Hyperbaric Oxygen Therapy

What is Hyperbaric Oxygen Therapy?

- Receiving 100% oxygen while at a pressure greater than sea level in a closed environment
- A standard treatment is 2.0-2.4 Absolute Atmospheres (ATA) for approximately 2 hours a day, 5 days a week.
  - 2.4 ATA
  - 46.2 FSW
  - 20.58 PSIG
- Effect:
  - 100% oxygen at a pressure 2-3 times sea level provides the body with increased oxygen in the plasma, stimulating angiogenesis and promoting healing.

History of Hyperbaric

- 1662 – The first documented use of hyperbaric therapy occurred when a British physician created an airtight chamber, called a 'domicilium', in which the atmosphere could be compressed and decompressed using oxygen bellows and valves.
- 1800's – hyperbaric chambers became popular throughout Europe.
- 1891 – Dr. J. Leonard Corning built the first hyperbaric chamber in the United States in New York.
- 1930's – Álvaro Osório de Almeida, a Brazilian physician, recognized the potential benefits of hyperbaric oxygen therapy and published several papers on his work on the effects of high doses of oxygen on tumors in animals and people.
- 1937 – The United States Navy conducted extensive research on the use of hyperbaric oxygen to treat decompression sickness. A significant report on this research was published by Behnke and Shaw.
- 1950's – Clinical trials uncovered a number of beneficial mechanisms from exposure to hyperbaric oxygen chambers. These experiments were the forerunners of contemporary applications of HBO in the clinical setting.
- 1967 – the Undersea and Hyperbaric Medical Society (UHMS) was founded to foster the exchange of data on the physiology and medicine of commercial and military diving.
- The Hyperbaric Oxygen Committee was developed by the UHMS in 1976 to oversee the ethical practice of hyperbaric medicine.

Types of Hyperbaric Oxygen Therapy Chambers

Monoplace

Multiplace

NON-APPROVED "HYPERBARIC CHAMBERS"

What Conditions Qualify For Medicare Reimbursement?

1. Acute carbon monoxide intoxication
2. Decompression illness
3. Gas embolism
4. **Gas gangrene**
5. Acute traumatic peripheral ischemia
6. Crush injuries and suturing of severed limbs
7. **Progressive necrotizing infections**
8. Acute peripheral arterial insufficiency
9. **Preparation and preservation of compromised skin grafts**
10. **Chronic refractory osteomyelitis, unresponsive to conventional medical and surgical management**
11. **Osteoradionecrosis as an adjunct to conventional treatment**
12. **Soft tissue radionecrosis as an adjunct to conventional treatment**
13. Cyanide poisoning
14. **Actinomycosis, only as an adjunct to conventional therapy when the disease process is refractory to antibiotics and surgical treatment**
15. **Diabetic wounds of the lower extremities if all of these apply:**
    - **Type 1 or Type 2 diabetes and have a lower extremity wound that's due to diabetes.**
    - **A wound classified as Wagner grade III or higher.**
    - **Failure in an adequate course of standard wound therapy.**

Indications and Rationale

- **Acute Carbon Monoxide Poisoning** – Relieve hypoxia; hasten elimination of CO; antagonize brain lipid peroxidation
- **Acute Exceptional Blood Loss Anemia** – Increase physically dissolved oxygen; treat hypoxia; support marginally perfused tissues
- **Acute Thermal Burns** – Relieve hypoxia; decrease fluid losses; limit burn wound extension and conversion; treat edema; promote wound closure
- **Arterial Gas Embolism** – Overcome free gas volume; relieve hypoxia; antagonize leukocyte mediated ischemia-reperfusion injury
- **Chronic Refractory Osteomyelitis** – Augment host antimicrobial defenses; induce angiogenesis; potentiate leukocytic dismutase superoxide and perioxide production; relieve hypoxia; augment antibiotic therapy; extend post-antibiotic effect; augment osteoclast activity
- **Clostridial Gas Gangrene** – Reduce size of gaseous bullae; inactivate clostridial alpha toxin; inhibit alpha toxin production; induce bacteriostasis; potentiate leukocytic dismutase superoxide and perioxide production
- **Compromised Skin Grafts/Flaps** – Support marginally perfused/oxygenated tissues; antagonize ischemic reperfusion injury; accelerate angiogenesis
- **Crush Injury; Acute Ischemia** – Provide interim tissue oxygenation in relative states of ischemia; reduce edema; reduce compartment pressures; antagonize ischemic-reperfusion injury; augment limb salvage
- **Decompression Sickness** – Overcome free gas volume-induced ischemia; relieve hypoxia; hasten elimination of offending inert gas; treat edema
- **Late Radiation Tissue Injury** – Re-establish wound oxygen gradients; relieve hypoxia; induce angiogenesis; prepare for definitive coverage
- **Necrotizing Soft Tissue Infections** – Induce bacteriostasis of anaerobes; (fasciitis and cellulitis) potentiate leukocytic dismutase superoxide and perioxide production; relieve hypoxia; more closely demarcate potentially viable tissue
- **Non-Healing Marginally Perfused Wounds** – Re-establish wound oxygen gradients; relieve hypoxia; reduce edema; induce angiogenesis; correct diabetic-induced leukocyte changes; prepare for definitive coverage

*UNDERSEA AND HYPERBARIC MEDICAL SOCIETY, 2008

Contraindications

Absolute Contraindications

- Untreated pneumothorax

Relative Contraindications

- Bleomycin, Doxorubicin, Cis-Platinum, Disulfiram, Mafenide Acetate (Sulfamylin)
- Upper respiratory tract infections or chronic sinusitis
- Seizure disorders
- Chronic Obstructive Pulmonary Disorders (COPD)
- Congestive Heart Failure (CHF)

CASE STUDIES

Wagner Grade 3 Diabetic Foot Ulcer

Pre-Hyperbaric
Length: 3 cm
Width: 5 cm
Depth: 0.9 cm

After 30 Hyperbaric Treatments
Length: 2.5 cm
Width: 4 cm
Depth: 0.2 cm

Wagner Grade 4 Diabetic Foot Ulcer

Initial Hyperbaric Consultation
Length: 4.7 cm
Width: 6.5 cm
Depth: 0.2 cm

After 8 Hyperbaric Consultation
Length: 5 cm
Width: 5.7 cm
Depth: 0.5 cm

After 58 Hyperbaric Treatments
Length: 1 cm
Width: 1 cm
Depth: 0.1 cm

Chronic Refractory Osteomyelitis

After 29 Hyperbaric Treatments
Length: 2 cm
Width: 2 cm
Depth: 0.5 cm

After 48 Hyperbaric Treatments & Bone Debridement
Length: 1.8 cm
Width: 1 cm
Depth: 1.7 cm

Complete Closure 4 Months After Hyperbaric
Length: 0 cm
Width: 0 cm
Depth: 0 cm

Soft Tissue Radionecrosis

Pre-Hyperbaric

After 40 Hyperbaric Treatments And Surgical Closure

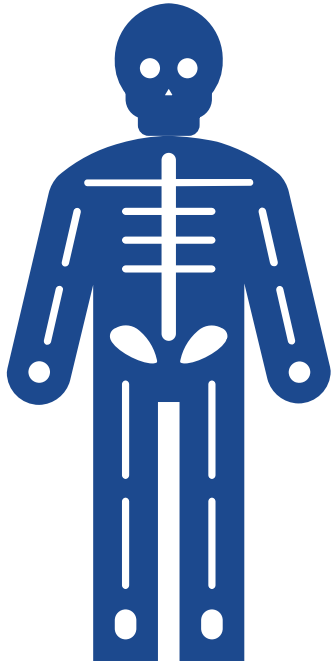
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3736394/

Osteoradionecrosis

The Marx's protocol for ORN treatment consists of a 90-minute HBO session at 2.4 ATA, once a day for 30 treatments before the surgery and 10 treatments after the surgery and if HBO therapy is used as a preventive method (not approved for CMS), the protocol is daily sessions for 20 treatments before surgery and 10 after.

What The Hyperbaric Team Needs

- Hemoglobin A1c if diabetic
- Vascular assessment for ulcers of the lower extremity
- Radiation records for the radiation patient
- Proof of the condition such as diagnostic imaging, scope, biopsy, etc.
- Documentation of the condition including treatment to date
- CXR, EKG, and basic lab work



Hyperbaric Process

- The patient is seen in an outpatient consultation by our team to make sure they are a good candidate for HBO.
- Obtain signed consents.
- Obtain appropriate documentation and records.
- Submit to the patient's insurance company for prior-authorization **if** it is required by their plan.
- If prior-auth is not required, we can begin treating the patient once they have obtained medical clearance from our Hyperbaric physician which can be an immediate process. Prior-auth can take anywhere from a few minutes to 2 weeks to obtain. But once it is obtained, treatments can be scheduled for same or next day.

What You Need To Know About Insurances

- Diabetic foot ulcers must be a Wagner Grade 3 or higher
- Chronic Refractory Osteomyelitis has to have been attempted to treat and has not responded to conventional treatment (medical and surgical intervention)
- **Every insurance is different!**

Questions?

Comments?