TROMBOSEPROFYLAKSE VED ARTROSKOPISK KNÆKIRURGI

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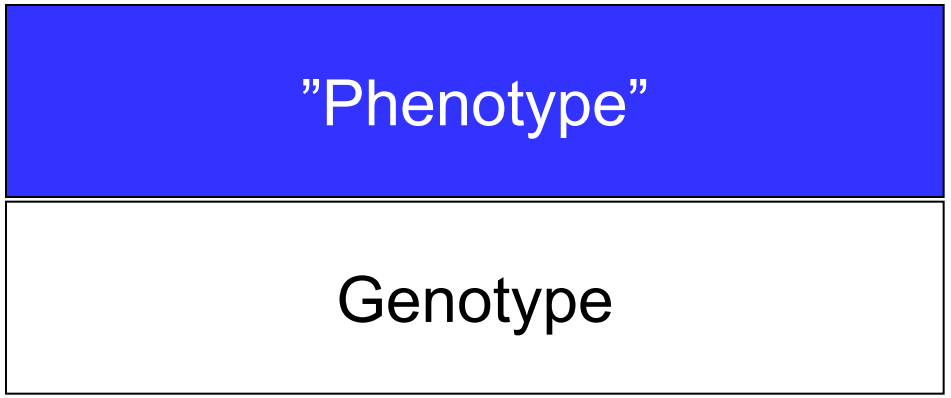
Risk composition

Total personal risk:

Genotype	Prot. S and C def., Factor V Leiden def., AT III def., TFPI, hemophilia, thrombophilia

Risk composition

Personal risk:



Age, previous DVT/PE,
BMI > 30, heart disease, cancer,
a. o.

Prot. S and C def., Factor V
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Risk composition

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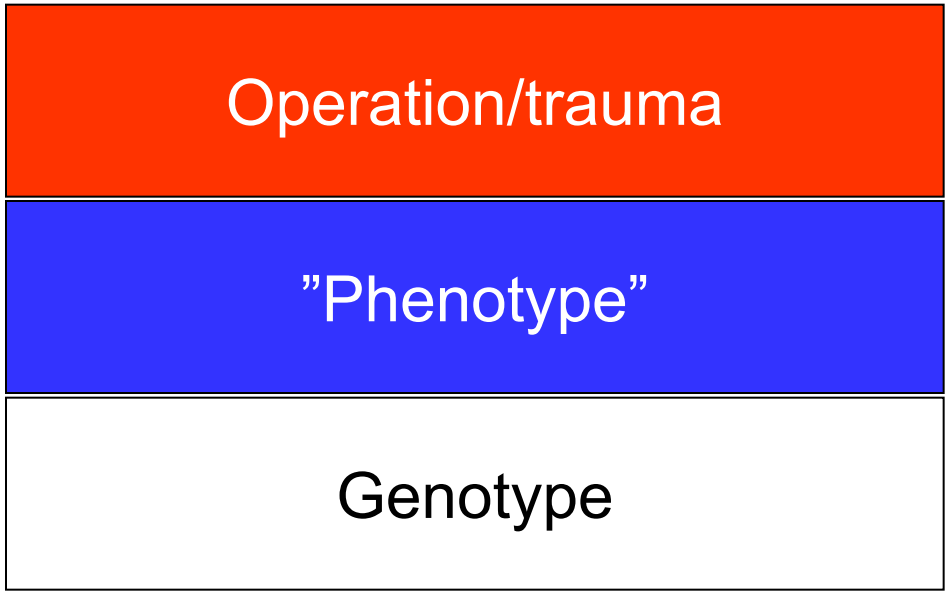


Virchow’s triad

Age, previous DVT/PE,
BMI > 30, heart disease, cancer,
a.o.

Prot. S and C def., Factor V
Leiden def., AT III def.,
TFPI, hemophilia, thrombophilia

The relative influence of the various elements can be assessed and may change with time

Known risk:

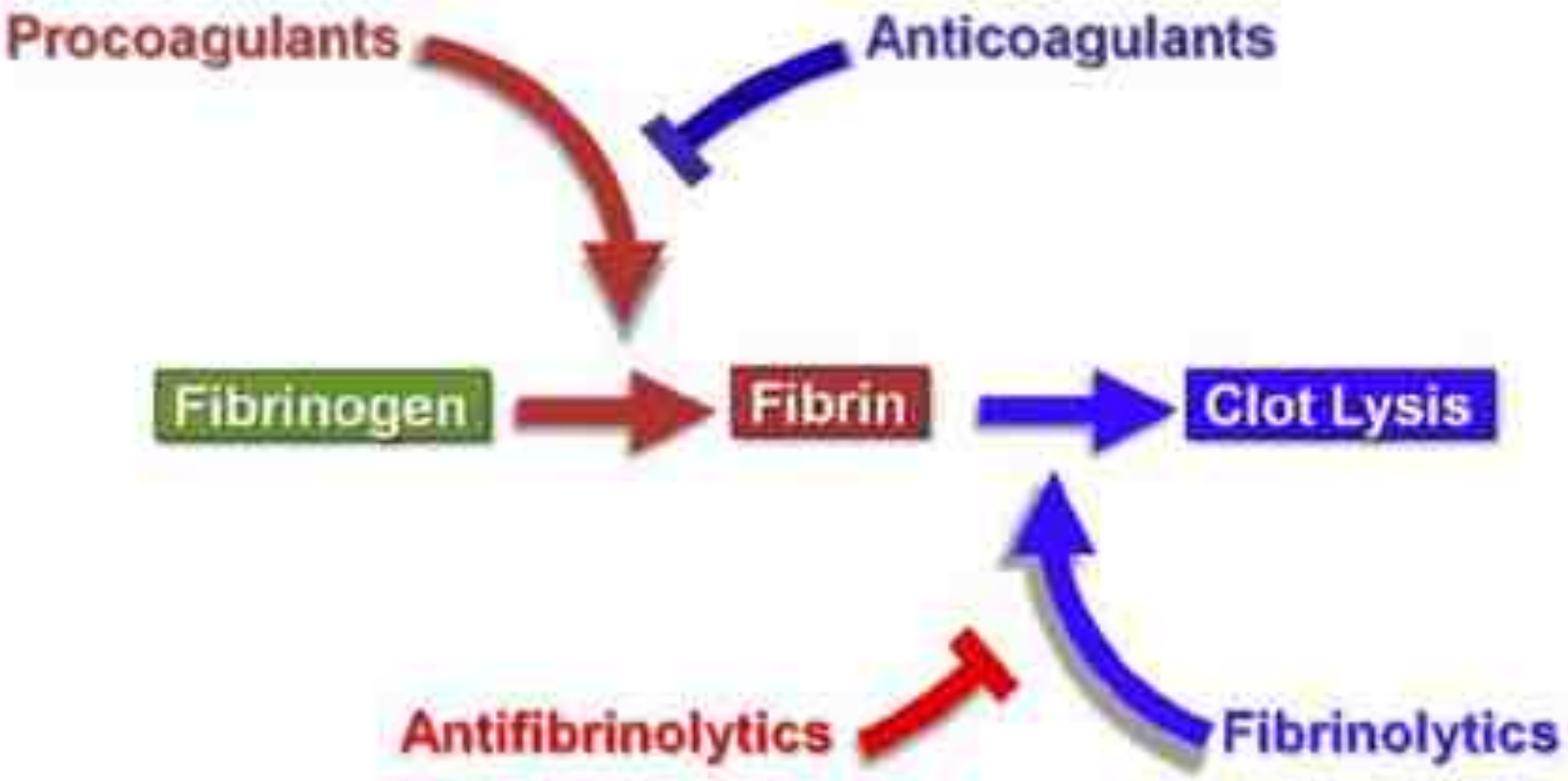
”Phenotype”

Unknown risk:

Genotype + Operation/trauma

The real-time response (thrombin generation) could be quantitated

The central players of the coagulation process



Stutz C, Rear LD, O'Neill KR, Tamborski ME, Crosby CG, Devin CJ, Schoenecker JG. Coagulapathies in orthopaedics: Links to inflammation and the potential of individualizing treatment strategies. JOT 2013; 27: 236-41.

Most important pro- and anticoagulants in normal subjects

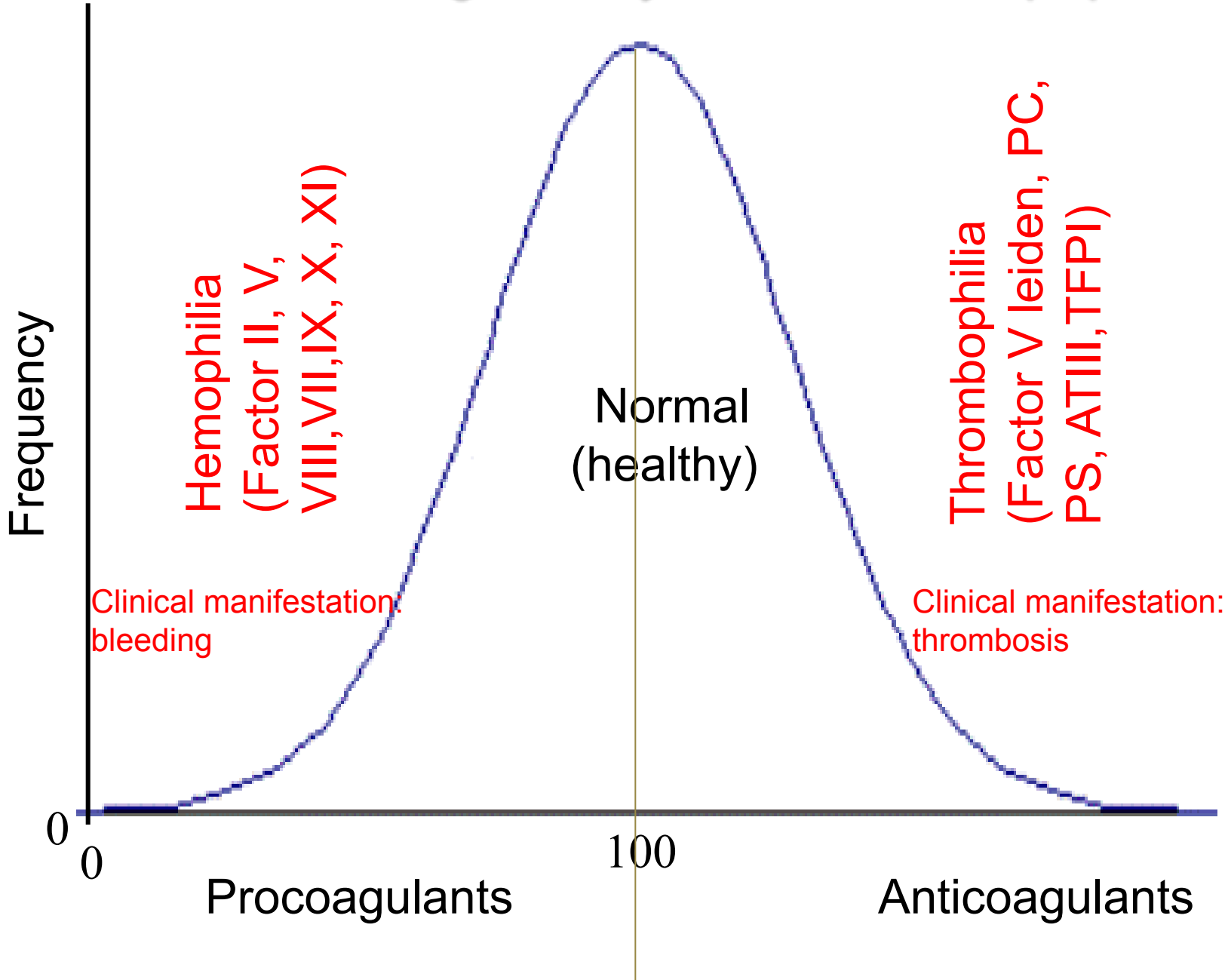
Procoagulant: Prothrombin

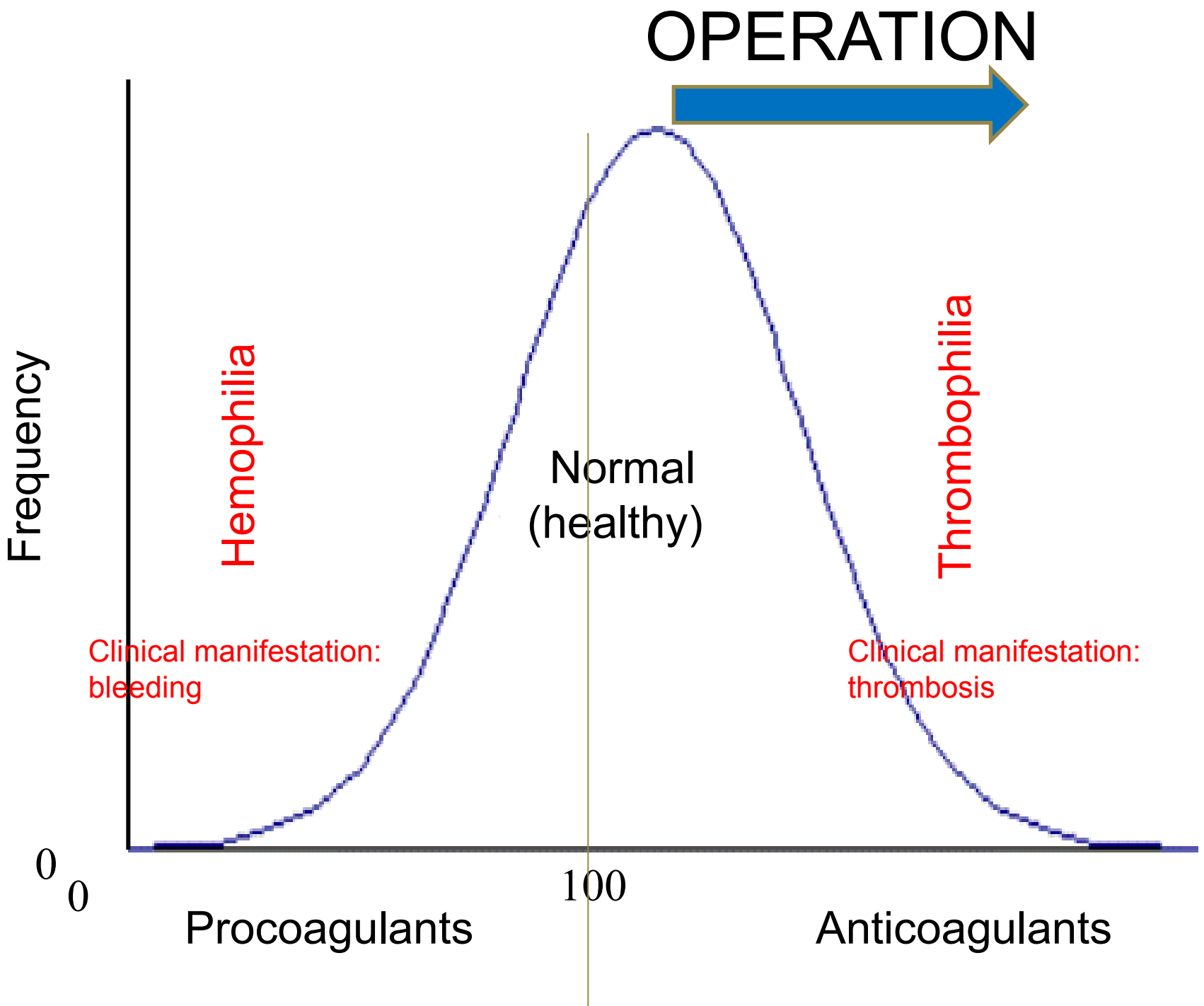
Glycoprotein precursor of thrombin
Produced in the liver
Occurring in plasma

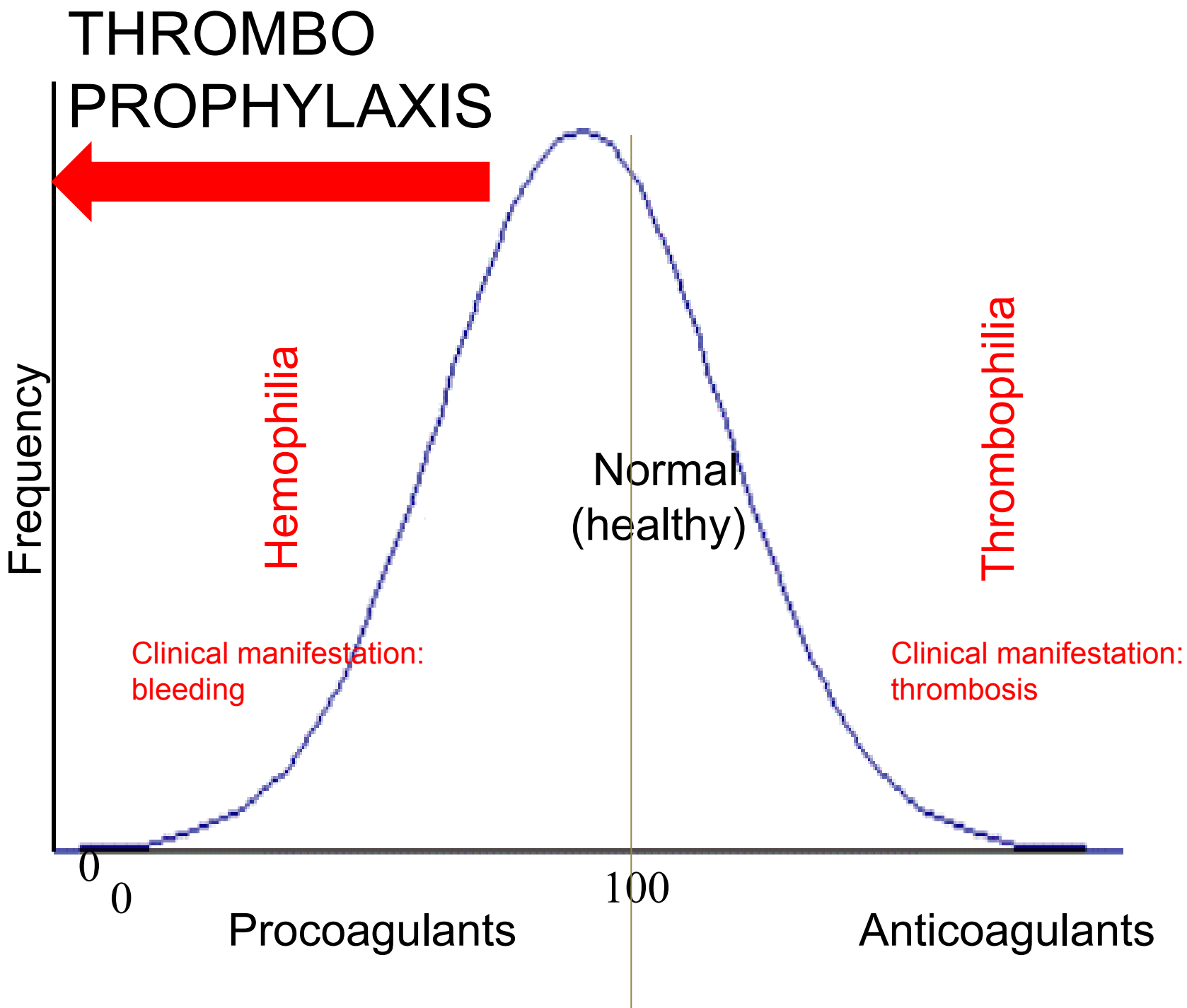
Anticoagulant: Antithrombin III

Serine protease inhibitor
Synthesized in hepatocytes
Common plasma proteine
Inhibits 1:1 Factors II (thrombin), XIIa, XIa, IXa and Xa by complex formation

Distribution of coagulability in the normal population




OPERATION
Frequency
Hemophilia
Normal
(healthy)
Thrombophilia
Clinical manifestation:
bleeding
Clinical manifestation:
thrombosis
0
0
100
Procoagulants
Anticoagulants

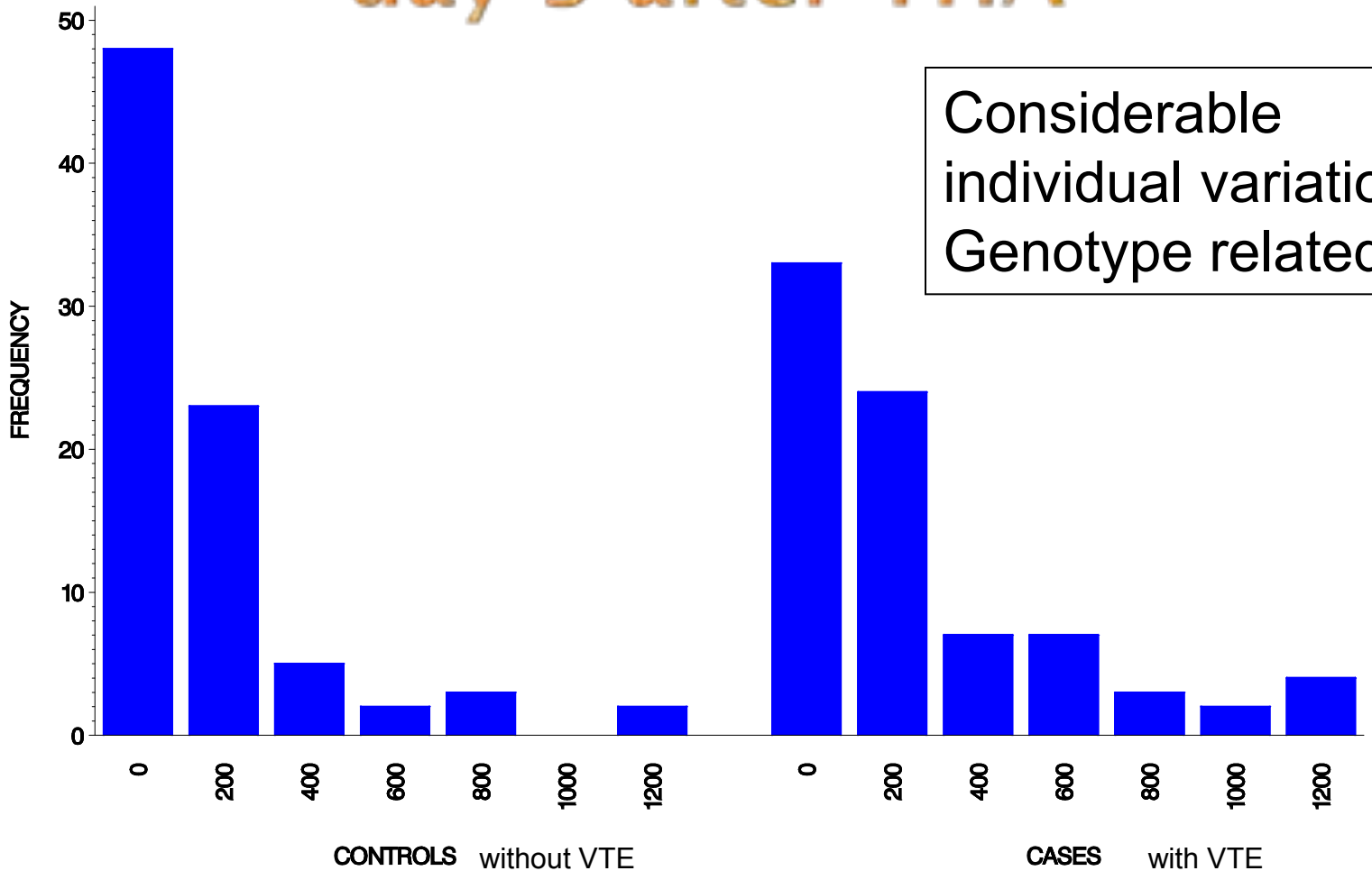

THROMBO
PROPHYLAXIS
Frequency
Hemophilia
Normal
(healthy)
Thrombophilia
Clinical manifestation:
bleeding
Clinical manifestation:
thrombosis
0
0
100
Procoagulants
Anticoagulants

Genetic variation

"The responsiveness in active thrombin generation to the same tissue factor challenge varies between individuals by 30-fold"

Mann KG et al. Does genotype predict phenotype ? Evaluations of the hemostatic proteome. J Thromb Haemost 2004;2:1727-34

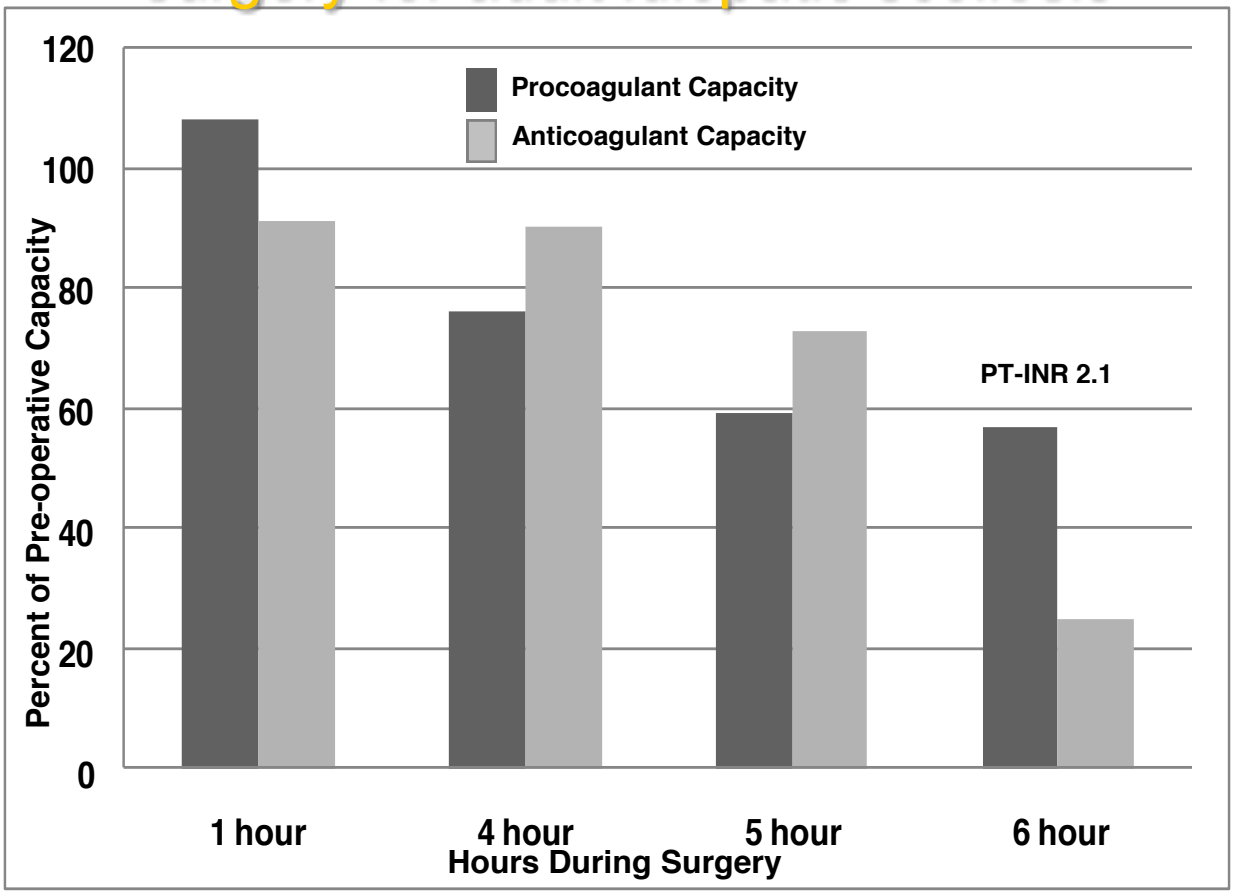
F1+2 excretion (pmol/L) in urine day 3 after THA



Considerable individual variations
Genotype related?

Borris LC, Breindahl M, Lassen MR, Pap AF, Misselwitz F. Differences in urinary prothrombin fragment 1+2 levels after total hip replacement in relation to venous thromboembolism and bleeding events. J Thromb Haemost 2008; 6: 1671- 9.

Dynamic changes of coagulation during surgery for adult idiopatic scoliosis



Blood loss > 1 L during 6 hours. Decreased procoagulable capacity reaching steady state after 5-6 h (INR 2.1 efter 6 hours) (consumption)

Sharp decline in anticoagulable capacity between 4 to 6 h which may result in a hypercoagulable state

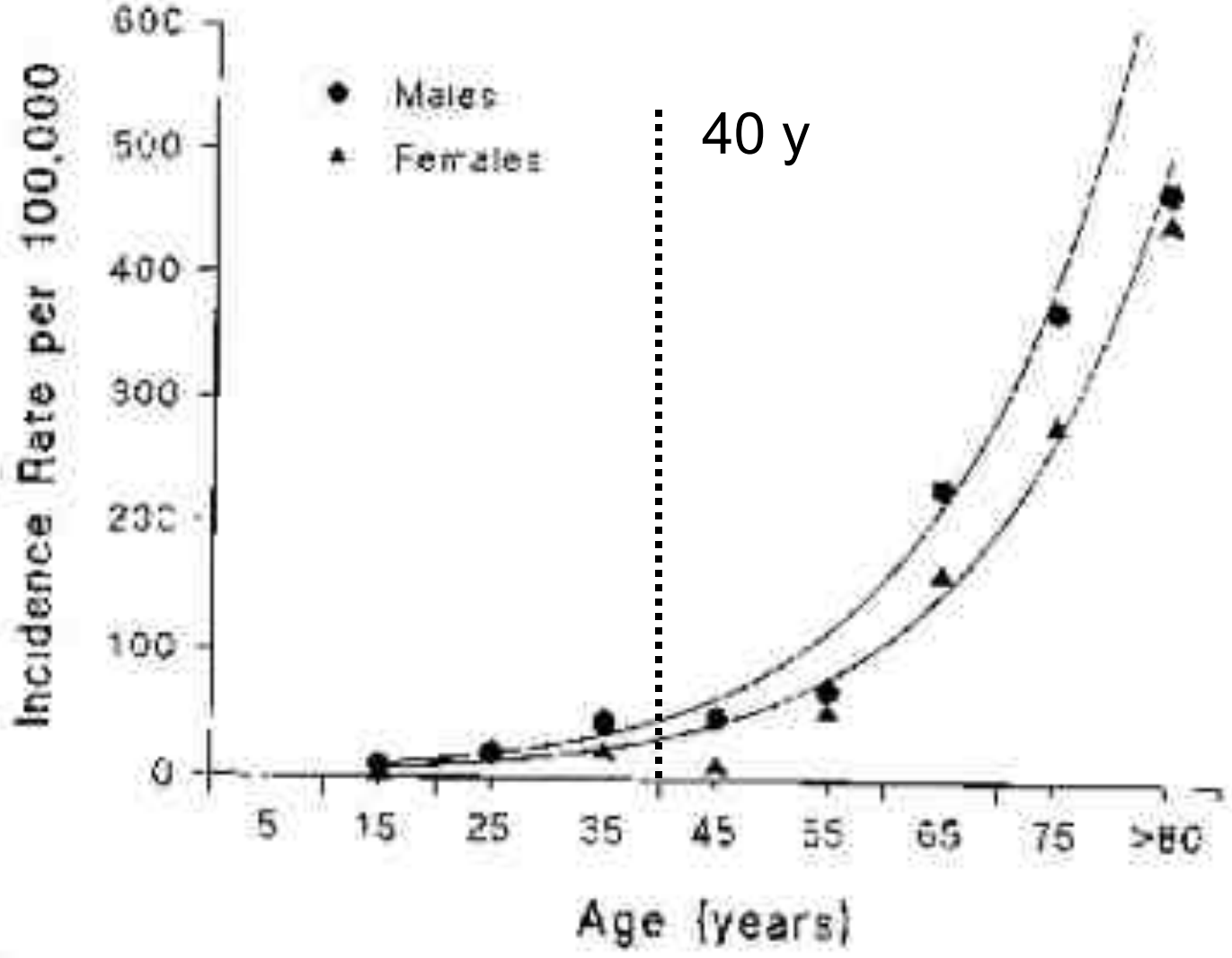
Stutz C, Rear LD, O'Neill KR, Tamborski ME, Crosby CG, Devin CJ, Schoenecker JG. Coagulapathies in orthopaedics: Links to inflammation and the potential of individualizing treatment strategies. J Orthopedic Trauma 2013; 27: 236-41.

General risk factors for VTE in surgery

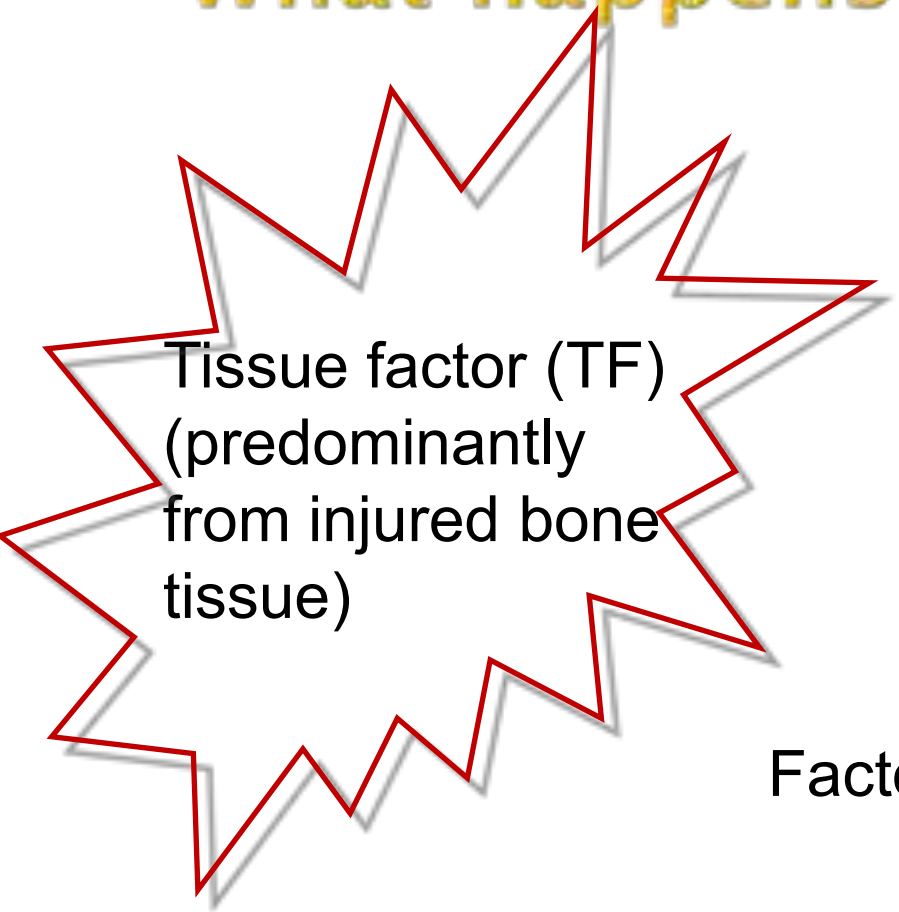
Phenotype:

- Age > 40 y
- Cancer
- Heart disease
- Diabetes
- Immobility
- Adipositas (BMI>30)
- Previous VTE (PE/DVT)

Importance of age
(incidense of clinical PE/DVT per 100,000)



What happens during surgery?



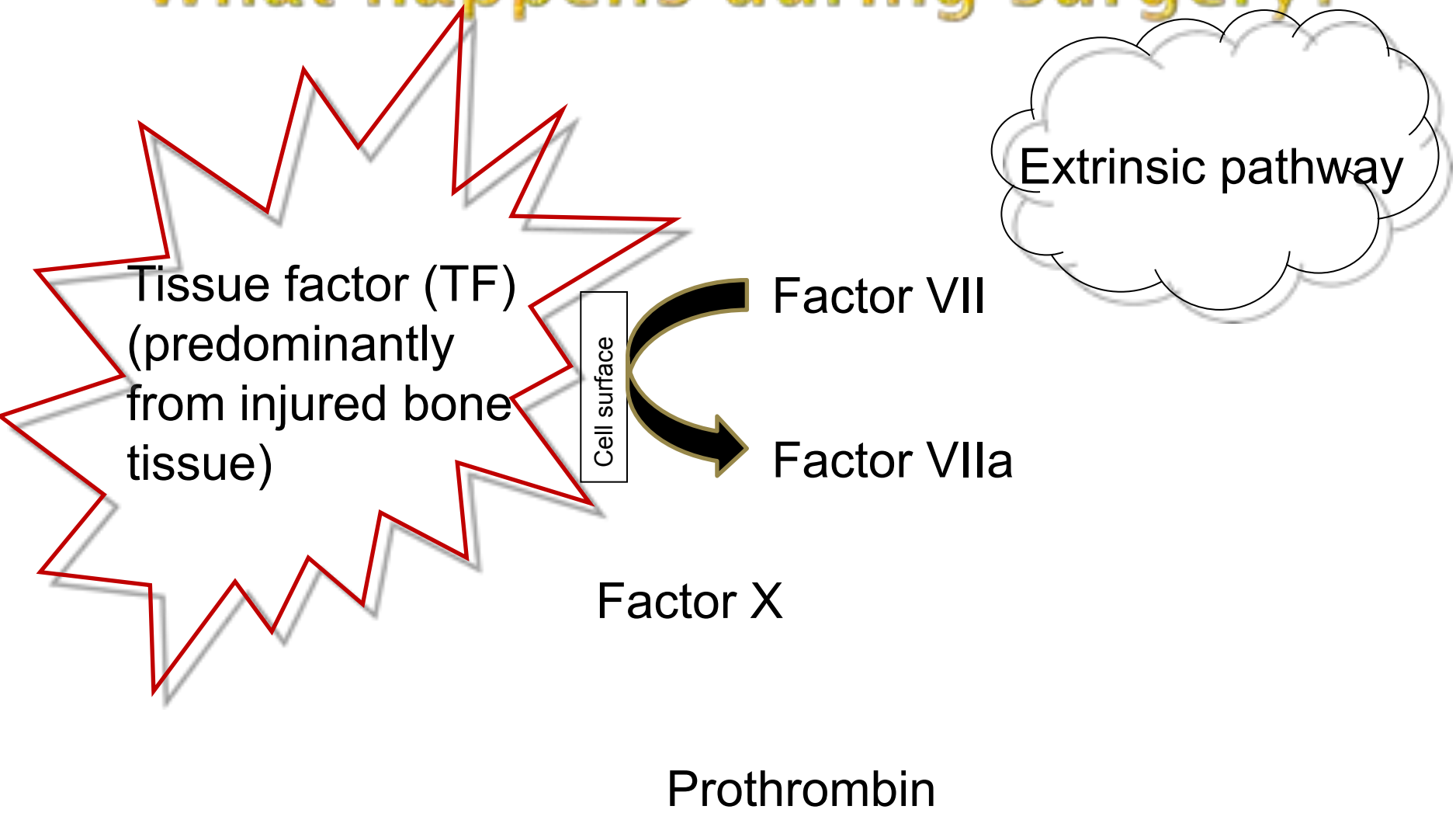
Extrinsic pathway

Factor VII

Factor X

Prothrombin

What happens during surgery?



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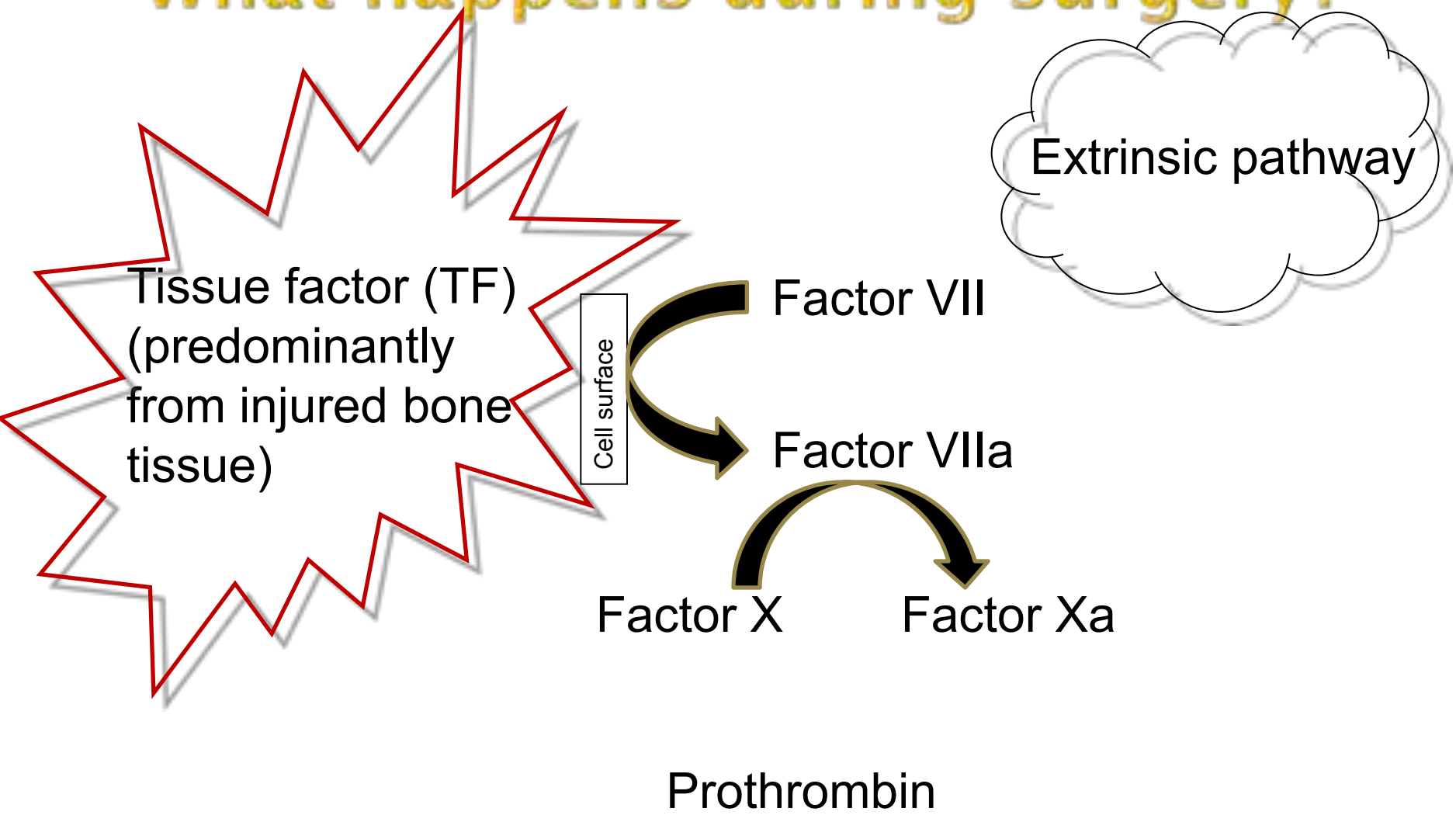

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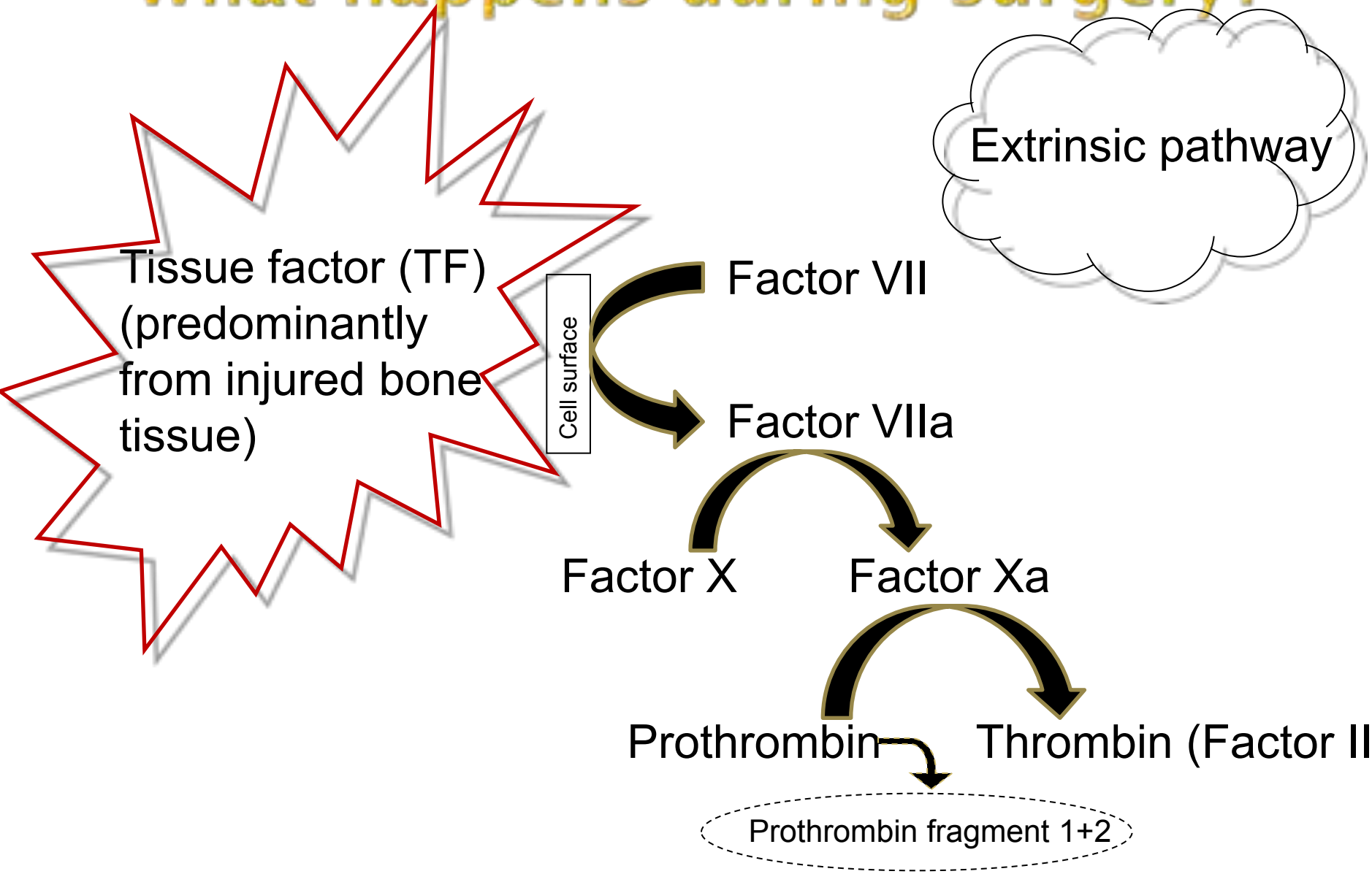

Epidemiology of VTE

Virchow's Triad

All components are involved after orthopaedic surgery

Characteristics of the arthroscopy patient

Risk factor	THA/TKA/HF	Knee arthroscopy
Age	> 40 y	< 40 y
Weight	BMI > 30	BMI < 30
Heart disease	Common	Uncommon
Diabetes	Common	Uncommon
Cancer	Common	Uncommon
Previous VTE	Common	Uncommon
Chronicly decreased mobility before operation	Common	Uncommon
Thrombophilia	?	?
Hospitalized	Often	Day-surgery

Additional risk factors in orthopaedic surgery

- THA or TKA
- Lower extremity fractures
- Multiple trauma
- Bandages (immobility)
- Tourniquet
- Duration of operation
- Use of implants

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- Duration of operation
- Use of implants (bone trauma)

Classical risk grading (%)

	Low risk	Moderate risk	High risk
Fatal PE	0.002	0.1-0.4	1-5
Proximal DVT	0.4	2-4	4-10
Distal DVT	2	10-20	20-80

*without active thromboprophylaxis, objective diagnosis

Geerts WH et al. Prevention of venous thromboembolism. Chest 2008; 133: 381S-453S.

Classical risk grading (%)

	Low	Moderate	High
Fatal PE	0.002	0.1-0.4	1-5
Distal DVT	2	10-20	20-80

Total risk is dynamic and not static

Geerts WH et al. Prevention of venous thromboembolism. Chest 2008; 133: 381S-453S.

Privious findings in arthroscopy

Meta-analysis of clinical studies in arthroscopy patients
6 studies, N=684

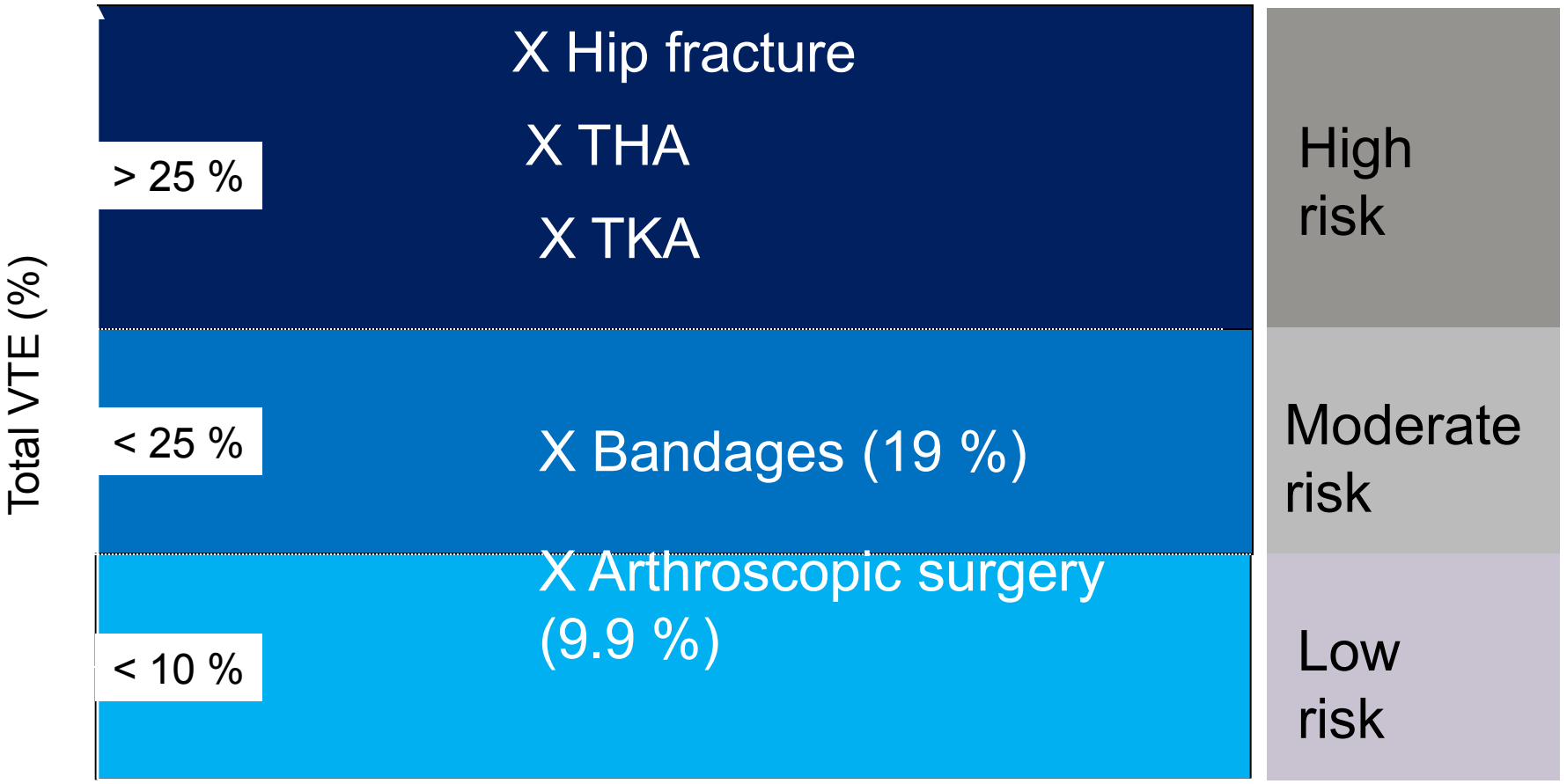
Findings in patients having no thromboprophylaxis:
Phlebography used for screening in 2 studies, ultrasound in 4

Result:
Overall DVT rate: 9.9 %

Proximal DVT: 2.1 %

Ilahi OA, Reddy J, Ahmad I. Deep venous thrombosis after knee arthroscopy: a meta-anamysis. Arthroscopy 2005; 21: 727-63

VTE risk rates for different orthopaedic patient categories without thromboprophylaxis



*objective diagnosis; mostly asymptomatic DVT events

A recent population study

USA (Olmsted County, MN)
Period: 1988 – 2005 (17 years)
Procedure: knee arthroscopy (+/- type of surgery not indicated)
Number of patients: 4833
End-point: symptomatic VTE (PE and DVT) within 3 months postop.
No routine thromboprophylaxis used

VTE incidence: 0.4 % (16 DVT, 1 PE, 1 DVT + PE within 6 weeks after surgery, no events later
Cumulative incidence rates at 7, 14 and 35 days: 0.2 %, 0.3 % and 0.4 %
Observed all cause deaths : 6 vs. expected : 5.2
P= 0.73

Mauck KF, Froehling DA, Daniels PR, Dahm DL, Ashrani AA, Crusan DJ, Petterson TM, Bailey KR, Heit AJ. Incidence of venous thromboembolism after elective knee arthroscopic surgery: a historical cohort study. J Thromb Hemost 2013; 11: 1279-86.

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Risk factors: old age (hazard ratio = 1.34 per 10-years increase of age P = 0.03).
Hospitalization before or after arthroscopy (hazard rate = 14.1 $p < 0.001$)

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Conclusion:
No recommendation of routine pharmacologic or mechanical VTE prophylaxis in this patient population

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The importance of use of tourniquet

Tourniquet time:
If the tourniquet time exceeds 60 minutes the risk of thrombosis is increased from low to moderate.

Williams et al. Incidence of deep vein thrombosis after arthroscopic knee surgery: a prospective study. Arthroscopy 1995; 11: 701-5.

Demers et al. Incidence of venographically proved deep vein thrombosis after knee arthroscopy. Arch Intern. Med 1998; 158: 47-50.

Influence of surgical time:

Patients who developed DVT tended to have a longer average tourniquet time and surgical time compared with patients who did not develop DVT.

Jaureguito JW et al. The incidence of deep venous thrombosis after arthroscopic knee surgery. Am. J Sports Med 1999; 27: 707-10.

Simple meniscus resection duration: < 60 mins

Ligament reconstruction duration: > 60 mins

Arthroscopic ligament reconstructions per definition: higher VTE risk due to more VF outflow

Basic principles for assessment of the need for thromboprophylaxis

- Operation (with or without bone involvement)
- Individual risk
- Immobility pre- and postoperation
- Anaesthesia
- Tourniquet time
- Operation time

Present recommendations

CHEST

Official publication of the American College of Chest Physicians

Prevention of VTE in Orthopedic Surgery Patients : Antithrombotic Therapy and Prevention of Thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines

Yngve Falck-Ytter, Charles W. Francis, Norman A. Johanson, Catherine Curley, Ola E. Dahl, Sam Schulman, Thomas L. Ortel, Stephen G. Pauker and Clifford W. Colwell, Jr

Chest 2012;141;e278S-e325S
DOI 10.1378/chest.11-2404

Recommendation

4.0. For patients undergoing knee arthroscopy without a history of prior VTE, we suggest no thromboprophylaxis rather than prophylaxis (Grade 2B).

Duration of thromboprophylaxis

When indicated:

For the entire duration of risk (which is largely unknown)

A solution would be to follow the coagulation activity (thrombin generation) post surgery

Urine testing for F1+2 could be a possibility (uF1+2-test)

Untill we have a solution, prophylactic treatment in these patients will be at the discretion of the surgeon

Take home message

There is not much evidence for routine administration of thromboprophylaxis in patients undergoing arthroscopic surgery (VTE incidence rate only 4 out of 1000 ops)

Operations with bone involvement, torniquet time > 60 mins and presence of personal risk factors probably may induce a moderate risk for thromboembolism