INTERNATIONAL HYPERBARICS ASSOCIATION, INC.

The Pressure Point

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In the News:

Diabetics are losing legs unnecessarily

From the Globe and Mail

Canadian diabetics are losing feet and legs at an alarming rate every year despite a growing body of scientific evidence which shows that a treatment already available can potentially prevent amputation in about 70 percent of cases.

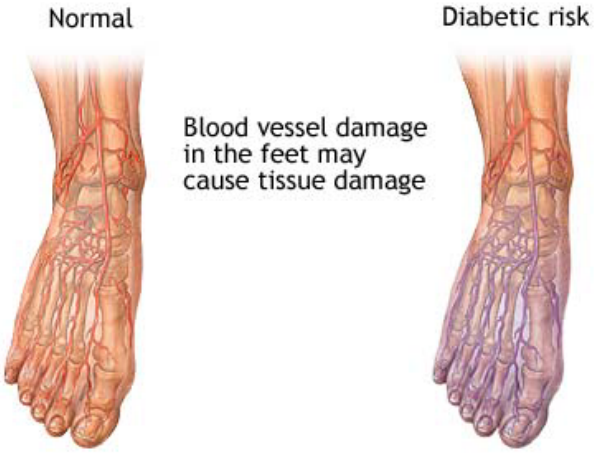
In Ontario alone, conservative estimates are that 2100 diabetics suffer below-or-above-the knee amputations every year due to foot ulcers, with some doctors quietly putting the number at twice that and a recent British study finding that amputation rates themselves are often unreliable and underestimated.

Statistically, every year about 2.5 percent of more than two million Canadians with diabetes develop foot ulcers—the disease often causes poor circulation and nerve damage in the extremities, with the result that such minor problems as calluses and cuts can quickly become infected before the patient realizes it—with about a quarter of those eventually going on to amputation.

Most are older people, if not elderly, their bodies worn down after decades of the disease's insidious effects.

Yet though the treatment—called hyperbaric oxygen therapy or HBOT—is, on paper, available in most major Canadian cities, its controversial history of overblown claims, combined with ignorance about its legitimate efficacy in more than a dozen conditions and a pharmaceutical-driven medical establishment, has resulted in the therapy being relegated to the sidelines.

"It's got no champion, " Dr. Wayne Evens, chair of the Ontario Medical Association's hyperbaric medicine division, said sadly of HBOT.



Diabetic Blood Circulation in Foot

Vascular Insufficiency of the Leg and Foot. People with diabetes are at risk for blood vessel injury, which may be severe enough to cause tissue damage in the legs and feet.

he told *The Globe and Mail* in a telephone interview from his office at HBOT Clinics Inc., a private facility that treated 12 diabetics last year.

"Diabetics are losing legs unnecessarily," Dr. Harrison said.

"It gets lost in the shuffle. It's not glamorous. The profession sees it as boring stuff involving yucky wounds mostly in old, smelly people."

Calgary hyperbaric physician Ross Harrison says the lack of information and widespread reluctance of doctors to refer their diabetic patients for HBOT is tantamount to a conspiracy of silence.

"That's definitely true,"

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Diabetics Losing Legs

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"There's no question. We run into a great deal of resistance from several different quarters," and mentioned one local health authority that flatly refuses to approve the treatment.

HBOT is long-established as a remedy for divers suffering from decompression illness and firefighters with carbon monoxide poisoning.

But since 1976, when the Undersea and Hyperbaric Medical Society first formed a committee to review research and clinical data, other therapeutic uses for HBOT have been added, with the recommended "indications" now refined to 13, including delayed radiation injuries (which may show up years after cancer treatment) and so-called problem wounds, the broad category into which diabetic foot ulcers fall.

Whether for treatment of "the bends" or a foot ulcer, patients enter a treatment chamber where they breathe 100-percent oxygen, at a pressure typically 2 ½ to three times that of sea level. With diabetic wounds, what this hyperoxygenation does is kick start a number of healing processes, chief among them the growth of new blood vessels.

Since 2001, there have been four randomized, controlled clinical trials of HBOT on diabetic ulcers—the gold standard in evidence-based medicine—though the patient numbers were small, ranging from 30 to 70.

All the studies found either markedly fewer amputations with patients who received HBOT (compared to those who didn't) or enormously improved healing.

Yet the Canadian Diabetes Association, which defines one of its functions as "effective advocacy" for diabetics, makes not a single mention of the therapy on its website. Indeed only last month did the CDA announce it will soon begin an independent technical review of the HBOT literature, with recommendations expected this summer.

The agency was responding to a letter from Bill Roman, president of the Canadian Council on Clinical Hyperbaric Oxygen Therapy, urging the group to "take a leadership role and provide this information to patients, physicians and the [Ontario] minister of health," and flatly describing the loss of limbs in Ontario as "a carnage."

Diabetes in Ontario, published in 2003 by the Institute for Clinical Evaluative Sciences and considered a top-level "practice atlas," devotes an entire chapter to peripheral vascular disease (the underlying problem that causes nerve damage and leads to amputation) without any reference to HBOT.

Federally, Health Canada devotes two pages on its website to HBOT and lists 11 recognized uses of the therapy—but none for problem wounds like foot ulcers.

Indeed Health Canada's "A-Z" on-line information guide has four listings about dengue fever, hardly the equal to the health crisis posed by diabetes, which experts universally estimate to be increasing by about 10 percent a year due to the aging baby boomer generation and what is euphemistically called "over-nutrition."

Yet there is one reference, currently unavailable, on the Ottawa website for hyper-

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Diabetic Trophic Ulcer. An ulcer is located just over the head of the first metatarsal, the result of vascular insufficiency and pressure. The patient most likely also has a loss of sensitivity to pain due to the neuropathy that commonly accompanies vascular insufficiency.

Dry Gangrene: Toes. The distal portions of several toes of the left foot are darkened because of gangrene. This is a form of coagulative necrosis that developed because of an insufficient blood supply most commonly the result of atherosclerosis of the arteries of the leg.

Diabetic Gangrene. The distal portion of the left leg is blackened because of gangrene probably due vascular insufficiency.

Dorsalis Pedis Artery. The lumen is markedly narrowed due to a thick intimal plaque which is the result of atherosclerosis.

Atherosclerosis of Anterior Tibial Artery. This artery is narrowed by a thickened intimal plaque due to atherosclerosis. The lumen is made up of two smaller lumens and calcium is deposited in a portion of the wall.

Diabetics Losing Legs

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baric oxygen therapy.

As Michael Garey, a hyperbaric doctor at Lakeview Hospital near Salt Lake City, Utah, says: "for some people, amputation is the best way to go. It's a good surgery. But a lot of people, we can save. And all of them deserve the right to have a say in it, and to know that there are options."

It was more than two years ago that the U. S. Centers for Medicare and Medicaid Services, the federal agency that administers the federal Medicare plan and helps states administer Medicaid, issued a "national coverage decision" expanding approved use of HBOT to specifically include coverage for "diabetic wounds of the lower extremities."

Starting in April of 2003, U.S. diabetics with serious ulcers that failed to heal within a month using standard treatment were eligible for HBO as an "adjunctive therapy,: a decision described by the OMA's Dr. Evans as "a very logical but gutsy move."

Dr. Evans, a hyperbaric doctor of 14 years at Toronto General Hospital's small unit and a University of Toronto assistant professor, noted that "the U. S. decision isn't the only piece of information. There's tons of scientific material that supports it [HBOT]. Admittedly, a large body of the older work is lower-quality evidence," he said, "but the recent work is pretty substantial evidence. It just doesn't get the headlines that a study of 5,000 patients gets. A huge study may be required to show a slight difference, but a smaller one can still show a statistically significant difference."

As Mr. Ted Sosiak, secretary of OMA's committee on hyperbaric medicine, told *The Globe*, because "there is no patent [to be had] on oxygen and no financial incentive, there's no one coming to do research with $20-million."

Yet, Dr. Sosiak says, "the evidence is there"—not only that HBOT works "about 75 percent of the time," but also that it's cost-effective.

"Amputation in Canada, using the CDA's own figures, costs about $74,000," he said, while an average course of HBOT treatment—30 or 40 are usually needed to fully heal a diabetic ulcer—costs between $8000 and $12,000.

"Amputation in Canada... costs about $74,000,... while an average course of HBOT—30-40 are usually needed to fully heal a diabetic ulcer—costs between $8,000 and $12,000."

The situation in this country is complicated by the provincial health insurance buttons, which cover HBOT. But some, like Ontario's , pay only for physician consultation, using archaic codes that were developed in 1968 when hyperbaric oxygen was used primarily with divers. In other plans, such as Alberta, clinics are also compensated with a "facility fee," which is billed to the local health region.

Because the Ontario style of funding pays no facility or technical fee, it means there's little incentive for hospital-based HBOT clinics, such as the one at Toronto General Hospital—the only hospital clinic serving the country's largest city—to treat elective patients such as diabetics or to expand. The TGH's so-called "standalone" budget is but $285,000, hospital spokeswoman Gillian Howard said, emphasizing that the clinic is meant to function as "an emergency service."

Ms. Howard said that in a given year, the clinic treats between 100 and 125 cases; there are about four elective patients a day, only two of whom *The Globe* has learned from other sources, are diabetics. These sources say this has translated to a waiting list of about a year at TGH, and about eight months at the provinces' other hospital clinics, located in Ottawa and Hamilton.

With TGH treating only about 15 diabetics a year, and the other hospitals together averaging about 35 annually, it means, Dr. Sosiak said, that not more than 50 of the thousands of Ontarians with deteriorating leg ulcers are able to take advantage of HBOT.

According to the Undersea and Hyperbaric Medical Society, there are 23 HBOT clinics—a mix of hospital, private and military facilities—across Canada. And diabetics who resist amputation and learn about the therapy will dig into their own pockets if necessary and travel to get the treatment.

Mary Svitek, a 64-year old from Windsor, guesses she spent about $10,000 for travel and accommodation while getting HBOT from a private Toronto clinic more than two years ago.

"Within two months, she told *The Globe*, "the ulcer on [her] right foot healed and even grew new skin that's still fine." But in early 2003 she developed three new sores on the bottom of the foot, and had to return for more treatment. "Two of them healed," Mrs.

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chronic Refractory Osteomyelitis

Pathophysiology and Hyperbaric Effects

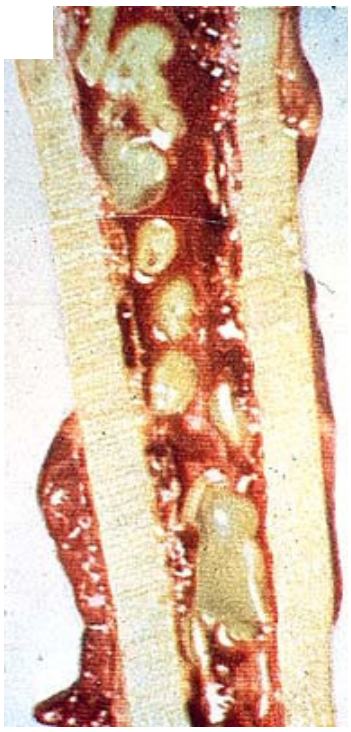
Osteomyelitis represents an inflammatory process with a bacterial infection involving bone. The disease involves ischemia as well as infection, and it may be acute, subacute, or chronic. The term "refractory osteomyelitis" refers to failure to heal despite adequate surgical and antibiotic therapy.

Osteomyelitis is currently classified by Waldvogel, et al., into hematogenous osteomyelitis, contiguous focus osteomyelitis, osteomyelitis associated with vascular disease, and chronic osteomyelitis. Clinicians use hyperbaric oxygen therapy (HBOT) for the treatment of refractory, acute, or chronic osteomyelitis. Osteomyelitis also may be classified by the Cierny-Mader classification as medullary, superficial, localized, and diffuse. The patients are also classified according to factors that may compromise their healing, such as "A," or normal host, or "B," compromised host.

Whatever staging system is used, HBOT is purely adjunctive and must be used with appropriate parenteral antibiotics (best determined by bone culture), surgical debridement, nutritional support, and reconstructive surgery.

In clinical practice, choosing the best treatment for osteomyelitis presents physicians with enormous challenges. Major therapies include antibiotics, surgery, and adjunctive therapies, such as HBOT. Historically, comparative clinical studies were used to evaluate the efficacies of different therapies. The multiple clinical variables involved in osteomyelitis make comparative clinical studies difficult to design and evaluate. Significant variables include different infected bones, differing organisms, and different treatment antibiotics. Additional variables include the routes of antibiotic administration, duration of antibiotic treatment, amount of bone penetration by the antibiotic, types of surgery, adequacy of debridement, dead space management, timing of surgery, and the status of adjacent soft tissues. Because osteomyelitis may relapse even years after apparently successful therapy, a minimum of two to five years of follow-up evaluation is recommended. Currently, the most valid osteomyelitis data come from animal model studies in which variables can be tightly controlled.

The results of several open clinical trials indicate that adjunctive hyperbaric oxygen therapy is useful in the treatment of chronic osteomyelitis. Slack reported on five patients with refractory chronic osteomyelitis who showed clinical improvement after treatment with hyperbaric oxygen at two absolute atmospheres. Perrins reported on 24 patients with chronic, recurrent osteomyelitis and cutaneous sinus tracts, in whom previous sequestrectomy, antibiotics, or marsupialization had been unsuccessful. A combination of HBOT and antibiotic therapy resulted in healing of 17 of Perrins' 24 cases. In four of the non-healed cases, drainage from the sinus tract diminished. In the remaining three cases, the sinus tracts were not influenced by the treatment. Depenbusch reported on 50 patients who had not responded to adequate antibiotic and surgical therapy. Thirty five of these patients (71 percent) had not healed completely after HBOT. The other 15 patients reported some improvement.



Acute Osteomyelitis. Osteomyelitis is a pyogenic infection of the bone and bone marrow. Often, it is due to blood borne bacteria (particularity in young persons), but may also be due to local trauma (especially compound fractures). Common agents are Staph aureus, Streptococci, enteric gram-negative rods, and Salmonella (especially in patients with sickle cell disease).

Pathologically, there is a suppurative reaction which can cause necrosis of fragments of bone (sequestra). The inflammatory exudate may develop considerable pressure and penetrate the cortex causing sinus tracts through the cortical bone into the soft tissues and through the skin. Chronic infections usually result in both bone destruction and formation. A rare, long-term complication of osteomyelitis is formation of squamous cell carcinoma in a sinus tract.

Two studies in which the patients served as their own controls were reported by Morrey and Davis. Morrey's patients met the following criteria: the infection persisted for longer than one month; at least one surgical debridement had been performed; at least two weeks of parenteral antibiotics had been administered; and the patients had been followed for at least one year after surgery. After HBOT therapy, appropriate surgery, and treatment with antibiotics, 34 patients (85 percent) remained clinically free of disease and six experienced recurrence of their osteomyelitis. Davis reported on 38 patients with chronic osteomyelitis who had failed to respond to a previous course of antibiotic and surgical therapy under the same criteria used by Morrey. Thirty four of these 38 patients (89 percent) treated with adjunctive hyperbaric oxygen, antibiotics, and surgery experienced an arrest of disease.

Esterhai performed the only randomized clinical study on adjunctive HBOT. Although his study represents a good attempt at evaluating adjunctive HBOT for osteomyelitis, it falls short of being definitive. The study involved a small number of patients and suffered from methodological problems. There was one failure in 14 patients in the non-HBOT

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group (93 percent) and three failures of 14 patients in the HBOT group (78 percent). However, three of the four HBOT treatment failures refused further necessary debridement surgery. The fourth patient had such extensive osteomyelitis the authors stated he required an ablative procedure that the patient refused. Thus, all four treatment "failures" were doomed by lack of cooperation, regardless of whether or not the patient received adjunctive HBOT.

To avoid the many variables of clinical osteomyelitis and to objectively evaluate the effect of HBOT in the laboratory, Mader used the Staphylococcus aureus osteomyelitis rabbit model developed by Norden. All animals treated developed stage 4A osteomyelitis in the Cierny-Mader classification system. The results of 28 days of treatment with either HBOT, antibiotic (cephalothin), or a combination of both, or no treatment (control) were compared. HBOT was administered for a total of 20 treatments. At the end of the study, cultures of bone were positive for S. aureus in 91 percent of the control animals, 36 percent of the animals treated with HBOT, 47 percent of the animals treated with cephalothin, and 40 percent of the animals treated with cephalothin and HBOT. All three treatment groups differed significantly ($p<0.01$) from the control group, but there were no significant differences among the treatment groups. Hyperbaric oxygen alone was as effective as cephalothin in the treatment of experimental S. aureus osteomyelitis.

To establish the mechanism of this effectiveness of hyperbaric oxygen in osteomyelitis, further studies were done. In vitro growth and cephalothin kill curves of this S. aureus strain were conducted after two hour exposure to HBOT. The studies revealed no change from parallel control studies in ambient air. Thus, the beneficial effect of HBOT was not due to the direct killing of the S. aureus.

Argon washouts (perfusion) and oxygen tensions were measured by intramedullary mass spectrometer probes placed in the metaphysis of infected and uninfected tibias. Mean tibial oxygen tensions under ambient room air were 21 mm Hg (infected) and 45 mm Hg (uninfected). During hyperbaric exposure, perfusion in the osteomyelitic bone decreased noticeably compared to normal bone. In vitro phagocytic kills of the S. aureus using a monolayer technique were performed in the tibias in these bones under ambient and HBOT conditions. Oxygen tensions measured 104 mm Hg (infected) and 321 mm Hg. In addition, studies were performed at oxygen tensions of 150 (ambient conditions) 760 mm Hg (100 percent oxygen) and 1500 mm Hg (1 ATA at 100 percent oxygen). Phagocytic killing of this S. Aureus strain decreased markedly at 23 mm Hg of oxygen; significantly improved at 45, 109, 150, 760 mm Hg; and was most effective at 1500 mm Hg.

These studies provided evidence for the following conclusions: hyperbaric oxygen, when administered under standard treatment conditions, was as effective as cephalothin in the eradication of S. aureus from infected bone; osteomyelitic bone in the experimental model has decreased blood flow and a greatly decreased partial pressure of oxygen; HBOT does not directly affect this strain of S. aureus; and HBOT can restore intramedullary oxygen tensions to physiologic or supraphysiologic levels, but this short exposure does not acutely increase blood flow in osteomyelitic bone. One mechanism for HBOT's effectiveness in S. aureus osteomyelitis may be the increase of intramedullary oxygen to tensions that maximize the efficiency of kill by phagocytes.

Increasing the oxygen tension produces a direct lethal effect on strict anaerobic organisms, and on some micro-aerophilic aerobic organisms. During hyperbaric oxygen therapy, an increase in oxygen tension leads to the increased concentration of superoxide, both intracellularly and extracellularly. Increased superoxide levels predispose to increased hydrogen peroxide production (as well as higher output of other toxic oxygen radicals). Anaerobic organisms are extremely sensitive to these proliferating oxygen radicals because most lack the superoxide-degrading enzyme, superoxide dismutase, and the hydrogen peroxide-degrading enzyme, catalase.

Thus, an increase in the oxygen tension with subsequent oxygen radical formation proves lethal or bacteriostatic for anaerobic organisms. Anaerobic organisms make up approximately 25 percent of the isolates in non-hematogenous osteomyelitis. In LeFrock's 1988 series focusing on long bone osteomyelitis at the University of Texas, Galveston, anaerobes made up 36 percent of the bone culture isolates.

Hyperbaric oxygen augments the bactericidal action of the aminoglycoside class of antibiotics. The major antibiotics in this drug class include gentamicin, tobramycin, amikacin, and netilmicin. The aminoglycosides lack good antibacterial activity under low oxygen tensions. Low oxygen tensions are found in osteomyelitic bone, and adjunctive hyperbaric oxygen increases tissue oxygen tensions in infected tissue, which allows the aminoglycosides to kill more effectively. Growth and killing studies of Pseudomonas aeruginosa were done aerobically, anaerobically, and under conditions which reproduce the hypoxic levels of infected bone, with reduction of the killing of Pseudomonas aeruginosa by tobramycin under hypoxic conditions.

The effect of tobramycin, of hyperbaric oxygen, and of hyperbaric oxygen plus tobramycin was next studied in the Ps. aeruginosa rabbit model of osteomyelitis. In this study, the presence of adjunctive hyperbaric oxygen enhanced the activity of tobramycin in the eradication of Ps. aeruginosa from infected bone. Adjunctive hyperbaric oxygen may also potentiate the bactericidal effect of vancomycin. Under low oxygen tensions, vancomycin, like the aminoglycosides, does not kill micro-organisms as well as under normal oxygen levels.

Oxygen is also important in wound healing. When the environment of the fibroblast has an oxygen tension of less than 10 mm Hg, the cell can divide, but it can no longer synthesize collagen. It also cannot migrate to where it is needed for healing. When the oxygen tension is increased, the fibroblast can again carry out these wound healing functions. The collagen produced by these cells forms a protective fibrous matrix, and new capillaries grow into this matrix. Wound healing is a dynamic process, and an adequate oxygen tension is mandatory for this process to proceed to a successful conclusion. HBOT provides oxygen to promote collagen production, angiogenesis, and ultimately wound healing in the ischemic or infected wound. Adequate wound healing is vital in the treatment of osteomyelitis.

Once the bone and soft tissue have been divided, whether by surgery or by infection, the bone and wound must be protected by healing tissues. Bone and soft tissue that fail to heal, or that heal slowly, are susceptible to bacterial reinfection or nosocomial infections. In patients with hypoxic and or/infected wounds, HBOT provides sufficient oxygen to promote collagen production, angiogenesis, and ultimately, wound healing. HBOT is generally unnec-

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Diabetics Losing Legs

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Svitek said, "but one is still open."

Yet she continues to walk and remain active. "To me, it would be very, very difficult to lose my leg. I'm a very active person."

Mrs. Svitek learned about HBOT on the Internet, where as the OMA;s Dr. Evans said, "You have to be a very good Googler and have an obsessive-compulsive persistence to unearth information."

"None of the doctors in Winsor seamed to be aware of it," Mrs. Svitek said. When she asked her family physician for a referral, she said his attitude was, "'Well, you can go ahead, but I don't know if it's going to work.' He was very impressed when he saw how it healed."

"It's made a believer out of me, Toronto private investigator Jack Hunter said. "I'd never heard of it, but it worked wonders."

At 66, Mr. Hunter's journey through surgery is typical of the slippery slope that for many diabetics begins with a minor amputation, and several agonizing procedures later, ends in death.

First the big toe on his right foot became discolored, then went black with gangrene; he had it amputated; then the adjacent toes went the same way; and on March 11, last year, the leg was amputated below the knee, and he walked out of the hospital five weeks later on a brand-new prosthesis.

But three months later, informed enough now to be panic-stricken, Mr. Hunter notices "a little black spot" between his toes on his left foot, and ultimately lost two toes and a piece of the sole. He credits HBOT, which he received at Toronto General Hospital from Dr. Evans, with saving his leg. "At the end of eight weeks, it's really doing well. It's almost healed. It's just amazing," he said.

Most of the physicians interviewed by The Globe say the demand for HBOT is primarily patient-driven. "Why isn't there more usage?" the OMA's Dr. Sosiak asked rhetorically. "Physician ignorance, no training [in HBOT] in our universities, patient ignorance, a culture of antagonism."

And, Dr. Garey of Utah's Lakeview Hospital said sadly, "Part of it is politics; part of it is that doctors are not exposed to it in resi-

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BottomLine

health

The Oxygen Cure

Daniel Hamner, MD

Every cell in the body requires oxygen to function properly. The brain alone uses at least 12% of the total oxygen that people inhale. *Problem*: The breathing habits of most people *don't* always provide all the oxygen that the brain and body need.

Oxygen deprivation is a leading cause of persistent fatigue—a condition that accounts for up to 15 million doctor visits annually, making it one of the most common health problems in the U.S. It also causes mental fogginess and, in some cases, depression.

My story: For years, I barely had enough energy to get through my workdays. I started reading about energy-building techniques—everything from yoga to the latest research in physiology. I quickly realized that all these techniques aim to increase oxygen levels in the body.

At age 47, I developed—and began practicing—a high oxygen program. Within a matter of months, my oxygen usage rose from 43.7 milliliters of oxygen per kilogram of body weight per minute to 55 milliliters—a 30% increase. At the same time, my energy levels rose dramatically.

Oxygen Therapy

For years, oxygen has been administered under high pressure to treat decompression sickness (the bends) in deep-sea divers...to enhance the body's ability to fight bacterial or viral infection… to deactivate lethal poisons, including carbon monoxide… and to heal burns and bone or tissue damage caused by radiation therapy.

***Now*:** Hyperbaric oxygen therapy (HBOT) is being used experimentally to aid stroke recovery and treat other serious conditions, such a multiple sclerosis, Lyme disease, cerebral palsy and autism.

***What's involved*:** Patients sit or lie in a sealed chamber while the atmosphereic pressure is gradually increased—to up to three times normal—and breathe up to 100% oxygen (normal air contains 21% oxygen).

HBOT is painless. Most people experience only sensations of fullness and "popping" in the ears (similar to what is felt when changing altitudes) during a 60- to 120-minute session. The number of sessions depends on the condition being treated, but ranges from 10 to 100. *Typical cost per session:* $100 to $300. Insurance may cover some uses of HBOT.

HBOT is available at 400 large hospitals and medical centers in the U.S and Canada.

Dr. Hamner is a physiatrist (physical rehabilitation specialists, and sports physician.

Chronic Refractory Osteomyelitis (*continued*)…

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essary in a non-compromised patient with a wound, unless there is either surgical hardware in the wound, or the infection occurs in a critical bony structure, such as the skull or sternum.

Refractory osteomyelitis is chronic osteomyelitis which has persisted or recurred after appropriate interventions have been performed, or acute osteomyelitis which has not responded to accepted management techniques. Most patients with refractory osteomyelitis are compromised hosts, and they generally have either systemic or local Cierny-Mader factors, which reduce their ability to heal. Cierny-Mader systemic factors include renal, immune, or liver failure, malnutrition, diabetes, hypoxia, malignancy, extremes of age, and tobacco abuse. Others encompass local factors, including edema, stasis, vascular compromise, scarring, fibrosis, and hypesthesia. Furthermore, studies by Niinikoski and Hunt have shown osteomyelitic bone to be profoundly hypoxic, with oxygen levels of 20 mm Hg or less. Hyperbaric oxygen therapy, HBOT, reverses the hypoxia, and modifies many of the Cierny-Mader factors. HBOT reduces edema, and causes the in-growth of new capillaries into fibrotic or scarred areas, as shown by Hunt et al. HBOT improves the ability of the host to fight infection by directly killing anaerobic bacteria (which comprise 15 percent of all isolates from chronic osteomyelitis); enhancing neutrophil functioning for the destruction of aerobic organisms (Hohn); and improving the transport of commonly used antibiotics, such as the aminoglycosides, across the bacterial cell wall, as shown by Mader et al., and by Morrissey.

Animal and human studies support the use of HBOT in chronic refractory osteomyelitis. Numerous human studies support the animal findings. Strauss found adjunctive hyperbaric oxygen to be the most cost-effective treatment for chronic refractory osteomyelitis. Davis et al., studied a unique group of osteomyelitic patients, those with malignant otitis externa, a progressive and potentially fatal Pseudomonas osteomyelitis of the ear canal and base of the skull. They found that all eight patients with Stage I disease (infection localized to the canal) treated with adjunctive HBOT survived, as did the Stage II patients (infection spread to the base of the skull). Their three HBOT patients with Stage III disease (intracranial extension) represented the first survivors with this severity of malignant otitis externa.

Based upon the extensive data submitted supporting the use of adjunctive hyperbaric oxygen therapy for chronic refractory osteomyelitis, and its subset, malignant otitis externa, we believe adjunctive HBOT to be both clinically effective and cost effective, and it is an appropriate use.

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Next issue: Stroke Awareness Month

The International Hyperbarics Association is a coalition of doctors, parents, patients, corporate chamber-industry professionals, hyperbaric center owners, and above all members who are committed to the cause of medical hyperbarics.

Our members come to us from all geographical areas with one common goal— to share their knowledge and information regarding the latest hyperbaric news.

Our driving force is our members, who are committed to do all we can "to give life to the world."

— "Mundo vitam dare"

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Diabetics Losing Legs

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dency and what they're not exposed to, they're leery of. I run into that when I lecture at the university… I always reply, 'How many of the 39,000 articles have you read?'

He said that in his six years of hyperbaric medicine, he has treated "dozens of people who were told they needed amputation, and we were able to save their limbs." Given that most diabetics facing amputation are older, Dr. Garey said, saving their legs "is a tremendous quality of life issue. Rehabilitation is not a fast thing, not any faster than wound care. Prostheses are much better now, true, but most of the elderly can never successfully use them. Almost 50 percent [of those who undergo amputation] die within months."

Dr. Garey said hyperbaric doctors often make the black joke that only when they develop a "scratch 'n' sniff panel for our pictures" will HBOT get the recognition it deserves.

In June, he will present a paper at the Undersea and Hyperbaric Medical Society conference in Las Vegas. The title of his paper? "Limb Salvage." Who would have thought that in 2005, such a discussion would be necessary.