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Dr C.J.Acott, FANZCA, Dip D and HM, is the Co-ordinator of the Diving Incidents Monitoring Study (DIMS). His address is Hyperbaric Medicine Unit, Department of Anaesthesia and Intensive Care, Royal Adelaide Hospital, North Terace, Adelaide, South Australia 5000.

A TRAINING AGENCY PERSPECTIVE OF EMERGENCY ASCENT TRAINING

Drew Richardson and Terry Cummins

Emergency ascent training has been a controversial subject in recreational diving since the early 1970s.[1] The associated controversy revolved around techniques, psychological and physiological considerations and concern about the changing legal climate.

The Catch 22 is this: Is it wise and ethical to train divers in emergency ascent techniques, even though the training itself may provide some hazard, or to not train these procedures and have the lack of training itself provide the hazard? We would have a moral concern over any situation where a student would attempt a unsuccessful emergency ascent, having never been trained in the procedure. As diving educators, instructors must concern themselves with practical training so that students will dive safely without supervision after certification.

Diving accident statistics tell us that divers do indeed experience loss or interruption of air supply, despite our best instructional efforts, sometimes with less than satisfactory results.[2,3] For this reason, emergency ascent training has been included in every entry level scuba course since the inception of diving instruction. It was improved in the late 1970s and again in the early 1980s. Literally millions of safe ascents have been made by divers involved in training programs. More importantly there is no way for anyone to tell how many near misses occur or how often injury or death has been avoided by these techniques in the field.

15 years ago concerned persons got together to discuss emergency ascent training. They tried to develop a mutual understanding in order to improve the safety and training of divers. The proceedings from the 15th Undersea Medical Society Workshop on Emergency Ascent Training,[4] has been discussed in another paper in this issue[1] and that discussion will not be repeated here. These goals were achieved. It is an extremely positive sign that we are all gathered here today, for similar reasons, to continue this worthwhile process.

Despite misconceptions, sensationalism, and a lack of understanding in some quarters, indications support scuba diving as one of the safest sports.[1,2] From time to time, recreational scuba diving finds itself under scrutiny, because of the reckless habits of a few divers. Fortunately improper diving behaviour and poor decision making are not the norm for recreational scuba divers. By and large, divers and diving are becoming safer. This is largely due to significant improvements in the standards and training methodologies of the training organisations, as well as improvements in equipment technology.

What is the incidence of morbidity and mortality in emergency ascent training?

During open water training PADI requires three normal ascents and one buddy breathing ascent, one alternative air source assisted ascent and one controlled emergency swimmings ascent. The minimum number of emergency training ascents each individual performs (as required by standards for certification) is three. Table 1 shows the total number of PADI entry level certifications by year and the number of injuries and deaths for the period 1989-1992. It also shows the minimum number of

TABLE 1

MORBIDITY AND MORTALITY REPORTED DURING PADI EMERGENCY ASCENT TRAINING 1989-1992

Year	Entry level trainees	Emergency ascents	Injuries reported	Deaths
1989	276,065	828,195	8	-
1990	304,352	913,056	8	-
1991	319,708	959,124	7	2
1992	351,443	1,054,329	10	-
Total	**1,251,568**	**3,754,704**	**33**	**2**

FIGURE 1

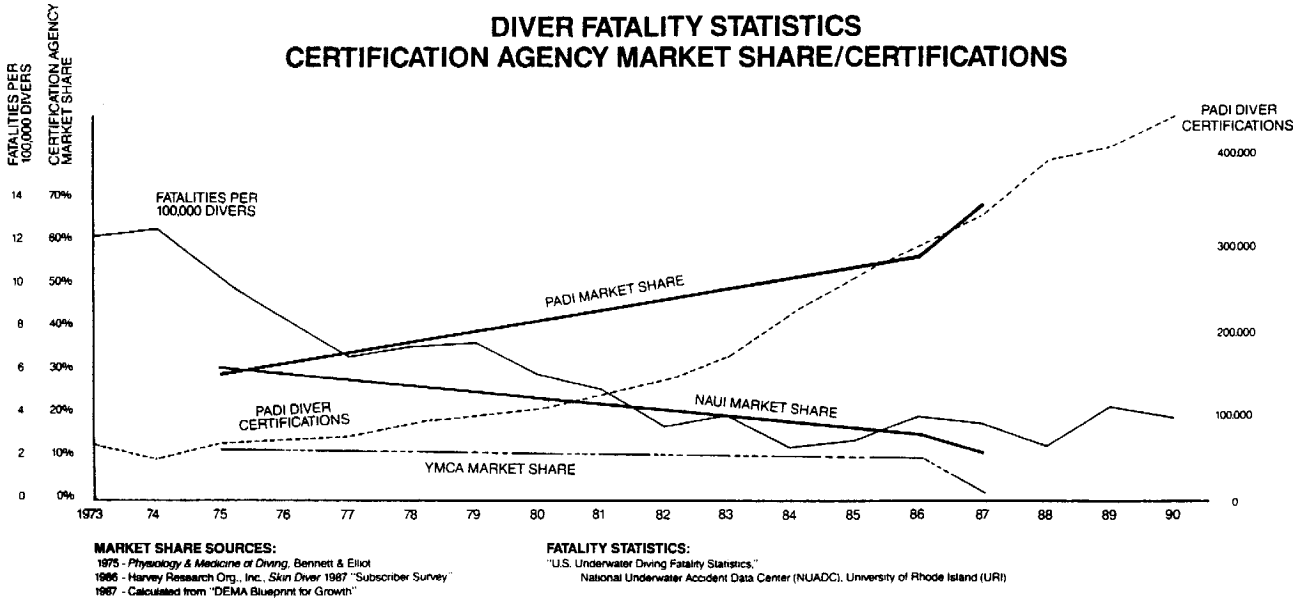

TABLE 2

MORBIDITY AND MORTALITY BY NUMBER AND TYPE OF INJURY DURING EMERGENCY ASCENT TRAINING 1989-1992

Injury	Controlled emergency swimming ascent	Buddy breathing ascent	Alternative air source assisted ascent
Ear	3 (1 ruptured drum)	1	2
Near drowning		2	1
Water aspiration		3	1
Squeeze			2
Embolism	4 (1 fatal)	3 (1 fatal [asthma])	2
DCI		1	
Nose bleed		1	
Admitted ICU			1
Chest pain		1	
Questionable embolism		2	
Panic (no injury)		1	
Hypoglycaemic convulsion	1		
Collapsed lung	1		
Total	**9**	**15**	**9**

TABLE 3

INCIDENCE OF REPORTED INJURY BY ASCENT METHOD

Method	Injuries	Ascents	%	Injuries per 100,000 ascents
Buddy breathing	15	1,251,568	0.00119	1.19
Alternative air source	9	1,251,568	0.00071	0.71
Controlled swimming ascent	9	1,251,568	0.00071	0.71
Total	**33**	**3,754,704**	**0.00087**	**0.81**

TABLE 4

INCIDENCE OF EMBOLISM OR LUNG OVER EXPANSION INJURY BY ASCENT METHOD

Method	Injuries	Ascents	%	Injuries per 100,000 ascents
Buddy breathing	5	1,251,568	0.00039	0.39
Alternative air sourc	2	1,251,568	0.00015	0.15
Ccontrolled emergency swimming	4	1,251,568	0.00031	0.31
Total	**11**	**3,754,704**	**0.00029**	**0.29**

emergency training ascents conducted by those trainees. This is a conservative number as it does not include the fact that instructors often have students switch roles from donor to receiver and repeat the ascent, and this does not reflect any remediation or repetition of the skill.

Table 2 shows the type and incidence of injury during PADI emergency ascent training, by method used, for the same period. This data may be considered as highly reliable. PADI instructors are obliged to complete incident and accident report within two weeks by PADI standards and also by a warranty of liability insurance coverage.

If a member neglects to report any incident and a suit is later filed, his insurance is rendered null and void. Quality assurance procedures are initiated by PADI for violations of standards. As can be seen from Figure 1 PADI now trains the majority of new divers.

When analysing accident reports, all events during emergency ascent training were accounted for by the authors. In cases where divers reported symptoms and signs that were indicative of lung over expansion injury, yet were not officially diagnosed as such, we have reported them as embolisms.

During the four year period, approximately 3,754,704 emergency ascents were conducted. A total of 33 incidents or injuries occurred, including two fatalities (one during a buddy breathing ascent and one during a controlled swimming ascent). This means that 3,754,671 emergency ascents were conducted successfully without incident. The incidence of injury was very low being 8.7 incidents per 1,000,000 ascents. The death rate was 0.5 per 1,000,000 ascents. Table 3 shows the incidence of reported injury by emergency ascent method for this period. Table 4 provides information about the incidence of lung damage

PADI's position

Since the 1970s PADI has taken a public stand on the necessity for including properly conducted emergency ascent training in the entry level scuba course. At the same time PADI has demonstrated a record of open-mindedness and diplomacy between all involved communities in public safety issues. We will attempt to convince you of the value and need for emergency ascent training for recreational divers. We believe that emergency ascent training is still an important basic survival skill, equally as important as mask and regulator clearing.

Of absolutely vital importance to all divers is the ability to surface safely when low on or out of air. Diving safety and peace of mind at depth require every diver be trained to handle a loss of air supply safely. It is our opinion that motor skill training and modelling are necessary for divers to handle an emergency ascent comfortably. Emergency ascent techniques allow a properly trained diver to do so if the need arises. We need to train divers to avoid this situation, but they must also be trained to manage it if it occurs. In spite of the controversy surrounding this issue, there are safe, effective methods to train divers in these skills. PADI was encouraged in the mid 1970s to conduct emergency ascent training by such people as the late Dr Charles Brown, past Medical Editor of *Skin Diver* magazine and *NAUI News*, who wrote, "I submit that emergency swimming ascent can be taught as safely as routine ascent, if the student is made to realise that he must neither hold his breath, nor actively empty his lungs."[5] Also Dr Karl Schaefer, Director, BioMedical Sciences Department Naval Submarine Medical Research Lab, wrote "I feel it is essential from a practical and from a psychological point of view that the (scuba) divers know how to make a free ascent." in a letter dated December 12, 1976 to Dennis Graver, then National Training Director of PADI. Dr A.B.Rechnitzer, United States Navy, Office of Oceanography, wrote to PADI, "Open water emergency ascent training is probably the strongest contribution to the confidence of a student diver. Having had several occurrences to personally call on this confidence and mental stability, I strongly recommend that open water emergency ascent training be retained in all diver training curriculum." in a letter dated November 3, 1976. These views and others like them, helped shape the basis and rationale for modern recreational scuba training methods.

PADI and the US based Recreational Scuba Training Council (RSTC), as well as the Australian Scuba Council (ASC), maintain that it is vital to develop student ability to manage an abrupt termination of air supply, affecting buddy or self, so as to return safely to the surface, with or without his buddy's aid. We base this view on training millions of divers over the years, and the conclusion of the NSTC and UMS meetings on this topic. [4,6-8]

Students are taught to monitor their air supply closely to avoid an out-of-air problem, however, if an emergency out-of-air situation was to arise after training, and the data suggests that it does, divers need to be adequately trained to return to the surface safely. Global incidence and accident reports confirm the need still exists.[2,3]

The data on the cost effectiveness of various techniques and training are limited. How many drownings have been averted because the individual had been trained is unknown. This figure will never be known, because one must not only find the number of successful emergency ascents that occur in the real world, but also how many made it home because of training. If all the figures were known, one could make a calculated judgment. From a scientific standpoint, no one has adequately shown if the risk of training is worth the benefit or not. In this paper, we present data to help evaluate this question. From a pragmatic viewpoint, however, diving's improving safety record is partly based on what is included in today's diver training standards.

Why should we conduct emergency ascent training? This has been discussed in the previous paper.[1] We believe that emergency ascent training significantly increases diver confidence and reduces anxiety. Self confidence and psychological mastery can actually prevent panic in an emergency situation. Additionally we should conduct emergency ascent training because these skills work equally well in all geographical areas, and thereby reduce accidents. Finally, we should conduct emergency ascent training because our personal experience and intuition as diving educators tell us we should.

The most easily corrected factor causing diving accidents is running out of air in the first place! This can be to avoided. No one should dive without a tank pressure gauge. Each diver should watch this gauge and plan to arrive at the surface with air in reserve. The need for emergency ascent training would be non-existent if we could guarantee divers would never lack air underwater. Human behaviour being what it is, we know this will never be the case. Without such a guarantee, we have an obligation to provide student divers with safe procedures to save their own lives should the need arise.

It is vital that we train divers in safe, realistic emergency procedures. Emergency ascent exercises are designed so that the students experience that it does work, thus breaking through the psychological barriers of fear and doubt. To do this, training methods need to be simple and effective and carried out under a variety of conditions. The training community has developed procedures that get the student relaxed and confident. Modern emergency ascent training methods are tightly controlled exercises evolved from the cooperative efforts of the educational, scientific and medical community.[1]

After certification, the responsibility for air management lies with the individual diver. The training community faces a responsibility to train the diver with all the skills necessary to dive safely and return to enjoy another dive on another day. Coping with an-out-of air emergency is considered to involve advanced motor skills. Educational experts around the world agree that practice is essential to develop advanced motor skills adequately. On these grounds alone it would seem that emergency ascent training requires not only inclusion in the modern scuba course, but its removal would result in a direct reduction in the quality of the diver produced. Certainly, any diver who did not have the opportunity to practice emergency ascent training under instructor supervision, would have potential

difficulties in co-ordinating the actual process under a real emergency.

In our understanding of the problem, we cannot foresee any alternative to emergency ascent training that would be completely satisfactory, if our goal is to eliminate all risks. Any approach to reach a solution will be faced with the knowledge that it will not provide for all eventualities. We are forced to consider trade offs that will, hopefully, put the risk-benefit ratio into an acceptable framework. Accepting or rejecting any course of action in emergency procedures in general should be based upon an objective assessment of risk verses benefit.

Modifying ascents to a horizontal simulation, as some have suggested, has major drawbacks. These methods are low on actual student confidence and psychology building for the real world. Simulations also are only used to a point in other industries. Eventually, one must have the confidence to perform the real skill. Examples include, flying an airplane, submarine escape and abandon ship drill in the Navy. Simulations ultimately are followed by actual practice and experience.

Loss of a diver's air supply may result from several factors, but in most instances it can be traced directly to poor or no dive planning, mismanagement of air supply, or in some instances, equipment malfunction. We believe dive planning relating to air supply should take into account several factors. These include existing water temperature, dive depth, physical activity level, total amount of air available, breathing rate an amount of reserve required for the dive. A submersible pressure gauge is an excellent monitor of air supply, and if used properly, will keep divers from running our of air.

Collective views

There are several notable conclusions found within the proceedings of the Undersea Medical Society Emergency Ascent workshop.[4]

"Most participants agreed that the data clearly did not indicate that training agencies should stop training divers in emergency ascent techniques, but there is an obvious need to improve these training techniques." (page 8)

"After further discussion, the group reached the consensus that open water emergency ascent training was not only important, but highly desirable and morally justified." (page 10)

"The requlator should not be removed from the mouth during a swimming ascent, since attempts to inhale through it may help." (page 19)

"Greater standardization of emergency ascent training and equipment was also recommended by the group." (page 21)

The major conclusions of the discussants were (page 21),

1 "despite the statistically small risk associated with emergency ascent training, the training agencies should continue to offer this training,"

2 "the voluntary and informed acceptance by the trainee of the agency's offer to train him/her in emergency ascent techniques implies an acceptance of the risks involved,"

3 "every effort should be made by the training agencies to improve training techniques to minimise the risk associated with training; thorough screening of ascent training applicants and intensive and careful emergency ascent training are examples of procedures likely to reduce this risk."

4 "Finally, the workshop participants agreed that it was essential for the training agencies and physiologists to stay in contact, so that the discussion begun at this workshop might continue."

The RSTC has put into place an improved medical screening process. Modern emergency ascent procedures and methods have taken into account the technique modifications suggested by the 1977 Workshop to minimise the risks in training.

Conclusion

As major stakeholders in diver safety issues, PADI and SPUMS must work together to develop the very best set of recommendations and methods, based on what we have learned and know today, to provide the millions of recreational scuba divers with the best training possible to manage safely the variables of scuba diving. We greatly value the opportunity to discuss these issues and come to a shared view. The diving public and community at large look to both groups for guidance and leadership.

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Drew Richardson is Vice-President Training, Education and Memberships, PADI International. His address is PADI International, 1251 East Dyer Road, # 100, Santa Ana, California 92705, U.S.A.

Terry Cummins is Chief Executive Officer, PADI Australia. His address is P.O.Box 713, Willoughby, New South Wales 2068, Australia.

A MEDICAL VIEW OF EMERGENCY ASCENT TRAINING.

John Knight and Guy Williams

Introduction

This paper is an attempt to use logic to discover what, if any, is the benefit of the present training in emergency ascents. We ask a number of questions. We also provide the answers and draw conclusions from the evidence. In this way I hope that everyone will be able to see past their fixed opinions and view emergency ascent training in a new light. One that allows impartial weighing of the benefits and costs of the various methods used today with students.

Why does a diver do an emergency ascent ?

The answer is simple. The diver is either out of air or injured. In both cases he or she needs to get to the surface as soon as possible.

What does the diver need from an emergency ascent ?

To arrive at the surface, preferably conscious. At the surface there is air to breathe, and, we hope, someone to rescue the diver. Failing to reach the surface is certain death.

Are emergency ascents always successful ?

No, they are not. Unfortunately, far too often the diver does not reach the surface, or sinks again after reaching it, and the body is recovered from the bottom with the weight belt still on.

Whatever method of emergency ascent is used there should be no possibility of failing to reach the surface. This involves the diver increasing his, or her, buoyancy. When one is out of air there is only one way to do this. Drop the weight belt and start what will eventually become a buoyant ascent, if one is wearing a wet suit or buoyancy compensator.

This is the best survival technique, which is carefully NOT practiced because it can result in an uncontrolled ascent.

Is there much need for emergency ascents ?

Most out of air problems are the diver's fault. Better air management would prevent most out of air situations. It would also prevent the usual precursor of an out of air problem, being low on air. No one dives these days without a contents gauge. So no diver should have air problems, if he or she is monitoring the air supply, unless there is an equipment failure and these are rare in Australasia.[1,2]

However it is clear from Bob Halstead's survey that experienced divers do have to make emergency ascents.[3] Approximately one third of his divers had had to make an emergency ascent because they ran out of air and another third because their buddy had run out of air.

Why practice emergency ascents ?

The main reason is training agency requirements. These are a hangover from the pre-contents gauge era, when to quote a SPUMS member at the Annual Meeting in Truk in 1977 "Every diver runs out of air once or twice a year !" Given such attitudes, there was a need to teach how to reach the surface safely when you ran out of air. The diving-related death statistics show that some failed to make the distance.

Skidding when driving can also be lethal, but no one has to practice on skid pans before getting a driving licence.

An argument in favour of emergency ascent training is that it demonstrates what the emergency feels like. This overlooks the panic factor. If an emergency ascent is really going to let the trainee find out what the out of air emergency is like it will be dangerous. No training agency