Clinical Guideline

INVESTIGATION AND MANAGEMENT OF PULMONARY EMBOLISM

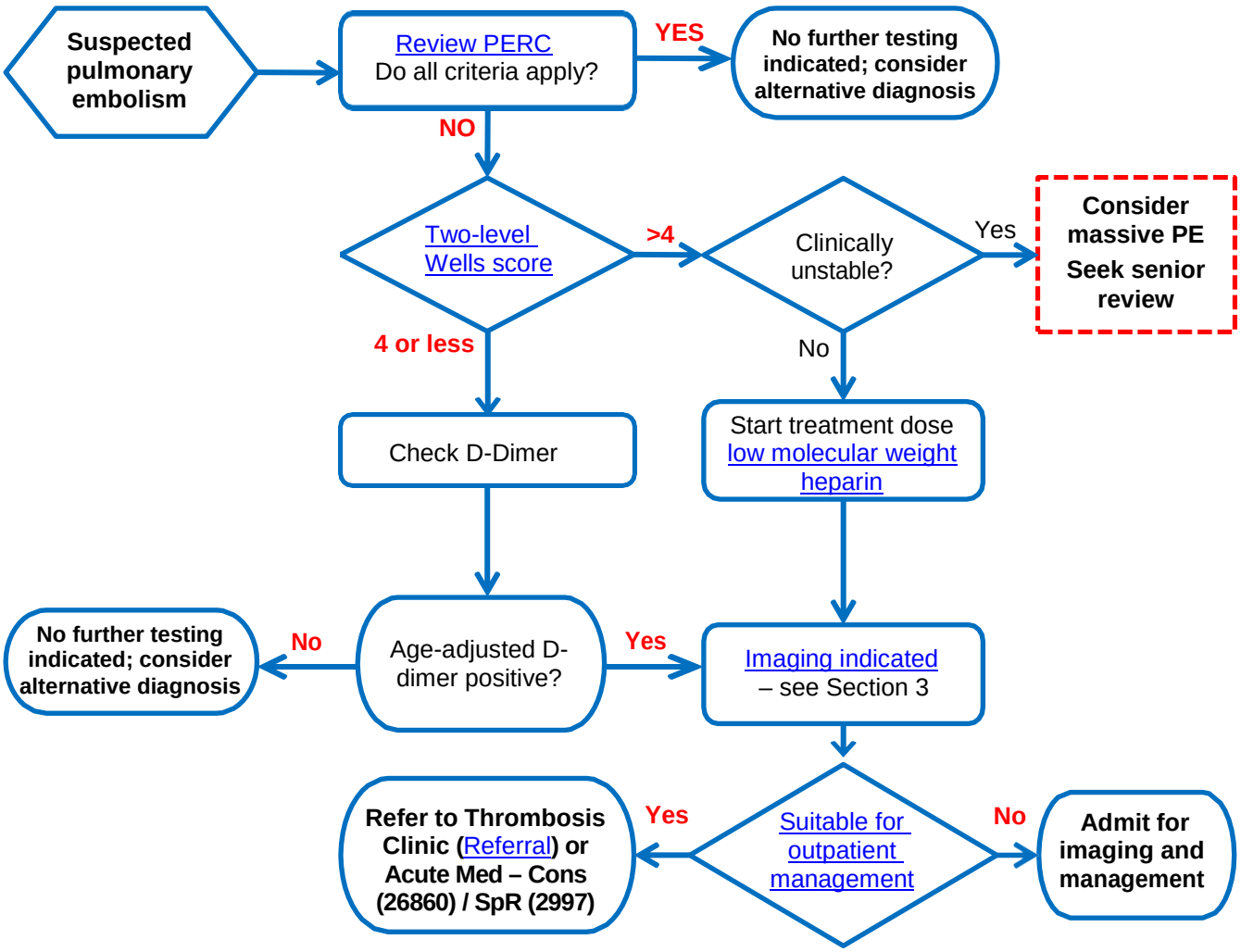
SETTING	Trustwide
FOR STAFF	Medical and nursing staff
PATIENTS	Adult patients with suspected or confirmed pulmonary embolism Excludes pregnancy and puerperium (see http://nww.avon.nhs.uk/dms/download.aspx?did=11244)

This guideline consists of three sections: Investigations for suspected PE; immediate management of confirmed PE; continuing management of confirmed PE.

Clinical judgement should always be used when deciding on management for individual patients.

1. Investigations for suspected PE in ED/inpatients*

(Underlined text links to explanatory paragraphs below)



* Patients referred from primary care with suspected PE will be discussed with medical consultant (in hours) or SpR (OOH), and seen directly in the Acute Medicine Clinic or AMU.

Authors: [redacted] (Haematology Consultant), [redacted] (Haematology Consultant), [redacted] (Radiology Consultant), [redacted] (Emergency Medicine Consultant), [redacted] (Acute Medicine Consultant).

Two Level Wells Score

Criterion	Score
Clinical signs of deep vein thrombosis (leg swelling or pain on palpation)	3
Pulmonary embolism is more likely than alternative diagnoses	3
Heart rate > 100 beats per minute	1.5
Immobilisation for more than 3 days or surgery in the previous 30 days	1.5
Previous deep vein thrombosis or pulmonary embolism	1.5
Haemoptysis	1
Malignancy (on treatment, treated within the last 6 months)	1

Interpretation of Two Level Wells Score:

Total score	Probability of PE	Interpretation
≤ 4.0	3%	PE unlikely (if score 0 or 1.0 see below for rule out criteria)
>4.0	28%	PE likely

Pulmonary Embolism Rule Out Criteria (PERC)

If clinical suspicion of PE is low (the clinician estimates the likelihood of PE to be <15% based on the overall clinical impression), PERC can be used to rule out PE. If all of the following apply, the patient is at ultra-low risk of PE:

- Age < 50 year old
- Heart rate < 100 beats/min
- SpO2 > 94%
- No unilateral leg swelling
- No haemoptysis
- No surgery or trauma within last 4 weeks
- No previous deep vein thrombosis or pulmonary embolism
- No current oral hormone use

No further investigations (including D-dimer) are indicated. Consider an alternative diagnosis to PE.

Outpatient investigation and/or management suitable if meets the following criteria:

- Haemodynamically stable – HR <110, systolic BP >100mmHg, no requirement for inotropes, thrombolysis or embolectomy
- Not requiring supplementary oxygen (SpO_2 ≥94%, except those with chronic respiratory disease (88-92%)
- None of the following contraindications to anticoagulation:
    - Active bleeding or risk of major bleeding (e.g. recent GI bleed or surgery, previous intracranial bleeding, uncontrolled hypertension)
    - History of heparin induced thrombocytopenia (HIT) previously (if LMWH is to be used as the out-patient treatment)
    - Chronic kidney disease (CKD) stages 4 or 5 (eGFR<30ml/min) or severe liver disease
    - Already on anticoagulation at the time of the suspected/confirmed PE
- No evidence of right heart strain, as evidenced by:
    - New or unexplained elevated troponin (>14ng/l)
    - ECG showing right heart strain
    - CTPA (if already done) showing evidence of right heart strain
- No other social concern or medical condition warranting admission

Patients with a confirmed or suspected diagnosis of pulmonary embolism thought suitable to be discharged should be assessed by a senior clinician (ST3 or above) prior to discharge. They should be given clear instructions on what to do if their condition deteriorates.

Patients discharged to return for imaging at a later date should be covered with an appropriate anticoagulant (see below).

2. Immediate management of confirmed PE

(Underlined text links to explanatory paragraphs below)

Confirmed PE

Shock or hypotension (persistent SBP<90mmHg despite fluid)

No

RV dysfunction or myocardial injury

No

Yes

Yes

Massive PE

High risk: >15% in hospital/30 day mortality

Sub-Massive PE

Intermediate risk: 3-15% in hospital/30 day mortality

Non-Massive PE

Low risk: <3% in hospital/30 day mortality

THROMBOLYSIS (see 4. below)

Consultant/ST3+ input required

Contraindications:

- Active bleeding
- Major surgery or serious trauma within last 14 days
- Clinical diagnosis of subarachnoid haemorrhage even if CT normal
- Caution and careful assessment of risk benefit IF:
  - treatment dose low molecular weight heparin within 24 hours
  - on treatment with an oral anticoagulant (rivaroxaban, , apixaban, edoxaban, dabigatran, or warfarin)

ALTEPLASE

10mg (10mL) IV bolus over 1-2min

Followed by IV infusion

90mg over 2 hours

(max total bolus + infusion 1.5mg/kg in patients <65kg)

Alteplase is kept in ED, A515, ITU and CCU

\+ **UNFRACTIONATED HEPARIN INFUSION (see notes below)**

Admit to **CCU/ICU/HDU/ Resp High Care** with cardiac monitoring
Prescribe low molecular weight heparin for minimum of 5 days as in patient
Enoxaparin 1mg/kg BD SC

ANTICOAGULATION

ENOXAPARIN low molecular weight heparin 1mg/kg BD

OR

Unfractionated heparin if high risk of bleeding or renal impairment (eGFR <30mls/min). See Trust protocol.

Monitor closely for shock or respiratory failure (to consider thrombolysis – discuss with senior)
Check troponin +/- BNP if abnormal ECG or RV dilatation on CT

ANTICOAGULATION

Routine management with

APIXABAN

10mg BD for 7 days, then 5mg BD thereafter

OR

RIVAROXABAN

15mg BD for three weeks, then 20mg OD thereafter

If still inpatient – consider outpatient management

Refer all patients to Thrombosis Nurses within 24 hours

Markers of right ventricular (RV) dysfunction or myocardial injury suggesting sub-massive PE:

- **ECG**: T wave inversion V1-V3, new right axis deviation, RBBB, S1Q3T3
- **CTPA**: RV dilatation
- **Raised troponin or BNP** (however routine BNP testing is not necessary)

Authors: [redacted] (Haematology Consultant), [redacted] (Haematology Consultant), [redacted] (Radiology Consultant), [redacted] (Emergency Medicine Consultant), [redacted] (Acute Medicine Consultant).

3. Choice of imaging modality

The appropriate imaging modality (Q SPECT/CT vs CTPA) depends on several factors.

a. Q scanning +/- SPECT/CT

Q scanning with or without SPECT/CT is available at UHBW Monday – Friday 9-5pm, and offers at least equivalent specificity and sensitivity to rule out PE compared with CTPA with a lower radiation dose. V scanning may be available where required (at the discretion of the NM radiologist). **It should be considered first-line in patients who meet all the following criteria:**

- **Aged <50**
- **Normal chest X-ray**
- **No features of submassive or massive PE (i.e. low risk)**
- **No significant history of asthma or COPD (i.e. not taking regular inhalers)**
- **Presenting at a time where Q / SPECT/CT can be performed within 24 hours**
- **Where ruling out PE is the only clinical question**

Half-dose Q scan is the first-line investigation for PE in pregnancy & the puerperium (see separate PE in Pregnancy guideline).

Q +/- SPECT/CT is also an option in place of CTPA where there is significant contrast allergy or renal impairment.

To arrange scans via Nuclear Medicine (NM), please request on ICE and telephone [redacted] ([redacted]) or [redacted] ([redacted]). If no answer please telephone the NM department ([redacted]) or the NM Superintendent Radiographer [redacted] ([redacted]) who will refer you to an appropriate radiology consultant to vet the request.

If same-day scanning is not feasible or available, the scan can be arranged for the following day and the patient seen in the Acute Medicine Clinic if they meet the outpatient criteria above – please contact [redacted] (M-F 9-7pm) or the medical SpR on call (bleep [redacted]) OOH to discuss.

If the patient presents OOH and the scan cannot be discussed, again the patient can be sent home with a clinic appointment the next day to review & arrange scanning (assuming discharge is safe per above criteria). The patient will require cover with an anticoagulant in the interim (see above).

If the patient presents on a Friday evening or Saturday then Q / SPECT/CT is not able to be performed in a timely manner (i.e. within 24h) and CTPA should be performed instead.

b. CT pulmonary angiography (CTPA)

CTPA is the first line test where the above criteria are not met, in particular if other pathology is being considered as well as PE, or if the patient has haemaodynamic instability or other features of right heart strain.

Please request CTPA on ICE and discuss with the vetting radiology registrar on call ([redacted]) as usual.

4. Thrombolysis of massive PE

Thrombolysis is indicated for acute PE with cardiogenic shock, i.e. BP <90mmHg despite fluid resuscitation and/or evidence of compromised organ perfusion, or cardiac arrest. Catheter-directed thrombolysis is also a treatment option in this situation; please discuss with the on-call cardiology SpR if this is being considered.

For patients with cardiogenic shock:
Alteplase comes in 50mg vials with 50ml sterile water diluent; 2 full bottles (100mg) will be required unless the patient weighs <65kg, in which case the total dose (bolus dose + infusion dose) will be 1.5mg/kg.

10mg (10ml) is administered as a bolus dose IV over 1-2minutes, followed by a 2 hour infusion of the remaining 90mg (90ml) alteplase via a syringe pump (or the remainder of the dose if the patient is <65kg).

For patients in cardiac arrest:
Give 50mg (50ml) as a bolus dose IV as above, with a 1 hour infusion of the remaining dose after return of spontaneous circulation.

Heparin infusion after completion of the alteplase infusion:

1. Check APTT level immediately after completion of the alteplase infusion
2. Initiate unfractionated heparin infusion as per UH Bristol IV heparin guidelines 3 hours after administration of alteplase, **providing APTT levels are less than 64 sec** (twice the upper limit of normal). A bolus dose should be given if heparin is being initiated.
3. Once the patient is stabilized consider alternative anticoagulation therapy

Patients who have been thrombolysed should be nursed on CCU or other high-dependency area (ITU).

5. Continuing management of confirmed PE

Refer to Thrombosis Specialist Nurses within 24h of diagnosis

➔ Provide counselling for anticoagulation decisions

➔ Facilitate discharge and provide initial follow up

Phone extension 24684: Mon-Fri 9am- 5pm & Sat-Sun 9am-12pm

Complete referral from on http://nww.avon.nhs.uk/dms/download.aspx?did=12441

Anticoagulant Choice

Apixaban 10mg BD PO for 7 days, then 5mg BD thereafter
OR
Rivaroxaban 15mg BD PO for 21 days, then 20mg OD thereafter
OR
Enoxaparin 1mg/kg BD SC for a minimum of 5 days with conversion to **Warfarin**

NB if using Enoxaparin recommended dose in symptomatic PE or where there are risk factors (e.g. malignancy) is now 1mg/kg BD initially

Duration of anticoagulation

➔ Provoked PE (i.e. secondary to **major** temporary risk factor): 3 months

➔ Unprovoked PE: minimum 3 months but consider long-term

➔ Pulmonary hypertension at 3 months: long-term anticoagulation

Special circumstances:

- **IVDUs** – Rivaroxaban is a good choice
- **Pregnancy** – Enoxaparin 1.0mg/kg SC BD
- **Active malignancy** – either DOAC if low bleeding risk/no drug interactions, otherwise enoxaparin 1mg/kg SC BD; may be reduced to 1.5mg/kg if symptoms improve (see specific malignancy-associated VTE guideline)
    - Initial period of anticoagulation 3-6 months; reassess need for further anticoagulation at 6mo
    - Check platelet count at 7-10 days if using LMWH

Investigation for underlying malignancy (to be arranged by the admitting medical team)

Occult malignancy is found **in less than 5%** of patients with an apparently unprovoked pulmonary embolism

- ➔ Thorough history and physical examination (incl. rectal and breast exam)
- ➔ FBC, LFTs, Calcium, PSA
- ➔ Urinalysis
- ➔ **CT abdomen/pelvis is not routinely recommended**; consider only when there is clinical suspicion based on history, examination, and abnormal blood tests. Occult malignancy is rare in under 40s where careful consideration should be given to radiation exposure. Again, consider mammogram +/- cervical screening according to history.

Choice of investigation should be guided by clinical presentation

Echocardiogram

Not indicated in the acute setting unless suspected massive PE and CTPA inappropriate or contraindicated. Even if CT suggests right heart strain, echo at this stage does not change management

If persistent dyspnoea at 3 months: → consider transthoracic echocardiogram

→ refer to respiratory: type '*goto/chest*' into the intranet / bleep 6059

Discharge Planning

Patients requiring hospital admission – recommended admission minimum 48hrs

- **Prior to discharge they should be reviewed by a senior clinician (ST3 or above)**

Consider the following parameters to be safe for discharge (taking into consideration their pre-morbid condition):

- RR ≤ 20
- BP > 100 systolic
- HR <100
- $Sa0_2$ ≥ 94% on air (i.e. not requiring oxygen)
- No undue dyspnoea on walking

The patient should be counselled regarding what to expect (i.e. that recovery may take some weeks) and that they should seek medical advice if still breathless at 3 months.

A patient information leaflet for patients has been written; a copy of the text is appended to this guideline.

6. Follow up

Haematology clinic → unprovoked PE in patients who are otherwise well at discharge
Primarily for discussion of longterm anticoagulation
Also consider for young patients with >1 first degree relative with VTE and
Post-partum follow up of all patients with PE during pregnancy

Respiratory clinic → patients with sub-massive PE, evidence of pulmonary hypertension, abnormal echo, or underlying lung disease

GP follow up only → provoked PE in patients who are otherwise well. The GP needs to assess for ongoing breathlessness at 3mo (and subsequent respiratory referral); this must be made clear in the discharge paperwork.

REFERENCES

1. British Thoracic Society Guideline for the initial outpatient management of pulmonary embolism. Thorax, 2018 73:S2
2. Venous thromboembolic diseases: diagnosis, management and thrombophilia testing. NICE guideline 26 March 2020. www.nice.org.uk/guidance/ng158
3. Pulmonary Embolism: NICE clinical knowledge summary. https://cks.nice.org.uk/pulmonary-embolism#!topicSummary

QUERIES Thrombosis Nurses (ext 24684)

Discharge advice after a pulmonary embolism

After being diagnosed with a pulmonary embolism (PE) – a blood clot in the lungs – you will be discharged when appropriate with anti-coagulant medication (medicine to thin your blood).

This can be in the form of tablets or injections, and may be for a short defined period or for long-term use – all depending on what is the best option in your case.

This leaflet provides you with information on what to expect and what to watch out for once you are home.

Treatment for pulmonary embolism

Treatment for PE aims to stop new clots from forming, and to prevent long-term complications from the clot. Blood thinners do not dissolve the clots themselves, but prevent the clots from getting any bigger while the body breaks the clots down by itself.

To ensure that you get better it is very important that you:

- **Take your medication regularly as prescribed – don't skip any doses**
- Get up and move around as your condition allows – it is important not to sit or lie still for long periods of time

Other things that you can do to prevent problems in the future include:

- Stopping smoking
- Staying at a healthy weight
- Exercising regularly as you are able

What to expect

When you are discharged from hospital, the team looking after you will have told you what follow-up arrangements are needed in your case, and how long you should take your blood thinning medicine for. **If you have any questions regarding this, please ask us before going home.**

Authors: [redacted] (Haematology Consultant), [redacted] (Haematology Consultant), [redacted] (Radiology Consultant), [redacted] (Emergency Medicine Consultant), [redacted] (Acute Medicine Consultant).

You will need to take your blood thinners for at least three months (you will get a few weeks' supply to take home, and then your GP will be able to continue the prescription for you – you will need to contact the GP surgery with plenty of time to make sure that you do not run out of medication).

Depending on how large your clot is, you may need to be seen by the respiratory (chest) medicine team after going home. This is to check that larger clots have dissolved fully, and have not caused any longer-term problems.

You may also need to see the haematology (blood) team. This will be to decide if your blood thinning treatment needs to continue longer term.

Some patients also require further scans after going home, either to look for causes of the clot, or to look at how well the heart is working with the clot. Your team will tell you about these scans if they are necessary in your case.

Things to watch out for:

1. Bleeding

All blood thinners are associated with a small risk of bleeding. You may notice that you bleed for longer than usual when you cut yourself, so take care when shaving and using sharp instruments. Do not play any contact sports.

Watch for bleeding and bruising whilst taking these medicines, for example bleeding gums or blood in the urine or bowel movements. If your bowel movements become black and tarry this can be a sign of bleeding. You should seek medical advice if you experience bleeding like this.

If you need any procedures at the dentist, or any other operation, you should tell the healthcare staff treating you that you are on blood thinners. You should also tell anyone who is prescribing you a new medicine that you are on blood thinners, in case it interacts with them.

2. If things aren't getting better

Because the body breaks down the clots by itself, it can take some time (several weeks) for all of your symptoms to clear and for you to feel completely better again – this is normal.

However, sometimes blood thinning treatment doesn't work, and the clot doesn't fully dissolve. This puts extra strain on the heart, which can cause long-term problems if it isn't spotted.

If you still feel breathless after 3 months of treatment it is very important that you seek medical advice. If this is the case, either your GP or your treating doctor can organise a heart scan and an appointment to be seen in our respiratory (chest) clinic.

3. If you feel worse

If your symptoms are getting worse rather than better, or if the symptoms of a clot come back again after going away, you should seek urgent medical advice.

If you have questions

If you have questions about your condition or treatment, you can obtain advice from either:

- Your GP
- Your local pharmacist
- The thrombosis team at Bristol Royal Infirmary
- The team who treated you when you were admitted

The telephone number for Bristol Royal Infirmary is 0117 923 0000, where you can ask to be put through to the appropriate team.