

SPUMS ANNUAL SCIENTIFIC MEETING 1985

HYPERBARIC OXYGEN TREATMENT IN HOBART

PW McCartney

I will start by describing the facility that is in Hobart, and then the work that has been undertaken in the last four and a half years.

The chamber is a standard "off the shelf" model as used on oil rigs for on-platform deck recompression of air, mixed gas, and saturation divers, and for short medical treatments of decompression sickness.

The chamber is 3.8m (12 feet 8 inches) long, comprising a 2.7m (9 feet) treatment compartment and a smaller access segment with an external door.

There is a medical transfer-under-pressure lock in the main compartment. This allows for drugs and equipment to be sent in and out of the chamber when a treatment is in progress. Large portholes allow for good interior lighting from an exterior source.

The air supply is from two compressors through a pressure reserve tank; in addition there is an ancillary air bank as a standby in case of compressor failure. On entering the chamber the air is ducted three quarters of the way along the entire complex and a silencer is installed in this system. This silencer proved to be effective in cutting down noise levels and is a valuable addition to the chamber as it enables easy conversion to take place in the chamber during treatments without raising voices. All efforts should be made to ensure as tranquil an atmosphere in the facility as possible.

Oxygen is supplied through two Scott duo-seal masks in the main chamber and an Airbox mask in the access chamber. The Scott masks have a demand valve on the oxygen inlet side and are sealed with a skirt to the contours of the patient's face; thus ensuring an atmosphere separate from the chamber air.

An oxygen overboard dump system is installed and used whenever hyperbaric oxygen therapy is being administered. This is very important both for chamber safety in respect of fire and explosion and for protection from oxygen toxicity in the medical attendant. The UPTD (units of pulmonary oxygen toxicity dosage) of attendants is very low and certainly well below 500 even after our longest treatments. Levels should be below 1,400 if pulmonary oxygen toxicity is to be prevented.

Chamber ambient oxygen levels have been monitored during treatments and the oxygen overboard dumping system works well. The levels of ambient oxygen being within the limits envisaged in the forthcoming standards requirements.

Two fire systems are installed, one entirely operated from outside the chamber. Considerable thought and planning went into the installation of this as it is necessary to pressure isolate the entire system from the hospital water supply.

Fireproof blankets are used, and temperature control has recently been made easier by using a ducted hot air system to heat the room where the chamber is installed.

TREATMENT

Over the 4 1/2 year period mentioned, a total of 242 separate treatments have been administered, approximately one

per week for the period.

Table 1

Diagnoses, and number of patients treated

Decompression Sickness	18
Necrotising Fasciitis	2
Gas Gangrene	5
Refractory Osteomyelitis	2
Problem Wound Healing	2
Multiple Sclerosis	16
Teaching and Demonstration	19
Accidental Air Embolism	1

Overall

Youngest patient ... 5 yrs. Oldest patient ... 85 yrs 9 patients were females.

I will comment on some of these categories.

Decompression Sickness

This group comprised 15 abalone divers and 3 "industrial" divers. There were no sports divers in the group. Four had spinal bends and two of these were severely injured and were left with sequelae.

The remaining 14 cases of limb bends recovered uneventfully.

Necrotising Fasciitis

I presented these two cases at the Madang Meeting and they appeared in the SPUMS Journal (Oct-Dec 1982; 12(4): 8-10).

Gas Gangrene

Of our 5 patients, the most toxic case was an immunosuppressed kidney recipient. The gravity of his condition made the clinicians consider the cessation of his immunosuppressants, thereby sacrificing his kidney, in order to save his life. This option was put to the patient and he indicated that he would commit suicide if this were done. This case was written up in the Australian Medical Journal, 12th June 1982. In all 5 cases the clinical results were satisfying, the tissue salvage was good and exceeded the expectations of the referring doctors. I feel that these results have made a positive contribution to hyperbaric oxygen therapy being used in Hobart.

Refractory Osteomyelitis

In both cases the wounds stopped discharging and antibiotics were stopped at the end of the hyperbaric oxygen treatment.

I have lost contact with one case but the second patient still contacts me from time to time and he is well after 2 1/2 years. He is an engineer and the success of his treatment has meant a great improvement in his life.

Problem Wound Healing

In both cases hyperbaric oxygen therapy effected healing after all other methods had been used without success.

Multiple Sclerosis

Strict guidelines are observed before a patient is accepted for treatment. Among the pre-treatment workup requirements are a detailed history of the disease profile, a neuro-

physician's comprehensive examination, and investigations, including audio evoked responses and visual evoked responses. These parameters are assessed by the physicians totally independent from the hyperbaric oxygen facility. After the course of treatment the same parameters are again measured. A full and frank explanation is given to the patients so as not to exaggerate their expectations, and they are asked to agree to the pre- and post-treatment measurements with the acceptance that this data is for research purposes.

Teaching and Demonstration

These have proven useful for a number of resident doctors and medical students, police divers, senior scuba instructors and the Australian Antarctic Division personnel.

Burns

I had to "knock back" the only patient with severe burns referred for treatment because he was too obese to fit through the door of the chamber.

I hope a larger facility will be available in the future as I feel that hyperbaric oxygen therapy has a role in modern medicine.

ENVENOMATION

CJ Acott

Over the past three years 30 suspected cases of envenomation have been admitted to the Intensive Care Unit (ICU) at the Rockhampton Base Hospital. Nine of these have required anti-venom. After studying these admissions I can state that the best time for touring Central Queensland is between July and September, if one wants to avoid the nasties.

Anti-venom for snake bites is the main use of anti-venom in Rockhampton. A third of all our snake bite victims have required treatment. Four sea snake victims have been admitted over the past 5 years. One of these has required anti-venom. This was a two year old girl who was bitten, savaged would probably be a better description of the attack, on her left foot and ankle. Poor first aid measures were used, and the child required intubation 40 minutes after being bitten. The snake was identified as an *Astrotia Stokesii*.

Since then three other people have been bitten by sea snakes. One victim was snorkelling and thought the snake was a large piece of wood. I think he was rather surprised when the piece of wood turned around and bit him on the forearm and on the wrist. Another victim was walking in shallow water and felt something bite his foot. He lifted his leg out of the water, and there was a snake curled around it. Good first aid measures were applied immediately and he was brought into hospital.

One is always likely to see sea snakes off the central Queensland coast when diving and because of this and the four victims of sea snake bite I have developed an interest in sea snakes.

SEA SNAKES

The Hydrophiliae (true sea snakes) are recognised by their flattened paddle-like tails. They grow to variable lengths, some can be more than 2 metres long. They are

mainly fish eaters, and are usually bottom feeders, however, the *Perlarmis Platurus* (Yellow Bellied Sea Snake) is a surface feeder. They are preyed upon by sea eagles, sharks and seals.

Lacking the ability to regulate their own body temperature, they are often found sunning themselves on the surface. This will only elevate their temperature slightly. They cannot breed or survive in water below 20°C, hence their distribution in tropical and sub-tropical waters throughout the Indian and Pacific Oceans.

The most widely distributed of all the species is the *Pel. Platurus*. Local distribution around any reef is patchy and is probably due to seasonal shifts which determine winds, currents and food supplies. They live in sea water, but captured ones have been kept alive in tap water. Some species of the *Enhydrina Schistosa* have been found in fresh water lakes of Cambodia and the Philippines.

There are strong evolutionary links between the Tiger snake and the Hydrophiliae. Baxter and Gallichio found that there was cross neutralization in vitro between some sea snake venoms and the Tiger Snake anti-venom. If no sea snake anti-venom is available, Tiger snake anti-venom can be used instead.

Sea snakes have one lung which extends into the abdominal cavity. This is divided into three sections, the two front sections are rich in blood vessels, while the posterior section acts as a gas storage organ, taking no part in gaseous exchange.

They are capable of diving to depths of 100 metres, and their maximum voluntary submergence time is two hours. Anaerobic metabolism is only used in an emergency. The sea snake's skin is unique. It has a respiratory function. Not only is a third of the snake's O₂ requirements taken up during a dive through the skin, but CO₂ and Na are eliminated.

Statistics of attacks and their subsequent outcome are difficult to obtain. There are probably thousands of attacks each year, the usual victim being fishermen in South East Asia.

Generally the species from Australian reefs are relatively inoffensive and only rarely will they attack when provoked. However catching, restraining or striking them may convert curious behaviour into an aggressive attack. Stay clear when they are feeding, or mating. If they are swimming in pairs, this usually indicates that they may be mating. Treat them with respect and handle them gently if you have to. Application of commonsense often prevents trauma both to you and to the snake.

The bite is usually painless, the victims hardly realizing that they have been bitten. Defensive bites rarely release venom. In the envenomating bite most venom seems to be released at the first bite. The *Astrotia Stokesii* (Stoke's Sea Snake) can inject large amounts of venom in each of seven successive bites. After their venom stores have been depleted it takes seven days for the supply to be replenished. The venoms of sea snakes are interesting. Fish and mice are susceptible, as well as man, but the reef eel is not. Broadly speaking they have either neurotoxic or myolytic properties or a combination of both.