OXYGEN THERAPY AND PRESCRIPTION FOR PAEDIATRIC INPATIENTS

NEW ALL WALES PRESCRIPTION CHART
NOVEMBER 2014
Prescribing Oxygen for Paediatric Inpatients

Background
Legal requirement
BTS guidelines
NPSA report and recommendations 2009

University Hospital of Wales – adult services

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Background

Oxygen is regarded as a medicine and therefore cannot be administered by nursing staff without a prescription. This is a legal requirement.


These guidelines indicate that oxygen for adult inpatients must be prescribed. There are currently no parallel guidelines for the management of children, but these are in the process of being developed and are likely to advocate the same.

The adult guideline provides guidance on the following principles:

- Defining target oxygen saturations for different patient groups
- Prescribing oxygen
- Monitoring and altering oxygen therapy accordingly


The NPSA issued a Rapid response Report in September 2009. They received 281 reports of serious incidents related to inappropriate administration and management of oxygen. Of these incidents, poor oxygen management appears to have caused nine patient deaths and may have contributed to a further 35 deaths.

Common themes identified from the review of these incidents

- **Prescribing:** failure to or wrongly prescribed
- **Monitoring:** patients not monitored, abnormal oxygen saturation levels not acted upon
- **Administration:** confusion of oxygen with medical compressed air, incorrect flow rates, inadvertent
- **Equipment:** empty cylinders, faulty and missing equipment
- **Disconnection** of supply

NPSA recommendations for every institution

- NPSA briefing sheets highlighting actions to minimise risks of oxygen therapy are immediately made available to all relevant staff.
- The use of oxygen cylinders is minimised
- Where the use of oxygen cylinders is unavoidable robust systems are in place to ensure reliable and adequate supplies, including checking and stocktaking of cylinders.
- The risks of confusing oxygen and medical compressed air are assessed and action plans developed
- Oxygen is prescribed in all situations in accordance with BTS guidelines (but note these do not cover critical care or children less than 16 years).
- In an emergency, oxygen should always be given immediately and documented later.
- Pulse oximetry is available in all locations where oxygen is used.
- A multidisciplinary group responsible for reviewing oxygen-related incidents, developing a local oxygen policy and a training programme.
University Hospital of Wales – adult services

UHW have implemented the following strategies to date

- Minimal oxygen cylinder use hospital wide.
- Governance strategies where use of oxygen cylinders is unavoidable hospital wide.
- Education programme in adult services.
- Mandatory prescription of oxygen in adult services.
- Doctor and nurses training programme for effective prescription and monitoring of oxygen therapy in adult services.
- System of oxygen therapy governance for monitoring of oxygen related incidents.

Oxygen prescribing: The Noah’s Ark Children’s Hospital for Wales

This document has been developed by a multidisciplinary team of doctors, nurse and pharmacists. It accompanies the introduction of oxygen prescribing for children at Noah’s Ark Children’s Hospital for Wales, Cardiff, and the inclusion of an oxygen section on the new All-Wales Paediatric Prescription Chart.

The document concentrates on implementing safe prescription, monitoring and titration of oxygen therapy in paediatric inpatients. It will need to be reviewed with reference to the BTS Guidelines for the Emergency Management of Oxygen Therapy in Children, when this document has been published.

Oxygen delivery systems

Oxygen is delivered to children on the ward through many different interfaces. These include nasal cannulae, facemask, headbox oxygen, non-rebreathe mask, CPAP, SiPAP, BiPAP, and high flow humidified oxygen systems (Vapotherm, Optiflow).

It is important to realise that for almost all of these systems, the amount of oxygen delivered to the lungs cannot be quantified as these are open systems where the patient can in-train surrounding air into the oxygen supply being delivered. This is called uncontrolled oxygen therapy. The exception is headbox oxygen where the %FiO₂ in the child’s immediate environment can be accurately controlled. This is an example of controlled oxygen therapy.

Is giving oxygen safe?

In adults with chronic respiratory disease and CO₂ retention, respiratory drive may be dependent on hypoxia. Giving oxygen to these patients may cause CO₂ retention (CO₂ narcosis).

These adult patients are managed with regular blood gases and lower target oxygen saturations. Children with chronic respiratory disease may also have CO₂ retention.

In theory, children may also be at risk of CO₂ narcosis but this is extremely rare in the paediatric population. It is possible in patients who have CO₂ retention from chronic lung disease, so pay particular attention to children with chronic lung disease of prematurity, end stage cystic fibrosis, neuromuscular weakness and obesity when prescribing oxygen. If in doubt talk to your consultant.

Emergency oxygen

In any emergency, oxygen may still be administered without a prescription. The prescription will need to be written retrospectively.
Target oxygen saturations

In general, oxygen is delivered to children to achieve specific target oxygen saturations. Different disease guidelines stipulate different thresholds and there is currently little consensus. Flowsheet guidelines are given in Appendix A

- Target saturations for most children are defined at >92%.
- Target saturations for children with chronic lung disease of prematurity are defined at 91-94%.
- Children with pulmonary hypertension should have oxygen saturations maintained above 95%.
- Children with congenital heart disease and blood mixing may have low oxygen saturations at baseline, and advice should be sought from the cardiology team with regard to target saturations in these patients.

Prescribing oxygen

Oxygen is regarded as a medicine and therefore cannot be administered by nursing staff without a prescription. This is a legal requirement.

The oxygen prescription chart has been designed to accommodate the following needs:

- Formalise oxygen delivery
- Maintain adequate flexibility so that nurses can continue to titrate oxygen appropriately without the restriction of needing to modify the prescription many times a day.
- Set the upper limit to the amount of oxygen that may be delivered before repeat medical reassessment is indicated. These limits are designed to precipitate a request for further medical consultation before oxygen therapy can be escalated.
- The oxygen chart must be able to accommodate multiple modifications in oxygen prescription in keeping with the changing condition of the child.

The oxygen prescription is explicit in the following:

- Target oxygen saturation
- Mode of oxygen delivery
- A range in the amount of oxygen that may be safely delivered to achieve the desired oxygen saturations.

Oxygen section in All Wales Paediatric Drug Chart
Oxygen monitoring by nursing staff

Drug chart

- Oxygen is a prescription only medication (POM).
- Nurses should use the time grid on the drug chart to double sign for the oxygen prescription 4 times/day

Observation chart

- A minimum of 4 hourly observations should be carried out. These are documented on the observation chart and should include:
  - Respiratory rate
  - Oxygen saturations
  - Level of oxygen administered
  - Mode of oxygen delivery*

Titrating oxygen therapy

- Nurses should always administer the minimum oxygen possible to achieve the desired oxygen saturations.
- Oxygen saturations should be monitored and documented 5 minutes after every change
- If the oxygen delivered reaches the upper extreme in the range prescribed, and oxygen saturations are still below the desired range, then a medical review should be requested. Oxygen can always be given in the acute situation to achieve the desired oxygen saturations without a prescription.

Stopping Oxygen therapy

- Oxygen therapy may be discontinued when oxygen saturations have been stable on minimal oxygen therapy for two consecutive observations.
- Note: Oxygen may still be required at night and with feeding

How to stop oxygen therapy

- Stop oxygen & monitor oxygen saturations for 5 minutes
- If stable, continue to monitor in air for 1 hour
- If oxygen saturations falls, then re-start oxygen
- If oxygen saturations remain stable at one hour, stay in air
- Document the changes you make
- Doctor should review and cross off oxygen on drug chart

*new requirement
Doctor and nurse responsibilities

DOCTORS
Prescribe oxygen
Target saturations
Device
Oxygen delivery limits
Sign drug chart

Review withdrawal of oxygen
Cross off oxygen on drug chart

NURSES
Start oxygen
achieve target straight away

Monitor oxygen
minimum 4 hourly.

Titrate and wean off oxygen
Always give the minimum oxygen required

Record
$O_2$ Sats, RR, $O_2$ delivery, delivery device
Sign drug chart every drug round
Document all changes in oxygen requirement

Inform doctors
If limits to oxygen prescription are reached
How to fill in the oxygen prescription chart

Example scenario
9 month child; bronchiolitis
Doctor’s initial prescription

Nurse documentation
Clinical deterioration day 3

Nurse contacts doctor

Doctor makes clinical assessment and increases oxygen prescription

Clinical deterioration overnight

Nurse increases oxygen as needed to maintain oxygen saturations

Nurse contacts doctor
Doctor makes clinical assessment and increases oxygen prescription

Child transferred to HDU
Child started on nCPAP with 10L/min O2
Appendix A: Guidance on target oxygen saturation levels

**EMERGENCY OXYGEN PRESCRIBING**

**PAEDIATRIC GUIDELINES IN SECONDARY CARE**

1. **Is the patient critically ill?**
   - Yes → APLS
   - No → Reservoir mask
     - Oxygen 15L/min
     - or bag-valve mask

2. **Discuss target O₂ sats with cardiology**
   - Yes → Does the child have congenital heart disease?
     - Yes → Target O₂ sats >95%
     - No → Patient has or is at risk of pulmonary hypertension
6. **Does the child have chronic lung disease of prematurity?**
   - Yes → Target O₂ sats 91-94%
   - No

3. **Could the patient have chronic CO₂ retention? (see orange box below)**
   - Yes → Discuss target O₂ sats with cardiology
   - No → Consider capillary blood gas

- Breathing in patients who have chronic CO₂ retention may be dependant on hypoxic drive
- Take care with oxygen in the following patients
  - Chronic lung disease of prematurity
  - Neuromuscular disease
  - Obesity
  - End stage cystic fibrosis
- Oxygen must be prescribed in the drug chart using the paediatric oxygen sticker
- In an emergency, oxygen can be given without a prescription
## Appendix B: Guidance on oxygen delivery interfaces in children

**Guidance on oxygen delivery interfaces in children**

<table>
<thead>
<tr>
<th>DEVICE/FIO₂</th>
<th>INDICATIONS</th>
<th>ADVANTAGES</th>
<th>LIMITATIONS</th>
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</table>
| **Headbox** | Suitable for infants and small children with acute episodes of respiratory illness eg bronchiolitis | • Controlled oxygen delivery  
• Well tolerated in infants  
• Easy delivery of humidified O₂ | • CO₂ build up may occur if flow <7l/min OR outflow from box is obstructed.  
• O₂ needs to be warmed for smaller infants as the environment inside can become cold  
• Access to give care can cause significant fall in oxygen delivered |
| Humidified and warmed O₂ 24-60% | | | |
| **Nasal cannulae** | • Long Term Oxygen Therapy (LTOT).  
• Minimal oxygen requirement  
• Recovery phase from acute episodes | • Low cost and  
• easy for patient to eat and talk  
• well tolerated  
• No re-breathing. | • Uncontrolled oxygen delivery  
• Oxygen delivery is affected by flow setting, respiratory rate, depth of breathing and geometry of nose.  
• Dries the nose, can cause headaches. |
| Maximum flow rate 2l/min  
Estimated oxygen delivery 24-40% | | | |
| **Facemask** | • Use for patients who need high oxygen delivery | Useful in children who  
• are mouth breathers  
• have nasal irritation  
• have epistaxis | • Minimum delivery 5litres/min to avoid rebreathing of expired CO₂.  
• Oxygen delivery is affected by flow setting, mask fitting, mask leak and patient’s breathing pattern. |
| 5-15 litres/min  
Estimated oxygen delivery 40-60% | | | |
| **Non re-breathe mask** | Often used in APLS setting (trauma, shock, severe asthma, convulsions, reduced level of consciousness) | Delivers very high concentrations of oxygen | • Minimum delivery 6 litres/min to avoid rebreathing of expired CO₂.  
• Oxygen delivery is affected by mask fitting and mask leak |