

Classification:

- May be acute or chronic.
- **Type I** - Hypoxaemic respiratory failure: $\text{PaO}_2 < 60 \text{ mmHg}$ (8kPa) with a norm/low PaCO_2 .
Caused by:
 - Ventilation-perfusion mismatch with either/both:
 - Under-ventilated alveoli (e.g. APO, pneumonia or acute asthma)
 - Venous blood bypasses ventilated alveoli (e.g. right to left cardiac shunts).
 - NB. Hyperventilation will $\uparrow \text{CO}_2$ removal but not $\uparrow \text{PaO}_2$ as blood leaving unaffected alveoli is already ~fully saturated.
 - Insufficient FiO_2 e.g. Altitude hypoxaemia
- **Type II** - Hypercapnoeic respiratory failure: $\text{PaCO}_2 > 50 \text{ mmHg}$ (6.5kPa) and indicates inadequate alveolar ventilation. Coexisting vent-perf mismatch will affect PaO_2 too.

Causes:**Type I respiratory failure**

- Chronic obstructive pulmonary disease
- Pneumonia
- Pulmonary oedema
- Pulmonary fibrosis
- Asthma
- Pneumothorax
- Pulmonary embolism
- Pulmonary arterial hypertension
- Cyanotic congenital heart disease
- Bronchiectasis
- Adult respiratory distress syndrome
- Kyphoscoliosis
- Obesity

Type II respiratory failure

- Chronic obstructive pulmonary disease
- Severe asthma
- Drug overdose, poisoning
- Myasthenia gravis
- Polyneuropathy
- Poliomyelitis
- Muscle disorders
- Head and neck injuries
- Obesity
- Pulmonary oedema
- Adult respiratory distress syndrome
- Myxedoema

Presentation:

Symptoms: The history may indicate the underlying cause, e.g. PND/orthopnoea in pulmonary oedema. Both confusion and reduced consciousness may occur.

Signs: Localized lung findings determined by the underlying cause. Neurological features may include restlessness, anxiety, confusion, seizures, or coma. Hypoxaemia and acidosis may $\rightarrow \uparrow \text{HR}$ and arrhythmias. Cyanosis. Polycythaemia is a chronic complication. Cor pulmonale: pulm $\uparrow \text{BP}$ is frequently present and may $\rightarrow \text{RVF}$, leading to hepatomegaly and peripheral oedema.

Investigations:

- Bloods: ABG, FBC, (infection, anaemia, polycythaemia), UEC, Trop & CK (MI, myositis)
- Chest x-ray.
- ECG \pm Echo
- Pulmonary function tests
- Thyroid function tests if myxoedema suspected
- Right heart catheterization: if ?cardiac function, ?volume status, and systemic O_2 delivery.
- Pulmonary capillary wedge pressure may distinguish cardiogenic & non-cardiogenic oedema

Management:

- A patient with acute respiratory failure generally needs admission. Most chronic respiratory failure can be treated at home with oxygen as well as drug therapy.
- Airway: ensure an adequate airway.
- Correction of hypoxaemia: Aim for PaO₂ of 60 mmHg or an arterial SaO₂ ≥ 90%.
- Beware prolonged high conc O₂ in COAD as hypoxic drive may maintain ventilation rate.
- NIPPV for hypoxaemia & hypercapnia
- IPPV - last resort esp in chronic sufferers as may be difficult to wean
- Appropriate management of the underlying disease.

Complications:

- Pulmonary: e.g. PE, pulmonary fibrosis, and Cx from use of mechanical ventilation.
- Cardiovascular: e.g. cor pulmonale, ↓BP, ↓CO, arrhythmias, pericarditis, and AMI.
- Gastrointestinal: e.g. haemorrhage, gastric distention, ileus, diarrhoea, pneumoperitoneum.
Stress ulceration is common in patients with acute respiratory failure.
- Polycythaemia.
- Hospital acquired infection: e.g. pneumonia, urinary tract infections
- Renal: acute renal failure and abnormalities of electrolytes and acid-base homeostasis in critically ill patients with respiratory failure.
- Nutritional: including malnutrition and complications related to administration of enteral or parenteral nutrition. Complications associated with naso-gastric tubes, e.g. abdominal distention and diarrhoea.
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Prognosis:

- The mortality rate assoc with respiratory failure varies according to underlying aetiology.
- The mortality rate for adult respiratory distress syndrome is approximately 40%.
- In patients with COPD and acute respiratory failure, the overall mort is approximately 10%.