



# MASSIVE PULMONARY EMBOLISM



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Massive pulmonary embolism is acute obstruction of the pulmonary circulation causing right ventricular (RV) failure and shock. Mortality is driven by delay to recognition, under treatment, and missed thrombolysis.

## ED priorities:

- Recognise obstructive shock physiology
- Support RV perfusion without harming preload
- Avoid iatrogenic collapse (fluids, intubation)
- Decide early on reperfusion therapy
- Escalate immediately to ICU / specialist care

Massive PE is an obstructive shock.

## DEFINITION

**Massive PE** = acute PE with:

- Sustained hypotension (SBP <90 or drop  $\geq$ 40 mmHg)
- OR cardiogenic shock
- OR cardiac arrest

(Submassive / intermediate risk PE  $\neq$  massive PE and is managed differently.)

## RECOGNITION (CLINICAL FIRST)

### KEY FEATURES

- Sudden dyspnoea
- Syncope or pre syncope
- Chest pain
- Unexplained hypotension
- Tachycardia
- Hypoxia (may be mild early)

### SIGNS OF RV FAILURE

- Raised JVP
- Clear lungs despite shock
- Narrow pulse pressure
- Loud P2 (late)
- New RBBB pattern on ECG

Shock + clear lungs = think **PE or tamponade**.

## PATHOPHYSIOLOGY

- Acute clot  $\rightarrow$  sudden  $\uparrow$  pulmonary vascular resistance
- RV cannot generate required pressure
- RV dilates  $\rightarrow$  septal shift
- LV preload collapses
- Systemic hypotension  $\rightarrow$  coronary hypoperfusion  $\rightarrow$  RV ischaemia

## IMMEDIATE ED PRIORITIES

1. **ABCs**
2. Oxygen (but hypoxia is secondary)
3. Rapid haemodynamic assessment
4. Minimise harmful interventions
5. Decide early: **thrombolysis**

## DIAGNOSIS

### IN UNSTABLE PATIENTS

Diagnosis is **clinical + bedside support**:

- Bedside echo showing RV strain
- ECG suggestive of PE
- History + shock with no other cause

**Do not delay treatment waiting for CT in shock.**

### IMAGING

- CT pulmonary angiography **only if stable**
- Not required before thrombolysis in cardiac arrest or profound shock

## BEDSIDE ECHO (HIGH VALUE, LOW DELAY)

Key findings:

- Dilated RV
- RV/LV ratio  $>1$
- Septal flattening ("D sign")
- Poor RV free wall function

Echo confirms **physiology**, not anatomy, that's enough to act.

## HAEMODYNAMIC MANAGEMENT (RV PROTECTIVE)

### OXYGEN

- Maintain SpO<sub>2</sub>  $\geq$ 94%
- Does not fix shock but reduces RV afterload slightly

### FLUIDS (CAUTION)

- RV is preload dependent **until it isn't**
- Small bolus (250 mL) only if hypovolaemic
- Stop immediately if JVP rises or BP worsens
- Large fluids worsen RV dilation and collapse LV filling.

### VASOPRESSORS

- **Noradrenaline** preferred
- Increases coronary and systemic perfusion
- Supports RV function

Avoid pure vasodilators.

## AIRWAY & VENTILATION (HIGH RISK)

- Intubation can precipitate cardiac arrest
- Avoid unless absolutely necessary
- If required:
  - RSI with extreme caution
  - Volume loading beforehand
  - Vasopressors ready
  - Lowest possible PEEP

Spontaneous ventilation is safer for RV filling.

## DEFINITIVE REPERFUSION THERAPY

### SYSTEMIC THROMBOLYSIS (LIFE SAVING)

Indications:

- Massive PE with shock or arrest
- No absolute contraindications

Benefits:

- Rapid clot reduction
- RV unloading
- Improved survival

Bleeding risk is outweighed by near certain death without treatment.

## ALTERNATIVES (IF AVAILABLE)

- Catheter directed thrombolysis
- Surgical embolectomy
- ECMO as bridge (select centres)

ED role: **recognise and activate**, not provide alone.

## ANTICOAGULATION

- Start heparin **unless immediate thrombolysis planned**
- Do not delay thrombolysis for heparin

## WHAT TO AVOID

- Large fluid boluses
- Delayed thrombolysis in shock
- Intubation without preparation
- CT scan delays in unstable patients
- Treating as septic shock

## DISPOSITION

- Massive PE = **ICU emergency**
- Early cardiology / ICU / PERT involvement
- Discuss thrombolysis **early, not as a last resort**



# CHECKLIST

## MASSIVE PULMONARY EMBOLISM

## IMMEDIATE STABILISATION (ABCDE)

### Airway

- Maintain spontaneous ventilation if possible
- Prepare for difficult intubation if required

### Breathing

- Oxygen to target SpO<sub>2</sub> ≥94%
- Avoid high PEEP

### Circulation

- IV access ×2
- Continuous BP & ECG
- Treat hypotension promptly

### Disability

- GCS
- Look for syncope / collapse

### Exposure

- Examine legs for DVT signs
- Look for alternative shock sources

## SUSPECT MASSIVE PE

- Shock with clear lungs
- Sudden dyspnoea/syncope
- No other cause identified

## BEDSIDE ASSESSMENT

- ECG (RBBB, S1Q3T3 may be present)
- Bedside echo → RV dilation / strain

## HAEMODYNAMIC SUPPORT

- Small fluid bolus only if indicated
- Noradrenaline started if hypotensive
- Avoid large fluids

## AIRWAY CAUTION

- Avoid intubation if possible
- If intubating:
  - Vasopressors ready
  - Minimal PEEP
  - Experienced operator

## DEFINITIVE THERAPY

- Systemic thrombolysis if shock/arrest
- Do not delay for CT if unstable
- Activate PE response / specialist team

## ANTICOAGULATION

- Heparin started unless thrombolysis imminent

## WHAT TO AVOID

- Excess fluids
- Delayed thrombolysis
- Intubation without preparation
- Treating as sepsis

## DISPOSITION

- ICU admission
- Early cardiology / critical care input
- Clear handover:
  - Haemodynamics
  - Echo findings
  - Thrombolysis given or planned
  - Response to therapy