

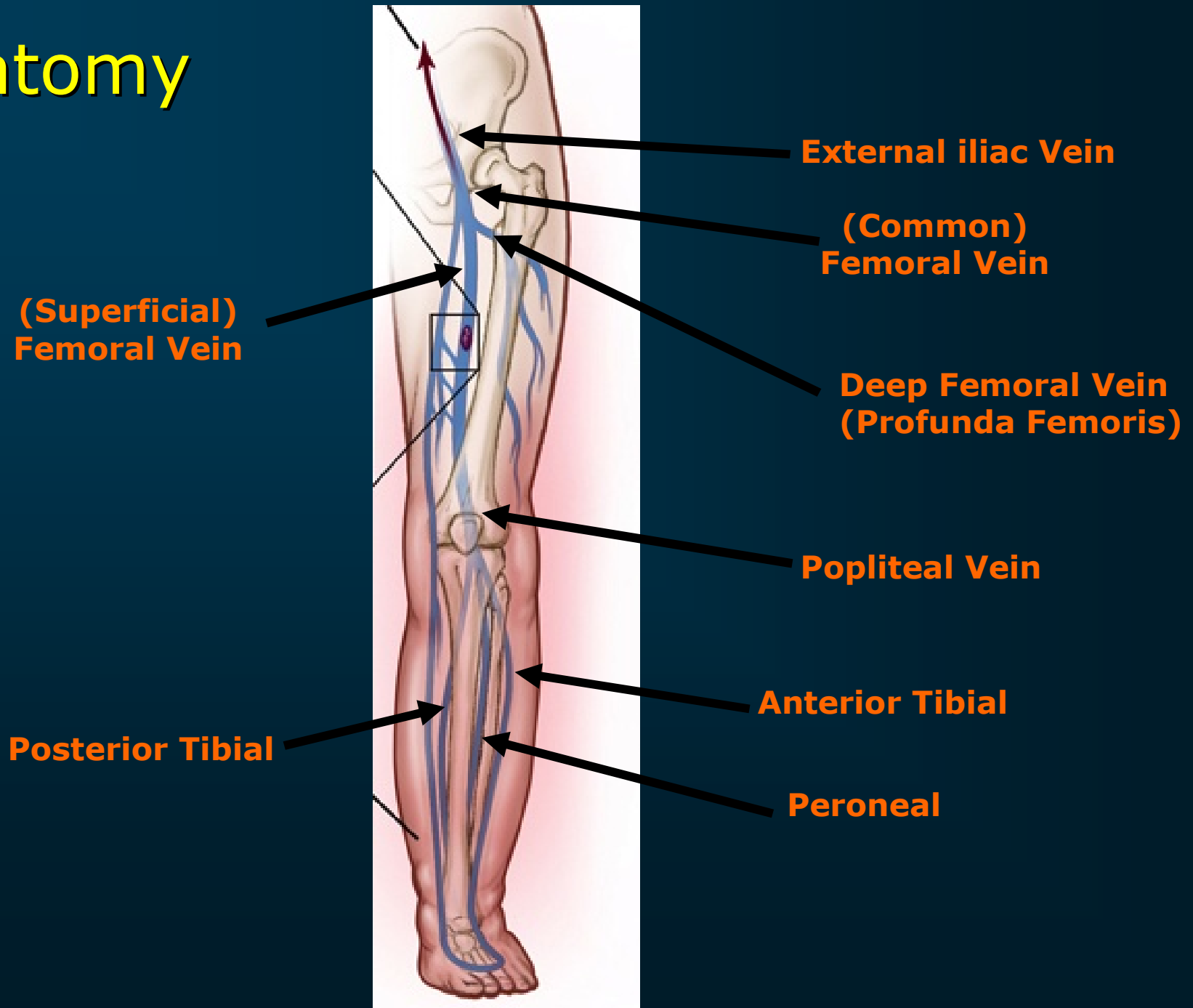
Deep Vein Thrombosis and Post-Thrombotic Syndrome

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Deep Vein Thrombosis

Anatomy



Proximal vs Distal DVT

Proximal

- Femoral/Popliteal veins = "Above knee"

Distal

- Tibial/Peroneal veins
- Gastrocnemius/Soleal veins = "Below knee"

What is Deep Vein Thrombosis?

- Formation of thrombus within the deep veins of the upper or lower limb
- Primary pathology of venous system
- Results in significant morbidity and mortality
- Inpatients
 - 48 per 100,000 develop DVT
 - 23 per 100,000 develop PE
 - Inpatient mortality from VTE = 12%

Incidence

- 1-2 per 1000 per year
 - 2/3 are DVT
 - 1/3 PE
 - Risk doubles every decade after age 40
- Major complications
 - Post thrombotic syndrome (PTS)
 - Death (PE)
 - Bleeding (Warfarin)

Risk Factors

- Surgery 20%
- Trauma 12%
- PHx - DVT / PE 25%
- Immobility (Hospital or Nursing Home) 8%
- Lower Extremity paresis 3%
- Cancer 4-6%
- Hormone replacement therapy 2%
- Oral Contraceptive pill 3%
- Inherited Thrombophilia
 - Factor V Leiden
 - Protein C, S deficiency
 - Lupus

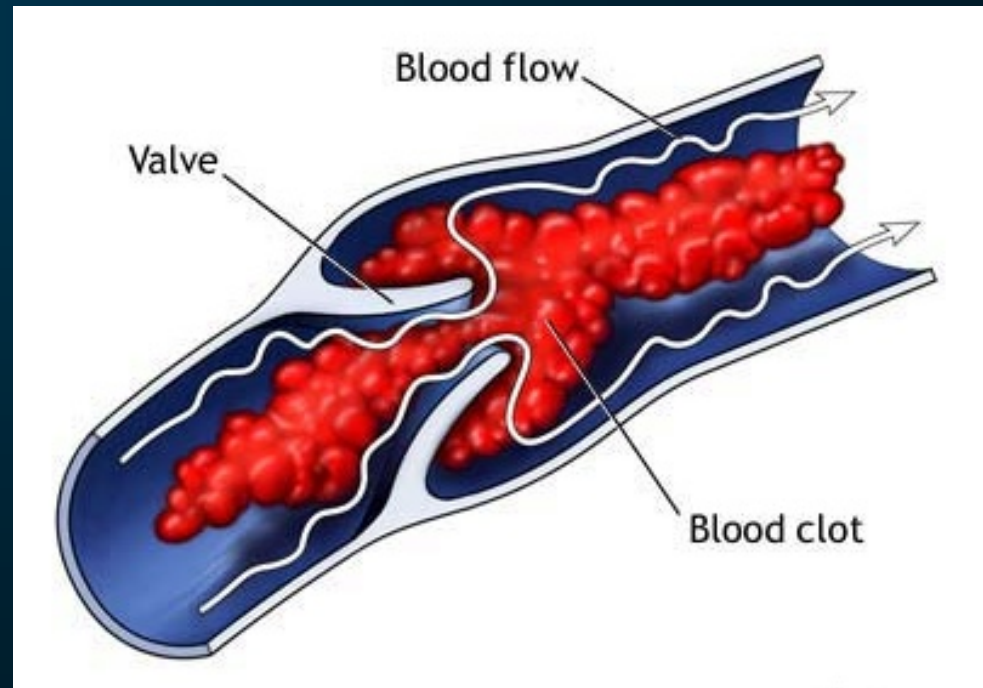
- Pregnancy
- Heart Disease
- Obesity
- Sepsis
- Age
- Gender (Female > Male)
- Sedentary occupation
 - Seated Immobility Thromboembolism Syndrome (SIT)

Pathogenesis

Virchow's triad (1856)

- Stasis
- Venous Injury
- Hypercoagulability

- Location
 - Valve pockets
 - Site of venous injury
 - Calf usually 1° site



Symptoms of DVT

- Swelling
- Pain, Tenderness
- Pitting Oedema
- Distension of superficial vessels
- Positive Homan's sign
- Shortness of breath
- Cutaneous erythema



Clinical Assessment

- Large differential diagnosis
 - Ruptured Baker's cyst
 - Cellulitis
 - Haematoma
 - Compartment syndrome
 - Superficial thrombophlebitis
 - Lymphoedema
 - CHF
 - Adenopathy
- Need standardised procedure...

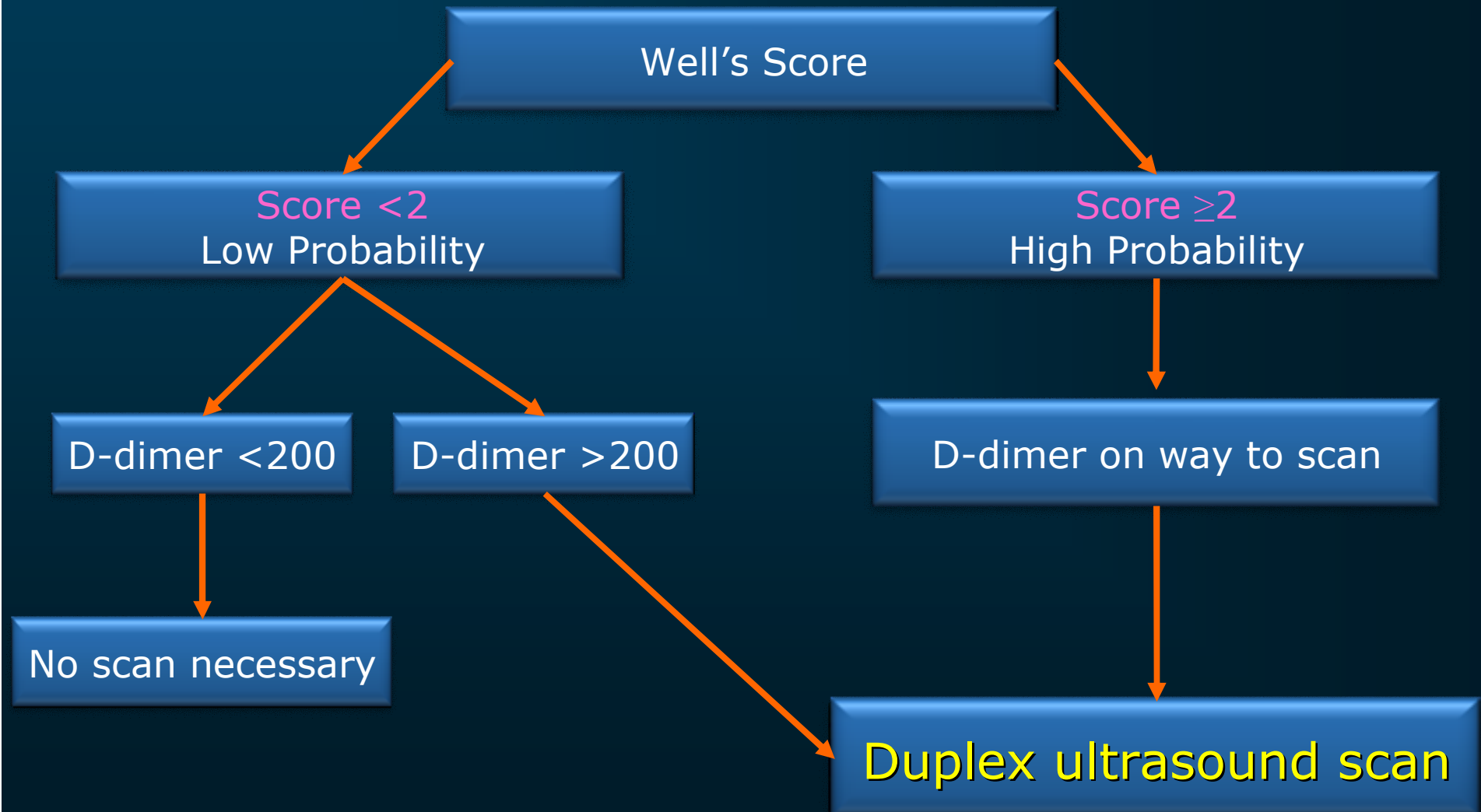
Well's Criteria

Clinical Features	Score
Active cancer (treatment ongoing, or within 6/12 or palliative)	1
Paralysis or recent plaster immobilization of the lower extremities	1
Recently bedridden for >3/7 or major surgery <4/52	1
Localized tenderness along the distribution of the deep venous system	1
Entire leg swelling	1
Calf swelling >3 cm compared to the asymptomatic leg	1
Pitting edema (greater in the symptomatic leg)	1
Previous DVT documented	1
Collateral superficial veins (non varicose)	1
Alternative diagnosis (as likely or > that of DVT)	-2

D-dimer

- Byproduct of Fibrinolysis
- Diagnoses thrombotic activity
- Non-specific in diagnosis of DVT
 - -ve D-dimer = DVT unlikely
 - +ve D-dimer = DVT or other coagulable state
- Other conditions cause raised D-dimer
 - Active cancer
 - Pregnancy
 - Infection
 - Post-surgery
 - Inflammatory processes
 - Trauma

Algorithm



Duplex Ultrasound

What is Duplex Ultrasound?

Combination of conventional imaging and
doppler flow information

Advantages of Ultrasound

- Accurate
- Cost effective
- Non-invasive
- No ionizing radiation
- No nephrotoxic contrast
- No contraindications
- Portable
- Assessment of blood flow and anatomy
- “Real-time” examination
- Patient friendly

Purpose

- Compressibility
- Visualisation of thrombus
 - Differentiate acute vs. chronic
- Assessment of venous flow
 - Spontaneous, Phasic, Augmentation
- Valve cusp movement

Limitations of Ultrasound

Accuracy

- Highly accurate when performed by experienced operator(s)
- Sensitivity: 97%, Specificity 96% from groin down

Any imaging test is only as strong as its weakest link
Patient, Equipment, Technique, or Operator

Equipment

- Colour duplex ultrasound
- High definition imaging
- Appropriate transducer frequency



Ultrasound Appearances

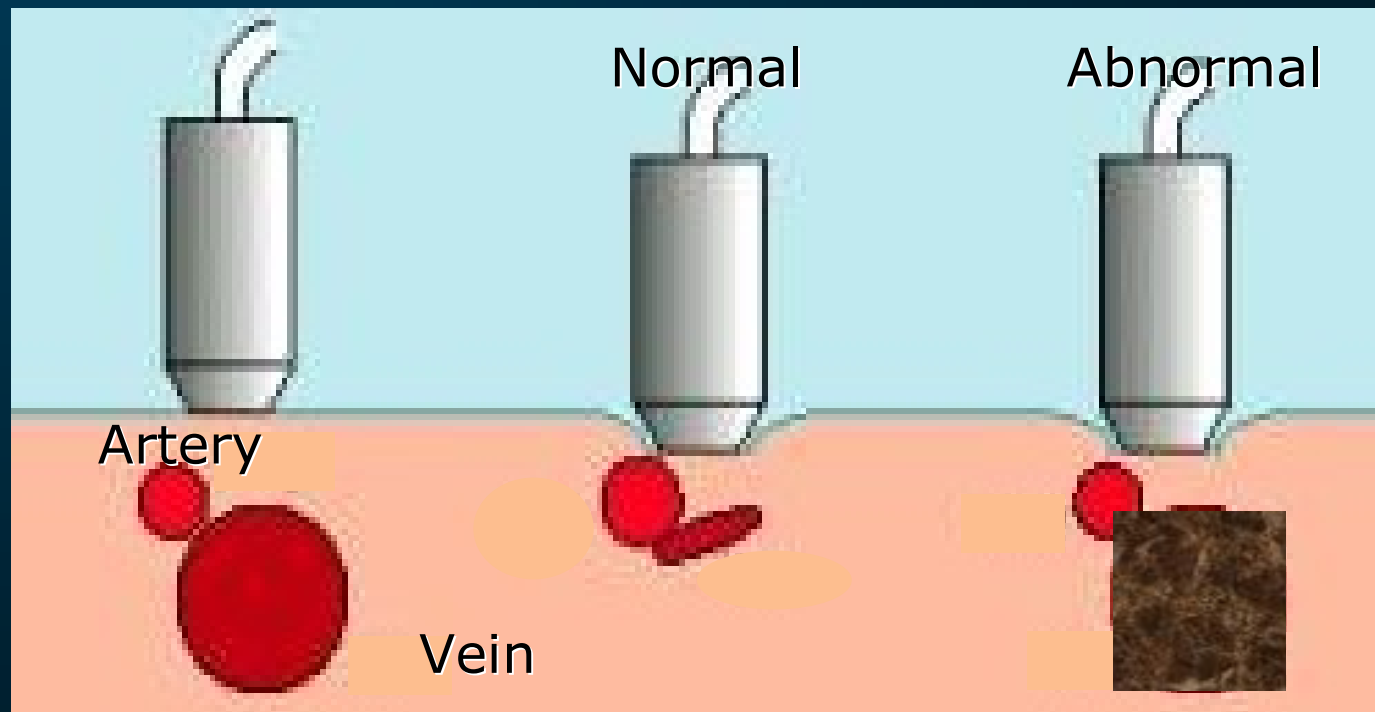
■ NORMAL

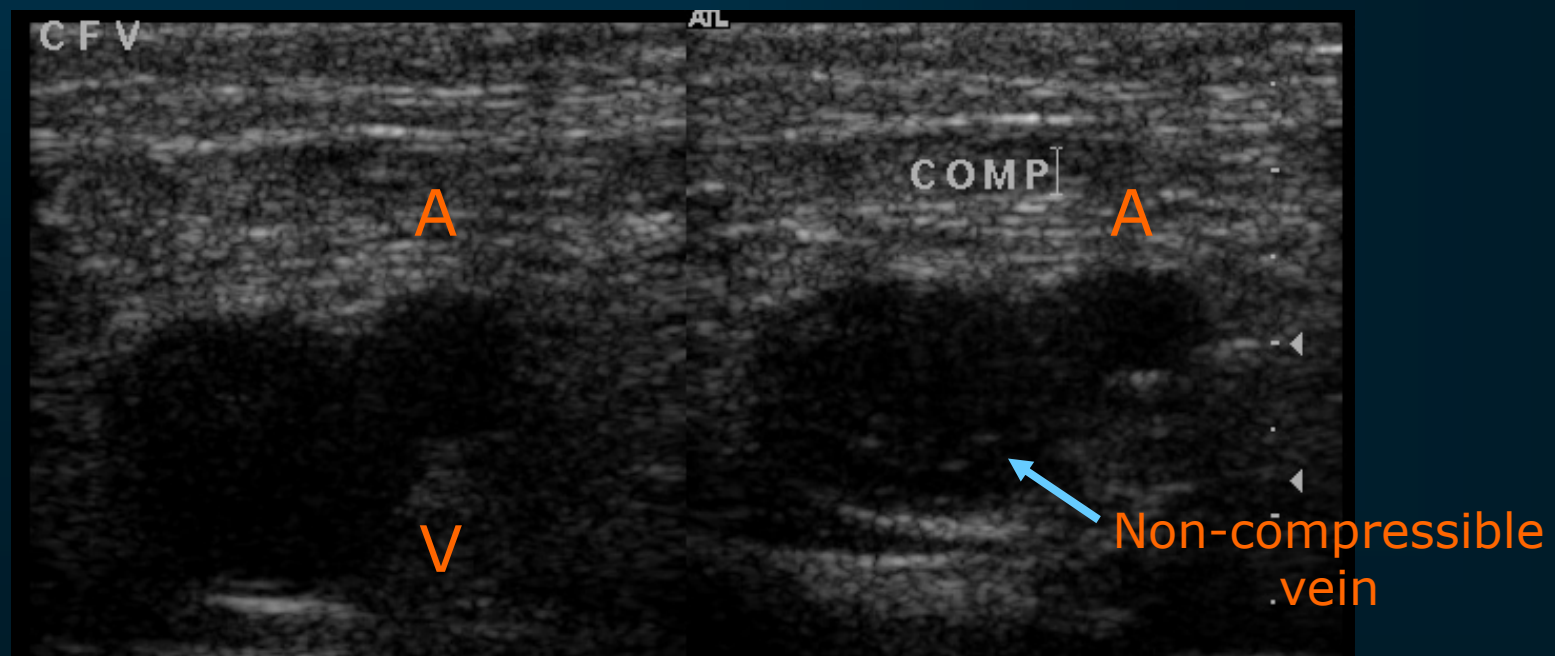
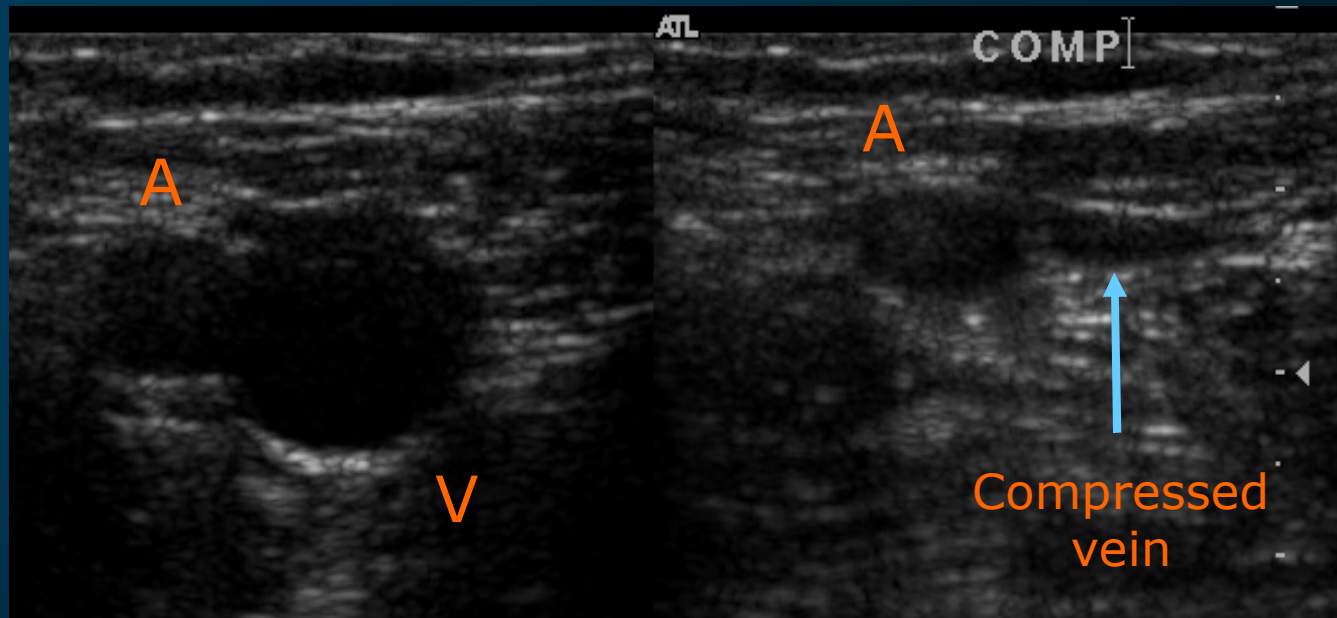
- Echo-free lumen
- Size – slightly larger than artery
- Compressible
- Spontaneous flow
- Phasic flow
- Augmentation with compression and release

■ ABNORMAL

- Echogenic material within lumen
- Distended veins
- Non-compressible
- Absent / diminished flow
- Continuous flow
- Dampened / absent flow with augmentation

Venous Compression

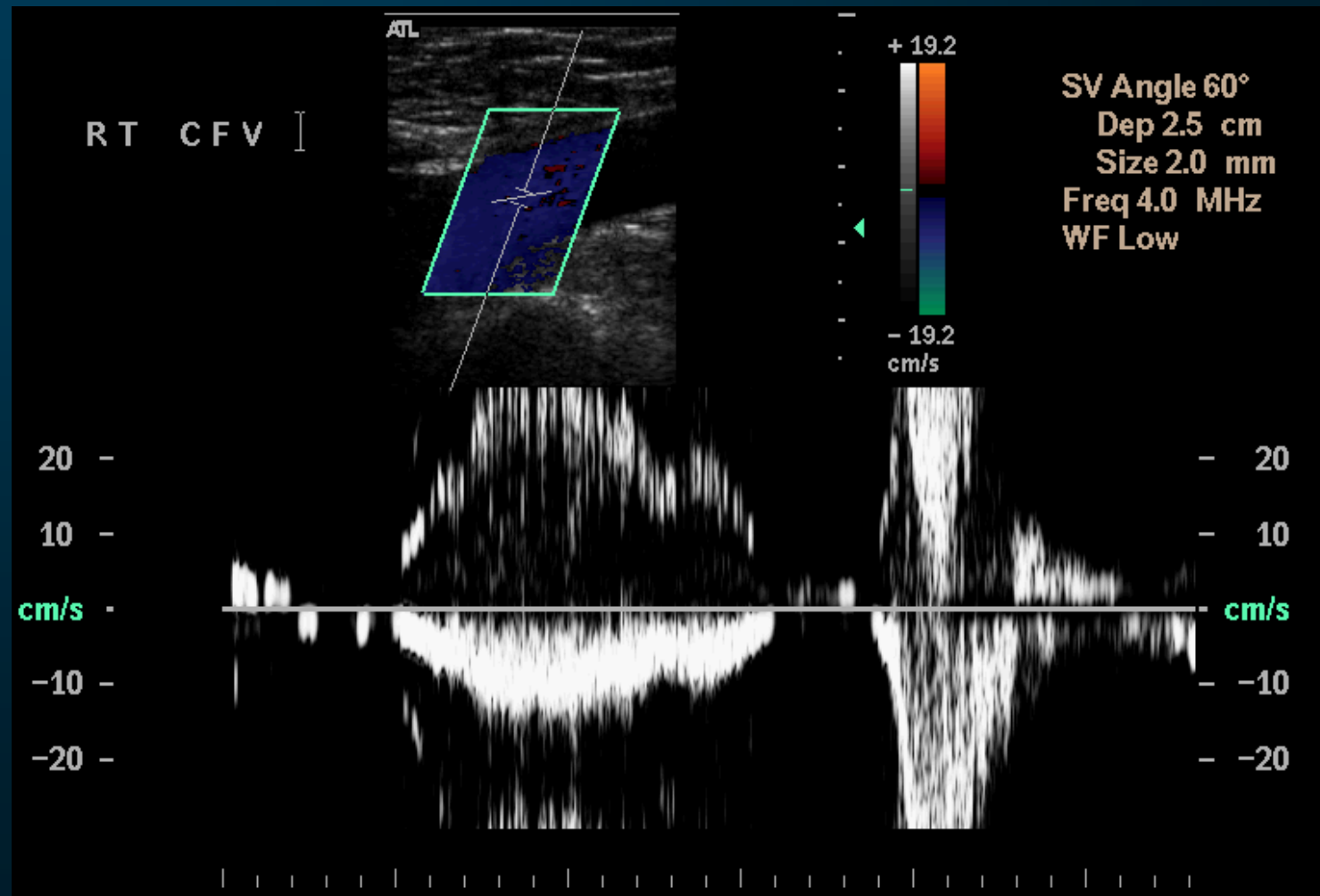




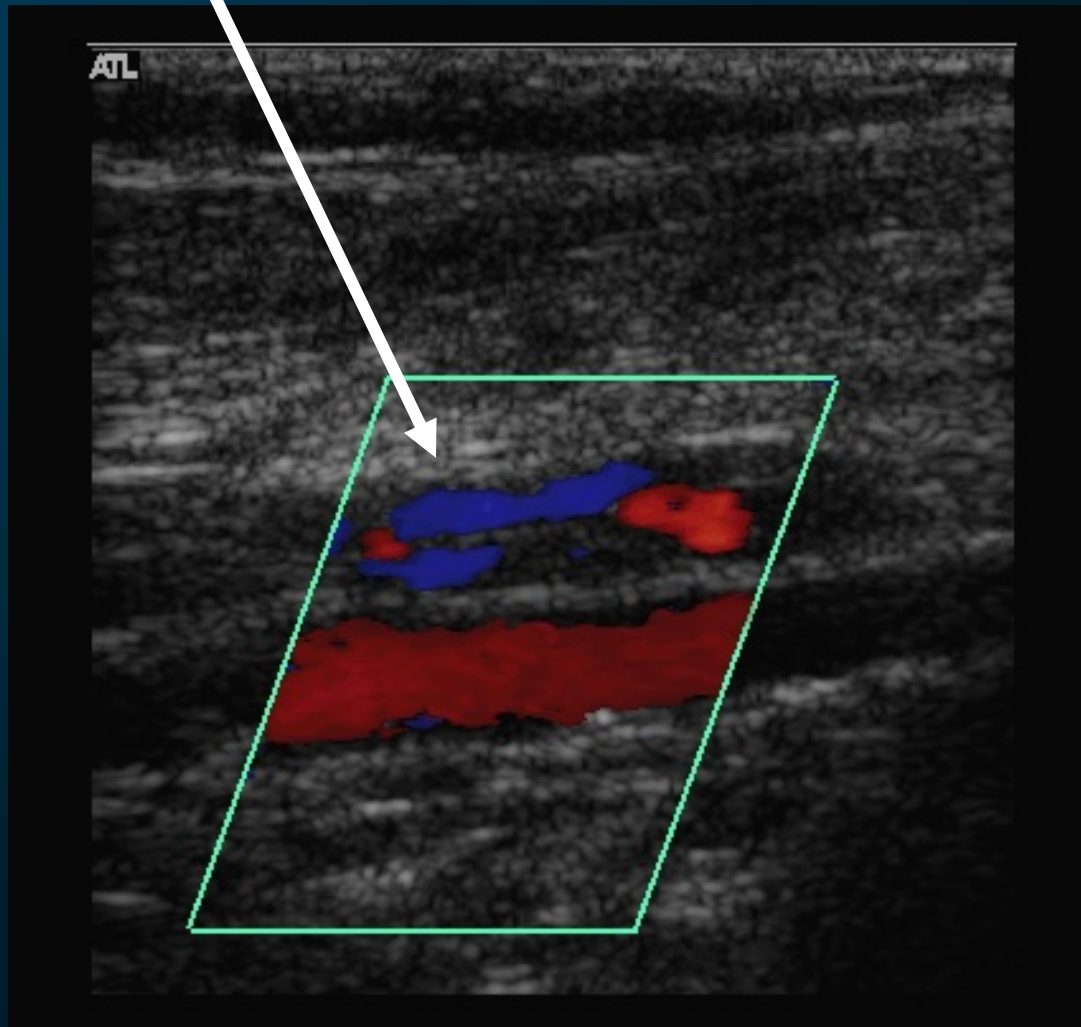
Spontaneous flow



Augmentation



Chronic thrombosis



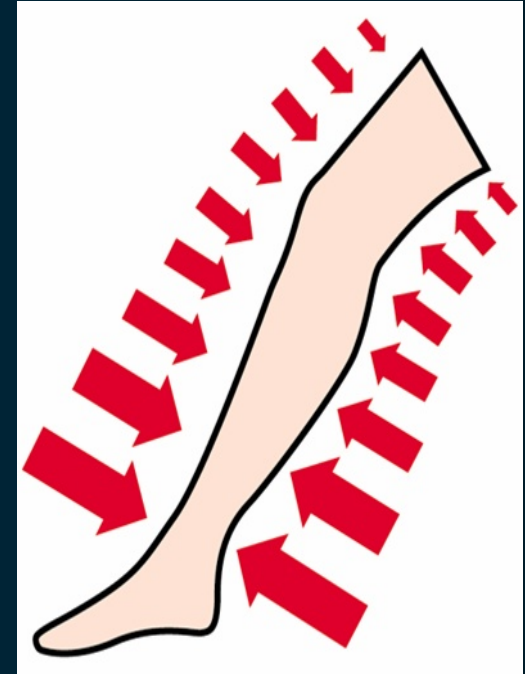
Treatment of Proximal DVT

- 5 days LMWH (Clexane) until INR 2.0 – 3.0
- Warfarin therapy 3-6 mths
- Class 2 graduated compression stockings (below knee) for 1-2 years

NOT white TED stockings

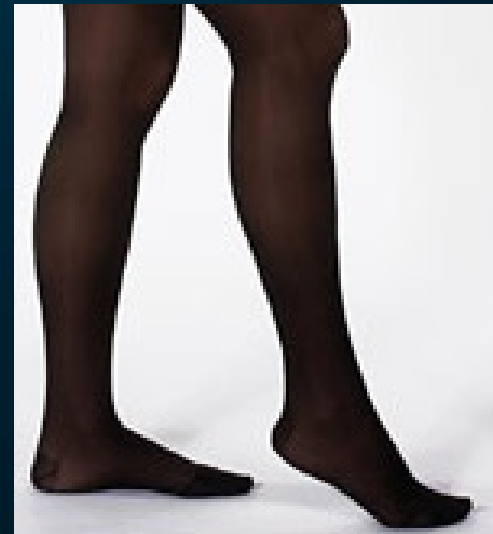
Compression Therapy

- Graduated Compression
 - Higher pressure at ankle
 - Promote cephalad flow of blood
- Reducing ambulatory venous pressure:
 - Compress varicose veins
 - Prevent pooling at ankle
 - Reduce oedema



Compression Classes

- Level of compression at the ankle
- European Standard
 - 1 – 18-21 mmHg
 - 2 – 25-32 mmHg
 - 3 – 36-48 mmHg
 - 4 – 48+ mmHg
 - Travel – 8-15mmHg



TED anti-embolism stockings

- 18 mmHg
- Prevention of DVT intra and post-operatively

Manufacturers Recommendation:

“For use in the non-ambulant convalescing patient”





NOT designed for ambulant use

2 year Randomised Controlled Trial, 2003

- 180 patients
- Class 2 graduated compression hose
- 1-2 years post DVT
- Significant reduction of PTS risk of up to 50%

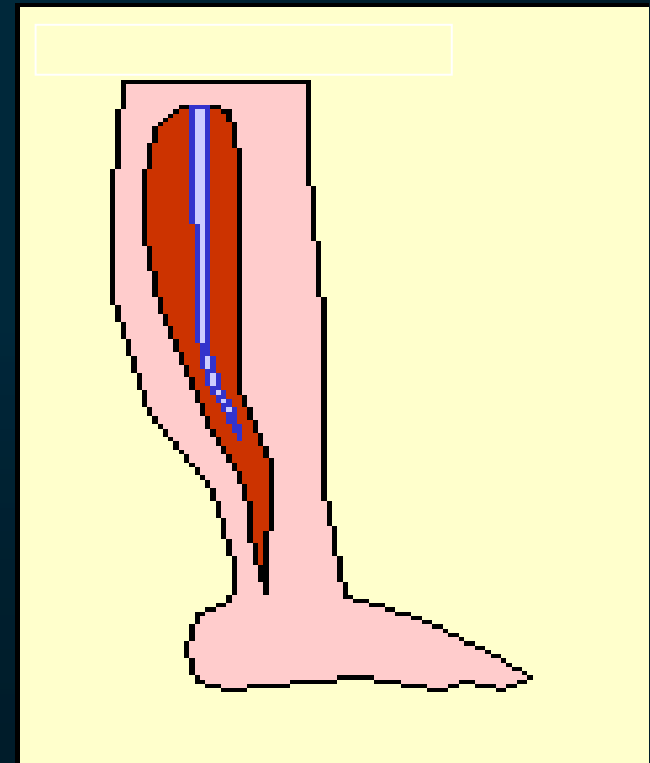
Recommendation:

Prescribe compression therapy for DVT.

Long-term effects of DVT

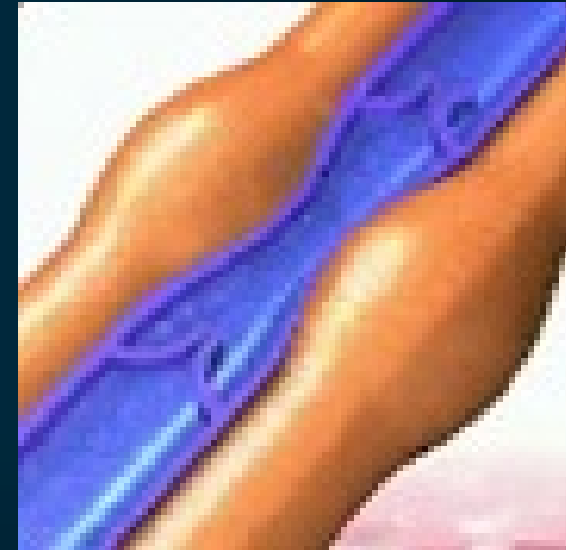
Calf muscle pump

- Veins are pliable
- Constrict & dilate over wide range
- Contraction of Gastrocnemius and Soleus muscles
- Blood expelled into Popliteal V.
- Valve closure prevents reflux
- More valves in calf than thigh

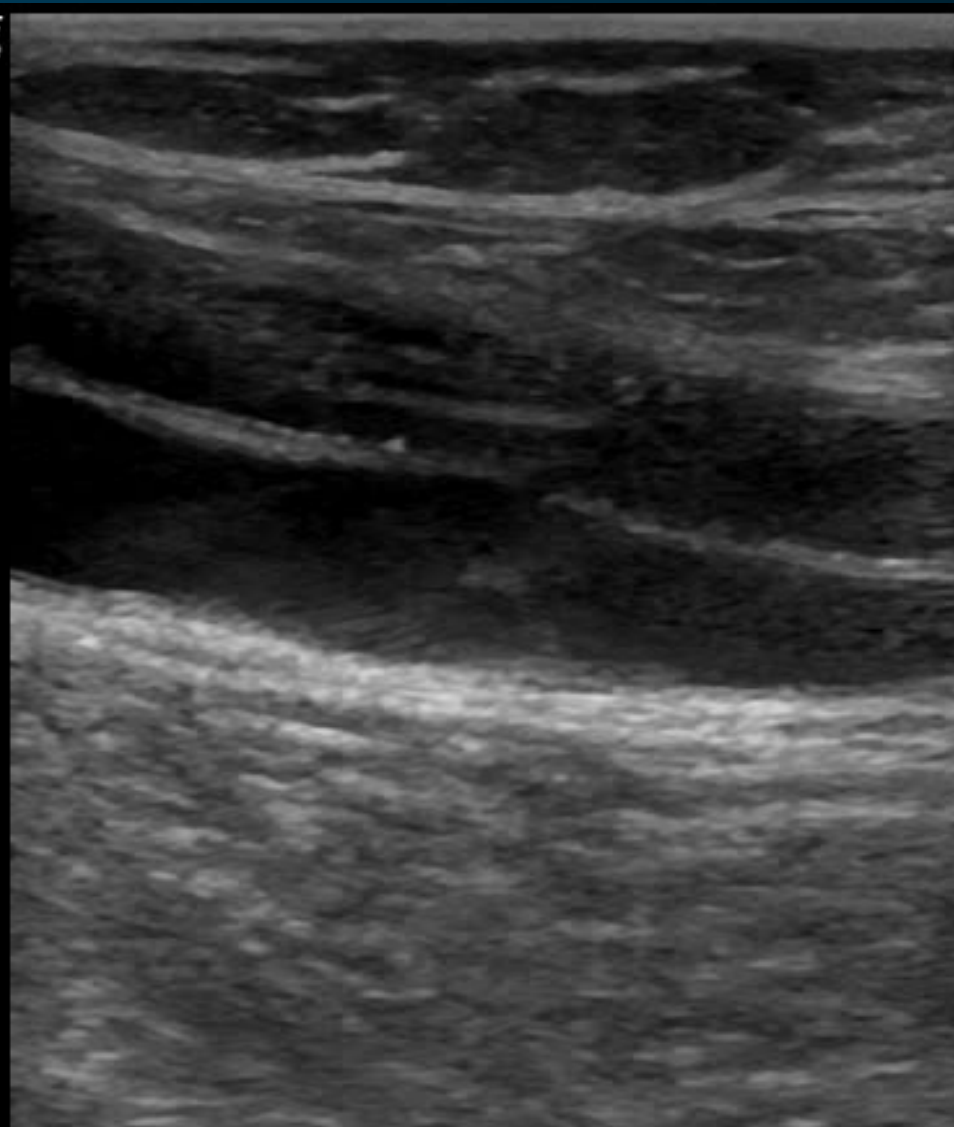


Calf muscle pump at rest

- Veins fill via arterial inflow @ 1-2ml per second
- Normal venous refill time at rest is approx 2 minutes
- Valve failure = high volume reflux = venous refill time is 20-40 seconds
- Leads to stasis in dependent veins



GE
Le



1-

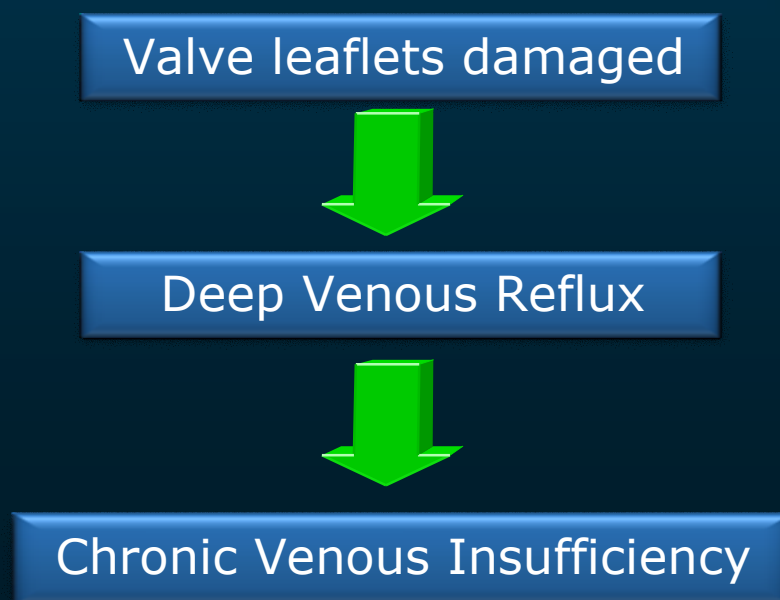
2-

3-

4-

Post Thrombotic Syndrome (PTS)

- Long term sequelae of DVT
- Up to 80% of patients within 1-2 years of DVT event
- Chronic venous obstruction or valvular reflux
- Failure of calf muscle pump
- Venous hypertension



Determinants of PTS

- Extent of DVT
- Rate of recanalisation (fibrosis)
- Venous valve function
- Recurrent DVT



Postthrombotic pigmentation



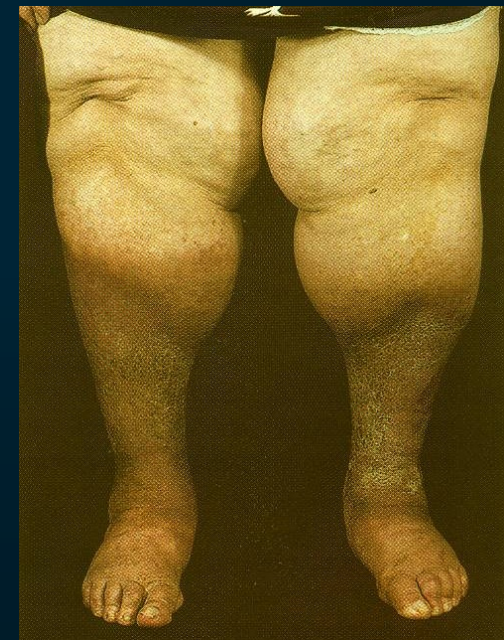
Healed skin ulcer and
postthrombotic pigmentation



Chronic (left) leg swelling, skin hardening,
and postthrombotic pigmentation

Symptoms

- Pain
- Oedema
- Hyperpigmentation (7-23%)
- Ulceration (4-6%)
- Lipodermatosclerosis (champagne glass leg)
- Heaviness
- Cramps
- Itchiness
- Numbness or tingling
- Dilatation of superficial veins
- Redness



Differential Diagnosis

- PVD
- Obesity
- Compartment syndrome
- Chronic Venous Insufficiency due to varicose veins
- Lymphoedema
- May-Thurner syndrome
- CHF

Diagnosis by duplex ultrasound

Treatment Options

- Prevention better than cure
 - Adequate Rx of DVT
- Valves permanently damaged
 - Valve reconstruction
- Prevention of complications
 - Graduated Class 2 compression stockings
 - Regular exercise
 - Elevate limbs while seated

Take-home messages

- Assessment and management of DVT within the community (as services allow)
- Awareness of possible long-term complications of DVT
- Compression Therapy

Thank-you for your attention

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