ABSTRACT

Objective: To evaluate hearing recovery following local application of insulin-like growth factor 1 (IGF1) in patients with sudden sensorineural hearing loss (SSHl) that was refractory to systemic steroids.

Methods: Twenty-five patients with SSHL showing no hearing recovery following systemic steroid treatment were applied gelatin hydrogels, impregnated with IGF1, into the round window niche, and examined alterations in pure-tone audiometry and evoked otoacoustic emissions over time.

Results: In total, 25 patients received the test treatment at a median of 23 days after the onset of SSHL. Before the test treatment, the mean hearing level at the five frequencies tested was 81.2 dB. At 24 weeks after the test treatment, 11.9 dB recovery in the mean hearing level was found. Statistically significant differences were observed compared with baseline at 0.25 kHz (5.8 dB), 1 kHz (11.9 dB), and 2 kHz (6.9 dB). Hearing recovery of more than 10 dB was found in pure-tone audiometry assessed within four weeks after the test treatment and sustained. Forty patients showed the recovery in evoked otoacoustic emissions together with hearing recovery in pure-tone audiometry.

Conclusion: Local IGF1 application via gelatin hydrogels may be efficacious for hearing recovery in patients with SSHL that is resistant to systemic steroids, and induces recovery of outer hair cell function by synergy to previous findings in animal experiments.

INTRODUCTION

IGF1, a polypeptide that plays a crucial role in embryonic development and nervous system homeostasis by influencing, autocrine and paracrine mechanisms. Crucial for development of the inner ear IGF-/- mice show hearing loss (review by Waring-Cunningham et al., 2011). A single intraperitoneal injection of IGF1 rescues auditory hair cells in animal models against noise-induced hearing loss (Lee et al., 2006; Lee et al., 2008) and against ischemia-induced hearing loss (Fujimura et al., 2006). Local IGF1 application via gelatin hydrogels rescues auditory hair cells in animal models.

AIM

To reveal details of alterations in audiometric measurements in patients with refractory SSHL following local IGF1 application via gelatin hydrogels.

METHODS AND MATERIALS

Study design: Retrospective chart review
Setting: Kyoto University Hospital
Subjects: 25 patients enrolled in UMIN-CTR. R000000936
Primary outcome: Alterations in hearing levels of pure-tone audiometry (PTA)
Secondary outcomes:
- Differences in PTA recovery among frequencies tested
- Time-periods of recovery in hearing levels over 12 weeks after treatment
- Alterations in numbers of patients who showed peak in DPOAEs for each IGF1

RESULTS

Alteration in hearing levels in PTA

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Average of 5 kHz tested</th>
<th>0.25 kHz</th>
<th>0.5 kHz</th>
<th>1 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 kHz</td>
<td>64% (95% CI, 28–69%)</td>
<td>516 Hz</td>
<td>36 Hz</td>
<td>70%</td>
</tr>
<tr>
<td>4 kHz</td>
<td>56% (95% CI, 28–69%)</td>
<td>886 Hz</td>
<td>70%</td>
<td>70%</td>
</tr>
<tr>
<td>8 kHz</td>
<td>51% (95% CI, 28–69%)</td>
<td>1044 Hz</td>
<td>70%</td>
<td>70%</td>
</tr>
</tbody>
</table>

The majority showed hearing recovery of 10 dB in 4 kHz after treatment, but showed hearing recovery later than 12 W. Local IGF1 application via gelatin hydrogels rescues auditory hair cells in animal models. Differences in hearing recovery among frequencies

Local IGF1 application by gelatin hydrogels significantly improved hearing levels at each frequency tested in PTA in refractory SSHL. There is a trend that better hearing recovery occurred in low frequencies. Hearing recovery appeared at 4 kHz after treatment in most cases, but few showed hearing recovery later than 12 W. The recovery in DPOAEs was found only in a low frequency.

CONCLUSION

Local IGF1 application using gelatin hydrogels may be efficacious for hearing recovery in patients with refractory SSHL.