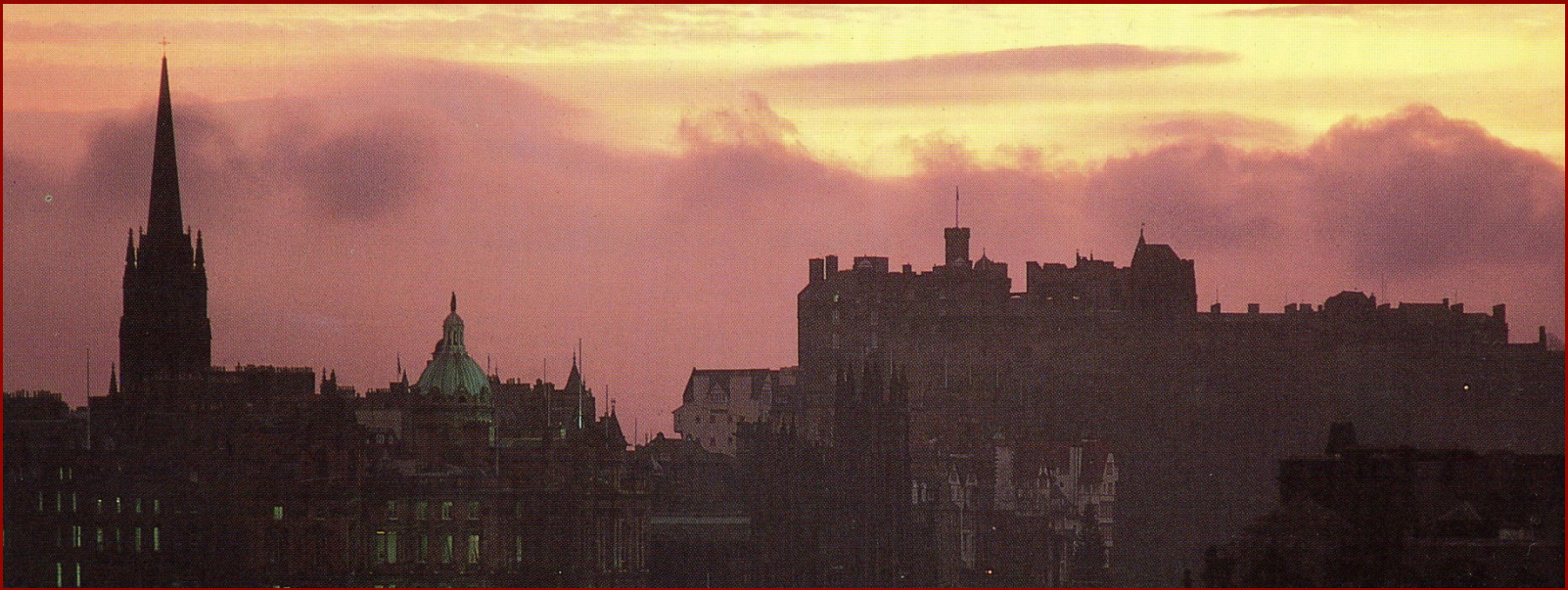




Thromboprophylaxis in Orthopaedic Trauma

JF Keating

Edinburgh Orthopaedic Trauma Unit



Thromboprophylaxis in Orthopaedic Trauma

Does it matter?

Thromboprophylaxis Orthopaedic Trauma

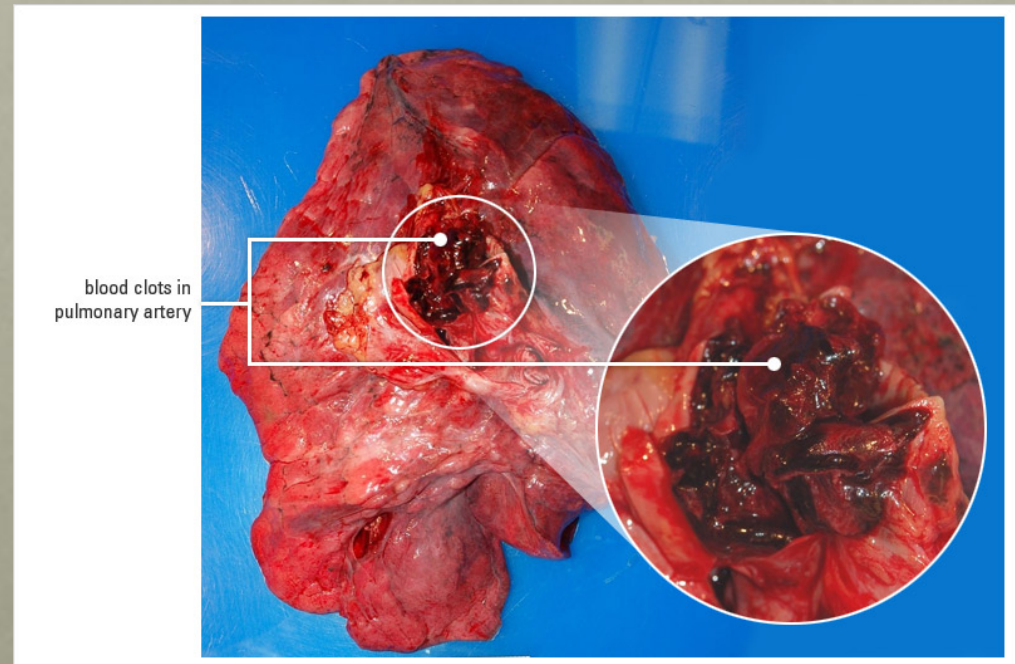
- Bimalleolar ankle fracture
- Required fixation
- Bed pressures
- Waited 2 weeks as an out-patient
- No risk factors/no prophylaxis
- Internal fixation – fatal PE in recovery



Thromboprophylaxis

Orthopaedic Trauma

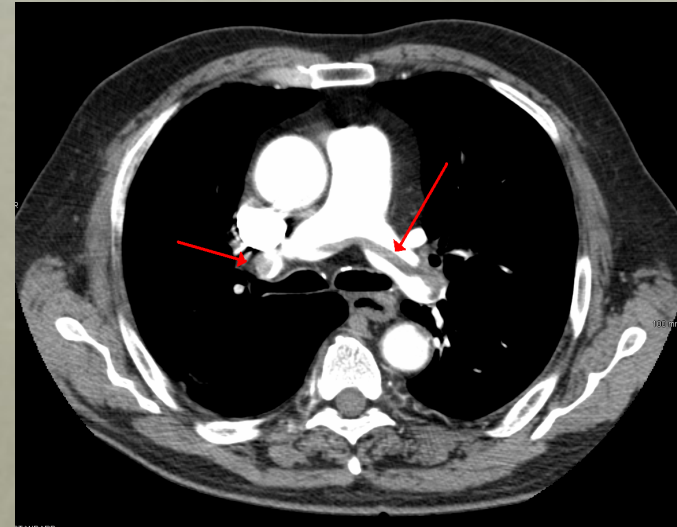
- DVT – not good
- PE – bad
- Fatal PE – very bad
- But rare



Death After Multiple Trauma

Major cause in early survivors

- Multiple organ failure
- Head injury
- Fatal PE
- PE most common late cause



Thromboprophylaxis

Orthopaedic Trauma

- Literature has many limitations
- Dearth of fracture specific data
- Particularly for less common injuries
- Distal femur/plateau = 2 – 3% of operative workload



Management of Fractures

Epidemiology

- Edinburgh Royal Infirmary
- Catchment 750,000
- One trauma centre
- Prospective studies
- What we do with fractures



Management of Fractures

- 7863 fractures
- Nonoperative 75%
- Adult nonop 67%
- Paediatric nonop 92%



COMMON FRACTURES

Which fractures occur most frequently?

9 most common fractures

5576 fractures

- Distal radius
- Hip fracture
- Metacarpal fractures
- Ankle fractures
- Proximal humerus
- Hand phalangeal fractures
- Metatarsal fractures
- Foot phalanges
- Carpal bones



9 most common fractures

- Distal radius
- Hip fracture
- Metacarpal fractures
- Ankle fractures
- Proximal humerus
- Phalangeal fractures
- Metatarsal fractures
- Foot phalanges
- Carpal bones

4629/5953

77% of fracture workload

9 most common fractures

- Distal radius
- Hip fracture
- Metacarpal fractures
- Ankle fractures
- Proximal humerus
- Phalangeal fractures
- Metatarsal fractures
- Foot phalanges
- Carpal bones

4629/5953

77% of fracture workload

% of top 9 treated operatively

- Hip fractures 98%
- Ankle fractures 40%
- Distal radius 30%
- Others <20%



ORTHOPAEDIC TRAUMA

How often do patients develop
DVT/PE?

Incidence after Trauma

German trauma database analysis 2010

7937 cases

DVT 1.16%

PE 0.93%

Incidence after Trauma

Gudipati et al, UK database analysis 2010

18,151 cases

85 PE (0.47%)

Fatal PE 13 (15%)

Mortality due to PE

Elective 0.02%

Trauma 0.15%

Thromboprophylaxis

Orthopaedic risk factors

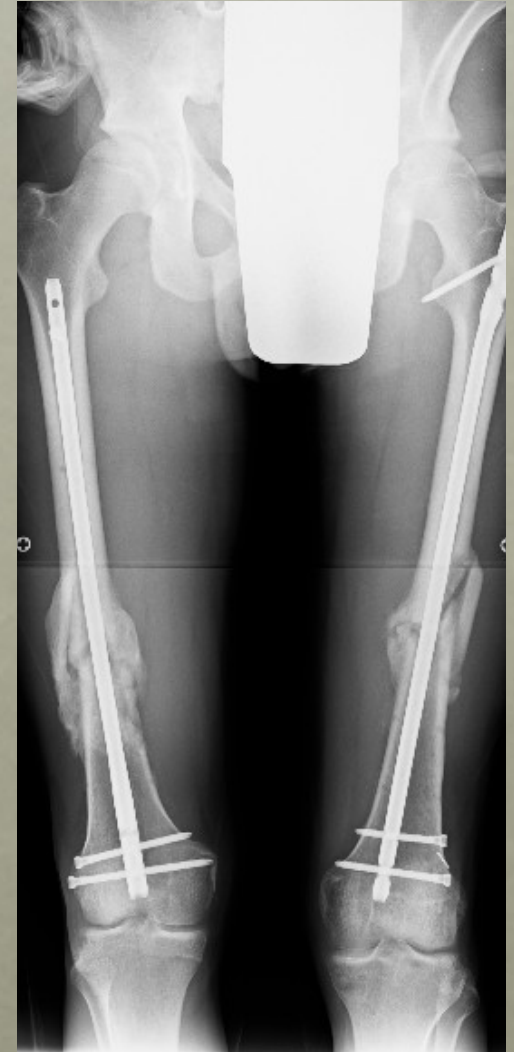
- Spinal injury
- Pelvic injury
- Multiple trauma
- Age, surgery, hospital stay



Thromboprophylaxis

Incidence of DVT

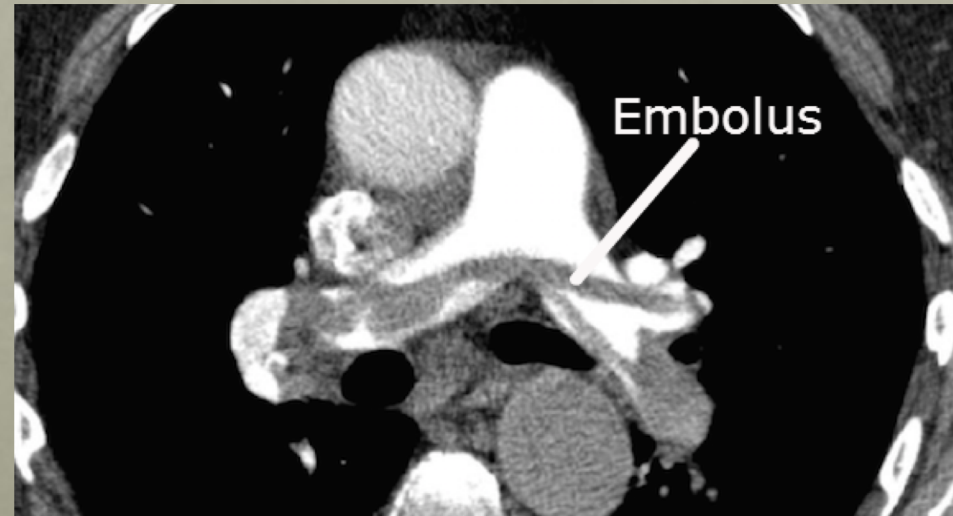
- Abelseth et al, 1996
- Incidence of DVT 9 days post injury
- Venography – 176 cases
- Occult DVT = 28%
- Femoral shaft 40%
- Plateau fracture 43%



Thromboprophylaxis

Incidence of DVT/PE – Gudipati et al, 2010

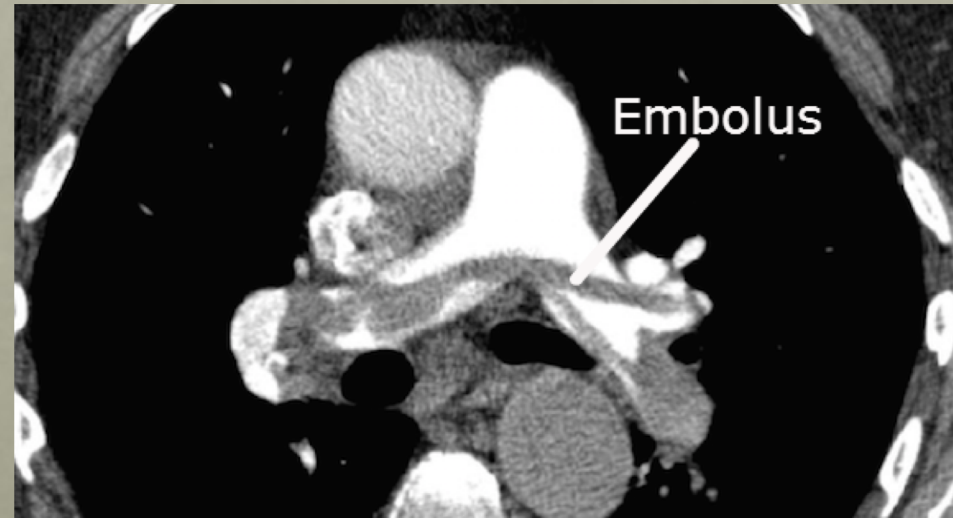
- 18151 patients
- PE 85 (0.47%)
- Fatal PE 13 (15%)
- Concomitant DVT 33%
- Median time to PE 23 days



Thromboprophylaxis

Incidence of DVT/PE – Gudipati et al, 2010

- 18151 patients
- PE 85 (0.47%)
- Fatal PE 13 (15%)
- Concomitant DVT 33%
- Median time to PE 23 days



Relative incidence of PE

- Hip fracture 23%
- Lower limb trauma 57%
- Upper limb trauma 15%
- Pelvis/acetabulum 3%
- Spine 1.5%

Relative incidence of PE

• Hip fracture	23%	<u>80%</u>
• Lower limb trauma	57%	
• Upper limb trauma	15%	
• Pelvis/acetabulum	3%	
• Spine	1.5%	

Thromboembolic events

Poorly reported in orthopaedic literature
What about trauma inpatients?

Thromboprophylaxis – hip fractures

Incidence of DVT/PE at 90 days

- Hip fractures – RIE
- 1000/yr
- VTE 2% in 2017
- Scottish mean 1.7%
- $P < 0.001$



Thromboprophylaxis

Incidence of DVT – early vs late

- Elsworth et al, 2016
- Plateau fractures
- 29 early ORIF; 20 late
- 1 DVT in early group



Meta-analysis of exfix vs ORIF

- Metcalfe et al, 2015
- Complex plateau fractures
- 7 studies; 419 fractures
- 3 studies reported DVT
- 3.8% - no difference



Cochrane Review 2013

Incidence of DVT – plateau fractures

- Fine wire exfix vs ORIF ?
- LISS vs ORIF no difference
- MIF vs ORIF ?
- Bone graft vs cement ?

Thromboprophylaxis

Incidence of DVT – distal femur fracture

- Hart et al, 2017
- 38 cases
- ORIF vs DFA
- DVT 1/38 (2.6%)



Thromboembolism Orthopaedic Trauma

- Pelvis/lower limb main risk
- Risk diminishes proximal – distal
- Hip
- Knee
- Ankle



Thromboembolism

Orthopaedic Trauma

- Hip
 - DVT 2 – 6%
 - PE 1.5%
- Knee
 - DVT < 5%
 - PE < 1%
- Ankle
 - DVT < 2%
 - PE < 0.5%



Thromboprophylaxis

Lower limb fractures

We do not have good data on the true incidence of DVT/PE after many lower limb fractures

Thromboprophylaxis

Lower limb fractures

Prevention of DVT/PE after lower limb fractures

Thromboprophylaxis

Lower limb fractures

- External mechanical devices
 - Foot pumps
 - Compression stockings
- Internal mechanical devices
 - IVC filters
- Pharmacological
 - LMWH
 - Warfarin/aspirin/rivoroxaban



Thromboprophylaxis

Lower limb fractures

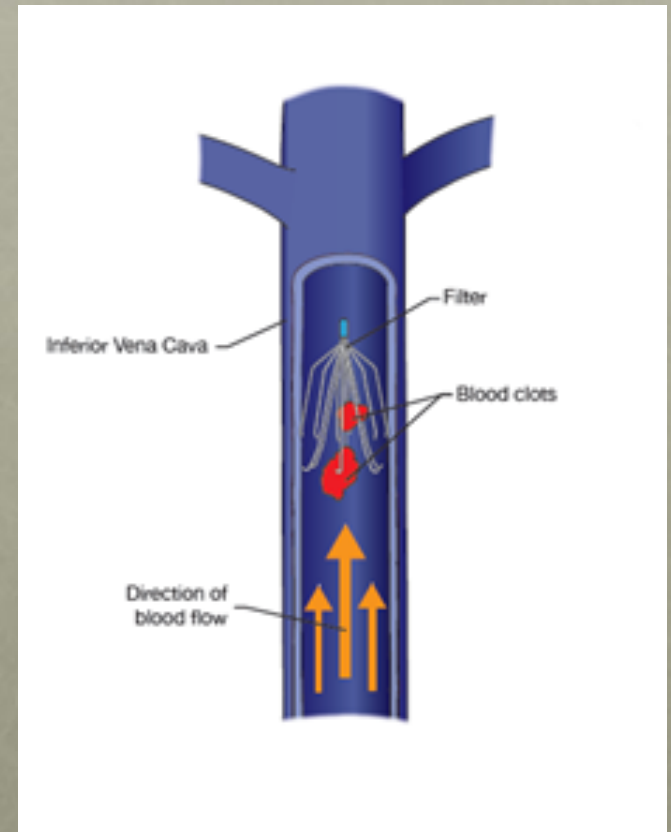
- External mechanical devices
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Thromboprophylaxis

Lower limb fractures

- External mechanical devices
 - Foot pumps
 - Compression stockings
- Internal mechanical devices
 - IVC filters
- Pharmacological
 - LMWH
 - Warfarin/aspirin/rivoroxaban



Thromboprophylaxis

Lower limb fractures

There are is a dearth of trials specifically addressing the issue of thromboprophylaxis after many lower limb fractures

Thromboprophylaxis in Trauma

Cochrane review 2013

- 16 studies; 3005 patients
- Prophylaxis vs nothing decreases DVT
- Chemical better than mechanical
- UH = LMWH
- Mechanical and chemical best

Thromboprophylaxis in Trauma

Hip fractures

- RCTs
- Meta-analysis
- Thromboprophylaxis works
- Rate of symptomatic DVT down
- LMWH most popular



Thromboprophylaxis

Lower limb fractures

Cochrane review 2013

Prophylaxis reduces rate of DVT

No effect on mortality or PE

Thromboprophylaxis NICE report 2017

“Although other types of non-arthroplasty knee surgery were searched for, including osteotomy, fracture surgery and peri-articular trauma, no studies involving these populations were identified for inclusion in this review.”

Thromboprophylaxis Fractures Around the Knee NICE Recommendation

Consider VTE prophylaxis for people undergoing other knee surgery (for example, osteotomy or fracture surgery) whose risk of VTE outweighs their risk of bleeding.

Thromboprophylaxis in Trauma

What should we use? TKR literature

- Aspirin for 14 days
 - or
- LMWH for 14 days
 - or
- Rivaroxaban
- + Compression stockings



Thromboprophylaxis

Plateau fractures

- Davidson and Keating, 2017
- 225 plateau fractures
- All had ORIF
- LMWH while in hospital
- DVT 4/225 (1.7%)
- Non-fatal PE 1 case – 0.4%



Thromboprophylaxis

Lower limb fracture inpatients

- Incidence of asymptomatic DVT probably $> 20\%$
- Symptomatic DVT $< 2\%$
- PE $< 1\%$
- Use LMWH for in-patients
- Post discharge prophylaxis?

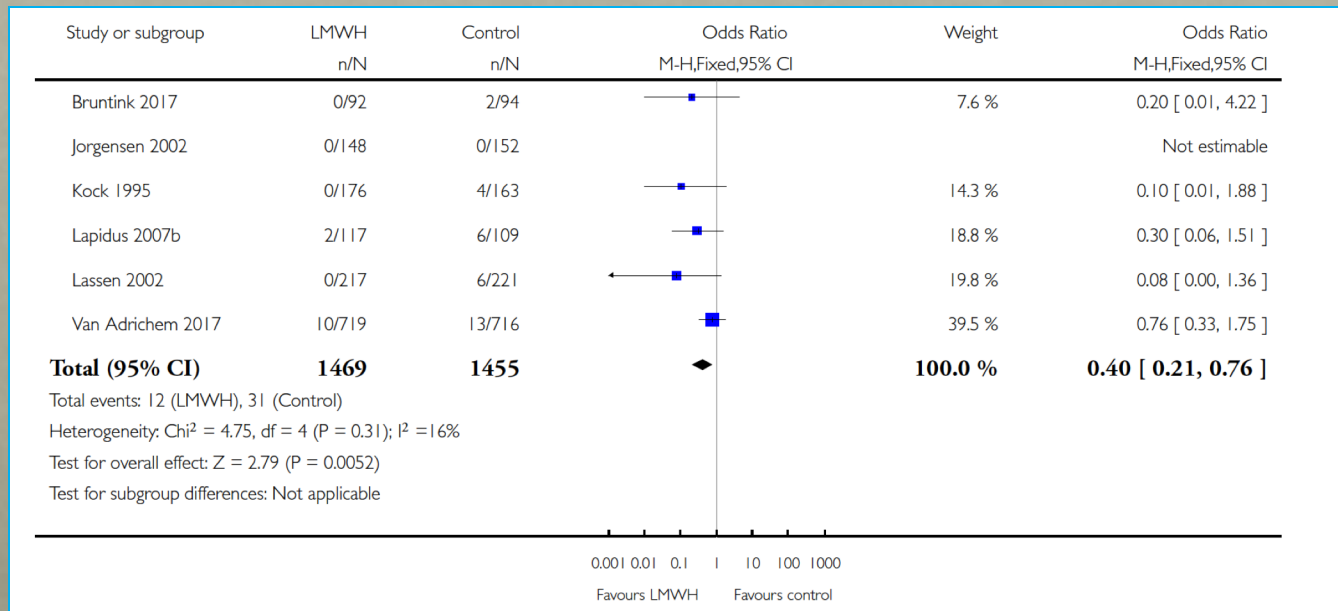


Thromboembolic events

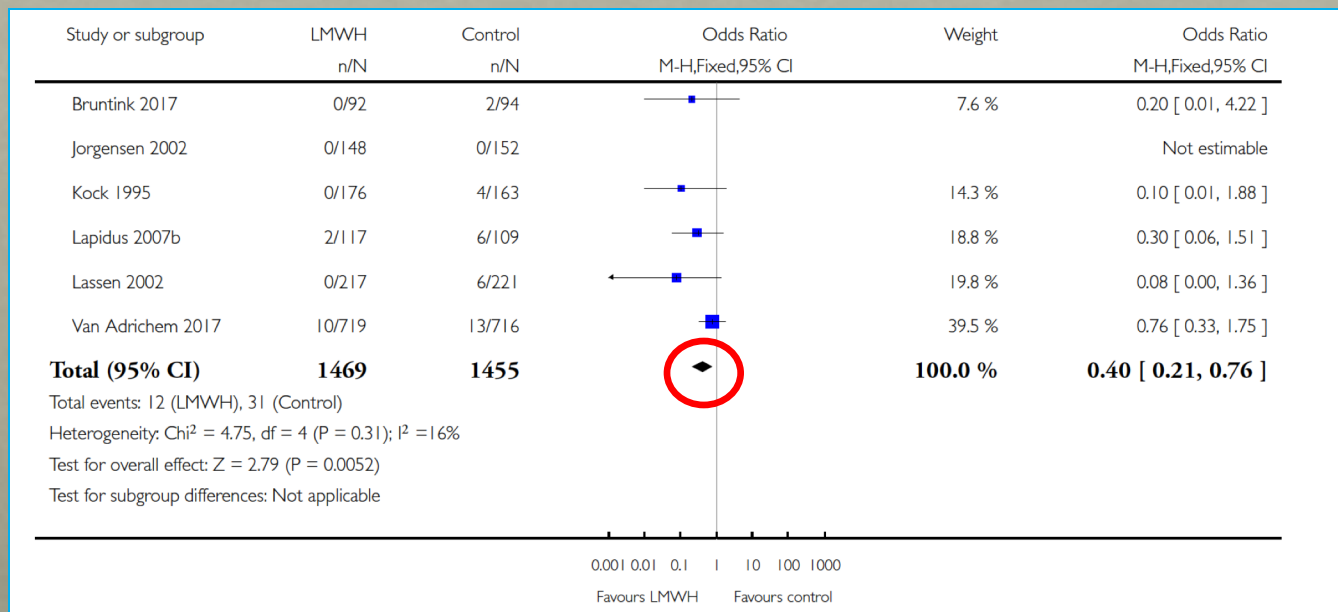
What about trauma outpatients?

The majority!

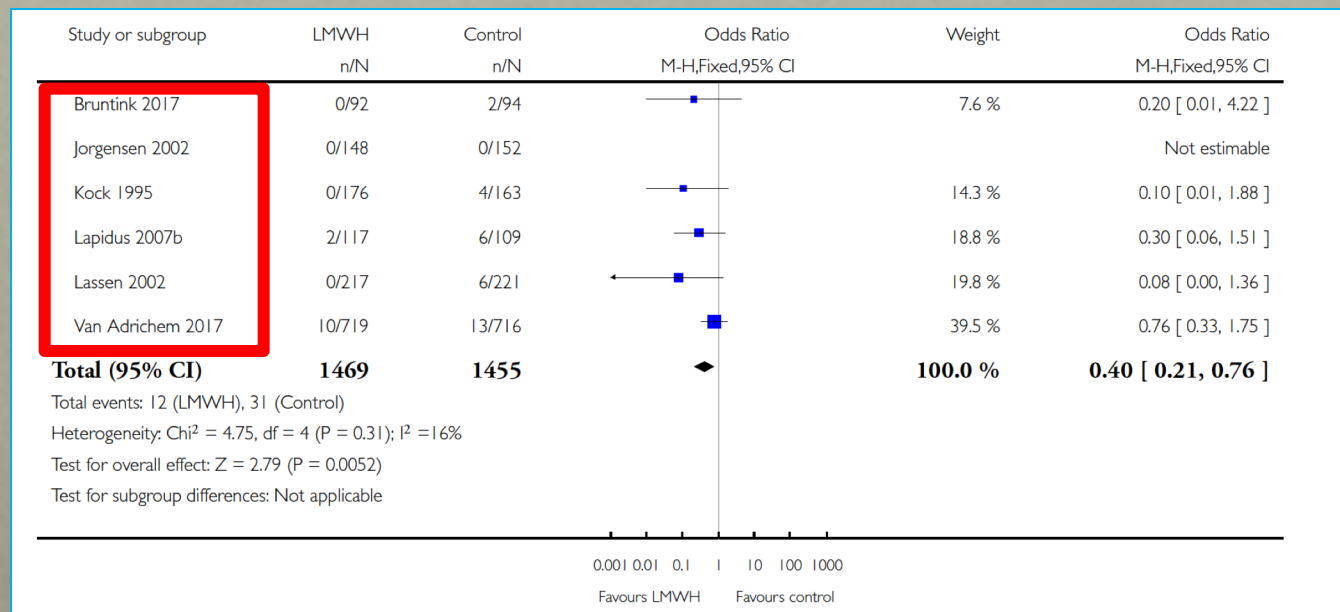
Meta-analyses show LMWH reduces DVT after lower limb injury



Meta-analyses show LMWH reduces DVT after lower limb injury



Meta-analyses show LMWH reduces DVT after lower limb injury



RCTs of thromboprophylaxis

	N	Duration	VTE rate		Conclusion
			Treatment %	Control %	Beneficial?
Lapidus Acta Orth 2007	272	5/52	21	28	no
Goell JBJS Br 2009	238	14/7	9	13	no
Kock Lancet 1995	339	?	0	4.3	yes
Lassen NEJM 2002	440	5/52	9	19	yes
Bruntink Injury 2017	467	4/52	0	11	yes

RCTs of thromboprophylaxis

	N	Duration	VTE rate		Conclusion
			Treatment %	Control %	Beneficial?
Lapidus Acta Orth 2007	272	5/52	21	28	no
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Kock Lancet 1995	339	?	0	4.3	yes
Lassen NEJM 2002	440	5/52	9	19	yes
Bruntink Injury 2017	467	4/52	0	11	yes

RCTs of thromboprophylaxis

	Inclusion criteria
Lapidus Acta 2007	Ankle fractures
Goell JBJS Br 2009	Leg fractures
Kock Lancet 1995	Leg casts
Lassen NEJM 2002	Fracture or TA rupture
Bruntink Injury 2017	Ankle or foot in cast



Venography

Doppler US



30 %

Venography



Doppler US



Clinically Important DVT and PE (CIVTE)



< 30 %

1 %

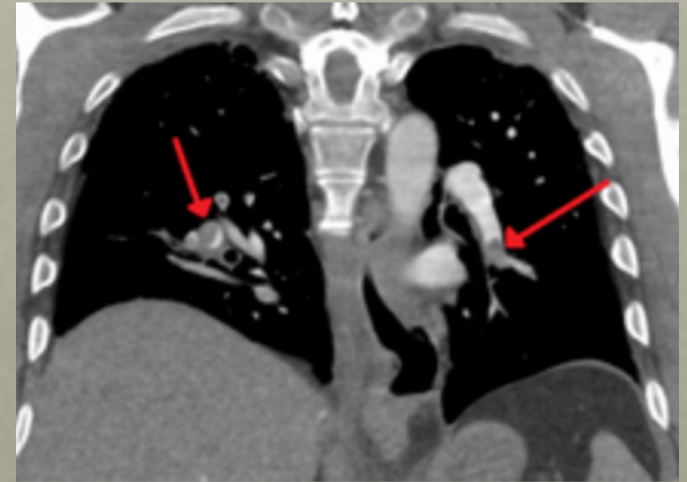
Venography



Doppler US



Clinically Important DVT and PE (CIVTE)

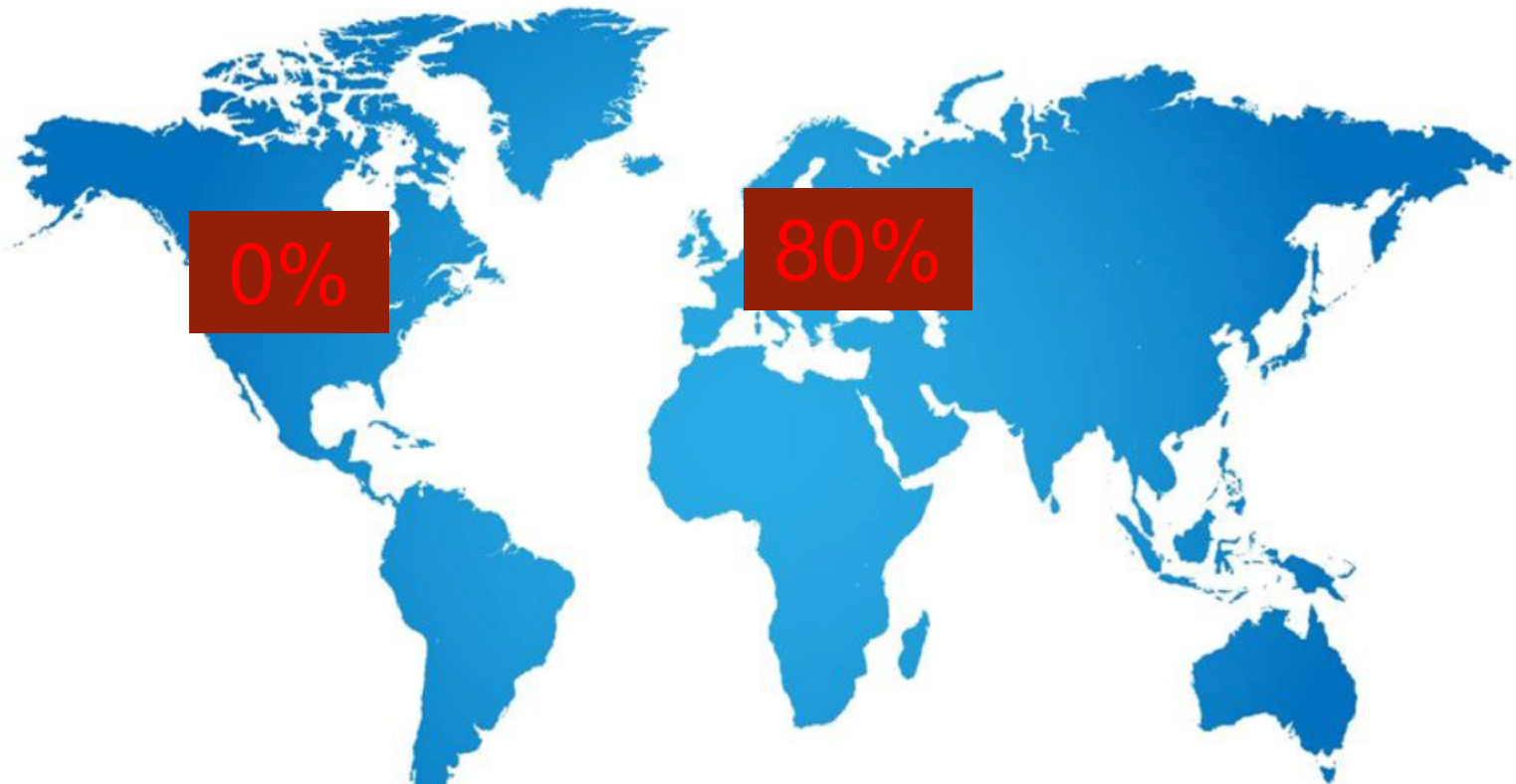


< 30 %

1 %

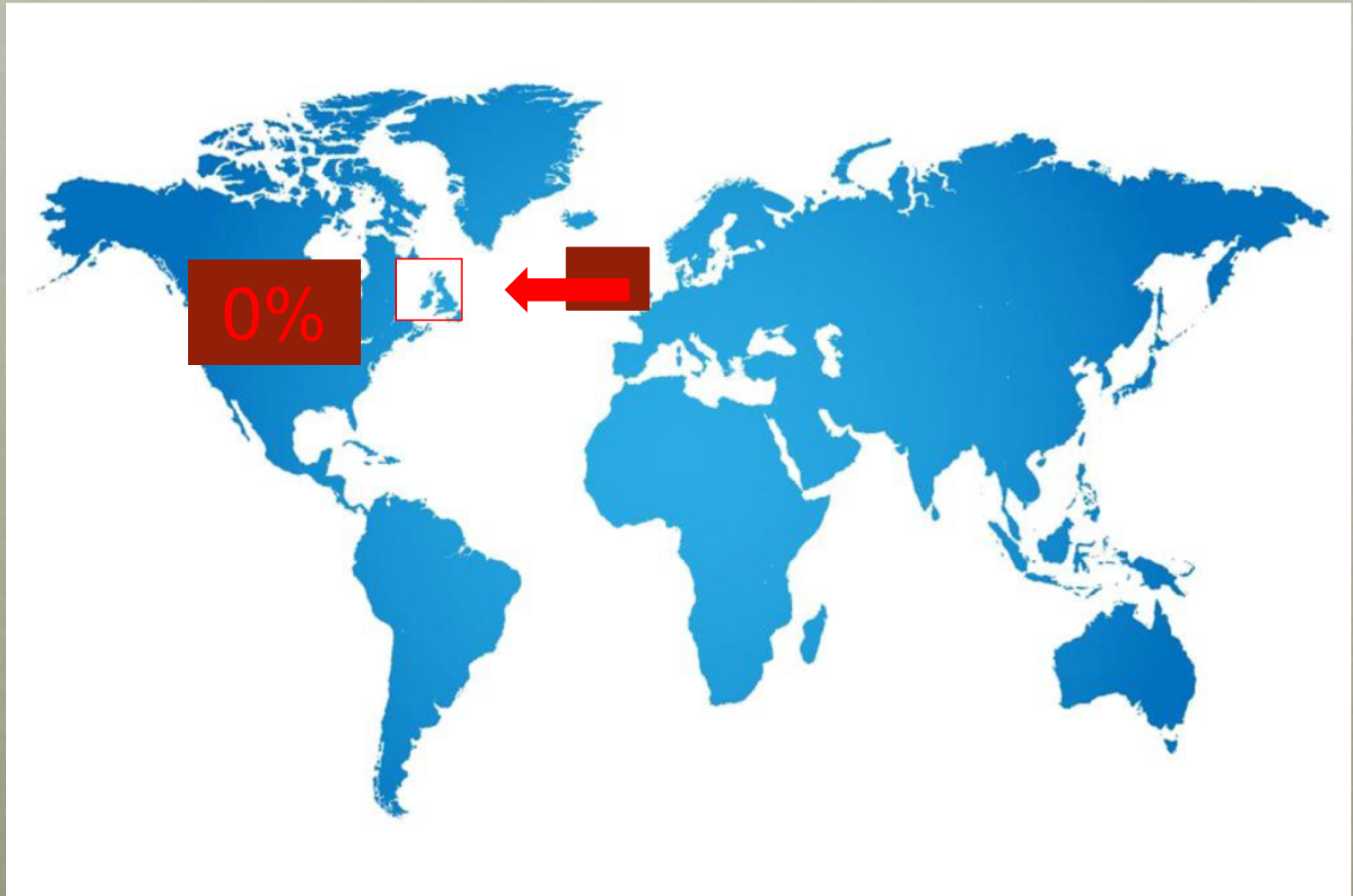
0.01 %





Neth J Med. 2015 Jan;73(1):23-9.

Thromboprophylaxis for lower leg cast immobilisation and knee arthroscopy: a survey study.
van Adrichem RA¹, van Oosten JP, Cannegieter SC, Schipper IB, Nelissen RG.



Edinburgh data

Ankle fractures

AIM

- Primary
 - Identify incidence of CIVTEs
- Secondary
 - Compare this to
 - Background rate of CIVTE
 - Rate following arthroplasty
 - Risk of thromboprophylaxis



Methods

1,283 consecutive patients

Operatively managed	Non operatively managed
415 (32%)	868 (68%)

Early mobilisation
Weight bearing
Supportive cast or orthosis

No pharmacological thromboprophylaxis
except as in-patient



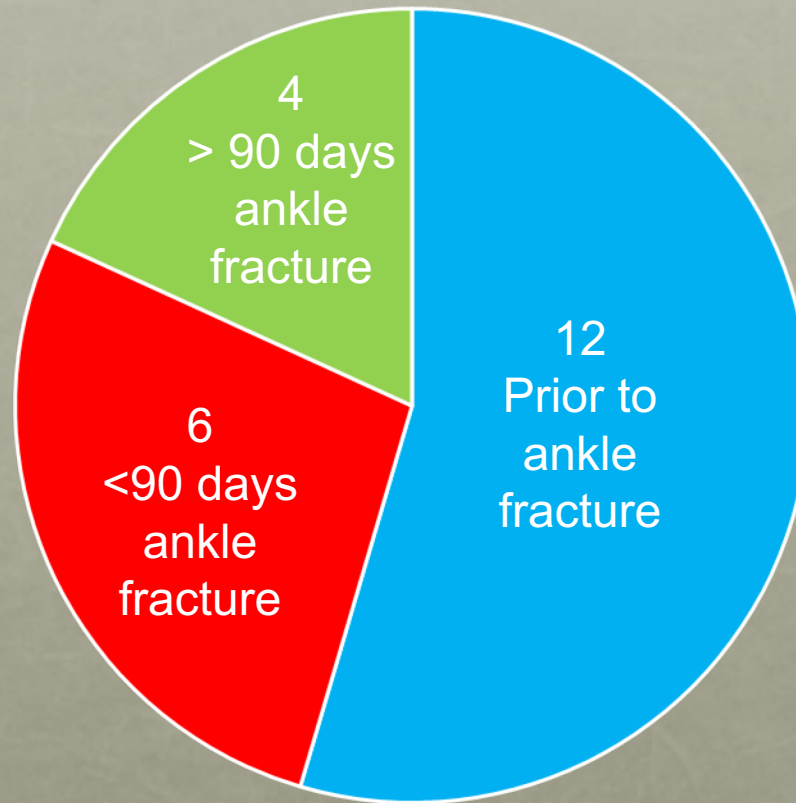
Identification of CIVTEs

- Scottish Hospital Episode Statistics
 - Local hospital database backup
 - All episodes of clinical DVT or PE: 1981 to 2014
-
- 22 / 1,283 patients diagnosed with CIVTEs

1.7% of patients *over 34 year period*

TIMING OF VTES

- 22 patients diagnosed with VTEs



Comparison with background rate

**Background
rate**

5 VTEs /
10,000
patients / year

**90 days post
fracture**

190 VTEs /
10,000
patients / year

Comparison with background rate

**Background
rate**

5 VTEs /
10,000
patients / year

**90 days post
fracture**

190 VTEs /
10,000
patients / year

38 times higher

Comparison with arthroplasty rate

**90 days post
arthroplasty**

2.41%

**90 days post
fracture**

0.72%

Comparison with arthroplasty rate

**90 days post
arthroplasty**

2.41%

**90 days post
fracture**

0.72%

3.3 times lower

Comparison with risk of pharmacological thromboprophylaxis

**Major
haemorrhagic
complications**

2%

**Symptomatic
VTE 90 days
post fracture**

0.72%

Comparison with risk of pharmacological thromboprophylaxis

**Major
haemorrhagic
complications**

2%

**Symptomatic
VTE 90 days
post fracture**

0.72%

2.7 times lower

Conclusion from Edinburgh Data

- Incidence of VTE is very low following ankle fracture
- Although higher than the background rate it is far lower than
 - Incidence of VTE following arthroplasty
 - Incidence of major bleeding following pharmacological thromboprophylaxis

A Double-Blind, Randomized Controlled Trial of the Prevention of Clinically Important Venous Thromboembolism After Isolated Lower Leg Fractures

Rita Selby, MBBS, FRCPC, MSc,† William H. Geerts, MD,* Hans J. Kreder, MD, MSc,‡
Mark A. Crowther, MD, MSc,§ Lisa Kaus,* and Faith Sealey, RN,*
on behalf of the D-KAF (Dalteparin in Knee-to-Ankle Fracture) Investigators*



2	CIVTE	3
2	DVT	2
0	PE	1
2	Minor bleeding	1



2	CIVTE	3
2	DVT	2
0	PE	1
2	Minor bleeding	1

**2% overall
rate CIVTE**



2	CIVTE	3
2	DVT	2
0	PE	1
2	Minor bleeding	1

Unable to show an effect
-even if groups doubled in
size –

Steering committee
stopped study early

The NEW ENGLAND
JOURNAL *of* MEDICINE

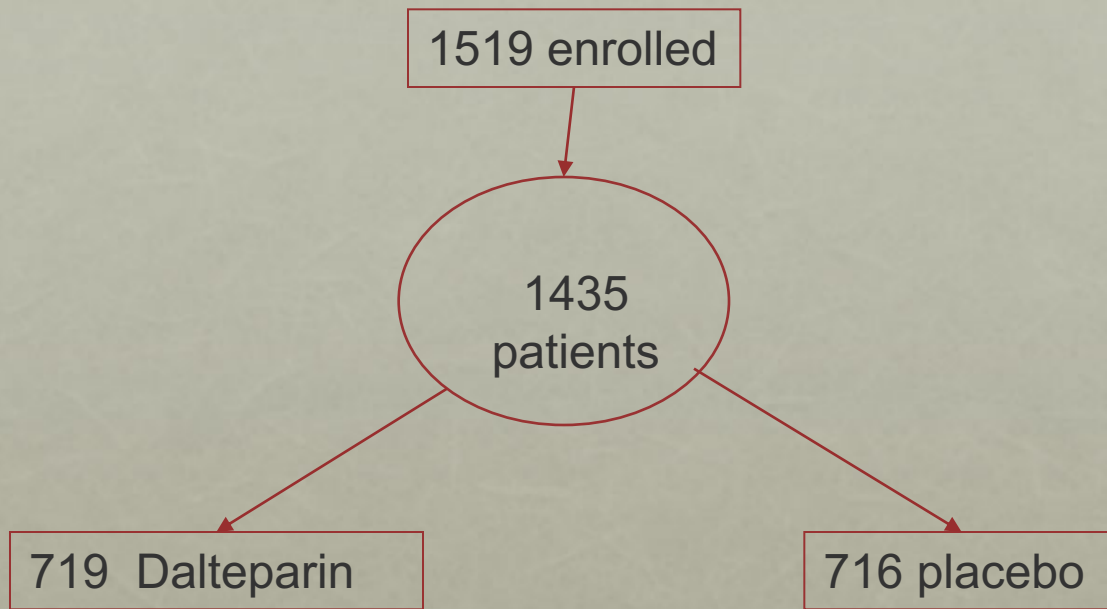
ESTABLISHED IN 1812

FEBRUARY 9, 2017

VOL. 376 NO. 6

Thromboprophylaxis after Knee Arthroscopy
and Lower-Leg Casting

Raymond A. van Adrichem, M.D., Banne Nemeth, M.D., Ale Algra, M.D., Ph.D., Saskia le Cessie, Ph.D.,
Frits R. Rosendaal, M.D., Ph.D., Inger B. Schipper, M.D., Ph.D., Rob G.H.H. Nelissen, M.D., Ph.D.,
and Suzanne C. Cannegieter, M.D., Ph.D., for the POT-KAST and POT-CAST Group*



Final analysis

10	CIVTE	13
6	DVT	8
3	PE	4
1	Minor bleeding	0

1.4% vs
1.8% CIVTE
-ns

Conclusions from two RCTs

- Incidence of CIVTE is low
 - Prophylaxis is ineffective in reducing these events
1. Ratio of risk : benefit unlikely to be favourable
 - Number needed to harm (HIT, bleeding)
 - Unless a high-risk group can be detected
 2. Ratio of cost : benefit unlikely to be favourable

Conclusions from two RCTs

- Incidence of CIVTE is low
- Prophylaxis is ineffective in reducing these events
 1. Ratio of cost : benefit unlikely to be favourable
 2. Ratio of risk : benefit unlikely to be favourable
 - Number needed to harm (HIT, bleeding)
- Irrelevant unless a high-risk group can be detected

Thromboembolic events

Is there a role of thromboprophylaxis in trauma outpatients?

Not for the majority!

Thromboembolic events

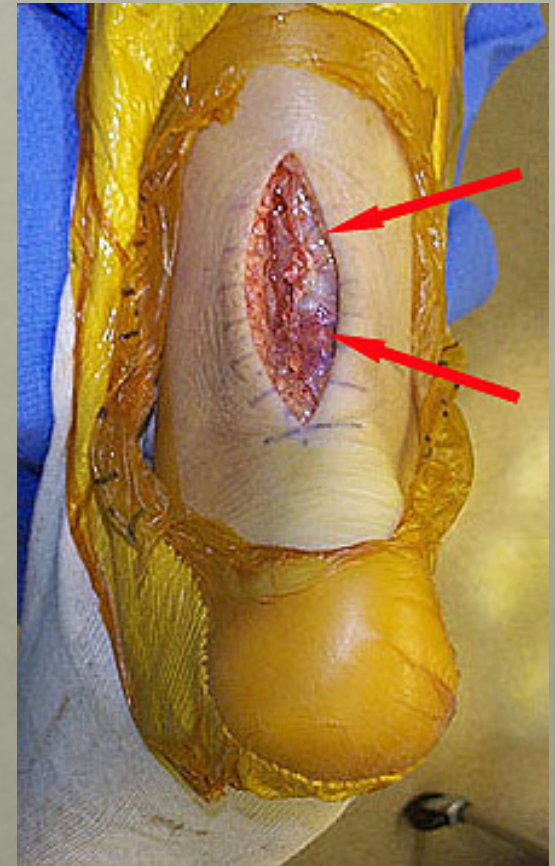
Is there a role of thromboprophylaxis in trauma outpatients?

But what about high risk patients?

Thromboprophylaxis

Outpatient trauma population

- Some injuries higher risk – TA rupture
- High risk patients
- History of DVT/FH of DVT
- Prothrombotic condition
- Other risk factors e.g. malignancy



Thromboprophylaxis

Outpatient trauma population

- Change of policy
- Risk screening
- High risk injuries
- Other risk factors
- Offer thromboprophylaxis
- Evidence – duration and agent?



Thromboprophylaxis

Inpatient trauma population

- Routine thromboprophylaxis
- LMWH and mechanical
- Duration of inpatient stay
- Extended prophylaxis for high risk



Thromboprophylaxis

Summary – Outpatient trauma population

- Upper limb fractures – no prophylaxis
- Lower limb fractures immobilised
- Risk assess patients
- High risk patients
- Offer prophylaxis



Thromboprophylaxis Summary

- Thromboprophylaxis prevents DVT in trauma patients
- Many agents are effective
- Chemical and mechanical for inpatients
- Newer oral anti-coagulants for high risk outpatients
- Fatal PE – RCT of > 100,000 patients needed

Thank you



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