

Sunday June 24th

Report by Dr Janene Mannerheim

Doctor Jefferson Davis commenced the SPUMS Conference for 1979 with an account of how a US Air Force Colonel became involved in Underwater medicine. Prior to 1959 the USAF had reported over 1700 cases of altitude decompression sickness and of these 750 were serious (neurological). Jeff has researched these and reported them (Davis JC, Sheffield PJ, Schuknecht L, Heimbach RD, Dunn JM, Douglas G, and Anderson GK. Altitude Decompression Sickness: Hyperbaric Therapy Results in 145 Gases. Aviation, Space and Environmental Medicine August 1977: 722-730). He was treating aviators with decompression sickness and in Amsterdam became involved in hyperbaric oxygen therapy. Since then there has been an explosive increase in sports diving cases and he has treated over 100 sports divers with decompression sickness.

Decompression sickness can be seen as three separate diseases.

1. Gas separation (bubbling) requiring immediate treatment.
2. Blood/bubble interaction requiring complicated treatment.
3. Permanent tissue damage.

The terminology of decompression sickness needs clarifying. There are objections to classifying decompression sickness as Type I and Type II, eg. Limb bends is a tag which really means that at the same time as joint pain is occurring central bubbling can be picked up pre-cordially with a Doppler detector. Better terms could be found for aero-embolism and dysbarism as they are too confusing, meaning different things to different people.

Limb bends symptomatically can vary from mild to severe. Where are the bubbles? The gas probably separates in tendons and ligaments, causing a tendonitis. It has been shown that gas in the joint cavity is painless. Swelling of the hands can occur from lymphatic bubbles. Exercise aggravates the pain. Pressure eases it. A sphygmomanometer cuff inflated over the site of pain eases it, by squashing bubbles which have separated out.

Jeff presented slides of the School of Aerospace Medicine, Brooks Air Force Base, Texas. The hyperbaric chamber facility consisted of a large hypo/hyperbaric chamber used for treatment and research, and a small chamber. Both with depth capabilities of 225 feet. An unconscious patient can be slid in on a trolley.

Hyperbaric oxygen can be used to treat:

1. Decompression Sickness
2. Gas gangrene
3. Carbon Monoxide
4. Gas embolism
5. Refractory Osteomyelitis
6. Osteoradionecrosis
7. Soft tissue radionecrosis
8. Non-healing ischaemic soft tissue wounds
9. Slow bone healing after osteotomies
10. Burns

Decompression sickness which has been treated in his chamber includes:

1. Decompression sickness presenting with skin rash pruritis and mottling.

2. Presenting with fatigue, often a precursor (as are skin manifestations) of more serious symptom.

3. Chokes, presenting with dyspnoea, substernal pain, cyanosis and an irritable non-productive cough. McIver, Fife and Ikels have shown that its pathophysiology requires numerous central venous bubbles filtered in the lungs to form pulmonary gas emboli followed by a blood/bubble interaction with a decrease in platelets and an increase in serotonin and in epinephrine (adrenaline for Australians).

4. Neurological decompression sickness. 15-25% of all cases (other than Pacific Island native divers) present as neurological decompression sickness. The clinical manifestations are confusing and there appears to be no pattern, which is understandable given the number of sites in the CNS where bubbles can lodge. Onset is gradual from within several minutes building up over approximately 6 hours. Never diagnose hysteria!

i. Spinal decompression sickness most commonly starts with low back pain - upper lumbar, lower thoracic level, radiating to the abdomen, then parasthesiae and weakness of the legs. It is followed by loss of the anal sphincter tone and bulbocavernosus reflex and finally urinary retention. What's that you say? The bulbocavernosus reflex. Put your finger in the patient's anus and with the other hand pull his penis. If the reflex is present the anal sphincter contracts and your finger is gripped. There was no information on how to elicit the reflex in females. Hallenback, Bove and Elliot's research on dogs supports the hypothesis that the following sequence of events occurs.

- a. Pulmonary Gas embolism
- b. Raised pulmonary arterial pressure
- c. Raised azygos vein pressure
- d. Obstruction of the epivertebral venous system causing stasis
- e. The stasis and bubbles lead to platelet aggregation and damage, thrombosis, congestion and haemorrhagic infarcts on the white matter.

Goats have been found to have congestive spinal infarcts although they have only had symptoms of limb bends.

Case 39 years old, Male Oral Surgeon. One 72 cubic foot tank. Depth 110-160 feet. Ascended on reserve. He repeated the dive after a 30 minute surface interval. He developed abdominal pain, numbness and weakness of his legs. He recompressed himself on air at 20 feet. When he ascended he had only tingling of his right foot. Next day he dived to 140 feet, on ascent spent ten minutes at 70 feet and 15 minutes at 10 feet. He still had tingling of his right foot. Management: First do a neurological examination. Tremor of the hands found. He was compressed and decompressed on an extended USN Table 6, which gave complete recovery.

ii. Brain decompression sickness presents often with visual disturbances, blindness blurring of vision, etc. Also spotty motor and sensory loss, mental confusion, headache and convulsions. The mechanism possibly involves bubbles in the lipids.