

# Venous Thromboembolism (VTE)

Saturday, November 22, 2014  
5:47 PM

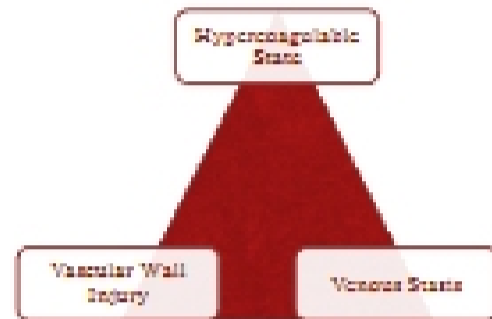
## Learning Objectives:

- Virchow's Triad: 3 categories & role
- risk factors
- primary vs. secondary hemostasis
- clotting cascade
- signs & symptoms
- diagnostic tests

## VTE: DVT + PE

THROMBUS - stationary clot  
EMBOLUS - motile clot  
PROPAGATION - clot spread/extension

## Virchow's Triad:



## Hypercoagulable States

Inherited	Acquired
- genetic: - VLeiden (aPC resistance) - Prothrombin G20210A mutation	- malignancy (cancer) - pregnancy & postpartum - anti-phospholipid Abs
- deficiency: - Protein C - Protein S - Antithrombin	- Lupus anticoagulant Abs - anti-cardiolipin Abs - anti-β <sub>2</sub> -glycoprotein I Abs - Estrogen (BC, SERMs)

Risk Factor	Points
Active CA (sxs &/or those with chemo/radiation in previous 6 months)	3
Previous VTE	3
Reduced mobility (Bedrest for at least 3 days)	3
Thrombophilia (antithrombin, protein C or S, factor V Leiden, G20210A, anti-phospholipid syndrome)	3
Recent (<1 mo) trauma and/or surgery	2
Elderly age (>70 y)	1
Heart and/or respiratory failure	1
Acute myocardial infarction or ischemic stroke	1
Acute infection and/or rheumatologic disorder	1
Obesity (BMI >30)	1
Ongoing hormonal treatment	1
<b>High risk: ≥ 4</b>	

## Vascular Wall Injury

- valve disease
- atherosclerosis
- trauma
- major ortho sx
- catheter

## Venous Stasis (poor blood flow)

- illness/hospitalization
- immobility/paralysis
- obstruction
- heart issues (HF, MI)
- sx (anesth >30mins)
- polycythemia vera (↑RBCs)
- obesity (BMI >30)
- varicose veins

## Other Risk Factors

- history\*
- age (doubles w/ each decade >50)
- Heparin-induced Thrombocytopenia (HIT)
- chemo

## Hemostasis

HEMOSTASIS - balance between clot formation & dissolution; highly regulated

Primary	Secondary
Platelet plug	"Extrinsic pathway" (permanent plug)
1) Adhesion (VWF) 2) Activation (TXA <sub>2</sub> /ADP) 3) Aggregation (Fibrinogen)	1) TF 2) Thrombin 3) Fibrin 4) Thrombus 5) Fibrinolysis

VWF - links platelet GPIIb & collagen  
TXA<sub>2</sub>/ADP - recruits platelets  
FIBRINOGEN - links platelets via GPIIb/IIIa  
THROMBIN - Fibrinogen → Fibrin; drives cascade  
FIBRIN - long/strong proteins that crosslink over the clot  
FIBRINOLYSIS - breaking down of fibrin clot

## Deep Vein Thrombosis (DVT)

### Types:

	DISTAL	PROXIMAL
Thrombus Location	calf	above knee
Embolus/Propagation Risk	low (20%)	high (50%)
PTS Risk	low (33%)	high (50%)

### Symptoms/Signs:

Symptoms	Signs
- pain	- Homan's Sign (flexing pain)
- tender	- palpable cord
- warm	- >2cm leg diameter diff
- red	
- swelling	

### Complications:

- PE
- PTS

## Post Thrombotic Syndrome (PTS)

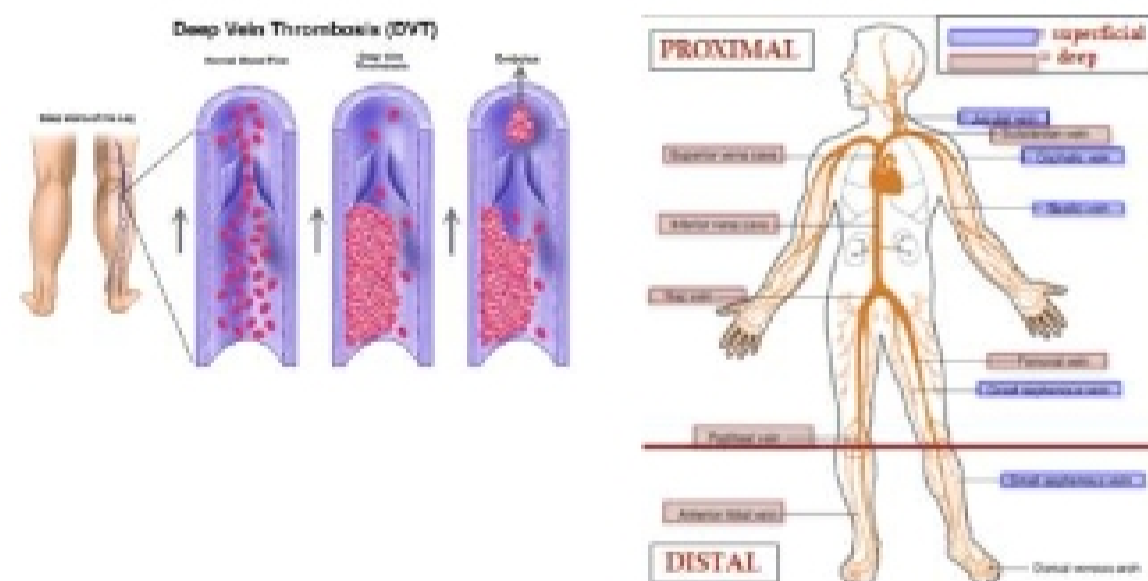
PTS - long-term complication caused by valve damage that causes chronic venous insufficiency

\*can occur 0-10 yrs after DVT

\*increases risk of VTE

### Symptoms:

- chronic pain
- swelling
- pigmentation
- ulcers
- infection



- SUPERFICIAL THROMBOPHLEBITIS - does not propagate; self-limiting  
Treatment: NSAIDs, rest + elevation, heat

**Pulmonary Embolism (PE)**

PE - partial/complete pulmonary artery thrombus; 90% caused by DVT; death can occur within minutes after symptoms

**Types:**

MASSIVE	SUBMASSIVE
<ul style="list-style-type: none"> <li>- causes <u>hemostatic instability</u>:                             <ul style="list-style-type: none"> <li>- ↓ BP</li> <li>- cardiac arrest (no flow)</li> </ul> </li> <li>- <u>life threatening</u>:                             <ul style="list-style-type: none"> <li>- RV Failure</li> <li>- Δ LV Preload</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Δ RV function (echocardiogram)</li> </ul>

**Pathophysiology:**

- 1) femoral vein
- 2) inferior vena cava
- 3) RA/RV
- 4) lungs

**Symptoms/Signs:**

Symptoms	Signs
<ul style="list-style-type: none"> <li>- chest tightness/pain</li> <li>- dizziness</li> <li>- dyspnea (SOB)</li> <li>- cough</li> <li>- hemoptysis (coughing blood)</li> </ul>	<ul style="list-style-type: none"> <li>- tachypnea (↑RR)</li> <li>- tachycardia (↑HR)</li> <li>- diaphoresis (sweating)</li> <li>- JVD</li> <li>- ↓BP (massive)</li> <li>- cyanosis (massive)</li> <li>- shock (massive)</li> </ul>

**Diagnostic Tests**

- WELLS PREDICTION RULE (DVT/PE) - clinical assessment of DVT probability to select appropriate diagnostic tests (High, Moderate, Low)
- D-DIMER - degradation product of fibrin clot; not specific (could be elevated due to CA, sx, pregnancy); rule out DVT, NOT diagnosis
- ESR ELEVATION - inflammatory marker

DVT	PE
<ul style="list-style-type: none"> <li>- CUS*</li> <li>- Venography (risky)</li> <li>- (CT Scan/MRI)</li> </ul>	<ul style="list-style-type: none"> <li>- V/Q Scan*</li> <li>- CT Scan*</li> <li>- Angiography (risky)</li> </ul>

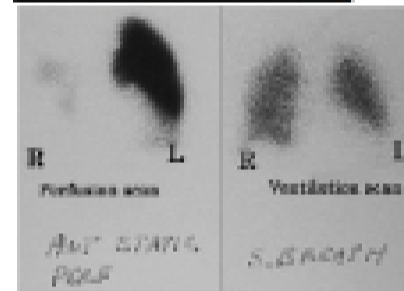
- CUS - determines compressibility of femoral & popliteal veins; diagnosis of DVT; (whole-leg option)
- VENOGRAPHY - catheter + dye

Pros	Cons
<ul style="list-style-type: none"> <li>- "gold standard"</li> <li>- diagnosis</li> <li>- distal + proximal</li> </ul>	<ul style="list-style-type: none"> <li>- invasive</li> <li>- side effects</li> <li>- cost</li> </ul>

- V/Q SCAN - finds "mismatch" in perfusion/ventilation; rule out PE
  - 1) Ventilation (V): inhalation of radioactive gas
  - 2) Perfusion (Q): labeled albumin

PE Probability	Result
Normal	<u>rule out</u> PE
High	↓ Q
Low	↓ V, ↓ Q

**V/Q: HIGH PE Probability**



- SPIRAL CT - visualizes lung during breath-hold; diagnosis of PE; common (more sensitive than V/Q)
- ANGIOGRAPHY - catheter + dye

Pros	Cons
<ul style="list-style-type: none"> <li>- "gold standard"</li> <li>- diagnosis</li> </ul>	<ul style="list-style-type: none"> <li>- invasive</li> <li>- side effects</li> <li>- death                             <ul style="list-style-type: none"> <li>- arrhythmias</li> <li>- heart perforation</li> </ul> </li> </ul>