REVIEW OF VENOUS THROMBOEMBOLISM IN CLINICAL PRACTICE
# Epidemiology of venous thromboembolism

<table>
<thead>
<tr>
<th></th>
<th>European consensus</th>
<th>French study(^{1})</th>
<th>Minnesota study(^{2})</th>
<th>California study(^{3})</th>
<th>Incidence in Spain(^{**})</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE</td>
<td>60*</td>
<td>123*</td>
<td>-</td>
<td>30*</td>
<td>25,000 cases/year</td>
</tr>
<tr>
<td>DVT</td>
<td>160*</td>
<td>60*</td>
<td>-</td>
<td>60*</td>
<td>65,000 cases/year</td>
</tr>
<tr>
<td>Total VTE</td>
<td>220*</td>
<td>183*</td>
<td>117*</td>
<td>90*</td>
<td>90,000 cases/year</td>
</tr>
</tbody>
</table>

\(^{1}\) Oger E. Thromb Haemost 2000  
\(^{2}\) Heit JA et al. Thromb Haemost 2001  
\(^{3}\) White et al. Thromb Haemost 2005  
\(^{*}\) (cases/100,000 inhabitants/year)  
\(^{**}\) Estimated
Cumulative incidence of VTE recurrence

Heit JA et al. Thromb Haemost 2001
### Mortality in VTE

#### Survival Following a First Episode of VTE (%)

<table>
<thead>
<tr>
<th>Time</th>
<th>DVT</th>
<th>PE</th>
<th>Total VTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>97.0</td>
<td>76.5</td>
<td>77.7</td>
</tr>
<tr>
<td>Day 7</td>
<td>96.2</td>
<td>71.1</td>
<td>74.8</td>
</tr>
<tr>
<td>Day 14</td>
<td>95.7</td>
<td>68.7</td>
<td>73.3</td>
</tr>
<tr>
<td>Day 30</td>
<td>94.5</td>
<td>66.8</td>
<td>72.0</td>
</tr>
<tr>
<td>Day 90</td>
<td>91.9</td>
<td>62.8</td>
<td>68.9</td>
</tr>
<tr>
<td>1 year</td>
<td>85.4</td>
<td>57.4</td>
<td>63.6</td>
</tr>
<tr>
<td>2 years</td>
<td>81.4</td>
<td>53.6</td>
<td>60.1</td>
</tr>
<tr>
<td>5 years</td>
<td>72.6</td>
<td>47.4</td>
<td>53.5</td>
</tr>
<tr>
<td>8 years</td>
<td>65.2</td>
<td>41.5</td>
<td>47.4</td>
</tr>
</tbody>
</table>

Heit JA et al. Thromb Haemost 2001
Etiopathogenesis of VTE
mechanisms of thrombus formation

**VIRCHOW’S TRIAD**

- Blood stasis in valves
- Vessel wall changes
- Blood flow slowing

**TF**: Tissue factor

- Platelets
- Colagen
General acquired risk factors of VTE

• Age:
  • > 40 years and surgery
  • > 60 years and medical conditions
  • > 75 years without other added factors
• Obesity (20 % > BMI)
• Prolonged immobilization
  (> 3 days)
• History of VTE

• Pregnancy
• Puerperium
• Oral contraceptives
• Estrogen replacement therapy
• Antipsychotic treatment
• Economy class syndrome (long airplane or terrestrial travel)
• Varicose veins
• Smoking
Age-related incidence of VTE

Heit JA et al. Thromb Haemost 2001
Risk factors for VTE associated to surgery or trauma

- Surgery lasting longer than 30 minutes in patients over 40 years of age:
  - Abdominal surgery
  - Urological surgery
  - Gynecological surgery
  - Any orthopedic surgery
  - Neurosurgery
  - Other types of surgery

- Other factors:
  - Some vascular examinations
  - Central venous catheters
  - Major or lower limb trauma
  - Fractures or conditions requiring plaster casts or prolonged immobilization
  - Kidney transplantation
DVT incidence in different types of surgery

Adapted from Bergqvist D et al. Br J Surg 1986
Risk factors for VTE associated to medical conditions

- Acute myocardial infarction
- Congestive heart failure
- Acute respiratory disease
- Chronic obstructive pulmonary disease
- Acute infectious disease
- Neurological lesions (stroke, paralysis)
- Presence of lupus anticoagulant and/or antiphospholipid antibodies
- Nephrotic syndrome
- Any acute medical condition requiring bed confinement > 4 days
- Diabetes
- Neoplasm
- Cancer treatment (hormonal, chemotherapy or radiotherapy)
- Some malignant hemopathies (chronic myeloproliferative syndromes, nocturnal paroxysmal hemoglobinuria and others)
- Chronic inflammatory bowel disease
- Lupus anticoagulant and/or anticardiolipin antibodies
- Acquired hyperhomocysteinemia
**Congenital risk factors for VTE**

<table>
<thead>
<tr>
<th>Congenital Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antithrombin deficiency</td>
</tr>
<tr>
<td>Protein C deficiency</td>
</tr>
<tr>
<td>Protein S deficiency</td>
</tr>
<tr>
<td>Activated protein C resistance (APCR)</td>
</tr>
<tr>
<td>Factor V Leiden</td>
</tr>
<tr>
<td>Prothrombin G20210A</td>
</tr>
<tr>
<td>Some dysfibrinogenemias</td>
</tr>
<tr>
<td>Fibrinolytic system changes</td>
</tr>
<tr>
<td>Hyperhomocysteinemia (congenital or acquired?)</td>
</tr>
<tr>
<td>Increase in factors VIII. IX and/or XI (congenital or acquired?)</td>
</tr>
<tr>
<td>APCR without factor V Leiden (congenital or acquired?)</td>
</tr>
</tbody>
</table>
Patient screening criteria for diagnosis of congenital thrombophilia

1. Venous and/or arterial thrombosis in patients < 45 years
2. Thrombosis in unusual venous territories (mesenteric, cerebral, etc)
3. Recurrent venous thrombosis during stable OAC therapy
4. Skin necrosis when OACs are started
5. Neonatal fulminant thrombosis or purpura
6. Family history of thrombosis
Laboratory tests for diagnosis of congenital thrombophilia

• Antithrombin functional and antigenic activity
• Protein C functional and antigenic activity
• Protein S (total and free) functional and antigenic activity
• Functional test of activated protein C resistance (APCR)
• Factor V Leiden

• Prothrombin G20210A
• Lupus anticoagulant and anticardiolipin antibodies
• Measurement of Factors VIII, IX, and XI
• Homocysteine plasma levels
Impact of risk factors on VTE incidence

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>11%</td>
</tr>
<tr>
<td>2</td>
<td>24%</td>
</tr>
<tr>
<td>3</td>
<td>36%</td>
</tr>
<tr>
<td>4 or more</td>
<td>100%</td>
</tr>
</tbody>
</table>
## Risk stratification in surgical patients

<table>
<thead>
<tr>
<th>Risk levels</th>
<th>Type of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>• Minor surgery in patients &lt; 40 years without ARFs</td>
</tr>
</tbody>
</table>
| Moderate    | • Minor surgery in patients with ARFs  
              • Surgery in patients aged 40-60 years without ARFs |
| High        | • Surgery in patients > 60 years  
              • Surgery in patients aged 40-60 years with ARFs (prior VTE, cancer, congenital thrombophilia) |
| Very high   | • Surgery in patients with multiple risk factors (age > 40 years, cancer, prior VTE)  
              • Orthopedic surgery: hip or knee arthroplasty or hip fracture  
              • Major trauma  
              • Spinal cord lesion |

ARFs: additional risk factors  

Geerts WH et al. Chest 2004
Incidence of VTE as a function of risk level

<table>
<thead>
<tr>
<th>Risk levels</th>
<th>Incidence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distal DVT</td>
</tr>
<tr>
<td>Low</td>
<td>2</td>
</tr>
<tr>
<td>Moderate</td>
<td>10-20</td>
</tr>
<tr>
<td>High</td>
<td>20-40</td>
</tr>
<tr>
<td>Very high</td>
<td>40-80</td>
</tr>
</tbody>
</table>

Geerts WH et al. Chest 2004
## Duration of VTE risk

<table>
<thead>
<tr>
<th>Type of patient</th>
<th>Risk duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>General surgery</td>
<td>7-10 days</td>
</tr>
<tr>
<td>Orthopedic surgery</td>
<td>4-6 weeks</td>
</tr>
<tr>
<td>Cancer surgery</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Medical patients</td>
<td>Highly variable</td>
</tr>
</tbody>
</table>
## Absolute risk of VTE in hospitalized patients

<table>
<thead>
<tr>
<th>Type of patients</th>
<th>DVT prevalence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical patients</td>
<td>10-20</td>
</tr>
<tr>
<td>General surgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Major gynecological surgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Major urological surgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>15-40</td>
</tr>
<tr>
<td>Cerebral infarction</td>
<td>20-50</td>
</tr>
<tr>
<td>Total hip or knee replacement surgery, hip fracture surgery</td>
<td>40-60</td>
</tr>
<tr>
<td>Major trauma</td>
<td>40-80</td>
</tr>
<tr>
<td>Medullary lesion</td>
<td>60-80</td>
</tr>
<tr>
<td>Patient in intensive care unit</td>
<td>10-80</td>
</tr>
</tbody>
</table>

Geerts WH et al. Chest 2004
Decision making in VTE

DIAGNOSIS

TREATMENT
Clinical signs of DVT (proximal and symptomatic) vs phlebography in DVT diagnosis

<table>
<thead>
<tr>
<th>Clinical signs</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>No. of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>68%</td>
<td>58%</td>
<td>7</td>
</tr>
</tbody>
</table>

Wheeler HB & Anderson FA. Haemostasis 1995
# A model for clinical prediction of DVT

<table>
<thead>
<tr>
<th>Clinical characteristic</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active neoplasm (treat. ongoing or in past 6 months, or palliative)</td>
<td>1</td>
</tr>
<tr>
<td>LL paralysis, paresis, or recent immobilization</td>
<td>1</td>
</tr>
<tr>
<td>Recent bed confinement &gt; 3 days or major surgery (&lt; 4 weeks)</td>
<td>1</td>
</tr>
<tr>
<td>Localized hypersensitivity at deep vein level</td>
<td>1</td>
</tr>
<tr>
<td>Edema in the whole limb</td>
<td>1</td>
</tr>
<tr>
<td>Calf edema &gt; 3 cm compared to asymptomatic leg</td>
<td>1</td>
</tr>
<tr>
<td>Edema (pitting) in symptomatic leg</td>
<td>1</td>
</tr>
<tr>
<td>Collateral superficial veins (non-varicose)</td>
<td>1</td>
</tr>
<tr>
<td>Reliable alternative diagnosis</td>
<td>-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>High probability ≥ 3 points</td>
</tr>
</tbody>
</table>

Wells PS et al. Lancet 1997
# Sensitivity and specificity of physical examination in DVT diagnosis

<table>
<thead>
<tr>
<th>Symptom/sign</th>
<th>Se (%)</th>
<th>Sp (%)</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calf pain</td>
<td>31</td>
<td>79</td>
<td>5</td>
</tr>
<tr>
<td>Calf hypersensitivity</td>
<td>52</td>
<td>71</td>
<td>6</td>
</tr>
<tr>
<td>Calf/thigh swelling</td>
<td>58</td>
<td>68</td>
<td>7</td>
</tr>
<tr>
<td>Edema in the whole limb</td>
<td>88</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Erythema</td>
<td>90</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Temperature difference</td>
<td>90</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>Superficial vein dilatation</td>
<td>80</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>Palpable thrombus</td>
<td>98</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Homans’ sign</td>
<td>75</td>
<td>39</td>
<td>6</td>
</tr>
</tbody>
</table>

Se = sensitivity; Sp = specificity; N = studies vs. phlebography included

Wheeler HB & Anderson FA. Haemostasis 1995
Differential diagnosis of DVT (I)

- Superficial thrombophlebitis
- Post-thrombotic syndrome
- Baker’s cyst (possible rupture)
- Calf hematoma (stone blow syndrome)
- Lymphedema
- Lymphangitis, erysipelas, and cellulitis
- Compartmental syndrome
- Systemic edemas (various)
- Other edemas of local origin
- Extrinsic venous compression
- Arteriovenous fistula
- Simulated edema
- Thrombotic neurosis

Kahn SR. Arch Intern Med 1998
Differential diagnosis of DVT (II)

BAKER’S CYST

EXTRINSIC VENOUS COMPRESSION
Supplemental examinations in DVT diagnosis

• Suspicion = Clinical examination
• Clinical prediction = Wells’ test
• Laboratory prediction = D-dimer
• Confirmation = Supplemental examination

• Gold standard = Phlebography (invasive)
• Method of choice = Echo-Doppler (non-invasive)
• Others = Plethysmography
• Under study = CT, MRI, isotopic

Validated diagnostic strategies

Line BR. Semin Nucl Med 2001
## Phlebography in DVT diagnosis

<table>
<thead>
<tr>
<th>Period</th>
<th>Method of choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1960</td>
<td>Clinical exam</td>
</tr>
<tr>
<td>1960-1970</td>
<td>Clinical exam + phlebography</td>
</tr>
<tr>
<td>1970-1980</td>
<td>Echo-Doppler + IPG</td>
</tr>
<tr>
<td>&gt; 1980</td>
<td>Echo-Doppler</td>
</tr>
</tbody>
</table>
Diagnostic criteria for DVT in phlebography (I)

1. NO OPACIFICATION OF DVS
2. SUDDEN CONTRAST INTERRUPTION
Diagnostic criteria for DVT in phlebography (II)

3. OPACIFICATION LAKES (THROMBI)
Diagnostic criteria for DVT in phlebography (III)

4. CONTRAST IN COLLATERALS
Disadvantages of phlebography

1. Invasive procedure
2. Painful
3. Relatively expensive
4. 2% phlebitis
5. 1-2% contrast allergies
6. Contraindicated in 5-10%
7. Difficult to interpret in 10%
8. Differences between observers
9. Rapid result?
10. Repetition?
Indications of phlebography for DVT diagnosis

1. Equivocal prior results
2. Need for confirmation (rDVT)
3. Additional information (extent/location/type)
4. Treatment evaluation (thrombolysis)
5. Insertion of caval filters
6. Congenital venous abnormalities?
7. Clinical research

Line BR. Semin Nucl Med 2001
Doppler ultrasonography

Eco-doppler

FIRST CHOICE TEST
# Sensitivity and specificity of echo-doppler in DVT diagnosis

<table>
<thead>
<tr>
<th>Test*</th>
<th>Se (%)</th>
<th>Sp (%)</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical examination</td>
<td>68</td>
<td>58</td>
<td>7</td>
</tr>
<tr>
<td>Doppler</td>
<td>85</td>
<td>88</td>
<td>23</td>
</tr>
<tr>
<td>Plethysmography</td>
<td>93</td>
<td>94</td>
<td>16</td>
</tr>
<tr>
<td>Echo-Doppler</td>
<td>96</td>
<td>96</td>
<td>25</td>
</tr>
</tbody>
</table>

* Proximal and symptomatic DVT vs phlebography
Se = sensitivity. Sp = specificity. No. = studies

Wheeler HB & Anderson FA. Haemostasis 1995
# Echo-doppler vs. Phlebography in DVT diagnosis

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Se (%)</th>
<th>Sp (%)</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptomatic patients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal DVT</td>
<td>96</td>
<td>96</td>
<td>25</td>
</tr>
<tr>
<td>Distal DVT</td>
<td>80</td>
<td>-</td>
<td>10</td>
</tr>
<tr>
<td>Asymptomatic patients</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal DVT</td>
<td>76</td>
<td>98</td>
<td>7</td>
</tr>
<tr>
<td>Distal DVT</td>
<td>11</td>
<td>-</td>
<td>4</td>
</tr>
</tbody>
</table>

Se = sensitivity. Sp = specificity. No. = studies

Wheeler HB & Anderson FA. Haemostasis 1995
Echo-doppler in DVT diagnosis

VEIN NOT PATENT OR COMPRESSIBLE
HYPOECHOGENIC MATERIAL

Echo-doppler in DVT diagnosis
(controversial issues)

- Focused Compression vs Continuous Full Lower Limb Examination
- Unilateral vs Bilateral Limb Examination
- Single vs Serial Scanning in Patients with Negative Echo-Doppler
- Isolated Calf Vein Thrombosis
- Screening Asymptomatic Patients with High Prevalence of DVT
- Suspected Pulmonary Embolism
- Suspected Recurrent DVT
- Urgent vs Off Hours Scanning
- Strategy for Symptomatic Patients

Gaitini D. J Clin Ultrasound 2006
Plethysmography (IPG) in DVT diagnosis

Magnetic resonance imaging (MRI) and CT in DVT diagnosis

Coche EE et al. Am J Roentgenol 2001
Larsson EM et al. Am J Roentgenol 2003
Sensitivity and specificity of MRI in DVT diagnosis

<table>
<thead>
<tr>
<th>Control*</th>
<th>Se (%)</th>
<th>Sp (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spritzer. 1990</td>
<td>97</td>
<td>95</td>
</tr>
<tr>
<td>Evans. 1993</td>
<td>95**</td>
<td>97</td>
</tr>
<tr>
<td>Carpenter. 1993</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Evans. 1996</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Se = sensitivity. Sp = specificity
*P = phlebography; D = echo-Doppler
** in calf = 87%

Tapson VF et al. Am J Respir Crit Care Med 1999
**Current status of imaging diagnosis of DVT**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phlebography</td>
<td>Gold standard</td>
</tr>
<tr>
<td>Echo-Doppler</td>
<td>First choice</td>
</tr>
<tr>
<td>IPG</td>
<td>Rarely used</td>
</tr>
<tr>
<td>MRI</td>
<td>The promise</td>
</tr>
<tr>
<td>Helical CT</td>
<td>More data needed</td>
</tr>
</tbody>
</table>
# D-dimer in DVT diagnosis

<table>
<thead>
<tr>
<th>Test*</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-dimer (ELISA)</td>
<td>99%</td>
<td>40%</td>
</tr>
<tr>
<td>D-dimer (latex)</td>
<td>90%</td>
<td>60%</td>
</tr>
</tbody>
</table>

*vs phlebography

**NEGATIVE PREDICTIVE VALUE < 90%**

(25 level 1 studies 1; Heim et al. 2004)

---

Heim SW et al. Clinical Chemistry 2004
Diagnostic objectives in DVT

- Existence of thrombosis?

- Thrombus characteristics?

- Presence of complications?

- Etiology?
Symptoms and signs of pulmonary embolism

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyspnea</td>
<td>Tachycardia</td>
</tr>
<tr>
<td>Pleural pain</td>
<td>Crackling rales</td>
</tr>
<tr>
<td>Cough</td>
<td>Tachypnea</td>
</tr>
<tr>
<td>Leg edema</td>
<td>Sweating</td>
</tr>
<tr>
<td>Leg pain</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>Fever</td>
</tr>
<tr>
<td>Palpitations</td>
<td>Homans</td>
</tr>
<tr>
<td>Syncope</td>
<td>Cyanosis</td>
</tr>
</tbody>
</table>

Stein PD et al. Chest 1991
Potential diagnosis of helical CT in PE

- PE
- Pulmonary infarction
- Chronic PE
- Pneumonia
- Nodules or masses
- Pleural effusion
- Pneumothorax
- Emphysema
- Lymphadenopaties
- Esophageal disease
- Cardiac abnormalities

- Aortic dissection
- SVC syndrome
- Other vascular diseases
- Rib fractures
- Bone abnormalities
- Diaphragmatic dis.
- Abdominal dis.
- Pulmonary interstitial dis.
- Tracheal abnormalities
- Bronchiectasis
- Other respiratory dis.

Garg K et al. Am J Roentgenol 1999
# Clinical prediction model of PE

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical signs of DVT (edema)</td>
<td>3</td>
</tr>
<tr>
<td>Hear rate &gt; 100 bpm</td>
<td>1.5</td>
</tr>
<tr>
<td>Immobilization &gt; 3 days or surgery &lt; 4 weeks</td>
<td>1.5</td>
</tr>
<tr>
<td>Prior DVT or PE</td>
<td>1.5</td>
</tr>
<tr>
<td>Hemoptysis</td>
<td>1</td>
</tr>
<tr>
<td>Cancer</td>
<td>1</td>
</tr>
<tr>
<td>No alternative disease</td>
<td>3</td>
</tr>
</tbody>
</table>

### PROBABILITY

- **High** > 6 points
- **Intermediate** = 2-6 points
- **Low** <2 points

---

Supplemental examinations in PE diagnosis

- Risk factors, symptoms, and signs of DVT and PE
- Examination of LLs
- Laboratory tests: arterial blood gases; D-dimer
- Chest X-rays and ECG
- Imaging: V/P scan; helical CT
- Arteriography
Obligatory confirmation of suspected PE

**Arterial blood gases:**
\[ pO_2 \text{ and } pCO_2 \]
Usually low, but may be normal

**X-ray:** abnormal; non-specific

**ECG:** S1Q3T3; non-specific

**D-dimer:**
Sensitive (ELISA); Non-specific
V/P scan in PE diagnosis (I)

PERFUSION DEFECTS IN SEGMENTS 1, 3, 6 (D), AND 9-10 (I)
V/P scan in PE diagnosis (II)

- Only 41% of PE patients have a V/P showing a high probability
- In patients with cardiopulmonary disease, 77% of V/P scans are non-conclusive
- Other problems:
  - Does not diagnose other conditions

PIOPED investigators. JAMA 1990
PE diagnosis: echocardiogram – transthoracic echocardiogram

- 50% sensitivity
- Low specificity
- Allows for ruling out other diagnoses
- Prognostic value
- UNDEFINED ROLE

Helicoidal CT in PE diagnosis (I)
Helicoidal CT in PE diagnosis (II)
# Sensitivity and specificity of helical CT in PE diagnosis

<table>
<thead>
<tr>
<th>Studies</th>
<th>Se (%)</th>
<th>Sp (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remy-Jardin, 1992</td>
<td>100</td>
<td>96</td>
</tr>
<tr>
<td>Googman, 1995</td>
<td>86</td>
<td>92</td>
</tr>
<tr>
<td>Remy-Jardin, 1996</td>
<td>91</td>
<td>78</td>
</tr>
<tr>
<td>van Rossum, 1996</td>
<td>95</td>
<td>97</td>
</tr>
<tr>
<td>Sostman, 1996</td>
<td>73</td>
<td>97</td>
</tr>
<tr>
<td>Mayo, 1997</td>
<td>87</td>
<td>95</td>
</tr>
<tr>
<td>Drucker, 1998</td>
<td>57</td>
<td>89</td>
</tr>
<tr>
<td>Perrier, 2001</td>
<td>70</td>
<td>91</td>
</tr>
</tbody>
</table>

Se = sensitivity; Sp = specificity

Garg K et al. Am J Roentgenol 1999
Sensitivity and specificity of helicoidal CT in PE diagnosis (II)

Hogg K et al. Emerg Med J 2006
Arteriography in PE diagnosis

REFERENCE TEST IN PE DIAGNOSIS
(SENSITIVE AND SPECIFIC)
Validated diagnostic strategies for DVT

- Serial echo-Doppler\(^1\)
- Serial echo-Doppler + D-dimer\(^2\)
- Wells test + echo-Doppler\(^3\)
- Wells test + D-dimer + single echo-Doppler\(^4\)

Diagnostic algorithm for deep vein thrombosis (I)

Clinical suspicion of DVT

Echo-Doppler / DD

Normal/Normal
No DVT

Normal/Abnormal
Clinical probability
Low
Repeat echo-Doppler (1 week)

Abnormal/Normal
DVT

Moderate/High
Phlebography

Abnormal/Abnormal
DVT

Phlebography

Normal
No DVT

Abnormal
DVT

DD = D-dimer

Wells PS et al. Lancet 1997
Diagnostic algorithm for deep vein thrombosis (II)

- Wells’ test
- D-dimer
- Echo-Doppler
- Phlebography

¿ DVT ?

< 3

> 3

No DVT

Monitoring
Differential diag.

Echo-Doppler

DVT

Treatment

Lozano F. Glosa ed. 2002
Diagnostic algorithm for pulmonary embolism (I)

Clinical suspicion

V/P scan or multidetector CT (+ DD)

Normal

Non-diagnostic

High probability

PE

DD

Normal

Abnormal

No PE

PE

Low

Clinical probability

Moderate/High

V/P scan or multidetector CT

Diagnostic

Normal

Arteriography

Abnormal

PE

Normal

No PE

No PE

CT = Digital tomography

DD = D-dimer

1Perform test not previously done

Wells PS et al. Thromb Haemost 2000
Diagnostic algorithm for pulmonary embolism (II)

CT
LLs
X-ray, ECG
Gases
Clinical signs of PE?

< 6
Wells' test
D-dimer

+  
-  

No PE
Differential diag.
Discontinue treatment
Monitoring

> 6

CT / g V/P

+  
?

No PE
Arteriography

PE
Continue treatment

Wells PS et al. Thromb Haemost 2000
Epidemiology of post-phlebitic syndrome

- Post-DVT sequela\(^1\)
- 20%-50% occur 1-2 years after first DVT\(^2\)
- Asymptomatic DVT as risk factor\(^3\)
- Severe CVI (ulceration): 5%-10% of cases\(^2\)
- Impaired quality of life\(^4\)
- Financial impact

1. Tran NT & Meissner MH. Sem Vasc Surg 2002
4. Lozano F & Launois R. M&F 2003
Complications of VTE

- VG
- PFS
- PE

ACTIVE ULCER
Grade 6 (CEAP)
Riks factors of post-phlebitic syndrome

Recurrent DVT

Risk X 6

Risk X 2.6

Post-Phlebitic Syndrome

Clinical signs and natural history of post-phlebitic syndrome

- Natural history[^1][^2]:
  - Progressive effect (years) of venous hypertension, secondary to valvular insufficiency, occurring following recanalization of venous thrombus.

- Clinical classification (CEAP)[^3]:
  0. No signs
  1. Vein ectasia
  2. Varicose veins
  3. Edema
  4. Trophic changes
  5. Healed ulcer
  6. Active ulcer

[^1]: Tran NT & Meissner MH. Sem Vasc Surg 2002
Pathophysiology of post-phlebitic syndrome

Valve changes → Reflux → Hypertension
Ulcer incidence in post-phlebitic syndrome

Nicolaides A et al. Geriatrics 1973
Treatment of post-phlebitic syndrome

**DAY**
- Stockings/Bandages

**NIGHT**
- LL elevation

**Drugs/Advice**
Treatment of venous hypertension

MORPHOLOGICAL

FUNCTIONAL
Prevention of post-phlebitic syndrome

- Prevention of DVT
- Prevention of ipsilateral DVT recurrence (grade 1C)
- Compression stockings (grade 2B)
- Thrombolysis (grade 2B/2C)

Kahn SR. Br J Haematol 2006
Kahn SR and Ginsberg JS. Arch Intern Med 2004
Prognostic factors for VTE recurrence

- Non-traumatic or postoperative etiology¹
- Permanent risk factors¹
- Idiopathic DVT¹.²
- Residual DVT²-⁴.⁷
- Duration of anticoagulation¹.².³
- LMWHs = UFH⁵
- D-Dimer levels².⁶

1. Prandoni P. Semin Thromb Hemost 2001
2. Goldhaber SZ. Circulation 2004