Letters to the Editor

An additional mechanism for aural injury

Dear Editor,

We read with interest the suite of articles relating to the ear and diving that was recently published in the SPUMS Journal.[1-4] These articles provide a useful description of the array of injury that may affect both the middle and the inner ear. It is notable that the authors, especially those of the two case series,[2,3] report aural injuries as having considerable symptomatology and a clear temporal relationship to a diving event. As reported, the diagnosis may initially be difficult to determine but the injuries may be associated with significant long-term morbidity.

We would like to propose an additional mechanism for aural injury while diving. This involves the cumulative effect, over a long diving career, of relatively minor aural injury that may be either symptomless or not requiring of medical attention. It is conceivable that these injuries result from repeated minor barotrauma with subsequent fibrosis and scarring or subclinical decompression sickness (DCS). Indeed, it is well recognised that minor aural barotrauma is common. Bubble formation upon ascent is also common and, while benign in most cases, has been demonstrated to cause pathological lesions in the central nervous system (CNS) in the absence of clinical signs or symptoms.[5] There is no reason to expect that the inner ear or CNS pathways that serve the sense of hearing are exempt from cumulative subclinical bubble injury.

A recent report of diving injuries sustained by experienced Australian and American divers tends to support the above hypothesis.[6] This study found that aural symptoms (deafness and tinnitus) were common among respondents and could not be adequately explained by the relatively rare events of significant aural barotrauma or DCS. To further investigate these findings, we are undertaking a retrospective cohort study that compares the hearing of experienced scuba divers with that of matched non-divers (controls). This involves pure tone audiometric testing utilising both air- and bone-conduction techniques. We hope to determine if subtle hearing loss is a real phenomenon among experienced divers and, if so, whether this loss is conductive (likely barotrauma related) or neural (likely DCS related) in nature.

Associate Professor David McD Taylor
Director of Emergency Medicine Research
Royal Melbourne Hospital.
E-mail: *<David.Taylor@mh.org.au>*

John Lippman
Executive Director, Diver Alert Network (SE Asia Pacific)
E-mail: *<johnl@danseap.org>*

References

1 Edmonds C. Diving and inner ear damage. *SPUMS J*. 2004; 34: 2-4.
2 Wong R, Walker M. Diagnostic dilemmas in inner ear decompression sickness. *SPUMS J*. 2004; 34: 5-10.
3 Edmonds C. Inner ear barotrauma: a retrospective clinical series of 50 cases. *SPUMS J*. 2004; 34: 11-4.
4 Doolette DJ, Mitchell SJ. A biophysical basis for inner ear decompression sickness. *SPUMS J*. 2004; 34: 15-21.
5 Reul J, Weis J, Jung A, Willmes K, Thron A. Central nervous system lesions and cervical disc herniations in amateur divers. *Lancet*. 1995; 345: 1403-5.
6 Taylor D McD, O'Toole KS, Ryan CM. Experienced scuba divers in Australia and US suffer considerable injury and morbidity. *Wilderness Environ Med*. 2003; 14: 83-8.

Reply:

There is absolutely no reason why the correspondents should not investigate the possibility of multiple subclinical pathology producing a clinical entity after multiple diving exposures. Indeed, such a proposal has been conjectured in many of the previous surveys of hearing damage in divers and submariners. The reason why such a pathogenesis was not referred to in the SPUMS articles is probably that there is no evidence for it, as opposed to the aetiologies that were mentioned.

There have been extensive surveys of navy divers, ranging back to 1942, as well as of professional diving groups over the last three decades. There have been fewer observations on amateur divers, possibly because they did not have pre-diving pure tone audiograms performed. This excuse is no longer relevant in Australia, as pre-diving medicals include this investigation, so that Taylor and Lippmann have an opportunity to correct this omission.

As well as hearing loss and tinnitus, a history of disorientation episodes needs to be included for an otological assessment, as does a competent otologist's examination in clinically significant cases. We found this out the hard way in our Abalone Diver Survey.

There are some qualifications. Firstly, I cannot understand why common aural symptoms could not be explained by aural barotrauma, which the authors previously admitted was common! Next, the problem with retrospective studies is that much information is missing (forgotten or not asked). Thus, conclusions based on the absence of evidence are not valid in these studies. The inadequate investigation is then often used to support a conclusion of 'no other cause being detected'. Why do a retrospective survey when a prospective one is possible?

Other causes of hearing loss are related to the diving