24% mortality rate. 9 of the 58 cases were from elective surgery on patients with peripheral vascular disease who received no antibiotic cover. 16 were caused by trauma, ie. agricultural and industrial accidents. Clostridium perfringiens is a Gram positive rod (however dead Cl. perf. stain Gram negative).

The patient's own immunity is important. If they cannot help themselves hyperbaric oxygen therapy cannot help them. Eg. a patient with Hodgkin's disease on immunosuppressants who had a WCC of 20,000 developed gas gangrene following grazing an elbow. Other cases of gas gangrene were shown including slides of a buttock pierced by a bull's horn, scrotal infections, necrotizing fascitis in diabetics, and a child who had had a hind quarter amputation before being referred to Prince Henry Hospital. This last patient probably would have kept his leg if he had been referred early in the disease.

Wednesday 27th June

Report by Dr Janene Mannerheim

In the morning some members visited the British Base Hospital in Vila and were invited to join a wardround. New Hebridean patients suffering from TB, tibial osteosarcoma, maxillary lymphomas (not Burkitt's) and bilateral corneal opacities were presented.

Following the AGM the new president, Dr John Knight, took us on a panoramic study of the hyperbaric chambers in the western Pacific. Slides of chambers at HMAS PENGUIN, and the Hyperbaric Unit at Prince Henry Hospital in Sydney were shown along with those of chambers at Prince Henry's Hospital, Melbourne, the Melbourne Metropolitan Water Board works at Braeside, and at the Fishermen's Co-operative at Mallacoota in Victoria. Outside Australia the slides showed chambers in Nauru and Truk. Finally two portable chambers were shown, one a Portable Inflatable Recompression Chamber or PIRC which was demonstrated at the UMS meeting at Miami in June 1979 and the other is produced by Dräger. In this the attendant sits up with his legs under the stretcher that the patient lies on. From the outside it looks like a large red boot. It can be attached to a Dräger chamber and the front of the foot removed and the patient lifted into the larger chamber. This transfer under pressure capability is useful but limited as it will only mate with a Dräger chamber.

Dr Jefferson Davis continued with the topic of hyperbaric oxygen therapy. It is possible for a hyperbaric chamber to pay for itself if it is used for the other conditions mentioned previously. The largest hyperbaric oxygen complex has six chambers and is in Moscow, USSR. Treatments are usually one per day per patient, every day, for thirty days, excluding Saturdays and Sundays. For instance patients with refractory non-healing treated with 100% oxygen at 2.4 ATA for 90 minutes. There are 5 minutes air breaks every 20 minutes during this time. Treatment is given five days a week. This exposure gives am arterial PO_2 of 1100 to 1300 mm Hg with additional oxygen carried in solution in the plasma. Optimum tissue PO_2 is 30 mm Hg. In these sorts of wounds the PO_2 is much lower. The rise in PO_2 results in fibroblastic proliferation, collagen formation and capillary buddings and the fistulae heal and epithelium grows over.

We were shown a series of slides of 23 cases of radionecrosis with non-healing. These patients were treated with hyperbaric oxygen, surgery and antibiotics. Most had pain relief within 10 days of starting hyperbaric oxygen and healing followed unless there was residual tumour.

In a series with osteomyelitis which was refractory to conventional treatment 53 were treated with hyperbaric oxygen. 12 months later only 6 of the 40 who were followed up had had a recurrence. This is an 85% success rate. The necessity of surgery, antibiotics and co-operation with the orthopaedic surgeon was stressed. Further slides of individuals whose chronic ulcerations and fistulae were healed by hyperbaric oxygen included radionecrosis of the vagina and buttocks, radiochondritis of the larynx, oro-cutaneous fistulae diabetic ulcers and gangrene, one requiring daily treatment for two years, a venous stasis ulcer present for 15 years, and amputation stumps.

If hyperbaric oxygen therapy is continued for too long the fibroblasts are killed. As a rule of thumb a wound that won't heal has tumour in it.

Following radiotherapy and prior to any surgery patients should receive hyperbaric oxygen therapy as it encourages good wound vascularization for further reconstruction.

The absolute contraindications for hyperbaric oxygen therapy are:

1. Pneumothorax
2. Pulmonary blebs
3. Pulmonary cysts
4. Systemic viral disease
5. Optic neuritis

The relative contraindications are:

1. Inability to equalise middle ear pressure. Those who cannot equalise may need polyethylene tubes inserted through the tympanic membrane.
2. Fever
3. Chronic pulmonary disease. These people require a very slow ascent to avoid pulmonary barotrauma.

Dr Ian Unsworth, who has the most experience of treating patients with hyperbaric oxygen in Australia continued the subject. He discussed its use in non-healing ulcers. He believes that it is necessary to apply oxygen topically to the ulcer as well as systemically to the patient. He covers the area with a plastic bag and seals it to the skin and runs oxygen through the bag. Ian mentioned the loss to the community, let alone to the individuals who suffer, from burns. More needs to be done in this field as some centres are reporting dramatic improvements with hyperbaric oxygen twice a day to burns. Not only does the burn tend to be less infected but they also heal much more quickly than with normal conventional burns therapy.

He also discussed the work that he and Dr Yeo have been doing with spinal trauma cases. The results are encouraging but not conclusive.

Thursday 28th June

Report by Dr Janene Mannerheim

Pulmonary Overpressure Accidents

Dr Jefferson Davis

The bursting pressure of the human lung is some 50 to 100 mm Hg which is equal to 3 to 5 feet of seawater.

Lung rupture results in:

Mediastinal Emphysema
Arterial Air Embolism
Pneumothorax

Precipitating factors are panic, breath holding, laryngospasm at depth, pulmonary disease, eg. blebs, obstructive lung disease, and abnormalities in lung compliance.

The greatest danger is in shallow depths, due to the greater expansion of air with the pressure change. For instance travelling from 99 feet to 66 feet produces the same gas expansion as travelling from 11 feet to the surface.

From the pulmonary capillaries air travels into the pulmonary veins, then to the left side of the heart and on through the internal carotids to the brain.

Slides of experiments involving air emboli in cat cerebral arteries showed the cat with its arteries exposed, then with bubbles visible and later in a 30° head low position with the arteries clear.

The Clinical Manifestations

Cerebral gas embolism manifests itself as loss of consciousness, confusion, aphasia, visual disturbance, parasthesiae, vertigo, convulsions, paralysis, chest pain, skin changes, retinal artery bubbles and arrhythmias.

Gas embolism, mediastinal emphysema and pneumothorax can all exist at the same time.

Treatment

Always do a neurological examination before beginning treatment.

Only treat a pneumothorax in a recompression chamber if it co-exists with air embolism. Put in a chest tube (intercostal cannulation and suction or underwater drainage) at depth before ascent. Air embolism patients should be immediately compressed to 6 ATA in the Trendelenberg position.

Special Considerations

Attendants will be required at depth as the patient may become violent. Remember the chamber is HOT AND NOISY and that the patient is disorientated and may have burst ear drums from rapid compression.

Drowning

Dr Jon Pegg

Jan Pegg is a regular, informative and welcome speaker at SPUMS annual conferences. His first slide depicted the evolution of man from water to land to water again in cartoon form. He then demonstrated osmosis with passage of fluid through a semi-permeable membrane from a hypotonic to a hypertonic solution.

We were entertained with a movie of an anaesthetised, tracheotomised rat submerged in isotonic fluid subjected to 200 psi partial pressure of oxygen. Although the rat was making heavy weather of breathing water he was getting enough oxygen and survived the experiment. He woke up under water as his ether anaesthesia wore off. For an adult human to breathe water in the sea seems physiologically impossible. There is the inability of the airways to move enough water, the non-isotonicity of seawater, and the difficulty of raising the PO_2 high enough.

In drowned victims estimates of serum sodium in mEq/L are as follows in blood taken from the left ventricle:

Fresh water	128 ± 12
Other Fluids	135 ± 10
Sea water	150 ± 13

However 10% have normal electrolytes and 10% have a normal PO_2 and dry lungs, presumably due to laryngospasm.

The surface tension is greater in larger alveoli due to the presence of surfactant. Freshwater denatures surfactant. In seawater pulmonary oedema occurs. There is bronchospasm with the inhalation of both sorts of water and also osmotic damage to the pulmonary epithelium. Any significant aspiration will cause an abnormal PO_2. It is important to observe near-drowning victims closely as atelectasis can suddenly develop. PO_2 should be measured. A patient with pulmonary alveolar collapse and shunting needs steroids.

Dr Pegg suggested the following points in treatment:

1. Ventilation is essential.
2. Use the Heimlich manoeuvre, ie. empty the upper airway before EAR.
3. Do not try to do EAR in deep water without flotation.
4. Do not give up too soon.
5. Make sure that the victim is drowned and not unconscious eg. a diver with air embolus.
6. Give bicarbonate intravenously according to blood gases.
7. Do not let the lung collapse completely during CPR.
8. Intubate with a cuffed tube or put the victim on his side to prevent aspiration.
9. Look for other causes often associated with drowning, eg. alcohol, myocardial infarction, head injury, epilepsy, diabetic coma and hypoglycaemia.
10. Do not extend the neck when clearing the airway in case there is a fractured cervical vertebrae. Protrude the jaw instead. Put on a cervical collar to avoid causing a quadriplegia. This applies especially to those who have dived in head first.
11. Bronchospasm, bradycardia and hypotension are signs of aspiration, not necessarily of a myocardial infarction.
12. Chest X-ray can show sand and other foreign bodies in the bronchi. This is proof of aspiration.
13. Warm the cold victim by insulation rather than by using active warming unless a defibrillator is available. Remember that warming the periphery leads to peripheral vasodilation, this improves the blood flow through the cold areas warming them but cooling the blood that goes back to the centre and so causing a drop in core temperature.

The reported cases of long survival following drowning are due to:

1. Cold water.
2. Cardiac arrest associated with the diving reflex trapping oxygenated blood in the cerebral circulation.

With a non-breathing victim in the water give on initial breath and then bring to shore as fast as possible. One should only pause occasionally to give EAR. Getting to shore or boat is more important. With a scuba diver who has air in his tank one can use his regulator purge button to inflate his lungs.

Flotation Devices, Cold Water and Swimming

Dr Peter McCartney

Peter has been doing trials in Tasmania's cold water, testing several different buoyancy vests or jackets. Subjects were timed while swimming two lengths of an Olympic sized pool and then again with the various vests. The aim of the trials was basically to show how buoyancy devices could help or hinder survival. For those who spend a lot of time in boats Peter recommended the U Vic Thermofloat, a jacket which turns into a wetsuit by pulling down a flap and making a pair of trousers. This is the brain child of Dr Hayward of the University of Victoria in British Columbia. The jacket contains a layer

of foam neoprene which gives both buoyancy and insulation. The jacket is practical and of good appearance. It is available in Australia from Protector Safety Services Pty. Ltd.

Friday 29th June

Report by Dr Janene Mannerheim

Dr Jefferson Davis discussed:

A. Decompression Sickness case histories:

1. 5 cases presenting as decompression sickness who were actually air embolism. Treatment was with USN tables 4, 5, 6 and 6a. Mannitol and Decadron were used intravenously.

2. A diver descended to 100 feet for 50 minutes. He later flew over a 4,000 foot mountain. Treatment included Dextran and Decadron as well as recompression.

3. A 42 year old male spent an unspecified time at 100 to 200 feet. He repeated the dive 2 and a half hours later. On surfacing he developed a cervical cord lesion. There was not enough oxygen available to use USN Table 6 (4 hours 45 minutes) so Table 5 (2 hours 15 minutes) was used and then Table 3 (air for about 18 hours). The results were not good. When oxygen arrived he was treated on Table 6 with good results.

4. A diver who spent 9 minutes at 110 feet at 6,000 foot altitude made a sudden ascent. He developed a spinal cord lesion.

5. Some Okinawan divers were diving on a shuttle system 150 feet, in an attempt to treat one of their number. The results were that two died and three survived after treatment with USN Table 6.

B. Gas Gangrene Case Histories.

A large commercial airliner crashed in a swamp in Florida. Surgeons closed wounds that should have been left open and several people developed severe gas gangrene.

C. Physical Standards.

In the USA the standards of diving physical examinations are equivalent to the 1930 standards for aviation physicals, ie. a form from the diving instructor for the doctor to complete, no chest X-ray requirements and usually performed by a doctor with no knowledge of underwater or hyperbaric medicine.

Absolute contraindications

1. Seizures except febrile convulsions as a child.
2. Syncope; neurological, cardiovascular, other.
3. Insulin dependant diabetics. Hypoglycaemias aggravated by cold water and exercise. He poses a threat to others who try to rescue him.
4. Coronary artery disease.
5. Sickle cell disease or trait.
6. Non-patent Eustachian tubes.
7. Meniere's disease.
8. Pulmonary disease, blebs, cysts and foreign bodies.
9. Middle ear surgery with a prosthesis.
10. Alcoholism and drug addiction.

Relative Contraindications

1. Previous history of pneumothorax. This may require a lung scan to exclude pathology.
2. Asthma. This becomes a 'maybe' dive situation if he has been totally clear for two years.
3. Migraine.
4. Psychiatric problems, eg. depression.
5. Previous history of neurological decompression sickness. These must be assessed on the previous recovery. Nerve root lesions.
6. Head injury with pre-disposition to post-traumatic epilepsy. Wait for two years. X-ray, EEG and neurological examination must be normal before allowing diving.
7. Poor vision.
8. Hypertension on drugs.
9. Perforated tympanic membrane.
10. Pregnancy.
11. Recent fracture or sprained joint.
12. Inguinal hernia.

Not all those present agreed with Dr Davis an energetic discussion ensued.

FATAL CRAB NIP

A newspaper reports that a man has died in America after being nipped by a crab while out fishing. He developed a severe illness and was admitted to a hospital, there having his leg amputated two days after receipt of the injury. Despite antibiotics he died 12 days later, apparently from a heart attack. It is believed that the infecting organism was a marine vibrio which thrives only in salt water, an infection that is hard to isolate. Dr Amodio, in reporting the facts, said "We are really not sure how dangerous the organism is. The problem is that perhaps it causes minor infection in people and usually isn't identified." People are believed to become infected by eating raw oysters in some instances. The US Centre for Disease Control has recorded 39 cases in which people have been infected by vibrio.

Australian, 10 September 1979