

***Guideline for the Management of Massive and Submassive Pulmonary Embolus on ICU***

**Reference No:**

**Introduction**

The overall mortality of pulmonary embolism (PE) is 60 – 70 cases per 100 000 people per year. Fifty per cent of cases occur in hospitals or in long term care. The in-hospital mortality rate is 6 – 15 per cent.

**Aim and Scope.**

To decrease morbidity associated with pulmonary embolism and introduce up to date treatment guidance. To be used in adult ICU.

**Abbreviations**

<b>MAP</b>	Mean Arterial Pressure
<b>CVP</b>	Central Venous Pressure
<b>HR</b>	Heart Rate
<b>EWS</b>	Early Warning Score
<b>ICU</b>	Intensive Care Unit
<b>RV</b>	Right ventricle
<b>TTE</b>	Transthoracic echocardiography
<b>CT</b>	Computed tomography
<b>BNP</b>	Brain natriuretic peptide

**Diagnosis of Pulmonary Embolus**

**Symptoms**

1. Dyspnoea is the commonest symptom
2. Pleuritic chest pain, often worse on inspiration
3. Light headedness or syncope
4. Cough with blood stained sputum

**Signs**

1. Tachycardia
2. Hypoxia
3. Cyanosis
4. Right ventricular dysfunction

**ECG changes**

1. Sinus tachycardia
2. T wave inversion V1 – V4
3. New onset RBBB or AF
4. S1 Q3 T3

**Chest X-ray changes**

1. Focal oligaemia
2. Peripheral wedge shaped density
3. Enlarged right descending pulmonary artery

**Investigations**

Imaging should be done within one hour of onset of symptoms if possible. An echocardiogram is diagnostic in massive PE and is readily available and can be performed in the ICU setting. It may also help to determine the prognosis of a sub massive PE. It is however not diagnostic of a submassive PE as other conditions can affect right ventricular function.

CT Pulmonary Angiogram (CTPA) is diagnostic for PE but requires the patient to be stable enough for transfer.

CTPA is the recommended imaging for non-massive PE. Results correlate well with clinical severity, and an alternative diagnosis may be recognised if a PE is excluded during imaging.  
If a good quality CTPA excludes a PE, no further investigations or treatment for PE are required.

### **Classification**

#### **Massive PE**

Systolic blood pressure <90 mm Hg for >15 mins

OR

Requiring inotropic support not due to:

1. Cause other than PE (LV dysfunction, arrhythmia, hypovolaemia, sepsis)
2. PEA
3. Persistent profound bradycardia

#### **Submassive PE**

Systolic blood pressure >90 mm Hg

AND

RV dysfunction as demonstrated by:

- RV dilation OR RV systolic dysfunction on TTE
- RV dilation on CT
- Elevation of BNP (>90 pg/mL)
- Elevation of NT pro-BNP (>500 pg/mL)
- ECG changes (new or incomplete right bundle branch block, anteroseptal ST elevation or depression or anteroseptal T-wave inversion)

OR

myocardial necrosis - elevation of troponin T (>0.1ng/mL).

Right heart strain on echocardiogram is defined as one or more of the following:

- 1) Right ventricle dilation (ratio of right to left ventricle (LV) diameter >0.9 measured in the apical four chamber view, at the lower third of the ventricle at end-diastole)
- 2) Presence of paradoxical septal systolic motion
- 3) RV systolic dysfunction (defined by a tricuspid annular plane systolic excursion (TAPSE) <16 mm measured in the same view using M-mode).

### **Treatment**

1. Thrombolysis is the first line treatment for a massive PE and may be instituted on clinical grounds alone if cardiac arrest is imminent.
2. If cardiac arrest is imminent give alteplase 50mg IVI
3. Reconstitute each 50mg vial of alteplase with 25ml of solvent using a syringe. The mixture should only be agitated gently until complete dissolution. Avoid vigorous agitation to prevent foam agitation.
4. In massive PE not in cardiac arrest or imminent cardiac arrest, give a bolus of alteplase, 10mg IV over 1-2 minutes, followed by an infusion of 90mg over 2 hours.  
**Please note total dose should not exceed 1.5mg/kg if patient's weight is less than 65kg.**
5. Commence IV unfractionated heparin post alteplase infusion, once the APTT ratio is less than 2.0, at a rate of 1200units/hour (**no loading bolus dose should be given**).
6. Check APTT 6 hours after starting IV heparin, and aim for ratio of 2.0-3.0.
7. Thrombolysis should not be used as a first line treatment for a non-massive PE.
8. If thrombolysis is contraindicated or unsuccessful then consider pulmonary embolectomy or pulmonary artery catheterisation and direct administration of thrombolysis.
9. If the patient is stable following immediate resuscitation then heparin should be given

Uncontrolled when printed  
intravenously prior to imaging. A dose of 80u/kg of unfractionated heparin is recommended.

10. Patients may be switched to LMWH once they are stable

**References:**

- 1) NICE guidelines on managing pulmonary embolism 2013
- 2) Jaff MR, McMurry S, Archer SL et al. Management of massive and submassive pulmonary embolism, iliofemoral deep vein thrombosis and chronic thromboembolic pulmonary hypertension: a scientific statement from the American Heart Association. Circulation 2011;123:1788-830.

**Documentation Control**

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