Pulmonary Embolus - Assessment and Imaging - Suspected Acute PE - Full Clinical Guideline

Reference No.: CG-T/2013/051

Pulmonary embolism (PE) most commonly occurs due to the migration of a deep vein thrombus from either leg or pelvic veins to the lungs. PE is a potentially fatal condition with a high mortality rate in untreated patients. Accurate diagnosis can be challenging due to non-specific presenting symptoms and signs. Patients are at risk of both a failure to recognise or of over investigation when a careful clinical assessment may yield a more likely alternative diagnosis.

The cornerstones of initial assessment are:

1. A thorough history, careful clinical examination and appropriate use of initial investigations (such as routine bloods, ECG and CXR) combined with objective assessment of clinical probability including a validated assessment score. This guideline follows the NICE guideline recommendation of using Wells scores.

2. Triage of patients with suspected pulmonary embolism using Wells score into “PE likely” or “PE unlikely “groups.

3. Use of D dimer testing in “PE unlikely” patients to exclude the diagnosis without need for imaging.

4. Appropriate radiological imaging tests for patients with, “PE likely”, and those with “PE unlikely” in whom D dimer tests are elevated.

D dimer is not a screening tool for PE. When used without proper objective assessment of probability it has inadequate specificity in patients as with a low pre-test probability of PE (too many false positives) and inadequate sensitivity for patients with high pre-test probability (chance of missing PE).

Timing of radiological investigation

All patients with suspected PE in whom radiological imaging is required after initial assessment should be imaged within 24 hours. Stable patients assessed out of normal working hours should be imaged on the first available list the following day. Unstable patients should ideally be imaged within 1 hour. The decision to image a patient urgently out of normal working ours is a matter of clinical judgement, which should take into account the urgency of confirming diagnosis, likelihood of the test altering management prior to the following morning, and contraindications to empiric anticoagulation. Where a patient's need for imaging is considered urgent, a senior clinician should discuss the case with the radiologist on call.

Patients with suspected sub-massive or massive PE: Read this guideline in conjunction with Trust guideline for thrombolysis in PE.

Patients who are fit for outpatient investigation of PE: Read this guideline in conjunction with the Trust guideline for management for patients with VTE or consult the BTS guidelines on ambulatory management of PE (2018).

https://brit-thoracic.org.uk/standards-of-care/guidelines/bts-guidelines-for-the-outpatient-managment-of-pulmonary-embolism/

Clinical evaluation

Common symptoms of PE include dyspnoea, pleuritic chest pain, haemoptysis or syncope. PE should also be considered in unexplained hypotension / tachycardia.

The classic triad of dyspnoea, pleuritic pain and haemoptysis occurs in a minority of patients. Over 90% of patients will be dyspnoeic, and where dyspnoea or RR >20/min are not present the diagnosis should be questioned, and other causes for symptoms such as chest pain or haemoptysis considered. A careful history is important, as pleuritic pain from

a pulmonary infarction may persist for several days after breathlessness has improved.

Presentations with PE are varied and include

1) Large central pulmonary embolus: Severe dyspnoea, signs of right ventricular dysfunction, may have central angina type chest pain due to right ventricular ischemia

2) Large peripheral PE: May result in pulmonary infarction leading to classic triad of dyspnoea, pleuritic chest pain and haemoptysis.

3) Small peripheral PE: painless dyspnoea. May be asymptomatic.

4) Atypical presentation: May present as “pneumonia” with fever and pleuritic pain, or painful pleural effusion. Clues include dyspnoea, hypoxia or cardiovascular compromise which are out of proportion to radiographic findings. Rigors and purulent sputum are, however, strongly suggestive of chest infection.

The history should include a search for risk factors, co-morbid cardiac or respiratory disease which might provide an alternative explanation for symptoms or influence the choice of imaging technique, and any potential contraindications or risks for anticoagulation.

Clinical examination should include a search for signs of DVT (present in a minority), attention to signs of RV dysfunction, blood pressure measurement, and signs of other cardio-respiratory disease. Be aware of the risk of rib fractures and haemothorax in elderly patients with history of falls, and examine the chest wall.

The combination of hypoxemia with a normal chest radiograph in the absence of features

of severe obstructive lung disease is strongly suggestive of PE.

Initial investigations should include;

1) CXR: should be performed in all patients. This may well be normal. In patients with chest pain due to pulmonary infarction may show non specific features such small effusions, plate atelectasis, or small areas of opacification which may be peripheral, and sometimes wedge

shaped. The main role of the CXR is to exclude other diagnoses with similar clinical presentations, eg pneumothorax.

2) ECG: important to exclude myocardial infarction. Features of PE are non specific and may include sinus tachycardia, ST segment or T wave changes, right bundle branch block, right axis deviation or signs of right heart strain.

3) Blood tests including U+E, LFT, FBC, INR and PTT.

4) Quantitative D dimer blood tests only if PE on Wells 2 level score is considered unlikely.

Assessing probability of PE

If there is clinical DVT and leg Doppler examination is positive and 2 level Wells score is “PE likely” PE can be assumed and no further imaging is required. After initial assessment and investigations, use the Two Level PE Wells score to determine the clinical probability of PE (see appendix 1 and 2).

If result of 2 level Wells score is “PE likely” proceed directly to PE imaging as follows:

• Age under 50 and no significant co-morbid cardiorespiratory disease with a normal

chest radiograph: VQ SPECT scan if available (Not available after hours – if patient presents between Friday morning and Sunday evening, VQ imaging within 24 hours cannot be guaranteed)

• Age over 50 or significant co-morbid cardiorespiratory disease, or abnormal chest radiograph: CTPA.

• In patients with suspected massive or submassive PE, CTPA is the preferred option

CTPA requires venous access in the right arm for optimal contrast dynamics, preferably a 20F cannula or larger in the right ante-cubital fossa.

Renal function should be considered before ordering CTPA. If eGFR < 60, read section on renal impairment below.

If result on Well's is "PE unlikely" assess quantitative D-dimer and image if D dimer is positive.

• If "PE unlikely" and D Dimer is normal PE is as unlikely as with a negative CTPA and VQ SPECT, and no further thoracic imaging for PE is warranted on this occasion.

• If "PE unlikely" and D-dimer abnormal then image for PE as above.

Patients awaiting imaging should receive empiric parenteral anticoagulation or a dose of direct oral anticoagulant (DOAC) while awaiting imaging unless imaging is available immediately or there is a major contraindication to anticoagulation.

Interpretation of results:

PE is confirmed by either CTPA or VQ scan report positive for pulmonary embolus in appropriately selected patients. Acute PE can resolve in as little as 2 days resulting in negative investigation. There is a small false positive rate with both tests

PE is highly unlikely (and no further thoracic imaging warranted) in the following situations

• "PE unlikely" two level Wells Score with a normal D-dimer test.

• Normal VQ scan

• Good quality negative CTPA.

All indeterminate V/Q scans should be followed by further imaging, usually CTPA.

A small proportion of CTPA may be indeterminate due to incomplete opacification

of pulmonary vessels or due to respiratory motion. These may not be sufficient to

exclude the diagnosis, unless the scan shows incontrovertible evidence of another

diagnosis to which the clinical syndrome can be definitely attributed. In cases with

indeterminate CTPA results the failure to obtain contrast opacification should be noted in

the clinical notes, and the clinical probability and scan result should be reviewed by a senior clinician with expertise in pulmonary embolism. If any doubt remains before determining further management (e.g. treat empirically or re-image).

Leg Doppler ultrasound (Done by clinical measurement department, not radiology). May be negative in significant proportion of patients with PE. May be used in suspected PE patients with strong clinical evidence of DVT. If negative then further imaging is required.

Doppler should still be carried out in patients with negative imaging for PE in whom

DVT is suspected clinically.

Renal impairment

Please refer to the trust and imaging policy on IV contrast and renal impairment.

http://flo/EasysiteWeb/getresource.axd?AssetID=2467&type=full&servicetype=Attachment

In patients with severe renal dysfunction in whom V/Q scan is not helpful, a positive

Doppler ultrasound may avoid the need for CTPA. Advanced renal failure is not an absolute contraindication for CTPA, particularly in the acutely unstable patient if a diagnosis is needed, but discussion with the renal team is essential to ensure an appropriate management/escalation plan in the event of worsening renal function post-contrast. **Echocardiogram**

An echocardiogram is the bedside test of choice for patients who are too ill to be transferred to go for imaging. Right ventricular dilatation and hypokinesis in the appropriate clinical setting can strongly suggest the diagnosis of massive PE. The decision for bedside echocardiography should be made in conjunction with the consultant responsible for the patient’s care.

Outpatient echocardiogram

The routine requesting of outpatient echocardiograms at 3 months in all patients with diagnosed PE should be avoided as there is a very low pick-up rate for abnormalities. Echo should be considered in the outpatient setting in patients who are persistently breathless despite adequate treatment for recent acute PE.

Cardiac Troponins / BNP / NT-proBNP

Cardiac Troponins / BNP / NT-proBNP may be raised in some PE patients, with more severe disease reflecting right ventricular myocardial damage due to RV strain. In this case they give prognostic information but used in isolation their role in clinical decision making remains unclear. They may allow recognition of a lower risk cohort of PE patients suitable for outpatient management, but only when used in conjunction with an appropriate risk score such as the Pulmonary Embolism Severity Index (PESI), simplified PESI or Geneva score.

In severely ill but normotensive patients they may help the experienced senior clinician to decide on the risk benefit ratio of thrombolysis.

Pregnancy:

The following points are of particular importance:

• The on-call obstetrics team should always be contacted when pregnant patients present with suspected PE

• Exposure to ionizing radiation and contrast media should be limited in pregnancy

• Indeterminate CTPA is more common in pregnancy due to increased pulmonary flow rates.

• In stable patients first choice imaging is VQ scan, however this is not available on weekend days and so CTPA should be requested if unable to wait until Monday for investigation.

• Dose of enoxaparin in pregnant patients is 1mg/kg bd, and not 1.5 mg/kg daily.

Malignancy screening

Patients with confirmed unprovoked PE or DVT should have the following assessment:

Careful history and examination looking for occult malignancy.

FBC, UE, LFT, Calcium

Urine dip

PSA and digital rectal examination if male and over 50 years

Breast examination if female

Investigations such as CT and endoscopy should be organised only if there are red flag symptoms or signs suggestive of occult malignancy.

Evidence does not support the routine use of CT abdomen and pelvis in patients with unprovoked PE in whom there are no underlying features in the history suspicious for occult malignancy or clinical / biochemical / radiological features suspicious of occult malignancy.

Thrombophilia testing

There is a limited role in the acute setting. Thrombophilia testing can be requested in the outpatient setting in specialist clinics when it may have an impact on length of anticoagulation treatment or further risk stratification.

Development of Guideline:	Dr Louise Haine (Consultant Radiologist) Dr James Donaldson (Respiratory Consultant) Dr Jim Birchall (Nuclear Medicine)
Consultation with:	
Approved By:	*4th October 2018 (Respiratory/Radiology)* Medical Division - 15/11/2018
Review Date:	December 2021
Key Contact:	Dr Louise Haine

Appendix 1and 2: 2 level Wells scores for PE and DVT

Pulmonary embolism (PE)

Table 2 Two-level PE Wells score[a]

Clinical feature	*Points*
Clinical signs and symptoms of DVT (minimum of leg swelling and pain with palpation of the deep veins)	3
An alternative diagnosis is less likely than PE	3
Heart rate > 100 beats per minute	1.5
Immobilisation for more than 3 days or surgery in the previous 4 weeks	1.5
Previous DVT/PE	1.5
Haemoptysis	1
Malignancy (on treatment, treated in the last 6 months, or palliative)	1
Clinical probability simplified score	
PE likely	**More than 4 points**
PE unlikely	**4 points or less**

[a] Adapted with permission from Wells PS et al. (2000) Derivation of a simple clinical model to categorize patients' probability of pulmonary embolism: increasing the model's utility with the SimpliRED D-dimer. Thrombosis and Haemostasis 83: 416–20

Deep vein thrombosis (DVT)

Table 1 Two-level DVT Wells score[a]

Clinical feature	*Points*
Active cancer (treatment ongoing, within 6 months, or palliative)	1
Paralysis, paresis or recent plaster immobilisation of the lower extremities	1
Recently bedridden for 3 days or more or major surgery within 12 weeks requiring general or regional anaesthesia	1
Localised tenderness along the distribution of the deep venous system	1
Entire leg swollen	1
Calf swelling at least 3 cm larger than asymptomatic side	1
Pitting oedema confined to the symptomatic leg	1
Collateral superficial veins (non-varicose)	1
Previously documented DVT	1
An alternative diagnosis is at least as likely as DVT	−2
Clinical probability simplified score	
DVT likely	**2 points or more**
DVT unlikely	**1 point or less**

[a] Adapted with permission from Wells PS et al. (2003) Evaluation of D-dimer in the diagnosis of suspected deep-vein thrombosis.