

## INTRODUCTION

A function of the pulmonary capillary bed is to filter the circulation of the minute blood clots that are a daily occurrence in health. Pathological obstruction of the pulmonary vessels usually presents as one of four types:

1. **multiple small pulmonary emboli** – characterised by progressive breathlessness more commonly identified at outpatients appointments than through emergency presentation due to the long standing nature of the problem
2. **segmental emboli with pulmonary infarction** – may present with pleuritic pain and / or haemoptysis but with little or no cardiovascular compromise
3. **major pulmonary emboli** – obstruction of the larger branches of the pulmonary tree may present with sudden onset of shortness of breath with transient rise in pulse and / or fall in blood pressure. Often a precursor to a massive pulmonary embolism (PE)
4. **massive pulmonary emboli** – often presenting with loss of consciousness, tachypnoea and intense jugular vein distension, and may prove immediately or rapidly (within 1 hour) fatal or unresponsive to cardio-pulmonary resuscitation

Pulmonary embolism and deep vein thrombosis (DVT) can be considered as two manifestations of a single entity; venous thromboembolism (VTE).

Evidence has shown that PE was not diagnosed in as many as 70% of people in whom it was subsequently found to be a main cause of death.

## HISTORY<sup>1-5</sup>

### See dyspnoea guideline

The most common symptoms of PE are (in order of frequency, most common first):

- dyspnoea
- tachypnoea
- pleuritic pain
- apprehension
- tachycardia
- cough
- haemoptysis
- leg pain / clinical DVT.

PE can present with a wide range of symptoms and is often atypical, however 80-90% of all confirmed PE patients exhibit one or more predisposing factors.

Any patient presenting with any symptom suggestive of PE, but in particular shortness of breath and/or chest pain, who also has a pre-disposing factor should be considered at risk of PE.

Wells criteria can be used to assess the risk of DVT (Table 1).

**Table 1 – Wells Criteria<sup>6</sup>**

Item	Score
Clinical signs and symptoms of DVT (leg swelling and pain with palpation of the deep veins).	3
An alternative diagnosis is less likely than pulmonary embolism.	3
Heart rate >100 beats/minute.	1.5
Immobilization or surgery in the previous 4 weeks.	1.5
Previous DVT/pulmonary embolism.	1.5
Hemoptysis.	1
Maglinancy (treatment ongoing or within previous 6 months or palliative).	1
<b>Total Points</b>	<input type="text"/>

### Probability of PE:

- >6 points – high
- 2 to 6 points – moderate
- <2 points: low

**Table 2 – Pre-disposing factors for PE (at least one present in 80-90% cases)**

<b>Surgery</b>	especially recent: <ul style="list-style-type: none"> <li>• abdominal</li> <li>• pelvic</li> <li>• hip or knee surgery</li> <li>• post operative intensive care.</li> </ul>
<b>Obstetrics</b>	pregnancy
<b>Cardiac</b>	recent acute myocardial infarction
<b>Limb problems</b>	recent lower limb fractures varicose veins lower limb problems secondary to stroke or spinal cord injury
<b>Malignancy</b>	abdominal and/or pelvic in particular advanced metastatic disease concurrent chemotherapy
<b>Miscellaneous</b>	age >40 (and risk continues to increase with age) previous proven PE/DVT immobility thrombotic disorder other recent trauma

Lesser risk factors include air, coach or other travel leading to periods of immobility, especially whilst sitting, oral oestrogen (some contraceptive pills) and central venous catheterisation.

Over 70% of patients who suffer PE have peripheral vein thrombosis and vigilance is therefore of great importance – it may not initially appear logical to check the legs of a patient with chest pain but can be of great diagnostic value in such cases.

## ASSESSMENT

Assess **ABCD**'s:

### Specifically consider:

- respiratory rate and effort
- any signs and symptoms combined with predisposing factors
- lower limb assessment may reveal unequal/swollen limbs that are occasionally hot and red. Calf tenderness/pain may be present. Extensive leg clots may also lead to femoral tenderness
- evidence of right heart strain (jugular vein distension)
- differential diagnoses include pleurisy, pneumothorax or cardiac chest pain
- evaluate whether any **TIME CRITICAL** features are present. These may include:
  - extreme breathing difficulty
  - cyanosis
  - severe hypoxia ( $\text{SaO}_2 < 90\%$ , unresponsive to  $\text{O}_2$ ).

If any of these features are present **correct A and B problems then transfer to the nearest suitable receiving hospital.**

Provide a Hospital Alert Message/Information Call.

## MANAGEMENT<sup>5,7</sup>

Follow **medical emergencies guideline** remembering to:

Start correcting:

- **AIRWAY**
- **BREATHING**
- **CIRCULATION**
- **DISABILITY** (mini neurological examination)

- Position for comfort and ease of respiration – often sitting forwards but be aware of potential hypotension
- Be prepared for cardio-respiratory arrest

### Specifically consider:

- monitor using ECG and pulse oximeter
- be aware that the classic  $\text{S}_1\text{Q}_3\text{T}_3$  12 lead ECG presentation is often **NOT** present, even during massive PE. The commonest finding is a sinus tachycardia.
- administer high concentration oxygen ( $\text{O}_2$ ) (**refer to oxygen guideline**) via a non-re-breathing mask, using the stoma in laryngectomee and other neck breathing patients, to ensure an oxygen saturation ( $\text{SpO}_2$ ) of  $>95\%$ , except in patients with chronic obstructive pulmonary disease (COPD) (**refer to COPD guideline**)
- consider assisted ventilation at a rate of 12–20 breaths per minute if:
  - $\text{SpO}_2$  is  $<90\%$  on high concentration  $\text{O}_2$
  - respiratory rate is  $<10$  or  $>30$
  - expansion is inadequate
- rapid transfer
- IV access en-route where appropriate.

## ADDITIONAL INFORMATION

Whilst there is no specific pre-hospital treatment available, there may be a window of opportunity to deal with massive PE before the patient progresses to cardiac arrest. Thrombolytic therapy has been proved of benefit to many of these patients but, because of the difficulty in accurate diagnosis, this should only be performed in the hospital setting. Surgical intervention (embolectomy) may also be required.

High index of suspicion and rapid transfer are the keys to saving these patients.

## Key Points – Pulmonary Embolism

- Common symptoms of PE are dyspnoea, tachypnoea, pleuritic pain, apprehension, tachycardia, cough, haemoptysis, leg pain / clinical DVT
- Risk factors may be identifiable from the history
- Ensure ABCD assessment and apply a saturation monitor early
- Lower limb may be unequal/swollen, occasionally hot and red, tenderness/pain may be present
- Apply oxygen and if in respiratory distress, transfer to further care as a medical emergency.

## REFERENCES

- <sup>1</sup> Donnamaria V, Palla A, Petruzzelli S. A way to select on clinical grounds patients with high risk for pulmonary embolism: a retrospective analysis in a nested case-control study. *Respiration* 1995;62(4):201-04.
- <sup>2</sup> Hoellerich VL, Wigton RS. Diagnosing pulmonary embolism using clinical findings. *Archives of Internal Medicine* 146;9(1699-1704).
- <sup>3</sup> Stein PD, Hull RD, Saltzman HA. Strategy for diagnosis of patients with suspected acute pulmonary embolism. *Chest* 1993;103(5):1553-59.
- <sup>4</sup> The British Thoracic Society Standards of Care Committee. Suspected Acute Pulmonary Embolism – a practical approach. *Thorax* 1997;52(Suppl 4):S2-S24.
- <sup>5</sup> American College of Chest Physicians: Consensus Committee on Pulmonary Embolism. Opinions regarding the diagnosis and management of venous thromboembolic disease [review]. *Chest* 1998;113(2):499-504.
- <sup>6</sup> Wells PS, Anderson DR, Rodger M, Ginsberg JS, Kearon C, Gent M, et al. Derivation of a simple clinical model to categorize patients probability of pulmonary embolism: increasing the models utility with the SimpliRED D-dimer. *Thromb Haemost* 2000; 83:4165-20.
- <sup>7</sup> Guidelines on diagnosis and management of acute pulmonary embolism. *Eur Heart J* 2000;21(16): 1301-1336.

## METHODOLOGY

Refer to methodology section.