

**DCI IN SPORTS DIVERS
DAN USA EXPERIENCE**

Richard Moon

Key Words

Accidents, decompression illness, diver emergency services, recreational diving, research.

The Divers Alert Network (DAN) in the USA was set up some years ago, primarily with the idea of providing emergency medical consultation for divers with decompression illness. There was at that time, and there still is, a fairly small number, proportionately, of physicians who are familiar with decompression illness and we continue to this day to provide that service as our major function.

In 1996 there were 13,000 information calls during the course of the year. These are non-emergency "Can I dive if ...". Now that we are on the Internet we are receiving an increasing number of e-mail enquiries, 1,000 last year. We also had roughly 2,000 emergency calls.

We enter all the recreational scuba diving decompression illness data we receive in the DAN database. The number of cases reported to DAN has been steadily increasing. This is not, I suspect, because the number of cases has been going up, but our ability to acquire

information has gradually improved. In the same period we have actually recorded about 600 cases per year in the decompression database. We receive forms on about two thirds these. Unfortunately many of them cannot be used because of incomplete data. We actually record about 600 cases per year in the decompression illness database.

We are a little bit schizophrenic in the way we classify decompression illness. We use the traditional classification. Type I includes pain, fatigue, skin, lymphatic symptoms and signs. Type II decompression sickness includes neurological or cardio-respiratory. We still use the term arterial gas embolism (AGE), being the pathophysiological classification of pulmonary barotrauma with intravascular gas, separately. Using that classification, approximately a quarter of our cases are recorded as Type I by the treating physician. About two thirds as Type II decompression sickness, and about 8% AGE. We have seen the proportion of AGE steadily decreasing over the last 10 years. It started off somewhere around 18% of cases and is now down around 8%. I suspect that this is actually not a reduction in the disease, but rather the decreasing frequency with which it is diagnosed.

It is interesting that there is a very high incidence of misclassification. The treating physicians classified 97 patients who had neurological symptoms as Type II. Twenty of these were reclassified as severe neurological cases and 77 as mild. Also a number of pain only cases, as reported by the diver himself, were reported as Type II decompression sickness or arterial gas embolism. We are

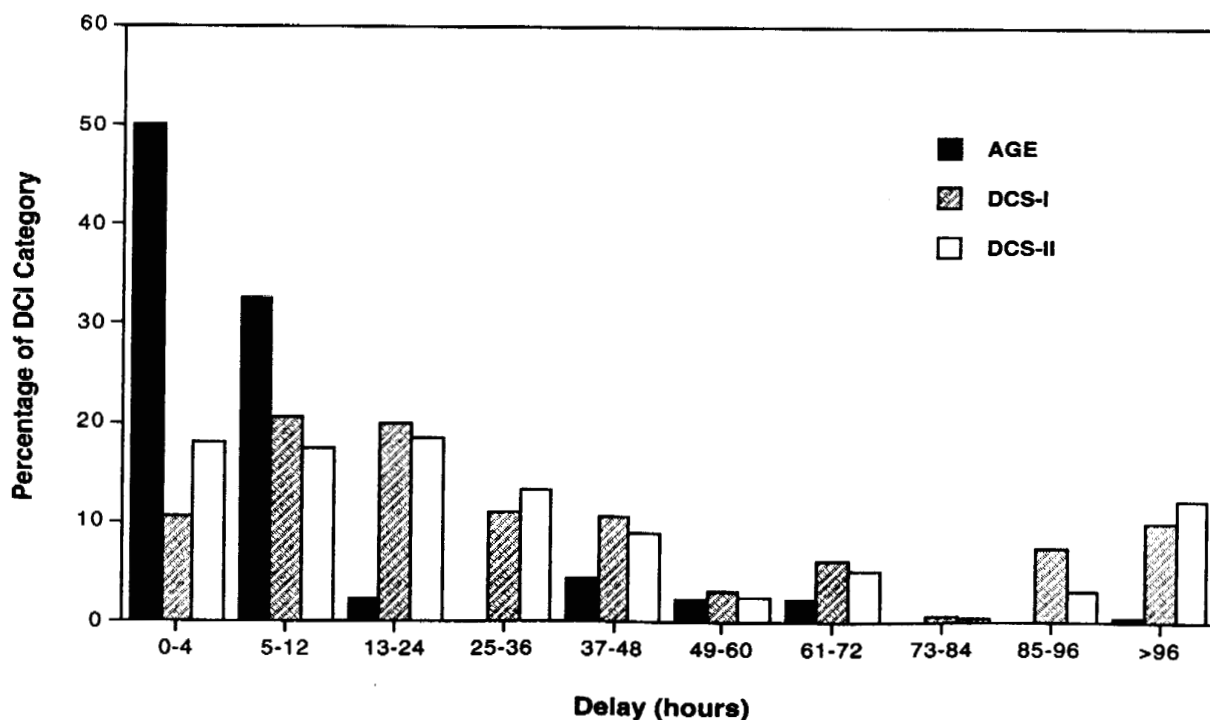


Figure 1. Delay from symptom onset to recompression therapy.

slowly getting rid of this classification in our database. It is kept only because it is so entrenched in the literature and we keep getting enquiries about the proportion of cases in these various categories.

It is interesting that a reasonably high proportion of divers with decompression sickness have previously reported DCI. Approximately 10 - 20% of cases between 1990 and 1992 had previously experienced decompression illness. This suggests to me that these "repeat offenders" represent a high risk subset of divers with an intrinsically high risk of DCI.

Chris Lawrence told us that it usually takes 24 hours from the time of death to starting an autopsy. That is very close to the time it takes our divers get to the recompression chamber. Figure 1, taken from DAN data, shows the delay in hours from symptom onset to recompression. Arterial gas embolism is shown in black, Type I decompression sickness is cross hatched, and Type II is white. The median delay was about 24 hours, part of which is due to the long distances we have, very similar to the ones in Australia, but also because the divers do not interpret their symptoms correctly or report them to anyone. Figure 2, also from DAN data) is delay from onset of symptoms to calling for assistance. Most of the AGEs get reported fairly quickly, but there is very a long tail on this distribution and sometimes people do not do anything for several days.

It is unfortunate that our educational efforts are not taken to heart. It turns out that many divers with decompression illness actually experienced symptoms prior

to their last dive. That is, they made a dive even in the face of symptoms, some of which are rather worrying. Nine divers in 1995 had severe neurological symptoms before their last dive and another 5 had difficulty breathing. I am not sure what this behaviour represents. It could be group pressure or denial.

We vigorously promote the use of oxygen as an initial treatment for DCI and have done so for many years. Unfortunately US divers have been fairly unreceptive so far. Only a small proportion of divers actually use surface oxygen, and many of these applications are very brief. In 1995 only 190 of 590 divers with DCS (32%) used oxygen. A couple of summers ago I was treating a diver, and he told me that he had used surface oxygen. I asked him "How long did you breath it for?", and he replied "About 5 minutes". I said, "Why only 5 minutes?", and he said, "Well, there were several other divers on the boat who had symptoms and they were sharing the tank".

We also collect information on fatalities. In the bad old days of the 1970s there was a rapid increase in the number of fatalities per year, reaching a peak of 147 in 1976. Those were the days when untrained divers were doing things like cave diving and getting into serious trouble. The number of fatalities in recent years has been around 100 and it seems to be fairly stable. We are also experiencing other patterns of diving besides the traditional compressed air breathing scuba. Divers are doing all kinds of fairly technically difficult and challenging dives. There is a lot of nitrox use and some of these divers having decompression accidents. One of the unfortunate things is that the quality

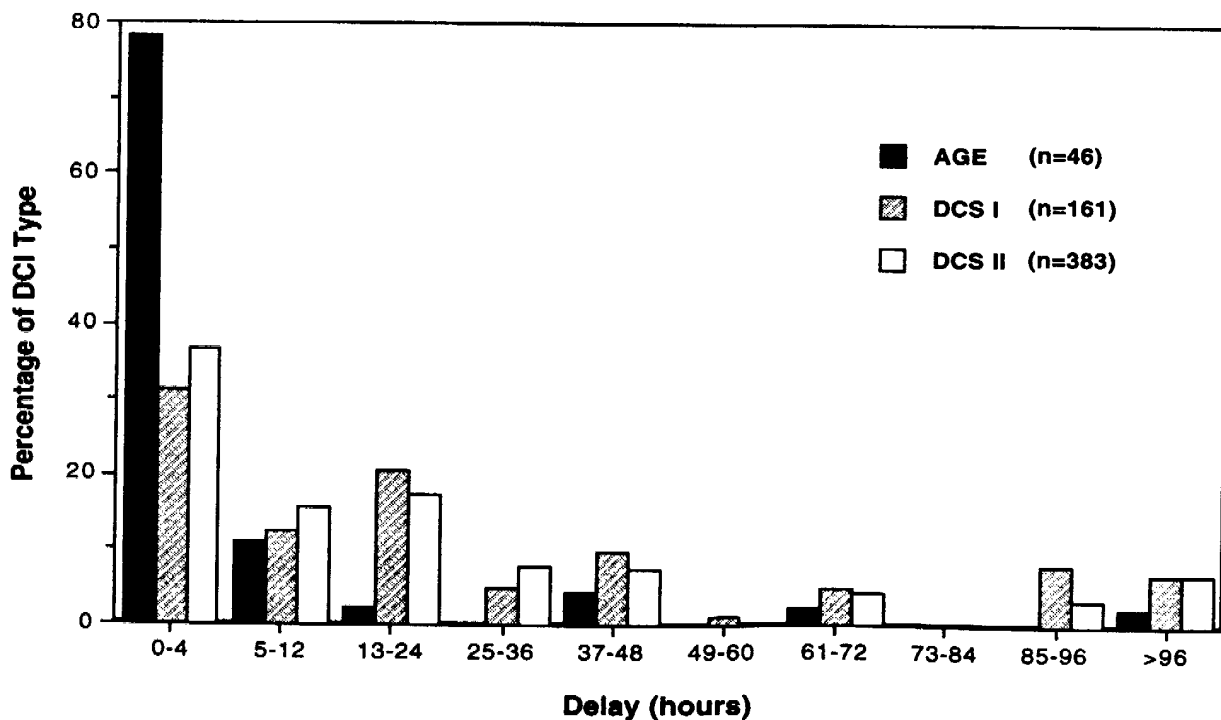


Figure 2. Delay from symptom onset to calling for assistance.

control on the gas mix is very variable and some divers know they are breathing nitrox but they have absolutely no idea what percentage.

We have now over 3,000 cases in the DAN database, and one of our major tasks which did not exist at the beginning of DAN but certainly does now, is research to try to promote diving safety and investigate pathophysiology. There are several ongoing projects in addition to analysis of the database. For instance in 1995 there were 590 accidents (DCS and CAGE). Analysis showed rapid ascents (170), buoyancy problems (90), dives outside the limits of computer or table (50) and equipment problems (77) were associated with nearly two thirds of diving accidents. There were also 35 divers who did not use a computer or tables. Adding them brings the total up to 422 divers or 71.5% with avoidable causes. Perhaps if we could change this behaviour, we might substantially reduce the number of decompression incidents.

Dick Vann is doing a project on flying after diving. A number of volunteer divers have been in our chambers, made a dive, followed by a pre-flight surface interval and then a simulated flight to an altitude of 8,000 feet. He has looked at a number of dive profiles at 60 feet as well as some 100 foot exposures. It appears that the guidelines that we currently operate under, which call for a surface interval before flight of 12 to 28 hours, seem to be correct. After 12 hours for a single dive, and beyond 22-24 hours for a multiple dive, the risk of decompression sickness is fairly low.

Dr Vann is also working on a long term project to collect depth-time profiles on enough dives to be able to assess the probability of DCI for any reasonable dive within the framework of recreational scuba. Project Dive Exploration is expected to take up to 10 years to complete and require actual recordings of about a million dives. Primary data collection is expected to start in 1998.

Other projects include field studies of blood glucose in divers with insulin-dependent diabetes mellitus, assessment of venous gas embolism in recreational divers and studies of the relationship between oral contraceptives, menstruation and the risk of DCI. These are in parallel with the statistical analysis of the ever enlarging data base.

Figures 1 and 2 are reprinted from the 1997 DAN Report on Decompression Illness and Diving Fatalities by kind permission of the Divers Alert Network.

More details about the 1995 recreational scuba diving injuries and deaths reported to DAN can be found in the 1997 edition of the DAN report on Decompression Illness and Diving Fatalities which is available from DAN, the Peter B Bennett Center, 6 West Colony Place, Durham, North Carolina 27705, USA.

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DES AUSTRALIA EXPERIENCE

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Key Words

Accidents, decompression illness, diver emergency service, first aid, recreational diving, transport.

Australian diving accident statistics are even less well collected than the statistics in the United Kingdom and the USA. The Diver Emergency Service, usually known as DES, is primarily a phone contact for medical advice to divers who have had diving accidents. It advises divers and tells them how to contact the appropriate authorities in their area who will organise their treatment. It is also contacted by medicos wanting diving medicine advice. There is no national data base of diving accidents in Australia.

More about DES

The Diver Emergency Service's primary function is to be the first contact in diving emergencies. Advice about diving medicine is very much less important. DES is accessed by phone. We have a free phone within Australia (1-800-088-200), which any diver can access at any time of the day or night. Outside Australia it is a user pays number (+61-8-8373-5312), which comes through to the same physicians 24 hours a day.

When a diving emergency occurs, divers phone the free phone number, or the number from outside Australia, and reach the St John's Ambulance switchboard in Adelaide. Immediately one of the five diving medicine consultants is paged. Our set up is unlike some of the other call networks around the world, as divers have immediate access to a physician, trained in anaesthesia, intensive care and diving medicine, within 3-5 minutes.

The DES workload

In 1996 there were approximately 506 calls. Approximately, because like all reporting statistics, not all the cases which phoned were recorded. Not surprisingly, most of the calls came from heavily dived areas, such as Queensland and New South Wales. Interestingly, we got