

CONTRAINDICATIONS AND SIDE EFFECTS

Are There Any Absolute Contraindications?

* The only absolute contraindication to HBOT is an untreated pneumothorax. The pneumothorax must be resolved before the commencement of compression by insertion into the lung cavity of the chest a tube with a nonreturn (Hemlich) valve in the system.

What Are The Relative Contraindications?

* Chronic sinusitis and upper respiratory infections – These render it difficult for patients to clear their ears and sinuses. These conditions are generally handled by slow compression and decompression with use of a nasal spray, if necessary (e.g., “AFRIN”), or an oral decongestant.

* Seizure disorders – These patients are more predisposed to oxygen seizures and may need sedation prior to exposure. Valium or anticonvulsants are generally employed. Current data shows in most cases seizure activity will decrease with HBOT. The risk of seizures with HBOT is 1 per 10,000 compressions. Oxygen seizures have produced no long-term sequelae.

* Emphysema with CO₂ intoxication – The high oxygen tension in the breathing mixture will reduce spontaneous ventilation. Carbon dioxide will increase, as well the tendency for an oxygen seizure. By using low ATA 1.25 patients with severe emphysema can be treated with HBOT.

* Uncontrolled high fever – This condition predisposes the patient to oxygen seizures. It may be necessary to sedate the patient with Valium.

* History of thoracic surgery – May have produced air-trapping lesion, which could expand upon decompression. Gas pockets must be determined from x-ray or CT of the lungs.

* History of ear surgery – The wire or plastic struts placed after stapedectomy can become disrupted. P.E. tubes laced.

* Asymptomatic pulmonary blebs – When these are shown on x-ray, they may cause a pneumothorax. Also, they can lead to extra-alveolar gas disease.

* Congenital sphenocytosis – HBO causes an increase in RBC fragility and may be followed by massive hemolysis.

* Significant pulmonary obstructive disease – Conditions such as asthma, emphysema, and obstructive bronchial disease can reduce the outflow of gas during decompression. Slow compression and decompression is required to avoid extra-alveolar gas disease. These patients can be safely treated at low ATA of 1.25.

to confirm that HBOT is effective in control of infection, especially clostridial, staph and pseudomonas. Clinical hyperbaric oxygen therapy is now available at many centers in the USA but used mainly for wound care.

Arterial PO₂ values of 1,100-1,900 mm Hg are achieved by the patient's breathing 100% oxygen at chamber pressures of 2.5 to 3.0. The elevated pressure significantly increases the diffusion distance of oxygen in a hypoperfused wound and ischemic disease. The increase in oxygen in plasma and fluids at 2.5 to 3 ATA can support normal tissue functions providing oxygen to areas of the body where there is decreased vascularity. The increased oxygen levels in tissue with HBOT has now been confirmed by polarographic oxygen electrode measurements.

Gas gangrene: The high oxygen partial pressure causes cessation of toxin production by the causative clostridial organisms and has a bactericide and bacteriostatic effect.

Acute carbon monoxide intoxications: The high oxygen partial pressure causes rapid dissociation of carbon monoxide from hemoglobin and CNS cytochrome oxidase A3 making physiologically dissolved oxygen availability to nervous tissue. The incidence of late central nervous system complications of carbon monoxide intoxications is reduced by the use of HBOT. HBOT can also be used to treat late symptoms.

Crush injuries, severed limbs, and skin grafting: Improved survival as marginal viable tissue responds well to HBOT. During the 1-1½ hour treatments, elevation of wound PO₂ results in: edema reduction, fibroblast division and collagen production to provide support for capillary proliferation. Thus, one use of HBOT is to help prepare a rich vascular bed for skin or bone grafting of venous stasis ulcers, diabetic ulcers with reasonable regional perfusion, infected open amputation stumps, and osteomyelitis.

Uncontrolled infection: Enhanced leukocyte killing of staphylococci and other bacteria and mycoses which improve results in osteomyelitis and severe soft tissue infections.

Stroke, brain trauma and encephalopathy: Respond well to HBOT. Reduction in edema which improved vascular circulation and hypoxia in the penumbria at the edge of the injured brain is helpful in stroke, head trauma and encephalopathy. Only HBOT can reduce edema while increasing oxygenation in tissue.

Bends and iatrogenic air embolism: Chamber pressure greater than sea level results in decrease of intravascular and tissue gas bubbles which trigger coagulopathy and other mechanisms in the complex diving disorder of decompression sickness. Restoration of CNS perfusion by compression of intravascular gas embolism is essential to rapid and complete recovery, therefore, high ATA is used for this protocol.

* Adrenocorticosteroids – Large doses within 24 hours may increase the risk of oxygen seizures (CNS oxygen toxicity). Maintenance doses of steroids cause no problem and are acceptable.

* Claustrophobia – Can usually be overcome with medication and confidence that the technician can quickly remove the patient from the chamber. If the patient can fly or ride in an elevator, HBOT will work.

Patient must have a lung x-ray before treatment with HBOT within the last six months. A copy of the radiologist's findings should be sent to the HBOT facility prior to the commencement of therapy.

What About Oxygen Toxicity as a Side Effect ?\

There is no question that oxygen toxicity can occur and presents as:

1. Pulmonary (Lorraine-Smith Effect) pulmonary edema
2. Central nervous system (Paul Bert Effect) seizure

These two complications are avoidable by operating within recognized time and pressure guidelines. When strictly observed, toxicity has generally been less than 2 per 10,000 treatments. Some centers have never observed oxygen toxicity. As mentioned in the preceding section, in some febrile patients or with a seizure history, medications (e.g., Valium or anticonvulsants) are required to control a seizure problem. Pulmonary oxygen toxicity is seldom encountered with current clinical HBOT protocols. In the treatment of gas embolism diseases or decompression sickness, however, oxygen toxicity is more of a problem because these conditions require higher ATA than is usual in most clinical HBOT protocols. For instance, the usual ATA for CNS injury is 1.5 ATA.

In the USA, Medicare and most insurance companies recognize about 13 indications for HBOT. In Russia, there are 73 approved uses of HBOT.

INTERNATIONAL INDICATIONS SYNTHESIS FOR HBOT

1. Conditions for which hyperbaric oxygen is considered to be the treatment of choice include:
 - Carbon Monoxide Intoxication (often present in burn patients)
 - Air Embolism
 - Acute Cyanide Poisoning
 - Decompression Sickness
 - Severe Blood Loss Anemia
 - Skin Grafts
 - Radionecrosis Osteo and Soft Tissue
 - Gas Gangrene
 - Aerobic and Anaerobic Infections with Tissue Necrosis

2. Conditions for which hyperbaric oxygen is considered to be sound adjunctive therapy include:
 - Radionecrosis of Bone and Soft Tissue
 - Fracture Healing
 - Bone Grafts
 - Suturing of Severed Limbs
 - Pre and Post Surgery Edema and Ischemia
 - Acute Thermal Burn
 - Bacteroides Infection
 - Crush Injury
 - Cerebral Palsy
 - Autism
 - Acute Cerebral Edema
 - Chemo Brain
 - Reflex Symptomatic Dystrophy
 - Lyme Disease
 - Infected and Migrating Prosthesis
 - Post Polio Syndrome
 - Traumatic Head and Spinal Cord Injury
 - Intestinal Obstruction (ileus)
 - Osteomyelitis
 - Acute Peripheral Traumatic Ischemia
 - Chronic Stroke
 - Chronic Skin Ulcers
 - Decubitus Ulcers
 - Gastric Ulcer
 - Trophic Skin Ulcer
 - Diabetic Skin Ulcer
 - Multiple Sclerosis

3. Conditions from which patients may benefit when hyperbaric oxygen is used as a long-term therapy include:
 - Diabetic Ulcers and Neuritis
 - Skin Ulcers (arterial insufficiency)
 - Decubitus Ulcers (bed sores)
 - Difficult Healing Bone (non-union fractures, etc.)
 - Soft Tissue Healing (postoperative or postradiotherapy)
 - Multiple Sclerosis
 - Post Stroke
 - Neurological Insufficiencies
 - Angina
 - Emphysema
 - Asthmas
 - Cortical Blindness