Case 15  A 24-year-old woman with pleuritic chest pain

A 24-year-old woman, Marie Lefevre, presents herself to the accident and emergency department complaining of sharp left-sided chest pain. She tells the triage nurse that it hurts to take a deep breath or cough.

What type of pain is this?
This is pleuritic chest pain (see Case 13).

Give a differential diagnosis for her presentation
- Pneumonia
- Pulmonary embolus
- Pneumothorax
- Pleural inflammation resulting from viral infection or connective tissue disease

Which of these conditions are most likely to occur in her because she is a young woman?
- Women are more likely than men to get pulmonary emboli as the oral contraceptive pill, pregnancy and hormone replacement therapy are all risk factors for this condition. Women are also more likely to develop connective tissue disease, whereas men are more at risk of pneumothorax
- Mesothelioma is a pleural malignancy that develops 20–40 years after asbestos exposure. At 24 years old she is extremely unlikely to have this disease

What features in the history may help to distinguish between these diagnoses?
- A cough productive of purulent sputum or blood may indicate underlying lung disease (i.e. pneumonia or pulmonary embolus)
- Fever, malaise and myalgia are suggestive of infection. Rigors (uncontrollable shaking) can occur in bacterial pneumonia
- Joint pains or skin rash could indicate connective tissue disease
- Calf pain could be caused by deep vein thrombosis as a source of pulmonary embolus
- Pulmonary emboli and pneumothoraces may be recurrent, so a previous history of disease is helpful
- You should ask about risk factors for the different conditions. Patients on immunosuppressive drugs or with a history of being immunocompromised (e.g. blood disorders, HIV) are at risk of pneumonia. Patients with underlying lung disease or who are tall and thin are at risk of pneumothorax. Risk factors for pulmonary embolus are given in Box 78

Miss Lefevre stated that the pain had been present for 24h. In addition, she had coughed up a small amount of bright red blood and found it painful to cough. She did not feel feverish; however, she had noticed some right calf discomfort which she had attributed to a ‘pulled muscle’. Three days ago she had travelled to London from the South of France by coach.

On further questioning, she has smoked 20 cigarettes per day since the age of 21, she does not take the oral contraceptive pill but there is no potential for her to be pregnant. Her mother had a deep vein thrombosis during pregnancy 25 years previously.

What is the most likely diagnosis and why?
Deep vein thrombosis complicated by pulmonary embolus.

The clinical features of pleuritic pain and haemoptysis without fever are most likely to be caused by a pulmonary embolus. Right calf discomfort could indicate a deep vein thrombosis as a source of the embolus. She has several risk factors for thromboembolic disease including immobility (long distance coach travel), cigarette smoking and a positive family history (Box 78).
On examination the following observations were made:

- Temperature 36.4°C
- Pulse 105 beats/min
- Blood pressure 115/70 mmHg
- Oxygen saturations 93% on air
- Respiratory rate 20 breaths/min

On chest auscultation she had a left-sided pleural rub

Calf diameters measured 10 cm below the tibia: right 36 cm, left 33 cm. The right calf was tender on palpation.

Do these examination findings support your provisional diagnosis?

- She has a tachycardia with normal blood pressure, an increased respiratory rate and hypoxia. These features are consistent with, but not specific for a pulmonary embolus
- A pleural rub is a grating noise that occurs on breathing in and out and is caused by inflamed pleural surfaces rubbing over each other. It is localized to the affected area. Not all patients with pleural inflammation have an audible rub, but its presence is helpful in supporting this diagnosis. A pleural rub can be distinguished from a pericardial rub, which sounds similar, by asking the patient to hold their breath briefly. A pleural rub will stop, whereas a pericardial rub will continue

- The diameter of her right calf is greater than that of the left, indicating that it is swollen. This would fit with a diagnosis of deep vein thrombosis as venous occlusion causes oedema of the calf muscle. Calf tenderness is caused by muscle swelling and by inflammation of the thrombosed vein

Is there a formal method of assessing how likely it is that she has had a pulmonary embolus?

The Wells criteria can be used to estimate the likelihood of pulmonary embolus from information obtained at clinical assessment. Miss Lefevre’s score is shown in Table 6.

### Table 6  Wells criteria for assessing clinical likelihood of pulmonary embolus (PE).

<table>
<thead>
<tr>
<th>Clinical feature</th>
<th>Points</th>
<th>Miss Lefevre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical symptoms of DVT</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Other diagnoses less likely than PE</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Heart rate greater than 100 beats/min</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Immobilization or surgery within past 4 weeks</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Previous DVT or PE</td>
<td>1.5</td>
<td>0</td>
</tr>
<tr>
<td>Haemoptysis</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Malignancy</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total points</strong></td>
<td><strong>10</strong></td>
<td></td>
</tr>
</tbody>
</table>

Wells criteria risk score interpretation (probability of PE):

- >6 points: high risk (78.4%)
- 2-6 points: moderate risk (27.8%)
- <2 points: low risk (3.4%)

DVT, deep vein thrombosis.

Miss Lefevre’s score is 10, therefore it is very likely that she has had a pulmonary embolus.
What is the purpose of clinical risk assessment?
In Miss Lefevre’s case it is very likely that she has had a pulmonary embolus, so she should have the appropriate investigations and treatment. However, these tests and therapies themselves have potential risks for the patient. The clinical risk score is therefore useful in helping clinicians decide on a course of action for individual patients. For example, in patients with a low score an alternative diagnosis may be sought.

What basic investigations would you perform at the initial assessment?
The patient should have a chest X-ray and electrocardiogram (ECG) to exclude other diagnoses such as pneumonia, pneumothorax and myocardial disease. Arterial gases will be helpful to assess the need for oxygen and supportive treatment as well as in supporting the diagnosis.

Investigation results:
- Chest X-ray – unremarkable
- ECG – sinus tachycardia
- Arterial blood gases on air:

<table>
<thead>
<tr>
<th>Investigation</th>
<th>Normal range</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.52 (7.35–7.45)</td>
</tr>
<tr>
<td>PO₂</td>
<td>9.2 kPa (10–13.1 kPa)</td>
</tr>
<tr>
<td>PCO₂</td>
<td>3.9 kPa (4.9–6.1 kPa)</td>
</tr>
<tr>
<td>HCO₃⁻</td>
<td>22 mmol/L (22–28 mmol/L)</td>
</tr>
</tbody>
</table>

How do you interpret her results?
The chest X-ray and ECG show no features consistent with alternative diagnoses.

Arterial gases:
- Mild hypoxia – respiratory impairment
- Hypocapnia – hyperventilation secondary to hypoxia
- Alkalosis secondary to hypocapnia driving the Henderson–Hasselbach equation to the right

Further investigation also showed:
- D-dimer level 0.84 mg/L (normal range <0.3 mg/L)

What are D-dimers?
In the normal control of haemostasis, procoagulant, anticoagulant and fibrinolytic factors are balanced to prevent intravascular thrombosis. Plasmin stimulates breakdown of fibrin (Fig. 54) and cross-linked fibrin degradation products are called D-dimers. Where thrombosis is activated anywhere in the body, fibrinolysis is also activated and D-dimer levels become elevated.

Are elevated D-dimer levels in Miss Lefevre diagnostic of pulmonary embolus?
No. D-dimers are elevated in many clinical conditions (e.g. following trauma or surgery, as a result of myocardial infarction, renal impairment, pregnancy, stroke). Therefore, a positive D-dimer test is not informative and should not guide further investigation and treatment.

Why do a D-dimer test then?
If D-dimers are normal then this is a useful result as pulmonary embolus is unlikely. Negative (normal) D-dimers have >90% negative predictive value for pulmonary embolus (i.e. >90% of people with a negative D-dimer result do not have pulmonary embolus). However, the D-dimer test may give false negative results.

When should you do a D-dimer test in clinical practice?
Measuring D-dimer levels is controversial and if used indiscriminately can be more of a hindrance than a help in making the diagnosis and can lead to unnecessary investigation. A reasonable approach is to measure D-dimers only in patients with suspected pulmonary embolus who are assessed as being at low or moderate clinical risk of pulmonary embolus using Wells criteria (Table 6). In these patients a negative result can exclude a pulmonary embolus and prevent unnecessary investigation and treatment, whereas a positive result is supportive of the need for definitive tests for pulmonary embolus. If a patient is judged as being at high risk of pulmonary embolus, D-dimer measurement is unnecessary. If pulmonary embolus is not suspected clinically, D-dimers should not be measured.

**KEY POINTS**
- Elevated D-dimers are not useful in making a positive diagnosis of pulmonary embolus
- However, normal (negative) D-dimers correctly exclude >90% of pulmonary emboli
- D-dimer results should be taken in clinical context and not used alone
**How do you assess Miss Lefevre now?**
She has a high clinical probability of pulmonary embolus and deep vein thrombosis and requires urgent treatment, followed by investigations to confirm the diagnosis.

**How does deep vein thrombosis occur?**
Deep leg veins are large veins that lie deep in the muscles of the leg and carry most of the deoxygenated, nutritionally depleted blood from the legs back up towards the heart. Movement of blood within these veins depends on compression by leg muscles and a system of valves that direct the blood out of the leg. Blood does not normally clot in the veins.

Thrombosis of blood in the deep veins can be precipitated by any of a triad of factors described by Virchow over 150 years ago (Box 78).
- **Venous stasis.** This promotes clotting as it allows more time for blood to clot, stops small clots from being washed away and increases blood viscosity
- **Imbalance of clotting factors.** In the blood, natural procoagulant, anticoagulant and fibrinolytic factors are balanced to prevent clots forming within the blood vessels. An imbalance of clotting factors (e.g. from hereditary abnormalities) can predispose to clots
- **Endothelial damage.** This triggers the coagulation cascade and forms a focus for clots

**How does clot form in deep veins?**
Clotting is initiated by one of Virchow’s factors, which triggers the coagulation cascade and aggregation of platelets, fibrin and large numbers of red blood cells (Fig. 54). The process of thrombosis triggers fibrinolysis with breakdown of formed clot. During thrombosis and fibrinolysis the thrombus is fragile and may break away from the vein wall, becoming an embolus. Alternative fates for thrombi are complete removal by fibrinolysis, organization, recanalization or calcification.

**Why do venous thrombi embolize to the lungs?**
Free thrombus in the deep leg veins will embolize via the pelvic veins and inferior vena cava into the right side of
the heart, then into the pulmonary artery (Fig. 55). The embolus will come to rest at a point in the pulmonary arterial circulation where its diameter exceeds that of these vessels. Thus, a large embolus may impact in the main pulmonary arteries, whereas a small embolus may pass into smaller arteries supplying segments or subsegments of the lung.

**Has Miss Lefevre had a large (massive) or small (non-massive) pulmonary embolus?**

Miss Lefevre’s symptoms are pleuritic chest pain and haemoptysis. These symptoms are caused by a small (correct term, non-massive) embolus that has impacted in a subsegmental or smaller artery, causing infarction of a small part of the lung (haemoptysis) and a patch of pleura (pleuritic pain). A large (correct term, massive) pulmonary embolus impacted in the main pulmonary arteries will block blood flow through the heart, causing shock and collapse. A massive pulmonary embolus does not immediately cause lung infarction because of dual blood supply to the lungs from the systemic circulation (bronchial arteries) and pulmonary arteries.

**What treatment should she receive?**

**Supportive therapy**

She should have oxygen to correct hypoxia and analgesia for her chest and calf pain.

**Therapy for thromboembolic disease**

She requires immediate anticoagulation with low molecular weight (LMW) heparin (Box 79; Fig. 56).

**What effect will anticoagulation with low molecular weight heparin have?**

Heparin will inhibit further extension of the deep vein thrombus. This will allow existing leg thrombus to become organized by natural processes, reducing the risk of further embolus.

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**Box 79 Pharmacology of low molecular weight heparin**

**Mechanism of action**

Heparin catalyses inhibition of factor Xa and thrombin by the natural anticoagulant antithrombin III (Fig. 56), hence inhibiting the coagulation cascade.

**Uses**

- Prevention or treatment of deep vein thrombosis and pulmonary embolus
- Early treatment of unstable angina and myocardial infarction
- Prevention of thrombosis in cannulae, dialysis circuits, etc.

**Pharmacokinetics**

- LMW heparin is poorly absorbed, hence is given by subcutaneous injection
- It has a plasma half-life of 4 h, but a longer duration of action and can be given once or twice daily
- Dose–response of weight-adjusted dose is predictable, hence dosage depends on patient weight. No monitoring of anticoagulant effect is required
- It is renally excreted and should be used with caution in patients with renal impairment

**Major side-effects**

- Bleeding
- Hypersensitivity – heparin is from animals and can be antigenic, causing allergic reactions
- Thrombocytopenia – this is a serious complication of heparin use, platelet counts should be monitored during treatment
- Osteoporosis may occur with prolonged heparin treatment
What will happen to the pulmonary embolus?
The pulmonary embolus will be dealt with by natural processes, either being cleared by fibrinolysis or remaining in the affected artery and organized, recanalized or calcified (Fig. 54). The LMW heparin will have no effect on the pulmonary embolus.

Why is Miss Lefevre not being given treatment to ‘dissolve’ her pulmonary embolus?
Where the pulmonary embolus is non-massive, natural processes are the safest and most effective way to clear the clot, as treatment to dissolve the clot (thrombolysis) carries a risk of major bleeding as a side-effect. However, if she had a massive pulmonary embolus causing circulatory collapse then thrombolysis to dissolve the clot would have been indicated.

What is low molecular weight heparin?
Heparins are mucopolysaccharides lining the inner surface of blood vessels. They were first discovered in liver (hence heparin) and are extracted for clinical use from bovine lung and porcine intestinal mucosa. The extraction process causes degradation of the heparin into molecules with weights ranging 300–30,000 kDa. The low molecular weight components 1000–10,000 kDa are purified from the unfractionated preparation to obtain LMW heparin (Box 79).

How is ventilation–perfusion scanning performed?
This test is made up of two parts.
- Lung perfusion. Albumin labelled with the radioactive isotope $^{99m}$Tc is injected intravenously and distribution of label throughout the pulmonary arterial tree is assessed with an external gamma camera.

Example text from the scan are shown in Fig. 57.
Lung ventilation. The patient inhales nebulized $^{99}$Tc$^m$ diethylene triamine-pentacetic acid (DTPA) and distribution of label in the airways and alveoli is assessed with an external gamma camera. If pulmonary emboli are present there will be areas of lung that are ventilated but not perfused (ventilation–perfusion mismatching; Fig. 57). The V/Q scan is interpreted by a radiologist who looks for areas of V/Q mismatching and reports their findings as ‘high’, ‘intermediate’ or ‘low probability’ of pulmonary embolus.

Are there any other tests that can be used to diagnose pulmonary embolus?

- **Pulmonary angiogram.** In this test a catheter is inserted via the femoral or brachial vein into the right side of the heart, then through into the pulmonary arteries. Radiographic contrast is injected into the pulmonary arteries and the pulmonary arteries are visualized by repeated X-rays to look for clot (Fig. 58).

- **Computed tomography pulmonary angiogram (CTPA).** In this technique an X-ray beam moves around the chest as the patient lies on a table, taking multiple pictures which are collated in a series of 2D images on a monitor. To obtain a CTPA, images are taken after intravenous injection of contrast.

What are the risks to the patient of these tests?

- **Radiation exposure.** CT involves the greatest radiation exposure (2–3 times the annual exposure to background radiation), which itself is associated with a 150–300 in 1,000,000 increased annual chance of death. Radiation exposure is less with V/Q scanning and least with angiography.
Allergy. Radiographic contrast (CT and non-CT angiography) contains iodine which may induce allergy and anaphylaxis if patients are sensitive to this.

Dangers of intervention. Pulmonary angiography requires insertion of a catheter through the right side of the heart into the pulmonary arteries. This has the risk of introducing infection and damaging myocardium, valves or vessels.

How do you decide which test to use?
Hospitals usually have a policy to use either V/Q scanning or CTPA as first line and only exceptionally use pulmonary angiography. These tests are roughly comparable in their ability to diagnose pulmonary emboli and availability generally depends on resource allocation by individual hospitals. Specific uses are:
- **V/Q scan** – patients with iodine allergy
- **CTPA** – patients with structural lung disease that will affect the V/Q scan

How could you confirm the diagnosis of deep vein thrombosis?

**Duplex ultrasound of the veins**
This non-invasive rapid technique is a combination of:
- **Standard ultrasound.** Sound waves are reflected off the vessel walls, allowing visualization of the vascular structures
- **Doppler ultrasound.** Bursts of sound waves are reflected off moving red blood cells, allowing detection of blood flow
  Clots may be visualized directly and as alteration in venous blood flow, although not all are detected.

**Venogram**
These are rarely performed these days but can be used if duplex ultrasound is not helpful. A foot vein is cannulated and radiographic dye is injected to show the leg veins. Clot appears as filling defects in the delineated veins. Complications include contrast allergy and phlebitis (inflamed veins).

**Miss Lefevre had a positive duplex of her right leg, confirming a right calf deep vein thrombosis. LMW heparin was continued while she commenced oral anticoagulation with warfarin. By day 4 of her inpatient stay she was well and pain-free and her international normalized ratio (INR) was 1.6. She was discharged with follow-up in the anticoagulant and respiratory clinics, remaining on self-administered dalteparin until her INR was >2.0.**

**Why was her heparin (dalteparin) treatment changed to warfarin?**
Standard practice is to anticoagulate patients for 3–6 months after a pulmonary embolus to minimize the risk of recurrence. Over a 3–6 month period tablets are preferable to (and cheaper than) daily injections. Also, heparin given for a prolonged period can cause osteoporosis.

**Why was she not given warfarin instead of heparin in the first place?**
After her pulmonary embolus she required immediate anticoagulation to prevent further clot. As warfarin inhibits synthesis of clotting factors (Fig. 56; Box 80) and...

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**Box 80 Pharmacology of warfarin**

**Mechanism of action**
In the final stages of synthesis of clotting factors II, VII, IX and X, the factors undergo gamma carboxylation, a process that oxidizes vitamin K. Vitamin K is recycled for further clotting factor synthesis by reduction catalysed by epoxide reductase. Warfarin inhibits clotting factor synthesis by inhibiting regeneration of reduced vitamin K.

**Uses**
- Prevention of recurrence of pulmonary emboli or deep vein thrombosis
- Prevention of intracardiac thrombosis in atrial fibrillation, mechanical heart valves

**Pharmacokinetics**
- Warfarin is metabolized by the liver, which terminates its action
- It has a narrow therapeutic range (i.e. the plasma concentration at which warfarin prevents clotting is close to the concentration at which major bleeding side-effects occur)
- Drug interactions are common in patients taking warfarin:
  - drugs that induce activity of liver enzymes increase warfarin metabolism and increase the risk of clotting (e.g. phenytoin, rifampicin and regular alcohol use)
  - drugs that inhibit activity of liver enzymes reduce warfarin metabolism and increase the risk of bleeding (e.g. erythromycin, ciprofloxacin, sodium valproate)

**Side-effects**
- Bleeding
- Skin necrosis
- Teratogenesis (fetal abnormalities when given to pregnant women)
existing clotting factors have to be used up, it can take 3–4 days after starting warfarin before anticoagulation is achieved. Heparin causes immediate anticoagulation as it promotes the natural anticoagulant effect of antithrombin III (Fig. 56), therefore it is used to bridge the gap while full warfarin anticoagulation is achieved.

**What is the international normalized ratio?**
Patients taking warfarin have blood sampled regularly for measurement of the prothrombin time, which is used to calculate the INR. During sampling, calcium is removed from the blood, then the sample is spun to remove blood cells. The resulting plasma is recalcified in the presence of a reagent with tissue factor activity which Activates the clotting cascade. The time to production of a clot (prothrombin time) is measured, normally 11–15 s.

The INR is calculated by dividing the prothrombin time of the patient taking warfarin by the prothrombin time of a control subject. An INR of 1.6 indicates that Miss Lefevre’s blood was clotting 1.6 times more slowly than a person not taking warfarin. In general, INR values of 2.0–4.0 are considered to indicate adequate anticoagulation, hence she was able to stop her heparin when her INR was >2.0.

**KEY POINT**
Before prescribing other drugs with warfarin, always check for potential interactions in Appendix 1 of the British National Formulary and adjust prescribing accordingly.

**How long should she remain on warfarin for?**
- Standard practice is for patients to take warfarin for 6 months following a deep vein thrombosis or pulmonary embolus to minimize the risk of recurrence
- Warfarin treatment should continue for longer than 6 months if the risk factor for clots (e.g. untreated uterine fibroids, persistent immobility, hereditary thrombophilia) is still present
- Warfarin treatment is often life-long in patients who have a recurrence of their deep vein thrombosis or pulmonary embolus
- Patients with deep vein thrombosis may stop warfarin earlier than 6 months if the risk factor has been removed

**Box 81 Overview of hereditary thrombophilia**
Patients with hereditary thrombophilia have an increased tendency to clot. The most common abnormalities are caused by deficiencies in the natural anticoagulant system.
- Factor V Leiden is a genetic variant of factor V which is resistant to natural inactivation by activated protein C.
- Proteins C, S and antithrombin inactivate clotting as part of the natural anticoagulant system. Genetic variants causing protein deficiencies result in anticoagulant defects and increased clotting tendencies.

**Box 82 Prevention of deep vein thrombosis during prolonged travel**
The aim is to maintain venous flow and minimize hypercoagulability.

**Maintain venous flow**
- Leg exercises, short walks, journey breaks if possible, avoid immobility
- Use travel compression stockings

**Reduce hypercoagulability**
- Keep hydrated
- Single dose prophylactic heparin with medical advice

**Does she need further investigation?**
- **Thrombophilia screen.** As Miss Lefevre is young and has a family history of thrombosis she may have an underlying genetic coagulation abnormality (Box 81) and should be tested for this after stopping warfarin as anticoagulation will affect the results
- **Pelvic ultrasound.** Miss Lefevre probably developed her thrombus because of immobility from a long coach journey. Patients without detectable risk factors (particularly women) should undergo pelvic ultrasound to look for predisposing masses or malignancy

**Outcome.** Miss Lefevre stopped her warfarin after 6 months and remained completely well. Her thrombophilia screen did not detect a heritable clotting abnormality. She was therefore given advice to help avoid recurrence of her thromboembolic disease (Box 82), encouraged to stop smoking and discharged from follow-up.
CASE REVIEW

Marie Lefevre presents with left-sided pleuritic chest pain and haemoptysis following a long distance coach journey. She has also noticed some right calf discomfort. A clinical diagnosis of deep vein thrombosis and pulmonary embolus is made and she is treated with LMW heparin. The following day these diagnoses are confirmed by a duplex ultrasound demonstrating right calf deep vein thrombosis and a V/Q scan showing high probability of a pulmonary embolus. She receives anticoagulation with warfarin for 6 months. Her thromboembolic disease is attributed to her long distance journey and cigarette smoking and a heritable clotting abnormality is excluded. She is advised to stop smoking and take precautions when immobile for long periods to reduce the risk of recurrence.

KEY POINTS

- Deep vein thrombosis can be precipitated by any of ‘Virchow’s triad’ of factors:
  - venous stasis
  - imbalance of clotting factors
  - endothelial damage
- Thrombi in the deep veins can break free, becoming emboli that travel to the lungs – pulmonary emboli
- Pulmonary emboli impact in the pulmonary circulation at the point where the diameter of the embolus exceeds that of the vessels
- Smaller pulmonary emboli impact in peripheral pulmonary arteries where they may cause infarction of the supplied lung and overlying pleura with symptoms of pleuritic chest pain and haemoptysis
- Pulmonary emboli can be difficult to diagnose:
  - at presentation, clinical features are used to estimate the likelihood of pulmonary emboli (Wells criteria)
  - D-dimer measurement can be used to rule out pulmonary emboli in patients with low or moderate likelihood of emboli
- definitive investigations including V/Q scanning and CTPA are often not available out of hours except in severe emergencies, so patients at moderate or high risk of emboli are usually treated until diagnosis can be confirmed
- Patients with suspected or proven deep vein thrombosis and/or pulmonary embolus are initially treated with subcutaneous LMW heparin to prevent further pulmonary embolus
- Existing thrombus or embolus is usually cleared or organized by intrinsic (natural) mechanisms
- Once the diagnosis has been confirmed, patients receive oral warfarin for 3–6 months to prevent recurrence
- Investigations including pelvic ultrasound scanning and hereditary thrombophilia testing should be performed to look for an underlying cause of thromboembolic disease
- Patients with recurrent thromboembolic disease should receive life-long anticoagulation