Oxygen Therapy

Principles & Practice

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To My Best Friends and Colleagues

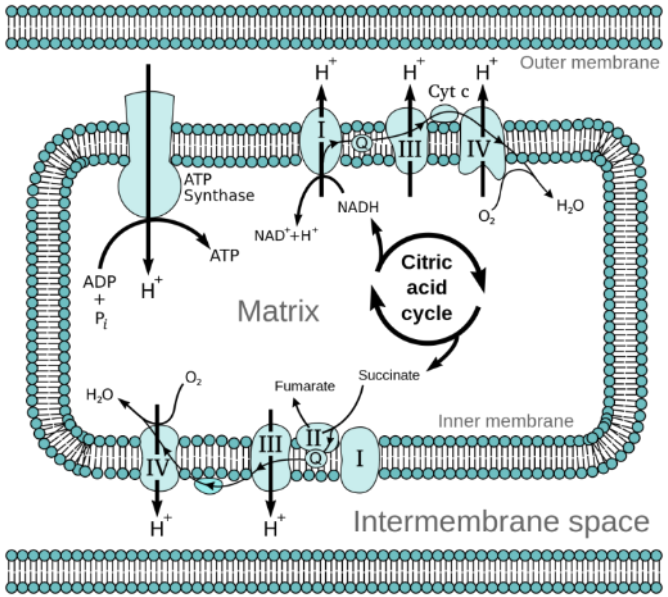
We Beat Corona

Together

- Why oxygen is required for survival?

Oxidative phosphorylation

- Glucose + O2 → CO2 +H2O + 38 ATP



Basics

- **Anoxia.** No oxygen availability in tissues
- **Hypoxia.** Lack of oxygen availability in tissues
- **Hypoxemia.** Lack of oxygen in the blood
- **FiO2** (Fraction of O2 in Inspired gas) 21%
- PaO2?
- SaO2?

FiO2

1 L\min=24%

2 L\min=28%

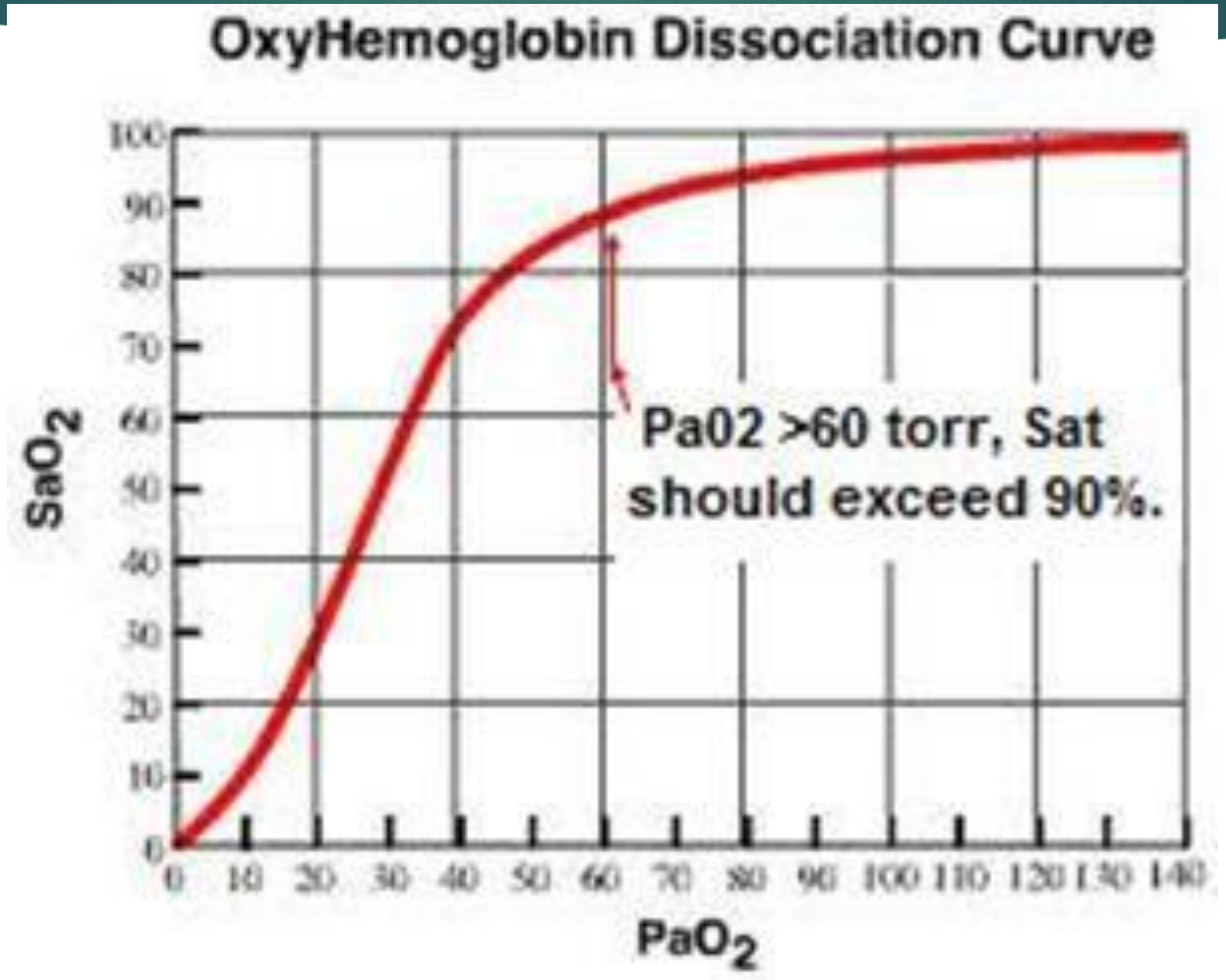
3 L\min=32%

4 L\min=36%

5 L\min=40%

6 L\min=44%

PaO_2/SaO_2


OxyHemoglobin Dissociation Curve
SaO2
PaO2
Pa02 >60 torr, Sat
should exceed 90%.
100
90
80
70
60
50
40
30
20
10
0
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

What is O2 Therapy?

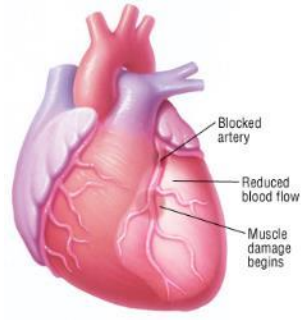
- Oxygen therapy is the administration of oxygen at concentrations **greater than that in room air** to treat or prevent **hypoxia**.

- *Oxygen should be regarded as a drug* **(BNF 2016).**
- **Oxygen must be prescribed in all situations (except for the immediate management of critical illness in accordance with BTS guidelines) (NPSA Oct 2009).**
- **If abused it can cause complication.**

Few important question:

- What are the indications for O2 therapy?
- How to administer optimally?
- What are the hazard?

Clinical goal of O2 therapy



- Treat hypoxia
- Decrease work of breathing
- Decrease myocardial work

Types of hypoxia

- Hypoxic hypoxia
- Anemic Hypoxia
- Stagnant hypoxia
- Histotoxic hypoxia

Benefit of O2 Therapy in Hypoxia

Types of hypoxia	Benefit
Hypoxic hypoxia	+++
Anemic hypoxia	+
Stagnant hypoxia	+
Histotoxic hypoxia	-

Indication for O2 Therapy

- **Hypoxia** – when PaO2 comes down to 60mmHg
- **Normoxic hypoxia** – like low cardiac output state, anemia, CO Poisoning
- **Traped gases** – like obstruction, pneumoencephalus
- **Special situation** – like anasthesia

Clinical Presentation

Effect of hypoxia

Acute hypoxia:

- Restlessness
- Disorientation, confusion
- In-coordination, impaired judgment
- Hyperventilation air hunger
- Circulatory changes (tachycardia → brady)

Chronic hypoxia:

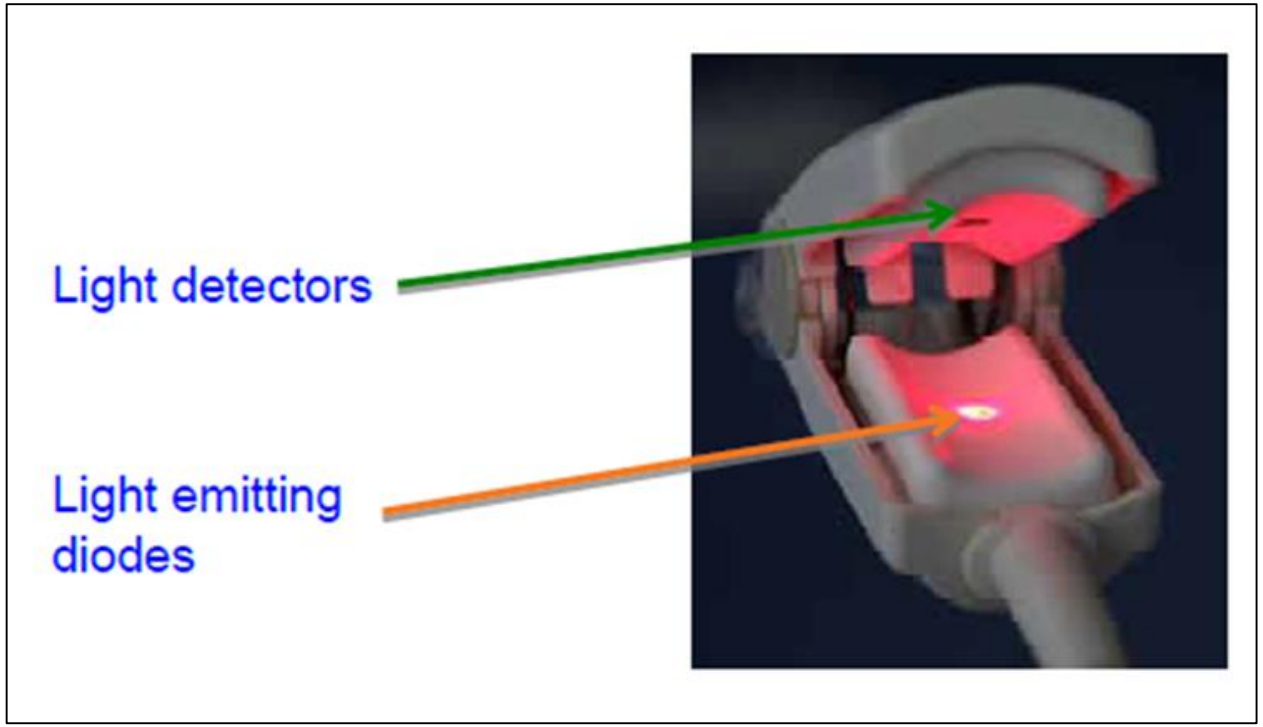
- Fatique, drowsiness,
- Inttentiveness, aphaty, deleyed reaction time

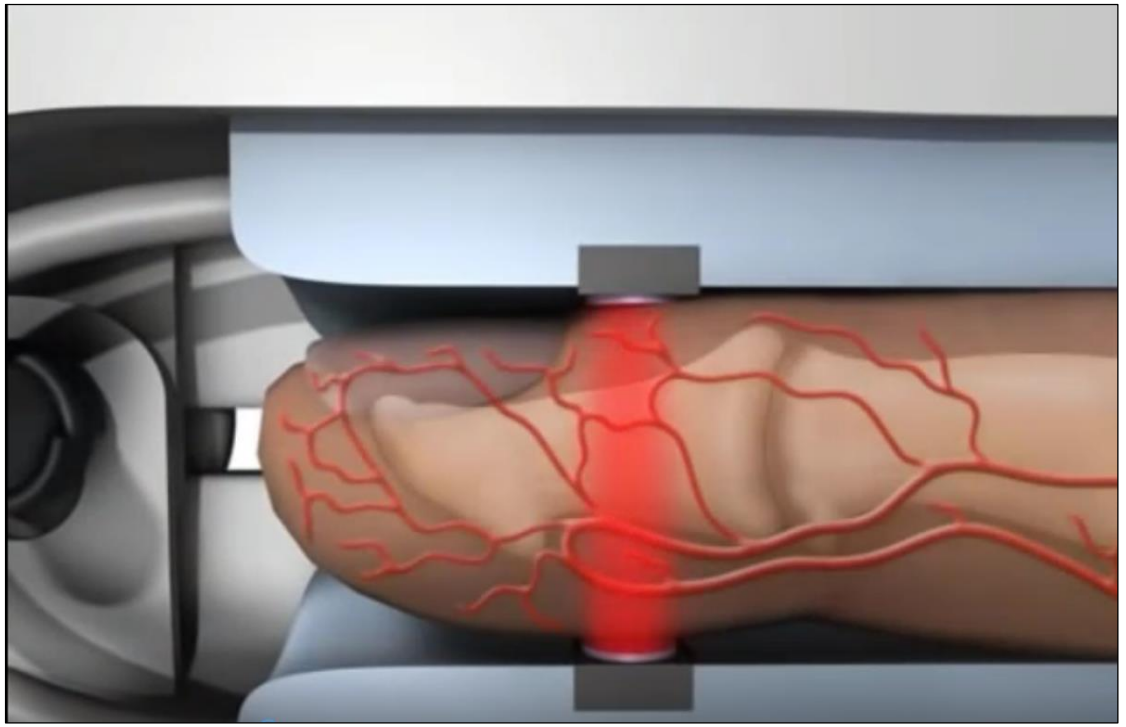
Assessment of need

- Presence of clinical indicators
- Measurement of inadequate oxygen saturation
  - Arterial blood gas
  - Pulse oximetry

Pulseoximetry

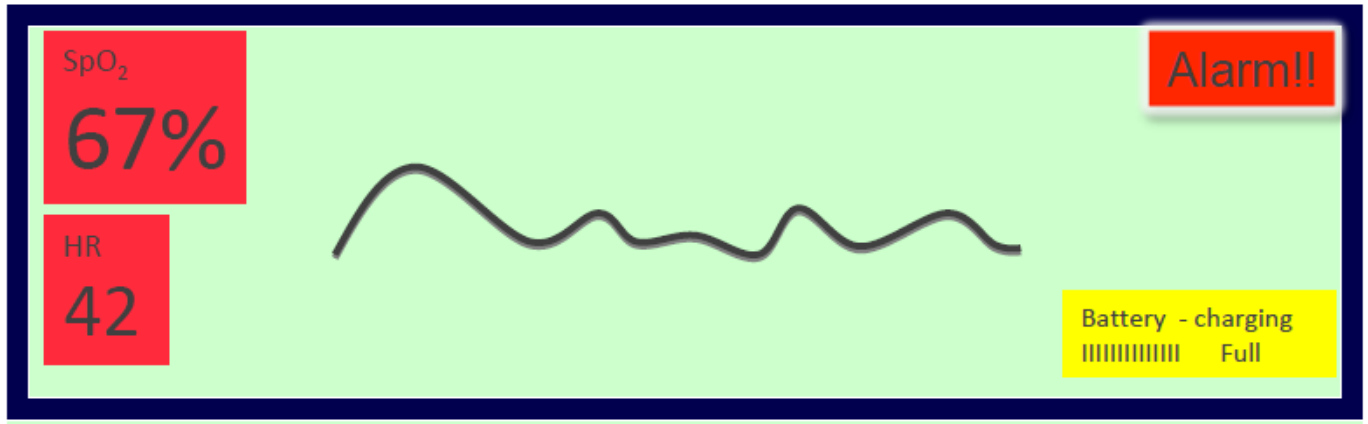
Pulseoximetry



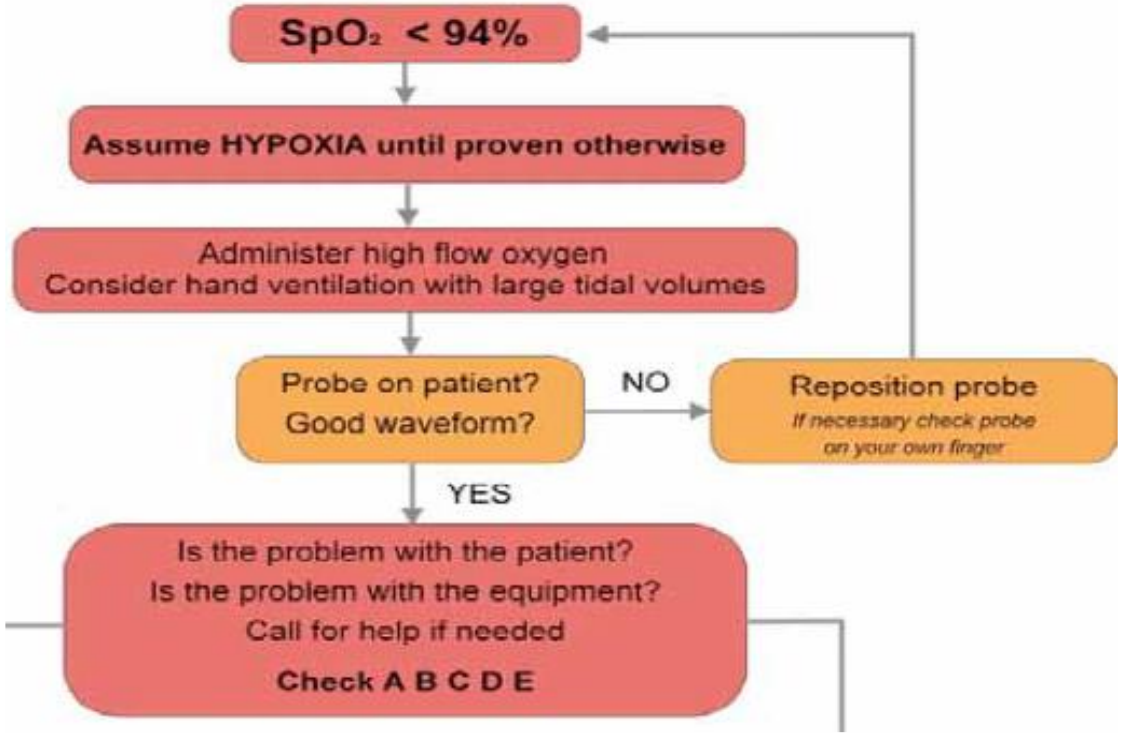


Pulseoximetry

What do you notice about this oximeter?



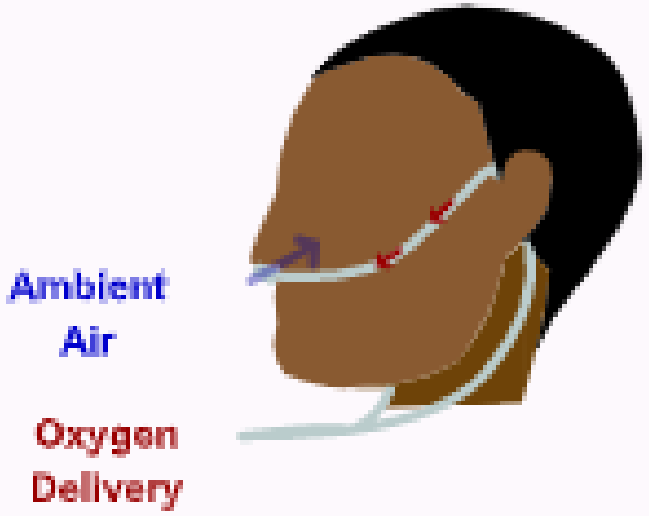
Pulseoximetry



O_2 Delivery Systems

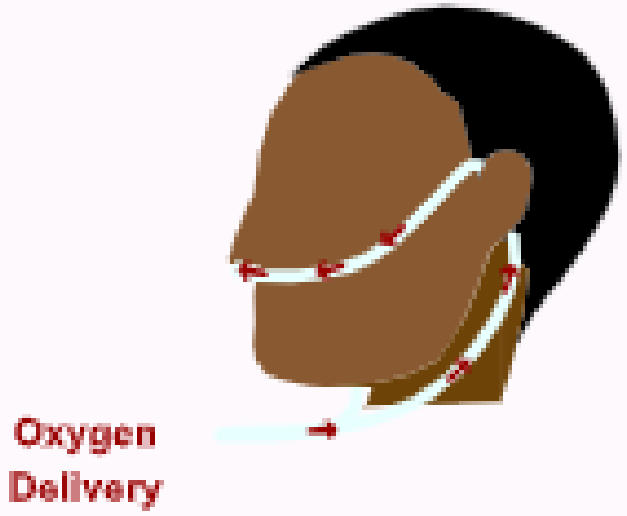
Low Flow Device

Example: Nasal Cannula



High Flow Device

Example: High Flow Nasal Cannula

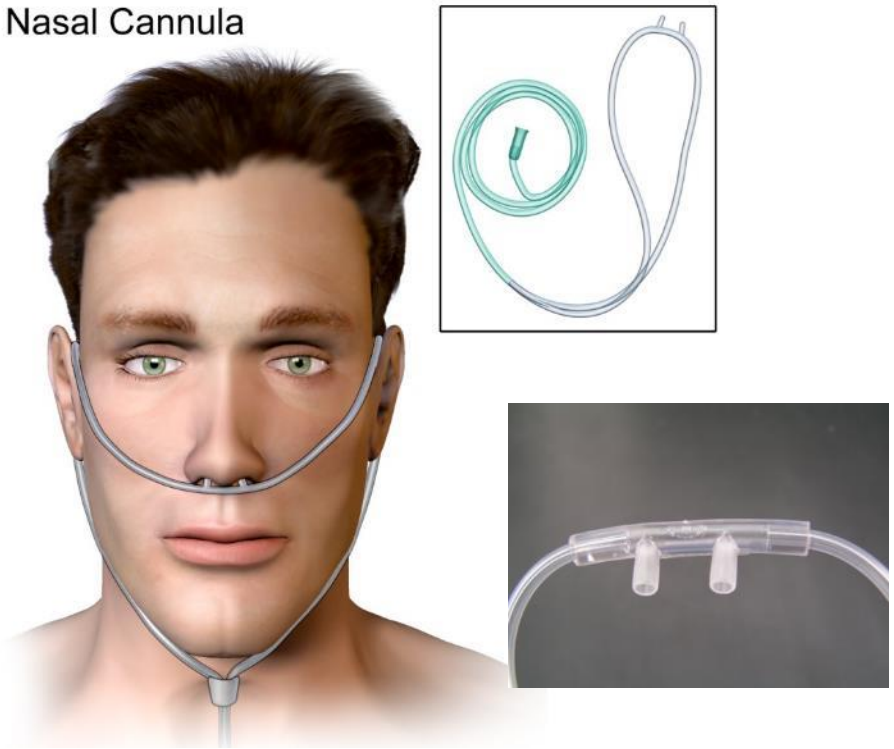


O_2 Delivery Systems

- Low flow systems
  - Contribute partially to inspired gas client breathes
  - Ex: nasal cannula, simple mask, non-re breather mask, rebreather mask
- High flow systems
  - Deliver specific and constant percent of oxygen independent of client's breathing
  - Ex: Venturi mask, High flow nasal canula, T-piece

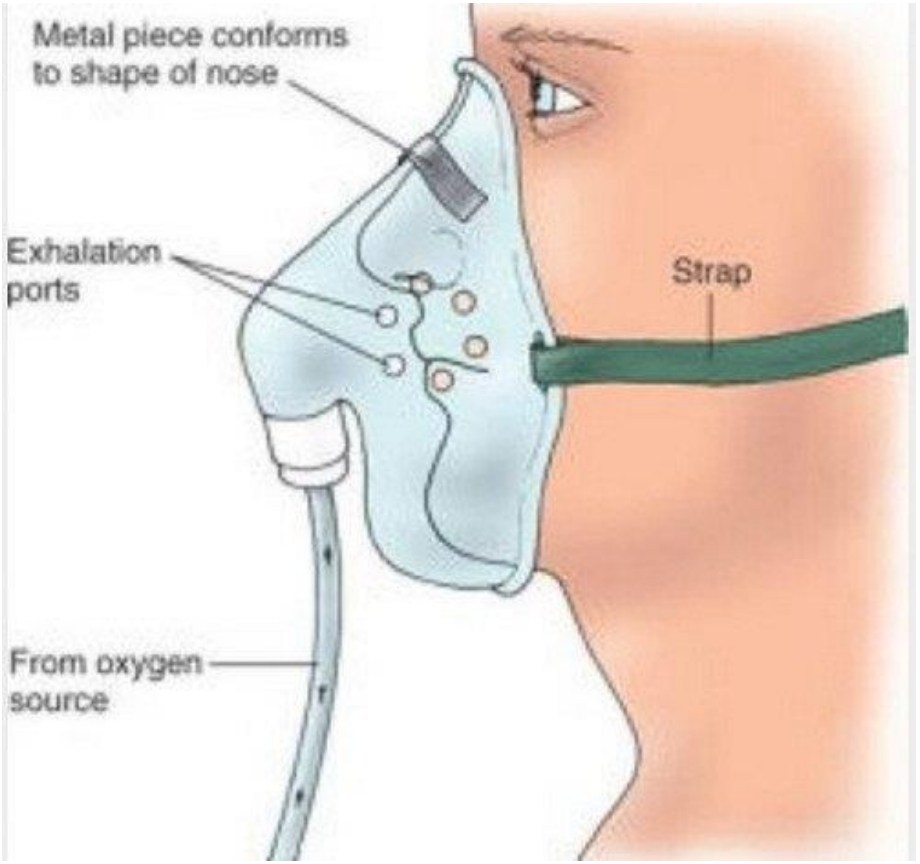
Nasal canulla

- The prongs protrude 1 cm into nares
- Used for low concentrations of Oxygen 24-44% at 1-6L/min.
- Patient are able to talk and eat with oxygen in place
- May cause irritation to the nasal and pharyngeal mucosa
- If oxygen flow rates are above 4 L/min variable FiO2



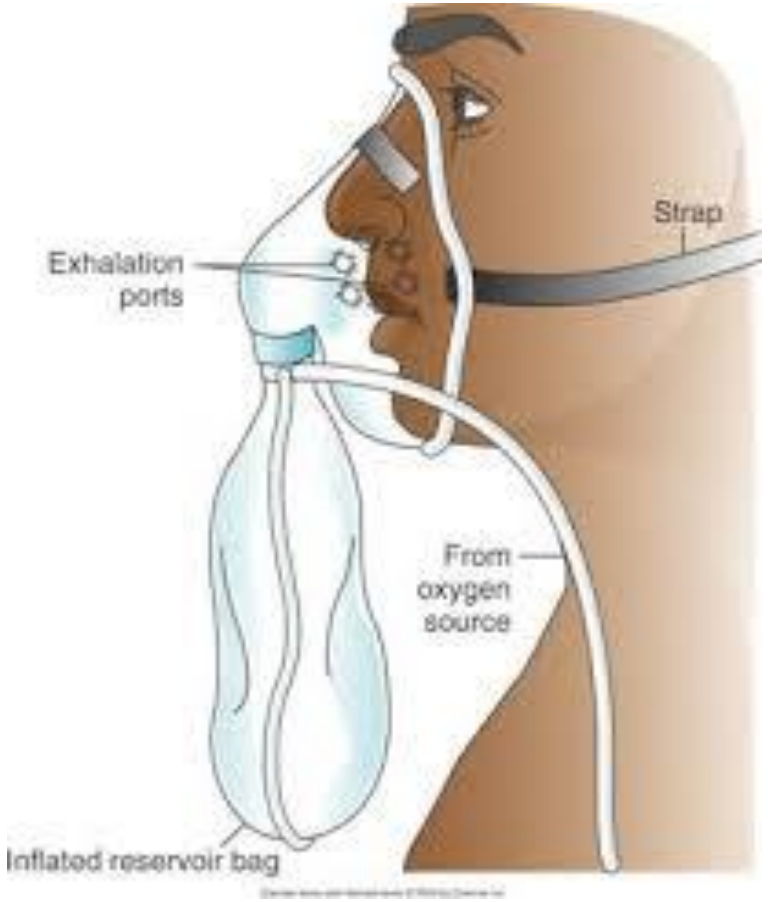
Simple face mask

- Client exhales through ports on sides of mask
- Air entrained through ports if O2 flow through dos not meet peak inspiratory flow
- It delivers 35% to 60% oxygen at 6-10 L/min.
- Flow must be at least 5 L/min to avoid CO_2 build up and resistance to breathing
- Potential for skin breakdown due to pressure and moisture
- Unconfortable while eating or talking. Obstruct coughing.



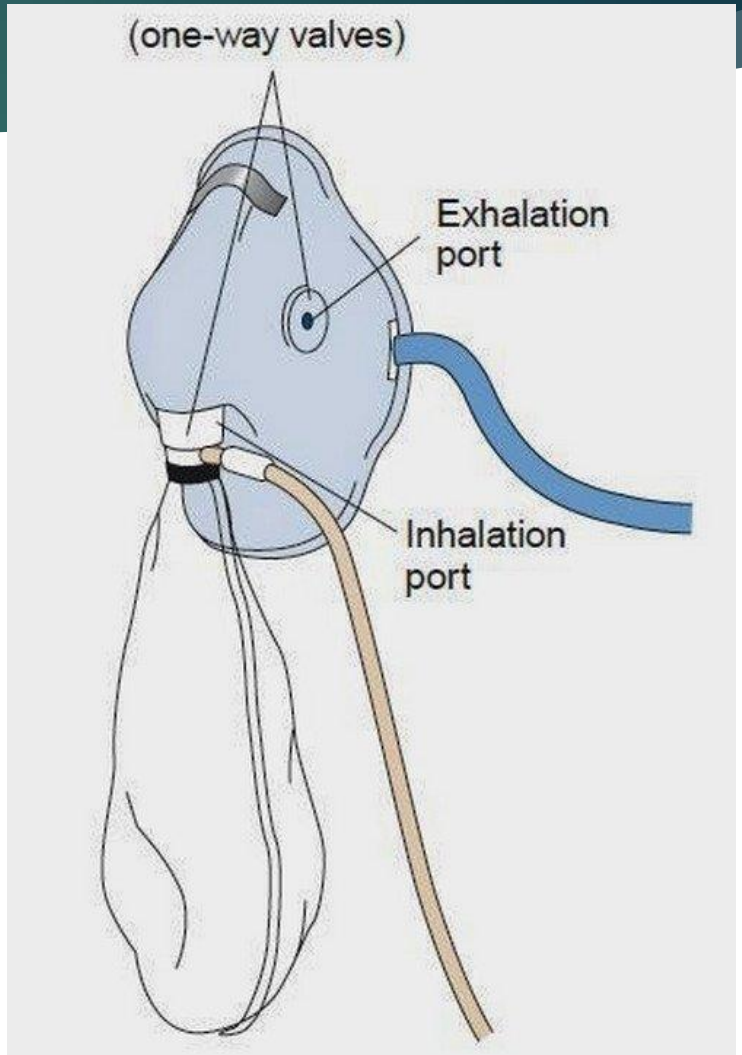
Rebreather Mask

- It is used to deliver oxygen concentrations up to 80% at 8-12L/m.
- O2 directed into reservoir
- Insp:draw gas from bag & room air
- Exp: first 1/3 of exhaled gas goes into bag (dead space)
- Dead space gas mixes with 'new' O2 going into bag
- Bag should remain at least 1/3 ful during inspiration



Nonrebreather Mask

- Have 2 one-way valves at exhalation ports and bag
- This mask provides the highest concentration of oxygen (95-100%) at 10-15L/min.
- Client can only inhale from reservoir bag
- Velve prevents exhaled gas flow into reservoir bag. Velve over exhalation ports prevents air entrainment.
- Bag must remain inflated at all times
- For Critical illness / Trauma patients, Post-cardiac or respiratory arrest
- Effective for short term treatment



Estimating FiO_2

O_2 Flow rate	FiO_2
Nasal cannula	
1	0.24
2	0.28
3	0.32
4	0.36
5	0.4
6	0.44

O_2 Flow rate	FiO_2
Oxygen mask	
5-6	0.4
6-7	0.5
7-8	0.6

O_2 Flow rate	FiO_2
Mask with reservoir	
6	0.6
7	0.7
8	0.8
9	0.80+
10	0.80+

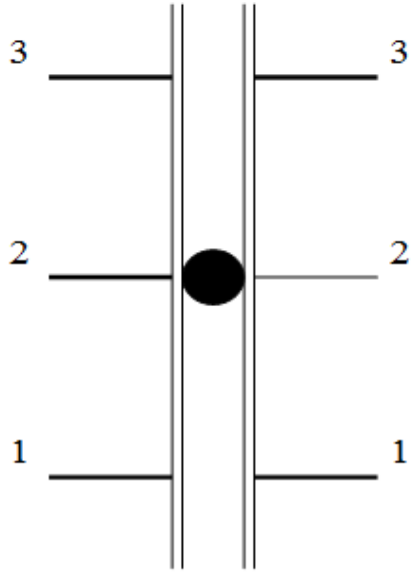
Venturi or fixed performance masks

- It is high flow concentration of oxygen.
- Oxygen from 24 - 60% At liters flow of 4 to 15 L/min.
- Aims to deliver constant and most precise oxygen concentration within and between breaths.
- With TACHYPNOEA (RR >30/min) the oxygen flow should be increased by 50% - see next slide
- Increasing flow does not increase oxygen concentration, it is a fixed dose device
- Good device for patients with raised C02 (patients with a target of 88-92%)


24% Venturi - 2 L/min - Use 3 l/min if RR >30
28% Venturi - 4 L/min - Use 6 l/min if RR >30
35% Venturi - 8 L/min - Use 12 l/min if RR >30
40% Venturi - 10 L/min - Use 15 l/min if RR >30
60% Venturi - 15 L/min - Change to RM if 60%
Venturi is not sufficient
28% 4L/MIN
24% 2 L/MIN
35% 8 L/MIN
40% 10L/MIN
60% 15 L/MIN

Oxygen flow meter

The centre of the ball indicates the correct flow rate.



The ball must be **centred** on the line.

This diagram illustrates the correct setting of the flow meter to deliver a flow of 2 litres per minute.

Hazard of O2 Therapy

- Drying of mucous membrane
- Depression of ventilation in COPD
- Reversal of compensatory hypoxic vasoconstriction
- Atelectasis due to absorption collapse
- O2 toxicity

Optimization

- My SpO_2 is < 90%, what next?
  - Is the pulse oximeter working/accurate
  - Do I have a good signal?
  - Heart rate plus/minus ?
  - Is there adequate perfusion at the probe site?
  - Can the probe be repositioned?
  - Do other vital signs or clinical manifestations give evidence of hypoxemia?

Optimization

- **Check my source!**
  - Ensure the O2 delivery device is attached to oxygen not medical air.
  - Follow tubing back to source and ensure patency
  - Are all connections tight?

- ***Is the flow set high enough?***
  - All nebs especially high flow large volume nebs need to be run at the highest rate.
  - Turn flow meter to maximum for large volume nebs.

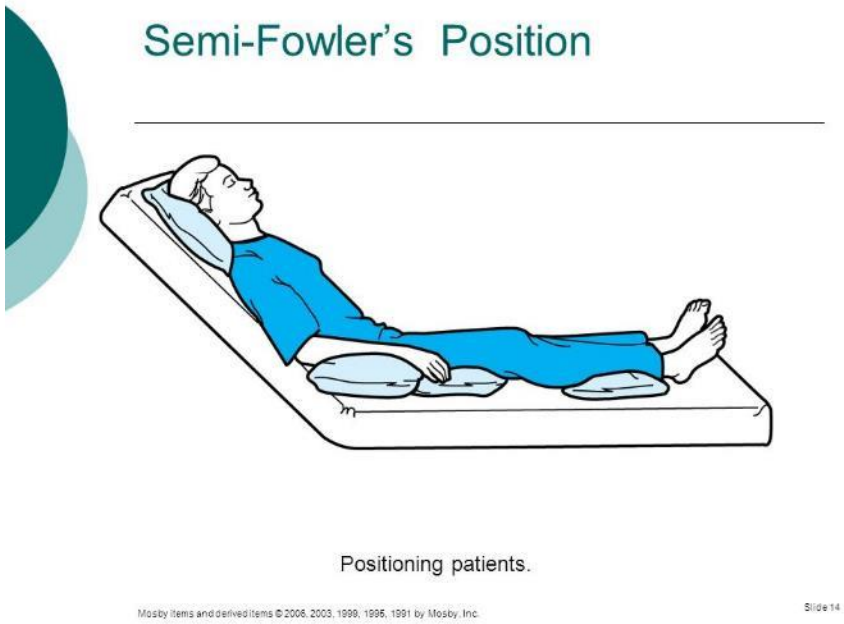
Optimization

- **Reposition patient.**
  - Avoid laying patient flat on back.
  - Raise head of bed.
  - Encourage deep breathing/coughing

- **Listen to chest.**
  - Wheezing?
    - Do they need a bronchodilator?
  - Crackles?
    - Encourage deep breathing/cough.
    - Are they fluid overloaded?

Optimization

- ***Can I improve the mechanics of breathing?***
  - **Patient position**
  - **Pursed lip breathing**
  - **Abdominal breathing.**
  - **Anxiety relief?**



Evaluation

- Breathing pattern regular and at normal rate.
- pink color in nail beds, lips, conjunctiva of eyes.
- No confusion, disorientation, difficulty with cognition.
- Arterial oxygen concentration or hemoglobin
- Oxygen saturation within normal limits.

- Thank you