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Complex Therapy of Neck-Related Tinnitus, Hypacusia, and Vertigo

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Abstract: The authors report the strategy of examination and treatment in patients suffering from tinnitus, hypacusia, and vertigo. In addition to the customary examinations, a routine cervical radiological examination and hemorrheological examination are recommended. The authors propose appropriate complex treatment and report their experience.

Keywords: cervical spondylosis; hemorheology; viscosimetry; microcirculation; hypacusia; tinnitus; vertigo

INTRODUCTION

When the patient suffering from tinnitus, hypacusia, and vertigo consults the doctor, the following question always arises: "What can be the causes of these complaints?" The causes can be simple, well-defined ones in the inner ear, such as:

-trauma
-inflammation
-tumor,

but they can be complex (multifactorial) ones, such as:

-metabolic diseases (diabetes, hyperuricemia, disorders of fat metabolism)
-hypertension
-heart disease
-hematological disorders [1]
-circulatory disturbances
-toxicosis
-occupational hazards
-locomotor/articular disorders, etc.

Among them the group of cervical spine diseases, namely the cervical spondylosis incidental to the senescence, plays a considerable role in the aetiological approach.

The progress of human evolution has started with standing and walking on our feet. This process has lead to the ability to operate arms and hands independently, allowing the first humans to use their hands for various purposes (instead of the constant reclining on them). The skull was given a practically new vertical position, with which came a new and slightly negative effect on the static position of the *neck spine*. For the raising to our two feet, humans have been paying a duty ever since. This duty appears in the form of *neck* and *back* pain beginning even at the age of 20, and getting more and more frequent towards the old age.

On account of cervical spondylosis, the static position of the cervical spine deteriorates, calcification evolves (osteophyte), the vertebral foraminae dwindle (which makes the function of vertebral arteries reduce), radicle neck pain appears, forced bearing of the neck arises, fibrositis appears in the muscles and unfavourable effects are influenced on the cervical sympathetic nerves. As a result of this process the intracranial blood-supply suffers trouble in different levels (in one or in both sides). In consequence of these alterations, insufficiency of vertebro-basilar circulation and its aftermath can form:

-peripheral vestibular disorders
-central vestibular disorders
-tinnitus in ears
-head-noises
-hypacusia.

In addition, similar complaints can be caused by arteriosclerosis, metabolic disease and the change of blood viscosity. Under their influence the microcirculation

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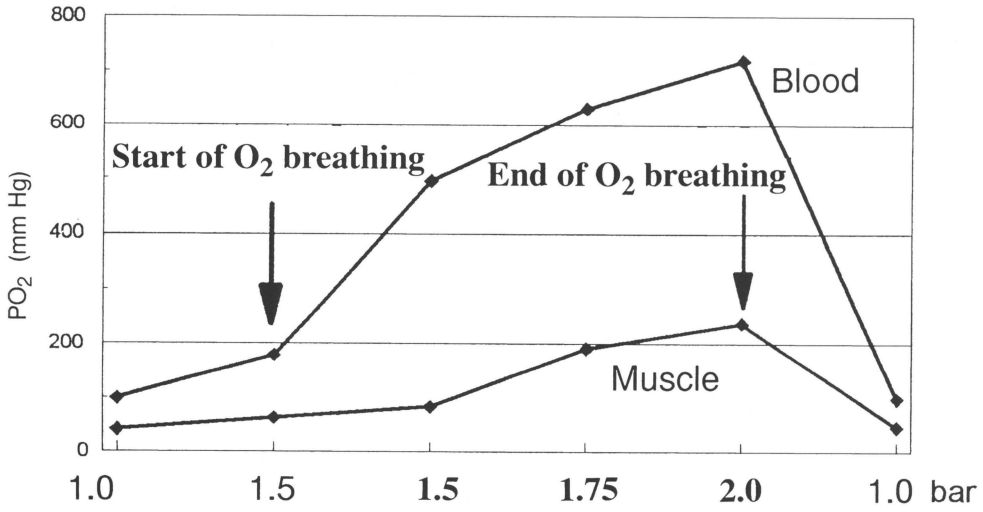

Figure 1. Oxygen partial pressure in the blood and muscular system under different chamber pressures.

this a lack of oxygen, it was a reasonable supposition to use HBO to influence this factor.

Investigations

For the first prospective study 47 patients received an HBO therapy within 3 months of tinnitus first occurring. In each case they already had received standard treatment with infusions and often combined with cortisone. The necessary medical examinations all were undertaken by the ENT center (Prof. v. Ilberg) at Frankfurt University.

In 64% of the cases an improvement was attained. During the follow-up examinations 27% of the patients confirmed a further decrease of the ringing in their ears during the 2 months following treatment [17].

In a retrospective study, patients who had been treated with infusions with no success and then received HBO therapy (n = 250) were compared to a group that had not received oxygen therapy. They were under observation for 21 months. Here also 60% ascertained a steady tinnitus improvement [18].

Due to the good results we made tinnitus an indication for hyperbaric oxygenation treatment. The number of tinnitus patients rose during the last few years and we now have circa 550 patients a year.

The data of the 1994 patients was statistically analyzed. Out of a total of 450 patients the data for 381 patients were complete and could be evaluated.

On average 15 single treatments for 90 minutes with a pressure of 2.2%–2.5 bar abs. (12–15 m diving depth) were carried out. Due to the pre-therapy examinations for suitability for treatment no severe complications during the therapy were registered. The patients with tinnitus often occurring difficulties with the tubal function occasionally caused irritations at the external auditory canal which however faded away after 2–3 days. The patients were asked to daily, and always at the same time of day, note down their subjective perceptions regarding sound volume and also how they feel.

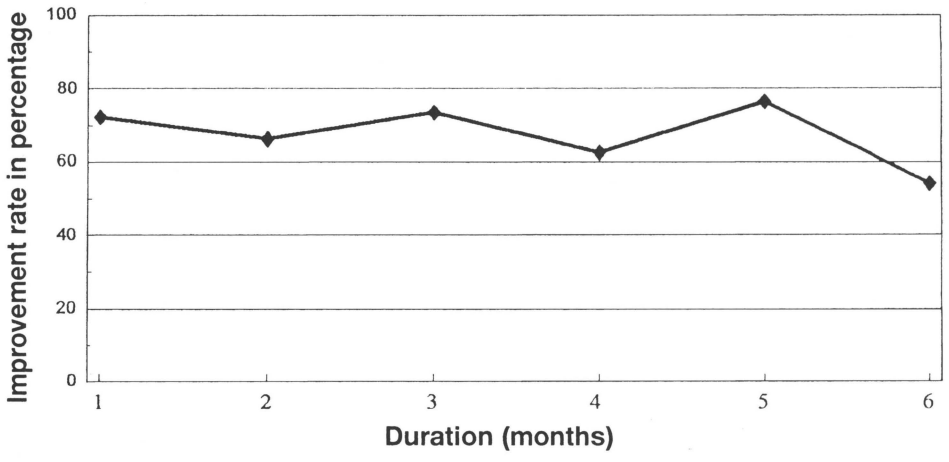

Figure 2. Duration of tinnitus from beginning of HBO.

Table 1.

	Sex:		Ear		
Age:	**f**	**m**	**Left**	**Bilat.**	**Right**
11–81 y.	113	268	99	164	118
ø 45,2 y.	29,7	70,3%	26%	43%	31%
Tab.: Biodatas (n = 381)			Tab.: Localization of tinnitus		

Changing in	**Percent**	**Tinnitus**		**Before**	**After**
completely healed	3,9	unbearable	grade 4	11	2
noticeable improvement	34,1	loud	grade 3	163	70
slight improvement	31,8	fairly loud	grade 2	188	162
no improvement	28,1	quiet	grade 1	19	120
worsening	2,1	no noises		0	27
Tab.: Results of treatment		Tab.: Subjective sensation degree before and after HBO-therapy			

The improvement of the tinnitus sounds with HBO treatment summarized from "becoming less" to "being completely healed" is noticeable in the first 6 months after tinnitus first occurs. The major advances starting with "unbearably loud" to "bearable" were made during the first 2–3 months. This also applies when tinnitus occured in conjunction with sudden hearing loss or as a result of the same.

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Nearly every patient felt better during or after the HBO treatment; particularly those who suffer under mental distress.

DISCUSSION

With HBO it is possible to increase the partial oxygen pressure in the blood in accordance with the oxygen pressure of inhaled air and thus obtain a sufficient pressure difference to the tissue pO_2 tissue, so ensuring the transfer of oxygen to the cell. Prerequisite is a satisfactory microcirculation in the affected area.

A disturbance in the blood supply will affect the inner ear, especially the extremely sensitive tissue of the cochlea more than the cerebral structure.

A possibility is that the various factors that cause tinnitus run to a disturbance of the Krebs cycle and thus a decline in the cell function.

This process can be reversed as long as the cells have suffered no serious damage. The more affected cells are however, the more they require a significantly higher O_2 pressure than normal for the healing process [19].

Other HBO centers also report good clinical results [20–23]. In nearly all cases a normal therapy had been carried out with no success before applying HBO. Comparisons are only possible up to a certain point as the tinnitus data is subjective and the scale of the sensations felt is varied. However, it seems that during the first 6 months an HBO treatment has a positive and promising effect on tinnitus [24,25].

With experimentally created disturbances in hearing one could measure a lack of oxygen in the perilymph. Additional oxygen significantly accelerated the healing process [26].

It is unfortunately not possible to distinguish with which tinnitus patients lack of O_2 plays an essential part in sustaining tinnitus. As HBO after a thorough preexamination and anamnesis carries little risk, it should be liberally applied when infusion therapy shows no success. Even after 4–6 months successful results were obtained with tinnitus patients, however, for sudden deafness patients there seems to be a time limit of 4–6 weeks. For this reason no time should be wasted in such cases. The experiment of carrying out an oxygen high pressure therapy during the infusion phase did not produce any convincingly better results, not even when the infusion was applied in the hyperbaric chamber during HBO. These test cases were, however, not planned and statistically monitored.

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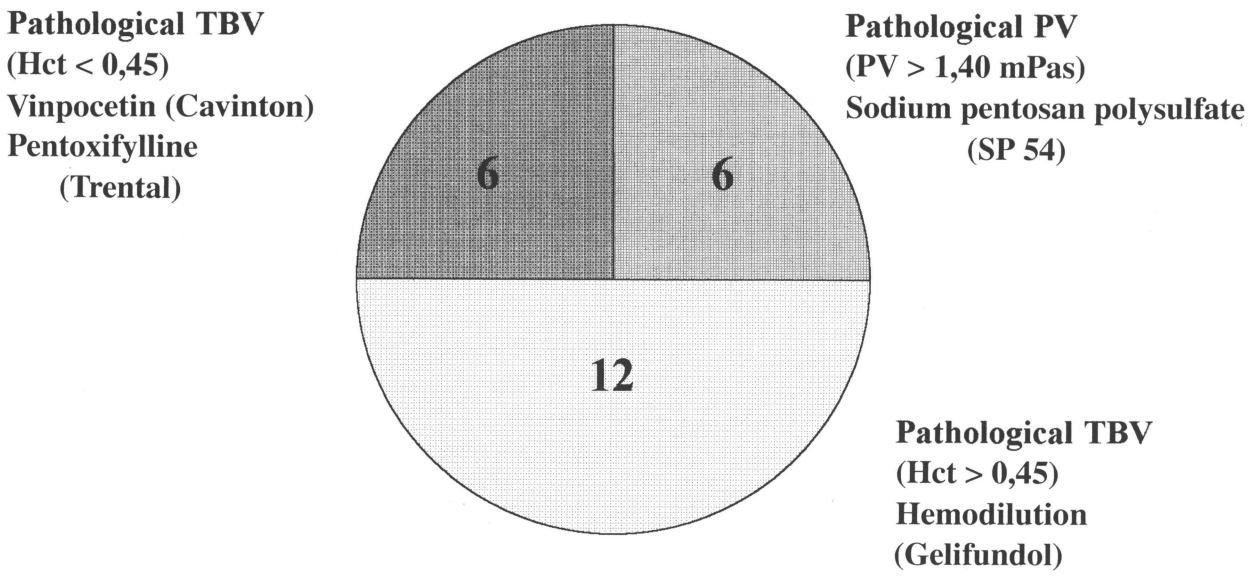

Figure 2. The types of rheological treatments II.

ical directed treatment the rheological values were normalized, vertigo disappeared in 6 cases, improved considerably in 2 patients and was unchanged in 2 cases.

It can be stated that in the tinnitus and the subjective improved hypacusia groups the Ht dependent hyperviscosity appeared significantly more. However, in the vertigo it was exactly the opposite because in this group the microrheological deviations could prevail (e.g.: decrease of erythrocyte filerability, increase of erythrocyte aggregability).

DISCUSSION

The so called "blood circulation improved" infusions were also applied until now in the ENT treatment of

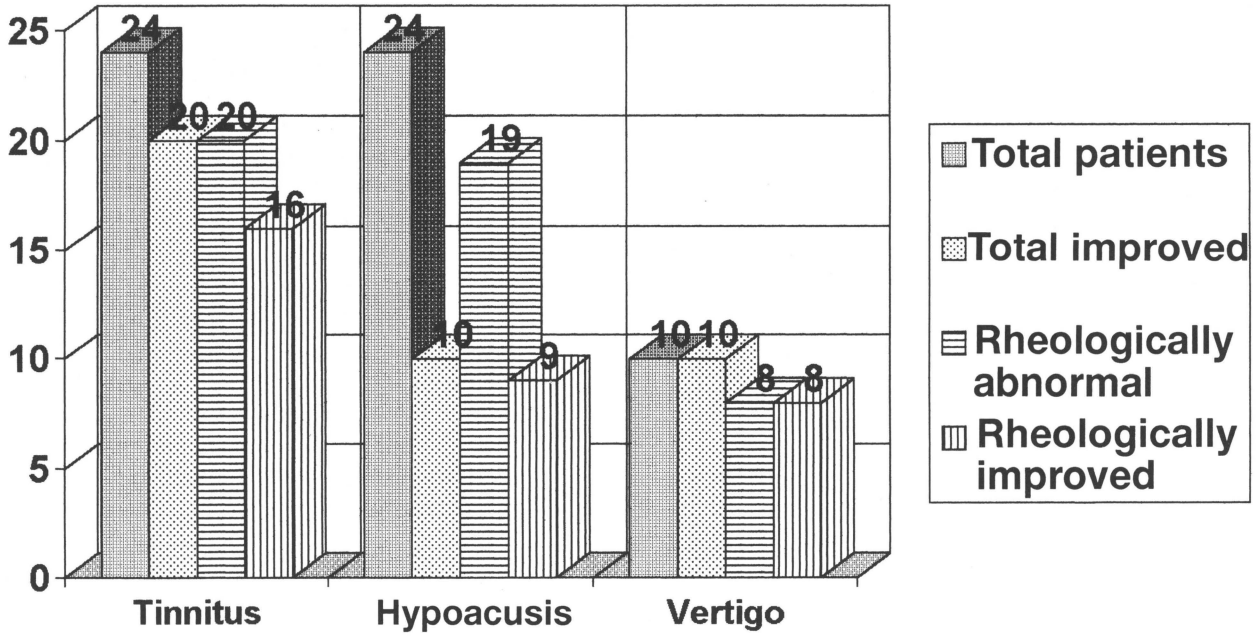

Figure 3. The results of rheological treatments.

tinnitus, vertigo and hypacusia. We are reporting the complex examination of these complaints and the complex, appropriate therapy of the patients. The hemorheological conditions of the patients in the treatment of the characterized circulation-failure and of the above mentioned complaints also have to be taken into consideration. In the examined material the value of Ht. above 0.45 and/or the increased plasma viscosity lurked behind the background of hyperviscosity in the nearly 75% of cases. Applying Pentoxifyllin in crystalloid solution, to increase erythrocyte filterability and/or Vinpocetine to make selective improvement of cerebral circulation with dissolving of angiospasm [7] do not basically influence the macrorheological alteration in case of secondary polycythemia observed by tinnitus, vertigo and hypacusia. In this case IHD is the practicable adequate solution. Infusions with Pentoxifyllin or Vinpocetine are also ineffective in case of increased plasma viscosity, in such case SP 54 treatment is advisable to apply because it repairs the macrorheological parameters by decreasing plasma viscosity. In addition, it moderates the increased bent for thrombosis [8]. There are a lot of causes of tinnitus, vertigo and hypacusia, some of them are in connection with the circulatory anomalies of inner ear [5].

Hemorheology, as an interdisciplinary branch of science, attends to the "blood-vessel unit" and endeavors to improve the circulatory parameters with the increase of blood fluidity.

In our early and limited experience:

1. Pathological rheological parameters were found in 80%.
2. Pathological neck spine findings were in 73%.
3. Rheological values returned to normal in 79% after adequate rheological treatment.
4. Clinical improvement was reached in 69% after complex therapy.

The aim of this conveyance is to direct the physicians' attention to the importance of hemorheological background in patients suffering from tinnitus, hypacusia and vertigo because it has direct therapeutical consequences. In addition to the customary treatment (e.g.: physiotherapy of neck spine, decrease of risk factors) the routine explanation of hemorheological condition and the apply of appropriate treatment are also justified.

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CONCLUSIONS

In cases of tinnitus, vertigo and hypacusia

-complex examination must be done,
-adequate and complex therapy should be applied,
-the patients must be treated, not only the symptoms.

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