Definition

- Deep vein thrombosis is the formation of a blood clot in one of the deep veins of the body, usually in the leg.
ETIOLOGY

- DVT usually originates in the lower extremity venous level, starting at the calf vein level and progressing proximally to involve popliteal, femoral, or iliac system.

- 80-90% pulmonary emboli originates here.
Virchow triad

- Virchow described a triad of factors of
  
a. Venous stasis,
  
b. Endothelial damage, and
  
c. Hypercoagulable state
Venous stasis

- Prolonged bed rest (4 days or more)
- A cast on the leg
- Limb paralysis from stroke or spinal cord injury
- Extended travel in a vehicle

Hypercoagulability

- Surgery and trauma
- Malignancy
- Increased estrogen
Disorders of coagulation

Inherited

Deficiencies of

1. Protein ‘S,
2. Protein ‘C,’ and
3. Antithrombin III

Acquired

a. Nephrotic syndrome
b. Antiphospholipid antibodies
c. Inflammatory processes such as SLE, Sickle cell disease and IBD
Presentation and Physical Examination

- Calf pain/tenderness
- Swelling with pitting oedema
- Increased skin temperature
- Superficial venous dilatation
- Assess limb perfusion.
- Detect acute arthritis/joint pathology.
- Neurologic evaluation
- Homans' sign
Wells Clinical Prediction Guide

- Active cancer (treatment ongoing, or within 6 months or palliative) = +1
- Paralysis or recent immobilization = +1
- Recently bedridden for >3 days or major surgery <4 weeks = +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
- Collateral superficial veins (nonvaricose) = +1
- Alternative diagnosis (as likely or > that of DVT) = -2
Total of Above Score

High probability: Score 3
Moderate probability: Score = 1 or 2
Low probability: Score 0
Diagnostic Studies

- Clinical examination alone is able to confirm only 20-30% of cases of DVT
- Blood Tests
- the D-dimer
- INR.
D-dimer

- D-dimer is a specific degradation product of cross-linked fibrin. Because concurrent production and breakdown of clot characterize thrombosis, patients with thromboembolic disease have elevated levels of D-dimer.

- Three major approaches for measuring D-dimer:
  - ELISA
  - Latex agglutination
  - Blood agglutination test
False-positive D-dimers occur in patients with

- recent (within 10 days) surgery or trauma,
- recent myocardial infarction or stroke,
- acute infection,
- disseminated intravascular coagulation,
- pregnancy or recent delivery,
- active collagen vascular disease, or metastatic cancer
Imaging Studies

- **Invasive**
  - venography,
  - radiolabeled fibrinogen and.

- **Noninvasive**
  - ultrasound,
  - MRI techniques
Venography

- Gold standard” modality for the diagnosis of DVT

Nuclear Medicine Studies

- Can distinguish new clot from an old clot
Ultrasonography

- Color-flow Duplex scanning is the imaging test of choice for patients with suspected DVT
  - inexpensive,
  - noninvasive,
  - widely available
- Ultrasound can also distinguish other causes of leg swelling, such as tumor, popliteal cyst, abscess, aneurysm, or hematoma.
Clinical limitations

- expensive
- reader dependent
- Duplex scans are less likely to detect non-occluding thrombi.
- During the second half of pregnancy, ultrasound becomes less specific, because the gravid uterus compresses the inferior vena cava, thereby changing Doppler flow in the lower extremities.
Magnetic Resonance Imaging

- It detects leg, pelvis, and pulmonary thrombi and is 97% sensitive and 95% specific for DVT.
- It distinguishes a mature from an immature clot.
- MRI is safe in all stages of pregnancy.
DIFFERENTIAL DIAGNOSIS

Cellulitis
Thrombophlebitis
Arthritis
Peripheral edema
Lymphangitis
Extrinsic compression of iliac vein
Lymphedema
Muscle or soft tissue injury
Neurogenic pain
Postphlebitic syndrome

- Prolonged immobilization or limb paralysis
- Ruptured Baker cyst
- Stress fractures or other bony lesions
- Superficial thrombophlebitis
- Varicose veins
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<tr>
<th>RISK</th>
<th>DOPPLER FINDINGS</th>
<th>DIAGNOSIS</th>
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<tr>
<td>High/Moderate</td>
<td>Positive</td>
<td>DVT</td>
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<tr>
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<td>Negative</td>
<td>+/-</td>
</tr>
<tr>
<td>Low</td>
<td>Positive</td>
<td>+/-</td>
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</table>
EMERGENCY DEPARTMENT CARE

- Objectives:
  1. prevent pulmonary embolism,
  2. reduce morbidity, and
  3. prevent or minimize the risk of developing the postphlebitic syndrome.

**Treatment options:**

- Anticoagulation
- Thrombolytic therapy
- Surgery
- Compression stockings
Anticoagulation

- Heparin prevents thrombus extension.
- Dose: Bolus-80U/kg f/b 18U/kg/hr
- Monitoring: aPTT
- Target: 1.5-2.3
Advantages of Low-Molecular-Weight Heparin Over Standard Unfractionated Heparin

- Superior bioavailability
- Superior or equivalent safety and efficacy
- Subcutaneous once- or twice-daily dosing
- No laboratory monitoring*
- Less phlebotomy (no monitoring/no intravenous line)
- Less thrombocytopenia

At the present time, 3 LMWH preparations,
- Enoxaparin,
- Dalteparin, and
- Ardeparin
Warfarin

- Interferes with hepatic synthesis of vitamin K-dependent coagulation factors
- Monitoring: INR
- Caution in active tuberculosis or diabetes; patients with protein C or S deficiency
Thrombolytic therapy for DVT

- Advantages:
  - prompt resolution of symptoms,
  - prevention of pulmonary embolism,
  - restoration of normal venous circulation,
  - preservation of venous valvular function,
  - prevention of postphlebitic syndrome

Thrombolytic therapy does not prevent
- clot propagation,
- rethrombosis, or
- subsequent embolization.
Surgery for DVT

- Indications
  a. when anticoagulant therapy is ineffective
  b. unsafe,
  c. contraindicated.
These pulmonary emboli removed at autopsy look like casts of the deep veins of the leg where they originated.
This patient underwent a thrombectomy. The thrombus has been laid over the approximate location in the leg veins where it developed.
Filters for DVT

- **Indications:**
  - Pulmonary embolism
  - Recurrent pulmonary embolism despite adequate anticoagulation

- **Controversial indications:**
  - DVT
  - In patients with pre-existing pulmonary hypertension
  - Free floating thrombus
  - Failure of existing filter device
  - Post pulmonary embolectomy
Compression stockings (routinely recommended)
Further Inpatient Care

- Most patients with confirmed proximal vein DVT may be treated safely on an outpatient basis. Exclusion criteria for outpatient management are as follows:
  
a. Suspected or proven concomitant pulmonary embolism
b. Significant cardiovascular or pulmonary comorbidity
c. Morbid obesity
d. Renal failure
e. Unavailable or unable to arrange close follow-up care
Duration of anticoagulation in patients with deep vein thrombosis

a. Transient cause and no other risk factors: 3 months
b. Idiopathic: 3-6 months
c. Ongoing risk: 6 -12 months
d. Recurrent pulmonary embolism/DVT: 6-12 months
e. Patients with high risk of recurrent thrombosis exceeding risk of anticoagulation: indefinite duration (subject to review)
Complications

- Acute pulmonary embolism
- Hemorrhagic complications
- Chronic venous insufficiency
Prognosis:

- All patients with proximal vein DVT are at long-term risk of developing chronic venous insufficiency.
- Proximal DVT---- 20% PE --10% mortality
- DVT confined to the calf: no PE
Patient Education:

- Advise women taking estrogen of the risks and common symptoms of thromboembolic disease.

- Discourage prolonged immobility, particularly on plane rides and long car trips.
DVT PROPHYLAXIS IN SURGICAL PATIENTS

- A VTE risk assessment should follow the following steps:
  - **Step 1** Assess the patient’s baseline risk of VTE, taking into account inherited and acquired pt factors
  - **Step 2** Assess the patient’s additional risk of VTE, taking account of the reasons for hospitalisation.
  - **Step 3** Assess the patient’s risk of bleeding.
  - **Step 4** Formulate an overall risk assessment (with consideration of VTE risk and bleeding risk).
  - **Step 5** Select appropriate methods of thromboprophylaxis based on the risk assessment.
Thromboprophylaxis is initiated depending on combination of multiple risk factors:

- Individual pt risk factors
- Risk factors related to acute medical illness
- Risk related to surgical procedure
Individual patient risk factors:

- age
- pregnancy and the puerperium
- active or occult malignancy
- previous VTE
- varicose veins
- marked obesity
- prolonged severe immobility
- use of oestrogen-containing hormone replacement therapy or oral contraceptives
- inherited or acquired thrombophilia
Risks related to an acute medical illness:

a. acute or acute on chronic chest infection
b. heart failure
c. myocardial infarction
d. stroke with immobility
e. some forms of cancer chemotherapy
f. acute inflammatory bowel disease

Risks related to an injury or surgical procedure:
All surgical procedures but especially abdominal, pelvic, thoracic or orthopaedic surgical procedures
BLEEDING RISK

- recent central nervous system bleeding
- intracranial or spinal lesion at high risk for bleeding
- current active major bleeding, defined as requiring at least two units of blood or blood products to be transfused in 24 hours
- current chronic, clinically significant and measurable bleeding over 48 hours
### Guidelines

#### Identification of risk:

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</tr>
<tr>
<td>High</td>
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<td>+nt</td>
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<tr>
<td>Highest</td>
<td>&gt;30 min</td>
<td>&gt;60</td>
<td>+nt plus history of VTE</td>
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PROPHYLAXIS

Non pharmacological methods:

a. Early mobilisation
b. Elastic stockings
c. Pneumatic compression devices

Pharmacological methods:

a. Aspirin
b. Unfractionated heparin
c. LMWH
d. Oral anticoagulants
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