

When Everything Goes Right: Implications for Scientific Diving Safety Programs

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Abstract

In April 2006, a serious injury incident occurred involving a diver at the Oregon Coast Aquarium, resulting in a near-drowning, full cardiac arrest, subsequent rescue, emergency medical treatment, rehabilitation and ultimately a full recovery for the 43 year old female patient. The diver was conducting a routine dive when she suddenly became unconscious at a depth of 26 ft. No medical history or contraindications for diving were evident, no equipment malfunctions were discovered, and the causative features of this event are not clear, however radiographic findings were consistent with pulmonary edema. The diver spent six days on a ventilator and several weeks making a full recovery, while the incident was investigated and analyzed. Virtually everything went right, yet puzzles remain. While this dive was not a scientific dive, many lessons can be learned which have implications for scientific diving programs.

Background

On Sunday, April 23rd, 2006, a serious injury incident occurred involving one of the volunteer divers at the Oregon Coast Aquarium, resulting in a near-drowning, full cardiac arrest, subsequent rescue and ultimately a full recovery for the female patient. For the purposes of this story we will call the 43 year old female patient Danielle, and her husband dive buddy will be known as Shane.

Shane had been a volunteer diver at the aquarium for more than three years, and his wife had joined him in the diving program first as a dive tender, and finally as a diver (once she had fulfilled the prerequisite training requirements). These requirements include an advanced level certification, 25 logged cold water dives, 50 logged dives total, first aid, CPR and a specialty aquarium diving course taught by Aquarium staff. She had been diving in the program for about six months. Both divers had all required documentation on file, and were volunteers in good standing. Shane, a dive master trainee, was partnered with his wife as a buddy for this dive. Volunteers use all of their own dive equipment for these dives except for cylinders, which are provided by the aquarium. Shane and Danielle owned top end dive equipment, which was kept in factory authorized annual repair. Danielle also had a valid medical on file, dated 6 months prior to the dive incident. There was no history of diving contraindications, such as medical problems or medications. Following the incident it was related that Danielle had suffered a pneumonia-type event six to eight weeks earlier, for which she received treatment from her local medical practitioner (she was not hospitalized), however it was described that she had recovered from that ailment and had been diving since with no apparent problem.

The dive location was Halibut Flats, one of three large exhibits that make up Passages of the Deep, the largest aquatic gallery at the Aquarium. All three exhibits are 26 ft deep and each has a section of acrylic viewing tunnel that guides visitors progressively through the three exhibits; Orford Reef, Halibut Flats and Open Sea. The dive platform is reached via a flight of stairs that leads to the topside

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of the exhibits, which are all housed indoors with a high arched ceiling. The entry areas for all three exhibits are in this area. Halibut Flats features a large flat, rubble substrate area with three rocky reef promontories and a simulated ship wreck. There are large and small halibut, skates, ling cod, and a variety of rockfish species in this exhibit. The top of the tunnel is at about eight feet of depth, and the bottom of the tunnel at about 16 ft, leaving approximately eight feet of clearance from the floor to the bottom of the tunnel. The only obstruction to continuous visibility is the floor of the tunnel, however there is also a floor window that allows some view. Divers enter the water using a controlled seated entry technique and deep water exit, though there is also an entry/exit platform on the far side of the exhibit. The entire exhibit is free of railings, making it possible to enter/exit the water from any point, 360 degrees around. With large open areas and a simple reef to flat bottom interface, Halibut Flats is one of the easiest exhibits to dive.

The Incident

Pre-Dive

Danielle and Shane left their home in Corvallis at about 0700 and drove to the Oregon Coast Aquarium, where they met the other members of the dive team, unloaded dive gear and prepared to dive. A pre-dive shift meeting was conducted, and divers divided themselves into buddy pairs to dive. Shane and Danielle prepped and checked their dive gear, and readied themselves to dive in Halibut Flats. The dive plan was to do a thorough animal health check and then return to the surface for acrylic tools to clean the tunnel. Samuel was tending for the first series of dives. He conducted the pre dive safety checks of both divers and their equipment and logged them into the water at approximately 0920. Both divers were wearing neoprene drysuits and high quality diving equipment that appeared to Samuel to be functioning correctly.

The Dive

Danielle and Shane descended uneventfully. After about 15 minutes they both surfaced to get acrylic cleaning tools and began to descend. They both returned to the surface almost immediately and Danielle asked for additional weight to make using the acrylic tools easier. She sat on the corner grate exit area and the tender, Samuel, added two 1.5 pound weights to the tank valve, while Danielle joked about her weight needs. The two then descended, and Shane described that Danielle was several feet below him as they approached the tunnel. It appeared to Shane that Danielle was going under the tunnel and he expected her to come up the other side. He arrived at the tunnel and placed the suction cup on the acrylic, but since Danielle hadn't arrived he stopped and looked down to see where she was. Through the floor window in the tunnel he could see her fins in a stationary position. He immediately dropped to the bottom where he saw her unconscious on the bottom with the regulator out of her mouth.

The Rescue

Shane grabbed Danielle and took her to the surface, where he yelled for help. He tried to remove her weight belt, but the buckle slid around her waist. He inflated his BC and started to swim to the side. In the process he kicked out of one of his fins. He was able to get her to the side, where he removed her weight belt. Another volunteer diver who was helping topside (Tony) and the dive tender Samuel arrived and lifted her out of the water with her cylinder and buoyancy compensator still in place. They described Danielle as blue and unresponsive. They removed her equipment and Samuel immediately began CPR. Tony went to the radio and called for assistance, specifically requesting security to call for an ambulance. Tony then returned to Danielle where Samuel was doing CPR and

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began to administer breaths. They described that Danielle was attempting to breathe. This was later determined to be agonal breaths. They experienced significant difficulty maintaining an airway due to foam and water coming out of Danielle's mouth. Scissors were requested, and though there were two pair in first aid kits on the diving deck, neither pair was located. Staff retrieved a pair from a nearby office and the drysuit was cut off of Danielle. CPR was not delayed. Samuel had started CPR immediately without removing the drysuit.

Within about 30 to 40 seconds of Tony's radio call, three staff arrived. These staff also noticed foam and water coming out of Danielle's mouth during compressions. Samuel verbally described the foam as pinkish in color. Security immediately called 911 and responded to guide emergency personnel through gates and to the scene. Staff moved Danielle to a larger and better lit area, and noticed that her color had begun to improve. Danielle was cared for by staff until the first (fire department) paramedic arrived, approximately three to four minutes later. The fire paramedic began CPR. The AED showed asystole. The fire paramedic administered cardiac drugs and was able to obtain a cardiac rhythm, but no pulse. CPR was continued. When the ambulance arrived additional drugs were administered and paramedics were able to obtain an effective rhythm and pulse. CPR was stopped at this point. Danielle was intubated on scene. The ambulance transferred Danielle to the local Samaritan Hospital.

Dive Safety Officer (DSO) Hodges received the call at home within about five minutes of the incident and arrived at the scene just as the ambulance was leaving. The police had also arrived and took photos of the dive equipment, evaluated the cylinder valve (it was all the way open) and asked to have the gear locked up until it could be evaluated and any additional information provided to them. It was taken to the compressor room and locked in.

The ambulance transported Danielle to the hospital. Hodges stopped briefly at the scene, picked up Tony and drove to the hospital while Tony briefed Hodges on the event as he understood it. Hodges met with the ER doctor and immediately requested the involvement of DAN (Divers Alert Network) as a resource for diving emergencies. Though the ER had no information or phone numbers for DAN they did call once Hodges provided them with the information. Later Hodges learned that the ER doctor spoke with the on-call DAN physician and used medical protocol provided by DAN. Within about 10 minutes of Danielle's arrival, her husband/buddy Shane arrived at the hospital and provided valuable details of the dive, including that there had not been an uncontrolled ascent or any sign of a diving malady prior to the sudden unconscious event at depth. For that reason DAN and the ER physician decided there was no reason to transport Danielle to a recompression chamber, and that she should be treated for near-drowning.

Post-Dive

Danielle was placed on a ventilator, transferred to ICU and was listed in stable/guarded condition. Hodges requested one of the volunteer diver shift captains to stay with Shane while Hodges returned to the aquarium. A brief staff meeting was held to communicate what was known about the event. A quorum of the DCB (Dive Control Board) was present at that meeting and the decision was made to have Hodges (with a witness) do a cursory inspection of the dive gear for any obvious problems, count the amount of weight and contact the police with any additional information they needed. Hodges conducted a cursory inspection with Tony present. Hodges later contacted the police officer assigned to the case and relayed the information that there was 38 pounds of weight total and no obvious problem could be detected upon cursory inspection of the gear. Everything appeared to be functioning correctly. Hodges then returned to the hospital to stay with Shane. Over the next four days Hodges spent most of the time with Shane at the hospital. Shane involved Hodges completely in

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the case, allowing access to Danielle in the ICU room, and involving Hodges in discussions with the attending physician.

The incident occurred on a Sunday, and on Monday a different doctor was assigned Danielle's case. This physician called the hyperbaric chamber in Portland, Oregon and after discussing the case with them decided to transfer Danielle to the chamber for recompression treatment. Shane immediately notified Hodges of this development, concerned that DAN had initially consulted with the ER physician and recommended against this treatment. Hodges immediately called DAN for consultation and with some difficulty Hodges and Shane were able to convince the attending physician to discuss the case with DAN. At first the physician was not convinced and still insisted on the transfer and hyperbaric treatment, however DAN worked to get all of the parties on the phone together (including the hyperbaric facility in Portland) and it was finally agreed to continue Danielle's current protocol and not transfer her for chamber treatment.

Despite numerous efforts over the next several days to reduce Danielle's sedation and take her off of the ventilator, Danielle remained on the ventilator. By Wednesday (day 4), Danielle's condition began to worsen slightly, and Shane related to Hodges that medical staff were concerned that Danielle could be beginning to suffer from ARDS (Adult Respiratory Distress Syndrome). Newport's hospital is a smaller community facility and does not have many of the resources that larger trauma hospitals have. Shane began to attempt to negotiate a transfer of Danielle to the Good Samaritan Hospital in Corvallis, Oregon where pulmonary specialists and additional medical technology was available to treat her. An emergency transfer was made on Thursday (day 5), and by Friday evening (day 6) doctors were able to remove Danielle from the ventilator and reduce her sedation enough that she became conscious. She clearly recognized family members and was responsive. By Monday (day 9) she was taken out of ICU and moved to the general hospital ward for recovery. By Wednesday, May 3rd (day 11) she was transferred to a nursing facility for continued recovery including physical and speech therapy. She experienced some balance and speech impairment early in her recovery, however those issues resolved with time. During this time, Hodges visited Danielle and found her to be tired but improving rapidly, in good humor and having no memory of the event and only scattered memory of the hour or so prior to the dive. Over the next several weeks Danielle continued to improve, until she was able to return home, return to work and has been described as completely recovered.

The Investigation

Oversight of the Incident by the Dive Control Board

The Dive Control Board discussed the events and evaluated them based on the dive program policies and procedures as provided by the Oregon Coast Aquarium Dive Manual. No violations to these policies or procedures could be found. In fact, it was seen by the board that staff and volunteers reacted in an exemplary manner, from the buddy system, the rescue, the egress to the administration of CPR, caring for the injured diver, contacting security, calling 911, notifying the Dive Safety Officer, and controlling the scene. Access to the facility for emergency personnel was handled exceptionally well by security staff, and personnel were stationed at the Passages stairs to direct them to the patient. All elements of the accident management plan appeared to have worked very well.

Hodges provided an overview to the DCB of possible causes of the unconscious event underwater, as suggested by DAN, including cardiac dysrhythmia, stroke, a tight drysuit neck seal, pulmonary edema, or accidental aspiration of water that might be caused by sudden choking, panic, or loss of regulator (M. McCafferty, personal communication, April 24, 2006). Deriving the cause was difficult because there were no witnesses to the moment of the unconscious event. There was a current dive medical on

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file for the diver, signed by a physician October, 2005. The diver had not notified the aquarium of any serious medical injuries, illnesses or admission to hospital since that medical was conducted. During the event, the diver's husband did relate to Hodges that the diver had a bout with pneumonia 6-8 weeks earlier, had received medication for it and had dived since that illness resolved. She was not hospitalized for that illness. The Aquarium's Dive Safety Manual required divers that have a major illness or injury/hospitalization to advise the Dive Safety Officer and to obtain a new release for diving from a physician. Danielle's pneumonia prior to the incident did not appear to meet those criteria, so no policy was violated in this case.

The DCB took the following information gathering actions:

1. The regulator used by the diver was sent to NOAA (National Oceanic and Atmospheric Administration) to be tested and inspected. The regulator was found to be operating properly.
2. Hodges obtained the software and cable to download the data in the diver's computer. The diver was using a Cobra dive computer that recorded time, depth, rates of ascent, and air consumption data throughout the dive. Hodges also obtained the buddy's dive computer data (also a Cobra). This information was helpful to establish a timeline for the dive, the profile and rate of ascent, and information regarding air consumption. This data appears to indicate the diver was rescued almost immediately and that there was no increase in the injured diver's air consumption toward the end of the dive, which might be found in a panic event. The computer recorded an in-water temperature of 52°F, 2,120 psi starting cylinder pressure and 960 psi ending cylinder pressure.
3. Hodges provided both data sets to DAN for further analysis, however no further insight was provided by the data (PJ Denoble, personal communication, May 03, 2006)
4. The remaining gear used by the diver was held in a lock up storage until it was determined it was no longer needed. It was eventually returned to the diver.
5. The air in the dive cylinder used by the diver was tested (following appropriate chain of custody and sample analysis procedures required by Dr. Ed Golla of TRI-Environmental Inc.) The air was found to be within standards. The dive program air fill station is tested every 6 months, and had just been tested the previous month.
6. Hodges reviewed the First Aid kits with divers, including the location of scissors.
7. An incident review/debriefing was held at the Aquarium on Thursday, April 27 2006 and all staff and volunteers, plus responding emergency personnel were invited. Several of these emergency personnel did attend and provided valuable feedback and answers to questions brought forward by staff and volunteers.
8. The Fire Department also offered to hold a critical incident debriefing session Thursday evening at 1800 for those staff and volunteers immediately involved in the event. A number of those involved did participate in that session. It was recommended the Dive Safety Officer not attend, in order to provide a non-supervisory atmosphere. Feedback from those attending indicated this was a very beneficial session.
9. Hodges met with each dive team to provide a verbal overview of the event, sharing the details appropriate to dive safety (while not sharing medical information) and emphasizing the policies and procedures critical to diver safety – including the buddy system and effective rescues, plus reinforcing the location of scissors and other first aid equipment.
10. Hodges spoke to Bob Hicks, General Counsel for AAUS regarding the incident. Hodges and Hicks discussed OSHA and the extent of jurisdiction in this event with a volunteer. Hicks related that determining whether the diver in this case should be considered a volunteer (not reportable to OSHA) or an unpaid employee (and therefore reportable to OSHA) could be evaluated on the basis of considering several criteria. Hicks draws his information from a recent Supreme Court ruling that said 'In determining whether a hired party is an employee..., we consider the hiring party's right to control the manner and means by which the product is accomplished' (US Supreme Court). Hicks related twelve factors relevant to the

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definition of employee which may be used to assess the employment status of the individual, including: the skill required, the source of instruments and tools, the location of the work, the duration of the relationship, whether hiring party can assign additional projects to hired party, extent of discretion over when and how long to work, the method of payment, who hires and pays assistants, whether work is regular business of hiring party, whether hiring party is in business, the provision of employee benefits, and the tax treatment of the hired party.

Hicks suggested that the aquarium seek the advice of local counsel and that if OSHA made contact with the aquarium that our legal staff and executive personnel should be prepared to describe this position effectively. In balance, the Aquarium was confident this diver should be treated as a volunteer and not as an employee.

Hicks additionally recommended that the Aquarium develop a written incident response detailing the procedure for incident response management. This incident was managed very well and should serve as a model. The plan should include specific details of who is in charge (Hicks recommended Hodges should be for diving incidents), who should be the spokesperson for the facility, what information should be released and when, and what information should remain confidential.

Hicks also applauded the intensive care/involvement and ongoing maintenance of the Aquarium's relationship with the patient and the husband and suggested that contact be maintained in the months to come. (R. Hicks, personal communication, May 3, 2006 and March 9, 2007).

A Medical Explanation

After her recovery, Danielle sought to return to diving as a volunteer at the Aquarium. Hodges explained that Danielle would need to obtain a new medical release for diving and recommended that she seek the professional advice of a physician with expertise in hyperbaric medicine.

Danielle's case was handled by Dr. Gordon Anderson, MD of Oregon Medical Group in Eugene, Oregon. Dr. Anderson is a UHMS Dive Medical Examiner and hyperbaric consultant. He examined Danielle, reviewed copies of her medical records and chest x-rays taken immediately after the incident and reviewed an extract of the DCB report of the incident (provided to him with Danielle's written permission). Dr Anderson then consulted with Dr. Cianci MD and discussed the case. Dr. Cianci has studied pulmonary edema in divers and was a co-author on a leading case report and review, *Pulmonary Edema Associated with Scuba Diving* (Slade *et al.*, 2001).

It is Dr. Anderson's opinion that Danielle suffered from idiopathic pulmonary edema which caused her to become unconscious (G. Anderson, personal communication, July 7, 2006). *The Physiology and Medicine of Diving* (Bennett and Elliot, 1993) describes immersion pulmonary edema as '*probably cardiogenic, caused by a combination of factors, including increased cardiac afterload due to water immersion, high inspiratory breathing resistance and exaggerated cardiac afterload due to cold-induced peripheral vasoconstriction.*' Dr. Anderson explained that in some individuals, the pressure of immersion causes 'increased preloading', or increased right atrial pressure and increased pulmonary artery pressure which can result in disruption of the membrane of the lung. He noted that it can typically be identified using radiological and physical findings, including listening to the lungs for symptomatic 'crackles' and is often accompanied by pink frothy sputum. Witnesses did observe pink frothy sputum, and Dr. Anderson reviewed Danielle's chest x-ray and noted that it showed a diffuse interstitial alveolar pattern, consistent with pulmonary edema. Bennett and Elliott (1993) also list symptoms of dyspnea, cough, haemoptysis or expectoration of frothy sputum, and describe that

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these symptoms 'often occur during descent or while at the deepest depth' as contrasted with cardiorespiratory decompression illness, which typically presents symptoms late in ascent or post dive.

Dr. Anderson stated that the etiology of immersion pulmonary edema is still not known, and has created something of a puzzle for diving physicians. He went on to say that currently there are no tests to predict this malady, but that some apparently healthy people get pulmonary edema while swimming, snorkeling or diving and we don't know why. The only preventive measure is to avoid swimming, snorkeling or diving once pulmonary edema has presented.

Dr. Anderson advised Danielle that she should not dive again and would not provide her with a medical clearance to dive. The patient and her husband agree that this is a good idea.

Pulmonary edema during scuba diving and swimming was first reported by Wilmhurst *et al.* (1981), who reported episodes in 11 individuals. Since that time, pulmonary edema has been associated with cold-water immersion and there have been further reports and reviews of cases, however the mechanisms responsible are still unclear. Pons *et al.* (1995) looked at the prevalence of pulmonary edema in healthy persons during scuba diving and swimming and concluded that it is extremely rare in healthy individuals. In a case that presented to the Auckland, New Zealand hospital, Grindlay and Mitchell (1999) discussed the highly effective treatment of continuous positive airway pressure ventilation and provided guidelines for its use in diving related accidents. They also discussed the occurrence of pulmonary edema as an isolated phenomenon (rather than a presenting feature of DCI and barotrauma) and listed the potential causes as 'salt water aspiration syndrome or near drowning; and cold, immersion and exercise-induced pulmonary oedema.' More recently, Slate *et al.* (2001) reported on eight scuba divers who developed acute pulmonary edema, all occurring in cold water. This report described pulmonary edema in scuba divers as multifactorial and highlighted the importance for physicians to be aware of 'this potential, likely underreported, problem in scuba divers'.

Discussion

The impact of a serious or fatal incident on a dive program can be devastating, from a human perspective as well as financially, legally, and operationally. In this incident, virtually everything that could go wrong went right; from having appropriate training, documentation and protocols in place, to all of the protocol being followed to the letter; from the proximity of a paramedic capable of providing life saving drugs, to the availability and responsiveness of the DAN. From a buddy who kept his cool, to a husband who was open, inclusive and never rattled, blaming or judgmental. In fact, the only issues that appeared were problems associated with medical insurance caps, which were only discovered post incident. These proved to not be a major issue in this case because the injured diver held major medical and DAN diving accident insurance.

To discuss the implications of a diving incident, one must look at what went right, and what went wrong, or what might have gone better. A primary concern and desire is the repeatability of what went right. By evaluating a list of what went right, we were able to prioritize and reinforce our training and procedures with the goal of repeating these positive outcomes, should it ever become necessary. The list of what went wrong also contributed to focusing training efforts and identifying program needs such as improved insurance coverage.

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What went right:

- The diver met prerequisites for inclusion in the Aquarium dive program
- The diver completed all required training (per Aquarium policies)
- The Aquarium had all required documentation on file for the diver
- The diver used high quality equipment that was maintained within manufacturer specifications, required annual maintenance and the Aquarium had proof of this on file.
- The Aquarium conducted all required air fill station tests and had documentation posted
- The divers conducted a pre-dive briefing
- The divers assembled their gear correctly
- The diver's equipment was checked prior to the dive (pre dive safety check) by the divers and the tender
- The divers practiced proper buddy procedures
- The buddy responded promptly when he lost sight of his buddy
- The buddy conducted an effective rescue
- The buddy immediately called for topside assistance
- The tender and another diver responded immediately and appropriately to render aid and remove the injured diver.
- One topside responder immediately began CPR while one went to call for help.
- The responder called correctly on the radio for help
- Security immediately called 911 without delay and responded to open gates and guide emergency personnel.
- The responders provided adequate CPR prior to removing the drysuit.
- The injured diver's color began to improve.
- A paramedic less than one mile away heard the call and responded.
- The responding paramedic was capable of administering cardiac drugs to restore a cardiac rhythm.
- The Dive Safety Officer was promptly contacted.
- The DSO was able to provide the emergency room doctor with contact information for DAN.
- DAN was able to provide medical protocol for near drowning and help evaluate the nature of the diver's injury-recommending no hyperbaric treatment.
- DAN was able to liaise with subsequent physicians and prevent the transfer and hyperbaric treatment of the injured diver.

What could have gone better:

- The rescuing diver lost a fin.
- The rescuing diver would ideally have taken the diver to the corner platform entry area for easier egress, but the loss of a fin made that a poor option.
- The rescuing diver had difficulty removing the weight belt on first attempt.
- The topside responders might have removed gear before removing diver from the water to minimize risk of injury to themselves.
- The topside responders were initially unsure of the injured diver's airway, mistaking agonal breaths for signs of breathing.
- When responders attempted to provide rescue breaths they experienced significant difficulty with the airway due to water and foam.
- The responders had to move the injured diver to a larger work area with better lighting.
- The responders and other staff did not find the two pair of scissors at the dive location and had to retrieve a pair from another location.
- After the event it was discovered that medical insurance coverage was capped at a maximum of \$10,000 (the injured diver fortunately held major medical insurance and DAN insurance).

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- The lack of locally available diving medical expertise and advanced medical equipment to aid in treating near drowning were problematic in this case, but this is not unusual. It is likely a problem for many rural/remote dive operations around the globe. This case was further complicated by the hospital's lack of knowledge of DAN and confidence in DAN's medical expertise. The action of the husband, the DSO and the staff at DAN to create a dialogue between the parties was important and provides a lesson for Dive Officers everywhere.
- The impact upon personnel that are involved in these types of events should not be under appreciated. A policy for dealing with the stress of such events can be valuable, such as providing a debriefing and proactively providing access to counseling and professional care. A stress incident debriefing was provided in this case, but could have been done earlier. Some personnel that were involved in this event described feelings of isolation and anxiety, as well as unpleasant visualizations and other stress related effects.

In summary, virtually everything in the management of this incident went right, demonstrating the value of training and having emergency protocols in place. It also highlights some potential pitfalls for dive programs, including the need to consider the resources and expertise of local medical centers, knowledge of DAN and how they can help, medical insurance coverage limitations, and the need to be prepared to handle stress responses. While this event did not result in any problems with the media, it should be mentioned that most dive programs should be prepared to handle media responses. The role of the DSO and the DCB should be carefully considered. Many DCB members have little direct experience handling diving accidents and investigations and errors can have grave implications. One of the tasks of the DSO and DCB is to juggle the priorities of all of the parties involved, including the injured diver and their family, other dive team members, staff and personnel involved, and the organization itself (risk management). An often overlooked area is that stress and trauma are experienced by those involved in managing, not only the incident, but the subsequent events. The organization should be ready and have a plan in place to address such issues.

The Puzzle Revealed

This incident provided more than a question of what caused the diver to become unconscious. A salient point for Dive Safety Officers and all dive buddies is the notion that sudden unexpected medical events can and do occur during dives. Another question worth looking at is whether the relationship of the two divers (husband/dive master and wife/less experienced diver) played a significant role in the effectiveness of the buddy system. Would other divers have responded so quickly to a buddy that they had lost visual contact with?

It has been our experience that many of our divers become very comfortable with the diving environment and their diving buddies. All divers are aware that the other divers in the program have received proper training, medical screening and are generally moderately to highly qualified divers. They come to trust their team members to perform to a certain standard. What could go wrong? So over time, these divers become complacent about pre-dive checks, the buddy system and proficiency in rescue/egress techniques. Dive Officers must be prepared to monitor, correct and reinforce these behaviors.

Dress for the Crash, Not For the Ride

There are some questions we will never have answers for. It is not necessary to have all of the pieces to get a pretty clear picture of what we need to know. More important is what we do with the information that we do have. It is clear that the real puzzle here is how to continue to assure critical safety behaviors among divers over time.

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