

## **Sudden Deafness**

### **Treatment of 522 patients with sudden deafness performed oxygenation at high pressure.**

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**INTRODUCTION:** Oxygenation at high pressure (OHP) is thought to be useful, even though regional blood flow is decreased, because increasing dissolved oxygen prevents the death of nerve tissue. In this report, we retrospectively investigated the effect of OHP on sudden deafness. **OBJECT AND METHOD:** We reviewed 522 patients treated with OHP at Kagawa Rosai Hospital over a ten-year period (January 1989 to December 1998). We discussed some prognostic factors: comparison between cases which had been treated with OHP previously and those which had not, number of days between onset and beginning of the treatment which included OHP, age, initial averaged five-frequency hearing level, vertigo, tinnitus, complications of OHP, cases of relapse and the time of the onset, which is about season, month and week. OHP was administered at a pressure of 2.5 atmospheres for 80 minutes a day from 10 to 15 times. All patients also received a course of intravenous administration of steroid, vitamin B12, Prostaglandin E1, ATP, and low-molecular dextran. **RESULTS:** Overall, complete recovery occurred in 19.7% of the patients, definite improvement in 34.9% (complete recovery included), and slight improvement in 58.1% (definite improvement included). Most of the patients (78.0%) were referred by other hospitals, because our hospital was the only one in the Sikoku area which had a big equipment of OHP. All 161 patients had already been treated in other hospitals over 8 days, but they had shown little improvement after the initial therapy. Of this group, complete recovery after the second course of treatment occurred in 13.0% of the patients, definite improvement in 19.3%, and slight improvement in 39.1%. OHP was thus effective for about 40% of patients who had been unresponsive to the initial therapy. Delay in treatment usually produces poor hearing recovery. There was a significant difference between those patients treated within 14 days and those treated 15 days or more after onset. The improvement rate also decreased with age. The prognosis of patients with vertigo was worse than those without vertigo. Tinnitus had no influence on the prognosis. There were no severe complications during the course of OHP, but otitis media with effusion occurred in 90 patients, and paracentesis was performed for 53 patients. **CONCLUSION:** The treatment of sudden deafness with OHP has been discussed in this report. Important prognostic factors were time between onset and beginning of the treatment which included OHP, age, vertigo, and the initial averaged five-frequency hearing level. We conclude that OHP should be performed within 14 days from onset, and that OHP was able to achieve hearing improvement in many cases unresponsive to the initial therapy if it was performed very early.

### **Acute sensorineural hearing loss at the Otorhinolaryngology Department of the General Hospital in Subotica 1991-1996.**

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**INTRODUCTION:** Sudden sensorineural hearing loss is an acute hearing loss of a perceptive type, of unknown etiology, in most cases one-sided, or, a every sudden sensorineural deafness that occurs in the period of three days or less. Modern scientific literature points to three possible etiological factors: viral cochleitis, vascular lesion of the labyrinth and unrecognized rupture of the membranous labyrinth. The therapy for this disease is extremely various. There are dozens of reported different (or similar) healing protocols, including vasodilators, Hydroxyethyl starch, low molecular dextran, diuretics, defibrinogenation, fibrinolytic therapy, steroids, prostacyclin, oxygen therapy, hyperbaric oxygen therapy, vitamins, etc. The aim of the study was to recapitulate in brief modern views of etiology and therapy of the sudden sensorineural hearing loss, to analyze cases of this illness within the period of 1991-1996 in our Otorhinolaryngology Department and to compare these data with the same or similar data of other authors. **MATERIAL AND METHODS:** In this study, medical records of patients admitted in the period of 1991-1996 in the Otorhinolaryngology Department of the Health Center in Subotica with a diagnosis of sudden sensorineural hearing loss were used. There were 53 patients with this diagnosis. All patients were treated in the hospital with infusions of rheoactive drugs. During the diagnostic

procedure, all patients underwent a complete clinical otorhinolaryngologic examination, detailed anamnesis was taken, acoustic impedance tests (tympanometry) and tonal liminal audiometry were performed. Routine blood test was made (including complete blood picture, sedimentation rate, blood sugar) and a complete urine examination. Sometimes we demanded x-ray of the temporal bones (Schnller and Stenwers). A short increment sensitivity index (SISI) test and Carhart test were also made, if necessary. Function of the vestibular system was tested in cases when the vestibular symptoms were more strongly expressed. This test was made after passing an acute attack of vertiginous symptoms. Control audiometry was made on the seventh and on the fourteenth day after admission. This therapy consisted of an infusion of physiologic solution (NaCl) 250 or 500 ml twice daily to which 300 mg xanthinol nicotinate ampulla, paracetam 1 g ampulla, dipyridamole 10 mg ampulla and C-vitamin 10% 500 mg ampulla were applied. The number of paracetam and xanthinol nicotinate ampullas was raised on the 14/day, and then it fell to the starting value. The therapy lasted 17 days. Patients were given multivitamine peroral therapy, tranquilizers and diet without coffee, smoking and allergenic food. RESULTS AND DISCUSSION: The study included 53 patients, 27 (50.94%) female and 26 (49.06%) males (Graph 1). Their age (Graph 2) ranged between 16-71 years. The biggest group of patients was between 40-49 (39.62%) years of age. Distribution per year (Graph 3) shows that the incidence of the acute sensorineural hearing loss differs from the findings of other authors, especially in the period of 1991-1994, due to very few cases. Connection of this illness with seasons is shown in Graph 4. We had most cases during summer time (August, 16.98%). There is a mild rise in winter (December, 13.21%). The degree of the hearing loss in decibels is shown in the Graph 5. Most of the patients (75.47%) had mild or severely damaged hearing (40-85 dB). Period of the deafness before patients were admitted to the hospital, is shown in Graph 7. Most of them came in the first seven days after they experienced acute deafness (52.83%). Symptomatology of the persons with acute hearing loss is shown in Table 1. All of them had the feeling of deafness, and 50.94% also had tinnitus. Table 2 shows that only two patients had a pathologic finding (hypo function) on the vestibular caloric test. 57.14% of patients tested by this method showed a normal function of the vestibular apparatus. The recovery of he

### **Effect of hyperbaric oxygen therapy in comparison to conventional or placebo therapy or no treatment in idiopathic sudden hearing loss, acoustic trauma, noise-induced hearing loss and tinnitus. A literature survey.**

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With the published clinical data to hand on the therapeutic results of patients with idiopathic sudden hearing loss, acoustic trauma or noise-induced hearing loss, it may be confirmed that 65% of those polypragmatically treated patients demonstrated a hearing improvement of 19 +/- 4 dB. In 35% of the cases, no hearing improvement was detected independent of the drugs administered. This corresponds to the results obtained from placebo-treated patients who demonstrated a hearing improvement of 20 +/- 2 dB in 61% of cases and no hearing gain in 39% of cases (fig. 1). A different set of results was obtained from patients with a hearing loss who were treated either with prednisolone or placebo. The percentage of patients who achieved normal hearing again in the placebo-treated group amounted to 31% and 38% and in the verum-treated group 50% and 78%. It may be concluded that a placebo therapy is equally effective to that of all nonsteroidal drugs. Problems arise when comparing non-treated patients since information on spontaneous remission rates differs greatly in the references, i.e. between 25-68% for spontaneous full remissions and 47-89% for spontaneous partial remissions. From a statistical view, 35% and 39% of patients experienced no success with nonsteroidal drugs or placebo, respectively. These patients can still be helped with HBO therapy. 18 patients only underwent primary HBO therapy. In all other 50 studies evaluated here with a total of 4, 109 patients suffering from idiopathic sudden hearing loss, acoustic trauma or noise-induced hearing loss and/or tinnitus, HBO therapy was administered as a secondary therapy, i.e. following unsuccessful conventional therapy. If the onset of affliction was more than 2 weeks but no longer than 6 weeks, one half of the cases showed a marked hearing gain (in at least 3 frequencies of more than 20 dB), one-third showed a moderate improvement (10-20 dB) and 13% showed no hearing improvement at all (fig. 2). 4% no longer experienced tinnitus, 81.3% observed an intensity decrease and 1.2% an intensity increase of their tinnitus condition. 13.5% remained unchanged (fig. 2). If HBO therapy was

administered at a later stage, but still within 3 months following onset of affliction, 13% showed a definite improvement in hearing, 25% a moderate improvement and 62% no improvement at all. 7% no longer suffered from tinnitus, 44% reported an intensity decrease, a similar percentage noticed no change and 5% a temporary deterioration of their tinnitus condition. If the onset of affliction was longer than 3 months up to several years, no hearing improvement can be expected in the majority of patients (fig. 3); however, one third of the cases reported an intensity decrease of tinnitus, 60-62% reported no change and 4-7% noticed a temporary intensity increase (fig. 4). In conclusion, it may be deduced that HBO therapy is recommended and warranted in those patients with idiopathic sudden deafness, acoustic trauma or noise-induced hearing loss within 3 months after onset of disorder.

### **Effectiveness of hyperbaric oxygen therapy in patients with acute and chronic cochlear disorders.**

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Over the course of 18 months 359 patients with defined acute and chronic inner ear disorders who had not responded to treatment with medication were given hyperbaric oxygen (HBO) therapy. The inner ear diseases of the patients were divided, based on the duration of their conditions, into four symptomatic groups. Of the patients who had had hearing loss for less than 3 months, noticeable improvement or complete recovery was seen in 13% (20 dB in at least three test frequencies); 25.2% showed an improvement between 10 and 20 dB. Changes up to 10 dB or less were not considered to be positive. Patients with a pretreated hearing loss for more than 3 months had markedly less benefit from HBO therapy. Two percent regained normal hearing function. In 30% an improvement of more than 10 dB was achieved. For patients who had suffered from tinnitus for less than 3 months excellent improvement was seen in 6.7% and noticeable improvement in 44.3% expressed by means of a visual analog scale. In 44.3% the tinnitus was described as unchanged. Patients who had had tinnitus for more than 3 months before HBO therapy showed a less favorable response to HBO. In none of the patients did the tinnitus disappear; 34.4% of the patients described a noticeable improvement in their complaints.

### **Therapeutic effect of hyperbaric oxygenation in acute acoustic trauma.**

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Retrospectively 78 patients with uni- or bilateral acute acoustic trauma (AAT) were evaluated to assess the therapeutic effect of hyperbaric oxygenation (HBO). All subjects received saline or dextran (Rheomacodrex) infusions with Ginkgo extracts (Tebonin) and prednisone. Thirty six patients underwent additional hyperbaric oxygenation at a pressure of 2 atmospheres absolute for 60 minutes once daily. Both treatment groups were comparable as far as age, gender, initial hearing loss and prednisone dose are concerned. The delay of therapy onset was 15 hours in both groups and treatment was started within 72 hours in all cases. Control audiometry was performed after 6.5 days, when the HBO group had had 5 exposures to hyperbaric oxygenation. The average hearing gain in the group without HBO was 74.3 dB and in the group treated additionally with HBO 121.3 dB ( $P < 0.004$ ). It is concluded, that hyperbaric oxygenation significantly improves hearing recovery after AAT. Therefore acute acoustic trauma with significant hearing threshold depression remains an otological emergency. Minimal therapy involving waiting for spontaneous recovery, which is mostly incomplete leaving a residual C5 or C6 and handicapping tinnitus, is not the treatment of choice. Randomized prospective clinical trials with a larger patient series are needed and further experimental studies are required to understand the physiological mechanisms of HBO responsible for the clinical success in AAT.

### **Value of the association of normovolemic dilution and hyperbaric oxygenation in the treatment of sudden deafness. A retrospective study.**

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The multiple treatments of sudden deafness shows how this pathology still remains quite unknown. The authors present a retrospective study of 87 patients treated by normovolemic hemodilution associated to hyperbaric oxygenation. They obtain a total a 60% of significant recovery (ratio between hearing gain and initial hearing loss, above 25%) and in severe hearing loss (threshold between 70 and 90 dB) 60% of good results (ratio above 50%). The importance of the initial form of audiogram and the presence of dizziness as prognostic factors is not confirmed. On the other hand, the evolution of tinnitus is correlated with the deafness and it is a supplementary means to evaluate the therapeutic efficiency. Moreover the persistence of tinnitus represents an important after effect. Sudden deafness still remains a medical emergency and the delay for carrying out any treatment should be as short as possible. On the other hand it is possible to reduce hospital stay by two sessions of hyperbaric oxygenation per day.

### **Clinical and animal experiment studies to optimize the therapy for acute acoustic trauma.**

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Despite extensive educational measures and improved ear protection, acute acoustic trauma still represents a major problem for the young soldier in the Federal Armed Forces. The aim of the investigation was thus to establish the optimum therapeutic scheme that could be applied by the generally young and still inexperienced unit medical officer to patients who had suffered acute acoustic trauma and to demonstrate the therapeutic scheme in animal experiments. In the clinical section, ten studies conducted on 500 patients who had suffered acute acoustic trauma made it possible to show that the combination of low-molecular dextran, or low-molecular hydroxyethyl starch, and hyperbaric oxygenation produced the best therapeutic results in terms of hearing gain and tinnitus elimination by a statistically significant margin. The studies only included patients who showed no tendency towards spontaneous recovery, with strict exclusion criteria being applied. Through animal experiments, it was seen that hyperbaric oxygenation, in the manner in which we conducted it (100% oxygen at 2.5 bar), leads to an increase in the oxygen partial pressure in the perilymph of the guinea pig cochlea. This is due partly to diffusion and partly to the blood flow. In a further experimental approach using animals, it proved possible to show that 60 hours after damage by acoustic trauma and hyperbaric oxygenation, the number of inner ear sensory cells that had suffered morphological damage in the animal was lower than without the hyperbaric oxygenation by a statistically significant margin. At the same time, valuable information was gained on the epidemiology of acute acoustic trauma.

### **Hyperbaric oxygen therapy in sudden deafness.**

Pilgramm M, Lamm H, Schumann K.

Based on two independent studies, an attempt is made in this paper to demonstrate the effect of hyperbaric oxygen therapy used as a supportive measure to accompany standard treatment in recent acute loss of hearing and in acute loss of hearing where preoperative treatment has proved unsatisfactory. Whereas hyperbaric oxygen therapy is superior to the standard treatment alone as far as the cochlear perception dysacusis and tinnitus in recent acute loss of hearing are concerned, these results could not be reproduced in existing, preoperatively treated acute loss of hearing. As such, hyperbaric oxygen therapy under the strict supervision of a specialist physician has proved an effective supportive measure in the treatment of recent acute loss of hearing.

### **Treatment of sudden deafness: first results of a comparative study.**

Dauman R, Cros AM, Poisot D.

A comparative study is undertaken in 36 cases of sudden deafness in order to appreciate the efficiency of three therapies: vaso-active drug and steroid administered through continuous perfusions, normovolemic hemodilution, and hyperbaric oxygen therapy. Groups are homogeneous with respect to age, time elapsed between onset of deafness and treatment, occurrence of vertigo, degree of hearing loss, and audiometric pattern. Results are expressed in terms of pure tone threshold improvement (dB), audiometric ratio recovery taking into account initial hearing loss, and effects upon tinnitus. These data are complemented with electrophysiological

measures (click-evoked electrocochleography and auditory brainstem responses). Analysis of variance does not show significant differences among the three procedures. Mechanisms and possible usefulness are discussed, keeping in mind the difficulty of ascertaining the real efficiency of therapies with respect to spontaneous recovery.

### **Hyperbaric oxygen therapy for acute acoustic trauma.**

Pilgramm M, Schumann K.

We conducted a study on the effect of hyperbaric oxygen therapy on 122 soldiers following acute acoustic trauma. The patients included in this study, after the effect of spontaneous recovery had largely been excluded, were randomly allocated to four treatment groups. The results of our studies show that hyperbaric oxygen therapy shortens the course of healing with respect to high-pitch perception dysacusis. The results of treatment after an observation period of 6 weeks is also more favorable when patients are treated with oxygen when compared to patients given infusions or vasoactive substances. Similarly, the use of hyperbaric oxygen therapy also reduces the frequency of relapse following discharge from hospital. In contrast, the vasoactive substance chosen in our studies (betahistine) failed to have a favorable effect on the course of healing. Our study has also shown that no method can compare with hyperbaric therapy in eliminating tinnitus following acoustic trauma.

### **Sudden deafness accompanied by asymptomatic mumps.**

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In this study we investigated asymptomatic mumps as a possible cause of sudden deafness. We studied 131 sudden deafness patients by measuring their serum mumps antibody values. Positive IgM antibody results, which strongly suggest recent mumps infection, were revealed in 9 of the 130 patients tested (6.9%). Asymptomatic mumps infections are apparently closely related to sudden deafness. Further studies will provide more definite diagnoses of mumps deafness and might be applicable to the treatment of such hearing loss.

### **Malignant or necrotizing otitis externa: experience in 22 cases**

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Malignant or progressive necrotizing otitis externa is an uncommon but severe infectious condition of the external auditory canal. Over a period of four years, we treated 22 patients: 60% had diabetes (1/4 insulin dependent) and 13% were immunodepressed. The causal germ was *Pseudomonas aeruginosa* in 87% of cases. The pretherapeutic work-up included a computed tomography scan and a technetium scintigraphy to confirm diagnosis and assess extension. Repeated scintigraphies with gallium were used to follow the course under treatment. Medical treatment was used in most cases (16/22) with parenteral antibiotic therapy using a third-generation cephalosporin (ceftazidime or ceftriaxone) and a fluoroquinolone (ciprofloxacin or ofloxacin) and, if there was no contraindication, hyperbaric oxygen. Surgery is not indicated in malignant otitis externa. We had a 95% cure rate with only 10% recurrence. We reviewed the data in the literature on malignant otitis externa and present the important diagnostic, imaging and therapeutic aspects.

### **Antioxidants and hyperbaric oxygenation in the treatment of sensorineural hearing loss in children**

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Vestn Otorinolaringol. 2002;(5):33-4.

Efficiency of hyperbaric oxygenation (HBO) in combination with antioxidants was studied in 36 children aged 1-14 years with neurosensory hypoacusis vs standard treatment. A course of HBO consisted of 10 sessions (1.4 atm) for 40 min. The response was registered in 72.2% patients. It manifested in improvement of sound perception at 5-25 dB. The highest effectiveness was seen in acute neurosensory hypoacusis. Thus, HBO in combination with antioxidants is recommended in combined treatment of neurosensory hypoacusis in children.

## **Complications of tympanostomy tubes inserted for facilitation of hyperbaric oxygen therapy.**

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**OBJECTIVE:** To document the incidence of complications occurring secondary to placement of tympanostomy tubes in patients undergoing hyperbaric oxygen therapy. **DESIGN:** Retrospective chart review. **SETTING:** Tertiary referral center. **PATIENTS:** Forty-five patients referred to the Department of Otolaryngology for inability to tolerate hyperbaric oxygen therapy between January 1, 1990, and December 31, 1995. **INTERVENTIONS:** All patients underwent bilateral myringotomy and tube placement. **OUTCOME MEASURES:** Charts were reviewed for complications of tube placement, including otorrhea, otalgia, hearing loss, persistent perforations, and tinnitus. **RESULTS:** Seventeen (38%) of 45 patients experienced complications, with most having more than 1. Most complications occurred after conclusion of hyperbaric oxygen therapy. Otorrhea was most common, occurring in 13 patients (29%). Persistent tympanic membrane perforations occurred in 7 patients (16%). **CONCLUSIONS:** The rate of complications is higher than reported for placement of tympanostomy tubes in other patient populations. Coexisting illness, such as diabetes mellitus, may contribute to the development of complications in patients undergoing hyperbaric oxygen therapy. Alternative methods of tympanostomy, with emphasis on shorter duration of intubation, should be considered in this patient population.