Chapter 29

DANGEROUS MARINE ANIMALS

There are many marine animals which are dangerous to eat, to be eaten by, or to touch. The diver who is content to observe or photograph the creatures of this undersea environment will rarely have his safety threatened by them. Of necessity, this chapter is an oversimplification, with many significant omissions. The photographs are copied from *Dangerous Marine Creatures*, by Carl Edmonds.

SHARKS

Although encounters with sharks are commonplace in diving, shark attacks on skin and scuba divers are not common. Many of the attacks recorded have been associated with spearfishing or shell harvesting, situations in which vibrations and chemicals given off by the wounded marine animal are likely to attract sharks.

In a large proportion of attacks on divers the victim was unaware of the presence of the shark until he was actually bitten. Several behaviour patterns preceding shark attacks have been documented. In some cases the **shark circles** the victim and occasionally bumps him (presumably to gain some sensory information about the nature of this unfamiliar but potential food source), before attacking.

In many tropical species, **sharks may exhibit a threat display (agonistic)**, apparently in response to a territorial invasion by the diver. This is characterised by the shark swimming with an irregular jerking motion, accompanied by an arched back, head up and pectoral fins

pointed downwards. This type of behaviour is the signal for the diver who wishes to experience old age, to depart the area.

The Great White shark has a "**bit and spit**" **technique** in which a single sudden powerful attack is made, with the shark then retreating until the victim (seal, dolphin, diver) haemorrhages in the water and loses consciousness. The shark can then feed without fear of damage from a counter attack.

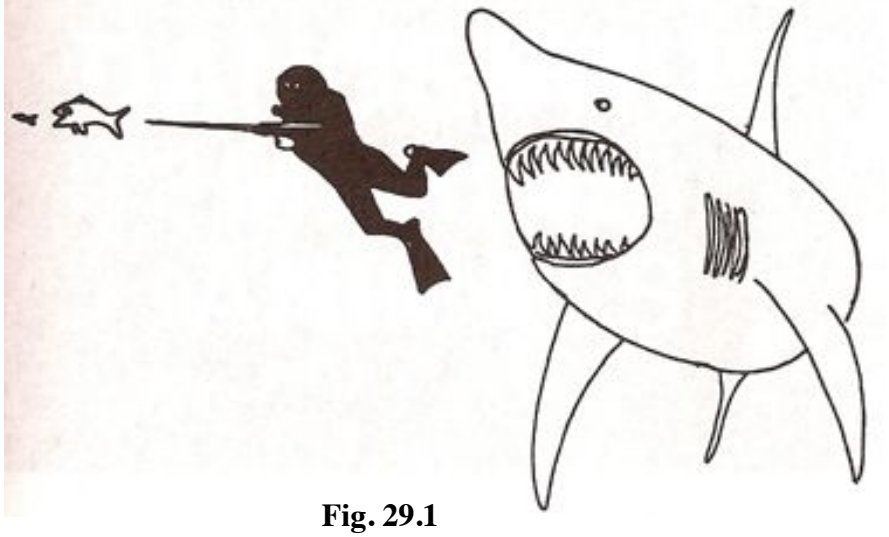


Fig. 29.1

Clinical Features

The seriousness of the injury depends on the size of the shark and the ferocity of the attack. Sharks larger than 2 metres in length have extremely powerful jaws equipped with razor sharp teeth which are easily capable of severing limbs or biting large pieces out of the torso. In spite of this, there have been many instances of divers surviving bites from sharks in excess of 4 metres in length. In some of these, the divers sustained severe lacerations from the puncture wounds of the teeth but no further injury. A shark of this size could easily bite a diver in two, so it appears that in some cases the shark will maul a victim and then not persevere, perhaps due to distaste for wet suit material or other items of the divers paraphernalia. Some divers may be as distasteful to sharks as they are to non-divers.

The blood loss from the massive lacerations accompanying shark attack is severe and immediate. Major blood vessels are frequently torn and generalised bleeding issues from the tissue laceration. Blood loss is often torrential and pulsates from severed arteries.

The victim will display clinical features of severe blood loss — pale clammy skin, a rapid weak pulse, low blood pressure and rapid respiration. Fatality occurs in 25% of cases.

Treatment

The principles of successful management of shark attack victims were first described by Australian and South African authorities following their combined experiences. They are:

❑ Stop the blood loss.

This must be done by rescuers **at the site** of the attack. Bleeding which is oozing or welling up from a wound can be stopped by applying a cloth pad (preferably but not necessarily clean) to the wound and pressing firmly with the hand or applying a tight bandage. Spurting arterial bleeders up to about 3 mm in size can also be stopped by a pressure bandage and pad. Larger arterial bleeders can be stopped by the application of pressure by a finger or thumb. Bleeding from major blood vessels (the size of a finger) can be stopped by pinching the end of the vessel between finger and thumb, or a tourniquet if a limb is involved. Tourniquets have to be released every 10–20 minutes to let blood return to normal tissues.

It is important that pads, used to stop bleeding, have pressure applied to them to force the blood vessels closed. It can be disastrous when rescuers merely cover bleeding areas with a dressing, without any pressure application. This soaks up and conceals the blood loss, without stopping it. Any clean material such as toweling, clothing or handkerchiefs are satisfactory in the first-aid situation.

❑ Resuscitate the victim at the site of the attack.

If the patient is unconscious the basic life support (**BSL**) priciples take precedence and should be followed (see Chapter 42).

I**mmobilisation** is advised. Once the victim is in a place of safety, (boat or shore) it is vital that he not be moved further. Bundling a victim into the back of vehicle for a bumpy ride to hospital has resulted in death of the victim on many occasions.

The victim should be kept lying horizontal at the rescue site and resuscitation equipment and personnel brought to him.

Resuscitation involves replacing the patient's blood loss by the **intravenous infusion** of blood or blood substitutes such as plasma, saline or other intravenous fluids. It is not safe to move the victim until a satisfactory circulating volume has been established. Evidence for this is a relatively normal pulse (rate less than 100) and blood pressure.

This management principle is sometimes difficult to accept by rescuers who understandably wish to dispatch the victim to hospital (anywhere!) as soon as possible. However, once the victim reaches there, exactly the same management as should have taken place at the shark attack site will be needed. i.e. arrest of the blood loss accompanied by the administration of intravenous fluids.

Major hospitals in shark attack prone areas have a shark attack protocol along the lines mentioned above. Equipment may be available for immediate transportation to a shark attack site. Shark attack is so rare, however, that practice at implementing this protocol is sometimes neglected.

In spite of the severity of the injuries, it is common for the patient not to experience significant pain for some time after the attack. This phenomenon is frequently seen in other forms of severe injury such as motor vehicle and war injuries. If the patient is suffering significant pain or shock, the rescuing medical team will administer morphine in an appropriate dose.

Nothing should be given by mouth to the victim, as an anaesthetic may be required.

Prevention

Since vibrations and chemicals given off by speared fish and other forms of marine life commonly attract sharks, the avoidance of fishing should lessen the risk to the diver. The carrying of speared fish or shell fish near the diver's body underwater invites a close inspection by an interested shark.

The well publicised practice of diving with a buddy should, on statistical grounds alone, reduce the likelihood of a shark attack on oneself by at least 50%.

Case Report 29.1 A young swimmer was attacked by a shark which amputated his leg above the knee. He was pulled from the water by his companions and the bleeding stump was wrapped in a blanket. He was noted to be pale and clammy with a weak thready pulse and was semi-conscious. He was placed in the back of a car and rushed to the nearest hospital which was over 20 kilometers away.

A subsequent newspaper report read: "shark attack victim died while being rushed to hospital".
It should have read: "shark attack victim died **because** he was rushed to hospital".

Swimmers are protected by swimming in enclosed or meshed areas. They should not swim where shark attacks have occurred, in estuaries and river mouths, or where fish or meat is ditched (fish markets, abattoirs etc.). It is safer to swim with groups of people and to avoid swimming at dusk (feeding time for sharks) or in areas of low visibility. Urine and blood are claimed to attract sharks and thus should not be released into surrounding water. Women who are menstruating, produce haemolysed blood which is not an attraction to sharks.

Divers are given the same advice, but also to avoid deep channels and drop-offs. If diving with sharks, carry something to fend them off (shark billy). Avoid sites where shark feeding is undertaken (a stupid act). A chain mail suit gives good protection, but it very heavy and thus dangerous for recreational divers. Ultrasonic, electrical, chemical and bubble deterrents are probably not effective against dangerous animals, but are enthusiastically marketed.

BOX JELLYFISH OR SEA WASP

This deadly stinging creature is found in the tropical waters of the Indian, Pacific and Atlantic oceans during certain seasons. The season for North Australia is October to March, but may be all year-long nearer the equator. They are rare in the temperate regions. The animal is an active swimmer which may be found even in very shallow water around beaches.

Its numerous tentacles may trail for up to 3 metres behind the body, which grows to 20 cm along each side of the cube. The tentacles cling to the victim's skin and contain many thousands of microscopic stinging cells (nematocysts) which can inject venom. The innumerable tiny doses of venom injected combine to form a large injection of toxin into the victim. The amount of venom injected depends on the length of tentacle in contact with the victim, and the area stung, as well as the thickness of skin.

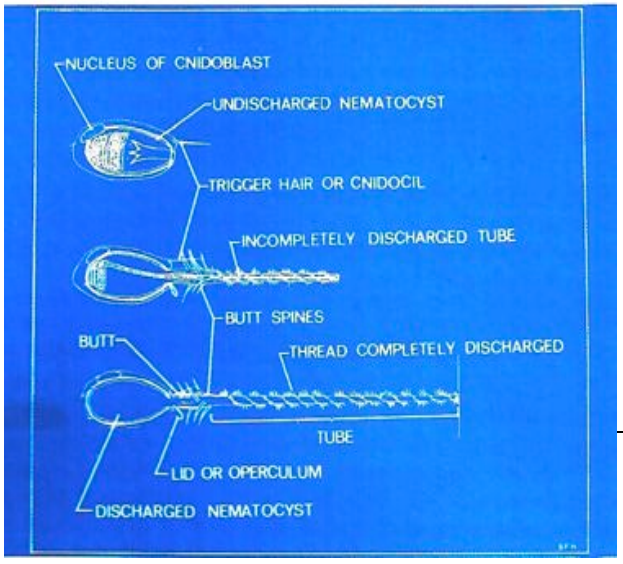


Fig. 29.2 Nematocysts from jellyfish

The venom has its most serious effects on the heart and the respiratory system. It paralyses the respiratory muscles leading to death. Weakening of cardiac contraction, as well as cardiac rhythm disturbances, compounds the problem. The venom exerts a local effect producing agonising pain with skin and muscle destruction.

Clinical Features

The victim experiences **immediate agonising pain** on contact with the tentacles. With a large sting, sudden **collapse**, **cessation of breathing, cyanosis**, **unconsciousness** and **death** may follow rapidly**.** These effects are particularly dangerous in small children or old frail swimmers.

If the victim recovers, severe pain still persists for many hours, and **scarring** is common in the stung areas due to local tissue destruction.

Treatment

Rescue the victim from the water and prevent drowning. This takes immediate precedence.

If the patient is unconscious the basic life support (**BSL**) priciples take precedence and should be followed (see Chapter 42) while enlisting medical assistance.

Apply copious amounts of ordinary **household vinegar** to the tentacles and gently remove the tentacles from the victim's skin. The tentacles cannot sting effectively through the thick skin of the palm of the hand and fingers so this may be safer than it sounds. It is important not to rub or damage the tentacles as this will encourage the injection of further venom into the victim.

Alcohol application is no longer advised, as there is some evidence that this may cause the discharge of further venom into the victim, as may pressure-bandage/immobilisation (see later). If the alcohol is of good quality, it may be more beneficial to the rescuer, once the victim has been taken safely to hospital.

The cause of death in box jellyfish sting is usually respiratory arrest. However, this may be transient if the victim is kept alive by expired air resuscitation or other **artificial ventilation** during this period. The victim should be transported to hospital urgently. Most survive, especially if still alive after the first few minutes.

Fig 29.3 Chironex – Box Jellyfish

An **antivenom** against the Chironex box jellyfish may neutralize some of the venom present in the victim's body. It has been developed by the Commonwealth Serum Laboratories (CSL Australia) and may be used in severe cases to prevent cardiovascular collapse, or where significant local scarring is threatened. It may not be as effective against other box jellyfish.

Prevention

The practice of covering as much exposed skin as possible by the wearing of a face mask, wet suit and hood, overalls or a Lycra suit, prevents the access of tentacles to the skin. This protection also reduces the risks of stings from other jellyfish and injuries from corals. Even water repellent skin preparations, such as sun-burn oils and creams, may reduce the danger.

OTHER JELLYFISH STINGS

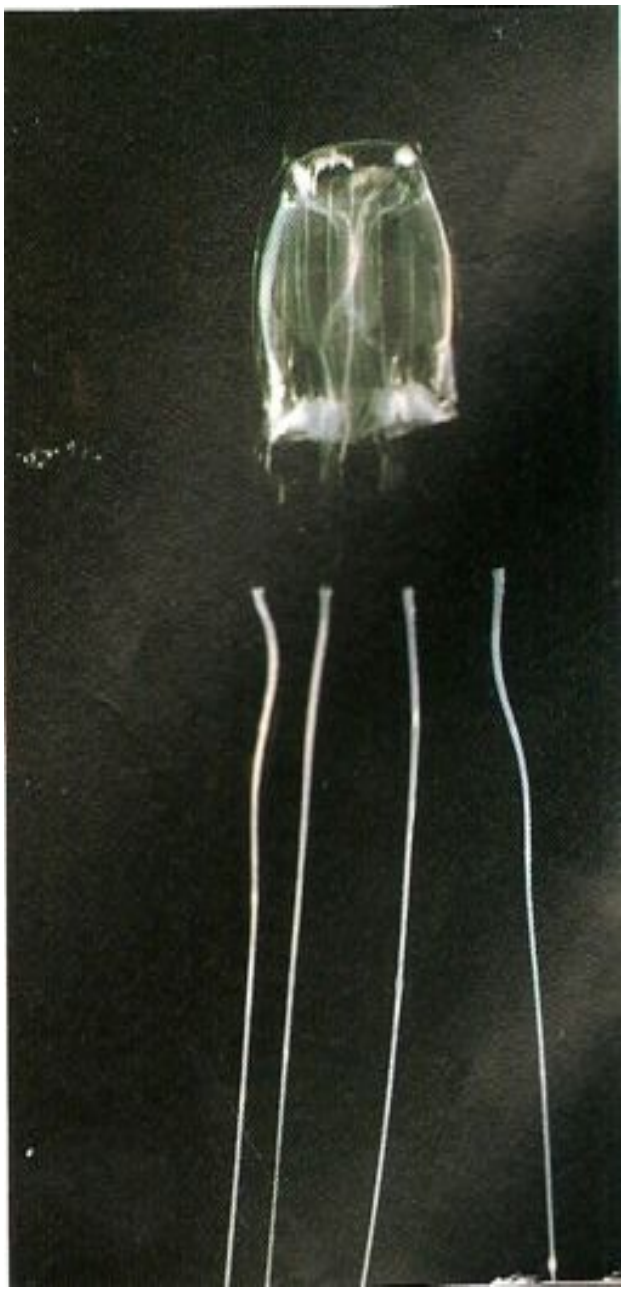
Several other stinging jellyfish such as the **Portuguese Man-of-War, fire coral** and **stinging hydroids** can produce painful and sometimes incapacitating stings, although they are unlikely to be lethal.

The same technique of general management as described for box jellyfish should be followed (rescue, resuscitation etc. See Chapter 42). However, different local applications seem to work for different species. Vinegar or alcohol may cause further nematocyst discharge in some jellyfish stings. Some degree of pain relief can be afforded by the application of **local anaesthetic** (e.g. lignocaine ointment) to the stung area. Other preparations which have a variable effect, include "Stingose", "Stop-Itch", Tannic Acid Spray, etc. Any **anti-burn** preparation, including ice packs, may give some relief. More recently, application of heat (about 45^{0}C. as for fish stings – see later) has been shown to alleviate some jellyfish stings.

Fig 29.4 Physalia (Blue Bottle, Man-of-War)

Fig 29.5 Stinging Hydroid

IRUKANDJI SYNDROME



This disorder was first described as a result of an almost unnoticeable small box jellyfish (*Carukia barnesi*) sting with big after-effects. It is now known to be a possible complication of many other jellyfish stings. It has been the cause of severe cardiac illness and has been confused with both an acute abdomen and cardio-pulmonary diseases, because of its various symptoms.

The victim may, or may not, be aware of the sting. If not, there still may be a red patch visible where the sting occurred. After a latent period of between a few minutes and two hours, severe muscular cramps and pain develops (abdominal, spinal, limbs, chest). The diver becomes anxious, restless, sweating and may have gastro-intestinal and respiratory symptoms. There may be increased pulse rate and high blood pressure recorded. Cardiac damage and pulmonary oedema can develop.

Because of the latent period, the relationship to the jellyfish sting may not be appreciated, leading to many other medical diagnoses, including decompression sickness.

First aid treatment may involve copious vinegar application, as for *Chironex* (above) if identified early. Successful medical investigations and therapies are available, but deaths have been reported.

The injury can be prevented by wearing protective clothing (see above).

Fig. 29.6 ***Carukia barnesi***. This is the most frequent animal incriminated in the Irukandji syndrome. Its bell is only a couple of centimetres (one inch) long, but the tentacles, which are not always easily seen, are up to a metre long.

VENOMOUS CONE SHELLS

A small number of species of the cone shell family are capable of delivering a lethal venom. This is injected by a tiny dart shot from a tubular appendage which the animal can direct to any part of its shell. This apparatus is normally used by the animal to kill its prey (usually small fish), but it will use it as a weapon against a human who is careless enough to handle it.

Expert knowledge is required to differentiate venomous from harmless cone shells, and divers are advised to avoid handling them at all. Reef walkers, being less valuable than divers, may do as they wish.

Clinical Features

The initial sting may or may not be painful. It can penetrate cloth and skin. They should not be handled or put in pockets. The toxin affects the heart, skeletal and respiratory muscles. Muscle spasms develop. Death is usually from respiratory arrest.

Fig. 29.7 **A collection of venomous cone shells**

Treatment

The prompt application of a **pressure bandage and immobilisation** (see later) should delay the spread of venom from the wound, although there have been no clinical case reports to verify this.

The first aid **basic life support** measures (see Chapter 42) may keep the patient alive until the respiratory paralysis has worn off. This may involve many hours of artificial respiration.

BLUE RINGED OCTOPUS

This attractive little animal is found in rock crevices along the water's edge of many islands in the Pacific and Indian oceans, as well as in deeper water. If annoyed it will display a colourful array of blue or purple rings on its skin. This may arouse the curiosity of a potential victim, especially a child.

Unfortunately it can inflict a small, relatively painless, bite and inject venom through a beak at the base of its tentacles. The bite may go unnoticed by the victim until the major effects of the venom develop.

The injected venom can produce general muscular paralysis within minutes, leading to cessation of breathing. The victim can then remain fully conscious- but unable to communicate with bystanders due to the paralysis. Death can then be due to respiratory failure, unless treatment is given.

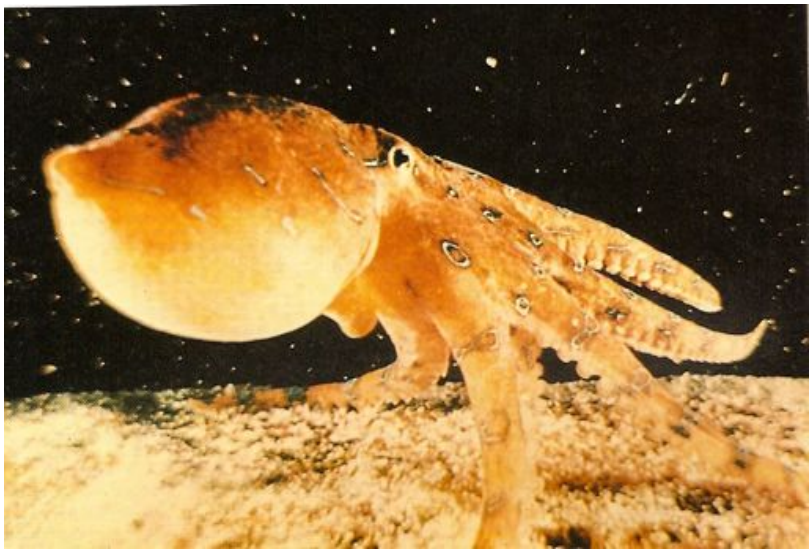


Fig. 29.8 Blue Ringed Octopus
This dangerous little animal should not be handled.

Treatment

Artificial respiration must be continued until recovery **(4 – 12 hours)**. This is necessary because of the respiratory muscle paralysis. Basic life support is needed (Chapter 42)

A **pressure bandage** and **immobilisation** (see later) should be applied promptly to delay spread of the venom, and maintained until full resuscitation measures are implemented.

Case Report 29.2. A diver found a small octopus with attractive iridescent blue rings - hiding in a shell. She placed it under her wet suit vest, intending to show it to her companion later. After the dive she complained of double vision and respiratory difficulty. When she showed the octopus to her buddy, the buddy correctly diagnosed the problem and kept the victim alive by mouth to mouth respiration until hospital was reached. The victim later pointed out that she was not encouraged by comments such as "it looks as though she is not going to make it " from bystanders who had not realised that she was fully conscious, in spite of being paralysed.

SEA SNAKE

Sea snake bites are not uncommon in the Indo-Pacific ocean waters. In certain areas, sea snakes will approach divers underwater. These advances may be inspired by curiosity, as it is rare for sea snakes to bite divers without provocation. They will retaliate if grabbed.

The venom of sea snakes is more potent than that of the cobra. Even when bites occur, the presence of short fangs at the back of the mouth deprives some sea snakes of an efficient way of delivering this venom into humans. Often venom is not injected, despite the biting.

Fig. 29.9 Yellow Bellied Sea Snake *(Pelamis platurus)*

Clinical Features

If envenomation occurs, **s**ymptoms may become evident within minutes to hours after the bite. Muscle weakness leading to paralysis, including **respiratory muscle paralysis** and **asphyxia**, and finally **cardiac failure** may follow the bite.

Occasionally the sea snake bite itself results in severe **lacerations** and **blood loss.**

Treatment

The prompt **pressure bandage + immobilisation** technique (see later) will delay the symptoms until medical assistance, resuscitation facilities and antivenom can be acquired.

The first-aid **basic life support** measures should be instituted where necessary (see Chapter 42). Mouth to mouth respiration is the major requirement. The victim should be taken to

hospital as soon as possible. Serious cases should be treated with sea snake **antivenom** (made by CSL – Australia).

STONEFISH

This is the most venomous fish known. It is extremely well camouflaged and may not move away when approached, as is implied by its name.

It is capable of inflicting severe stings by means of 13 poisonous spines along its back. The spines are able to penetrate rubber soled shoes or neoprene boots. At the base of each spine is a venom sac which empties its contents into the victim's wound.

Fig. 29.10 Stonefish

Clinical Features

Envenomation results in severe **agonising pain at the site** of puncture. Extreme **swelling** and **local paralysis** develops rapidly. The venom can lead to **respiratory distress**, **cardiac disturbances** and syncope (**fainting**) with a reduction in **blood pressure**. Death is uncommon except in children or the infirm.

Treatment

Immersion of the stung area in hot water about **45°C** (first tested by the attendant's hand, to ensure against scalding) often gives significant pain relief and should be employed as soon as possible as a first-aid measure. Elevating the wound may reduce swelling.

The severe pain of the sting can be relieved by the **injection of local anaesthetic** (with no added vasoconstrictor agent such as adrenalin) **into the puncture sites.** This treatment may need repeating several times before the pain stops recurring as the effects of the local anaesthetic injection wear off. A physician may prefer to block the nerve supply to the region with local anaesthetic as an alternative. Cleansing of the wound and antibacterial treatment is required.

The first-aid **basic life support** measures should be instituted where necessary (see Chapter 42). **Antivenom** from the Australian CSL Laboratories is available and its use may be necessary in severe cases.

OTHER SCORPION FISH

Other members of the scorpion fish family such as the **fortescue, lionfish** (or **butterfly cod)** and **bullrout**, produce painful stings similar to that of the stonefish, although both the local and generalised effects are usually not as severe. **Cat fish** have a similar effect.

Fig. 29.11 Butterfly Cod

Fig 29.12 Fortescue

Pain relief can be obtained by **immersing the area in hot water** at about **45°C** (previously tested by immersing an unaffected limb in the water) as for the Stonefish sting (above), while more sustained relief can again be obtained by **injecting the punctures with local anaesthetic (no adrenolin).** Cleansing of the wound and antibacterial treatment may be required, and the wound should be elevated.

STINGRAY

These flattened relatives of the shark have one or more long bony spines, which are intended for self defence, at the base of the tail.

The animals often bury themselves in the sand where they can inadvertently be stood upon, or otherwise disturbed, by an unsuspecting diver. The stingray defends itself by swinging its tail quickly over the top of its body, driving the spine into anything which happens to be above it.

The spine may produce a puncture and deposit venom. Its serrated edge can cause serious or even lethal lacerations. Parts of the spine, marine organisms and a toxic slime may be left in the wound to cause infections and local inflammation.

Clinical Features

Fig. 29.13 Typical manner in which a stingray injury occurs

Pain caused by the toxin is **immediate** and **very severe. Swelling** is rapid. Toxin may be absorbed into the body producing **generalised symptoms** of syncope (**fainting**), weakness, palpitations, low blood pressure and disturbances of cardiac rhythm. **Death** is rare – except in cases where a vital organ such as the heart have been pierced by the spine.

Despite initial improvement, there can be a deterioration in the clinical state some days later, if there is any foreign material or organisms left in the wound, or if damaged tissue becomes necrotic. For this reason, all cases should be referred for medical assessment.

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Treatment

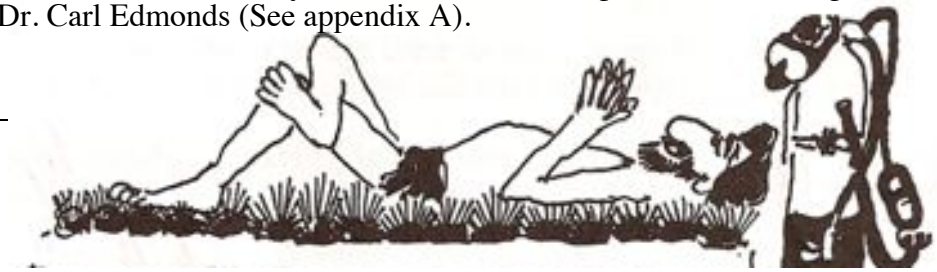
The **basic life support** resuscitation may be needed (Chapter 42). **Hot water** immersion treatment and/or **injected local anaesthetic**, as described for stonefish injury, are useful. The wound should be **cleaned** to remove any foreign body or venom. An X–ray, ultrasound, CT or MRI may demonstrate an embedded spine, which needs to be removed surgically. Local antibiotic cream, and often oral antibiotics (such as doxycycline), are indicated.

Prevention

Shuffling the feet while wading in areas frequented by stingrays will usually allow them to move away. Footwear may not be adequate to protect the feet or lower legs from these injuries. Diving into shallow waters where these animals inhabit could be dangerous. Divers should swim well above the sea bed.

OTHER MARINE ANIMALS

Many other marine animals may cause major or minor injuries, and require different first-aid treatments. These, together with more detailed descriptions of the potentially lethal animals and those poisonous to eat, are fully discussed in the companion text "Dangerous Marine Creatures" by Dr. Carl Edmonds (See appendix A).



PRESSURE BANDAGE + IMMOBILISATION TECHNIQUE

This is used to delay the absorption of venom from a wound. A bandage (preferably stretchable) is applied over the bite and then wrapped around the limb (and extending up the limb) tight enough to block the drainage vessels (lymphatics). The pressure is approximately the same as that used to treat a sprained ankle.

Care must be taken not to put the bandage on so tight that it causes pain and cuts off circulation. For this reason the technique is not applicable to painful, swollen bites or stings that already have circulation impairment – such as fish stings

The limb should then be immobilised with a splint to prevent any local muscle movement (this spreads the venom despite the bandage).

The pressure bandage+immobilisation of a limb should be continued until the victim has knowledgeable medical personnel and facilities available to cope with the envenomation. This happens as the bandage is released and the venom moves into the bloodstream. The doctors may well administer antivenom (if available), before removing the bandage.

The technique is especially applicable to sea snake, blue ringed octopus and cone shell bites. A variant may be used if the bite is on the torso, with a pad and bandage to produce the pressure.

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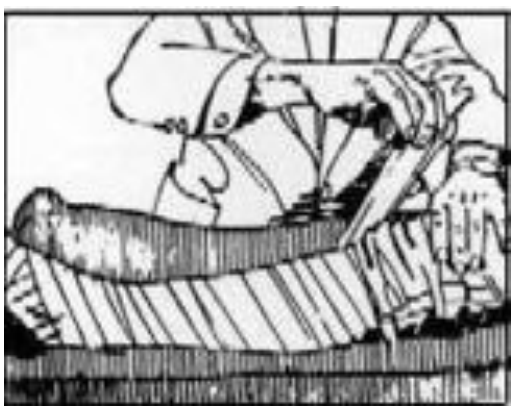

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