

SARI CLINICAL CARE TRAINING

LEARNING SEQUENCE 6 OXYGEN THERAPY

Learning objectives

At the end of this lecture, you will be able to:

- Describe importance of oxygen therapy.
- Recognize indications for oxygen therapy.
- Describe how to initiate oxygen therapy.
- Describe two different methods to measure blood oxygen levels.
- Explain how to titrate oxygen therapy.

Importance of oxygen therapy

- Hypoxaemia is a life-threatening condition that can be easily treated with oxygen therapy:
 - **oxygen therapy saves lives.**
- Oxygen therapy is an essential medicine that should be available in all areas that may care for SARI patients.
- Oxygen therapy is cost-effective.
- Oxygen therapy is safe in newborns (preterm and term) that are hypoxic.

Importance of oxygen therapy



Oxygen therapy for children



“Effective oxygen delivery systems should be a universal standard of care and should be made more widely available.”
(WHO, 2016)



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Oxygen: indications 1/2

- In the hospital setting, give oxygen **immediately** to patients (adults and children) with SARI who have signs of severe illness:
 - severe respiratory distress
 - sepsis with hypoperfusion or shock
 - alteration of mental status
 - or hypoxaemia
 - $\text{SpO}_2 < 90\%$ (if patient is haemodynamically normal)
 - $\text{SpO}_2 < 94\%$ (if patient with any emergency signs of airway, breathing or circulation)
 - $\text{SpO}_2 < 92\text{--}95\%$ (if pregnant woman).

Do NOT delay oxygen administration.



Oxygen: indications 2/2



- In children, clinical signs that should trigger oxygen therapy include (when pulse oximeter not available):
 - central cyanosis
 - nasal flaring
 - inability to drink or feed (when due to respiratory distress)
 - grunting with every breath
 - depressed mental state (i.e. drowsy, lethargic)
 - and in certain conditions (severe lower chest indrawing, $RR \geq 70$ bpm, head nodding).

Do NOT delay oxygen administration.

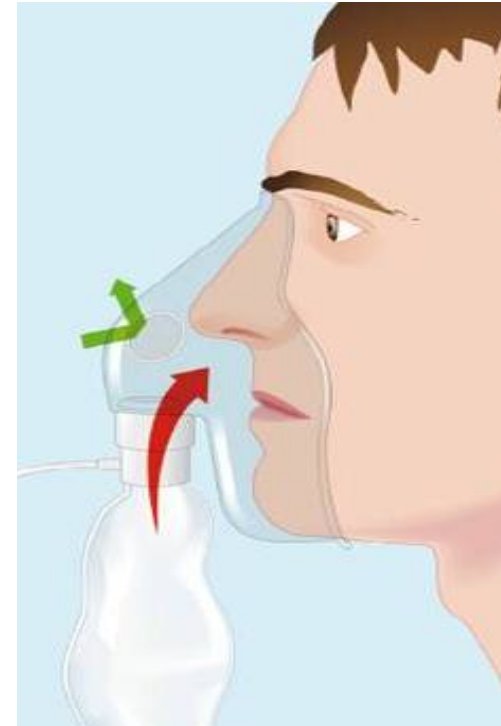


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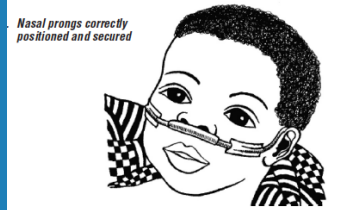
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If patient is critically ill, give higher flow rates

- In adults and older children, start with 10–15 l/min via face mask with reservoir bag.
- Less ill patients can start with 5 L/min by nasal cannula.



In children < 5 years, preference is nasal cannula



Age of child	Maximal oxygen flow rates
Neonates	0.5–1.0 L/min by nasal cannula
Infants	1–2 L/min by nasal cannula
Pre-school aged	1–4 L/min by nasal cannula
School-aged	1–6 L/min by nasal cannula

If severe hypoxaemia persists despite maximal flow rates:

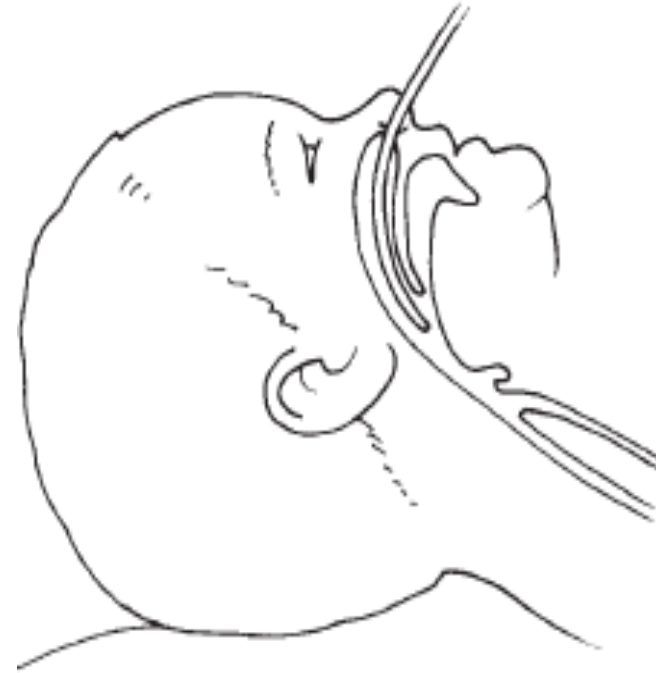
- start CPAP (if available)
- start secondary source of oxygen with face mask with reservoir bag
- insert nasopharyngeal catheter (passed uvula into the pharynx) and give oxygen at flow rates: neonates 0.5 L/min; infants 1 L/min.



Nasopharyngeal catheter



- For severe hypoxaemia:
 - place passed uvula into the pharynx
 - provides higher oxygen levels at similar flow rates because of PEEP
 - needs to be humidified
 - neonates, dose is 0.5 L/min
 - infants, dose is 1 L/min
 - use with nasogastric tube.



Oxygen therapy in children



- Compliance may require assistance from nursing staff and family members.
- Humidification is not required when using standard flow rates, as natural nasal mechanisms heat and humidify.
- FiO_2 is determined by flow rate, nasal diameter and body weight:
 - in infants up to 10 kg: 0.5 L/min (35%); 1 L/min (45%); 2 L/min (55%).

Monitor oxygen levels



- Clinical signs are not reliable indicators of hypoxaemia.
- Pulse oximeters should be available in all settings caring for patients with SARI and used to measure the SpO_2
 - pre-hospital, emergency area, ward, and ICU.
- Blood gas analyser should be available in the ICU:
 - measures pH, PO_2 , and PCO_2 for patients on mechanical ventilation, with severe hypoxaemia, risk of hypercapnea and shock states.



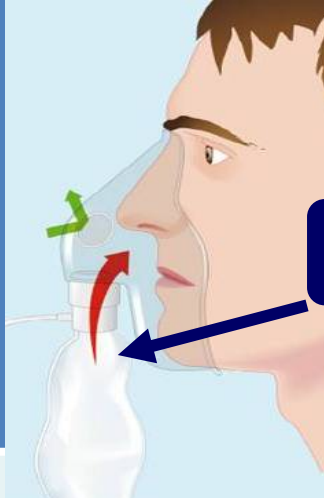
Oxygen titration to reach target

- Titrate oxygen to target:
 - $\text{SpO}_2 \geq 90\%$ in adults and children
 - $\text{SpO}_2 \geq 92\text{--}95\%$ in **pregnant** patients
 - $\text{SpO}_2 \geq 94\%$ if child or adult with signs of multi-organ failure, including shock, alteration of mental status, severe anaemia until resuscitation has stabilized patients, then resume target $\geq 90\%$.
- Titrate oxygen up and down to achieve target.
- Wean oxygen when patient is stable.

Titrate oxygen: use appropriate dose and delivery device



Medical Illustration, Leicester Royal Infirmary,
Leicester, UK

		 <div>Make sure bag is full</div>
O ₂ dose 1–5 L/min	O ₂ dose 6–10 L/min	O ₂ dose 10–15 L/min
FiO ₂ estimate 0.25–0.40	FiO ₂ estimate 0.40– 0.60	FiO ₂ estimate 0.60–0.95
Nasal cannula	Simple face mask	Face mask with reservoir bag

IPC and oxygen therapy

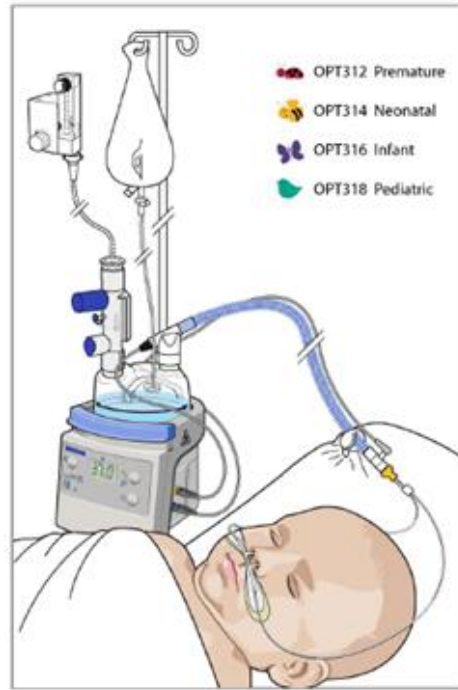
- Ensure single patient use of nasal prongs, simple face masks and face masks with reservoir bag to prevent nosocomial infection.
- Humidification is **not** necessary when delivering low flow rates. The oropharynx and nasopharynx provide sufficient humidity.
 - In children, flow rates are considered high when $> 2 \text{ L/kg/min}$.
- Avoid bubble bottles because of risk of infection.



Recognize acute hypoxaemic respiratory failure

- Patients not responding to increasing oxygen therapy are developing acute hypoxaemic respiratory failure:
 - signs of severe respiratory distress
 - hypoxaemia ($\text{SpO}_2 < 90\%$) despite escalating oxygen therapy
 - $\text{SpO}_2/\text{FiO}_2 < 300$ while on at least 10 L/min oxygen therapy
 - Cardiogenic pulmonary oedema not primary cause.

High-flow oxygen system for acute hypoxemic respiratory failure



High-flow oxygen systems can be used for adults and children:

- Selected patient must be awake, cooperative, haemodynamically stable without urgent need for intubation.
- May generate aerosols so should be used with airborne precautions.

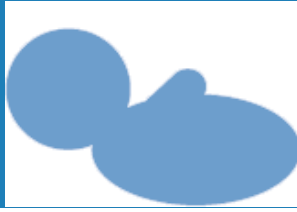


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High-flow oxygen system

- Comfortable nasal cannula interface.
- Reliably titrates FiO_2 up to 100%.
- Humidification prevents dryness.
- In adults, delivers flow rates as high as 60 L/min.
- In infants and young children, maximum flow rates are less, based on age and weight:
 - i.e. 2 L/kg/min up to maximum of 60 L/min



High-flow oxygen therapy

- Aims to match patient's inspiratory demand.
- Reduces work of breathing.
- Washes out nasopharyngeal dead space.
- Provides low level of PEEP.
- May induce less injury to the lung in ARDS.
- Monitor closely for need for intubation.



Tips: about oxygen use

- Appropriate use of oxygen will optimize quality care and minimizes waste.
- When using traditional nasal cannula and face mask, increasing flow rates does not reliably deliver higher oxygen concentrations (FiO_2), because patients also breathes in room air, which dilutes oxygen making exact FiO_2 variable.

Useful website

- http://www.who.int/patientsafety/safesurgery/pulse_oximetry/tr_material/en/

Summary

- Give oxygen immediately to patients with SARI with severe respiratory distress, sepsis with hypoperfusion/shock or hypoxaemia, $\text{SpO}_2 < 90\%$.
- In critically ill adults and children start with highest flow rate available and appropriate for age.
- Pulse oximeters should be available in all areas where emergency oxygen is delivered. Blood gas analyzer should be available in the ICU to also measure ventilatory parameters (pH, PaCO₂)
- Titrate oxygen to target $\text{SpO}_2 \geq 90\%$ in adults and children, $> 92-95\%$ in pregnant females, or $\geq 94\%$ during resuscitation of patient with multi-organ failure using the appropriate dose (flow rate) and delivery device.
- Newer high flow oxygen systems can be used in select cases of non-hypercapnic, hypoxemic respiratory failure.

Acknowledgements

Contributors

Dr T Eoin West, University of Washington, Seattle, USA

Dr Janet V Diaz, WHO Consultant, San Francisco, USA

Dr Arjun Karki, Patan Academy of Health Sciences, Kathmandu, Nepal

Dr Niranjana Bhat, Johns Hopkins University, Baltimore, USA

Dr Timothy Uyeki, Centers for Disease Control and Prevention, Atlanta, USA

Dr Simon Mardel, University Hospital of South Manchester NHS Foundation Trust

Dr Paula Lister, Great Ormond Street Hospital, London, UK

Dr Neill Adhikari, Sunnybrook Health Sciences Centre, Toronto, Canada

Dr Andy Petros, Great Ormond Street Hospital, London, UK



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