

## Hyperbaric Oxygen: An Adjunctive Therapy



Photo courtesy of Sechrist Industries, Inc.

### Problem:

Chronic wounds represent a significant burden to patients, health care professionals, and the US health care system, affecting 5.7 million patients and costing an estimated 20 billion dollars annually.<sup>1</sup>

There are 23.6 million children and adults in the United States, or 7.8% of the population, who have diabetes. Every year 5% (1.2 million) of persons with diabetes will develop foot ulcers and 10-30% with foot ulcers will eventually require amputation.<sup>2</sup>

### Reason:

Typically, wounds proceed through a sequence of events that ultimately result in a healed state with restoration of anatomic and functional integrity. Chronic wounds, however, usually experience a failure at some point in the sequence leading to a breakdown in the healing process.

Of primary concern is the presence of infection, tissue ischemia/hypoxia, inadequate local wound responsiveness, and unrelieved pressure. Correction of any and all of these factors plays an important role in many non-healing wounds.

### Solution:

The **Advanced Wound Center (AWC)** at [insert hospital name] offers a multidisciplinary approach to the manage-

ment of these complicated wounds. Oftentimes the amount of care required for desirable outcomes surpasses the resources which any single physician can provide. Wound healing at the AWC is achieved in cooperation with referring physicians, surgeons, podiatrists, and other specialists as required.

Treatment options include the utilization of advanced wound care modalities which have proven to improve healing rates and prevent amputations. Hyperbaric oxygen therapy (HBOT) is used adjunctively with other procedures, such as revascularization, or as a primary treatment when other options fail. HBOT is a daily

treatment, in which a patient breathes 100% oxygen at pressure greater than normal atmospheric pressure in a hyperbaric chamber. HBOT systemically delivers 100% oxygen to the patient at 2-3

times greater than atmospheric pressure. This elevated pressure within the hyperbaric chamber results in a 10-15 fold increase in plasma oxygen concentration, which translates to arterial oxygen values of between 1,500 and 2,000 mmHg. The steep oxygen gradient provided by HBOT produces a four-fold increase in the diffusing distance of oxygen from functioning capillaries.

The evidence supporting the beneficial physiologic effects of HBOT is encouraging:

1. Decreased local tissue edema
2. Improved cellular energy metabolism
3. Improved local tissue oxygenation
4. Improved leukocyte killing ability
5. Increased effectiveness of antibiotics
6. Promotion of collagen deposition
7. Promotion of neoangiogenesis
8. Enhanced epithelial migration

Topical application of oxygen to a wound site does NOT meet the defini-

tion of HBOT. An assessment performed for the Agency for Healthcare Research and Quality (AHRQ) was unable to draw conclusions from reported research stating that *this method of oxygen administration lacks basic and clinical research to support beneficial effects of topical oxygen in wound healing.*<sup>3</sup>

### Indications:

CMS (Medicare) lists the following indications as approved coverage for Hyperbaric Oxygen Therapy in their National Coverage Decision (NCD) 20.29 (in order of decreasing utilization):

1. Diabetic Wounds of the Lower Extremities (DWLE)
2. Soft Tissue Radionecrosis
3. Compromised Flaps & Grafts
4. Chronic Refractory Osteomyelitis
5. Acute Peripheral Arterial Insufficiency
6. Osteoradionecrosis
7. Progressive Necrotizing Infections
8. Crush Injuries
9. Acute Traumatic Peripheral Ischemia
10. Gas Gangrene
11. Acute Carbon Monoxide Intoxication
12. Decompression Illness / Sickness
13. Gas Embolism
14. Cyanide Poisoning
15. Actinomycosis

The administration of HBOT takes place in either a monoplace (single person) or multiplace (multiple person) chamber. The treatment duration can vary from 45 to 300 minutes; however, a typical session ranges from **90 to 120 minutes.**



Photo courtesy of SE Tx Center for Wound Care & HBO Medicine

The Undersea and Hyperbaric Medical Society (UHMS), an international, non-profit organization, serves as the primary source of scientific information for diving and hyperbaric medicine physiology worldwide. Many non-Medicare payors use the UHMS list of approved indications for HBOT as their medical policy of coverage. The UHMS list includes 14 of the 15 CMS indications (does not include Actinomyces) as well as the following three:

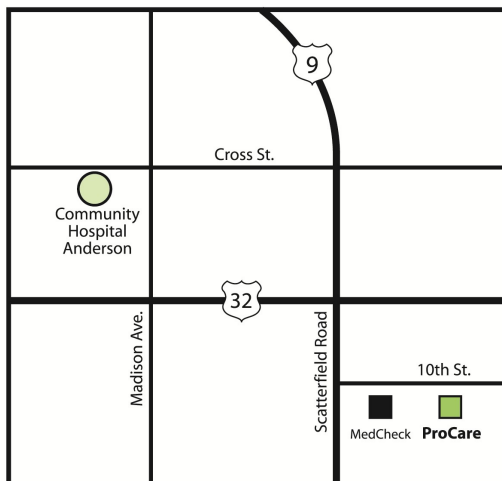
1. Thermal Burns
2. Exceptional Blood Loss Anemia
3. Intracranial Abscess

**Note:** Medicare does **NOT** cover the three indications listed above.

### Non-Covered Indications:

"All other indications not specified under §270.4(A) are not covered under the Medicare program. No program payment may be made for HBO in the treatment of the following conditions:"

- Cutaneous, decubitus, and stasis ulcers
- Chronic peripheral vascular insufficiency
- Anaerobic septicemia and infection other than clostridial
- Skin burns (thermal)
- Senility
- Myocardial infarction
- Cardiogenic shock
- Sickle cell anemia
- Acute thermal and chemical pulmonary damage
- Acute or chronic cerebral vascular insufficiency
- Hepatic necrosis
- Aerobic septicemia
- Nonvascular causes of chronic brain syndrome
- Tetanus
- Systemic aerobic infection
- Organ transplantation or storage
- Pulmonary emphysema
- Exceptional blood loss anemia
- Multiple Sclerosis
- Arthritic Diseases
- Acute cerebral edema



Continued HBOT will not be covered if there are no measurable signs of healing during a 30 day period. Additionally, patient education is vital to improve compliance with initial treatment requirements and lifestyle modifications may be necessary to prevent future wounding.

Adjunctive hyperbaric oxygen therapy cannot improve healing in all problem wounds; however, those that can demonstrate reversible local tissue hypoxia and poor response to infection can be significantly improved by the addition of HBOT.

Since periwound tissue hypoxia has been shown to be an important determinant of wound healing in many patients, the **Advanced Wound Center** can perform transcutaneous oxygen measurements (PtcO<sub>2</sub>) when necessary. Patients with demonstrated tissue hypoxia and an abnormal pulse examination go on to further peripheral vascular evaluation and possible surgical intervention.

**Patients can be referred to the Advanced Wound Center for aggressive, outcome-based wound management.**

Wounds with a PtcO<sub>2</sub> < 30 mmHg are predicted not to heal based on critical ischemia/hypoxia without the addition of HBOT. Wounds with a PtcO<sub>2</sub> of 30-50 mmHg might

heal without HBOT, but on average they will take more than 12 weeks.<sup>4</sup>

Patients can be referred to the **Advanced Wound Center** for aggressive, outcome-based wound management. The physicians at the AWC provide specialized care in close coordination with the patient's primary physician. Care includes the application of advanced wound care technology and hyperbaric oxygen treatment, as indicated, based on evidence-based clinical pathways. The referring physician will continue to provide overall medical care for the patient and will receive frequent updates on the patient's response to care at the AWC.

### References:

1. Branski LK, Gauglitz GG, Herndon DN, et al. A review of gene and stem cell therapy in cutaneous wound healing. *Burns*. Jul 4 2008;[[Medline](#)].
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3. Agency for Healthcare Research and Quality. Technology assessments. Available from URL: <http://ahrq.gov/clinic/techix.htm>.
4. Marston WA, et al. Natural history of limbs with arterial insufficiency and chronic ulceration treated without revascularization. *J Vasc Surg* 2006; 44:108-114.

## The Curespot

### A Publication of Acelecare Wound Centers

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