Pulmonary Embolism Crib sheet Version 1.7 See more at abcmedicalnotes.com. See below on terms of use. This is for personal study only. DOK MD

ACUTE PULMONARY EMBOLISM

Introduction: Acute obstruction of the pulmonary artery and its branches by thrombus which may cause haemodynamic disturbance.

PATHOPHYSIOLOGY

One or more venous thrombi in the veins of the leg and pelvis embolises to the IVC → RA → RV → PA → branches. Spectrum from asymptomatic to fatal. Depends on size, number, frequency, cardio-respiratory status. Causes obstructive shock/RV failure. Distal clots may infarct lung with pleurisy. Central clots may be painless.

RISKS OF VENOUS THROMBOSIS AND PE

Previous DVT/PE. Active cancer. COVID-19. Recent surgery. Lower limb trauma. Significant immobility, e.g. hospitalisation, pregnancy + first 6 weeks postpartum. OCP, HRT, thrombophilia, APL, long-distance travel, obesity, age > 60.

CLINICAL SYMPTOMS AND SIGNS

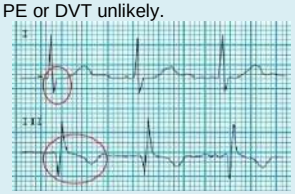
- Pallor, Chest pain (pleuritic) nay suggest lung infarction, Breathless
- Syncope, tachycardia, hypotension, shock, Hypoxia mobilising" walk test"
- Pregnant or has given birth within the past 6 weeks.

DIFFERENTIALS

- Pneumothorax, pneumonia, acute exacerbation of chronic lung disease.
- Acute coronary syndrome, cardiogenic pulmonary oedema, aortic arch dissection or rupturing aortic aneurysm, and pericarditis.
- Musculoskeletal chest pain. Note that the chest wall may be tender in up to 20% of people with confirmed PE.
- Gastro-oesophageal reflux disease, Oesophageal rupture.
- Collapse: vasovagal syncope, orthostatic (postural) hypotension, cardiac arrhythmias, seizures, and cerebrovascular disorders.

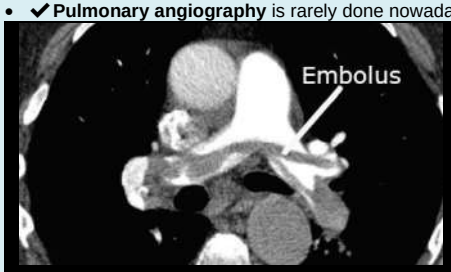
INITIAL INVESTIGATIONS

- FBC, U&E. LFT. CRP. ↑ Raised BNP. Check PT/APTT baseline
- ↑ Raised **Dimers**: Irrelevant if Wells score 4 or more. Dimer value may be adjustable for age. The negative predictive value of D-dimer testing is high, and a normal D-dimer level renders acute PE or DVT unlikely.
- **ABG** Low pH, Low O_2, Low/Normal CO_2
- ↑ Raised **Lactate** >2 mmol/L worse prognosis
- **ECG**: Most common normal. Sinus tachycardia. Right heart strain. RBBB. S1 Q3 T3. Useful to exclude STEMI/NSTEMI
- ↑ Raised **Troponin** in large PEs
- COVID-19 PCR where appropriate



IMAGING PULMONARY EMBOLISM

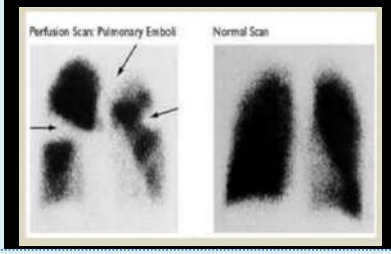
- ✔ **CXR** is normal in most patients. Watermark sign is an area of reduced vascular markings. Lung infarction may show with wedge consolidation and be mistaken as infection. Useful to exclude pneumonia, heart failure, pneumothorax.
- ✔**CT Pulmonary Angiography** allows adequate visualization of the pulmonary arteries down to the subsegmental level. Readily available around the clock in most centres. Excellent accurate. The exam of choice in most patients. Provides additional info that may help. See the trouser legs of the right and left pulmonary arteries below pulmonary trunk with dark clot in the lumen
- ✔**Lower limb compression venous ultrasound:** may be useful if there are signs of DVT or even if no signs can do bilateral and find DVT in pregnant women in whom irradiation from other imaging may be harmful and used as supporting evidence for anticoagulation. CUS has a sensitivity >90% and a specificity of 95% for proximal symptomatic DVT.
- ✔**Ventilation-perfusion or perfusion scintigraphy (isotope lung scanning).** If available useful but often results may be indeterminate. Requiring further diagnostics. Consider in circumstances (for example, half-dose perfusion scintigraphy in pregnancy). There should be a normal CXR.
- ✔**Echocardiography:** for those with hypotension (clinically 'massive' PE). Acute PE may lead to RV pressure overload and dysfunction, which can be detected by echocardiography. Absence of right heart strain excludes large PE. Assess LV function, valves, exclude pericardial effusion/tamponade.
- ✔**Pulmonary angiography** is rarely done nowadays. CTPA easier.

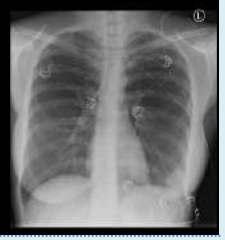


CTPA embolism is a darker filling defect in a brighter pulmonary artery filled with contrast.

VQ: PE is a scan with ventilated but not perfused lung

CXR: Wedge infarcts, oliguemic areas.





TWO LEVEL PE WELLS SCORE ASSESS CLINICAL PROBABILITY

Clinical features of DVT	+3
Heart rate greater than 100 beats per minute	+1.5
Immobilization > 3 days or surgery in past 4 weeks	+1.5
Previous DVT or PE	+1.5
Haemoptysis	+1
Cancer (cancer treatment < 6 months, or palliative)	+1
Alternative diagnosis less likely than PE: + 3 POINTS	+3

- ✔Wells score > 4 pts (PE likely), arrange hospital admission for an immediate CTPA and, where necessary, other investigations
- ✔Wells score of 0-4 points (PE unlikely), offer a D-dimer test with the result available within 4 hours. If positive arrange CTPA: If negative, consider alternative diagnoses.
- If the Dimer or CTPA test result cannot be obtained within 4 hours, *offer interim therapeutic anticoagulation while awaiting the result* (if possible, choose an anticoagulant that can be continued if PE is confirmed).

Ambulatory care

Low risk patients may be managed through ambulatory care. Treatment should be started if diagnostics delayed but target should be assessment and tests done same day. Low risk patients have a sPESI score of 0 points with a 1.1% risk of death and 1.5% having recurrent VTE or non-fatal bleeding.

SIMPLIFIED PESI SCORE: LOW IF ALL ZERO!

Age, years	≤80	**0**	>80	**+1**
History of cancer	No	**0**	Yes	**+1**
Known cardiopulmonary disease	No	**0**	Yes	**+1**
Heart rate, bpm	<110	**0**	≥110	**+1**
Systolic BP, mmHg	≥100	**0**	<100	**+1**
O_2 saturation	≥90%	**0**	<90%	**+1**
LOW RISK SCORE =0 !				

MANAGEMENT

- ABC, Oxygen as hypoxaemia a feature of severe PE. Give High Fio2.
- RV failure consider IV N-Saline to boost right sided pressures
- Arrange appropriate tests. If confirmed or delay, then anticoagulation choices below. Determine if provoked or not.
- Consider Thrombolysis for those with haemodynamic compromise.

ANTICOAGULATION

Current choices depend on clinical assessment and local protocols

- Apixaban 10 mg BD for 7 days, then maintenance 5 mg BD.
- Rivaroxaban 15 mg BD for 21 days, then 20 mg OD taken with food
- **Warfarin** loading dose with LMWH/UFH cover for 5 days. Warfarin used if significant renal disease and DOACs contraindicated. Continue LMWH until the INR is at least 2.0 in 2 subsequent readings.
- **Unfractionated Heparin** IV infusion. Used if concerns over bleeding
- **Unfractionated Heparin** 15,000 U SC BD
- **Tinzaparin** 175 units/kg OD SC or **Enoxaparin** 1.5 mg/kg OD SC

Duration of Treatment: Provoked PE (e.g. post op) with cause removed minimal is 12 weeks then reassess. Given for longer usually 6 months if unprovoked VTE and reviewed and may be continued life-long. Needs individualised expert assessment and follow up in VTE clinic and patient discussion. DOAC is reasonable with active cancer. Usually for 3-6 months and then review.

UNPROVOKED PE OR TREATMENT FAILURE: LOOK FOR CAUSES

- Malignancy: FBC, U&E, LFT, PT and APTT, and offer a physical examination. Further investigations dependent on findings
- Heparin-induced thrombocytopenia
- Antiphospholipid syndrome: consider sending antiphospholipid antibodies
- Thrombophilia screen if unprovoked PE + affected 1st degree relative

PULMONARY EMBOLISM AND PREGNANCY

- PE is number one cause of maternal mortality. Risk extends to 6 weeks post-partum. Shared decision making with patient and obstetrics
- Diagnostic tests: All breathless and pregnant patients get a CXR (shield fetus). If Dimer negative may suggest considering alternative diagnosis.

Preferred order of diagnostic tests that minimise radiation

- Compression USS of lower legs for DVT if possible
- CTPA vs VQ scan often depends on local access to resources and time
- If CXR normal, then consider half-dose VQ scan (Risks of radiation to fetus).
- If CXR abnormal then consider CTPA (Risks of radiation to breast)

PULMONARY EMBOLISM WITH RV DYSFUNCTION/SHOCK

Consider thrombolysis after assessing patients for bleeding risk and risk of decompensation and death. Thrombolysis benefits patients with high-risk PE - those with RV dysfunction and shock with a significant reduction in the combined outcome of mortality and recurrent PE. There is a 10% risk of severe bleeding and a 1.7% rate of intracranial haemorrhage. Avoid LMWH or UFH first.

- **Hypotensive/Hypoxic but stable**: Alteplase: 10 mg, to be given over 1-2 minutes, followed by (by IV infusion) 90 mg, over 2 hours. Reduce to 1.5 mg/kg in patients less than 65 kg.
- **Peri arrest/Cardiac arrest** Alteplase 50 mg stat IV and CPR should be continued for 60-90 minutes.
- **Interventional management**: Selected centres may consider surgical embolectomy or catheter-directed treatment. Poor evidence base for catheter-directed thrombolysis.
- **Circulatory Support:** Ensure volume filled with N-Saline. Consider HDU referral for Inotropes such as Noradrenaline and Dobutamine may be considered.
- **ECMO** may be helpful in patients with high-risk PE, and circulatory collapse or cardiac arrest. Survival of critically ill patients has been described in a number of case series. ECMO may be considered with surgical embolectomy or catheter-directed treatment which may be available in some centres

RETRIEVABLE IVC FILTERS

IVC filters may have a role in those who cannot be anticoagulated due to systemic bleeding risk. The evidence seems to show that they appear to reduce the risk of subsequent PE, increase risk of DVT, but no impact on overall mortality. They are not without risk and I have seen one patient die directly due to vascular damage from the procedure. Should be used on an individualised basis. Avoid unless deemed truly necessary. They are usually removed after several weeks.