# VENOUS THROMBOEMBOLISM (VTE)

# DEFINITION

- Deep venous thrombosis (DVT) and pulmonary embolism (PE) can be considered under this heading.
- The majority (79%) of pulmonary emboli arise from the propagation of lower limb DVT.

# RARE CAUSES INCLUDE

- Septic emboli (from endocarditis affecting the tricuspid or pulmonary valves),
- Tumour (especially choriocarcinoma),
- Fat,
- Air,
- Amniotic fluid
- Placenta.

# THE INCIDENCE

- The incidence of VTE in the community is unknown
- It occurs in approximately 1% of all patients admitted to hospitals and accounts for around 5% of in-hospital deaths.
- It is a common mode of death in patients with cancer, stroke and pregnancy.

# CLINCAL FEATURES

- For patients who have DVT, the most frequent history is a cramp in the lower calf that persists for several days and that becomes more uncomfortable as time progresses.
- Not all leg pain is due to DVT.
- Sudden, severe calf discomfort suggests a ruptured Baker's cyst.
- Fever and chills usually herald cellulitis rather than DVT, though DVT may be present concomitantly.

# CLINCAL PRESENTATIONS

- Acute massive pulmonary embolism
- Acute small/medium pulmonary embolism
- Chronic pulmonary embolism

# Risk factors

**surgical**
- Major abdominal/pelvic surgery
- Hip/knee surgery
- Post-operative intensive care

**Obstetrics**
- Pregnancy/puerperium

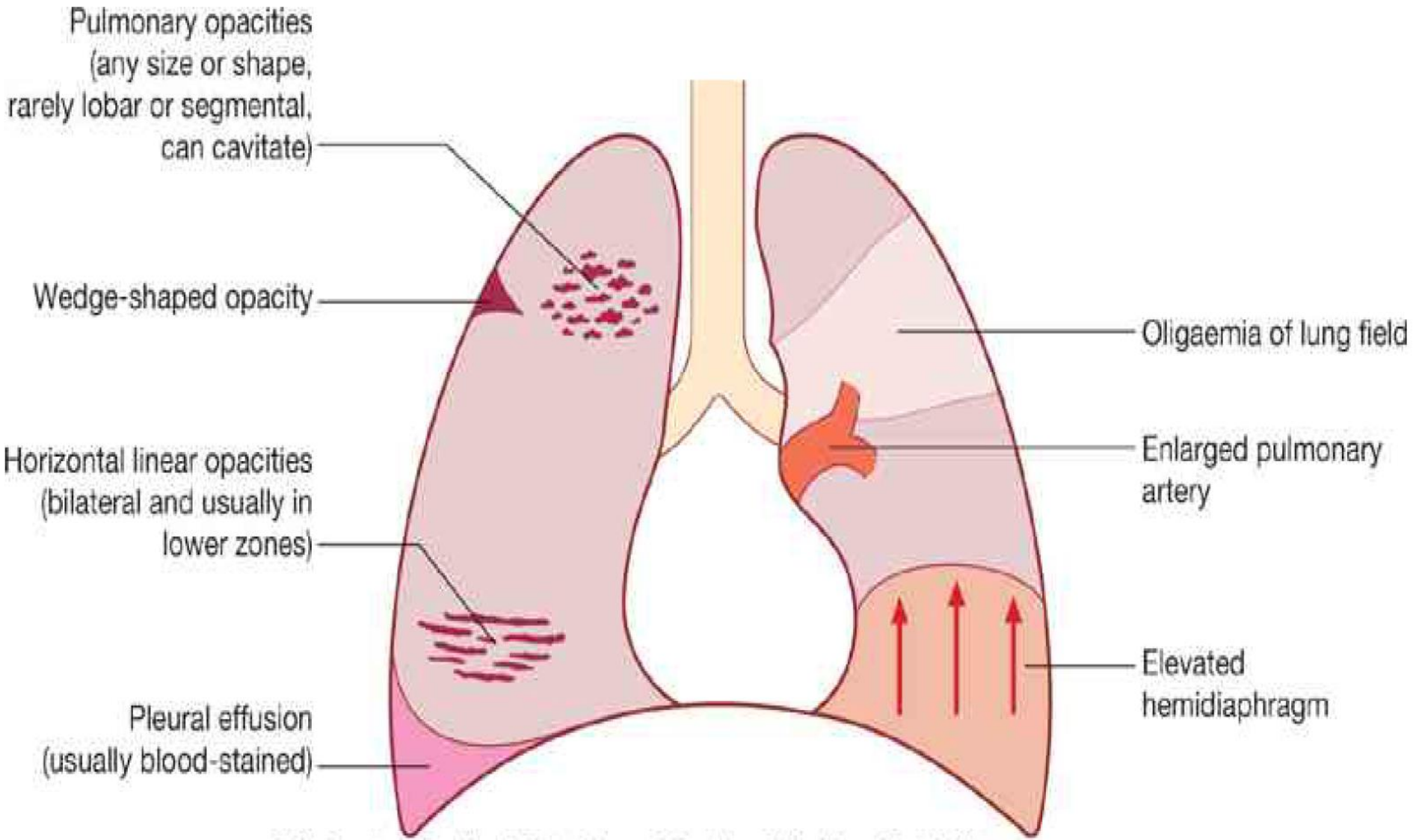
**Cardiorespiratory disease**
- COPD
- Congestive cardiac failure
- Other disabling disease

**Lower limb problems**
- Fracture
- Varicose veins
- Stroke/spinal cord injury

**Malignant disease**
- Abdominal/pelvic
- Advanced/metastatic
- Concurrent chemotherapy

**Miscellaneous**
- Increasing age
- Previous proven VTE
- Immobility
- Thrombotic disorders
- Trauma

# DIAGNOSIS: CHEST RADIOGRAPHY



# ELECTROCARDIOGRAPHY

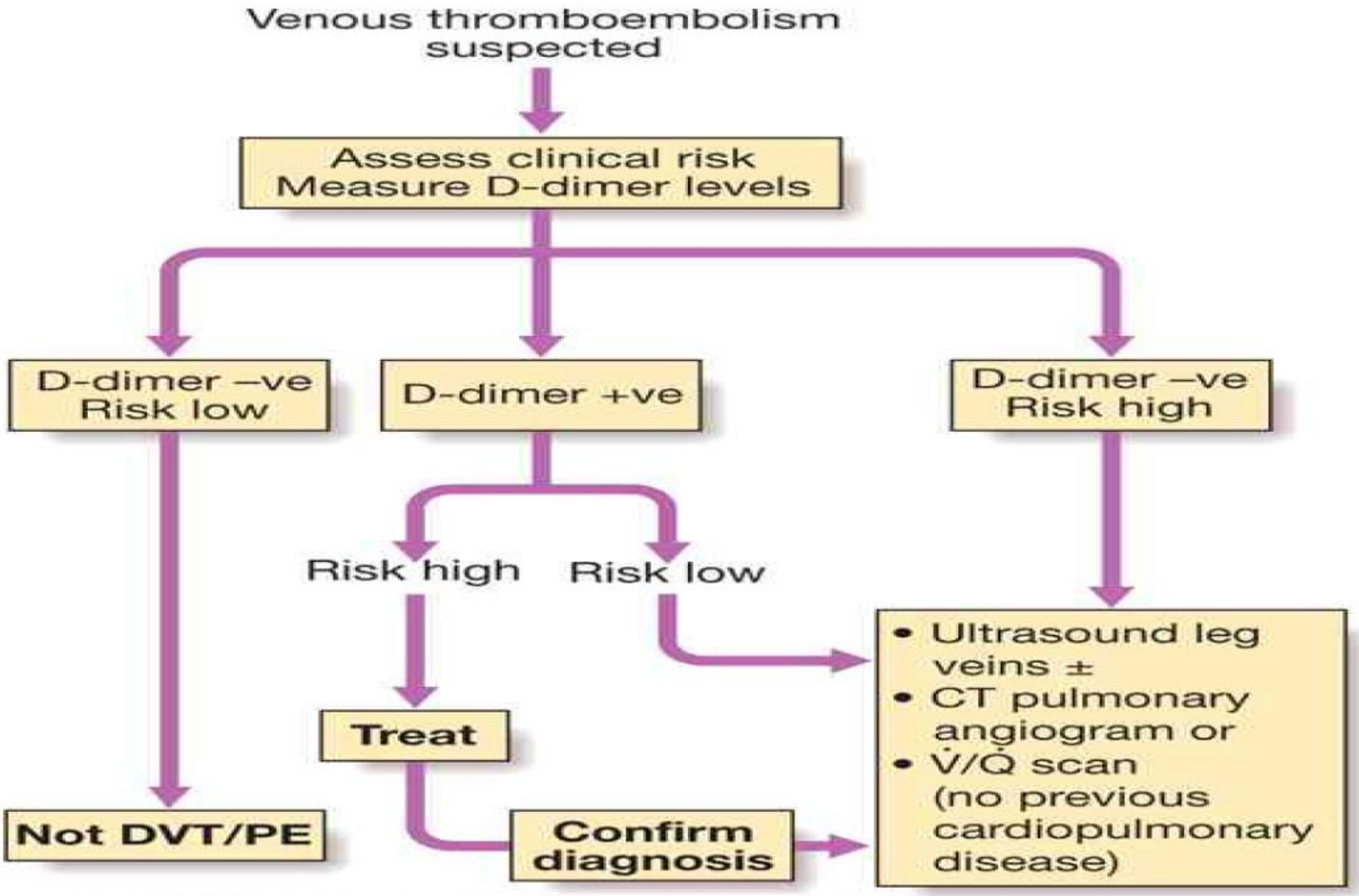
- 1-The ECG is often normal
- 2-but is useful in excluding other important differential diagnoses such as acute myocardial infarction and pericarditis.
- 3-The most common abnormalities in PE include
- Sinus tachycardia and anterior T-wave inversion but are non-specific;
- Larger emboli may cause right heart strain revealed by an S1Q3T3 pattern, ST-segment and T-wave changes, or the appearance of right bundle branch block

# ARTERIAL BLOOD GASES

- Arterial blood gases typically show
- A reduced $PaO_2$, a normal or low $PaCO_2$,and
- An increased alveolar-arterial oxygen gradient,
- but may be normal in a significant minority.
- A metabolic acidosis may be seen in acute massive PE with cardiovascular collapse.

# D-DIMER AND OTHER CIRCULATING MARKERS

- An elevated D-dimer is of limited value, as it occurs in a number of conditions including PE, myocardial infarction, pneumonia and sepsis.
- However, low D-dimer levels (< 500 ng/mL measured by ELISA), particularly where clinical risk is low, have a high negative predictive value and further investigation is unnecessary).
- The D-dimer result should be disregarded in high-risk patients, as further investigation is mandatory even if it is normal.
- Other circulating markers that reflect right ventricular micro-infarction, such as troponin I and brain natriuretic peptide, are under investigation.



# IMAGING

- CT pulmonary angiography
- CTPA is the first-line diagnostic test .
- It has the advantage of visualizing the distribution and extent of the emboli or highlighting an alternative diagnosis, such as consolidation, pneumothorax or aortic dissection.
- As the contrast media may be nephrotoxic, care should be taken in patients with renal impairment, and CTPA avoided in those with a history of allergy to iodinated contrast media.
- In these cases, either V⁄Q scanning or ventilation/perfusion single photon emission computed tomography (V⁄Q SPECT) may be considered.

# COLOUR DOPPLER ULTRASOUND

- Colour Doppler ultrasound of the leg veins may be used in patients with suspected PE, particularly if there are clinical signs in a limb, as many will have identifiable proximal thrombus in the leg veins.

# ECHOCARDIOGRAPHY

- Bedside echocardiography is extremely helpful in the differential diagnosis and assessment of acute circulatory collapse.
- Acute dilatation of the right heart is usually present in massive PE, and thrombus (embolism in transit) may be visible.
- Important differential diagnoses, including left ventricular failure, aortic dissection and pericardial tamponade, can also be identified.

# PULMONARY ANGIOGRAPHY

- Conventional pulmonary angiography is still useful in selected settings or for the delivery of catheter-based therapies.

# MANAGEMENT ( GENERAL MEASURES )

- Prompt recognition and treatment are potentially life-saving.
- Sufficient oxygen should be given to hypoxaemic patients to maintain arterial oxygen saturation above 90%.
- Circulatory shock should be treated with intravenous fluids or plasma expander, but inotropic agents are of limited value as the hypoxic dilated right ventricle is already close to maximally stimulated by endogenous catecholamines.
- Diuretics and vasodilators should also be avoided, as they will reduce cardiac output.
- Opiates may be necessary to relieve pain and distress but should be used with caution in the hypotensive patient.
- External cardiac massage may be successful in the moribund patient by dislodging and breaking up a large central embolus.

# ANTICOAGULATION

- The mainstay of treatment for all forms of VTE is anticoagulation.
- LMWH followed by a coumarin anticoagulant, such as warfarin.
- Treatment of acute VTE with LMWH should continue for a minimum of 5 days.
- Patients treated with warfarin should achieve a target INR of 2.5 (range 2–3) with LMWH continuing until the INR is above 2

# DOAC ( DIRECT ORAL ANTICOAGULANTS )

- Alternatively, patients may be treated with a DOAC.
- Rivaroxaban and apixaban may be used immediately from diagnosis without the need for LMWH,
- while the licences for dabigatran and edoxaban include initial treatment with LMWH for a minimum of 5 days before commencing the DOAC.

# DURATION OF ANTICOAGULATION

- The optimal initial period of anticoagulation is between 6 weeks and 6 months.
- Patients with a provoked VTE in the presence of a temporary risk factor, which is then removed, can usually be treated for short periods (e.g. 3 months).
- If there are ongoing risk factors that cannot be alleviated, such as active cancer, long-term anticoagulation is usually recommended, provided that the risk of bleeding is not deemed excessive.

- For patients with unprovoked VTE, the optimum duration of anticoagulation can be difficult to establish.
- Many patients who have had unprovoked episodes of VTE will benefit from long-term anticoagulation.
- Several factors predict risk of recurrence following an episode of unprovoked VTE.
- The strongest predictors of recurrence are male sex and a positive D-dimer assay measured 1 month after stopping anticoagulant therapy.

# THROMBOLYTIC AND SURGICAL THERAPY

- Thrombolysis is indicated in any patient presenting with acute massive PE accompanied by cardiogenic shock.
- In the absence of shock, the benefits are less clear but thrombolysis may be considered
- In those presenting with right ventricular dilatation and hypokinesis or
- severe hypoxaemia.
- Patients must be screened carefully for haemorrhagic risk, as there is a high risk of intracranial haemorrhage.
- Surgical pulmonary embolectomy may be considered in selected patients but carries a high mortality.

# CAVAL FILTERS

- Indications for an inferior vena caval filter include
- A patient in whom anticoagulation is contraindicated,
- A patient who has suffered massive haemorrhage on anticoagulation, or
- Recurrent VTE despite anticoagulation.
- Retrievable caval filters are particularly useful in individuals with temporary risk factors.
- The caval filter should be used only until anticoagulation can be safely initiated, at which time the filter should be removed if possible.

# PROGNOSIS

- Immediate mortality is greatest in those with echocardiographic evidence of right ventricular dysfunction or cardiogenic shock.
- Once anticoagulation is commenced, however, the risk of mortality rapidly falls.
- The risk of recurrence is highest in the first 6–12 months after the initial event, and at 10 years around
- One-third of individuals will have suffered a further event.
- The vast majority of patients attain normal right heart function by 3 weeks but persisting pulmonary hypertension may be present in around 4% of patients.

# PULMONARY EMBOLISM IN PREGNANCY

- Maternal mortality: venous thromboembolism is the leading direct cause in the UK.
- CTPA: may be performed safely with fetal shielding
- V/Q scanning: greater radiation dose to fetus
- Warfarin: teratogenic, so pulmonary embolism should be treated with low-molecular-weight heparin during pregnancy.

# PROPHYLAXIS OF VTE

- All patients admitted to hospital should be assessed for their risk of developing VTE and appropriate prophylactic measures should be put in place.
- Both medical and surgical patients are at increased risk.
- Early mobilization of patients is important to prevent DVT, and those at medium or high risk require additional antithrombotic measures; these may be pharmacological or mechanical

# MODERATE RISK OF DVT

- *** Major surgery: In patients > 40 years or with other risk factor for VTE
- *** Major medical illness, e.g.:
- Heart failure
- Myocardial infarction with complications
- Sepsis
- Inflammatory conditions, including inflammatory bowel disease
- Active malignancy
- Nephrotic syndrome
- Stroke and other conditions leading to lower limb paralysis

# HIGH RISK OF DVT

- Major abdominal or pelvic surgery for malignancy or with history of DVT or known thrombophilia
- Major hip or knee surgery
- Neurosurgery

# METHODS OF VTE PROPHYLAXIS

- Mechanical
- • Intermittent pneumatic compression
- • Mechanical foot pumps
- • Graduated compression stockings
- Pharmacological
- • LMWHs
- • Unfractionated heparin
- • Fondaparinux
- • Dabigatran
- • Rivaroxaban
- • Apixaban
- • Warfarin