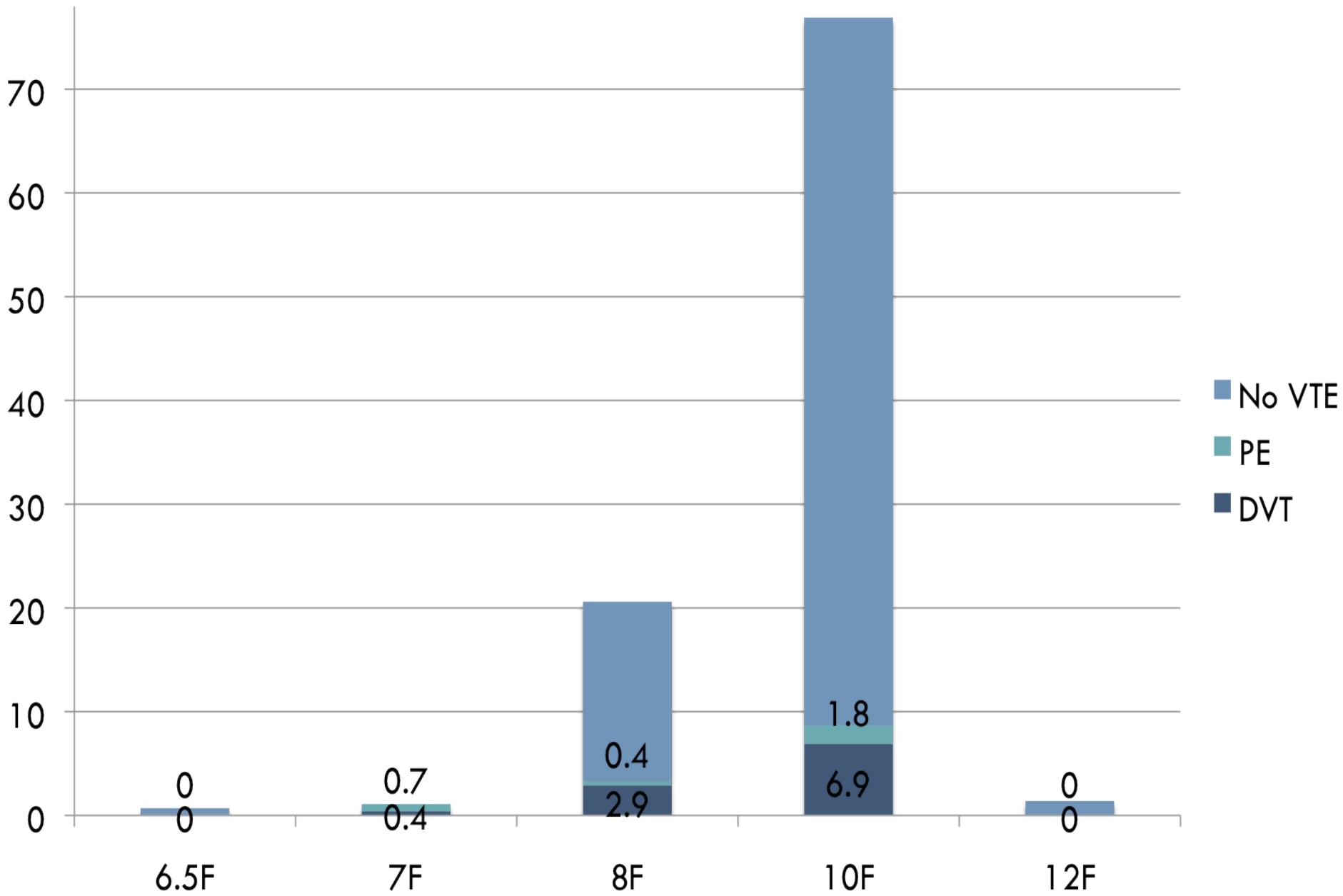
Demographic Characteristics Trauma Patients with IVC Filter Placed

Subjects	277
Age (years)	44 \pm 21
Gender (male)	72%
Body Mass Index	28 \pm 7.1
Injury Severity Score	22 (13 – 29)
Time to filter placement (days)	5 (3 -10)
Pharmacologic prophylaxis	96%
Pharmacologic prophylaxis start (hospital day)	3 (2 – 7)
Follow up (months)	4.8 (1.3 – 12)



IVC Filter Technical Factors and Thromboembolic Events

	Total	DVT	PE
N = 277			
Filter Type			
Permanent	188	21 (11%)	1 (1%)
Retrievable	89	7 (8%)	5 (6%)*
Filter Model			
Vena Tech	126	12 (10%)	0
G2	79	6 (8%)	2 (3%)
Trap Ease	57	8 (14%)	1 (2%)



Summary

- After a mean follow up of 5 months, 10% of trauma patients with IVC filter placement developed DVT and 2% developed PE
- Statistically significant correlations were found between
 - ▣ introducer sheath size and DVT formation
 - ▣ retrievable filter and PE
- Endothelial injury associated with IVC filter deployment may predispose the venous system to subsequent clot formation
- Retrievable filters may be less effective at preventing PE

REFERENCES

- Kidane B, et al. The use of prophylactic inferior vena cava filters in trauma patients: a systematic review. *Injury*, 2012. 43:542-547.
- PREPIC, g., *Eight-year follow-up of patients with permanent vena cava filters in the prevention of pulmonary embolism: the PREPIC (Prevention du Risque d'Embolie Pulmonaire par Interruption Cave) randomized study*. *Circulation*, 2005. **112**(3): p. 416-22.
- Rogers, F.B., et al., *Five-year follow-up of prophylactic vena cava filters in high-risk trauma patients*. *Arch Surg*, 1998. **133**(4): p. 406-11
- Shackford, S.R., et al., *The increasing use of vena cava filters in adult trauma victims: data from the American College of Surgeons National Trauma Data Bank*. *J Trauma*, 2007. **63**(4): p. 764-9.
- Spain, D.A., et al., *Venous thromboembolism in the high-risk trauma patient: do risks justify aggressive screening and prophylaxis?* *J Trauma*, 1997. **42**(3): p. 463-7