THE MEDICAL HAZARDS OF SKIN DIVING

J. J. SAMMUT

Please allow me to address you not only as doctors who might be called upon to minister to skin-divers in trouble but also as potential skin-divers yourselves.

The amateur skin-diver's dress is often just a pair of bathing trunks, some sort of goggles or mask to protect his conjunctivae and to give him clear vision, with a breathing-tube or snorkel attached for surface reconaissance. If these are brightly coloured, say orange or red, they warn off water-skiers. A shiny bald head is an advantage. Rubber flippers on the feet give rapid propulsion with the minimum of effort.

There are two main types of mask. The so-called "Pinocchio" type has a single glass across the eyes notched above the nose and enclosed in a watertight rubber face-piece to just below the nose, leaving the mouth uncovered, the whole being strapped around the back of the head. The snorkel in this case is J-shaped, the short end being held in the mouth as the swimmer faces down, the long end ascending along the side of the face. A valve at the top keeps water out on diving. The experienced diver discards the valve, which has a habit of sticking, and uses the tube as a simple blow-hole. Through the soft portion over the nose it is easy to perform the Valsalva manoeuvre under water, though with practice it is possible to clear the Eustachian tubes just by swallowing. Equalization of pressure increases in importance with depth.

A mask usually worn by beginners consists in a large oval glass with rubber frame enclosing the whole face, including the mouth. Breathing takes place through a tube on either side of the mask, each fitted with a valve which cannot be removed without flooding the inside of the mask on diving, thus impairing vision. Still, the beginner here does not have to operate a blow-hole. If neither valve reopens on surfacing the suffocating swimmer gropes at them blindly to get air, then panics and tries to tear the mask off his face, but it is tightly strapped to his head. The remedy really is quite simple but must be kept in mind. At the first sign of valve-trouble, an index-finger or thumb is inserted under the lower edge of the mask which is then flung off. Eventually this become a reflex action.

A veteran skin-diver tells me that the dress of choice on the way to the beach, especially in cold weather, *is the lightest possible,* to help acclimatization prior to a 3 or 4 hour diving session. Especially when the weather is cold, a tight-fitting rubber suit is worn as a sort of blubber. A woollen vest underneath gives added insulation by virtue of the air enmeshed in it. Smearing the body with vaseline also helps. Long exposure to cold lowers resistance to trauma. A jelly-fish sting at the beginning of a swim is a nuisance but causes no real discomfort; but the pain of a similar sting towards the end of a long diving session can be excruciating and cause very real shock. Simply grazing the knee against the rocks on leaving the water may cause great pain and prostration, whilst a deeper cut might be very well tolerated earlier on.

As in flying, NEVER dive with any of nasal congestion. However deep one dives, so long as internal and external pressures on the tympanic membrane are equal, it will not suffer. At a certain depth, variable with individuals and with the state of the mucosa, external pressure is felt on the drum. If Eustachian tube clearance is unsuccessful, especially if pain supervenes, diving any deeper is courting trouble.

The clinical appearances of the ear following barotrauma from sea-diving are much the same as those from air-diving. In mild cases of barotrauma the drum is merely injected, next, capillary haemorrhages may confluatee and cause bruising between the drum layers, sometimes blistering the epithelial outer layer. If the drum remains intact and is reasonably transparent, a haemotympanum of the

ear might be observed. In extreme cases the drum may rupture.

During swimming deep sensibility through the feet is eliminated and at a certain depth, even through a mask, range and field of vision are restricted. This leaves only one means of orientation, namely the static labyrinth. A sudden inrush of cold water through a perforation temporarily knocks out this organ as well. In such a predicament, the diver should rid himself of any excess weight, not struggle, and trust to natural buoyancy.

The short term local treatment for this type of perforation is NOTHING. Nasal decongestants might help and full doses of a broad-spectrum antibiotic *systemically* might combat secondary infection. Drops of any sort into the ear itself are contraindicated. If left alone, and the patient does not blow his nose (or go diving) for a few days or weeks, the drum will heal, any blood resorb and hearing return to normal. A haemotympanum is usually limited to the hypotympanum, far away from the "works" of the middle ear, so to speak, but if it fills the middle-ear cavity and causes the drum to bulge, a paracentesis under the strictest asepsis is indicated.

Barotrauma can also affect the paranasal sinuses. Anybody who has had an acute sinusitis, or even just a stuffy nose, may have experienced a splitting headache on bending the head down, the pain being referred to ears, teeth, eyes and the whole skull. This is more marked on diving headfirst. If a diver notices any of the above symptoms, he should right himself immediately and call off diving for that day. The same symptoms may occur during an ascent, when air trapped under pressure in one or more head cavities cannot escape quickly enough through a congested ostium.

In recent years the really large fish, like groupers, have had to be sought ninety or more feet down. Considering that each thirty feet of water has the pressure of an added atmosphere some idea is had of what some enthusiasts let themselves in for.

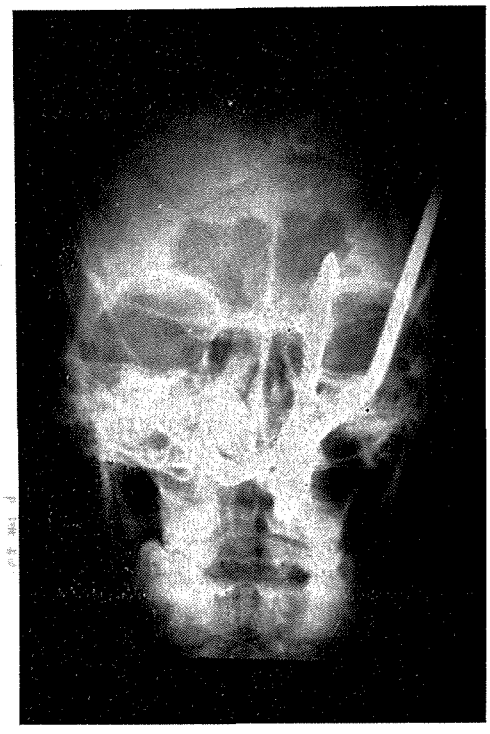
As a rule, accidents happen either as the result of a sense of rivalry or out of an exaggerated sense of loyalty to a partner or team. Numerous examples could be cited. Here is just one: early on in the 1961 International Subaqua Fishing Competition, which was being held in Malta waters, the then Malta champion was just about to surface, but had not quite, from a sixty foot dive after having captured a very large and heavy grouper, when he dropped his harpoon gun. As time was precious he turned over again, without surfacing, and dived, grouper and all, to recover his gun from the bottom, a much greater depth than that at which he had just been. He did get his gun, but reached the surface in a collapsed condition, and had to be taken ashore at Gozo for treatment. As a result, the Malta team was one man short for most of the contest, and a major tragedy was averted only because of the diver's youth and general good health.

This brings us to another hard and fast rule: *never* go diving if feeling even the slightest bit "off sorts" or after a full meal.

As a sport, the "game" is naturally fish, the weapon having evolved from a simple spear, through various types of spring and compressed air guns, to the sophisticated cartridge rifle. The shaft may have a single barbed point or end in a three pronged fork. Whatever its make, a gun is liable to go off accidentally, and when carried on shore it should be held pointing downwards at all times. The X-ray picture shows a young man who disregarded this fundamental rule. By the most fantastic good fortune no injury was done to eyes, brain, or any other important structure. He presented a very macabre picture on admission to hospital with this great big harpoon growing out of his face. Under general anaesthesia the shaft was sawn off near the trident which was then skilfully removed by Professor V. G. Griffiths. I think one stitch was put in somewhere and he was discharged the next day.

One of the first rules of any subaqua club or team anywhere is that divers must always go out in twos, so that each can keep an eye on the other. It is wise to hold

one's gun pointing away from one's partner.



When the shaft leaves the gun, several yards of cord are paid out, and it would not be impossible for a diver's leg or arm to get entangled by it around some projecting rock, and a sharp knife is usually carried in a sheat against this or any other eventuality.

Malta waters are fortunately free from the really dangerous denizens of the sea. The odd shark sometimes fouls the nets of regular deep-sea fishermen, but within living memory, with one possible exception, a shark has never attacked a human. The moray-eel does exist here but no skin diver has ever been attacked by one. The sting-ray, a flat square cartilaginous fish with a ropy tail growing out of one corner, glides along sandy bottoms; it can inflict a very severe sting with its tail, but only if interfered with, and it is a sitting target to any spear-fisherman. Sea urchins are no problem because the diver can always put hands or feet down under direct vision. A jelly-fish sting can be rather unpleasant but not serious. These medusae invade an area in shoals, suspended a few inches below the surface. It is fairly easy, if you see one coming, to squash it between your two flippers. For the actual jelly-fish sting, some local or systemic antihistaminic helps, but usually the burn wears off on its own.

For the diver who would like to spend longer periods submerged than his own lungs will allow, the Aqualung is available. This consists, in the case of amateurs, of one or more compressed air cylinders strapped to the back and connected by breathing tubes to a mouth-piece. (Professional divers use varying mixtures of Oxygen with Nitrogen or even Helium.) The deeper one dives, and the longer one stays under, the more nitrogen is accumulated in the body. As long as this is under pressure it is held in solution in the body fluids, But, should the diver who has been submerged long and deep suddenly have to surface, nitrogen is released as bubbles of gas, which, if not eliminated by the lungs in time, may give rise to embolisms in joints, heart, lungs or the central nervous system — the dreaded "bends" of caisson disease — which, if not dealt with immediately, may cause permanent crippling or even death.

Therefore —and this is vital — unless an aqualung has been declared by an expert to be in perfect working order, it is on no account to be issued to, or accepted by, a diver.

The staging of an ascent is governed by a set of rules based on the depth and duration of dives. There is no time for details here, but as examples: for a dive of 2 hours at 60 feet, half an hour is required for the ascent and for a dive of 4 hours at 60 feet, one and a half hours are necessary. If a diver does fall victim to the bends, one or two things, or both, should be done with the least possible delay: either (i) he is taken down again, with aqualung, to his original depth and helped to surface by stages, or (ii) he is taken to the nearest compression chamber if one is available. This is an air-tight chamber inside which the air-pressure (or other breathing mixture) can be raised or lowered as necessary. In Malta we are grateful to the Fleet Clearance Diving

Team of the Royal Navy who are always ready with their advice and practical assistance. In the chamber, a diver can be subjected to air compression equivalent to that of the depth at which he has been and then decompressed by corresponding stages.

When a series of tiny bubbles are seen rising in the sea and popping at the surface, they usually indicate the position below of a diver using a normally-functioning aqualung. But, if the bubbles are large and follow each other in quick succession, they are issuing directly from the aqualung mouthpiece, no longer held in the diver's mouth, and this spells trouble. In such a case, the diver, who is probably unconscious, is located immediately, an aqualung mouthpiece applied to his mouth, and he is raised as quickly as possible to the surface. Life-saving here takes priority over the prevention of bends. Mouth-to-mouth respiration is given immediately on reaching the surface, whilst still in the water. At the first convenient place, on a boat or on land, manual artificial respiration is administered, the method of choice being that with which the operator is most familiar. Naturally a free airway is a "sine qua non" and if water has been inhaled the victim had better be in the prone position. Cardiac arrest is treated by cardiac message and cardiac stimulants, such as intracardiac adrenaline.

To conclude on an optimistic note. Diving accidents are rare and mostly avoidable, and the prizes well worth trying for. Cousteau's "silent world" can be a veritable paradise for those under its spell. There is no necessity for slaughtering fish: there are other, more fascinating, things to see and do. For hours one can be held spellbound just gazing at the configuration of the rocky deep and shelves, the variegated shapes and colours of the sea vegetation and the varieties and behaviour of the fauna. For instance, the commensalism between pen-shells and their sentinel crabs, the jet-propulsion of clams and squids, the screw-action by which certain sea-snails bury themselves in the sand, the gentle grace of the nudibranch literally flying through the sea and numberless others.

This is to say nothing of the thrills provided by spotting Phoenician, Roman, or mediaeval potsherds half buried in the sand, and, who knows, perhaps even the odd anchor from a foundered galleon of bygone days. In fact, so long as the rules are observed, skin diving is a safe and exhilarating form of occupational therapy strongly recommended for the harassed medical practitioner.