VENOUS THROMBOEMBOLISM UPDATE

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Pulmonary Embolism

- The patient presented to ER with nonproductive cough, mild wheezing, dyspnea, and moderate back pain for 5 days
- The patient developed a massive PE and died 3 days after admission to intensive care unit

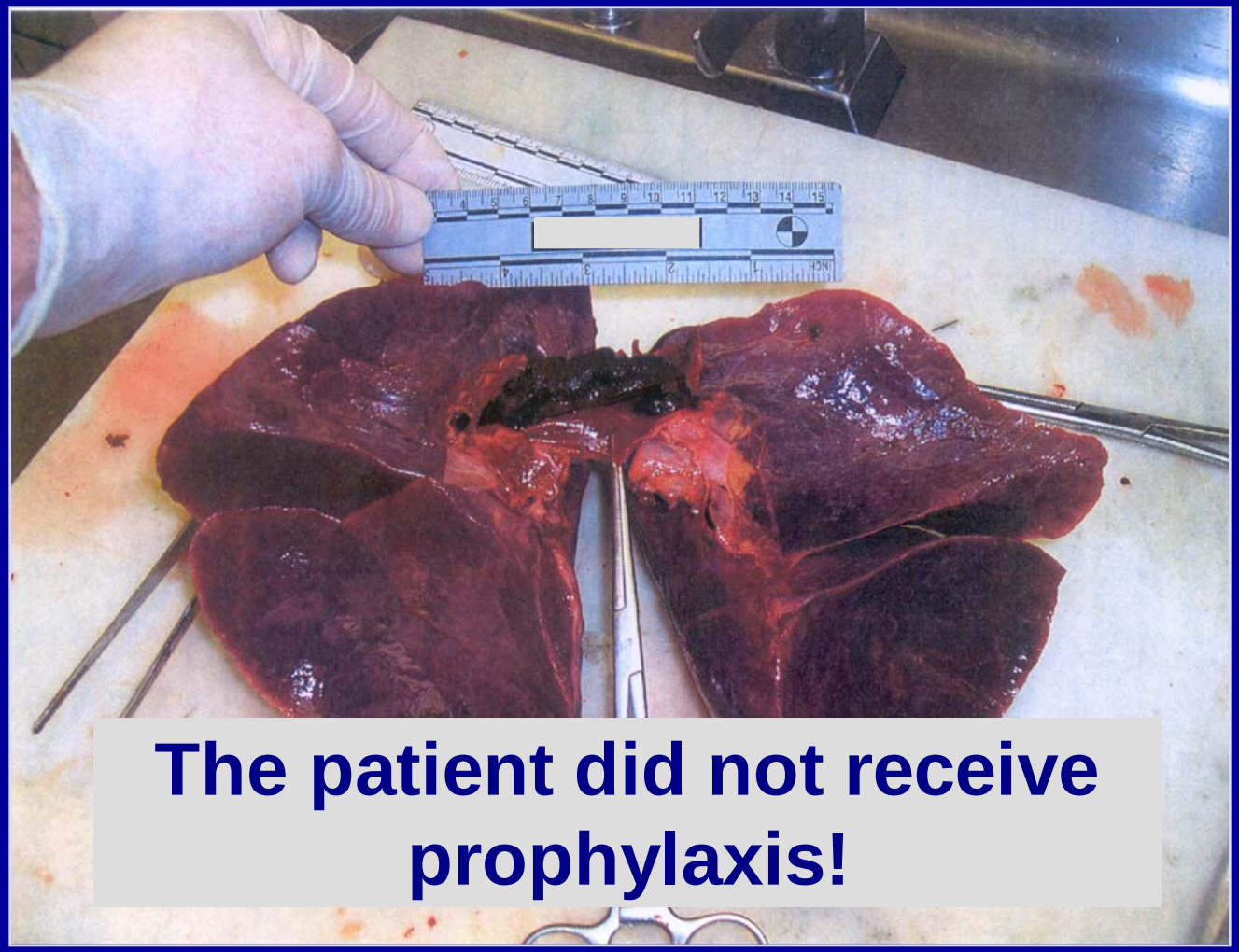


Photo courtesy of Victor F. Tapson, MD.

The Many Faces Of Venous Thromboembolism

- Prevent Fatal pulmonary emboli.
  - 1-5% incidence in patients with >4 risk factors.
  - 16.7% mortality at 3 months.
  - 34% of those with Pulmonary emboli present as sudden death.
- Prevent chronic pulmonary hypertension
  - 4% of patients suffering PE
- Prevent clinical venous thromboembolism.
  - Morbidity, drugs, tests, hose, changes in life style
  - Phlegmasia Cerula & alba Dolens
  - Venous Gangrene with limb loss
- Prevent silent venous thromboembolism.
  - Risk of subsequent event double that of control population.
- Prevent embolic stroke (20-30% PFO rate).
  - 50% disabled; 20% die; 30% recover.
- Prevent the post thrombotic syndrome and venous insufficiency-induced lymphedema.
  - 25% incidence following DVT and 7% severe.
  - May not be evident for 2-5 YEARS>

Risk Assessment

**“I’m sorry, the CAT scanner is broken,
so I’ll have to take your history and physical.”**

Thrombosis Risk Scoring

- Assign a point value to each risk factor according to the relative risk of VTE based on the literature.
- Total the points to obtain a score.
- Compare the scores to 30 & 60 day incidence of clinically relevant VTE.
- Use prophylaxis for a score of 4 or more
- Use extended prophylaxis for a score of >8.

Caprini JA, Arcelus JI, Hasty JH, et al. Clinical assessment of venous thromboembolic risk in surgical patients. Seminars in Thrombosis & Hemostasis 1991;17 Suppl 3:304-12.

Venous Thromboembolism Risk Factor Assessment

Patient's Name:_____ Age: ___ Sex: ___ Wgt ____lbs Hgt: _____inches

Choose All That Apply

Each Risk Factor Represents 1 Point

- ❑ Age 41-59 years
- ❑ Minor surgery planned
- ❑ History of prior major surgery
- ❑ Varicose veins
- ❑ History of inflammatory bowel disease
- ❑ Swollen legs (current)
- ❑ Obesity (BMI >30)
- ❑ Acute myocardial infarction (< I month)
- ❑ Congestive heart failure (< 1 month)
- ❑ Sepsis (< 1 month)
- ❑ Serious lung disease incl. pneumonia (< 1 month)
- ❑ Abnormal pulmonary function (COPD)
- ❑ Medical patient currently at bed rest
- ❑ Leg plaster cast or brace
- ❑ Central venous access
- ❑ Other risk factor _____

For Women Only (Each Represents 1 Point)

- ❑ Oral contraceptives or hormone replacement therapy
- ❑ Pregnancy or postpartum (<1 month)
- ❑ History of unexplained stillborn infant, recurrent spontaneous abortion (≥ 3), premature birth with toxemia or growth-restricted infant

Each Risk Factor Represents 2 Points

- ❑ Age 60-74 years
- ❑ Major surgery (> 60 minutes)*
- ❑ Arthroscopic surgery (> 60 minutes)*
- ❑ Laparoscopic surgery (> 60 minutes)*
- ❑ Previous malignancy
- ❑ Morbid obesity (BMI >40)

Each Risk Factor Represents 3 Points

- ❑ Age 75 years or more
- ❑ Major surgery lasting 2-3 hours*
- ❑ BMI > 50 (venous stasis syndrome)
- ❑ History of SVT, DVT/PE
- ❑ **Family history of DVT/PE**
- ❑ Present cancer or chemotherapy
- ❑ Positive Factor V Leiden
- ❑ Positive Prothrombin 20210A
- ❑ Elevated serum homocysteine
- ❑ Positive Lupus anticoagulant
- ❑ Elevated anticardiolipin antibodies
- ❑ Heparin-induced thrombocytopenia (HIT)
- ❑ Other thrombophilia
  Type_____

Each Risk Factor Represents 5 Points

- ❑ Elective major lower extremity arthroplasty
- ❑ Hip, pelvis or leg fracture (< 1 month)
- ❑ Stroke (< 1 month)
- ❑ Multiple trauma (< 1 month)
- ❑ Acute spinal cord injury (paralysis)(< 1 month)
- ❑ Major surgery lasting over 3 hours*

Total Risk Factor Score ☐

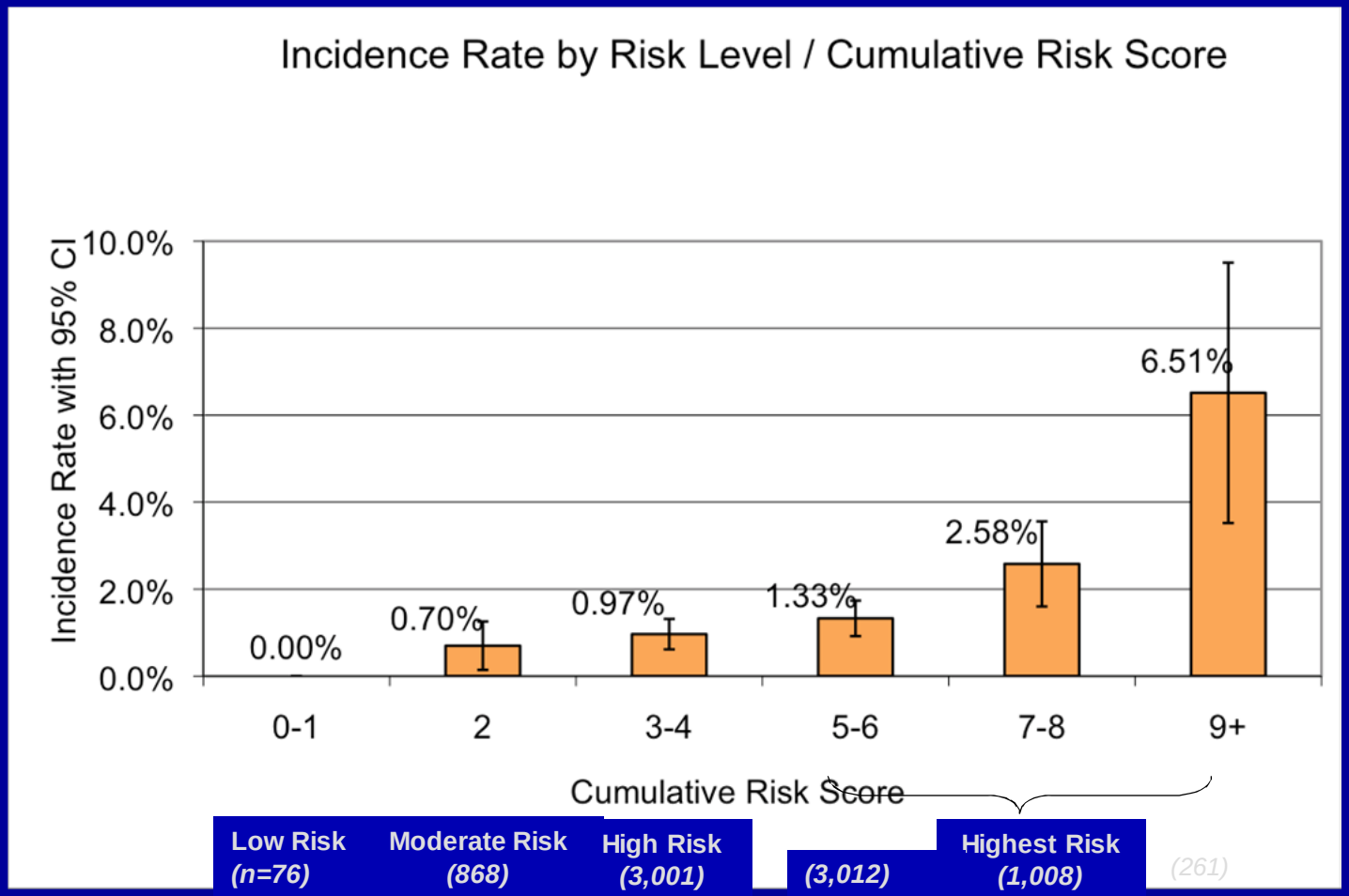
*Select only one from the surgery category

Please see Following Page for Prophylaxis suggestions and Safety Considerations

*V. Bahl, H. Hu, P. K. Henke, T. W. Wakefield, D. A. Campbell, J, Caprini JA. Ann Surg: 2010; **251: 344-5**

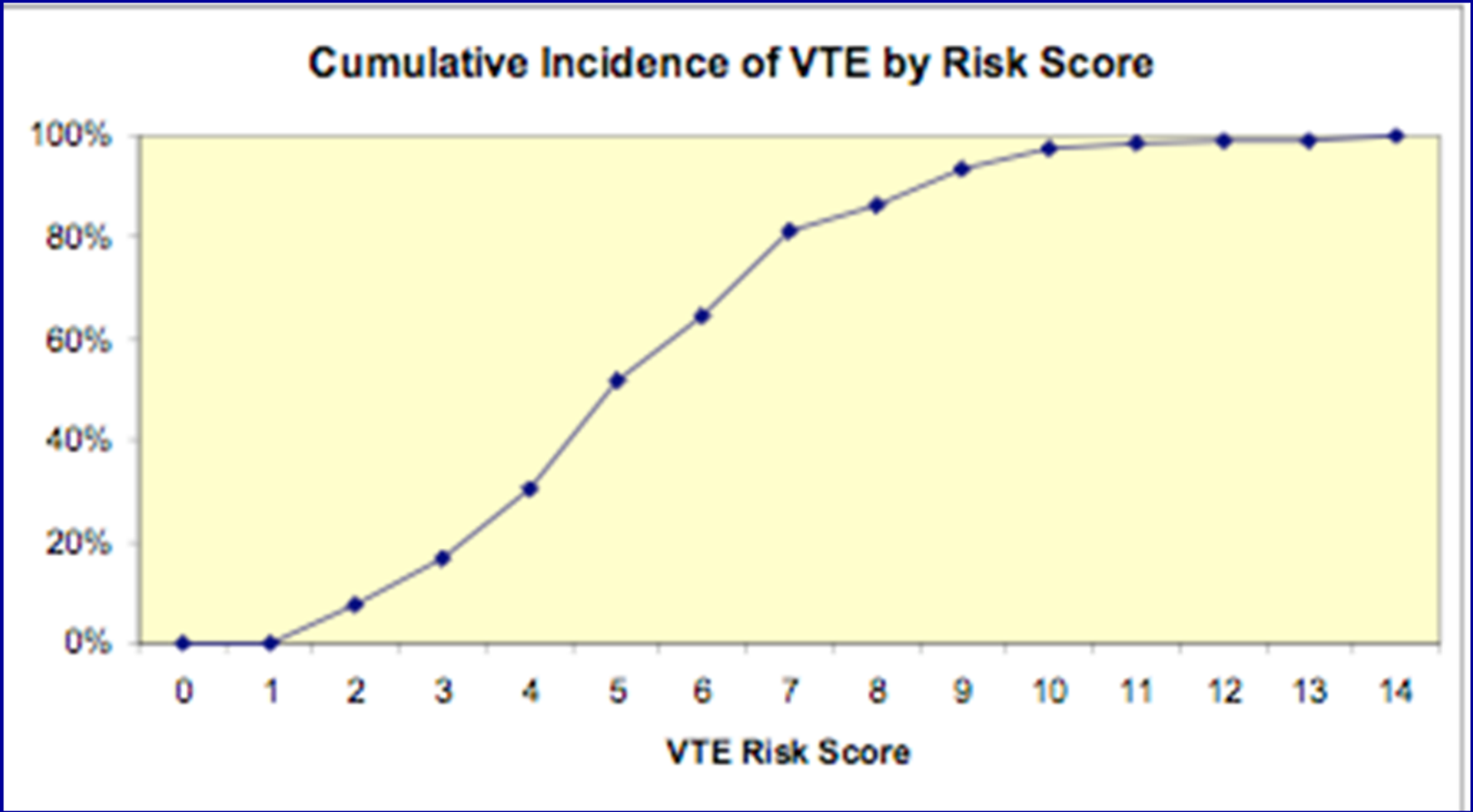
A Validation Study of a Retrospective Venous Thromboembolism Risk Scoring Method

*V. Bahl, H. Hu, P. K. Henke, T. W. Wakefield, D. A. Campbell, J, Caprini JA. Ann Surg: 2010; 251: 344-5



Clinically evident-imaging proven VTE rates at 30 Days

A Validation Study of a Retrospective Venous Thromboembolism Risk Scoring Method



**V. Bahl, H. Hu, P. K. Henke, T. W. Wakefield, D. A. Campbell, J, Caprini JA. Ann Surg: 2010; 251: 344-5*

Validation of the Caprini Risk Assessment Model in Plastic and Reconstructive Surgery Patients

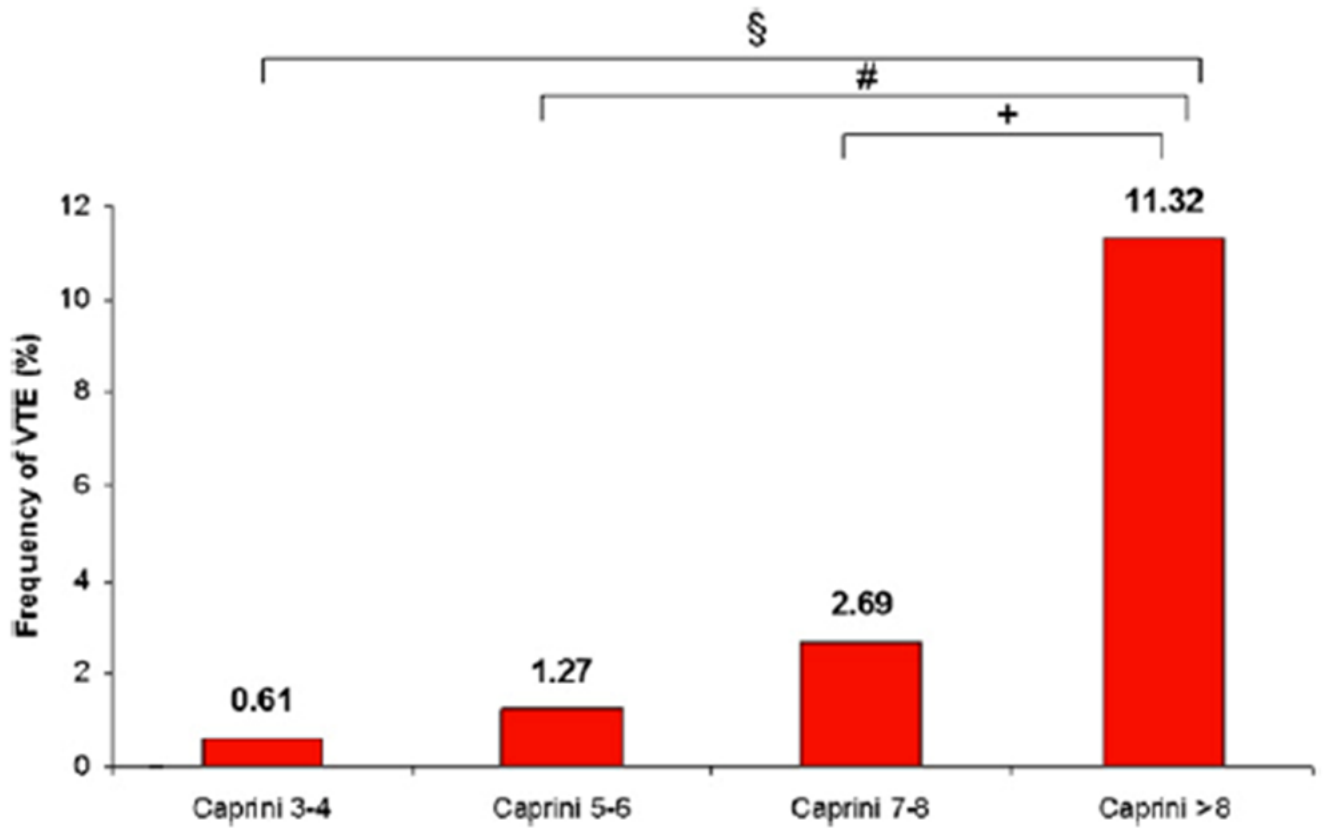


Figure 3. Rates of venous thromboembolism (VTE) in the first 60 postoperative days by stratified Caprini score (n = 1,126). OR, odds ratio; § Compares Caprini>8 to Caprini 3-4, OR 20.85, p<0.001; # compares Caprini>8 to Caprini 5-6, OR 9.93, p<0.001; + compares Caprini>8 to Caprini 7-8, OR 4.62, p=0.015.

Panucci,C. et al: J Am Coll Surg 2011;212:105–112

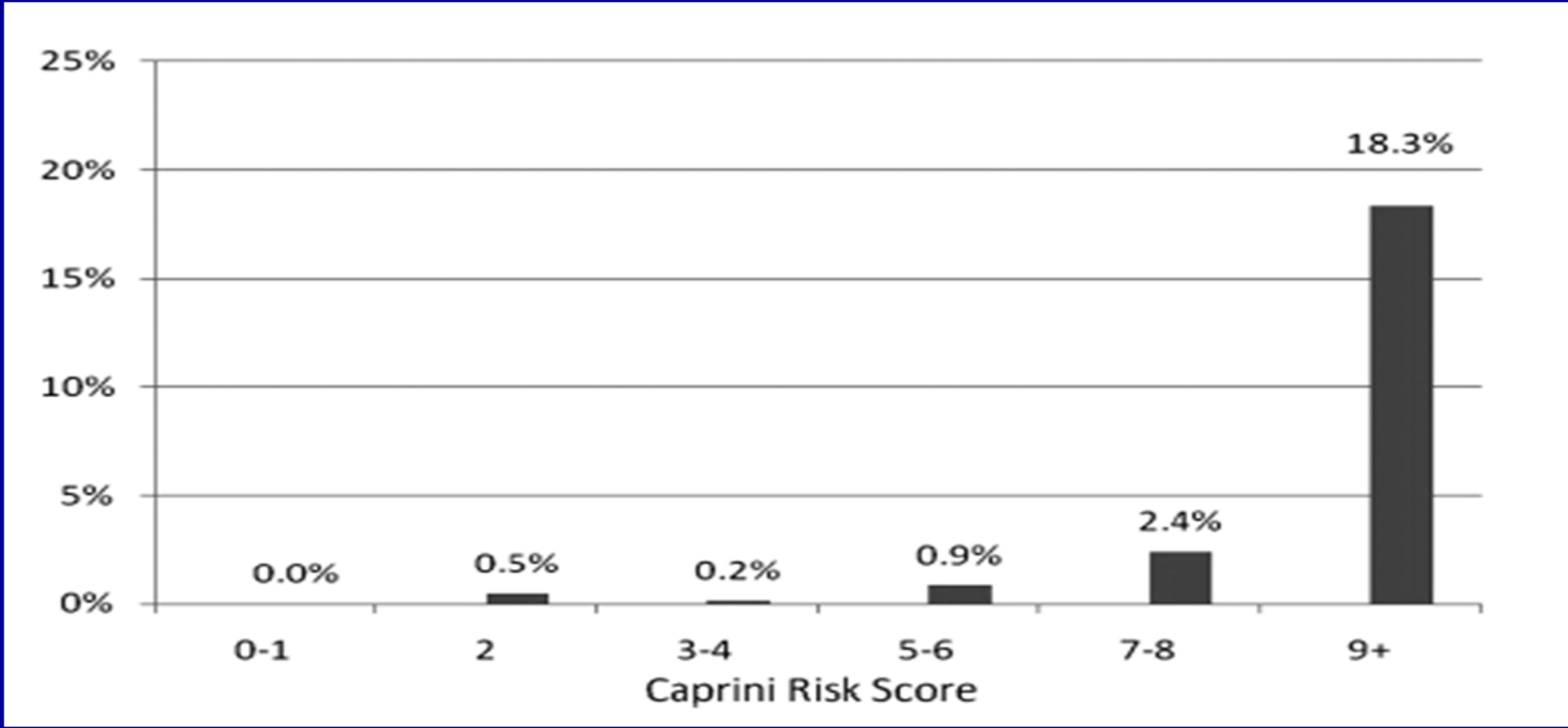
Evidence-Based Practices for Thromboembolism Prevention: Summary of the ASPS Venous Thromboembolism Task Force Report*

PATIENT POPULATION	RECOMMENDATION
In-patient adult aesthetic and reconstructive plastic surgery who undergo general anesthesia	**Should complete** a 2005 Caprini risk factor assessment tool in order to stratify patients into a VTE risk category based on their individual risk factors. **Grade B** **or** **Should complete** a VTE risk assessment tool comparable to the 2005 Caprini RAM in order to stratify patients into a VTE risk category based on their individual risk factors. **Grade D**
Out-patient adult aesthetic and reconstructive plastic surgery who undergo general anesthesia	**Should complete** complete a 2005 Caprini risk factor assessment tool in order to stratify patients into a VTE risk category based on their individual risk factors. **Grade B** **or** **Should complete** a VTE risk assessment tool comparable to the 2005 Caprini RAM in order to stratify patients into a VTE risk category based on their individual risk factors. **Grade D**

PATIENT POPULATION	2005 CAPRINI RAM SCORE*	RECOMMENDATION **The scores listed apply to the 2005 Caprini RAM and were not intended for use with alternative VTE risk assessment tools.**
Elective Surgery Patients adult aesthetic and reconstructive plastic surgery who undergo general anesthesia	**7 or more**	**Should consider** risk reduction strategies such as limiting OR times, weight reduction, discontinuing hormone replacement therapy and early postoperative mobilization. **Grade C**
Patients undergoing the following major procedures when the procedure is performed under general anesthesia lasting more than 60 minutes: ▸ Body contouring, ▸ Abdominoplasty, ▸ Breast reconstruction, ▸ Lower extremity procedures, ▸ Head/neck cancer procedures	**3 to 6**	**Should consider** the option to use postoperative LMWH or unfractionated heparin. **Grade B**
	3 or more	**Should consider** the option to utilize mechanical prophylaxis throughout the duration of chemical prophylaxis for non-ambulatory patients. **Grade D**
	7 or more	**Should strongly consider** the option to use extended LMWH postoperative prophylaxis. **Grade B**

*Murphy, RX et al. *Plast. Reconstr. Surg.* 130: 168e, 2012.

Stratifying the Risk of Venous Thromboembolism in Otolaryngology



Patients with Caprini scores greater than 8 are at an approximately 20-fold increased risk of VTE, and those with scores of 7 to 8 are at an approximately 5- to 10-fold risk when compared with low-risk patients across surgical specialties

Shuman, AG et al. *Otolaryngology -- Head and Neck Surgery* 2012 146: 719

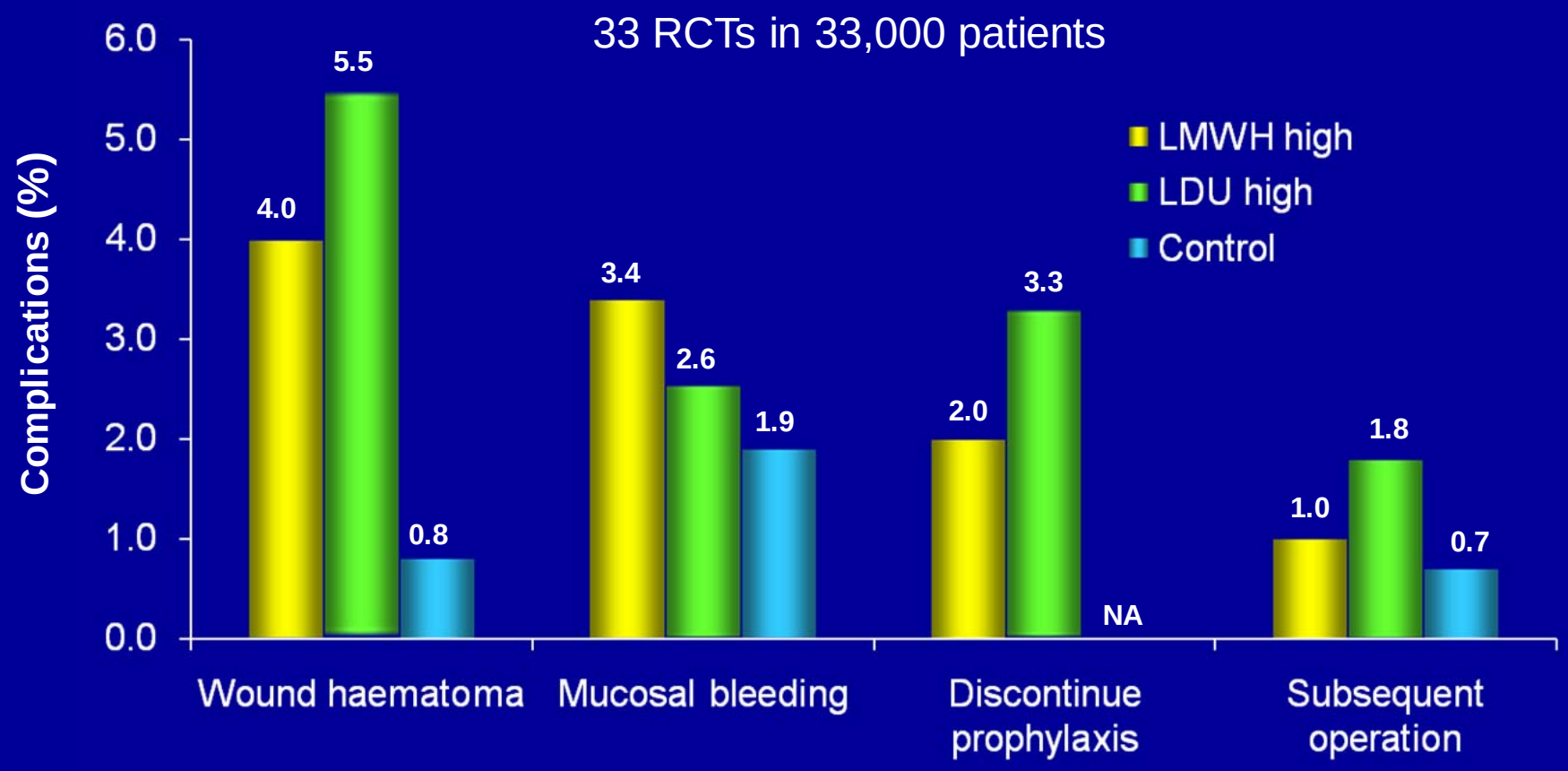
CHEST Consensus Guidelines 2012

Risk	Caprini Score	*VTE incidence	Prophylaxis
Very low	0	0.5%	Early ambulation
Low	1-2	1.5%	IPC
Moderate	3-4	3.0%	LMWH, UFH,IPC
High	5+	6.0%	LMWH, UFH + IPC or GS

*Estimated baseline risk in the absence of pharmacologic or mechanical prophylaxis

Gould, MK et al; CHEST 2012; 141(2)(Suppl):e227S–e277S

The rate of bleeding complications after pharmacological DVT prophylaxis



Leonardi MJ, et al. Arch Surg. 2006;141:790-9.

Caprini Risk Score

- Avoids blanket prophylaxis with anticoagulants since those with low scores have a risk of thrombosis that is lower than the bleeding risks with anticoagulation
- High scores may justify those who might benefit from combined anticoagulant and IPC prophylaxis due to their risk of thrombosis
- The score can help select patients who would benefit from ongoing prophylaxis after discharge

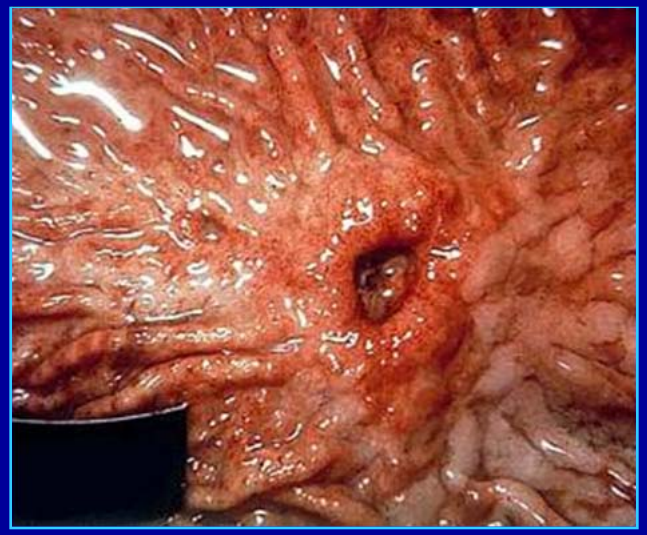
Caprini Scores in Surgical Patients

- The remarkable association between increasing risk score and clinically-relevant VTE is present over a wide variety of surgical patients.
- The score has the ability to single out those who are at high risk among surgical populations that have a low global incidence of VTE
- Justification for extended prophylaxis for those with high scores appears valid since the clinically-relevant VTE rate far exceeds the risk of bleeding
- Data are available demonstrating that the risk of fatal PE is 0.15% if patients are given a seven day course of unfractionated or low molecular weight heparin prophylaxis*.

* Haas S, Wolf H, Kakkar AK, et al. Thrombosis & Haemostasis 2005;94:814-9.

Risk Assessment For Bleeding

Bleeding events

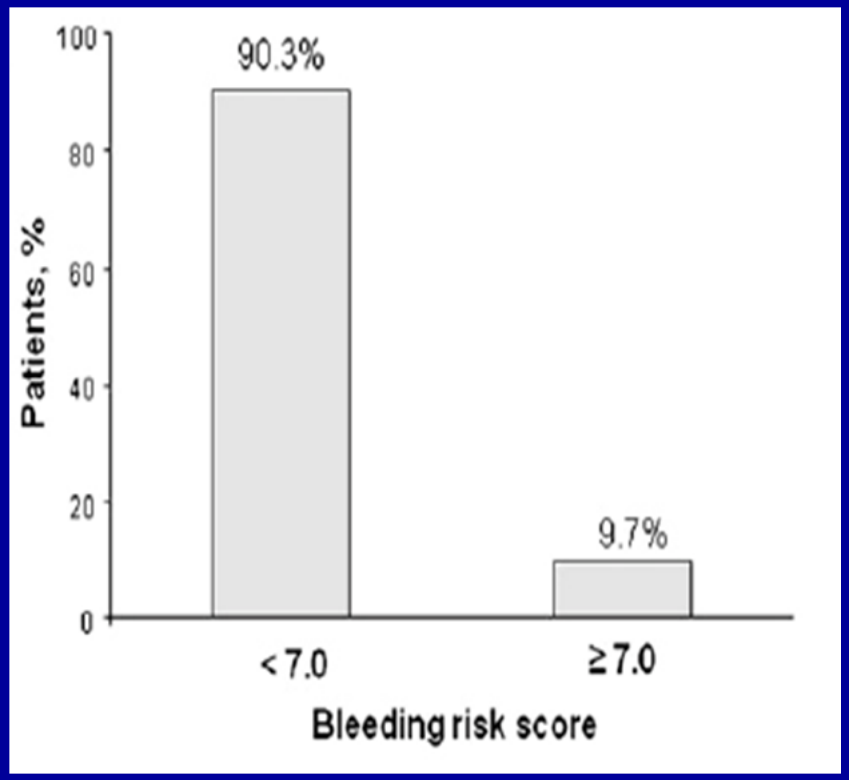


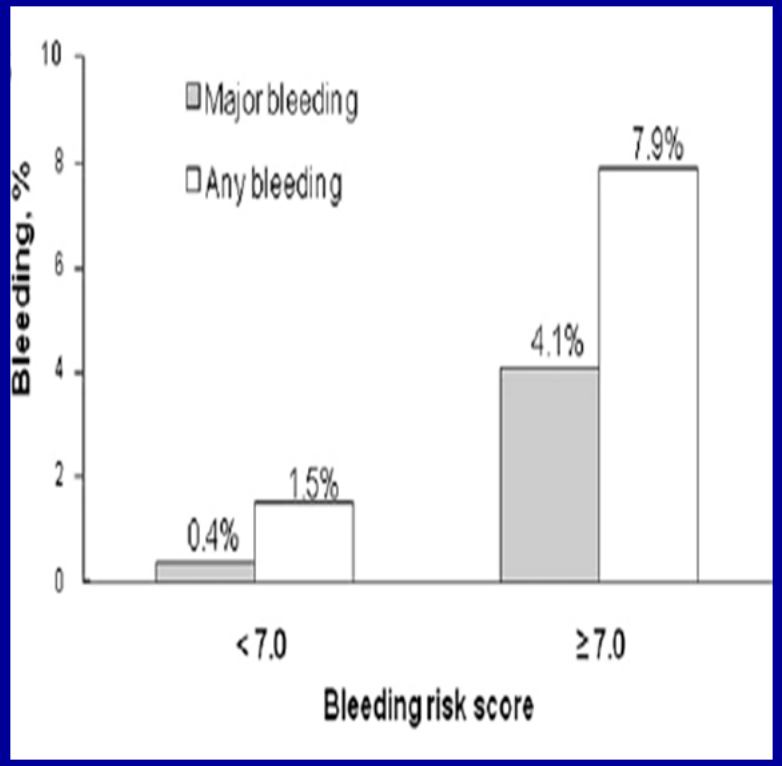
Factors at Admission Associated With Bleeding Risk in Medical Patients

Bleeding Risk Factors	Points
Moderate renal failure, GFR 30-59 vs ≥60 mL/min/m²	1
Male vs female	1
Age, 40-84 y vs <40 y	1.5
Current cancer	2
Rheumatic disease	2
Central venous catheter	2
ICU/CCU	2.5
Severe renal failure, GFR <30 vs ≥60 mL/min/m²	2.5
Hepatic failure (INR >1.5)	2.5
Age, ≥85 y vs <40 y	3.5
Platelet count $<50 \times 10^9$ cells/L	4
Bleeding in 3 mo before admission	4
Active gastroduodenal ulcer	4.5

The IMPROVE investigators: CHEST 2011;139 (1): 69-79

Factors at Admission Associated With Bleeding Risk in Medical Patients





The IMPROVE investigators: CHEST 2011;139 (1): 69-79

Venous Thromboembolism Following Hospital Discharge

Preventing VTE After Discharge

- The current practice is to administer VTE prophylaxis during hospitalization
- Upon discharge, it is assumed that the risk of VTE abates, and consequently, prophylaxis is discontinued
- In reality, the risk persists in patients with ongoing risk factors
- Remember the efficacy of anticoagulant prophylaxis in clinical trials was based on 5-7 days of prophylaxis
- Therefore, consider extending prophylaxis after hospitalization in selected patients (Score>4)

Is Duration of VTE Prophylaxis Analogous to Duration of a Course of Antibiotics?

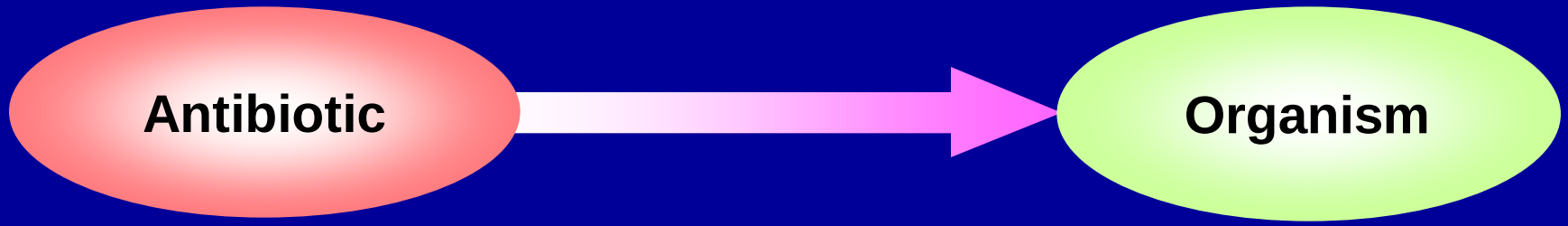
- If a patient who is on an antibiotic is admitted to the hospital, and by day 3 is ready to be discharged, would you stop the antibiotic at that point?
  - Of course not — the patient should remain on the antibiotic for the duration of a course, 7 to 10 days

- Or would you see a patient with pneumonia in the ED and wait until the next morning when he/she is on the hospital floor before starting antibiotics?

You should think about VTE prophylaxis much the same way

Is Duration of VTE Prophylaxis Analogous to Duration of a Course of Antibiotics?

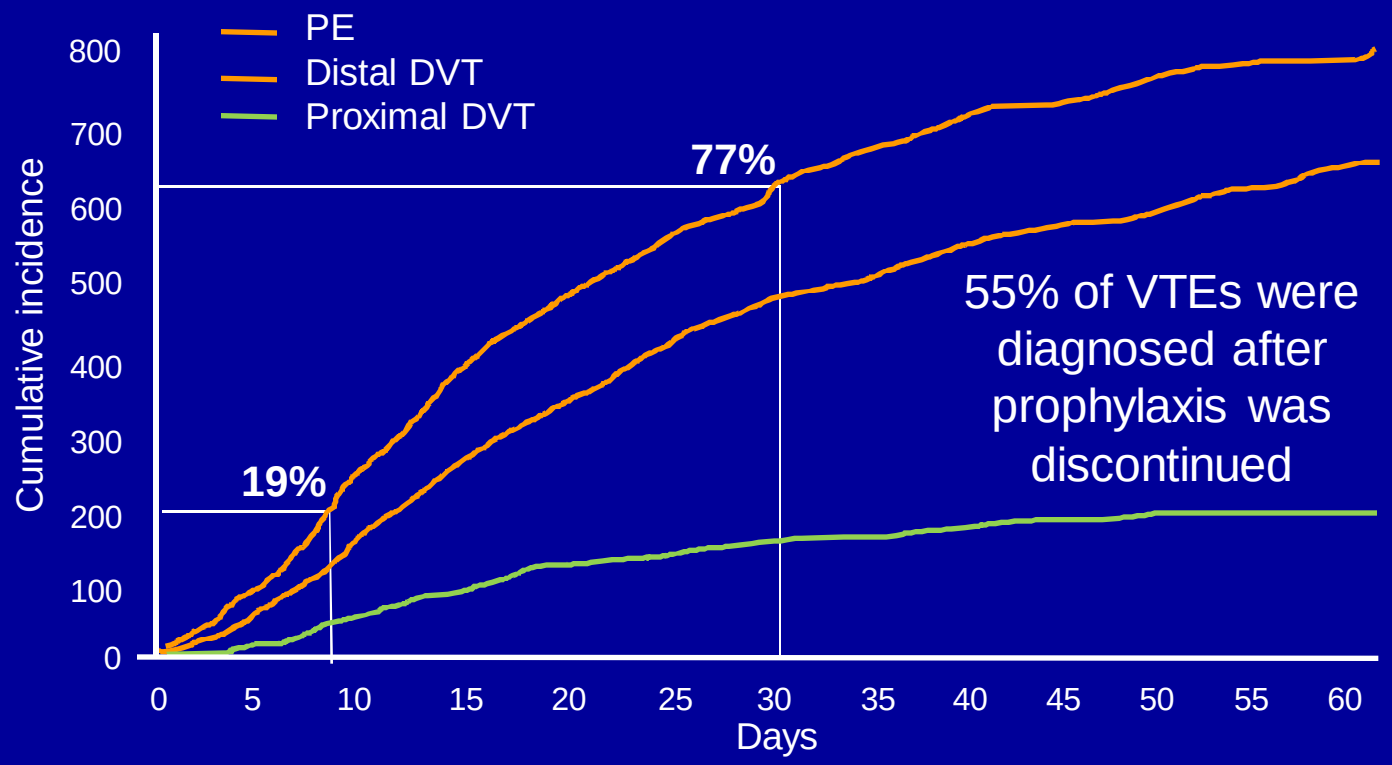
Indication	Average LOS, d	Duration of Prophylaxis
Acute medical illness	3-5	6-11 d
Abdominal surgery	2-10	7-10 d
Hip replacement	2-6	7-10 d or 3 wk
Knee replacement	2-5	7-10 d



Process Components:

1. Failure to give the antibiotic
2. "Resistance" of the organism
3. Initial timing of the antibiotic
4. Duration of treatment

Time course and clinical presentation of postoperative VTE in RIETE

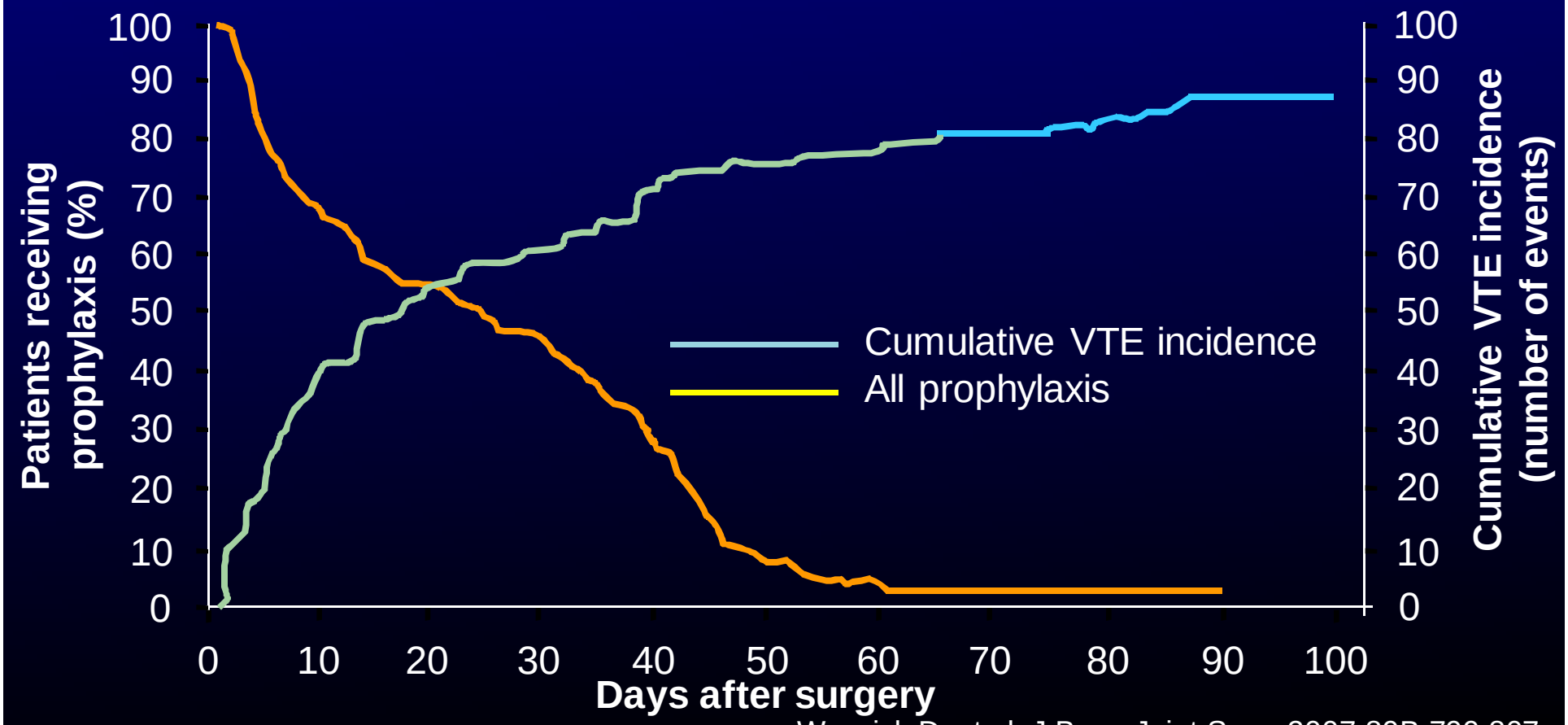


	24 hours	48 hours	7 days	15 days	30 days	60 days
Clinically overt PE	22 (2.8%)	41 (5.2%)	149 (19%)	376 (48%)	608 (77%)	787
Distal DVT	2 (1.1%)	5 (2.78%)	34 (19%)	98 (54%)	145 (80%)	182
Proximal DVT	9 (1.4%)	21 (3.3%)	91 (14%)	248 (39%)	432 (68%)	633

Arcelus JI, et al. Thromb Haemost. 2008;99:546-51.

Duration of prophylaxis use vs cumulative incidence of VTE following THA and TKA

- Patients usually discharged from hospital on day 4 – 5
- By PO day seven , 25% were not receiving prophylaxis



Warwick D, et al. J Bone Joint Surg. 2007;89B:799-807.

Million Women Study

- Prospective cohort study involving 947,454 woman followed for 6 years
- Surgery was done in 239,614 patients with 5419 VTE events including 270 VTE related deaths
- Compared with not having surgery, women were 70 times more likely to be admitted with venous thromboembolism in the first six weeks after an inpatient operation and 10 times more likely after a day case operation.
- The risks were lower but still substantially increased 7-12 weeks after surgery.

Sweetland S, et al, BMJ 2009;339:b4583

Rates Of Venous Thromboembolism
Occurrence in Medically-ill Patients (Data from Premier insured database)

	Total (N=158,325)	Cancer (N=39,242)	CHF (N=16,357)	Severe infectious disease (N=75,272)	Lung disease (N=27,454)
Event , n (%)					
VTE	8,895 (5.62%)	2,970 (7.57%)	914 (5.59%)	3,665 (4.86%)	1,365 (4.94%)
DVT	6,300 (3.98%)	1981	662	2782	875
PE	2,324 (1.47%)	889	226	778	431
DVT/PE	271 (0.17%)	100	26	95	50
Time to VTE event: (median days)					
VTE	74	70	125.5	62	84
DVT	76.0	71	123.0	63.0	61.0
PE	72.5	72.0	140.50	57.0	69.0
DVT/PE	34.0	33.5	24.5	30.0	43.0

Spyropoulos, AC et al:Thromb Haemost 2009; 102: 951–957

Vencava Filters

Use of a Retrievable Vena Cava Filter with Low- intensity Anticoagulation for Prevention of Pulmonary Embolism in Patients with Cancer: An Observational Study in 106 Cases

- PE recurred in three of 58 patients (5.2%).
- None of the 48 patients with DVT alone developed PE or had recurrent DVT
- The filter was removed in 14 patients (13.2%)
- 16 complications occurred in seven patients:
- one migration (0.9%); four cases of vena cava thrombosis (3.7%), three of which were associated with recurrent PE (2.8%);
- one filter fracture (0.9%); and one IVC penetration (0.9%).
- Filter tilting greater than 15° occurred in six patients (5.7%) and was associated with other complications in five (4.7%)

Damascelli, B et al: *J Vasc Interv Radiol 2011; 22:1312–1319*

Use of a Retrievable Vena Cava Filter with Low- intensity Anticoagulation for Prevention of Pulmonary Embolism in Patients with Cancer: An Observational Study in 106 Cases

- Indications for retrieval of the filter were documented resolution of the DVT or no evidence over time of recurrence of PE in patients without DVT at the time of enrollment
- Low-intensity warfarin keeping the INR between 1.5 and 2.0 was used during the study
- LMWH bridging was used for filter placement and removal
- Although these were cancer patients the study shows the range and severity of complications associated with filter placement and removal
- The use of full-dose LMWH anticoagulation long-term is an alternative that needs to be compared to this strategy before recommending this approach in the cancer patient.

Damascelli, B et al: *J Vasc Interv Radiol 2011; 22:1312–1319*

Antiembolism Stockings: Myth Vs. Reality

Antiembolism Stockings
Ineffective Post Stroke in Preventing DVT

- Immobile acute stroke patients (N=2518)
- Standard care, with or without thigh-high graduated compression stockings (GCS)
- Duplex ultrasound of both legs at 7-10 days and 25-30 days after enrollment
- Proximal DVT rates were not significantly different between groups (10.0% and 10.5% with and without GCS, respectively)
- Skin breaks, ulcers, and blisters were more common with GCS vs without GCS (5% vs 1%, respectively)
- Conclusion: *Do not use in medical patients*

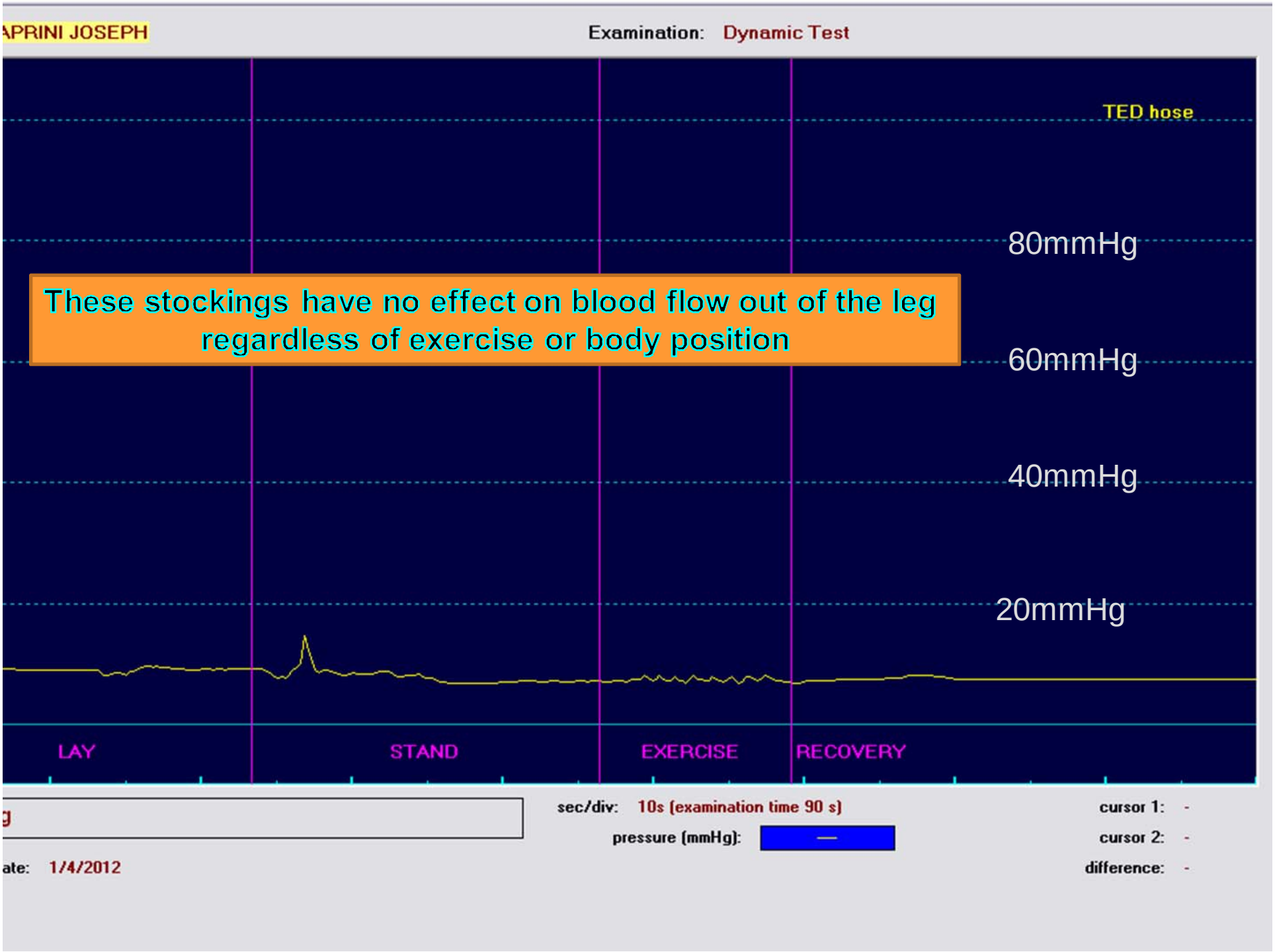
The CLOTS Trials Collaboration. *Lancet.* 2009;373:1958-1965.

Thigh-Length Versus Below-Knee Antiembolism Stockings for Deep Venous Thrombosis Prophylaxis After Stroke--A Randomized Trial (CLOTS 2)

The CLOTS (Clots in Legs Or sTockings after Stroke) Trial Collaboration*

- This study involved 1552 immobile stroke patients who were randomized to receive either thigh-length or below-knee stockings during hospitalization.
- Proximal DVT occurred in 98 patients (6.3%) who received thigh-length stockings and 138 (8.8%) who received below-knee stockings; *P= 0.008, an odds* reduction of 31% (CI, 9% to 47%).
- Skin breaks occurred in 61 patients who received thigh-length stockings (3.9%) and 45 (2.9%) who received below-knee stockings.

Ann Intern Med. 2010;153:553-562.



These stockings have no effect on blood flow out of the leg regardless of exercise or body position

Antiembolism Stockings

Edema

Skin lesion

Ulceration

Conclusions

- ***Remember the many faces of VTE***
- ***Perform a complete risk assessment (H&P) for both thrombosis and bleeding***
- ***Extend prophylaxis for the period of time that the patient is at risk***
- ***Avoid the use of antiembolism stockings as a sole thromboprophylaxis method***
- ***Be extremely selective in the use of vena cava filters***


THE END

Which One of the Following Statements is Not True?

a) The caprini score represents the total of weighted risk factors.

b) A caprini score of >8 is associated with a 20 fold incidence of VTE compared to those with a low-risk score.

c) The score has been validated in a variety of surgical groups.

d) The score is too complex for use without an electronic medical record.

Which One of the Following Statements is Not True?

A) Most VTE events do not occur during hospitalization.

B) Seventy-seven percent of VTE events occur following hospital discharge.

C) The mean time to develop VTE in medical patients is day 74.

D) When screening tests for VTE are done they disprove the theory that most events occur after discharge.