3 Walker R. Fifty divers with dysbaric illness in Townsville General Hospital during 1990. *SPUMS J* 1992; 22(2): 66-70.
4 Parker J. The diving medical and reasons for failure. *SPUMS J* 1991; 21(2): 80-82.
5 Parker J. The assessment of the PADI resort course questionnaire. *SPUMS J* 1991; 21(2): 82-83.
6 Parker J. The relative importance of different parts of the diving medical in identifying fitness to dive and the detection of asthma. *SPUMS J* 1991; 21(3): 145-153.
7 Thomas RL. Queensland's new 1989 diving regulations. *Underwater Geographic* 1990; No 31.
8 Walker D. Provisional report on diving related fatalities during 1989. *SPUMS J* 1992; 22(1): 3-15.
9 Edmonds C and Walker D. Scuba diving fatalities in Australia & New Zealand. *SPUMS J* 1989; 19(3): 94-104.

## DIVERS' EARS

Whitsunday Diving Medical Centre
P.O. Box 207, Airlie Beach
Queensland 4802
10 July 1992

Dear Editor,

On a recent two day diving trip on the Great Barrier Reef with 20 recreational divers, (19 of whom had medical or nursing qualifications), every diver had their ears examined before diving commenced and after all diving had ceased.

The group consisted of 9 males and 11 females with varied diving experience.

| Number of dives | Number of divers | Percentage |
|---|---|---|
| 1 - 10 | 9 | (45%) |
| 11 - 50 | 8 | (40%) |
| 50 plus | 3 | (15%) |
| | 20 | |

Diving the weekend the divers had an average 5.3 dives (range 2-7).

Of the 20 divers 5 (25%) had symptoms of aural barotrauma of descent. Only one had to stop diving prematurely. At the end of all diving 10 (50%) divers were seen, on direct inspection of the tympanic membrane, to have aural barotrauma involving 16 ears.

| Grade | Ears affected | Symptomatic ears |
|---|---|---|
| 1 | 11 | 2 |
| 2 | 1 | 1 |
| 3 | 4 | 2 |
| **Total** | **16** | **5** |

The 10 divers with aural barotrauma came from all the experience groups in approximately the same ratios in the group.

| Number of dives | Divers affected | Percentage |
|---|---|---|
| 1 - 10 | 5 | (50%) |
| 11 - 50 | 4 | (40%) |
| 50 plus | 1 | (10%) |

It was interesting to note that over the weekend 5 divers were taking Sudafed tablets for symptoms of mild upper respiratory tract congestion. Of these 5 divers, 3 suffered aural barotrauma, 2 with symptoms, but no one had to stop diving prematurely.

Also interesting was that 7 divers used transdermal hyoscine (SCOP) patches as prophylaxis for sickness despite a favourable weather forecast.

Although anecdotal this weekend demonstrated that
1 Aural barotrauma is very common in recreational diving despite diving experience (and medical knowledge).
2 Subclinical aural barotrauma is also very common.
3 Grade 1 aural barotrauma can be symptomatic and grade 3 can be asymptomatic.
4 Decongestants (especially pseudoephedrine preparations) and transdermal hyoscine are commonly used by divers.

John Parker

## HIGH TECH DIVING

### A response to the editorial in the Jan-Mar 1992 SPUMS Journal.

Hamilton Research Ltd
80 Grove Street, Tarrytown
New York, 10591-4138
5 August 1992

Dear Editor,

The essay on "high tech" diving by Des Gorman in the 1992 Jan-Mar issue of *SPUMS Journal* stands firmly as the opinion of one of the most knowledgeable and respected members of the international diving community and would not normally require a response. However, the essay mentions my involvement, and lest by default I be assigned the role of the villain in the piece, I feel a response is necessary. That involvement, by the way, has not been very great in Australia, but I seem to have found myself in the middle of several issues in the US related to technical and special mix diving, some of which deserve discussion.

My Australian involvement is simple. Rob Cason of Fun Dive Centre asked if I would provide tables to support his introduction of technical diving into Australia. I agreed to do that, provided of course that he would do things in a responsible way. He also requested decompression support for the use of a rebreather. Another client of mine had had excellent results using rebreathers, so I agreed to work with these as well. Later this was rumoured to be for dives to 200 msw. This, I felt, was so ludicrous as not to merit a response. Such dives could indeed to be done with rebreathers, but to do so would require such an enormous support operation that it would not be likely to happen in the "recreational" diving mode. I regret any misunderstandings I may have allowed to develop on this issue.

Since the issue has been brought up, please let me say a bit about the concept of "technical diving" and why I am involved in it. People have been making deep dives on air since the invention of scuba, usually but not always successfully (a good history of deep air diving is in Gilliam et al.[1]). My involvement began when Parker Turner and Bill Gavin asked for help in adding some helium to their breathing mix to reduce narcosis for some extensive 75 m depth cave dives. These "trimix" dives gave good results; we used an enriched air intermediate "decompression mix" and oxygen breathing from 6 m. The use of several mixes is easy in cave diving since many tanks of gas are often needed, and they are relatively easy to find. I had the feeling that in a way I was blackmailed; if I had not agreed to help, they would have gone ahead and done the dives with air.

My role is primarily in the area of decompression procedures, but there are many, many other aspects to these complex operations which make the decompression part look easy.

That set the pace for one aspect of technical diving, and the concept spread, even to the extent of spawning a journal (*AquaCorps*). By no means do I encourage people to make these deep dives, but if they are going to do it anyway then a case can be made that it could be regarded as unethical to deny access to the safer approaches of using a less narcotic mix with an efficient decompression.

But don't let me leave the impression that this is easy or safe. Two recent trimix fatalities in the 75 msw range off the US East Coast attest to the importance of high level training and preparedness. Both of these divers appeared to have run out of gas. Also, Parker Turner died in a cave last November. He was doing things right but got caught in the midst of a geological upheaval that blocked the exit to his cave while he was inside.

This information certainly supports the main thesis of Des Gorman's essay, especially the point that many divers may not full appreciate the risks involved. There are some other points.

My purpose is not to "refute" but to comment. First, as mentioned, I thoroughly agree with the individuals' right to accept the risk, but the risk should be understood, and the diver should be thoroughly trained to deal with it. This is where we have a great need. At present there is no standard for training or qualification in technical diving. I strongly urge technical divers to form their own member-run association and take control of these needs before the opportunity goes away.

Regarding the several USN heliox divers who died following 200 msw-plus dives and missed decompression, with a modest search I have not been able to locate a report on this series, unless it is the submarine lockout accident that happened in the USS Grayback and which is not particularly relevant to technical diving. The valid message here is that when one moves up to technical diving the nature of the operation has to change. All contingencies have to be planned for in advance. Many diving accidents move from incidents to accidents because the response to a disturbance of some sort is not optimal, for whatever reason.

The issue of decompression is of course a major one, but at this point it appears to be under some control; certainly the technical divers are better off than the USN statistics Dr Gorman cites (20% DCS), but documentation is limited (data collection is a major continuing effort). Divers using the trimix pattern described earlier to depths of 75 msw (not 200 msw) and for times in the 20 minute range have several hundred dives with, so far, a negligible incidence of DCS, but some samples of Doppler bubbles scores have been unacceptably high. Regarding thermal stress, most of these divers use dry-suits, usually with argon as the insulation gas, and this works well for short exposures. Only the long cave dives (12-13 hours in some cases) pose a real thermal problem. The endurance possible with a dry suit is limited for a variety of reasons. The 90 msw "limit" is probably not so binding with argon in the suit, but again, gas limitations keep the the thermal limits from getting out of hand. Breathing gas heat will indeed be needed when divers spend more than a few minutes in the 150 msw range, unless the water is unusually warm. This is not likely to be a problem in this community any time soon.

Oxygen toxicity is a major concern in decompression planning. From the beginning we decided to avoid the risk of breathing oxygen at 12 or 9 msw and use it only at 6 and 3 (or at only 6) msw. This puts the diver just at the edge of the toxicity limit cited by NOAA of 1.6 bar[2] and for a diver decompressing at rest this is acceptable.

Regarding treatment, it is not my place to take on a respected authority in this arena, but I think Dr Gorman will agree with me on these points. First, regarding technical trimix diving, since the entire decompression part of the dive is done with enriched air or pure oxygen, standard treatments are entirely appropriate. In any case no diver should ever be refused treatment because of some misguided notions that a

treatment is "not right" because the diver has used a special mix. There is too much more to this issue to tackle here, but we can be sure that a prompt treatment with oxygen at 2.8 bar (USN Table 6) will cure most decompression disorders, regardless of the mix. A good thing to think about at this point is that the tough treatments usually result from operational problems like abrupt surfacing or missing the entire decompression. Good planning, high quality equipment properly maintained, and thoughtful gas management are what it takes to avoid the circumstances that result in such incidents.

Finally, let me address briefly the matter of enriched air, the so called "nitrox" diving. There seems to be more dialogue on this practice (which is not technical diving) than on technical diving, probably because it seems more likely to invade the domain of "recreational" diving and hence is more threatening to the "industry." Actually, not much in the way of extra diving skills are needed to do enriched air diving, but some care needs to be taken in mixing and handling the mixes. The issue of enriched air diving was addressed in a workshop at the time of the big DEMA (Diving Equipment Manufacturers' Association) show in January 1992. Because that Workshop settled some issues and defined others more clearly, most the controversy has died down (at least in the USA). For example, misinformation that enriched air corrodes tanks more than air, or that standard treatments do not work, has been laid to rest, good oxygen-compatible lubricants have been identified and both good and bad practices outlined. These are included in a report on the workshop.[3] Because I have no vested interest in enriched air diving (except perhaps to try to get people to call it by its right name, enriched air, and to save "nitrox" for the mixes lower in oxygen that air), it was my privilege to be engaged to help organize and to chair this meeting. In addition to the report, a working group was organized to deal with several remaining issues.

Let me add one last point to both my essay and Des Gorman's. I, too, want to discourage anyone from technical diving, but especially anyone who is not equipped and inclined to do it right. It involves a considerable investment in planning, equipment, decompression tables, gases, training, practice, organization, team-work and patience, and of course considerable risk. If you must go into this, go into it with your eyes open and be well prepared.

R.W. (Bill) Hamilton

**References**

1 Gilliam B, Von Mair R, with Crea J and Webb D. *Deep diving. An advanced guide to physiology, procedures and systems*. San Diego: Watersport Publishing Inc., 1992

2 *NOAA Diving Manual: Diving for science and technology. Third ed*. Silver Spring, Maryland: NOAA Office of Undersea Research, U.S Department of Commerce, 1991

3 Hamilton RW. *Workshop findings: Evaluating enriched air ("nitrox") diving technology.* Boulder, Colorado: Scuba Diving Resource Group, 1992*

* Available from Outdoor Recreation Council of America / Scuba Diving Resource Group (ORCA/SDRG), P.O.Box 3353, Boulder, Colorado (International phone 1-303-444-3353) for $US 10.00 plus postage ($US 2.00 in U.S.A., $US 5.00 outside). Also available by telephone/ credit card from DUI (International phone 1-619-236-1203, International fax 1-619-237-0378).

## ASTHMA AND DIVING

Whitsunday Diving Medical Centre
PO Box 207, Airlie Beach
Queensland 4802
25th August, 1992

Dear Editor,

The safety of asthmatics scuba diving has been an continuing controversy. The fact that many asthmatics do dive with little obvious catastrophe has been countered with many anecdotal series of catastrophic cases but none of scientific persuasion.

Most "diving doctors" would agree that "conventional wisdom" would advise "active asthmatics" not to scuba dive. The problem has been how many years without symptoms are needed after a history of asthma before diving can be allowed. Edmonds et al.[1] suggest a history of no asthma for five years is acceptable providing lung function is normal. This is a softening of "conventional wisdom" which used to advise that anyone with a past history of asthma should not dive.

The most useful objective investigation to assess "reactivity" of the airways is a challenge test, usually using inhalation of metacholine, histamine or hypertonic saline. The techniques used are rapid, inexpensive, reproducible and safe.[2-5]

Histamine and metacholine challenge tests require minimal equipment but are fiddly and involve a high patient compliance. Both histamine and metacholine are intermittently hard to get, costly and the solutions need to be constantly refrigerated and changed frequently.

Hypertonic saline challenge tests require an ultrasonic nebuliser (with an output of at least 1.2 ml/minute) and 4.5% saline. They are easy to perform and easily justified to a diver...."If salt water will make you wheeze in the surgery it will also do it while diving underwater". Moreover, when