PRESENTATION

Oxygen (O_2) is a gas provided in compressed form in a cylinder. It is also available in liquid form, in a system adapted for ambulance use. It is fed via a regulator and flow meter to the patient by means of plastic tubing and an oxygen mask / nasal cannulae.

ACTIONS

Essential for cell metabolism. Adequate tissue oxygenation is essential for normal physiological function.

Oxygen assists in reversing hypoxia, by raising the concentration of inspired oxygen. Hypoxia will, however, only improve if respiratory effort or ventilation and tissue perfusion are adequate.

If ventilation is inadequate or absent, assisting or completely taking over the patient's ventilation is essential to reverse hypoxia.

CAUTIONS

Oxygen increases the fire hazard at the scene of an incident.

Defibrillation – ensure pads firmly applied to reduce spark hazard.

INDICATIONS

Children

- Significant illness and/or injury.

Adults

- Critical illnesses requiring high levels of supplemental oxygen (refer to **Table 1**).
- Serious illnesses requiring moderate levels of supplemental oxygen if the patient is hypoxaemic (refer to **Table 2**).
- COPD and other conditions requiring controlled or low-dose oxygen therapy (refer to **Table 3**).
- Conditions for which patients should be monitored closely but oxygen therapy is not required unless the patient is hypoxaemic (refer to **Table 4**).

CONTRA-INDICATIONS

Explosive environments.

SIDE EFFECTS

Non-humidified O_2 is drying and irritating to mucous membranes over a period of time.

In patients with COPD there is a risk that even moderately high doses of inspired oxygen can produce increased carbon dioxide levels which may cause respiratory depression and this may lead to respiratory arrest. Refer to **Table 3** for guidance.

DOSAGE AND ADMINISTRATION

- Measure oxygen saturation (SpO_2) in all patients using pulse oximetry.
- For the administration of **moderate** levels of supplemented oxygen nasal cannulae are recommended in preference to simple face mask as they offer more flexible dose range.
- Patients with tracheostomy or previous laryngectomy may require alternative appliances e.g. tracheostomy masks.
- Entonox may be administered when required.
- Document oxygen administration.

CHILDREN

- **ALL** children with significant illness and/or injury should receive **HIGH** levels of supplementary oxygen.

ADULTS

- Administer the initial oxygen dose until a reliable oxygen saturation reading is obtained.
- If the desired oxygen saturation cannot be maintained with simple face mask change to reservoir mask (non-rebreathe mask).
- For dosage and administration of supplemental oxygen refer to **Tables 1-3**
- For conditions where **NO** supplemental oxygen is required unless the patient is hypoxaemic refer to **Table 4**

[1] This guidance is based on O'Driscoll BR, Howard LS, Davison AG, on behalf of the British Thoracic Society. BTS guideline for emergency oxygen use in adult patients. Thorax 2008;63(Suppl_6):vi1-68, with kind permission of the British Thoracic Society.

Table 1 - **High** levels of supplemental oxygen for adults with critical illnesses

Target saturation 94-98%	Administer the initial oxygen dose until the vital signs are normal, then, reduce oxygen dose and aim for target saturation within the range of **94-98%** as per the table below.

Condition	Initial dose	Method of administration
▪ Cardiac arrest or resuscitation: o basic life support o advanced life support o foreign body airway obstruction o traumatic cardiac arrest o maternal resuscitation ▪ Carbon monoxide poisoning	Maximum dose until the vital signs are normal	bag-valve mask
▪ Major Trauma: o abdominal trauma o burns and scalds o electrocution o head trauma o limb trauma o neck and back trauma (spinal) o pelvic trauma o the immersion incident o thoracic trauma o trauma in pregnancy ▪ Anaphylaxis ▪ Major pulmonary haemorrhage ▪ Sepsis e.g. meningococcal septicaemia ▪ Shock	15 litres per minute	Reservoir mask (non-rebreathe mask)
▪ Active convulsion ▪ Hypothermia	Administer 15 litres per minute until a reliable SpO_2 measurement can be obtained and then adjust oxygen flow to aim for target saturation within the range of **94-98%**	Reservoir mask (non-rebreathe mask)

NOTE – Some oxygen saturation monitors cannot differentiate between carboxyhaemoglobin and oxyhaemoglobin owing to their similar absorbances

Table 2 - **Moderate** levels of supplemental oxygen for adults with serious illnesses if the patient is hypoxaemic

Target saturation 94-98%	Administer the initial oxygen dose until a reliable SpO_2 measurement is available then adjust oxygen flow to aim for target saturation within the range of **94-98%** as per the table below.

Condition	Initial dose	Method of administration
▪ Acute hypoxaemia or clinically centrally cyanosed (cause not yet diagnosed) ▪ Deterioration of lung fibrosis or other interstitial lung disease	**SpO_2 <85%** 10-15 litres per minute	Reservoir mask (non-rebreathe mask)
▪ Acute hypoxaemia (cause not yet diagnosed) ▪ Deterioration of lung fibrosis or other interstitial lung disease ▪ Acute asthma ▪ Acute heart failure ▪ Pneumonia ▪ Lung cancer ▪ Postoperative breathlessness ▪ Pulmonary embolism ▪ Pleural effusions ▪ Pneumothorax ▪ Severe anaemia ▪ Sickle cell crisis	**SpO_2 ≥85-93%** 2-6 litres per minute	Nasal cannulae
	SpO_2 ≥85-93% 5-10 litres per minute	Simple face mask

Table 3 - **Controlled or low-dose** supplemental oxygen for adults with COPD and other conditions requiring controlled or low-dose oxygen therapy

Target saturation 88-92%	Administer the initial oxygen dose until a reliable SpO_2 measurement is available then adjust oxygen flow to aim for target saturation within the range of **88-92%** or **prespecified range** detailed on the patient's alert card, as per the table below.

Condition	Initial dose	Method of administration
▪ Chronic obstructive pulmonary disease (COPD) ▪ Exacerbation of cystic fibrosis	4 litres per minute	28% Venturi mask or patient's own mask
	NOTE **–** if respiratory rate is >30 breaths/min using Venturi mask set flow rate to 50% above the minimum specified for the mask.	
▪ Chronic neuromuscular disorders ▪ Chest wall disorders ▪ Morbid obesity (body mass index >40 kg/m^2).	4 litres per minute	28% Venturi mask or patient's own mask
NOTE - If the oxygen saturation remains below 88% change to simple face mask.	5-10 litres per minute	Simple face mask
NOTE - Critical illness AND COPD/ or other risk factors for hypercapnia.	If a patient with COPD or other risk factors for hypercapnia sustain or develop critical illness/injury ensure the same target saturations as indicated in **Table 1 – Critical Illness.**	

Table 4 – No supplemental oxygen required for adults with these conditions unless the patient is hypoxaemic but patients should be monitored closely

Target saturation 94-98%	**If hypoxaemic (SpO_2 <94%)** administer the initial oxygen dose then adjust oxygen flow to aim for target saturation within the range of **94-98%**, as per the table below.

Condition	Initial dose	Method of administration
▪ Myocardial infarction and acute coronary syndromes ▪ Stroke ▪ Cardiac rhythm disturbance ▪ Non-traumatic chest pain/discomfort ▪ Implantable cardioverter defibrillator firing	**SpO_2 <85%** 15 litres per minute	Reservoir mask (non-rebreathe mask)
	SpO_2 ≥85-93% 2-6 litres per minute	Nasal cannulae
▪ Pregnancy and Obstetric Emergencies: o birth imminent o haemorrhage during pregnancy o pregnancy induced hypertension o vaginal bleeding ▪ Abdominal pain ▪ Headache ▪ Hyperventilation syndrome or dysfunctional breathing ▪ Most poisonings and drug overdoses (refer to **Table 1** for **carbon monoxide poisoning** and special cases below for **paraquat poisoning**) ▪ Metabolic & renal disorders ▪ Acute and sub-acute neurological and muscular conditions producing muscle weakness (assess the need for assisted ventilation if **SpO_2 <94%**) ▪ Post convulsion ▪ Gastrointestinal bleeds ▪ Glycaemic emergencies Heat exhaustion/heat stroke	**SpO_2 ≥85-93%** 5-10 litres per minute	Simple face mask
Special cases ▪ Poisoning with paraquat		

NOTE – patients with paraquat poisoning may be harmed by supplemental oxygen so avoid oxygen unless the patient is hypoxaemic. Target saturation **88-92%**

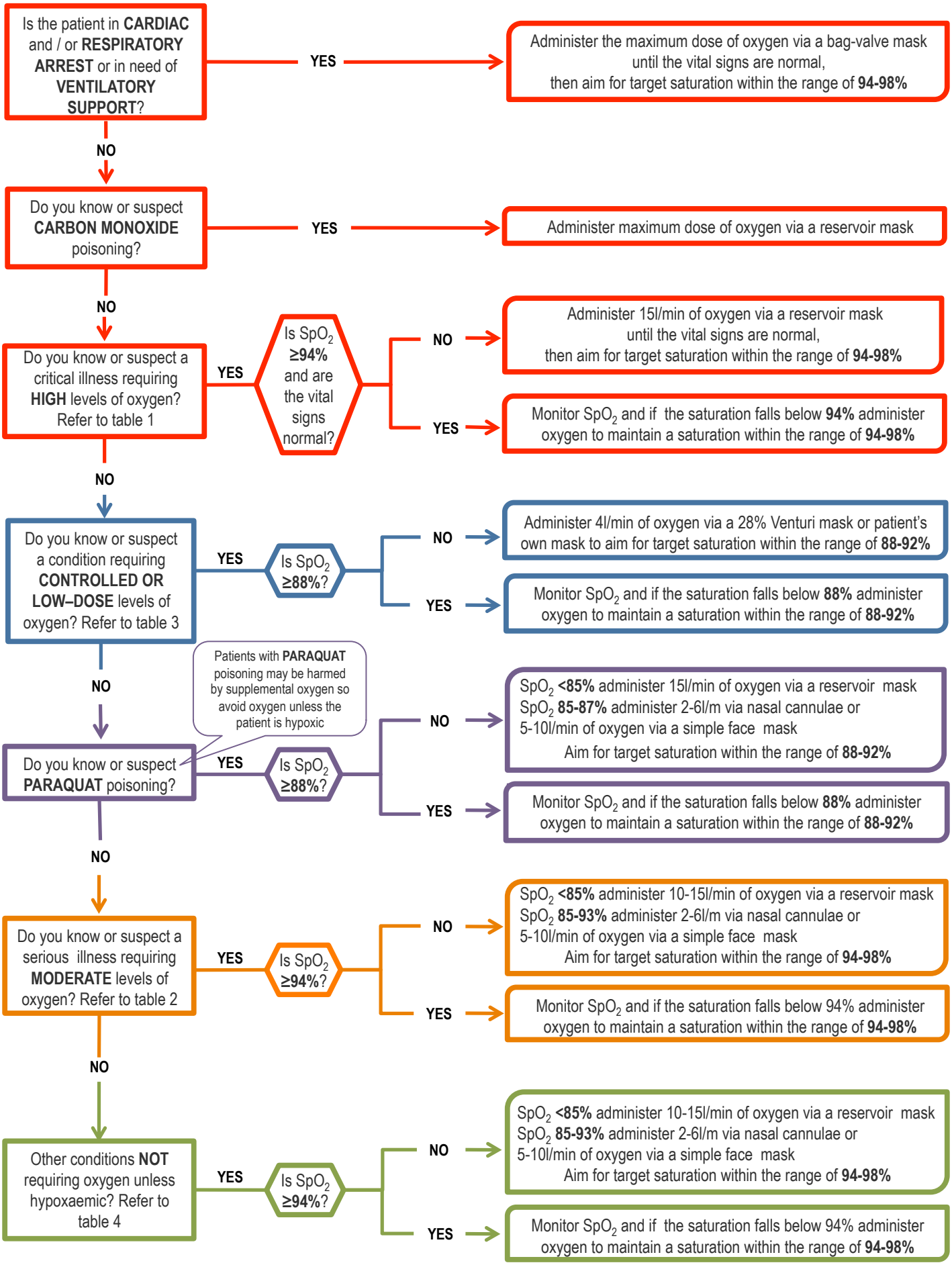

Figure 1 – Administration of supplemental oxygen in prehospital care

Table 1 - Critical illnesses in adults requiring HIGH levels of supplemental oxygen

- Cardiac arrest or resuscitation:
  - basic life support
  - advanced life support
  - foreign body airway obstruction
  - traumatic cardiac arrest
  - maternal resuscitation
- Major Trauma:
  - abdominal trauma
  - burns and scalds
  - electrocution
  - head trauma
  - limb trauma
  - neck and back trauma (spinal)
  - pelvic trauma
  - the immersion incident
  - thoracic trauma
  - trauma in pregnancy
- Active convulsion
- Anaphylaxis
- Carbon monoxide poisoning
- Hypothermia
- Major pulmonary haemorrhage
- Sepsis e.g. meningococcal septicaemia
- Shock

Table 2 - Serious illnesses in adults requiring MODERATE levels of supplemental oxygen if hypoxaemic

- Acute hypoxaemia or clinically centrally cyanosed (cause not yet diagnosed)
- Deterioration of lung fibrosis or other interstitial lung disease
- Acute asthma
- Acute heart failure
- Pneumonia
- Lung cancer
- Postoperative breathlessness
- Pulmonary embolism
- Pleural effusions
- Pneumothorax
- Severe anaemia
- Sickle cell crisis

Table 3 - COPD and other conditions in adults requiring CONTROLLED OR LOW-DOSE supplemental oxygen

- Chronic Obstructive Pulmonary Disease (COPD)
- Exacerbation of cystic fibrosis
- Chronic neuromuscular disorders
- Chest wall disorders
- Morbid obesity (body mass index >40 kg/m^2)

Table 4 - Conditions in adults NOT requiring supplemental oxygen unless the patient is hypoxaemic

- Myocardial infarction and acute coronary syndromes
- Stroke
- Cardiac rhythm disturbance
- Non-traumatic chest pain/discomfort
- Implantable cardioverter defibrillator firing
- Pregnancy and Obstetric Emergencies:
  - birth imminent
  - haemorrhage during pregnancy
  - pregnancy induced hypertension
  - vaginal bleeding
- Abdominal pain
- Headache
- Hyperventilation syndrome or dysfunctional breathing
- Most poisonings and drug overdoses (except **carbon monoxide** poisoning)
- Metabolic & renal disorders
- Acute and sub-acute neurological and muscular conditions producing muscle weakness
- Post convulsion
- Gastrointestinal bleeds
- Glycaemic emergencies
- Heat exhaustion/heat stroke

Special cases:

- paraquat poisoning