Clinical Guideline

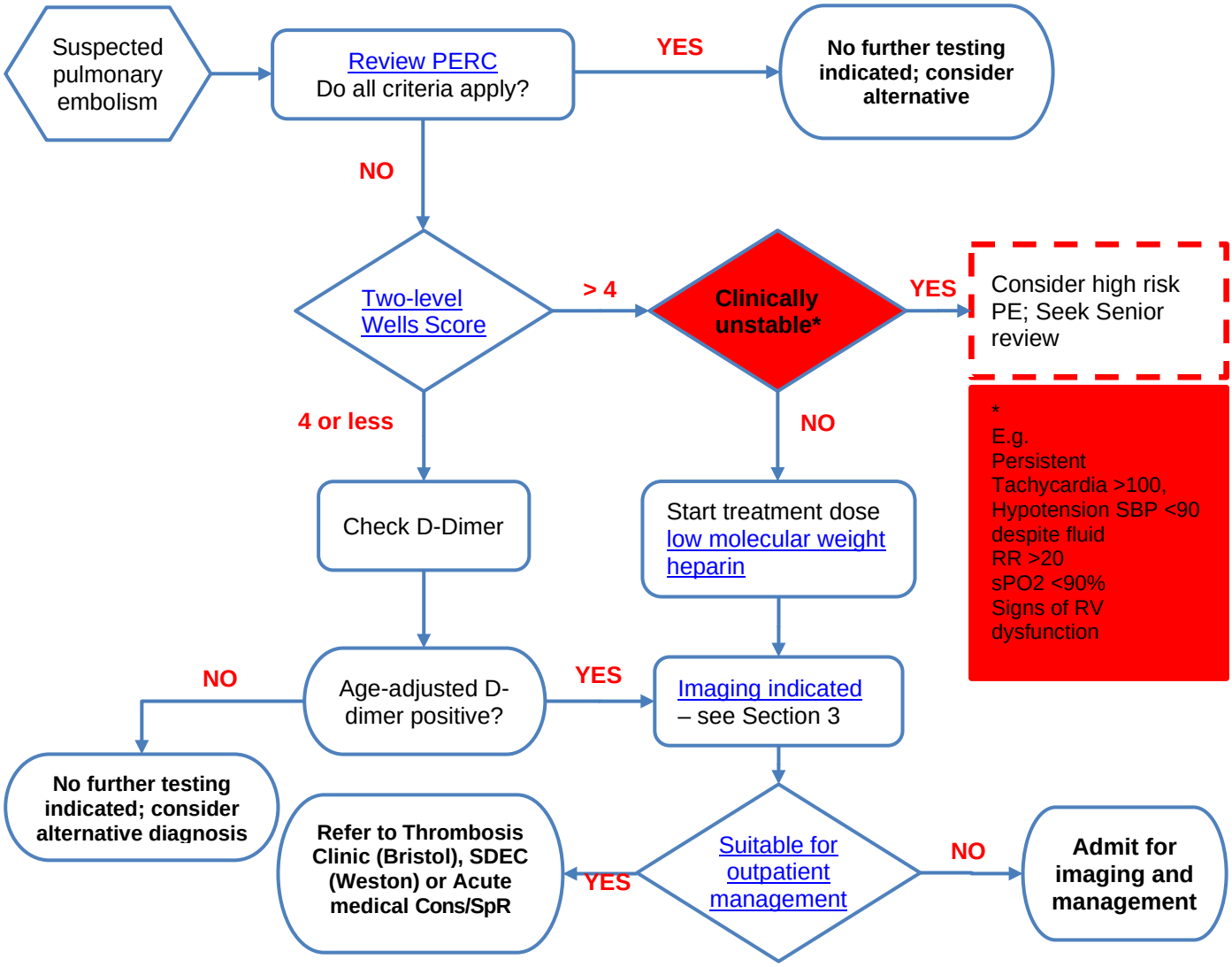
INVESTIGATION AND MANAGEMENT OF PULMONARY EMBOLISM

SETTING	Trust wide
FOR STAFF	Medical and nursing staff
PATIENTS	Adult patients with suspected or confirmed pulmonary embolism Excludes pregnancy and puerperium (https://uhbw.mystaffapp.org/document/show_document/12574)

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.

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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
Hemoptysis	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 scores 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:

Patients can be considered for outpatient management of PEs if they have a sPESI score of 0. To calculate the sPESI score, you score 1 for each of the following criteria:

- Age >80 years
- History of cancer
- History of chronic cardiopulmonary disease
- Heart rate ≥110 bpm
- Systolic BP <100
- Oxygen saturation <90%

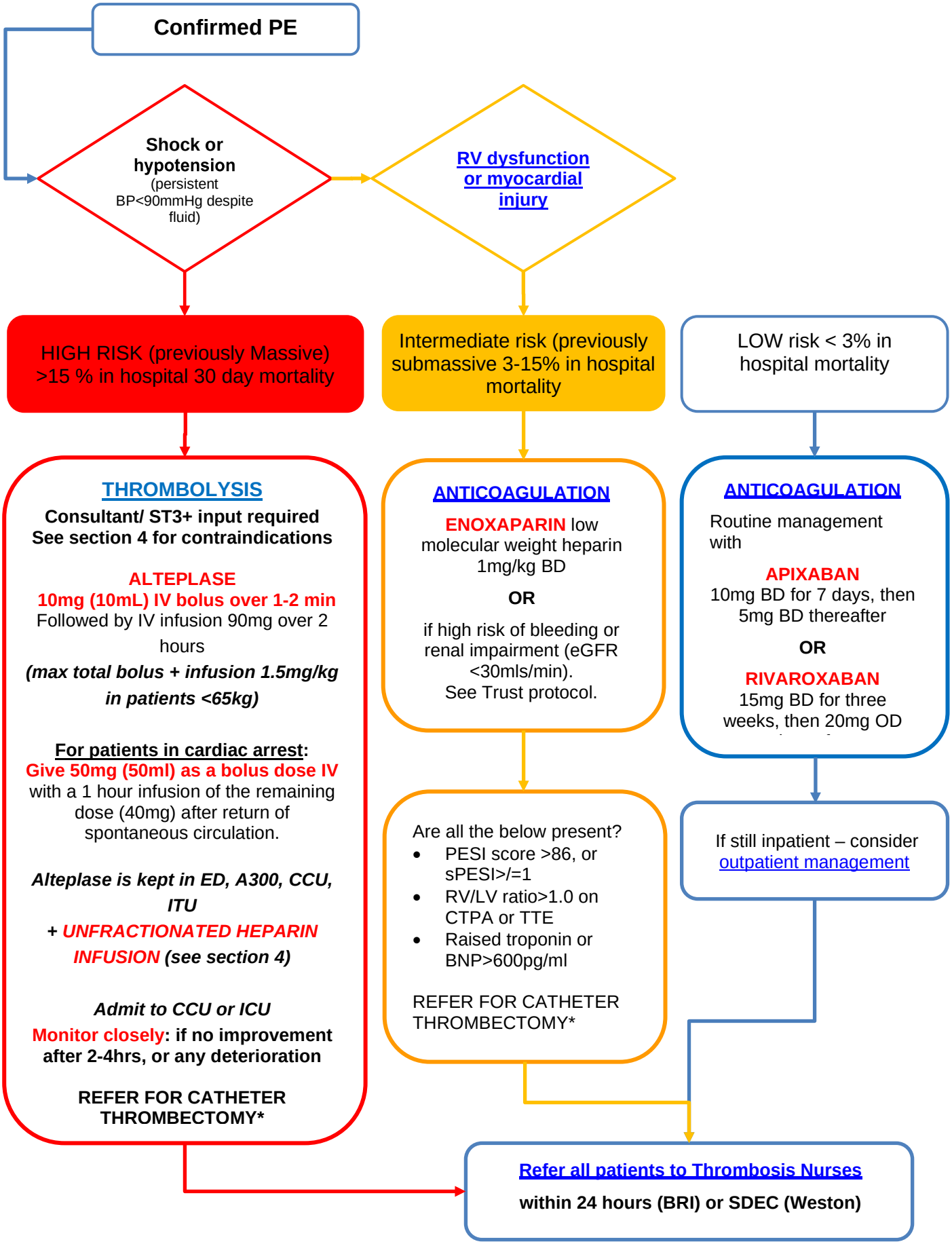
Patients with an sPESI score of 0 may need to be considered for admission if they have the following:

- Weight about 150kg or very high BMI – it may be able to manage these as outpatients, but they need to be discussed with haematology before discharge as they may need special monitoring.
- Renal failure – if the eGFR is l < 30ml/min, please see renal anticoagulant guideline for enoxaparin dosing and DOAC advice in renal impairment- for specific advice discuss with haematology or the renal team in NBT. It is likely that they will need to be initially stabilized on enoxaparin and then consider switching to a DOAC after a few weeks of treatment (this is unlicensed if GFR<15).
- Active bleeding or risk of major bleeding (e.g. recent GI bleed or surgery, previous intracranial bleeding, uncontrolled severe hypertension)
- Severe liver disease
- Already on anticoagulation at the time of the suspected/confirmed PE.

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).

1. Immediate management of confirmed PE



2. Choice of imaging modality

a. CT pulmonary angiography (CTPA)

Computed tomography pulmonary angiogram (CTPA) is the first line imaging modality for diagnosis of PE in high and intermediate risk patients.

Offer CTPA immediately if possible.

Please request CTPA on ICE and discuss with the vetting radiology registrar on call (ext. 23141), or Everlight radiologist (via switch) if out of hours.

b. Q scanning +/- SPECT

For people with an allergy to contrast media, severe renal impairment (estimated creatinine clearance less than 30 ml/min) or a high risk from irradiation, assess the suitability of a perfusion single photon emission computed tomography (Q SPECT) scan, as an alternative to CTPA.

In view of lower radiation dose, consider Q scanning +/-SPECT as first line in young (particularly female), low risk (SPESI<1) patients with normal CXR in whom ruling out PE is the only clinical question.

Please note that Q SPECT scan **cannot provide alternative diagnosis if PE is excluded**.

Q scanning with or without SPECT is available at UHBW Monday – Friday 9-5pm. V scanning may be available where required (at the discretion of the NM radiologist).

To arrange scans via Nuclear Medicine (NM), please request on ICE and contact Dr Iara Sequeiros (ext. 29393), or Dr Randeep Kulshrestha (ext. 29387), or Dr Ayah Nawwar (ext. 29374), or Dr Julian Kabala (ext. 29388) via telephone or email.

If no answer, please telephone the NM department (29359) or the NM Superintendent Radiographer Aline Demmery (22687) 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 26860 (M-F 9-7pm) or the medical SpR on call (bleep 2997) 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.

If a CTPA, V/Q SPECT or V/Q planar scan cannot be done immediately, offer interim therapeutic anticoagulation.

In the event of a PE diagnosis lower limb dopplers should only be considered if there are significant limb symptoms in which case discuss with vascular surgery as to whether the patient might be eligible for CDT/thrombectomy in which case a scan might be indicated.

3. Thrombolysis of high-risk PE

Thrombolysis is indicated for high-risk PE – i.e.: cardiac arrest, obstructive shock (systolic BP<90mmHg or vasopressors required to achieve a BP of >90mmHg despite an adequate filling status), or persistent hypotension (systolic BP<90mmHg, or a drop >40mmHg for >15min, not caused by new-onset arrythmia, hypovolaemia or sepsis.

Contraindications for systemic thrombolysis (ESC 2019 criteria):
Absolute:

- History of hemorrhagic stroke or stroke of unknown origin
- Ischaemic stroke in previous 6 months
- Major trauma, surgery or head injury in previous 3 weeks
- Bleeding diathesis
- Active bleeding

Relative:

- TIA in previous 6 months
- Oral anticoagulation.
- Pregnancy or first post-partum week
- Non-compressible puncture sites
- Traumatic resuscitation
- Refractory hypertension (systolic BP>180mmHg)
- Advanced liver disease
- Infective endocarditis
- Active peptic ulcer disease
- Use of ECMO

***CATHETER THROMBECTOMY- Call Cardiology SpR on #6527 See section 4.1**

Referrals:

HIGH RISK: refer immediately patients who have thrombolysis indicated but who have contraindications / or no response to thrombolysis. (MG or consultant refer, involve ICU)

INTERMEDIATE RISK: refer if no improvement following anticoagulation 24-48 hours (consultant decision PTWR)

Dose of thrombolysis

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 should have minimum of 5 days of heparin (UFH or switch to LMWH as an inpatient).

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

Catheter directed therapy/ thrombectomy

Catheter thrombectomy is now a treatment option for the following patients- patients will be considered for this on a case by case basis:

- **Patients with high-risk PE who have contra-indications to thrombolysis. Refer Immediately- MG or above (involve ICU)**
- **Patients with high-risk PE who have received systemic thrombolysis, but failure to improve or further deterioration within 2-4hours after completion of the alteplase infusion. Refer Immediately- MG or above (involve ICU)**
- **Patients with intermediate-high risk PE who have failure to improve or deterioration despite receiving up to 48hrs anticoagulation. Consultant led decision on PTWR.**

To refer for this, contact the on-call cardiology registrar on #6527. NB Weston patients will require transfer to BRI if accepted for thrombectomy.

4. Continuing management of confirmed PE

Refer to Thrombosis Specialist Nurses within 24h of diagnosis (Bristol) or SDEC (Weston)

➔ Provide counselling for anticoagulation decisions
➔ Facilitate discharge and provide initial follow up

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** (this is rarely used but may be needed for specific patient groups or if a DOAC is contraindicated due to CrCl <15ml/min)

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

If a patient has had a few days of enoxaparin treatment dose before switching to a DOAC, these days count towards the DOAC loading duration e.g. if a patient has had 3 days of enoxaparin, they would only need to complete 4 more days of 10mg BD apixaban before switching to 5mg BD maintenance

Please note that people with a very high body weight (>150kg) should be discussed with haematology
People with an eGFR<30ml/min should also be discussed with haematology or the renal team.
If the eGFR is 15-30ml/min, consider enoxaparin 1mg/kg OD for the first few weeks and then switch to a DOAC when stable. DOACs can't be used if the creatinine clearance (CrCl) is <15ml/min - discuss with renal team (do not use eGFR for DOAC dosing)

Enoxaparin is unlicensed in eGFR <15ml/min but can be used with anti-Xa monitoring – see renal anticoag guideline.

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 (if unsure, contact haematology)
    - 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.

All patients defined as high risk by sPESI criteria or with RH strain on CTPA should have an OP ECHO booked at 3/12

For low/ medium risk patients: If persistent dyspnoea at 3 months: refer to respiratory: type '*goto/chest*' into the intranet / bleep 6059 and book OP ECHO

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.

5. Follow up

Haematology clinic for:

- Unprovoked PE and DVT with weak risk factors such as minor surgery, flight associated, etc - all patients < 65 years, but older if there are specific considerations, such as concerns over long term anticoagulation - in most patients with unprovoked PE long term anticoagulation is recommended with treatment dose of Apixaban/Rivaroxaban for 3-6 months and then dose reduction if long term anticoagulation is indicated.
- Hormonally associated thrombosis - pregnancy, oral contraceptive and HRT
- Any woman of childbearing potential who has a venous thrombosis to outline a plan for future pregnancies.

- Any recurrence on anticoagulation where compliance has been explored and there is a high certainty that they were taking their medication.

Referrals to Haematology will be reviewed by a consultant prior to allocating an appointment and may be given advice rather than reviewing the patient in clinic. We aim to see patients at around 10 weeks so that we speak to them before the three months but if referred to Haematology and accepted patients should continue anticoagulation.

Other patients who may require discussion with haematology include:

- Recurrent VTE off anticoagulation but may not all need review - depends on circumstances
- Obese patients >150Kg (we err on the side of not dose reducing if a DOAC is used).

Echo – All patients with sub-massive or massive PEs, or right heart strain on echo, or CTPA should have a 3-month outpatient echo booked and referred to the respiratory clinic if this is abnormal.

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.

Appendix 1 – 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.**

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.

Appendix x – Evidence of Learning from Incidents

The following table sets out any incidents/ cases which informed either the creation of this document or from which changes to the existing version have been made.

Incidents	Summary of Learning
Yes	Guideline updated in response to incident

Table A

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
RELATED DOCUMENTS AND PAGES	
AUTHORISING BODY	Clinical Effectiveness Group
SAFETY	
QUERIES AND CONTACT	Thrombosis Nurses (ext. 24684)
AUDIT REQUIREMNTS	How will implementation and adherence to this document be evidenced/ measured i.e. via KPIS. How will test compliance from implementation of the Guidelines be evidenced? NOTE: any actions need to be realistic. Associated patient information leaflets should be reviewed to ensure they are consistent with any changes to the Guidelines ☐

Plan Elements	Plan Details
The Dissemination Lead is:	Anne Frampton
Is this document: A – replacing the same titled, expired guideline, B – replacing an alternative guideline, C – a new Guideline:	A
If answer above is B: Alternative documentation this guideline will replace (if applicable):	
This document is to be disseminated to:	Via an all staff alert and also sent through authors to teams
Method of dissemination:	
Is training required and how will this be delivered:	No training required

Document Change Control

Date of Version	Version Number	Lead for Revisions	Type of Revision	Description of Revision
Aug 24	4.3	VTE Lead	Minor	
Oct 24	4.4	VTE Lead	Minor	No material changes in terms of clinical advice, but some specifics around haematology follow up added and a line re DVT scanning