CLEARING THE AIR ON HYPERBARIC OXYGEN THERAPY

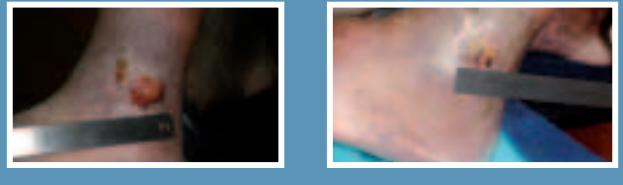
Studies show that about half of diabetes patients already have diabetes-related complications such as blindness, nerve damage, kidney failure, heart disease and limb amputation at the time of diagnosis. Perhaps the most dramatic and debilitating complication of diabetes would be amputation. Dr Nantha Kumar & Dr Kevin U. Chan of Hyperbaric & Occupational Medicine Pte Ltd dive into the topic of hyperbaric oxygen therapy (HBOT) and its treatment of wounds.

Diabetes is one of the most common chronic illnesses in the developed world today. Worldwide, the prevalence is estimated at 4%. This is expected to increase to 5.4% by 2025. Unfortunately, Singapore has an even higher prevalence of diabetes, with a survey in 1999 showing that 9% of Singaporeans have diabetes. This translates into almost 300,000 Singaporeans suffering from diabetes.

Diabetic foot ulcers affect 15% of all people with diabetes. Foot ulcers precede approximately 85% of all major amputations of the lower limb. Within a year of amputation approximately 9 to 20% of all people with diabetes undergo a second amputation. There can be few things as distressing, for both patients and their loved ones, emotionally and disabling physically as losing a limb. In addition to this, with fast spiralling health care costs, amputation and the subsequent costly physical and mental rehabilitation places a further stress on patients' pockets.

For a long time, the mainstays of treatment for patients with lower limb ulcers have been surgical debridement and wound dressing. However with an almost four-fold greater incidence of peripheral vascular disease in people with diabetes, most patients have very poor blood supply to the extremities. This leads to the ever present danger of non-healing wounds even after debridement. And the poor blood supply also means that no matter how much antibiotics are prescribed, the tissue concentration of these expensive antibiotic cocktails does rarely reach therapeutic levels. Mixed with decreased sensation to the feet, dry and fissured skin, and a generally depressed immune system and you have a festering ulcer waiting to happen.

CHRONIC NON-HEALING ULCER



BEFORE *AFTER*

With an ever increasing number of people with diabetes and the fact that amputations and chronic wound care push up the burden on our health care costs, it becomes clear that a novel adjunct must be found to prevent amputations. The light at the end of the proverbial tunnel seems to be HBOT.

HBOT is hardly a new invention. It has been in use since 1943, the year it was adopted by the United States Navy, for the treatment of decompression sickness or the "bends" as the illness is more commonly known. Over the past 50 years, hyperbaric medicine has come into its own. With increasingly sophisticated trials and more light being shed on the tissue and cellular effects of HBOT, the conditions which seem to benefit from HBOT has increased tenfold. The Undersea and Hyperbaric Medical Society, the governing body of hyperbaric medicine, has approved HBOT for the treatment of 13 selected conditions (see table on P17).

What exactly is HBOT? Simply defined, it is the administration of pure oxygen to the patient in a pressurised environment (greater than 1 atm). The effects of this are astonishing to say the least. Due to the gas dynamics of a pressurised environment, the amount of oxygen dissolving into the plasma increased by almost 400 per cent. The partial pressure of oxygen at 2-3 atm is almost 15 times that of oxygen at normal 1 atm. In short, there is a quantum leap in the amount of oxygen reaching the tissues.

SKIN BURN

BEFORE *AFTER*

The sum total of the increase in tissue oxygenation is to combat the chronic hypoxia (low oxygen levels) that is all too common in diabetic foot infections. This results in increased cellular proliferation and increased formation of small blood vessels. Increased collagen synthesis has also been shown in animal studies. Furthermore, bacteria which thrive in an oxygen poor environment are destroyed by the tidal wave of oxygen that seems to occur with HBOT. HBOT increases the killing ability of white blood cells in the tissues of that area,

NO	13 CONDITIONS	LAYMAN TERMS
1	Air or Gas Embolism	Diving Accident
2	Decompression Sickness (DCS)	Diving Accident
3	Carbon Monoxide Poisoning	Gas Poisoning from Carbon Monoxide
4	Clostridial Myositis and Myonecrosis (Gas Gangrene)	Infection of skin & bone
5	Crush Injury, Compartment Syndrome and other Acute Traumatic Ischemia	Inflammation & swelling of limbs
6	Enhancement of Healing in Selected Wound Problems	Improve wound healing for diabetic wounds
7	Exceptional Blood Loss (Anemia)	Low blood count
8	Intracranial Abscess	Infection inside the brain
9	Necrotizing Soft Tissue Infections	Soft tissue infection
10	Osteomyelistis (Refractory)	Bone infection
11	Delayed Radiation Injury (Soft Tissue and Bony Necrosis)	Post radiation therapy of bone & skin
12	Skin Grafts & Flaps (Compromised)	Process for skin transfer
13	Thermal Burns	Skin burns

making them more able to combat the bacteria that cause foot ulcers. HBOT inhibits toxin formation and promotes the ingestion of bacteria by the body's normal immune system. Increased oxygen levels in the local tissue also seem to promote the effects of antibiotics administered. In short, HBOT seems to have a plethora of beneficial effects on local tissues and makes a definite impact on decreasing the risk of amputation and increasing the rates of wound healing. This has been evidenced by a number of international trials in the last eight years.

Currently, HBOT is in its infancy in Singapore. With clear clinical data that proves the efficacy of HBOT in the treatment of a number of conditions including wound healing, there is no doubt that the awareness of HBOT will grow among the medical community of Singapore.

While HBOT has been demonstrated to have significant benefits, it plays both a primary treatment and a supportive role in the management of the various conditions. As a primary treatment, HBOT is used to treat diving accidents like Decompression Sickness (DCS), Arterial Gas Embolism (AGE), and it also works best as a supportive treatment when used in combination with surgical debridement and wound care by a dedicated health care team. Its advantages are that it potentiates the effects of existing treatments while providing beneficial effects to wound healing. It is non invasive, and causes minimal discomfort to the patient. This makes it very suitable for a wide spectrum of patients including the young and the old.

BEFORE

AFTER

In short, diabetic foot care is a pillar of the total multidisciplinary approach that must be the bedrock of diabetes treatment in day and age. The prevention and aggressive treatment of complications of foot ulcers coupled with good sugar control has been demonstrated to reduce greatly the number of serious infections and amputations. HBOT seems to provide a non-invasive, effective way to treat chronic foot and other non healing wounds. While the long term verdict is out and larger scale HBOT trials are underway, there is clear evidence that HBOT does improve wound healing outcomes. It provides a welcome ray of light to people with diabetes the world over.