STONEFISH ENVENOMATION

Chris Acott

CASE REPORT

JR trod on something while getting out of a boat in an estuary. He experienced sudden pain which became excruciating over the next ten minutes. He arrived at the Rockhampton Base Hospital about an hour later, in considerable pain. No first aid measures had been tried.

I made the diagnosis of a stonefish sting over the telephone when I asked the Registrar to take the ear piece away from his ear and I could hear the unfortunate patient screaming in the background. His foot was immersed in some hot water, which gave him considerable relief, and he was transferred to the ICU.

The wounds were on the medial aspect of his right foot in the distribution of the medial plantar and sural nerves. These were blocked using Bupivicaine 0.5%. There were 6 superficial puncture wounds, bluish in colour with a reddened periphery. His foot was also oedematous. His right inguinal lymph nodes were palpable but not painful, but he was complaining of considerable discomfort in his calf and thigh. There was no joint pain. Every time his foot was removed from the hot water, he complained of pain.

An intravenous line was inserted. Blood was taken for analysis. 6 ml of antivenom (3 ampoules) were given intravenously as I considered that a 6 ml intramuscular injection would be cruel.

The pain subsided within half an hour. When he arrived the pain seemed so severe that I considered a unilateral sub-arachnoid (spinal) block, but decided to block the sural and medial plantar nerves instead.

After the antivenom he only complained of some moderate discomfort in his foot and a cramping sensation in his calf and thigh muscles which were controlled by incremental doses of intravenous Omnopon. This discomfort continued for a few days. The foot remained swollen for a couple of days. However there was no sign of local infection.

Investigations revealed a CPK three times normal. The blood was taken about 1 hour after the sting. Discussion with Dr S Sutherland revealed this to be the first recorded case of an elevated CPK following a stonefish sting. He assumed that it was due to the local effects of the venom on the muscles of the foot.

JR was discharged three days after admission.

DISCUSSION

This case illustrates several points about stonefish envenomation:

1. The sting is excruciatingly painful. Although the patient was in considerable distress he did not become irrational, which has been reported in other cases. However the severity of signs and symptoms are directly proportional to the depth of penetration of the spines. His wounds were superficial.

2. First aid measures: Considerable relief is obtained by immersing the affected area in hot water (about 50°C), so the venom is probably heat labile.

3. The wound appearance was classical from the description given in “Dangerous Marine Animals of the Indo-Pacific Region”, by Carl Edmonds. “The area has a bluish tinge, and becomes swollen and oedematous. The pain will spread to the regional lymph nodes and involve adjacent muscles.”

4. The best methods of pain relief are by local anaesthesia blocks, antivenom and hot water immersion.

The Venom

It is a heat labile protein with a molecular weight 150,000. It also contains some potent hyaluronidase and capillary permeability factors. There is no protease or phospholipase A2 activity. It has no effect on the blood clotting mechanisms nor does it cause haemolysis.

The venom will remain toxic in the venom glands for several days after the death of the animal. There are 13 dorsal spines to each stonefish and each spine has 2 venom glands which can discharge along the ducts of the spine. The spines are capable of penetrating a sandshoe. The average yield of venom per spine is 6 mg, and the total yield is 49-88 mg.

Tests on various animals showed transient hypo- and hyper-tension. Electrocardiographic changes showed either AV block or VF. Other workers showed it to have strong myotoxic properties which effects all muscle types, causing paralysis probably by blocking depolarization.

Deaths have been recorded in the Indo-Pacific region, but no deaths have been recorded in Australia.

Antivenom

The antivenom is prepared by immunizing horses and is available as a pure equine preparation. Each ampoule contains 2 ml which will neutralize, in vitro, 20 mg of venom. Antivenom is indicated in all cases of stonefish stings. The recommended doses are, for 1 or 2 puncture sites 1 ampoule, for 3 or 4 puncture sites 2 ampoules, and for 5 or 6 puncture sites 3 ampoules. The antivenom is usually given as an intramuscular injection except in severe cases when it is given as an intravenous injection.

First Aid and Hospital Management

1. No attempt should be made to retard movement of venom. To delay the escape of the venom will only enhance local pain and tissue necrosis.

2. Immerse the limb in hot water at about 50°C.

3. Emetine hydrochloride has been tried in the past. Injection around the wound will give some pain relief, probably due to the acidity of the solution.

4. Potassium permanganate should not be used, as it will only cause local tissue damage and aggravate the wound.

Hospital management is directed towards pain relief, antivenom, bed rest, and treatment of any cardiovascular or respiratory problem. Attention should be paid to tetanus prophylaxis and local wound treatment.

THE UNDERWATER TRAINING CENTRE IN MORWELL

John Knight

Why have an underwater training centre 60 km from the coast? Largely because basic training and training in the use of equipment and tools does not need the sea, only water. In fact the sea can be a nuisance because it can get too rough to be safe. The Commercial Diving Center, which is now the College of Oceaneering, in Wilmington, California, has access to very protected water and yet has large on-shore tanks for training. The other reason is that Morwell is the base for the major activities of the National Safety Council of Australia (NSCA) Victorian Division which purchased the Underwater Training Centre (UTC) from its Sydney owners about 2 years ago.

The UTC trains divers to the standards set by Part 1, Scuba Diving (*'persons not normally working underwater but who are required to dive in connection with archaeology, non-commercial research, scientific work and observation tasks"), Pa*rt 2, Restricted Commercial Air Diving (*'personnel who will be engaged in professional and/or commercial underwater operation, at limited depths .... using surface supplied compressed air or self contained breathing apparatus and not having access to a surface compression chamber. Such qualification is the minimum required by regulatory authorities who are responsible for the control of on shore diving, eg construction of jetties, dams.") and Part 3, Profe*ssional Air Diving with surface compression facilities *("Such qualification is the minimum required by regulatory authorities who are responsible for the control of off-shore diving, eg oil and gas exploration") of* the draft Australian Standard for the Training and Certification of Divers. Part 4, Bell Diving (*'related to the further training of experienced air divers and underwater workers to permit them to operate safely and competently as bellmen and lock-out divers")* has not as yet been started. There are a number of reasons for this including the present depressed state of the diving industry and its high unemployment and the lack of a safe 100m deep site at sea off the Victorian coast. This depth is necessary if the UTC training is going to be accepted by the UK authorities as equivalent to their standards for bell divers in the North Sea oilfields.

In addition to training divers the UTC is engaged in helicopter-crash survival training. They have the cabin of a helicopter sitting on a bar. It is held vertical by uprights at each end of the bar. The trainees get in, and the assembly is hoisted up and positioned over the pool and then rapidly lowered into the pool simulating a crash at sea. The RAN and ESSO-BHP are using this service.

Another group being taught by the UTC is the NSCA air-sea rescue paramedics who not only have to be able to winch down to a ship but are trained to parachute and scuba dive.

The UTC has a pool that is 6 m in diameter and 9 m deep which is used for most of the training. It is in this that trainees learn the joys of wearing a Kirby Morgan Band mask, so called because the hood is held to the mask by a steel band. These have an oro-nasal mask instead of a mouthpiece on the regulator, which is all part of the full face mask. The regulator can have its working pressure adjusted and can also be converted to free flow. There is a delightful gadget that pushes up and blocks the nostrils so that the diver can clear his ears more easily. The great advantage is that the diver can talk to topside and hear replies. There is a microphone in the oro-nasal mask and earphones lie against the ears. Like any other full face mask it must be held firmly onto the face by straps or it will fill with water.

The KM Superlite is hardly light. It is the much more comfortable successor of the brass "hard hat". The Superlite has the mask part of the KM band mask set in a complete helmet. Worn inside the helmet is a padded hood which provides comfort and insulation. It is worn with a neck dam, a tight fitting neoprene sleeve round the neck which broadens out over the shoulders to be attached to a metal collar that locks onto the helmet. Because the head is in air the diver can hear better than with a band mask. Because the neck dam seals the helmet it can be worn with both wet and dry suits.

The band masks and helmets are surface supplied. The umbilical has a hose for the breathing gas and another for the pneumofathomometer as well as wires for the communications. The pneumofathomometer tube is open at the bottom. Air is blown down the tube at a pressure above that at the diver's depth, then the supply is turned off and the pressure in the system will drop to that of the diver's depth. This pressure can be read off a pressure gauge calibrated for depth. This is a much more accurate system than relying on a possibly faulty depth gauge on the diver's wrist, which of course the supervisor cannot see!

In the pool the trainees work with various power (hydraulic) tools such as are used for construction work. Welding underwater was a skill taught at the Commercial Diving Center when I visited it in 1977. At present the UTC is not teaching this skill.

A commercial diver must not only be safe at work in the water but he must be able to provide a safe environment for others to work in the water. This means learning how to control gas supplies to the diver and how to work the pneumofathomometer. The control panel varies in complexity, being relatively simple for a surface supplied bounce dive. The control panel for a chamber has a full set of controls for each compartment and for the trunking joining any bell to the chamber. There are deep and shallow pressure gauges, ideally one pair for each compartment. But often gauges can be connected to more