

# 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.<sup>1-4</sup> 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,<sup>2,3</sup> 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.<sup>5</sup> 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.<sup>6</sup> 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.

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## References

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- 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

population, without necessarily being due to diving per se. Thus, the various 'cohort groups' need to be carefully controlled for these factors, and a dose-response relationship between the diving exposures and the pathology being claimed needs to be evident before any conclusions can reasonably be drawn.

Another problem is that arguing by analogy is especially inadequate when the analogy is not accurate. There has been no consensus on multiple subclinical injuries leading to clinical entities in the proposed neurological or psychological complications of diving. The reference quoted is probably the worst scientific study on this subject since that of Roszahegyi in 1959.<sup>1,2</sup> There have been at least three international conferences on this topic and in none has there been any substantial agreement that such a subclinical cumulative effect has been demonstrated, despite many attempts. Indeed, the opposite has been concluded. With these provisos, I wish the researchers well, offer any assistance that I can, and look forward to their results.

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#### References

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- 2 Roszahegyi I. The late consequences of the neurological forms of decompression sickness. *Br J Ind Med*. 1959; 16: 311-7.

#### Key words

Letters (to the Editor), ear barotrauma, decompression illness

### Funding of recompression chambers in the Pacific

Dear Editor,

Thank you for highlighting some of the challenges we face. I would like to correct some points in your editorial.<sup>1</sup> With reference to paragraph 3, DAN has not set up any chambers in the South-East Asia Pacific region. Hyperbaric Health Pty. Ltd., an Australian-based company, manages 15 chambers operating in this region. These include Melbourne (Berwick), Hong Kong, Singapore, Kuala Lumpur, Ipoh-Malaysia, Philippines, Papua New Guinea, Vanuatu, Fiji, Pohnpei, Chuuk, Palau, Yap, Nauru and soon the Solomon Islands. Subaquatic Safety Services have set up three.

With regards to the costs of treating tourist divers, none of the local communities we are associated with is required to fund the upkeep or any ongoing costs or maintenance of the systems; we do that at our cost.

You mention that you suspect the majority of tourist cases to be uninsured but I can confirm that the reverse is true. The majority of tourist cases are in fact insured and only a small number elect to be "self insured" (uninsured). We refer to them as self insured as they choose not to buy insurance but rather retain the premium they would otherwise pay and therefore carry the risk themselves. Even when a self-insured tourist diver presents for treatment at one of our chambers the charges are borne by ourselves and not the local community.

We are yet to be paid for any self-insured diver whom we have treated and who promised to pay us. Not a one. (We have never withheld a treatment for any diver due to lack of insurance or inability to pay.) Local (indigenous) divers are usually treated for no charge. We do request a contribution towards oxygen but seldom receive it.

I would also like to point out a correction to Dr Rob Grace's review of diving medicine in Vanuatu in the same issue.<sup>2</sup> In the first paragraph Rob states "...a chamber was procured, funded by subscriptions levied on the dive operators." In fact, the chamber was funded by Hyperbaric Health Pty. Ltd. Initially, there were some small levies collected by the local dive operators, which were contributions towards the ongoing upkeep of the system, but these contributions amounted to very little. The practice of collecting levies in Vanuatu was then abandoned by us and we have never applied it at any other location.

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#### References

- 1 Davis FM. The Editor's offering. *SPUMS J*. 2004; 34: 1.
- 2 Grace RF. A review of diving and hyperbaric medicine in Vanuatu. *SPUMS J*. 2004; 34: 23-6.

#### Key words

Letters (to the Editor), hyperbaric facilities, tourism, insurance

### Proceedings of the 14th International Congress on Hyperbaric Medicine

Dear Editor,

Thank you for the opportunity to write in regard to the review by Martin Hodgson of the Proceedings of the Fourteenth International Congress on Hyperbaric Medicine