PROVISIONAL REPORT ON AUSTRALIAN DIVING-RELATED DEATHS, 1979

Dr Douglas Walker

Overview

Ten diving related fatalities have been identified as having occurred during 1979 in Australian waters.

There were two breathhold divers, six using Scuba and two with hookah air supply systems. Adverse water conditions were significant in four cases, narcosis and excessive weighting in one, and some degree of inexperience in all except two. These two suffered from misadventure, one being drowned by a crocodile and the other poisoned by carbon monoxide fumes.

Mention is made of the omission of Inquest Proceedings in two cases where the bodies were not recovered, though legal powers appear to exist to cover such events.

In one investigated incident the buddy was so little present that the police omitted to question him about the dive, while in another incident the buddy was at the same risk as was the victim whom he was attempting to aid.

Two Autopsy examinations were outstanding in that the pathologist involved paid special attention to the possibilities of barotrauma and air embolism, conducting the examinations with particular care, in one case obtaining an X-Ray before opening the body.

In two of the incidents hired tanks were being used.

The use of effective buoyancy vests would have improved the chances of survival in all of the Scuba diver fatalities : only one wore a vest and as this was of the CO type it was ineffective at the depth of the incident.

One victim remarkably took off his new Fenzy vest before starting his dive.

The general conclusion is that trained and experienced divers avoid dying in diving incidents which claim the lives of the inexperienced, including those newly certificated. This indicates that many diving fatalities are potentially preventable.

Brief Case Reports Case

BH 79/1

Four friends were on their annual fishing holiday at the opening of the crayfish season, a ritual followed for eight or more years, at their usual area of rocky coast. Three were line fishermen, the fourth was said to be “a good swimmer for his age, experienced in breath-hold diving”. He was aged 51.

On the critical day they decided to move some pots which had washed too close to the cliffs but realised that the sea conditions made it too risky to take the boat close enough in, so the diver member swam and retrieved one. He then returned with a rope to reach the remaining “ring” but was overwhelmed by the second of four large waves “that seemed to rise out of a calm sea”. The boat turned bow into the waves only just in time to survive.

The victim failed to surface, so the alarm was raised. By the time the police diving squad arrived the surge and waves had become too dangerous to allow recovery of the body although its position was known, and the two police divers placed themselves at considerable risk in freeing it from entangling kelp and towing it seaward to the waiting launch the next day. It was found in one of the numerous gullies in about twelve feet of water. The rescue divers deserve commendation for their efforts. Witnesses stated that the dangerous sea conditions should have been apparent to any experienced diver. Unfortunately this swimmer realised too late the overwhelming power of waves and surge over rocks, especially at the base of the cliffs; entanglement made his fate more certain.

Case BH 79/2

This unfortunate man was on holiday and was diving for crayfish with a friend, while his wife waited on the bank of the creek. The peaceful scene was shattered when he surfaced and screamed out, at the same time seeming to be hitting at something with his hand. He then seemed to be physically pulled under the water and was seen to be towed out and away from the bank. His companion started towards him initially but realised the danger of involvement with a predator of unknown size. An intensive police search was carried out and the body discovered in a creek approximately one and a half kilometres away, a little over six hours later. A large (3 metre) estuarine crocodile was seen nearby. It was later captured and destroyed. As crocodiles are territorial in habit it seems highly probable that the responsible animal was indeed caught. Autopsy showed that the victim’s left elbow had been dislocated as he fought to escape being dragged underwater. He had been wearing a wet suit and using snorkel and mask, about 30 m from the shore, when attacked at about 5.00 pm. Although local radio warnings about crocodiles had been broadcast these only advised caution, not avoidance of all swimming. This is the first recorded case, as far as is known, of a crocodile attacking a diver in Australian waters.

Case SC 79/1

The victim of this incident was certificated for scuba diving a year previously but had confined himself to snorkel diving subsequently. This is believed to have been his first scuba dive since his course. He was aged 60.

On this day he first made a short snorkel dive with his buddy, then both returned to the shore to kit up with the scuba tanks. He seems to have removed his wet suit top and his new Fenzy ABLJ, and possibly also left off his fins, for this dive. His buddy advised him to wear his Fenzy but apparently he declined, giving as reason that it was too uncomfortable.

The sea was choppy, the water only 10 to 15 feet deep and visibility poor. The two divers seem to have proceeded independently of each other, and

as a result the buddy (also certificated for one year) concluded his dive and returned to the beach unaware of his friend's fate.

The police obtained no statement from him, possibly in the realistic belief that he had no awareness of the actions of his "buddy". It is thought that the victim was swimming to a nearby wreck, in shallow water close to the shore.

He was seen by a witness on the beach to surface several times and then to float on his back quietly. After observing this non movement for 5-10 minutes the witness felt alarmed and started to swim out to him, but found that he was "out of condition" and in danger of getting into difficulties himself.

He therefore raised the alarm and lifesavers recovered the body, which no longer had any weight belt, tank or snorkel. The missing equipment was never recovered for examination being (probably) stolen before a search was made to recover it. It is thought that he would not have run out of air so soon after starting his dive.

The Autopsy did not show evidence of any heart attack, though "marked sclerosis of coronary blood vessels" was noted. The sea condition was described by the lifesavers as "good" but may have been too much for a person inexperienced with scuba equipment and used to the greater freedom of snorkel diving. It cannot be known whether he suffered anginal pain or whether some other problem induced him to ditch his equipment. His Fenzy could have been lifesaving.

Case SC 79/2

Few details are available concerning this incident. It is said that the victim was separated from other divers to swim after a turtle and was never seen again.

The dive base was a reef island and it is said that adverse weather conditions for both boats and divers had been declared, but as the body was not recovered there was no Inquest held into the proven disappearance and presumed drowning.

Though police inquiries will have been made into the matter, their reports are not available. In a newspaper report, the mother of the victim stated that her daughter had been advised against diving deeper than 3m because of her Asthma. It is hoped that an Inquest will be held at some later date. Diving experience - 3 years.

Case SC 79/3

In this incident the three divers had completed their dive on the seaward side of a reef which was connected by a jetty to the shore. The two less experienced divers were low on air when they climbed onto the reef, which was being washed by 3 foot waves.

The most experienced member, the only one wearing a buoyancy vest, decided to make his way along the reef to the ladder at the end of the jetty, the other two choosing to snorkel back to steps part way along the jetty.

While one was preparing himself to re-enter the water, his companion started his swim. By this time the "dive leader" had got onto the jetty and looked back. He saw the victim making his way on the surface and did not immediately realise that he was in any difficulty in the choppy water, taking his equipment off before noticing that the victim had lost his mask.

He shouted to the third diver, still on the reef, and dived back into the water.

The victim had ditched his back-pack and had his hands firmly about the quick release of his weight belt when reached. The belt could not be released (later check established that it was a wire type release, difficult to operate with cold hands). He appeared to be semi-conscious, and in-water mouth to mouth resuscitation was made impossible by the waves continually breaking over them, so the rescuer towed him back to the reef and, with assistance, got him back to and onto the jetty. Resuscitation attempts (EAR and closed chest cardiac compression), both on the reef and after 'raising onto the jetty, were unavailing.

The victim was aged 19 and this is thought to have been his fourth dive since taking a course a year previously. While one of the other divers, the one with the buoyancy vest, had several years' experience (and still had 1,000 psi air remaining), the remaining diver had only just completed a course (and was on reserve air when he reached the reef). It was found that the victim's tank still contained 650 psi air, the equipment was new and functioning correctly, and the weight belt carried 15 lb of lead.

It is probably that the victim felt overweighted for the water conditions which he experienced but was unable to drop his weights due to cold hands, design of the release and involuntary submergence. The use of the air remaining in his set, especially had he been wearing a buoyancy aid, could well have allowed him to complete his return to the jetty without experiencing any problems. This dive area has claimed a number of previous victims and misjudgement of ability in relation to sea conditions appears to be a major problem with such incidents.

Case SC 79/4

This club dive ended in disaster. It was a boat dive on a newly popular dive site, a spectacular series of drop-offs from an initial 10 m to a maximum of over 65 m but subject to strong currents and only short times of slack water. The buddy pair involved wore "twin 88's" and had a buddy line connecting them.

They completed their planned dive to 50m for 5 minutes and had begun to ascend when the buddy saw the victim having some problem with his demand valve. He tried to assist, pulling the cord on the victim's vest to activate the CO_2 cylinder. Either the unit failed to fire or the depth rendered the gas volume ludicrously inadequate, for the vest failed to provide needed buoyancy and the victim started to descend instead of making the desired ascent.

The buddy felt that he would blackout and that his own life was at great risk, so left the

victim (now unconscious?) on a ledge at 60 m and made a rapid no-stop ascent ignoring planned "stops" advisable for such dive profiles in order to raise the alarm. Several other divers made an immediate but unsuccessful search for the victim and later a surface search was made in hope that he had surfaced and been washed away unseen by those in the boat.

Because the body was not recovered no Inquest into the incident has been held to this date, a year later. Other sources of information have been used for the above report. It is thought that the dive was made without appreciating the dangers inherent in open water deep dives in the presence of strong currents. Cold, poor visibility, nitrogen narcosis and decompression sickness, are additional factors in such dives. There was no provision for in-water decompression stops other than the air remaining to each individual diver, and it is said that the initial surface concern was regarding DCS rather than the victim's out of air/ drowning risk.

An experienced diver familiar with this site suggests that "cave dive" techniques be employed and that careful dive planning is mandatory. The ascent "stops" can only be made on a weighted line so a line from this, or the anchor, to the diver is necessary if he is to find it for his ascent at the conclusion of his dive.

The victim is said to have used a throat spray before the dive because of headaches after and during previous dives. It is not known what type of buoyancy aid, if any, the survivor wore.

It is obvious that correct weighting, a submersible air pressure gauge and an ABLJ are basic requirements for safe deep diving, and the experience to recognise and plan for all likely risks.

Case SC 79/5

This fatality unfolds with some of the inevitable logic of a Greek Tragedy. The victim had almost completed his course, one lecture still remaining, but dive requirements completed. The group of five was led by one of the assistant instructors, though this was not part of the course, and he hired the tank for the victim. The dive shop owner was under the belief that a pool dive was planned, but the group intended to swim to a reef about 25 m from shore, a relatively shallow area.

The group entered the sea and were checked for air on, etc., when about chest deep. Shortly after starting the swim three of the group decided to abort their expedition because they found the water conditions too adverse. In fact the "dive leader" continued to the reef in the belief that all the others had returned to the beach, and he returned to the beach only after he completed his solo dive, unaware of the tragedy occurring in his absence.

The victim was seen to signal that he was in difficulties but the waves prevented his friends from reaching him from the beach. The calls for help attracted a board rider, who had initially thought that the victim was merely calling to his friends. He found it impossible to get the distressed diver onto his board, or to help himself greatly, and was unable to remove the diving equipment. The current washed them out over the reef and separated them for a while. However, with the aid of another board rider he eventually brought the victim back to the beach. Resuscitation was unsuccessful. The board riders deserve praise.

The plan was to snorkel out to the reef and it is thought he did not use his scuba. He had no buoyancy vest. It is reasonable to suppose that he would have survived had he worn a buoyancy aid and used his scuba air rather than persisting with his snorkel. He was aged 44.

The subject of the next lecture was to be the management of the many dangerous currents at this dive site.

Case SC 79/6

The exact sequence of events during this dive is unknown, for the victim was alone when death occurred. He was aged 28, an experienced freediver but untrained and inexperienced with scuba. This was probably his third dive, though a claim was advanced that he had received training and was experienced. His buddy had 20 dives experience.

The victim borrowed one tank and hired two more, the buddy supplying his own tank. They made a brief dive and then moved to another site to dive again. The victim mentioned some ear discomfort after this first dive but showed no reported difficulty in descending with his buddy to 30 feet at the second site. After about 10 - 15 minutes the buddy noticed that he was alone, so surfaced, took off his equipment and got into their boat.

As he saw no sign of his companion, he made a boat search of the area, but without success. He therefore went ashore and gave the alarm, then resumed his search. About half an hour later he located his friend lying on the rocky sea bed in all his gear. The body was brought into the boat, obviously lifeless.

The Autopsy showed no signs of pulmonary barotrauma (a chest X - ray was performed before the opening of the body), but there were a few air bubbles in the ascending aorta suggesting that some PBT did occur. There was a fresh haemorrhage noted in both middle ears and mastoid cells, an event likely to incapacitate a diver by the pain and vertigo produced. It is possible that otic barotrauma on the first dive might have predisposed to this problem but it is not known which was worn by the victim, which by his buddy. They contained 790 psi and 2,500 psi so it is reasonable to think that the fatality occurred very soon after descent and that buddy contact had been brief. It is unfortunate that he was so easily able to borrow and to hire tanks, given that he was untrained and inexperienced with scuba.

Case H 79/1

Assistants on abalone boats naturally aspire to the better paid and more status satisfying position of Diver. On this occasion the diver acceded to the requests of his tender/sheller to

be allowed to dive after he had finished diving, for he was aged 21, claimed experience in New Zealand, and had seemed competent on several previous trial dives. After all, he said later, the water was only 25-30 feet deep. While the victim was underwater the water trap valve of the compressed air reserve tank vibrated loose and fell out with a loud noise and the air escaped.

This was such a common type of mishap that the Diver unconcernedly awaited the surfacing of the victim. When this did not occur ha replaced the valve and pulled on the hose, as no bubbles were seen ascending when the air supply was restored. The victim was not breathing and could not be resuscitated. He was still wearing the weight belt, with the hose attached. The compressor was said to be virtually new, though the hose was in poor condition. Apparently cut-offs and gear failure are an accepted occupational hazard and free ascents are commonly made when such occur, sometimes from 80 ft. The victim was insufficiently experienced to accommodate to such diving conditions and failed to appreciate the need to ascend when deprived of air.

Examination of the compressor unit revealed that sanitary napkins were used to dry the air, and were wet, so ineffective. The air was said to have a “bad taste” but was not apparently, tested for purity.

Case H 79/2

Abalone divers have a reputation for tolerating poor working conditions and the acceptance of “dirty air” by this diver contributed to his demise, though unique additional factors were the immediate critical inputs into the diving situation. The victim was a professional diver aged 25, working from a small boat which contained the compressor and his tender/sheller. The divers and assistants lived on a larger boat, which carried several such dinghies.

His routine was to send up his net full of abalone by parachute, indicating by line whether he wished to remain down or to move to another site. This morning the bag came up after about 15 minutes. To the surprise of the dinghy boy it only contained 20 instead of the usual 140 abalone, so he line signalled to establish whether the diver wished to try another place. As he appeared to get a reply meaning the diver wished to remain down, he returned the bag and waited a further 10 minutes in a certain degree of uncertainty. He took the occasion to contact divers in another boat and they noted bubbles ascending but got no line call reply. The air line was used to pull him to the surface.

His equipment was on but the regulator was out of his mouth. The immediate belief was that he had been attacked by a shark and had stayed down for fear of one, but no such attack had occurred.

Investigation established that he was experienced (he had survived compressor pieces blowing out) and tolerant of “dirty air”, for several months previously another diver had used his compressor and refused to use it again because of the impurity of the air it supplied. He had mentioned headaches after diving on recent days, suggestive of carbon monoxide contamination. Test running the compressor on land showed excessive presence of Carbon Monoxide, but not sufficient to explain the observed blood saturation of Carbon Monoxide of 68%, a lethal level, following a short exposure at 30-40 feet depth. More detailed consideration of the events of the dive provided an explanation. The sea was calm and there was probably little wind (witnesses differed on this). The little aluminium dinghy was anchored in a current and kept stern into this current by running the outboard motor. There was a piece of loosely fitting tube over the inlet of the compressor and this could easily have been pointed towards the exhaust of the outboard, sucking up the fumes. The regulator was found to contain foreign matter sufficient to impair its function, another indicator of the maintenance standards for this hookah unit.

Discussion

There is nothing to suggest that those who died were in any significant way different from the majority of their fellow divers, save in the outcome of their dives. The critical factors operating in their dives were probably present in many other dives which did not exact such drastic penalty. It is hoped by detailing the circumstances and identifying the most probable adverse factors it will make it possible for others to recognise disadvantageous aspects of their personal diving techniques, which they can then eliminate or at least modify. It is noteworthy that trained divers who have acquired some experience do not figure in this role of victims, as far as present information goes, unless they put themselves at special risk. No person wearing an ABLJ died, while absence of any effective buoyancy aid proved a critical disadvantage to several. Water power is clearly a force of importance capable of leading to the death of surface divers without buoyancy aids. Two divers had air at the surface but failed to use it, a lethal error in rough conditions.

Dive planning is always important, particularly for any club diving a deep area subject to currents. Consideration must be given to the adequacy of the training and experience relative to the planned dive. Keeping in mind Murphy’s Law, consider water conditions (cold, visibility, waves, currents the problems of safe exiting/retrieval of divers, dive discipline, correct equipment buoyancy vests, contents gauges, lines, etc.), correct weighting of divers for depth, and preparedness for emergency situations. It is not possible to institute underwater stops unless adequate air is available and a fixed line is used. Narcosis, cold and decompression sickness must be expected possibilities with deep dives. Divers need to have knowledge of emergency procedures, the ditching of the backpack not being advisable or appropriate in most circumstances as a priority action in a panic situation. Buoyancy aids give a surface diver time for calm consideration of his problem. Naturally an entangled tank requires removal ... if the buddy is not there to give assistance. To use a “crook” hookah denotes careless diving habits which are indefensible.

The fact that two fatalities occurred while using borrowed or hired tanks highlights the anti-social effects of allowing the inexperienced to use scuba other than under carefully controlled circumstances.

Solo diving, and separation from one’s

buddy, appears to adversely effect safety by reducing the changes of assistance in the vital early moments of some crisis.

Medical factors may incapacitate a diver unexpectedly, immediate assistance being vital for survival. The medical conditions noted in this series (coronary artery disease, middle ear haemorrhage) might not be fatal if the victim receives immediate assistance. The history of asthma in one victim raises ethical and legal considerations which will not be discussed here.

In brief, those at greatest risk are the inexperienced, diving alone without buoyancy vests or contents gauges in environmental conditions beyond their ability to manage.

Acknowledgments

This report would not have been possible without the interest and assistance of many persons and groups, and in particular the generous and continued assistance of the Attorney-General's and Justice Departments in every State, and the Coroner in the Northern Territory. The valued assistance of the Water Safety Councils, in NSW and South Australia in particular, and the National Safety Council is gratefully recorded. Detailed reports by individual divers has been of decisive importance in several cases. The AUF and FAUI are thanked for their continued interest and assistance.

Project Stickybeak

Readers are requested to support this research and thereby assist further raising the safety record of diving. Any type of diving-related incident however minor may hold clues to safer diving. No problem can be remedied until it has been recognised, no improvement occurs unless the information is shared. All information supplied is treated as confidential concerning the actual persons involved. Please write to:

Dr. Douglas Walker,
PO Box 120,
NARRABEEN NSW 2101

THE CORONIAL INVESTIGATION OF "SKIN-DIVING" FATALITIES IN NEW ZEALAND

Dr PRJ Lewis

I have recently reviewed the New Zealand skin-diving fatalities for the period 1961-1973 (*NZ Medical Journal* 89:472-475) and found major deficiencies in the information made available to the coroners, on which they reached their conclusions. In only one case had an overall assessment of the facts been made by a skin-diving expert. The Coroner's Act states "The principle functions of a coroner shall be to enquire in accordance with the provision of this act, into the manner of death of any person in any case where this act requires that the death be reported to the coroner". It seems reasonable to interpret this as requiring the coroner to investigate why the incident occurred rather than merely how the death occurred. To state only that someone "drowned by skin-diving" leaves too many questions unanswered. Why should these fatalities be investigated in such a way? I see two main reasons. First, to establish the factors that contributed to the fatality, and second that we may learn from the mistakes of others. These lessons can be incorporated into instruction programmes leading, hopefully, to safer diving practices.

The following 21 case histories illustrate the varied critical factors that have been identified in this series.

Case 1

This 50 year old had been a scuba diver for 2 and a half years and was thought to be competent. He was crayfishing with a buddy in 12m of water from a boat in calm conditions. All was well until he indicated that he was going to surface with a sack of crays. The buddy watched him ascend and then as he started to follow he saw the sack of crays come down. He recovered the sack and on reaching the surface saw the deceased face down in the water just below the surface. Frothy blood dribbled from the mouth. The rescuer dropped the deceased's weight belt and mouth to mouth resuscitation was given whilst towing the deceased to the boat, but to no avail. No buoyancy compensator was worn by the deceased. The equipment does not appear to have been checked following the incident. The postmortem showed signs of drowning and patchy atheroma of the coronary arteries with almost complete occlusion of the anterior descending coronary artery. It was concluded that death was a consequence of the coronary artery disease.

Cardiac arrhythmia or myocardial infarction are especially hazardous when they occur in the water. If buddy contact had not been broken at the time of ascent, it would have been theoretically possible to prevent drowning. The outcome would then be dependent on the severity of the cardiac arrhythmia or infarction.

Case 2

This 51 year old was a newly qualified diver and a member of an New Zealand Underwater Association club. He was diving with a buddy at an off-shore island from a boat. They had a shallow dive for 15 minutes, after which they surfaced and had lunch in the boat. One hour later they dived again for 25 minutes in water 10m deep. The deceased gave a signal to surface which they did together, and they found that they were 30 metres from the boat. The sea was quite choppy and the deceased was having difficulty in breathing.

The buddy had lost his own snorkel and both