Oxygen Therapy

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Oxygen should be regarded as a "drug"

"Oxygen Therapy is usually defined as the administration of oxygen at concentrations greater than those found in room air"

Goals of Oxygen Therapy

"*To treat or prevent hypoxemia thereby preventing tissue hypoxia which may result in tissue injury or even cell death*"

BASIC TERMINOLOGY

- Hypoxia. Lack of oxygen availability in tissues
- FiO2. Fraction of O2 in Inspired gas
- SpO2. Oxygen Saturation

Hypoxia

Hypoxia refers to a condition where the amount of oxygen available to the cells is not adequate to meet metabolic need.

Detection

- Clinical evaluation
- Pulse oxymetry
- ABG

Acute hypoxia presents as

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

Pulse Oxymetry

- Based on the Red and Infrared light absorption
- Oxygenated hemoglobin absorbs more Infrared light and allows more Red light to pass through
- Deoxygenated (or reduced) hemoglobin absorbs more Red light and allows more Infrared light to pass through.
- Normal SpO2 values vary between 95 and 100%

Indications for Oxygen therapy

- Cardiac and respiratory arrest
- Respiratory distress (RR>24/minute)
- Hypoxemia (Sat<90%)
- Hypotension (Systolic BP < 0 mmHg)

Oxygen therapy devices

- Low Flow or Variable performance devices
  - No capacity – nasal catheters, cannula
  - Small capacity – masks
  - Large capacity – masks with reservoir bag
- High Flow or Fixed performance devices
  - HAFOE systems
  - Anaesthesia circuits
  - Ventilators

Nasal Prongs

Nasal canula/ prongs

- The prongs protrude 1 cm into nares
- Used for low concentrations of Oxygen 24-44% at 1-6L/min (4% every liter /min)
- Reservoir – nasopharynx (50 ml dead space)

Guidelines for Estimating FiO2 with Low-Flow Oxygen Devices

100% O2Flow Rate (LPM)	FiO2
Nasal cannula or catheter	
1	0.24
2	0.28
3	0.32
4	0.36
5	0.40
6	0.44

Nasal catheters and cannulae

Advantages

- No rebreathing
- Better tolerated

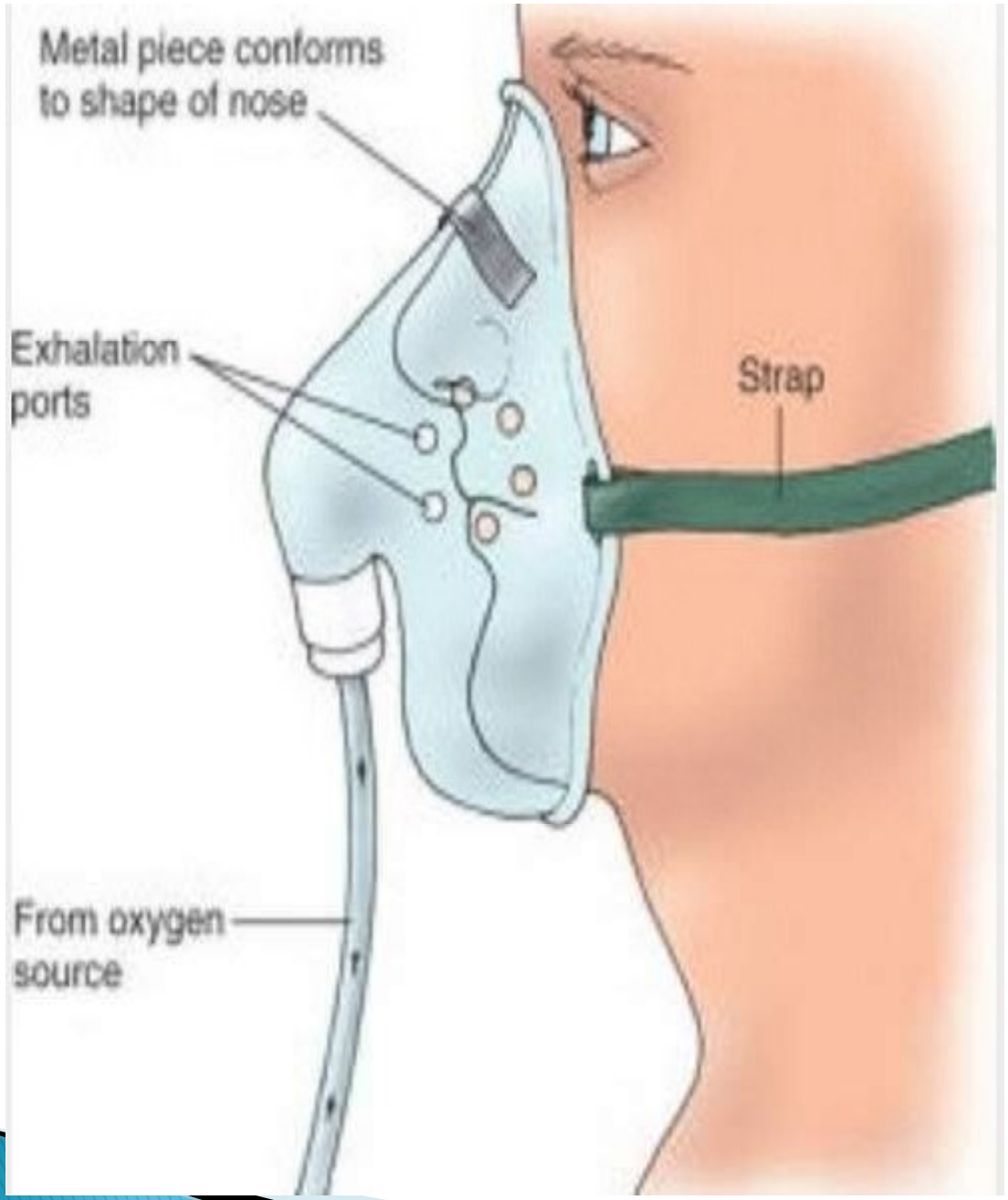
Disadvantages

- FIO2 > 0.44 not possible
- Flow >6 L / min not tolerated
- Gastric distension, regurgitation
- Drying of mucosa
- O2 wastage

Face Mask ("Hudson")

Simple face mask

- Most Commonly used Mask.
- Mary Catterall Mask or Hudson Mask.
- Patient exhales through ports on sides of mask
- Air entrained through ports if O2 flow does not meet peak inspiratory flow
- It delivers 35% to 60% oxygen at 6-10 L/min.
- Flow must be at least 5 L/min



Flow rate	FiO2
5-6	40%
6-7	50%
7-8	60%

Advantage	Disadvantage
Simple	Limited FiO2
Easy to use	If loosely fitted ,lower FiO2
Cheap	Cant use mouth for eating or drinking
Higher FiO2 compared to nasal prong	Potential for skin breakdown due to pressure and moisture
Can be used for nebulization	Less tolerated than nasal prong

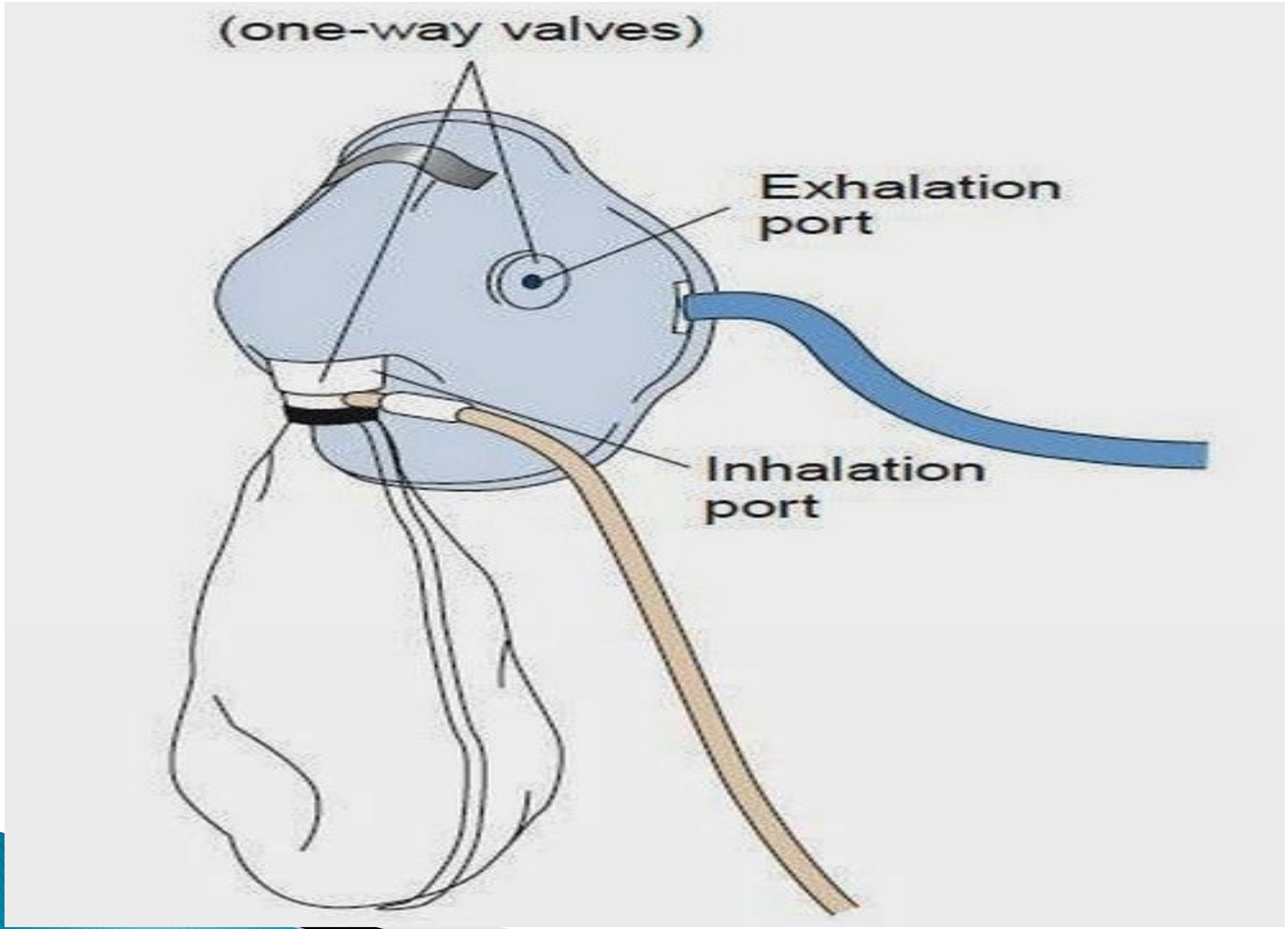
Oxygen tent

- Clear plastic sheet that cover child's upper body
- FiO2 50%
- Not reliable
- Limit access to patient
- Not useful in emergency situations

Non rebreathing mask(NRBM)

Non rebreathing mask(NRBM)

- Have 2 one-way valves at exhalation ports and bag
- This mask provides the highest concentration of oxygen (95-100%) at 10-15L/min.
- Patient can only inhale from reservoir bag
- Valve prevents exhaled gas flow into reservoir bag and valve over exhalation port 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


(one-way valves)
Exhalation port
Inhalation port

High flow oxygen delivery devices

- Air Entrainment Mask (Venturi)
- High Flow Nasal Oxygen Therapy
- Mechanical Ventilators
  - Non-invasive
  - Invasive

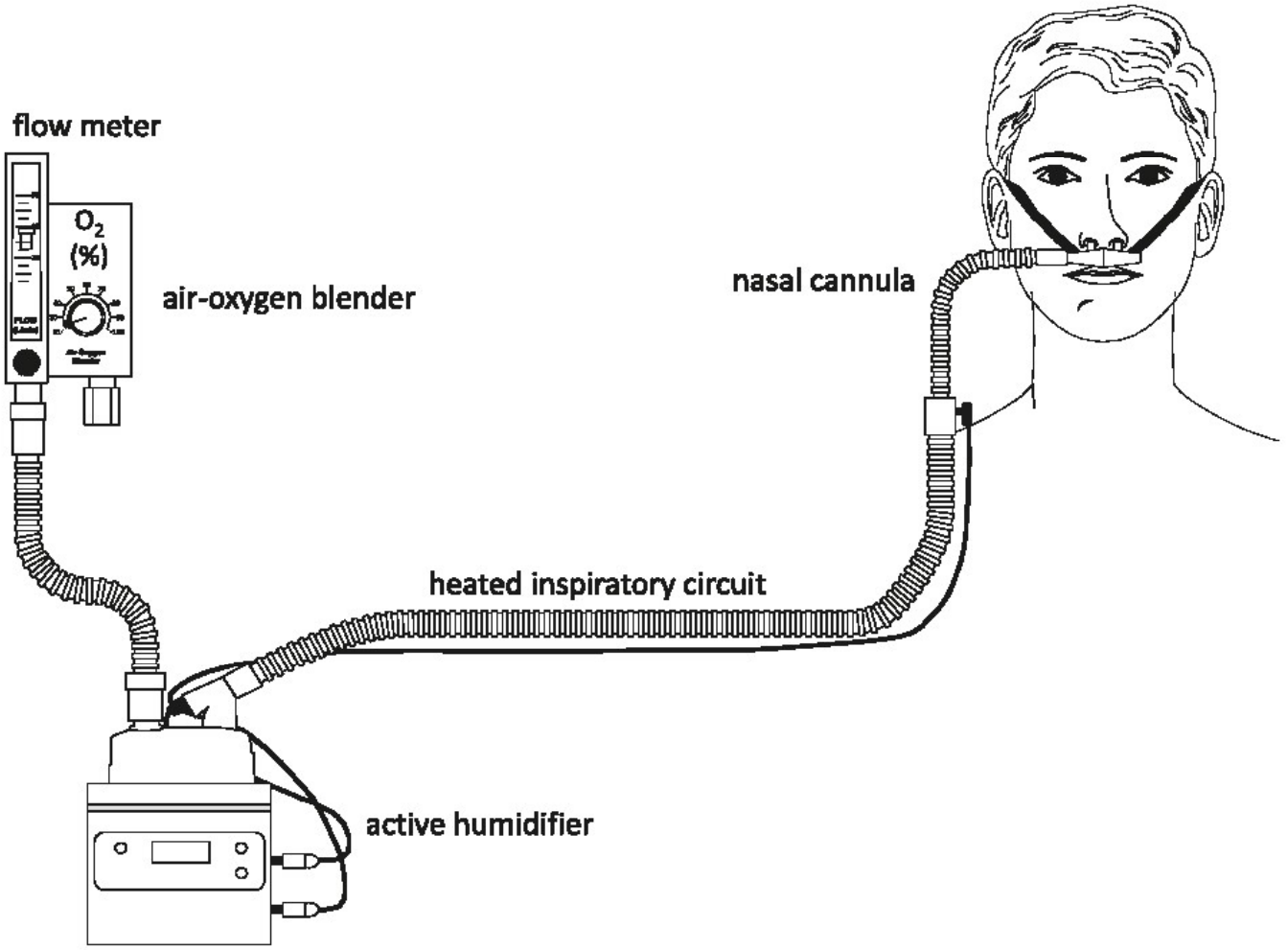
Bag Valve Mask Ventilation

- Two hands must be used :
- One hand- head tilt- chin lift maneuver
- Other hand- compress ventilation bag
- A neutral sniffing position is maintained.
- Distention of stomach frequently occurs.

HIGH FLOW NASAL OXYGEN

- Provides a valuable triad ▲of
- Humidity,
- High fiO2 ,
- Better patient compliance.
- Delivers a flow rate rate up to 8 lit/min in infants and 60 lit/ min in adults

High Flow Nasal Cannula



ple setup of high-flow nasal cannula oxygen therapy. An air/oxygen blender, allowing from 0.21 to 1.0 F_iO_2, c

HFNC

Three main features:

- delivery of a high FiO2,
- meeting or exceeding the patient's minute ventilation and therefore acting as a fixed oxygen delivery device, and
- generating a distending positive airway pressure

Non Invasive Ventilation

- Avoids intubation
- Reduces work of breathing
- Bipap machine/Ventilator
- Contraindications
  - Hemodynamic instability
  - Multi organ failure
  - Altered mental status

NIV Mask

- Flow : 20 – 40 L/min
- Fio2 : Up to 100%
- Claustrophobia
- Pressure sore
- Bipap or Ventilator

Adjuncts to oxygen therapy

- Optimize cardiac output – infusions, transfusion, inotropes, diuretics, digoxin
- Improve lung condition – humidification, antibiotics bronchodilators, intubation, tracheostomy
- Raise haemoglobin
- Reduce oxygen demand – prevent hyperthermia, shivering .

Oxygen Dosage

- Oxygen should be given continuously.
- Dosage of oxygen can be changed (increased or decreased) according to the response.
- Changes in dosage are usually made by increments or decrements of 10% per time.
- Oxygen therapy should be used for the least possible time. Starting from few hours to several days or several weeks.
- Oxygen should be withdrawn gradually. With concentrations above 40% decrements by 10% per time are appropriate. With concentrations below 40% decrements should be by 5% per time

Oxygen Dosage

- In emergency situations (eg.acute cyanosis,shock), 100% oxygen should be immediately given by a tight non rebreathing face mask or by assisted ventilation with the bag and mask attached to 100% oxygen.
- In less urgent situations (eg. arterial hypoxemia), treatment usually starts with an oxygen mask with concentration between 40-60%.

JUDICIOUS USE OF OXYGEN

- Start suplimental oxygen only when saturation falls below 94%.
- Never try to achieve oxygen saturation of more than 96% with oxygen support.
- Oxygen concentrator if available should be used for patients initially and in recovering stage.
- Oxygen delivering masks should be tightly fitted to achieve maximum FiO2 and prevent leakage.
- Awake pronning of patients should be promoted .

- Oxygen delivering devices should be used in chronological order with their specific flow rate

Oxygen delivering device	Flow rate
Nasal Prongs	2-6 Litre per minute
Simple Face Mask	5-8 Litre per minute
NRBM (High Flow Mask)	10-12 Litre per minute (maximum upto 15 Litre per minute) flow should be adjusted to keep the reservoir bag inflated

- If patient is not maintaining saturation the device should be upgraded instead of increasing the flow rate beyond the prescribed range .

- Reverse should be followed during weaning.

- BiPAP with oxygen enrichment and adequate PEEP should be started when patient is not maintaining saturation with NRB Mask.
- High Flow Nasal Cannula should be used very very selectively.
- If patient is not improving clinically and not maintaining saturation he/she should be taken on invasive ventilation.

- One staff should be dedicated in each shift for continuously checking any leakage from oxygen source or delivery device.
- Close the oxygen valves when not in use like patient is taking meals or is not on bed.
- Divide the hospital in two zones ,one for patients having high oxygen demand and other for those needing less or no Oxygen.

Daily oxygen consumption calculation

Number of patients X O2 flow (L/min.) X 60 X 24

- If 2 patients are on face mask and 2 patients are on non rebreathing mask than approximate daily oxygen consumption/ requirment would be

Daily oxygen consumption calculation

Face mask 2 Pt X 5L/m X 60 X 24 = 14400 L/day

NRBM 2 Pt X 15 L/m X 60 X 24 = 43200 L/day

Total 57600 L/day

Capacity of one D type cylinder = 7000 L

So daily requirement of D type cylinders will be

57600 / 7000 = 8.2 cylinders

THANKS