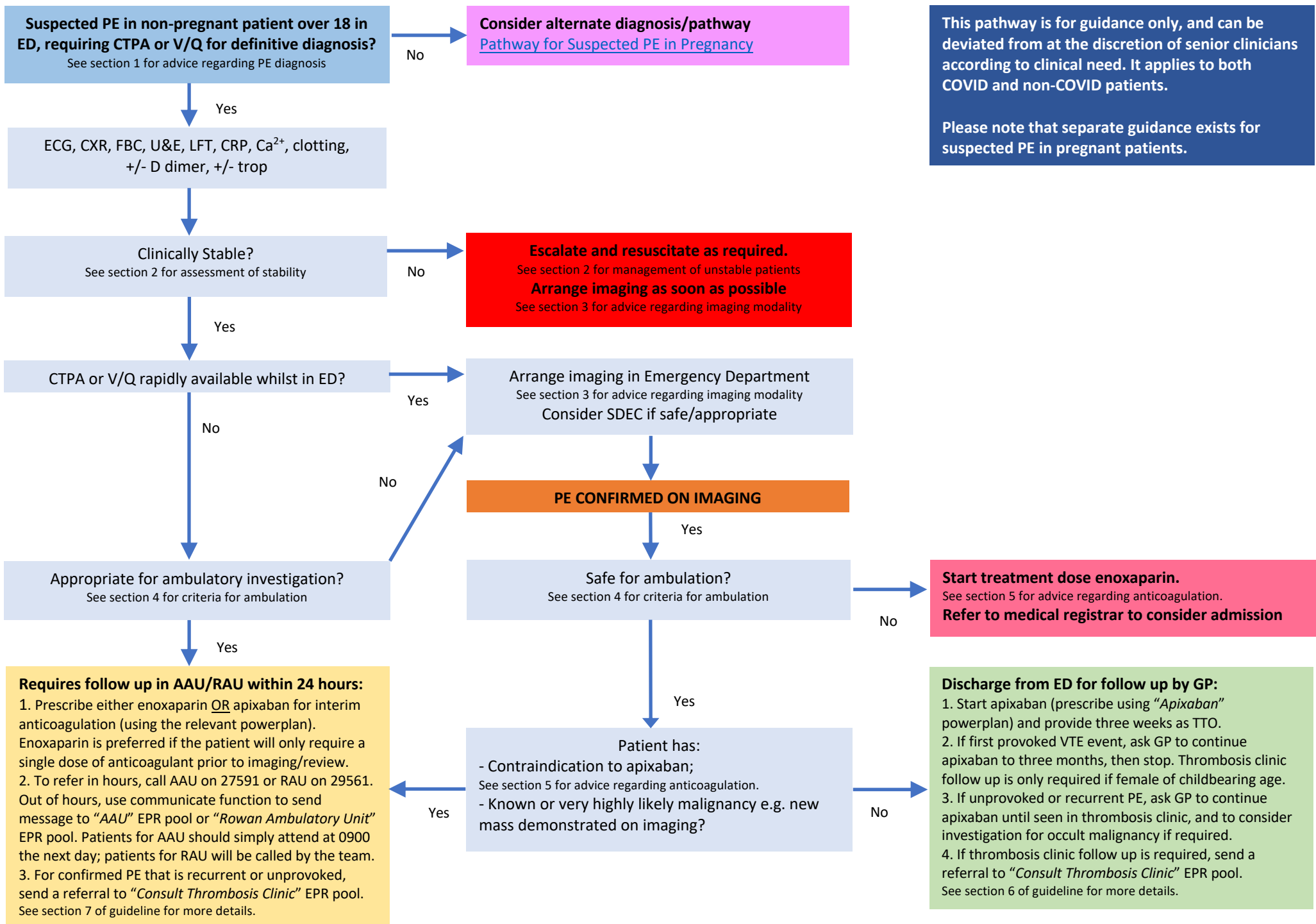




1. Diagnosis of Pulmonary Embolism – When is Imaging Needed?

Diagnosis of clinically significant PE is difficult. Both over investigation and missed diagnoses carry risk. If in doubt, discuss with a registrar or consultant.

If you think PE is a potential cause for the presentation, then calculation of Wells' score with measurement of D dimer where appropriate can be used to risk stratify patients and assess the need for imaging.

Since D dimer is interpreted according to clinical risk, Wells' score must always be calculated when sending a D dimer. This is because if Wells' score is greater than four, PE cannot be safely excluded even with a negative D dimer and imaging is always required.

Wells' Score is calculated as follows:

Clinical features of DVT	3 points
PE is deemed most likely diagnosis by clinician's judgement	3 points
Heart rate > 100	1.5 points
Immobilisation for three days or surgery in last four weeks	1.5 points
Previous PE or DVT	1.5 points
Haemoptysis	1 point
Malignancy	1 point

If Wells' score is four or less, PE can be excluded if D dimer is under the [age-adjusted D dimer threshold](#), which has a better specificity than a single cut off value.

If PE is excluded using Wells' score and D dimer, then imaging is not required.

If D dimer is above the age-adjusted threshold and PE is suspected to be cause, then imaging with CTPA or V/Q scan is required to confirm or refute the diagnosis – see section 3 for further guidance.

2. Assessing Clinical Stability and Managing Unstable Patients

Patients with suspected or proven PE who:

- require supplementary O₂ > 4L/min;
- have significant respiratory distress;
- are hypotensive; or
- have reduced level of consciousness

should be immediately escalated to a senior ED doctor (registrar or consultant) who can help guide appropriate investigation and treatment.

Patients with suspected or proven PE and

- hypotension (SBP < 90mmHg or a drop in SBP > 40mmHg) lasting over 15 minutes with no other cause such as hypovolaemia or arrhythmia, **and**
- evidence of right heart strain

are considered haemodynamically unstable (formerly termed “massive PE”). This group of patients is at risk of rapid deterioration, potentially to cardiac arrest.

For suspected haemodynamically unstable PE:

- Escalate immediately and move patient to resus if possible;
- Administer high flow oxygen;
- Gain IV access and take blood for VBG, FBC, G&S, coagulation screen, CRP, LFT, U&E, calcium, troponin and pro-BNP;
- Perform ECG;
- Perform immediate CTPA and bedside echo where possible.

Trust guidelines on the use of thrombolysis in haemodynamically unstable PE are available [here](#). The decision to thrombolysate haemodynamically unstable PE should be made by the most senior available clinician, senior registrar or higher. To avoid medication errors, a bolus dose and infusion of alteplase should be prescribed using the “Thrombolysis for Cardiac Arrest and Unstable PE” powerplan.

In the event of cardiac arrest in patient with suspected or proven PE, consider immediate administration of a bolus of alteplase 50mg and prepare for a prolonged resuscitation attempt.

3. Choosing an Imaging Modality

Imaging will be required for patients deemed at high risk of PE using Two Level Wells' Score.

CT Pulmonary Angiogram (CTPA) is the preferred imaging modality in most instances, and almost always in a patient who is clinically unstable.

V/Q scan is an alternative that may be appropriate for:

- Patients where PE is considered less likely and the CXR is normal;
- Young, female patients;
- Patients who are breastfeeding;
- Known allergy to CT contrast;
- Severe renal failure;
- Myeloma and paraproteinaemia.

Where the best choice of imaging modality is unclear, the case should be discussed with the duty radiologist.

Imaging does not necessarily need to be performed overnight for patients with suspected PE who are clinically stable and safe to ambulate.

Note that V/Q scans can only be performed inside weekday working hours in the nuclear medicine department of the John Radcliffe Hospital.

Where imaging will not be performed within one hour of request then patients should receive an interim dose of anticoagulation unless there is reason not to do so (for example, high bleeding risk), in which case the reason should be documented. Note that a contraindication to anticoagulation may be an indication for an urgent scan.

4. Assessing Suitability for Ambulation

Before considering ambulatory investigation and management, patients should be discussed with a registrar (ST3 or above). **The presence of one or more higher risk criteria does not absolutely contraindicate outpatient treatment**, but the risks of discharge should be carefully considered, and the decision to ambulate the patient should be made by a senior clinician guided by the symptom burden and physiological condition of the patient.

Higher Risk Criteria for Ambulation (Adapted from BTS/Hestia/sPESI criteria)

- Age > 80 or significant frailty;
- Weight > 180kg;
- Pregnancy;
- Haemodynamic instability (systolic BP < 100, pulse > 110);
- Oxygen saturations < 91% or need for supplementary oxygen;
- Active bleeding;
- Risk of major bleeding (e.g. recent GI bleed or surgery, previous intracranial bleed, uncontrolled hypertension with systolic BP > 180mmHg or diastolic BP > 110mmHg);
- Already receiving anticoagulation at time of PE;
- Severe pain not adequately controlled with opioids;
- eGFR < 30;
- Severe liver disease;
- Significant chronic cardiac or pulmonary disease;
- Previous Heparin Induced Thrombocytopaenia (HIT) or allergy, if apixaban is unsuitable and it is planned to use LMWH as outpatient treatment;
- Inability to return for outpatient imaging, inability to manage at home, etc.

Active cancer is not a contraindication to outpatient management, but these patients have a higher 30-day mortality risk, and benefit from early consultant review either as an inpatient or in AAU/RAU.

Where there is evidence of RV dilatation/strain, high clot burden or saddle embolus on imaging, measure troponin and pro-BNP – low levels are associated with better prognosis and may help support an ambulatory strategy, whilst elevated troponin in PE is associated with higher mortality and may support admission.

For patients who are being ambulated, it is good practice to record a [sPESI score](#).

5. Starting Anticoagulation

Apixaban and enoxaparin are first line anticoagulants in treatment of suspected or confirmed PE in OUH. All patients with suspected PE must be weighed and this weight recorded, and should have FBC, U&E, LFT, calcium and clotting measured. All women of child bearing potential must have a pregnancy test.

Patients with suspected PE for whom imaging cannot be performed within an hour should commence anticoagulation unless this is contra-indicated, e.g. significant liver or renal impairment, coagulopathy, or risk of major bleeding. If a decision is made not to administer an anticoagulant prior to imaging, this should be clearly documented.

Apixaban

Apixaban does not require therapeutic monitoring or concurrent treatment with enoxaparin at initiation of treatment. Apixaban may be unsuitable:

- In patients under 18;
- In patients weighing < 40kg or > 120kg;
- In breastfeeding;
- With renal impairment with CrCl < 30;
- With severe liver disease and/or coagulopathy;
- When the patient is taking enzyme inhibitors e.g. macrolide antibiotics, azole antifungals, HIV protease inhibitors, or enzyme inducers e.g. rifampicin, phenytoin, carbamazepine, phenobarbital or St John's Wort.

Advice can be sought from the haematology registrar.

Prescribe Apixaban using the “Apixaban” Powerplan. The usual dose for treatment of VTE is 10mg BD for 7 days, and 5mg BD thereafter, continued for at least three months.

Enoxaparin

Enoxaparin can be considered as an alternative when apixaban is contraindicated. Enoxaparin is contraindicated if previous allergy or Heparin Induced Thrombocytopenia (HIT) – consult a haematologist for advice on treatment.

Enoxaparin should be administered using fixed dose syringes and prescribed by weight using the appropriate “Enoxaparin (Inhixa) VTE Treatment” powerplan – standard risk, high risk or renal impairment.

Routine monitoring, e.g. platelet count, is generally not required with LMWH.

6. Patients Who Can Be Followed Up By Their GP

Well patients with PE who are able to take apixaban can be discharged from ED.

Apixaban should be prescribed according to the “Apixaban” powerplan – 10mg BD for 7 days, and 5mg BD thereafter. Provide the patient with three weeks TTO, and ask the GP to continue the prescription, either for three months, or until clinic follow up if that is required (see below). The patient should be advised to make an urgent appointment with their GP so this can be actioned.

Provoked PE

PE is provoked if it is associated with known risk factors such as surgery, immobilisation or administration of exogenous oestrogens within the last three months. Anticoagulation can stop at three months if it is the first provoked VTE event. Patients with clearly provoked PE do *not* require thrombosis clinic follow up *unless* they are a female of childbearing age.

Unprovoked PE

If no apparent cause is obvious, PE is unprovoked, and careful and detailed assessment is required to identify patients with occult malignancy. Ask about red flags, such as

- Unintentional weight loss;
- Altered bowel habit;
- Dysphagia;
- Chronic cough;
- Urinary hesitancy, frequency or nocturia in men, or
- Presence of breast lump in women.

Other (more subtle) clues pointing to the presence of occult malignancy include mild anaemia or hypercalcaemia.

The presence of any red flags should be highlighted in the GP summary, with advice to refer the patient urgently for a 2 week wait assessment according to the appropriate pathway.

Patients with unprovoked PE should continue anticoagulation until thrombosis clinic review.

Patients with unprovoked or recurrent PE, and women of childbearing age with PE, need to be followed up in thrombosis clinic. Ensure a referral has been made to thrombosis clinic before the patient leaves the emergency department. Use the EPR Communicate function to send a message to the “Consult Thrombosis Clinic” Pool, and type “~R-ThrombosisClinic” to bring up the referral proforma.

Please note that thrombosis clinic cannot investigate for malignancy – these investigations should be arranged by the patient's GP prior to attending clinic.

Give a Patient Information Leaflet and safety netting advice prior to discharge.

7. Patients Who Require Early Follow Up in AAU or RAU

Follow up in the Ambulatory Assessment Unit at JRH or Rowan Ambulatory Unit at HGH is advised within 24 hours if:

- Imaging cannot be performed rapidly in the emergency department, but it is safe to ambulate the patient, or
- Apixaban is contraindicated (in which instance, additional thought will need be given to anticoagulation strategy), or
- The patient is known to have malignancy, or a new lesion suggestive of malignancy has been identified on imaging (in which case early consultant review is beneficial).

To refer in hours, call AAU on 27591 or RAU on 29561 – the patient may be able to be seen the same day, saving repeated visits to the hospital.

Out of hours, use the EPR communicate function to send a message to either the “AAU” pool or the “*Rowan Ambulatory Unit*” pool, giving a brief summary of the clinical situation and contact details for the patient. Patients for AAU should be instructed to simply attend AAU at 0900 the next day to be seen. Patients for RAU will be contacted by the RAU team with an appointment time.

RAU is not available over the weekend, so patients with suspected or proven PE presenting to the HGH ED on a Friday or Saturday will need a bespoke early follow up plan, which should be discussed with ED senior and medical registrar. Options may include a return to ED in hours for imaging, or referral to AAU at JRH.

Weigh the patient, and then ensure that the patient has been prescribed interim anticoagulation (enoxaparin OR apixaban), unless this is contraindicated. Enoxaparin is preferred if only a single dose of anticoagulant is required prior to review. If patients will require multiple doses prior to review, apixaban may be more appropriate.

It is worth noting that contraindication to anticoagulation may make ambulatory investigation and management inappropriate – such cases should be discussed with a senior ED doctor.

Patients with unprovoked or recurrent PE, and women of childbearing age with PE, need to followed up in thrombosis clinic. Ensure a referral has been made to thrombosis clinic before the patient leaves the emergency department. Use the EPR Communicate function to send a message to the “Consult Thrombosis Clinic” Pool, and type “~R-ThrombosisClinic” to bring up the referral proforma.

Give a Patient Information Leaflet and safety netting advice prior to discharge.

8. References and Acknowledgements

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Many thanks to:

- ED consultants Drs Mandalia, Baron and Norris-Cervetto;
- AAU consultants Drs Novak and Bowen and RAU consultant Dr Rogers
- Haematology consultants Drs Curry, Dalia, Davies and Shapiro, team leader S Osborne, and lead pharmacist V McDonnel.

for their contributions to the development of this guidance.

