Did you know Life Bridge Northwest Hospital Center for wound healing offers hyperbaric oxygen (HBOT) treatments? Did you also know we have a team of specialists in wound care and healing? We offer a wide range of services to help you manage your patient. Let us partner with you, to help you heal your patients. Below is some information about how Hyperbaric Oxygen Therapy can help you, heal your patients.

**Which foot and ankle conditions benefit from HBO treatment? Does clinical evidence support HBO treatments?**

Patients undergoing HBO therapy enter a chamber filled with 100 percent oxygen atmosphere pressurized to 2.0 to 2.5 ATA (atmospheric pressure absolute), which is equivalent to the pressure 33 to 48 feet below sea level. Hyperbaric oxygen therapy treatment “force feeds” oxygen through the lungs to the rest of the body. A 90-minute treatment in this hyperbaric environment induces “hyper oxygenation” with oxygen levels over 10 times the normal amount in the bloodstream.1

Driven by a systemic effect, HBO therapy requires high pressure, sturdy chambers made of metal and acrylic materials. “Portable” or “collapsible” or chambers made of plastic and vinyl materials (often sold as non-medical, over-the-counter devices) are not built to withstand such high pressures over 2.0 ATA. These devices are no more therapeutic than administering oxygen via nasal canula or face mask. “Topical” oxygen therapy that encloses a body part (e.g. a lower extremity with wounds) lacks strong clinical evidence at this time. Medicare does not reimburse either “portable” or “topical” HBO therapy

Oxygen is a metabolite in respiration and an essential component of human physiology. Of the same token, wound repair mechanisms require oxygen to build skin, granulation tissues and new blood vessels. Interestingly, oxygen under hyperbaric conditions “behaves as drugs” and hyper-oxygenation causes:

- A decrease in leg edema and excessive inflammation;
- An increase in the growth factors and receptors (VEGF and PDGF);
- Doubled flexibility of red blood cells;
- Increase in bactericidal capacity; and
- Mobilization of the stem cell within the bone marrow to increase the circulating progenitor cells within the blood stream eightfold.2-5

These effects triggered by HBO treatments specifically counteract the factors known to impair wound healing, especially in patients with diabetes.
What Are The Guidelines For HBO In Diabetic Foot Wounds?
Several years ago, the Center for Medicare and Medicaid Services (CMS) approved reimbursement of HBO treatments for diabetic foot wounds. Following this decision, virtually every private payer now reimburses HBO treatment of diabetic foot wounds. Medicare’s HBO reimbursement guidelines require patients to meet the following three criteria.

- Presence of diabetes and lower extremity wounds
- Thirty days of standard wound care have shown no improvement
- Wounds must be Wagner Grade III (deep wound with abscess, osteomyelitis or tendonitis extending to those structures), Wagner Grade IV (gangrenous toes and forefoot) or V (gangrenous foot).

Hyperbaric oxygen therapy is not a “cure-all” treatment. It is an adjunctive therapy for proper wound care and is certainly not a substitute for vascular workup and revascularization efforts.

In our center we utilize a transcutaneous oximetry monitor (TCOM) as another microcirculatory test predictive of wound healing in the initial vascular assessment stage. The ankle brachial index (ABI) and toe brachial index (TBI) are useful screening tools of ischemia if the patients do not have calcified leg vessels due to diabetes or end-stage renal disease (ESRD).

I urge physicians to familiarize themselves with local HBO facilities by accessing the chamber directory on the Undersea and Hyperbaric Medical Society’s Web site (www.uhms.org). Several HBO physicians suggest calling first for referrals and “referring early” before extensive hypoxic damage occurs. Discussing the patient’s case and follow-up arrangements with a local HBO physician can determine if the patient is a candidate for treatment and if he or she will receive care. Be prepared to provide copies of the patient’s most recent history and physical, wound progress notes, lab and imaging results, a consultation request and a letter of medical necessity if applicable.

What You Should Know About The Convenience And Safety Of HBOT
Outpatient HBOT treatments (commonly called “dives”) usually last 90 minutes while patients are napping or watching TV. Ideally, patients should undergo 40 to 60 daily treatments. Every HBOT treatment is closely monitored by a certified hyperbaric technician and supervised by a HBOT physician for patient safety.

Is HBO dangerous?
The risk versus benefit ratio of HBO is remarkably favorable. The most common side effect of HBOT is otic barotrauma, which may cause ear discomfort. Physicians have traditionally reported a 2 percent incidence of this side effect but a recent retrospective review shows the incidence of otic barotrauma may be as low as 0.821 percent.1,7 While claustrophobia reportedly occurs in 2 percent of the general
population, the aforementioned review cites a 0.34 percent incidence of confinement anxiety as the second most common side effect based on 90,186 HBO treatments. As VAC therapy dressings (KCI) are compatible with HBO treatment, we often utilize VAC and HBO simultaneously for deep foot wounds, skin graft preparation and/or bolstering. (Note: The machine is disconnected temporarily while the patient is being treated within a chamber.)

**What The Clinical Evidence Reveals**

Diabetic foot wounds are precursors to 85 percent of major leg amputations, which lead to increased morbidity and mortality rates rivaling that of many cancers. The medical, rehabilitation, social and emotional costs of major leg amputations are all enormous. The concept of “limb preservation” advocates best practice wound care and multidisciplinary team approaches, which are known to save “at-risk” limbs.

In 2005, Kranke, et al., systematically reviewed “HBO and chronic wounds” based on publications from 1966 to 2003, including five randomized controlled trials (RCT) This review came to the conclusion that HBO for diabetic foot ulcers “significantly reduced the risk of major amputation and may improve the chance of healing at one year.” The study also suggested that “the application of HBOT to these patients may be justified where HBOT facilities are available.” The analysis predicts surgeons avoided one major leg amputation per four patients treated via HBO.

In March 2007, a similar conclusion was published by the Canadian Agency for Drugs and Technology in Health with the report “Adjunctive HBOT for Diabetic Foot Ulcer.” In this report, adjunct HBO therapy in diabetic foot ulcer treatment was more effective and healed more wounds versus standard care (SC) alone, and subsequently lowered the incidence of major leg amputations (11 percent for the HBO group versus 32 percent for standard care). Moreover, this review calculates the economic benefit of avoiding major leg amputations, which translates to significantly lower treatment costs ($40,695 HBO versus $49,786 SC) and increased “quality of life years” (3.64 HBO versus 3.01 SC).

**A Guide To Indications For HBO In Non-Diabetic Wounds**

Although the clinical evidence is less robust in these “non-diabetic wound” indications, HBO treatments are nonetheless effective and reimbursable by Medicare and most payors.

**Refractory osteomyelitis.** This condition, also called chronic osteomyelitis, is one of the hardest diseases to treat. It necessitates multiple surgical interventions, weeks of IV antibiotics and lifetime suppressive oral antibiotic therapies. Hyperbaric oxygen therapy is synergistic with many antibiotics and also has a direct suppressive effect on anaerobic organisms. Consequently, HBO can arrest infections in 60 to 85 percent of refractory osteomyelitis cases.4 The UHMS Oxygen Therapy Committee Report 2003 indicated AHA level II-b for this indication, based on cohort and case-controlled studies.1

**Failed skin flaps and grafts.** Hyperbaric oxygen therapy is helpful in wound bed granulation and is valuable in salvaging failed skin flaps and grafts by direct oxygenation. One can also utilize HBO for
dehiscence after surgical closure of minor foot amputations (e.g. partial ray, TMA, etc.) treated as “failed flaps.” A comprehensive evidence-based review of HBO use on flaps and grafts by Friedman, et al., concludes that although more RCTs are desirable, there is “enough animal evidence and observational data to warrant the application of HBO in selective situations.”

**Arterial insufficiency ulcers.** Medicare recently decided to reimburse HBO treatments for ischemic ulcers that failed to improve after revascularization procedures. Medicare stated that “Arterial insufficiency ulcers may be treated with HBO therapy if they are persistent after reconstruction surgery has resolved large vessel function.” This decision is limited to the Medicare Fiscal Intermediary of Florida and Ohio. However, this policy is expected to extend across the nation in the near future. The Wound Healing Society rates the literature on HBO treatment for arterial insufficiency ulcers as Evidence 1-b.

**In Conclusion**

When it comes to severe foot and ankle wounds, advanced wound care modalities, such as VAC therapy, skin substitutes and surgical reconstructions (flaps and grafts) are justified by clinical evidence as providing superior efficacy over conventional treatments. While HBO may appear “exotic,” this treatment is one of the safest and effective modalities for reducing major leg amputations from diabetic foot ulcers in statistically significant fashion.

Increasing incidences of diabetes and peripheral vascular disease, and growing Medicare/senior populations yield many patients who are candidates for HBO treatments. It is our duty to present this valuable adjunctive treatment to our patients as it has been proven to save limbs and lives.

**References:**

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