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# INTRATYMPANIC DEXAMETHASONE FOR TINNITUS IN SUDDEN SENSORINEURAL HEARING LOSS AFTER FAILURE OF SYSTEMIC THERAPY: A RETROSPECTIVE STUDY

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**ABSTRACT** The purpose of the study is to test the effectiveness of intratympanic dexamethasone injections treatment for severe tinnitus in idiopathic sudden sensoneural hearing loss(SNHL).We studied 37 patients who received intratympanic dexamethasone injection and 14 control patients who did not receive it with severe tinnitus after onset of sudden sensoneural hearing loss. The relationship between the duration of tinnitus and the effectiveness of treatment was investigated in SNHL. We used a visual analogue scale to evaluate 51 patients with tinnitus.41% patients showed significant improvement after treatment. The average period between onset of sudden SNHL and initiation of intratympanic injection of dexamethasone was significantly shorter (207 days) in the improved group compared to the unchanged group(375 days).

**KEYWORDS :** Intratympanic injection, Dexamethasone, tinnitus, Sudden sensoneural hearing loss,

## INTRODUCTION

Systemic steroids are known to improve hearing limits in sudden sensoneural hearing loss and many other inner ear diseases. Higher steroid concentrations can be achieved in inner ear and systemic side effects can be avoided. Although the previous studies treated a range of otologic diseases with intratympanic dexamethasone, in this study we evaluated single disease i.e tinnitus after sudden SNHL.

## Materials & Methods

Subjects: One ear of each of 37 patients were treated with intratympanic dexamethasone injection. All patients had severe tinnitus after onset of sudden SNHL. The hearing levels of all patients were stable during the study. The average hearing level was expressed as an average score of three frequencies (500, 1000, 2000 Hz). If the patient did not respond to maximum level of sound generated by audiometer, 5dB was added to the maximal level. The outcome of sudden SNHL was evaluated using the criteria of Minister of Labour and Welfare. The average hearing level on this criteria was calculated as the mean of hearing levels measured at 500, 1000, 2000 Hz. Recovery was ranked as follows.

1. No change (improvement in hearing of less than 20 dB)
2. Slight improvement (of more than 10dB less than 30dB)
3. Remarkable improvement ( of more than 30dB)
4. Complete recovery (all frequencies on the final audiogram are same as contralateral ear).

In our study all patients have no change or slight improvement with regard to hearing improvement after the onset of SNHL. As control, 14 patients had severe tinnitus at the stage of stable hearing level. They did not receive intra tympanic dexamethasone.

**Table 1 gives the comparison of study and control groups**

| | | Study | Control | P |
|---|---|---|---|---|
| Age | | 54.9 | 54.3 | 0.89 |
| Sex | Male | 16 | 6 | |
| | Female | 21 | 8 | 0.32 |
| Hearing level (dB) | | 64.2 | 71.1 | 0.42 |
| Improvement of VAS | | 1.54 | 0.57 | 0.068 |

**Table 2 gives the age, sex, side of the affected ear, VAS score and the time between the onset of SNHL and the first intratympanic dexamethasone injection for 37 patients.**

| | | | | VAS score | | | | |
|---|---|---|---|---|---|---|---|---|
| Patient No. | Sex | Age | Side of symptom | Pretreatment | Posttreatment | | Period to injection (day) | Hearing level (dB) |
| 1 | F | 67 | R | 6 | 4 | * | 44 | 68 |
| 2 | F | 77 | L | 7 | 2 | * | 1403 | 53 |
| 3 | F | 73 | L | 8 | 5 | * | 147 | 57 |
| 4 | M | 36 | R | 8 | 6 | * | 71 | 70 |
| 5 | F | 61 | R | 10 | 10 | | 449 | 75 |
| 6 | M | 46 | R | 8 | 8 | | 456 | 98 |
| 7 | M | 18 | L | 5 | 5 | | 46 | 67 |
| 8 | M | 28 | R | 7 | 7 | | 49 | 68 |
| 9 | F | 62 | R | 5 | 5 | | 870 | 113 |
| 10 | M | 47 | R | 8 | 5 | * | 28 | 22 |
| 11 | M | 58 | L | 3 | 1 | * | 21 | 113 |
| 12 | F | 58 | L | 6 | 6 | | 83 | 35 |
| 13 | F | 69 | L | 8 | 8 | | 2490 | 43 |
| 14 | F | 62 | L | 5 | 5 | | 435 | 58 |
| 15 | M | 52 | R | 6 | 5 | | 23 | 55 |
| 16 | F | 74 | R | 6 | 5 | | 243 | 100 |
| 17 | F | 70 | L | 4 | 4 | | 973 | 58 |
| 18 | M | 64 | R | 6 | 5 | | 1948 | 107 |
| 19 | M | 76 | L | 9 | 2 | * | 153 | 25 |
| 20 | F | 51 | R | 5 | 5 | | 424 | 70 |
| 21 | F | 41 | R | 4 | 1 | * | 39 | 50 |
| 22 | F | 56 | L | 6 | 6 | | 1473 | 19 |
| 23 | M | 53 | L | 9 | 3 | * | 34 | 45 |
| 24 | M | 68 | R | 6 | 3 | * | 23 | 113 |
| 25 | M | 63 | R | 7 | 4 | * | 600 | 80 |
| 26 | M | 28 | R | 3 | 2 | | 33 | 82 |
| 27 | F | 84 | L | 8 | 4 | * | 171 | 90 |
| 28 | M | 19 | L | 5 | 5 | | 47 | 32 |
| 29 | F | 44 | L | 7 | 3 | * | 45 | 37 |
| 30 | F | 67 | L | 8 | 8 | | 59 | 42 |
| 31 | F | 69 | R | 7 | 7 | | 67 | 60 |
| 32 | F | 53 | L | 6 | 6 | | 112 | 8 |
| 33 | M | 37 | R | 7 | 7 | | 49 | 112 |
| 34 | F | 44 | R | 8 | 6 | * | 275 | 45 |
| 35 | F | 56 | L | 4 | 3 | | 257 | 15 |
| 36 | F | 46 | L | 7 | 4 | * | 46 | 77 |
| 37 | M | 56 | R | 5 | 5 | | 22 | 113 |

Patient characteristics of the study group

Tinnitus severity before treatment as measured by VAS score ranged between 3 and 10 with an average of 6.4. It scored between 5 and 7 for 57 patients, above 7 for 30% of patients in the study group. 15 of the 37 patients showed signifiv=cant improvement with treatment. There was no correlation between the age of the patient and the impact of treatment. 7 out of 15 patients who had good response acquired satisfaction after 1 month. 5 patients were relieved of severe tinnitus after 1 year.

## Patient characteristics of control group.

Table 3 showed patient characteristics of the control group. Tinnitus severity before treatment as measured by the VAS score ranged between 3 and 7 with an average of 4.1. It scored between 5 and 7 for 35.7% of patients in the control group. The average hearing level was

64.1 dB in treatment group and 71.1 dB in control group. No significant difference was observed between the two groups. No significant difference was observed between the two groups concerning the affected side of the ear: 19 on the right side and 18 on the left side in the study group and 7 on the right side and 18 on the left side in the control group.

**Table 3**

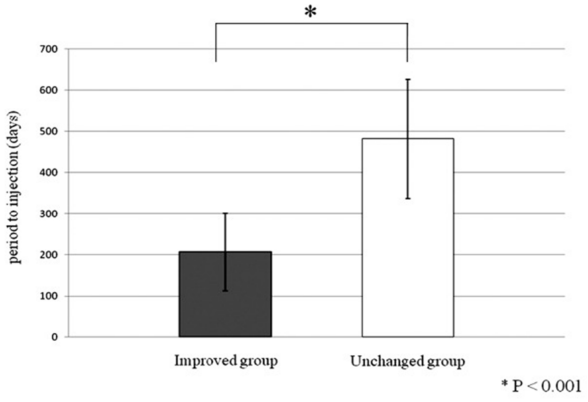
**Patient characteristics of control group.**

| Patient No. | Sex | Age | VAS score Side of symptom | Pre | Post | Hearing level (dB) |
|---|---|---|---|---|---|---|
| 1 | M | 72 | L | 4 | 2* | 81 |
| 2 | M | 70 | L | 3 | 2 | 39 |
| 3 | M | 57 | R | 5 | 5 | 56 |
| 4 | F | 54 | L | 4 | 3 | 63 |
| 5 | F | 55 | R | 5 | 5 | 78 |
| 6 | F | 59 | L | 5 | 5 | 70 |
| 7 | M | 43 | L | 3 | 3 | 111 |
| 8 | F | 43 | R | 6 | 6 | 88 |
| 9 | F | 35 | L | 4 | 3 | 84 |
| 10 | M | 43 | R | 4 | 3 | 73 |

From the tinnitus questionnaire, we have 4 cases with high-pitch tinnitus and 1 case with low pitch in control group. On the other hand, there were 16 with high-pitch tinnitus and 3 with low pitch in study group. The others were unclassified type of tinnitus. There was no relationship between improvement of VAS and tinnitus pitch.

## COMPARISON OF THE TWO GROUPS WITH TREATMENT

The $\chi^2$ test showed a significant difference between the improved group and the unchanged group with respect to the duration of tinnitus before intratympanic treatment ($P$<0.001) but no significant difference with respect to age, sex or the side of the affected ear.




Furthermore, there were no significant differences between the groups in hearing level (all frequencies), configuration of audiogram, or tone and variety of tinnitus. No patient had vertigo following the intratympanic injection. No changes in hearing level were noted in either group after treatment.

## DISCUSSION

This is the first report to evaluate the effectiveness of intratympanic steroid injection in severe tinnitus of sudden idiopathic SNHL patients. Our results showed that the shorter the period from onset of sudden deafness to the start of intratympanic treatment of dexamethasone, the greater the improvement in tinnitus that could be expected after treatment. Forty-one per cent of patients had significant (at least two graduations on VAS) improvement of their symptoms. Only one patient presented significant improvement spontaneously in control group. However, we recognize weakness of this study because control cases did not include intratympanic saline injection group.

A previous study by Sakata *et al.* reported good overall results in 77% of patients with various diseases immediately after the intratympanic dexamethasone treatment, and Shulman and Goldstein showed that five of 10 patients who received intratympanic treatmant experienced tinnitus control for at least one year after treatment. In contrast, Araújo *et al.* showed in a randomized, prospective and single blind study that 33% of patients in the dexamethasone group and 29% in the saline group had significant improvements of their symptoms. However, these previous studies included patients with tinnitus from several different causes, while our study focused on sudden SNHL. In addition, we showed a relationship between the duration of tinnitus and the effectiveness of treatment in sudden SNHL. It is possible that in the early phase of sudden SNHL, even in those patients with a stable hearing level, disorder or inflammation of the inner ear has not yet settled down. In a study using three-dimensional fluid-attenuated inversion recovery magnetic resonance imaging, a high pre-contrast signal in the affected inner ear did not disappear until 90–150 days after the onset of sudden SNHL, although the hearing level was stable within two months. High pre-contrast signals may reflect minor haemorrhage or an increased concentration of protein in the inner ear.

Our study revealed that intratympanic dexamethasone injection might be an effective treatment for tinnitus associated with sudden SNHL. Inflammation is associated with increased permeability of blood vessels. Contrast enhancement of the inner ear after intravenous gadolinium injection, which is recognized in one-third of cases with sudden SNHL, indicates increased permeability of blood vessels in the inner ear. Anti-inflammatory function of dexamethasone may be effective when there is increased permeability of blood vessels in the inner ear. In such cases, we considered a possibility of electrolyte altering and increasing cochlear blood flow effects of the corticosteroid.

## CONCLUSION

There appears to be an advantage for intratympanic dexamethasone injection in the treatment of severe tinnitus in the early phase of sudden SNHL at the stage of stable hearing levels. However long-time effect of intratympanic steroids is unclear, our preliminary study revealed that intratympanic steroid treatment might be a good treatment option for severe tinnitus in idiopathic sudden SNHL in short term. Further placebo-controlled studies are needed in order to verify the effectiveness of transtympanic dexamethasone injections for the treatment of patients with tinnitus and sudden SNHL.

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