RESEARCH ARTICLE

Different treatment protocols for moderate idiopathic sudden sensorineural hearing loss

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ABSTRACT

Treatment of idiopathic sensorineural hearing loss (ISSNHL) is problematic due to the unclear etiology of the illness. Corticosteroid is recommended by some papers, and hyperbaric oxygen (HBO_2) by others. Recently HBO_2 has been shown to be an important therapy for ISSNHL, with an increasing number of studies demonstrating its beneficial results. Recovery from ISSNHL depends on the interval period between onset and treatment, hearing loss severity and audiogram type used to determine damage. Treatment of ISSNHL requires a detailed analysis.

In this retrospective study we reviewed data from 56 patients with moderate ISSNHL. These patients were divided into three groups based on different treatments: corticosteroid group; corticosteroid + HBO_2 (combination)group; and HBO_2-only group. Additionally, all patients received intravenous vasodilator treatment. Hearing levels before and after treatment were compared. All three groups had a similar recovery rate, with an effective rate of more than 50%, and a hearing gain average of 17.38 decibels (dB). HBO_2 treatment got a higher recovery rate. The combination therapy, which included corticosteroid and HBO_2, did not elevate the recovery rate.

INTRODUCTION

Idiopathic sudden sensorineural hearing loss (ISSNHL) is experienced by patients with a hearing decrease of more than 30 decibels (dB) over at least three consecutive frequencies in a period of three days. These sudden hearing changes present a problem often seen in the ENT clinic. Application of corticosteroid, either by systemic intake or intratympanic injection, is recommended for treatment of ISSNHL by some studies and guidelines [1]. Hyperbaric oxygen (HBO_2) therapy, however, is secondary to corticosteroid as a salvage treatment [1-3].

As part of initial treatment, the effect of adjuvant HBO_2 therapy has shown conflicting results in recent studies. When comparing pharmacotherapy only and pharmacotherapy with HBO_2 in the treatment of ISSNHL, some studies showed similar effects [4-7], while others demonstrated favorable effectiveness of HBO_2 and a combination of HBO_2 with corticosteroid, especially for severe to profound hearing loss [8-11].

Given the fact that different hearing loss severities (mild to profound) and audiogram type (low frequency, flat and high frequency) had distinct recoveries, and interval time from onset to treatment greatly influenced the results, treatment of ISSNHL has been problematic. For example, severe and profound hearing loss was sensitive to HBO_2 [8, 9], low frequencies showed better improvement without any treatment [5, 12], and corticosteroids were not effective for ISSNHL at lower frequencies [13].

Until now, the treatment of moderate ISSNHL has not been well analyzed. This retrospective study aims to compare the effectiveness of different treatments, and to demonstrate the effectiveness of HBO_2 when accompanied with a vasodilator.

MATERIALS AND METHODS

Patients

Data for patients treated at our hospitals between January 2010 to June 2018 were reviewed. Only those matching the ISSNHL definition, with unilateral moderate hearing loss (46-75 dB decrease), and less than 14 days' onset were included [14]. Exclusion criteria were as follows:

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- age younger than 18 years;
- history of fluctuant or repeated hearing loss;
- previous ipsilateral or contralateral hearing loss;
- bilateral hearing loss; intracranial neoplasms and presentation with acute neurological symptoms;
- interval time longer than 14 days.

The interval time was defined as the period between disease onset and treatment: If the patient accepted treatment on the same day of onset, the interval time was described as 0 days in this study.

All patients underwent a detailed history and physical examination. Hearing level for each subject was examined with pure tone audiogram (PTA) and acoustic impedance. Blood biochemistry and complete blood count were tested. Temporal computed tomography (CT) and magnetic resonance imaging (MRI) were performed for all patients.

Treatment and hearing evaluation

Patients were divided into three groups according to treatment patterns:

- corticosteroid group;
- corticosteroid + HBO_2 (combination) group; and
- HBO_2-only group.

All patients accepted concurrent intravenous administration of vasodilator with an injection of extract of ginkgo biloba leaves (Dr. Willmar Schwabe GmbH & Co. KG, Germany). Thrombolytics and/or mecobalamin were used in some patients as an additional treatment to the ginkgo. Choice of treatment was based on the patient's condition, contraindication(s), and accessibility of the HBO_2 unit. If the HBO_2 treatment lasted fewer than five days or corticosteroid fewer than three days, the patient was not considered to have accepted this treatment.

The corticosteroid treatment was dexamethasone, administered intravenously: 5-10 mg according to patient weight over seven days. If the patient demonstrated no recovery, tapering with oral prednisone was conducted over the next week. HBO_2 was started within three days of admission and performed as the standard protocol for five to 20 days. The inpatient treatment was generally conducted over a two-week period, and the hearing test was performed every week or whenever a patient indicated a significant recovery. Hearing improvement level was classified as:

- complete recovery (final hearing level ≤25dB);
- partial recovery (>15 dB hearing gain and final hearing level 26-45 dB);
- slight improvement (>15 dB hearing gain and final hearing level 46-75 dB); and
- no improvement (<15 dB hearing gain) according to a modified Siegel's grade [14].

The patients were discharged home after seven to 14 days of treatment. Some patients with partial recovery or no improvement accepted HBO_2 treatment up to 20 days. Follow-up lasted for six months.

Statistical analysis

Hearing levels before and after treatment at decreased frequencies were recorded. Complete recovery, partial recovery and slight recovery were regarded as effective treatment. IBM SPSS Statistics Version 19 (IBM Corp., Armonk, New York, U.S.) was used for the statistical analysis. Demographic data and hearing outcomes were expressed as mean ± standard deviation (SD) or n%. Analysis of variance (ANOVA) was performed for group comparisons. Results were evaluated using a confidence interval of 95%, and a two-sided $p < 0.05$ was considered significant.

RESULTS

Fifty-six patients matched the inclusion criteria. The corticosteroid group included 16 patients, the combination groups comprised 32 patients, and the HBO2 group had only eight patients. The age, gender, interval time and course of treatment showed no significant differences among the three groups (Table 1).

All groups showed significant recovery after treatment. The effective rate was ≥50% (Table 2). The average hearing improvement was 17.38 dB for all patients, while when it came to patients with complete and partial recovery, the number increased to 31.45 dB. The combination group showed better hearing gain (33.88 dB), and the HBO_2 group showed the best recovery rate (62.5%), but there was no significant difference among the three groups ($p>0.05$). Among the three groups no patients showed only a slight recovery. The combination group and corticosteroid group included more patients with a flat-type audiogram (27/32 and 11/16 respectively), while the HBO_2 group had only two in eight patients. These patients achieved a recovery rate of less than 50% (17/40). For the patients with high-frequency decreases, the corticosteroid group included five cases and obtained preferable result with a recovery rate of 80% (4/5), while the other two groups included two and three cases respectively with a lower recovery rate (≤50%). As to the lower-frequency hearing loss, all six patients in the

Table 1: Demography of the ISSNHL patients in three groups

groups	number	age (years)	gender	interval days	treatment days
corticosteroid	16	48.31±16.47	M7 F9	4.31±3.05	9.25±2.65
combination	32	48.06±14.05	M18 F14	4.44±3.78	10.44±3.13
HBO_2	8	51.13±17.10	M4 F4	4.38±2.67	10.13±3.94

Table 2: Treatment results

group	complete recovery	partial recovery	no improvement	effective rate	averaged hearing gain (dB)	effective hearing gain
corticosteroid	5	4	7	56.25%	17.22±15.72	29.65±7.22
combination	8	8	16	50.00%	17.36±19.99	33.88±11.04
HBO_2	2	3	3	62.50%	17.76±13.97	26.91±7.69

combination and HBO_2 groups showed recovery, including complete recovery in two cases and partial recovery in four cases.

DISCUSSION

The current retrospective study showed similar recovery rates in moderate ISSNHL between systemic corticosteroid + vasodilator treatment; corticosteroid + HBO_2 + vasodilator treatment; and HBO_2 + vasodilator treatment. HBO_2 with vasodilator was competent to improve hearing, while HBO_2 with corticosteroid and vasodilator did not promote recovery rate any further.

Most of the literature compared treatment effect without classification of the hearing level severity and audiogram type, which varied significantly and thus affected recovery rate extensively [6, 8, 11, 12]. In addition, results were also influenced by the interval time from disease onset to treatment. It is well known that early treatment often leads to better outcomes, and 10 to 14 days after onset was considered the dividing line [6, 10, 14]. In this paper, only patients with initial ipsilateral ISSNHL and history of fewer than 14 days were admitted. It helps to compare the effect of different treatments, avoiding the influence of delayed treatment and other diseases. In some papers, the HBO_2 or corticosteroid treatments lasted for 10 days or more. A patient with good recovery generally has obvious improvement at about seven days after treatment is begun, so we included patients who underwent treatment longer than five days.

For the uncertain etiology of ISSNHL, various therapies are currently used to improve hearing. In general clinical practice, vasodilator, thrombolytics, vasoactive substances and vitamins also serve as conventional treatments [1, 13, 15], but only corticosteroids and HBO_2 are considered useful. Corticosteroids are accepted by most doctors and guidelines, with an anti-edematous effect as the underlying mechanism. HBO_2 has been used for ISSNHL treatment since the 1960s. It helps to improve tissue hypoxia, and more recently it has been used as the initial treatment for ISSNHL [6-8]. Both treatment methods with coricosteroids or HBO_2 respectively have favorable results, but when used together, there is debate. Toroslu, et al. found addition of HBO_2 to corticosteroid did not improve the average PTA values [6-8]. Eryigit and others showed the overall enhancement of hearing recovery rate in patients treated with PTA and systemic corticosteroids versus those treated with systemic corticosteroids alone [10, 16]. In our study, all patients accepted the vasodilator injection as the basic treatment. Three groups presented a similar recovery rate, and the addition of HBO_2 to corticosteroid showed no special benefit for moderate hearing decreases. The HBO_2 group had a higher recovery rate, and the combination group had the lowest recovery, in line with a previous report [5]. Of course, there is no obvious statistical difference between these groups, but this phenomenon may cause some confusion. We do not know why adding HBO_2 has a lower recovery rate in Kratochvílovà's study [5], while in

this paper there is more flat-type hearing loss in the combination group, which presented lower recovery (42.50% or 17/40) and may influence the final results. Currently our study demonstrates corticosteroid has the same effect as HBO_2 for moderate ISSNHL. The accepted spontaneous recovery rate of ISSNHL is 35%-39% [12]; additional treatment can improve it approximately 10% or more [5-7, 14, 16]. Actually, since we do not know which treatment is helpful, more precise and randomized controlled studies are needed.

The overall efficacy was 53.57% (30/56) in the present study, and the hearing regain was the same as others, from 18.8 dB to 19.3 dB [6,10]. In published articles, treatment with corticosteroid – whether HBO_2 or a combination – showed the recovery rates ranged from 32.5% to 96% [5-7, 14, 16, 17], depending on hearing loss severity or type. For instance, in Cekin's study, the combination of HBO_2 and corticosteroid had the same effect as the corticosteroid only: 71.3% in the control group and 78.95% in the study group. The underlying reason may be that 34 of 36 patients treated within three days of the problem onset [4].

One strange problem emerged in the present study: No patient made a just slight recovery (>15 dB hearing gain and final hearing level 46-75 dB). That means moderate hearing loss has two kinds of results in this study: better hearing or no improvement. But normally, hearing level after treatment should show a slight improvement. We postulate that the patient number was not large enough to contain all types of recovery. Cheng's study showed the same result. Moderate ISSNHL (46-75 dB) had higher recovery with initial concurrent intravenous and intratympanic corticosteroid treatment (96% or 23/24), though the overall rate was only 50.91% (56/110) [14].

CONCLUSION

The current study proved that HBO_2 has the same effect as corticosteroid treatment for moderate ISSNHL within the first 14 days. Combination treatment with HBO_2 and corticosteroid did not achieve a better outcome. Early diagnosis and treatment for ISSNHL was beneficial for recovery regardless of the therapeutic methods. Whether HBO_2 could replace corticosteroid for moderate ISSNHL still needs a larger-sized sample and randomized study.

Conflict of interest statement
The authors have declared that no conflict of interest exists with this submission.

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