Oxygen Therapy

Oxygen comes out of the tap in wall at 100% concentration. Different devices tolerate different flow rates (0-15L/min). This flow rate can be set on the wall tap. The % of oxygen delivery depends on the flow rate and the delivery device. Delivery devices include:

**Nasal cannula**
Delivers 24-30%. Comfortable. Flow rate 1-4L/min. Use for non-acute ward use, or if mildly hypoxic.

**Hudson mask**
Delivers 30-40%. Flow rate 5-10L/min. Step up from nasal cannula but doesn’t deliver specific % of oxygen like venturi.

**Venturi (air entrapment) mask**
Delivers 24-60%. Flow rate (oxygen flow rate is set on the O₂ wall tap. It is shown on mask along with the % O₂ delivery). Often used in COPD. Types:
- BLUE = 2-4L/min = 24% O₂
- WHITE = 4-6L/min = 28% O₂
- YELLOW = 8-10L/min = 35% O₂
- RED = 10-12L/min = 40% O₂
- GREEN = 12-15L/min = 60% O₂

**Non-rebreather mask**
Delivers 85-90% with 15L flow rate. Bag on mask with valves stopping almost all rebreathing. Used for acutely unwell patients.

**Non-invasive ventilation (CPAP/BiPAP)**
CPAP = continuous positive airway pressure = high pressure air/oxygen with a tight fitting mask. Positive pressure all the time. Keeps airways open in sleep apnoea or heart failure.
BiPAP = bilevel positive airway pressure = high positive pressure on inspiration and lower positive pressure on expiration. Used in COPD and atelectasis.

**Invasive ventilation**
100%. A ventilation bag or machine is attached to an artificial airway to ventilate lungs. Used in intensive care and theatre.

**General notes**
- Intubate if GCS is less than (or equal to) 8
- Aim for oxygen saturations of 94-98% in non-COPD patients and 88-92% in COPD patients
- If O₂ therapy is being used maximally and oxygen levels continue to drop, involve intensive care with a view to non-invasive ventilation or intubation and ventilation
- Oxygen saturation of less than 90% is problematic because the oxygen-haemoglobin saturation curve drops significantly at this point, meaning haemoglobin will rapidly become significantly less saturated with small changes in oxygen partial pressure
- Do an ABG on any patient with oxygen saturations of <92%
- Humidified oxygen can help with secretions and if prolonged oxygen therapy is required

**CO₂ retainers**
- Possible CO₂ retainers: severe obstructive lung disease (10% of COPD, bronchiectasis, CF); severe restrictive lung diseases (neuromuscular, severe kyphoscoliosis, severe obesity)
- Background knowledge: respiratory drive is normally driven by CO₂ levels. However, ‘CO₂ retainers’ are desensitised to hypercapnia and rely on hypoxia to stimulate respiratory drive. The aim of acute oxygen therapy in a CO₂ retainer patient is to increase oxygen level without causing respiratory drive to decrease (which will increase CO₂ levels and worsen respiratory acidosis).
- Generally, start on 24-28% (via Venturi mask) if no ABG results – however, if they need it (e.g. they are in respiratory distress or dangerously hypoxic) then you have no choice but to give high flow oxygen
- Perform baseline ABG (preferably on room air):
  - Hypoxia with hypercapnia (PaCO₂ > 5.3kPa) = hypoxic drive likely → continue 24-28% initially
  - Hypoxia without hypercapnia (PaCO₂ < 5.3kPa) = hypoxic drive unlikely → can try higher flow rate of oxygen
- If significant hypoxia continues, try increasing the oxygen level in increments and repeat ABG after 30 minutes of next stage up
Hypercapnia & acidosis worsening = hypoxic drive → reduce oxygen and consider non-invasive ventilation if oxygen levels stay dangerously low
Hypercapnia & acidosis stable or improving = no hypoxic drive → scope to increase oxygen

- i.e. if you cannot get enough oxygen into them to maintain sats 88-92% without decreasing their respiratory drive and causing a hypercapnic acidosis, then they need non-invasive ventilation (BiPAP)