High-frequency audiometry after diving

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Introduction: Due to the tonotopic arrangement of the cochlea, pure tone audiometry (250-8,000 Hz) cannot examine the whole length of the basilar membrane. High-frequency audiometry (HFA, > 8 kHz) can examine the basal end of it. HFA possesses a well-established role in monitoring possible ototoxicity, noise-induced hearing loss, as well as hearing impairment due to chronic renal failure.

Objective: This paper aims at presenting HFA results in patients with hearing complaints after diving, whose basic audiograms revealed hearing within normal threshold limits.

Method: This is a retrospective review of 11 divers (1 scuba diver and 10 free divers). They consulted the ENT outpatient praxis of General Hospital of Ikaria complaining of hearing impairment either as a single symptom, or combined with tinnitus and/or vertigo. Inclusion criteria were negative otoscopy, and normal results of pure tone and impedance audiometry. Their age ranged from 16 to 55 years, their gender being 10 male, 1 female. After this routine examination they underwent HFA (10, 12.5, 16 kHz). Pure tone and high frequency audiometry were conducted with the same device in the same sound proof booth, using different headphones, according to manufacturer’s guidelines.

Results: Amongst the 22 examined ears (11 divers), air conduction threshold exceeded normal range in 1 ear on 10 kHz, in 4 ears on 12.5 kHz and in 8 ears on 16 kHz. Totally, in 9 out of the 22 examined ears (5 divers) HFA exceeded normal range at least in one frequency, though standard examination had proved within normal range. (An example is shown on the adjacent photo)

Discussion: One of the audiological debates in current literature regards the hearing threshold of divers. Some authors advocate a high rate of hearing impairment amongst divers having estimated a 6.6 dB deterioration of hearing through 5 years after eliminating the aging effect. Others conclude that reduced hearing levels of professional divers found in other studies are probably due to occupational high noise levels or are caused by ear accidents. However, according to our results (abnormal HFA in 5 out of 11 subjects) all these divers who were not examined with HFA might have been misdiagnosed as healthy. In this paper the 16 kHz frequency proved to be the most vulnerable one. This corresponds with the results of HFA of sufferers from noise-induced hearing impairment.

Conclusion: High frequency audiometry, especially the 16 kHz frequency, is a very useful “tool” in the audiological test-battery in divers. Limiting the testing of hearing of professional divers to pure tone audiometry will most probably lead to several misdiagnoses.

Literature: