Is Corticosteroid Therapy Effective for Sudden-Onset Sensorineural Hearing Loss at Lower Frequencies?

Shin-ichiro Kitajiri, MD; Keisaku Tabuchi, MD; Harukazu Hiraumi, MD; Tomoko Hirose, MD

Objective: To assess the efficacy of corticosteroid therapy for sudden-onset sensorineural hearing loss at lower frequencies.

Design: Retrospective, nonrandomized, controlled study.

Patients and Methods: The recovery rate, recovery/improvement rate, and period between the start of therapy and improvement of symptoms were studied in 2 groups: the control group, consisting of 36 patients treated with adenosine triphosphate disodium, kallidinogenase, and cyanocobalamin between March 1, 2000, and January 31, 2001; and the corticosteroid-treated group, consisting of 42 patients treated with corticosteroids in addition to the previously mentioned drugs between April 1, 1997, and February 29, 2000.

Results: No significant difference (P = .83) was noted in the recovery rate between the control group (81%) and the corticosteroid-treated group (79%), and the recovery/improvement rate was the same for the 2 groups (83%). In addition, there was no significant difference (P = .84) for the mean ± SD period between the start of therapy and improvement of symptoms between the control group (3.9 ± 2.7 days) and the corticosteroid-treated group (3.7 ± 2.1 days).

Conclusion: Corticosteroids were not effective for sudden-onset sensorineural hearing loss at lower frequencies.


Sudden-onset sensorineural hearing loss (SSNHL) at lower frequencies can have clear causes, such as endolymphatic hydrops, but there are many cases with unknown causes. These cases have been categorized as variants of SSNHL.

Treatment of SSNHL, including the low-frequency variant, has not been established because the pathogenesis of this condition has not been clarified.1 Therapeutic methods, especially medication with corticosteroids combined with some vasodilators, diuretics, histamine, plasma expander, carbogen (5% carbon dioxide and 95% oxygen) inhalation, and/or calcium channel blockers, have been attempted.1,2

Sudden-onset sensorineural hearing loss at lower frequencies has recently been classified as an independent disease entity because of its good prognosis.2,3 This study was conducted to examine the effectiveness of corticosteroids, which often cause serious adverse effects, in the therapy of SSNHL at lower frequencies. Therapeutic outcomes were compared between 2 groups of patients (those who did and did not receive corticosteroids).

RESULTS

The recovery rate was 81% (29 of 36 patients) in the control group and 79% (33 of 42 patients) in the corticosteroid-treated group, with no significant differences between the 2 groups (P = .83). The recovery/improvement rate was 83% (30 of 36 patients) in the control group and 83% (35 of 42 patients) in the corticosteroid-treated group, with no significant differences between the 2 groups (P > .99). The mean ± SD period between the start of therapy and improvement of symptoms was 3.9 ± 2.7 days in the control group and 3.7 ± 2.1 days in the corticosteroid-treated group, with no significant differences between the 2 groups (P = .84) (Table 2).

COMMENT

Sudden-onset sensorineural hearing loss at lower frequencies can have clear causes, such as endolymphatic hydrops, but there...
PATIENTS AND METHODS

Between March 1, 2000, and January 31, 2001, 38 patients with SSNHL at lower frequencies were treated on an outpatient basis, after obtaining informed consent, with the following: oral adenosine triphosphate disodium, 300 mg/d; kalidinogense, 150 IU/d; and cyanocobalamin, 1500 µg/d. After excluding 2 patients who did not visit our hospital for follow-up, the remaining 36 were included in the control group. Before March 1, 2000, at Toyooka Hospital, Toyooka City, Hyogo, Japan, patients with SSNHL had been generally hospitalized and treated with corticosteroid therapy (an intravenous infusion of prednisolone sodium succinate at reducing doses of 300 mg/d for 3 days, 200 mg/d for 3 days, and 100 mg/d for 3 days) and the oral administration of the same drugs as given in the control group, irrespective of the type of hearing loss. The corticosteroid-treated group consisted of 42 patients with SSNHL at lower frequencies who were hospitalized and treated with this regimen between April 1, 1997, and February 29, 2000. The recovery rate, the recovery/improvement rate, and the period between the start of therapy and improvement of symptoms were compared between the 2 groups. The statistic we used was χ².

Our diagnostic criteria of SSNHL at lower frequencies are as follows: (1) SSNHL is of unknown origin, (2) pure-tone hearing levels at higher frequencies (1000, 2000, 4000, and 8000 Hz) have no differences greater than 10 dB between the right and left ears, and (3) the sum of pure-tone hearing levels at lower frequencies (125, 250, and 500 Hz) is deteriorated by 30 dB or more on the affected side than on the normal side. A glycerol test and, in some cases, a magnetic resonance imaging scan was performed before starting the treatment, and patients with positive results were eliminated from this study. Following the evaluation criteria of hearing improvement established by the Study Group of Sudden-Onset Hearing Loss, Japanese Ministry of Health and Welfare, we evaluated improvement of hearing loss. Recovery indicates that the hearing levels at the lower 3 frequencies are 20 dB or lower on the affected side, or the difference of the mean hearing level at the lower 3 frequencies between the affected side and opposite side is 5 dB or lower; improvement, the hearing level at the lower 3 frequencies improved by 30 dB or more on average, although the improvement does not fulfill the standard of recovery; and no change, the change in hearing does not fulfill the standard of recovery or improvement.

There were no significant differences between the 2 groups for sex (P = .82), age (P = .98), affected side (P = .75), period between the onset of hearing loss and the first hospital visit (P = .95), or hearing loss compared with the opposite ear (P = .76) (Table 1).

There are many cases with unknown causes. These cases have been categorized as variants of SSNHL. As for the cause of SSNHL, including the low-frequency variant, various factors have been reported, including viral infection, vascular insult, perilymphatic hypoxia, intralabyrinthine membrane rupture, and inflammatory and metabolic causes, but none has been shown to cause all, or even most, cases of SSNHL. And there is not even universal acceptance of a standard definition of SSNHL. Thus, treatment of SSNHL cannot be established until the pathogenesis of this condition is clarified. Only corticosteroid therapy was reported to be effective for SSNHL in a prospective, randomized, placebo-controlled study. However, several studies reported that corticosteroids were ineffective for SSNHL. Therapeutic methods, especially medication with corticosteroids combined with some vasodilators, diuretics, histamine, plasma expander, carbogen inhalation, and/or calcium channel blockers, have been attempted. At Toyooka Hospital, patients with SSNHL, irrespective of the type of hearing loss, had been treated with a combination of corticosteroids, adenosine triphosphate disodium, vasodilators, and cyanocobalamin. It is well-known that corticosteroids have serious adverse effects, including gastric ulcer, infection, diabetes mellitus, shock, thrombosis, and infarction.

Sudden-onset sensorineural hearing loss at lower frequencies has recently been classified as an independent disease entity because of its good prognosis. Although the spontaneous recovery rate is about 65% for all cases, the rate is about 80% for the low-frequency type. This study was conducted to examine the effectiveness of cor-

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corticosteroid-Treated Group (n = 42)</th>
<th>Control Group (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male-female ratio</td>
<td>13:29</td>
<td>12:24</td>
</tr>
<tr>
<td>Age, y</td>
<td>51.9 ± 15.3</td>
<td>51.4 ± 17.9</td>
</tr>
<tr>
<td>Affected side (right-left ratio)</td>
<td>19:23</td>
<td>15:21</td>
</tr>
<tr>
<td>Time between the onset of hearing loss and the first hospital visit, d</td>
<td>5.0 ± 4.2</td>
<td>5.0 ± 3.8</td>
</tr>
<tr>
<td>Sum of hearing loss at the lower 3 frequencies compared with the opposite ear, dB</td>
<td>76.9 ± 21.8</td>
<td>79.0 ± 36.1</td>
</tr>
</tbody>
</table>

*Data are given as mean ± SD unless otherwise indicated.

**Calculated as number of patients who recovered divided by the total number of patients.

†Calculated as number of patients who recovered and improved divided by the total number of patients.

Table 1. Demographic and Hearing Loss Variables in the 2 Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corticosteroid-Treated Group (n = 42)</th>
<th>Control Group (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recovery</td>
<td>33</td>
<td>29</td>
</tr>
<tr>
<td>Improvement</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>No change</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Recovery rate, %†</td>
<td>79</td>
<td>81</td>
</tr>
<tr>
<td>Recovery/improvement rate, %‡</td>
<td>83</td>
<td>83</td>
</tr>
<tr>
<td>Time to improvement, mean ± SD, d</td>
<td>3.7 ± 2.1</td>
<td>3.9 ± 2.7</td>
</tr>
</tbody>
</table>

*Data are given as number of patients unless otherwise indicated.

Table 2. Recovery and Improvement Variables in the 2 Groups


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corticosteroids in the therapy of SSNHL (with a good prognosis) at lower frequencies. Therapeutic outcomes were compared between patients who did and did not receive corticosteroids. As a result, no significant difference was noted in the recovery rate between the control group (no corticosteroids administered) and the corticosteroid-treated group. The difference in the recovery/improvement rate was not significant between the 2 groups. As for the period between the start of therapy and improvement of symptoms, no significant difference was noted between the control group and the corticosteroid-treated group. Therefore, corticosteroids were not effective in the treatment of SSNHL at lower frequencies. A placebo group may be needed to prove the ineffectiveness of corticosteroids, but we considered it difficult to obtain informed consent from patients who would be included in an untreated group.

Although adenosine triphosphate disodium, a vasodilator, and cyanocobalamin were given in the control group, the recovery/improvement rate was 83%, almost the same as the reported spontaneous recovery rate of SSNHL at lower frequencies. Therefore, these drugs might not be effective in the treatment of SSNHL at lower frequencies. To examine this hypothesis, a group of patients who do not receive medication but who do receive placebo should be followed up.

To our knowledge, there are no established diagnostic criteria of SSNHL at lower frequencies. Most studies include patients with sudden-onset hearing loss at lower frequencies and normal hearing at higher frequencies in this category. However, hearing at higher frequencies deteriorates with age. Elderly patients with SSNHL at lower frequencies may have hearing loss at higher frequencies due to age-related deterioration in hearing. When these criteria of normal hearing at higher frequencies are used, such elderly patients might be excluded. We used the following criteria: the bone-conduction hearing level at lower frequencies was deteriorated on the affected side compared with the opposite side and no differences between the right and left ears were noted in hearing at frequencies higher than 1000 Hz.

In conclusion, corticosteroids were not effective in the treatment of SSNHL at lower frequencies. Further studies should be performed to establish a treatment method for this disorder.

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REFERENCES