



Inner ear disorders after diving- a safe treatment concept

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Introduction:

Inner ear decompression illness (IEDCI) is thought to be a rare phenomenon in recreational divers, isolated signs and symptoms of inner ear dysfunction usually being attributed to inner ear barotrauma (IEB). New data let us think that the prevalence of inner ear decompression illness is underestimated. Nachum et al.¹ presented 29 cases in 24 divers who have been treated with the diagnosis of IEDCI representing 26 percent of the divers treated for severe DCI from 1987 to 1999. This year Cantais et al.² presented 34 divers with IEDCI of 101 divers treated for DCI. In our hospital we treated 11 cases in 9 divers with IEDCI during the last six years³. These figures show that IEDCI is not a rare disease in divers but seems to be one of the regular manifestation of DCI.

As the differential diagnosis to inner ear barotrauma can be very difficult and in some cases impossible we developed a safe treatment concept for divers that present with isolated inner ear symptoms after dives that could lead to symptoms of decompression illness.

Concept:

Following standard diving medicine text books hyperbaric oxygen therapy is contraindicated in divers with inner ear barotrauma but is the treatment of choice for inner ear decompression illness and has to be administered as fast as possible. The problem is that inner ear barotrauma with or without rupture of the round/oval window membrane is worsened by the valsalva manoeuvre during HBO therapy.

For this reason we suggest treating every patient with inner ear symptoms (after long or deep dives that make the diagnosis of decompression illness possible when there is a possibility of inner ear barotrauma) with HBO but only after bilateral paracentesis. After paracentesis there is no increase of labyrinth pressure during recompression because there is no need for equalization of the middle ear. A paracentesis is easily performed in a few minutes and doesn't delay HBO treatment.

With this procedure every diver with inner ear decompression illness is treated as fast as possible by HBO. If the diagnosis turns out to be IEB, HBO treatment did not harm the diver. It is even possible that divers with IEB have a benefit of HBO treatment because potential bubbles in the inner ear can be washed out.

- 1. Nachum Z, Gordon CR, Shahal B, Spitzer O, Shupak A. Active high-frequency vestibulo-ocular reflex and seasickness susceptibility. *Laryngoscope* 2002;112(1):179-82.
- 2. Cantais E, Louge P, Suppini A, Foster PP, Palmier B. Right-to-left shunt and risk of decompression illness with cochleovestibular and cerebral symptoms in divers: case control study in 101 consecutive dive accidents. *Crit Care Med* 2003;31(1):84-8.
- 3. Klingmann C, Benton PJ, Ringleb P, Knauth M. Embolic inner ear decompression illness. *Laryngoscope* in press.



Image 1

Left middle ear with barotraumatic signs. A paracentesis should be performed before HBO treatment to prevent further damage.



Image 2

After paracentesis the diver doesn't have to perform a Valsalva manoeuvre during recompression. There is no harm to the inner ear if there the diver has a possible perilymphatic fistula.

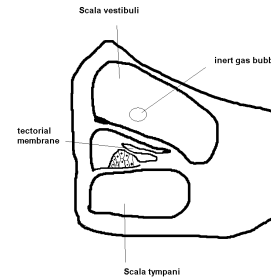


Figure 1

After inner ear barotrauma gas bubbles can enter the inner ear through a patent perilymphatic fistula. During ascent the bubbles can increase their size.

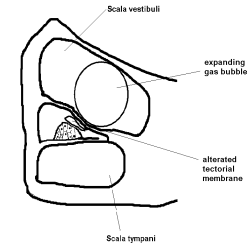


Figure 2

The increased bubble destroy inner ear structures. HBO may accelerate the wash-out of the bubble.