# Learn simply

## Pulmonary Edema

**Passion profession same**

**Pulmonary edema[1]**

Confirm the diagnosis

- Identify risk factors for pulmonary edema[2]
- Take a detailed history and perform a physical examination[3]
- √ chest x-ray
- Consider alternative diagnoses[4]

Initiate treatment immediately

- **Admit to hospital, manage in an ICU setting**
- Vital signs and oxygen saturation q 15 min
- √ EKG
- Confirm gestational age and fetal wellbeing
- *Consider empiric antibiotic therapy and ionotropic support, if needed*
- **L – Lasix (to promote diuresis)**
- **M – Morphine (decreases anxiety and promotes pulmonary vascular dilatation)**
- **N – $Na^{2+}$ (sodium) and water restriction**
- **O – Oxygen supplementation at 4–6 L/min**
- **P – Position patient in an upright posture**

Identify the cause (√ maternal echocardiography)[5]

Non-cardiogenic pulmonary edema[6]

- **Treat the underlying cause (e.g., with antibiotics or anticoagulation)**
- **Suspend tocolysis and excessive fluid management**
- Consider MFM, NICU, anesthesia consultation
- Continuous fetal heart rate monitoring

Does the patient have preeclampsia?

No

- Continue expectant management
- Treat the underlying cause
- Discharge home once stable

Yes[7]

- Stabilize the mother
- Resuscitate the fetus *in utero*
- **Consider antenatal steroids**

Proceed with urgent delivery regardless of gestational age

Cardiogenic pulmonary edema[8]

- **Urgent cardiology consultation**
- Exclude myocardial injury: √ serial EKG and cardiac enzymes (troponin, creatine kinase) q 8 hourly × 3
- Consider MFM, NICU, anesthesia consultation
- √ CBC, renal and liver function
- Consider serial arterial blood gas (ABG) to monitor the extent of hypoxemia
- Continuous fetal heart rate monitoring

- Stabilize the mother
- Resuscitate the fetus *in utero*
- **Consider antenatal steroids, if indicated**
- Reserve delivery for usual obstetric indications

1. Pulmonary edema refers to an abnormal and excessive accumulation of fluid in the alveolar and interstitial spaces of the lungs.
2. Risk factors for pulmonary edema include
   - preeclampsia,
   - infection,
   - iatrogenic fluid overload,
   - and tocolytic therapy (such as β-agonist medications).

3. Accumulation of fluid in the alveolar space leads to
   - decreased diffusing capacity,
   - hypoxemia, and
   - shortness of breath (dyspnea).

4. Patients present with worsening dyspnea and orthopnea (inability to lie flat) which may be acute or slowly progressive in onset.
5. Other symptoms may include
   - cough,
   - chest pain,
   - palpitations,
   - fatigue, and
   - low-grade fever.
6. Physical examination may reveal
   - tachycardia,
   - elevated blood pressure, and
   - peripheral edema.

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1. Cardiac evaluation may uncover an irregular heart beat, elevated jugular venous pressure (which reflects an elevated right-sided filling pressure), and the presence of a S3 or S4 heart sound or both (“summation gallop”) as well as a new or changed heart murmur.
2. Chest examination usually reveals crackles indicative of interstitial pulmonary edema and some patients may have wheezing (“cardiac asthma”).
3. The diagnosis is typically confirmed on chest radiograph. Radiographic findings can range from mild pulmonary vascular redistribution to extensive bilateral interstitial marking and pleural effusions.

4. The presence of bilateral peri-hilar alveolar edema may give the typical “butterfly” appearance. The presence of cardiomegaly suggests a cardiac cause.
5. Consider alternative diagnoses, including pulmonary embolism, severe asthma exacerbation, and pneumonia.
6. All pregnant women with pulmonary edema should have a maternal echocardiogram (ideally a trans-esophageal echo) to exclude underlying cardiac disease.

1. Non-cardiogenic pulmonary edema is defined as radiographic evidence of fluid and protein accumulation in the alveolar space of the lungs without evidence of a cardiogenic cause (i.e., a normal maternal echo and pulmonary capillary wedge pressure <18 mmHg).
2. The major causes of non-cardiogenic pulmonary edema include:
    - the acute respiratory distress syndrome (ARDS) and, less often,
    - high altitude pulmonary edema,
    - neurogenic pulmonary edema,
    - pulmonary embolism,
    - salicylate toxicity,
    - opiate overdose,
    - preeclampsia,
    - amniotic fluid embolism, and
    - reperfusion pulmonary edema.

3. ARDS can develop as a result of a number of insults, including
    - sepsis,
    - acute pulmonary infection,
    - non-thoracic trauma,
    - inhaled toxins,
    - disseminated intravascular coagulation,
    - shock lung,
    - freebase cocaine smoking,
    - post-coronary artery bypass grafting,
    - inhalation of high oxygen concentrations, and
    - acute radiation pneumonia.

1. Frequently overlooked is the common iatrogenic cause associated with tocolytic therapy.
2. The combination of betamimetics, excessive fluid, and corticosteroids can cause significant pulmonary edema.
3. Hypoalbuminemia alone is not a cause of non-cardiogenic pulmonary edema.
4. The primary pathophysiologic mechanism of non-cardiogenic pulmonary edema
5. If the patient has preeclampsia (gestational proteinuric hypertension), the presence of pulmonary edema puts her in the “severe preeclampsia” category and is a contraindication to continued expectant management.
6. Immediate delivery should be recommended regardless of gestational age.
7. Whether delivery can be delayed for 24–48 hours to complete a course of antenatal corticosteroids in women remote from term (<32 weeks) should be individualized

1. Cardiogenic pulmonary edema is characterized by increased transudation of protein-poor fluid into the pulmonary interstitium and alveolar space.
2. Fluid transudation results from a rise in pulmonary capillary pressure (as measured by pulmonary capillary wedge pressure ≥18 mmHg) due to an increase in pulmonary venous and left atrial pressures.
3. This typically occurs in the absence of a change in vascular integrity or permeability.
4. The major causes of cardiogenic pulmonary edema include:
   - myocardial injury or infarction,
   - valvular heart disease,
   - cardiomyopathy,
   - cardiac arrhythmia,
5. poorly controlled systemic hypertension, and, less often, severe anemia, thyroid disease, toxins such as cocaine and alcohol, fever, intercurrent infection (such as pneumonia), and uncontrolled diabetes.

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