

PRODUCT INFORMATION: BOC GASES REFRIGERATED LIQUID OXYGEN MEDICAL GRADE(S)

WARNING: OXYGEN AIDS AND INCREASES COMBUSTION.

Oxygen strongly supports combustion (including some materials which do not normally burn in air). Smoking is prohibited when Medical Oxygen is in use, and no naked flame is allowed.

There is a high risk of spontaneous combustion if oxygen comes into contact with oils, greases and tarry substances.

See Precautions and Instructions for Use.

NAME OF THE MEDICINE

BOC Gases Refrigerated Liquid Oxygen Medical Grade(s)

Chemical structure: O = O

CAS Number: 7782-44-7

DESCRIPTION

Compressed medical gas for medicinal use

Contains 99.5% v/v Oxygen

Pharmacotherapeutic group GASMED, Gas, Medical

ATC Code V03AN01

Chemical characteristics

Complies with current British Pharmacopoeial specifications, purity not less than 99.5%.

Purity	Not less than 99.5% v/v
Carbon dioxide	Not more than 300 ppm v/v
Carbon monoxide	Not more than 5 ppm v/v
Water	Not more than 67 ppm v/v

Physical characteristics

Appearance	Odourless, colourless gas
Molecular weight	32
Boiling point	-183.1°C (at 1 bar)
Density	1.335 kg/m ³ (at 15°C)
Combustion characteristics	Non-flammable. Strongly supports combustion

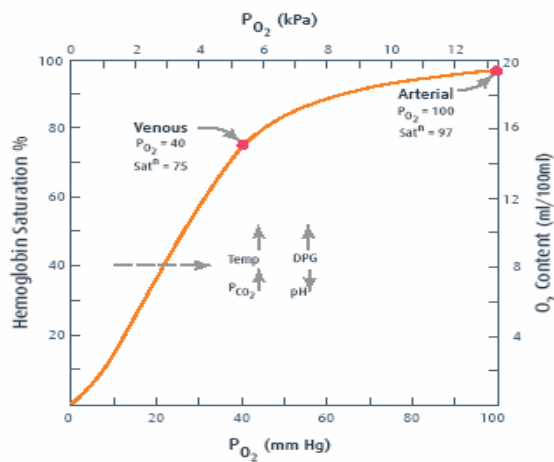
PHARMACOLOGY

Oxygen is present in the atmosphere at 21% and is essential for cellular metabolism. The therapeutic use of oxygen is intended to improve, or prevent a reduction in, the oxygen content of blood leaving the lungs (or the oxygenator of a heart-lung machine).

Pharmacokinetics

Inhaled oxygen is transported via the airways to the lung with the inspired air. Oxygen is absorbed in the alveoli by gas exchange resulting from the difference in partial pressure from the inspired air/gas mixture to the capillary blood. Increasing the inhaled oxygen concentration, (i.e. inspired gas oxygen fraction, FiO₂), is intended to compensate for problems of ventilation, diffusion and ventilation/perfusion mismatch, by increasing the alveolar partial pressure of oxygen. Oxygen is transported mainly bound to haemoglobin. A small amount though is free and dissolved into plasma.

The uptake of oxygen by the blood in the lungs and discharge to the tissues is determined by the oxygen dissociation curve. The characteristic sigmoid curve ensures that, at tensions between 40 and 15 mmHg, the oxygen carried in the blood from the lungs can be readily given up to the tissues.



The oxygen dissociation curve. The oxygen content scale is based on hemoglobin concentration of 14.5 g/100 ml.

The uptake from the lungs is rapid, because blood flow through the capillaries, where exchange takes place, occurs in about 0.5 seconds. The uptake of oxygen is favoured by simultaneous loss of carbon dioxide, which is excreted in the expired air. Conversely, the entry of carbon dioxide into the blood from the tissues facilitates oxygen transfer to the cells.

At rest, mixed venous blood returning to the lungs contains 13-14 mL of oxygen per 100 mL, but with severe exercise, the oxygen content may fall to 3-4 mL. In very active tissue, there is almost complete extraction of oxygen.

Pharmacodynamics/Physiology

The basal oxygen consumption in humans is approximately 250 mL/min for a body surface area of 1.8 m². It is reduced by about 10% during anaesthesia and natural sleep and by about 50% for a 10°C fall in body temperature. Under normal conditions, alveolar air contains about 14% oxygen (105 mmHg) and the arterial blood has an oxygen tension of 97 mmHg. The difference, known as the alveolar-arterial oxygen tension gradient, increases with age and may be as great as 30 mmHg in a healthy elderly individual. Oxygen in the blood is primarily bound to haemoglobin. The oxygen saturation of

haemoglobin in arterial blood is approximately 97%. Each gram of haemoglobin binds approximately 1.34 mL of oxygen, giving a maximum capacity of about 20 mL per 100 mL of blood. A small amount, 0.3 mL, exists in solution in the same volume of blood.

The concept of “oxygen availability” can be used to quantify the amount available to the body. It can be expressed as product of cardiac output and the oxygen content of the blood. This is estimated by (cardiac output) x (Hb concentration) x (amount of oxygen carried by one gram of haemoglobin) x (% saturation of haemoglobin), plus the amount in solution.

The average healthy individual with basal oxygen consumption has no more than four minutes supply of oxygen circulating in the blood.

INDICATIONS

For respiratory delivery where there is a requirement for medical oxygen to treat or prevent hypoxemia.

CONTRAINDICATIONS

There is no formal contraindication to normobaric oxygen therapy.

Due to the increased risk of fire, patients should not smoke during oxygen therapy.

See PRECAUTIONS.

PRECAUTIONS

Domiciliary oxygen therapy is not indicated for adult patients with severe airflow limitation whose main complaint is dyspnoea but who maintain a PaO₂ > 60 mm Hg and who show no secondary effects of chronic hypoxia, or who have not received adequate therapy of other kinds (e.g. bronchodilators and corticosteroids, treatment for right ventricular failure, or for any respiratory infection). (See DOSAGE AND ADMINISTRATION).

Oxygen therapy may affect the level of consciousness in a patient with hypercapnia and reduced respiratory drive. (See DOSAGE AND ADMINISTRATION).

General

WARNING: OXYGEN AIDS AND INCREASES COMBUSTION.

Oxygen strongly supports combustion. Smoking is prohibited and no naked flame is allowed.

Oxygen in contact with oils, greases and tarry substances creates a highly dangerous environment due to the risk of spontaneous combustion.

Electrical equipment capable of sparking or generating extreme heat should not be used in the vicinity of patients receiving oxygen.

Check the following before use

Oxygen cylinders must be fitted with an appropriate and lawfully supplied pressure-reducing device dedicated to use with medical oxygen and complying with Australian Standards (See Dosage and Administration and Instructions for Use). Where this device is separate, it must match the cylinder valve pin index outlet. Where the dispensing equipment connection is separate, this must be connected by an oxygen-specific coupling.

Cylinder pressure may be used as an indicator of the quantity of gas remaining in the cylinder.

Use of gas cylinders

Medical oxygen is stored in high pressure gas cylinders at ambient temperature. Care is needed in the handling and use of compressed medical oxygen gas cylinders.

Under no circumstances should oils or grease be used to lubricate any part of the compressed gas medical oxygen cylinder or the associated equipment used to deliver the gas to the patient.

Cylinders must not be exposed to extremes of temperature.

Always ensure hands are clean and free from any oils or grease.

See DOSAGE AND ADMINISTRATION, HANDLING AND INSTRUCTIONS FOR USE, and STORAGE. Additional information is contained in the Material Safety Data Sheet for Medical Oxygen from the Sponsor.

Oxygen toxicity may occur with prolonged exposure to high inspired oxygen levels. High oxygen concentrations should be given for the shortest possible time required to achieve the required clinical outcome, and reduced as soon as possible to the lowest concentrations needed to prevent or treat hypoxia.

There is evidence in the literature that the risk of oxygen toxicity can be minimised if the treatment follows these guidelines (oxygen fraction in the inhaled air/gas mixture = FiO_2):

Oxygen in concentrations up to 100% (FiO_2 1.0) should not be given for more than 6 hours

Oxygen in concentrations above 60-70% (FiO_2 0.6-0.7) should not be given for more than 24 hours

Oxygen in concentrations above 40-50% (FiO_2 0.4-0.5) should not be given during the next 24 hours

Oxygen concentrations > 40% (FiO_2 > 0.4) can potentially cause damage after 2 days.

Premature infants are excluded from these guidelines because retrolental fibroplasia may occur with a much lower FiO_2 . The lowest effective concentrations should be sought in order to achieve an adequate oxygenation appropriate for neonates (see also DOSAGE AND ADMINISTRATION).

The response to oxygen varies depending on the underlying disorder, cause of hypoxia, and clinical status of the individual patient. The clinician should consider all relevant factors in selecting the inspired oxygen concentration, flow rate, and duration of therapy, taking into account the risk of oxygen toxicity. The general recommendation is that the lowest dose – FiO_2 – to achieve the desired result of therapy, a safe PaO_2 must be the aim. Careful monitoring of oxygen therapy is required, with repeated clinical assessment and monitoring of inhaled oxygen concentration (FiO_2) and checks of arterial oxygenation e.g. by arterial blood gas measurements (PaO_2), or arterial oxygen saturations (SaO_2) via pulse oximetry, as clinically appropriate.

If oxygen is mixed with other gases, its concentration in the gas mixture inhaled (FiO_2) must be maintained at least at 21% in the inhaled gas. Oxygen inhaled fraction can be increased up to 100%.

Use in pregnancy

Category A when oxygen is used in pregnancy as clinically required, to treat intercurrent illness and avoid hypoxemia, at the lowest concentration for the shortest possible time.

Hyperbaric oxygen treatment during gestation in mice, rats, hamsters and rabbits led to increased resorptions and foetal abnormalities, and decreased foetal body weights. Category A does not relate to hyperbaric oxygen treatment and specialist literature should be consulted.

Pregnant women should not be exposed to hyperbaric oxygen.

Use in Lactation

Oxygen can be used during breast-feeding as clinically required, to treat intercurrent illness and avoid hypoxemia, at the lowest concentration for the shortest possible time.

Paediatric use

Special care must be observed when administering oxygen to neonates. Preterm infants are more susceptible to the direct and indirect potentially toxic effects of oxygen exposure, including retinopathy of prematurity. Clinical protocols appropriate to the condition and age of the infant should be followed, including advice for appropriate arterial oxygen saturation monitoring. Ongoing

monitoring is required to achieve the targeted arterial saturation using the lowest possible inspired oxygen levels. See DOSAGE AND ADMINISTRATION.

Use in the Elderly

Use in the elderly is determined by clinical assessment and course of the illness. Some elderly patients with chronic severe obstructive airways disease may rely on hypoxic drive for respiration and require relatively low inspired oxygen concentrations: See Dosage and Administration.

Effects on fertility

Medical oxygen has not been shown to adversely affect fertility when used as clinically required.

Interactions with other medicines

High oxygen fraction may further impair the damages caused by lung toxic agents.

The pulmonary toxicity associated with drugs such as bleomycin, amiodarone and similar antibiotics may be exacerbated by inhalation of high concentration of oxygen. See respective Product Information.

Effects on ability to drive and use machines

Under normal conditions, oxygen does not interfere with consciousness, however patients who require continuous oxygen support will require individual assessment, taking their entire medical situation into account for evaluating their ability to drive or operate machinery. See also PRECAUTIONS.

ADVERSE EFFECTS

Oxygen toxicity depends upon both inspired partial pressure of oxygen (a function of concentration and barometric pressure) and duration of exposure, the safe duration decreasing as the pressure increases. With 100% normobaric oxygen, symptoms of pulmonary toxicity are cough, substernal chest pain, mild dyspnoea, malaise, nausea, or transient paresthesia after 6-24 hours, substernal distress, atelectasis, decrease in vital capacity (after 18 hours) and acute respiratory distress syndrome (after 24-48 hours). Up to 2 atmospheres, pulmonary toxicity occurs before CNS toxicity; at higher pressures, the reverse applies. Symptoms of CNS toxicity include nausea, mood changes, vertigo, twitching, convulsions and loss of consciousness.

Adverse effects of oxygen exposure as described in standard texts include:

Eye disorders:

Retinopathy of prematurity, retrolental fibroplasia in neonates, tunnel vision, myopia with hyperbaric oxygen.

ENT:

Mucosal dryness and irritation, ear or sinus trauma, tympanic membrane rupture with hyperbaric oxygen.

CNS disorders:

Drowsiness/carbon dioxide narcosis if given in high concentrations to patients with reduced sensitivity to carbon dioxide tension in arterial blood; effects of hyperbaric oxygen toxicity include vertigo, convulsions, loss of consciousness.

Respiratory:

Chest tightness, dry cough, pain on inspiration; decreased vital capacity; pneumonitis; atelectasis; bronchopulmonary dysplasia in neonates; carbon dioxide retention when given in high concentrations to patients with reduced sensitivity to arterial CO₂ tension. Pneumothorax or air embolism has been reported with hyperbaric oxygen.

Gastrointestinal:

Nausea.

General

Haemolysis of red blood cells; lipid peroxidation and cell membrane damage due to chemical toxicity in any metabolising cells.

DOSAGE AND ADMINISTRATION

Medical oxygen is administered by inhalation through the lungs. The major exception is when a metered supply is fed into the oxygenator of an extracorporeal circulation of a cardio-pulmonary bypass system.

Inhaled Medical Oxygen must be administered using an appropriate pressure reduction device and equipment such as mask or nasal prongs to deliver the required inspired concentration of oxygen, between 21% and 100%, as determined by the prescriber after full clinical assessment. Most delivery systems for adults result in an inspired oxygen concentration of 60% or less. Inhaled oxygen may require humidification when treatment duration is longer than an hour.

Standard texts and clinical protocols should be consulted for the oxygen requirements specific to the underlying condition and the clinical status of the individual patient. It is essential to monitor ventilation, arterial oxygen saturation, and the clinical effect of the treatment.

In general, the aim of treatment is to ensure, by adjusting the oxygen fraction in the inhaled air (F_{iO_2}), so that the oxygen partial pressure in arterial blood (P_{aO_2}) does not fall below 60 mmHg or that the oxygen saturation of haemoglobin in arterial blood does not fall below 90%. The dose (F_{iO_2}) must be adjusted according to each patient's individual needs, taking into account the risk of oxygen toxicity. The general recommendation is to use the lowest dose necessary to achieve the desired result of treatment. In cases of pronounced hypoxia, oxygen fractions that can involve a risk of oxygen toxicity may be indicated (see Overdose).

In short-term treatment with oxygen, the oxygen concentration i.e. the fraction in the inhaled gas mixture (F_{iO_2} ; avoid $>0.6=60\%$ O_2 in the inhaled gas mixture) should be maintained so as to achieve an arterial oxygen partial pressure (P_{aO_2}) > 60 mmHg.

In patients with chronic respiratory disorders with hypercapnia, there is a risk of reduced respiratory drive with high oxygen concentrations, and low controlled oxygen concentrations (24%-28%) are generally used, with incremental increases based on individual clinical assessment and arterial blood value.

Treatment of neonates with oxygen may be required but must be strictly monitored, so that the oxygen concentration may be reduced when the patient's condition allows. For neonates (full-term and preterm) the appropriate institutional protocols, based on full clinical assessment, should be followed. The lowest effective concentrations should be sought in order to achieve an adequate oxygenation appropriate for neonates.

In the emergency/acute setting, the usual dose for adults to treat or prevent acute oxygen deficiency is 3-4 litres per minute when using nasal prongs or 5-15 litres per minute with a mask.

Oxygen treatment must be continuously evaluated and the effect measured by means of P_{aO_2} or arterial oxygen saturation.

The use of medical oxygen for hyperbaric oxygen treatment is beyond the scope of this registered therapeutic good. See specialist literature.

OVERDOSAGE

In oxygen intoxication there may be pulmonary symptoms of chest tightness, dry cough, and pain on inspiration. Care must be taken where symptoms cannot present (e.g. intensive care) since the onset of objective evidence for pulmonary oxygen toxicity occurs late in its development (see ADVERSE EFFECTS).

The oxygen therapy should be reduced or, if possible, stopped, and symptomatic treatment should be started in order to maintain vital functions (e.g. artificial ventilation/assisted ventilation should be given if the patient shows signs of failing respiration).

HANDLING AND INSTRUCTIONS FOR USE

Warning: Medical Oxygen increases burning and the risk of fire

DO NOT use medical oxygen if:

- a. You are smoking**
- b. You are near open flames**

All personnel handling medical Oxygen should have adequate knowledge of:

- Properties of the gas
- Precautions and actions to be taken in the event of an emergency.

Under no circumstances should oils or grease be used to lubricate any part of the compressed gas medical oxygen system or the associated equipment used to deliver the gas to the patient. Always ensure hands are clean and free from any oils or grease.

Where moisturising preparations are required for use with a facemask or in nasal passages etc., avoid using oil based creams. If in doubt, check with the manufacturer to ensure that the product of choice is suitable for use with oxygen.

PRESENTATION

Medical oxygen is supplied via reticulated gas circuits within the hospital. Oxygen is identified via the label on the wall or other outlets.

Vessel size (Litres)	Gaseous Capacity (m³) (1 atmosphere and 15°C)	Identifying markings
VIE 1,500	840	White, "BOC", "Medical Oxygen", relevant placarding.
VIE 3,000	2,100	White, "BOC", "Medical Oxygen", relevant placarding.
VIE 7,000	5,560	White, "BOC", "Medical Oxygen", relevant placarding.
VIE 15,000	11,300	White, "BOC", "Medical Oxygen", relevant placarding.
VIE 30,000	22,300	White, "BOC", "Medical Oxygen", relevant placarding.

Steel vacuum insulated evaporators (VIEs, 1,500, 3,000, 7,000, 15,000 & 30,000) with brass valve closures.

STORAGE

Due to the nature of the VIE it can be stored under any ambient conditions and still keep the liquid oxygen at below -190 degree C. Storage and shelf life according to appropriate Australian Standard. Vessels and vessel compounds must be maintained according to relevant Australia Standards, customer agreements and other legislation, such as Dangerous Goods storage legislation. A water tap must be provided for ice removal from the valve. Warning notices prohibiting smoking and naked

flames must be clearly posted around the vessel. Emergency Services should be advised of the location of the vessels.

POISON SCHEDULE

Not scheduled

NAME AND ADDRESS OF SPONSOR

BOC Medical
10 Julius Avenue
North Ryde, NSW, 2113

TGA approval/last amendment: 14 March 2008