

PULMONARY EMBOLISM

RECOGNITION AND ASSESSMENT

Pulmonary venous thromboembolism (PE) is often missed clinically; suspect the diagnosis in any patient with vague symptoms, or who does not respond to initial therapy, or in whose condition there has been an unexplained deterioration.

Most episodes follow popliteal or iliofemoral deep DVT; calf vein DVT rarely leads to PE although it can propagate to become a popliteal DVT.

Clinical patterns of PE

- Sudden collapse with raised jugular venous pressure (faintness and/or hypotension)
- Pulmonary haemorrhage syndrome (pleuritic pain and/or haemoptysis)
- Isolated dyspnoea (i.e. no cough/sputum/chest pain) – most patients are breathless and/or tachypnoeic (rate >20/min)

PE is easily missed

- in severe cardiorespiratory disease
- in elderly patients

PE is rare if age <40 with no risk factors

Major risk factors for venous thromboembolism (relative risk 5–20)

- DVT (present in 50% of patients)
- Surgery (where appropriate prophylaxis used, relative risk much lower)
- Major abdominal/pelvic surgery
- Hip/knee replacement
- Post-operative intensive care
- Lower limb problems
 - -Fracture
 - -Varicose veins
- Malignancy
 - -Abdominal/pelvic
 - -Advanced/metastatic
- Reduced mobility
 - -Hospitalisation
 - -Institutional care
- Previous proven VTE
- Obstetrics
 - -Late pregnancy
 - -Caesarean section
 - -Puerperium

Thrombo-embolic disease is a major cause of maternal mortality, consider in pregnant patient who becomes breathless or presents with pleuritic chest pain. D-Dimer also rises through pregnancy, but a normal D-dimer is still a good negative predictor for VTE

Minor risk factors (relative risk 2–4)

- Cardiovascular
 - congenital heart disease
 - congestive cardiac failure
 - hypertension
 - superficial venous thrombosis
 - indwelling central vein catheter
- Oestrogens
 - oral contraceptive
 - hormone replacement therapy

- Miscellaneous
- COPD
- neurological disability
- occult malignancy
- thrombotic disorders
- long-distance sedentary travel
- obesity
- inflammatory bowel disease
- nephrotic syndrome
- chronic dialysis
- myeloproliferative disorders
- paroxysmal nocturnal haemoglobinuria
- Behçet's syndrome

MASSIVE PULMONARY EMBOLUS

Symptoms and signs

Massive PE is highly likely if there is:

- Collapse/hypotension, and
- Unexplained hypoxia, and
- Engorged neck veins, and
- Right ventricular gallop (often)
- Cardiac arrest. 'Blue light' patients with out-of-hospital cardiac arrest due to PE rarely recover

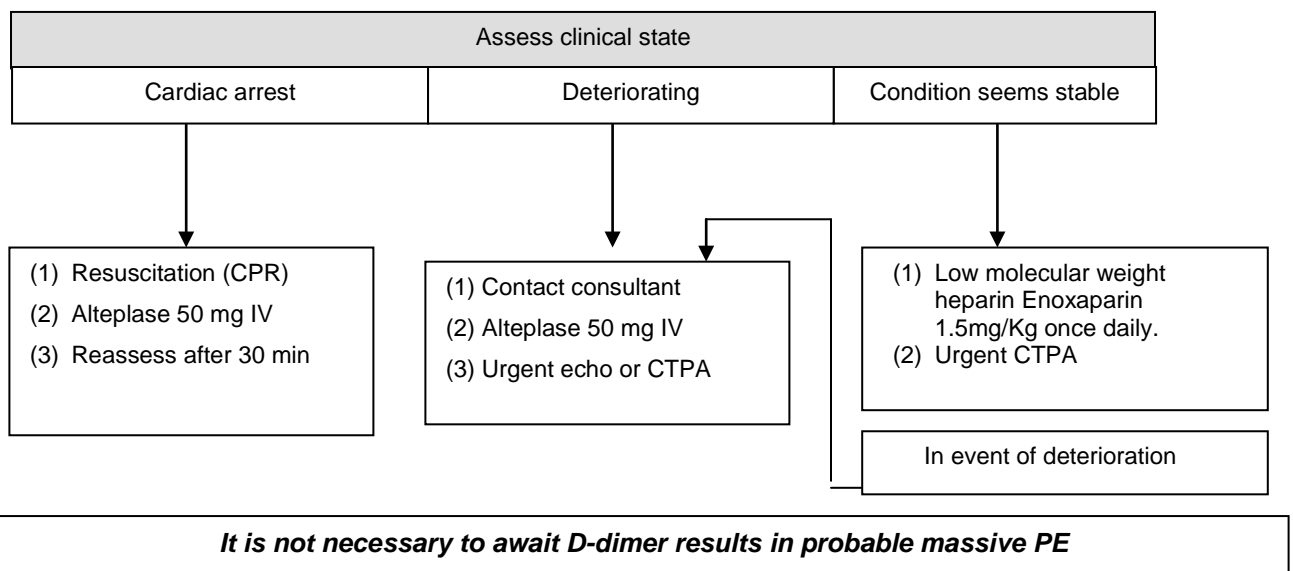
MANAGEMENT

General

- O₂ to maintain SaO₂ >= 94%
- Adequate analgesia for pleuritic pain: ibuprofen 200-400 mg orally 6 hrly (not if pregnant); codeine phosphate 30-60 mg orally 8 hrly; diamorphine 2.5 - 5mg SC 4 hrly. Give metoclopramide 10 mg (5 mg in young adults 15-19 yr <60 kg) IV with ≥8 hrs before repeating
- Allow right atrial pressure (i.e. JVP) to remain high if elevated
- **AVOID** diuretics

PREGNANCY

If pregnant woman has collapse or shock associated with a massive pulmonary embolism, consider thrombolytic therapy – associated with 1-6% maternal bleeding complication rate, 1.7% fetal mortality, but no maternal mortality – discuss with on-call obstetric consultant



Thrombolysis

- If life-threatening features present (right heart failure, shock), give alteplase 50 mg IV as bolus injection. Failure to respond to alteplase may be an indication for pulmonary embolectomy: contact consultant to discuss with on call cardiothoracic team. If thrombolysis is contraindicated then discuss with on call cardiothoracic team. If it is felt that right heart catheter monitoring would be helpful, arrange to transfer patient to critical care unit
- In stable patients, that is without systemic hypotension, in whom massive PE has been confirmed, consider thrombolysis if right ventricular dysfunction on echocardiogram. However this remains controversial. Give alteplase 10 mg by IV injection over 1-2 min, followed by 90 mg by IV infusion over 2 hr (max 1.5 mg/kg in patients weighing <65 kg). Otherwise anti-coagulate with enoxaparin and warfarin as in section on **Non-massive Pulmonary Emboli**

If there are contraindications to giving alteplase or anticoagulation, a consultant physician, trust physician or registrar must make a decision as to which carries most risk – possible complications of therapy, or embolism

Post-thrombolysis

- After thrombolytic therapy has ceased, wait until APTT ratio has fallen below 2 before commencing or recommencing anticoagulation as follows:
- In all patients, continue or start low molecular weight heparin. In pregnant women, monitor anti-Xa concentration as a guide to dosage adjustment
- If not pregnant, start warfarin – see **non-massive pulmonary emboli**

NON-MASSIVE PULMONARY EMBOLI

Symptoms and signs (signs may be absent)

- Dyspnoea (present in 90% of cases) – may be of sudden onset
- Pleuritic chest pain
- Haemoptysis
- Syncope
- Tachypnoea (>20 breaths/min)
- Fever
- Pleural rub
- Tachycardia

Differential diagnosis

- Pneumonia
- Myocardial infarction (MI)
- Exacerbations of asthma and COPD

Confirming diagnosis

ECG and chest X-ray are often normal and should not be used to confirm/refute the diagnosis, but are useful for identifying other diseases and explaining symptoms. ECG may show sinus tachycardia, an S1 Q3 T3 pattern, anteroseptal T wave inversion, right bundle branch block, p pulmonale or right axis deviation. Chest X-ray may show non-specific shadows or a raised hemidiaphragm, pulmonary oligoemia, linear atelectasis or small pleural effusion

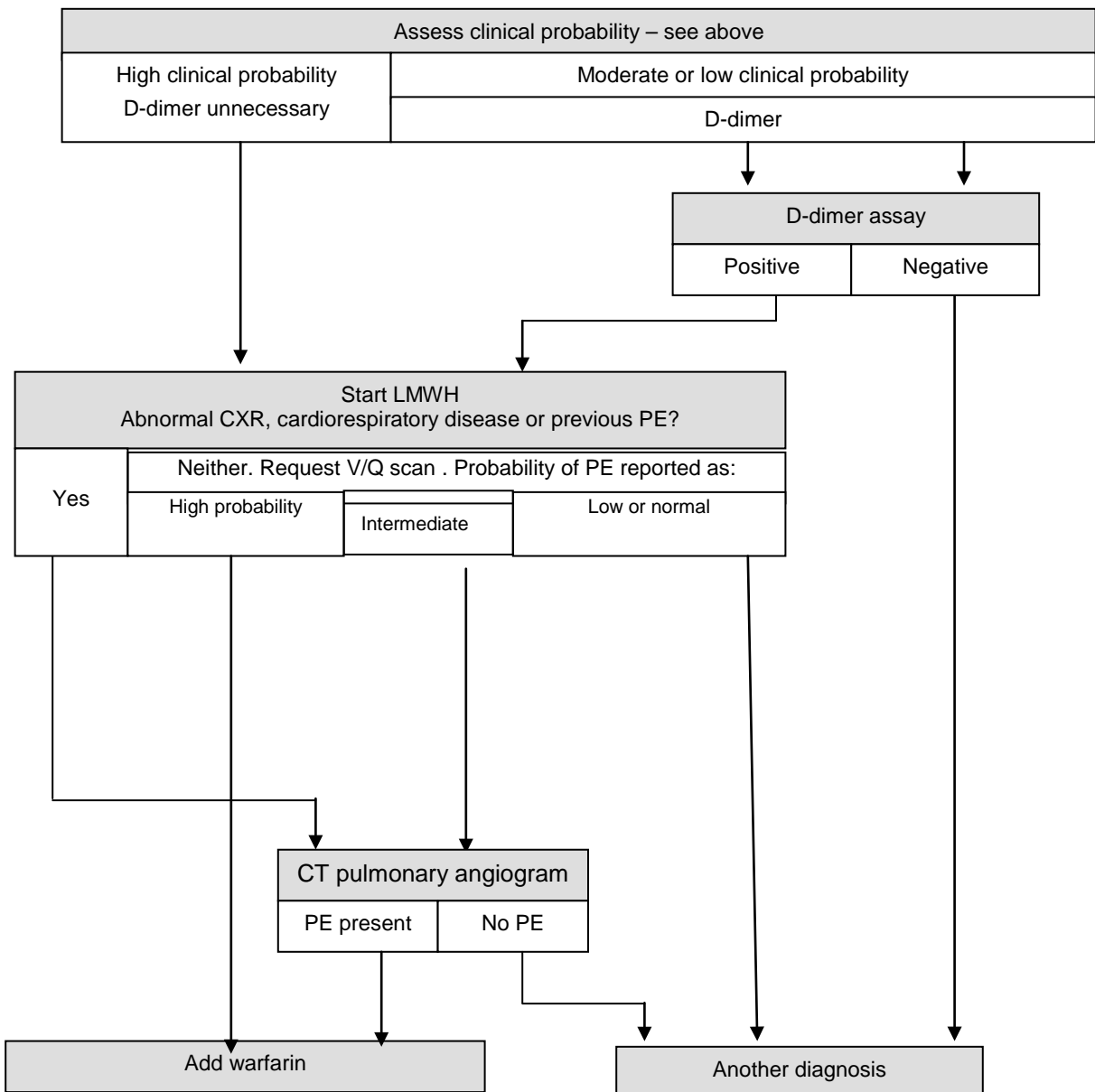
- Determine pre-test probability (Table 1) and follow flowchart

Table 1: Clinical scoring system for PE

Are other diagnoses unlikely?	Is a major risk factor present?
<ul style="list-style-type: none"> On clinical grounds After basic investigations: <ul style="list-style-type: none"> white cell count chest X-ray ECG spirometry or peak flow blood analysis 	<ul style="list-style-type: none"> Recent immobilisation or major surgery Recent lower limb trauma and/or surgery Clinical deep vein thrombosis Previous proven DVT or PE Pregnancy or postpartum Major medical illness
If YES, score +1	If YES, score +1
Total score	Pre-test probability
0	Low
1	Moderate
2	High

Flowchart for diagnosis of non-massive PE

- If patient pregnant, follow separate obstetric guidelines



Investigations

- If indicated by pre-test probability, request D-dimer assay. Do not request where an alternative diagnosis is highly likely, clinical probability of PE is high. **Only a negative result is of value.** See Table 2
- Request ventilation/perfusion (V/Q) scan or CT pulmonary angiogram (CTPA) as indicated by flowchart.
- In patients with clinical DVT, leg Doppler ultrasound is alternative to lung imaging
- FBC, PT, APTT

Table 2: Examples of clinical states other than venous thromboembolism associated with an elevated D-dimer concentration

- Acute MI
- Chronic subdural haematoma
- Disseminated intravascular coagulation
- Gram negative bacteraemia
- Leukaemia
- Liver disease
- Metastatic malignancy
- Peripheral vascular disease
- Pregnancy
- Recent surgery
- Renal disease
- Rheumatoid disease
- Sickle cell crisis
- Subarachnoid haemorrhage
- Thrombolytic therapy
- Trauma with pathological thrombosis

IMMEDIATE TREATMENT

General

- O₂ to maintain SaO₂ \geq 94%
- Adequate analgesia for pleuritic pain: ibuprofen 200-400 mg orally 6 hrly (not if pregnant); codeine phosphate 30-60 mg orally 8 hrly; diamorphine 2.5 - 5mg SC 4 hrly. Give metoclopramide 10 mg (5 mg in young adults 15-19 yr <60 kg) IV with \geq 8 hrs before repeating
- Allow right atrial pressure (i.e. JVP) to remain high if elevated
- **AVOID** diuretics

Specific

- As starting enoxaparin, take blood for FBC, PT, APTT
- If platelet count $<100 \times 10^9/L$, seek advice from on-call haematologist before starting anticoagulation
- If platelet count $\geq 100 \times 10^9/L$, weigh patient and prescribe enoxaparin 1.5 mg/kg
- Patients at increased risk of bleeding include those who have severe liver or renal failure, thrombocytopenia or defective platelet function and those following surgery, trauma or haemorrhagic stroke
- Dose of enoxaparin may need to be adjusted if patient is significantly underweight or overweight, or has renal impairment (eGFR <30 ml/min).
- Anti-Xa activity monitoring should be considered in extremes of weight, significant renal failure, bleeding tendency or if pregnancy (consult haematologist)

For anticoagulation with heparin and warfarin refer to relevant Trust guidelines.

MANAGEMENT OF PREGNANT WOMAN WITH SUSPECTED MILD-TO-MODERATE EMBOLI

Contact obstetric team. See obstetric department guideline for management of DVT and PE in pregnancy (Women's and Children's Services, Delivery Suite Guidelines, Section 9, Thromboembolic Diseases).

References

BTS guidelines for the management of suspected pulmonary embolism, 2003