

## Fate of Sudden Deafness Occurring in the Only Hearing Ear: Outcomes and Timing to Consider Cochlear Implantation

The present study was undertaken to learn the outcome of patients with idiopathic sudden sensorineural hearing loss (ISSNHL) in their only hearing ear. Timing to conduct a cochlear implantation was also determined in those who did not recover the hearing. The study group comprised 25 patients who confronted ISSNHL in their only hearing ear. A total of 192 patients, who had ISSNHL in one ear and had normal contralateral ear, served as the control. Demographically there were no significant differences between the groups. The recovery rate was similar between the groups: 64.0% in the experimental and 62.5% in the control group. The duration until the recovery of ISSNHL in the only hearing ear was 5-90 days (average 17.6 days). In the experimental group, 8 patients did not recover from ISSNHL, and underwent cochlear implantation in 6 with satisfactory results. These results suggest that the same treatment is applicable for patients with ISSNHL regardless of whether their contralateral ear is deaf or normal. For those who do not recover from ISSNHL in their only hearing ear, culminating in bilateral deafness, we may consider further definitive treatment including cochlear implantation as early as 3 months after initiating the treatment of ISSNHL.

**Key Words :** *Hearing Loss, Sudden; Cochlear Implantation; Treatment Outcome*

© 2010 The Korean Academy of Medical Sciences.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

**Seung Su Lee, Hyong Ho Cho,  
Chul Ho Jang, and Yong Bum Cho**

Department of Otolaryngology and Head and Neck Surgery, Chonnam National University Medical School, Gwangju, Korea

Received : 28 January 2009

Accepted : 23 April 2009

### Address for Correspondence

Hyong Ho Cho, M.D.

Department of Otolaryngology and Head and Neck Surgery, Chonnam National University Medical School, 671 Jebong-ro, Dong-gu, Gwangju 501-757, Korea  
Tel : +82.62-220-6772, Fax : +82.62-228-7743  
E-mail : victocho@hanmail.net

## INTRODUCTION

Idiopathic Sudden sensorineural hearing loss (ISSNHL) is one of the emergent conditions among various otologic diseases. It is the acute onset of hearing loss of 30 dB in three contiguous frequencies, which may occur instantaneously or progressively over several days (1). It occurs mostly unilaterally, with a bilateral occurrence in 1-7.1% (2).

Treatment strategy is variable, while steroids, vasodilators, and anti-viral agents are most frequently prescribed. The patient with ISSNHL in their only hearing ear requires special consideration. Stahl and Cohen (3) recently determined the outcome in patients with ISSNHL in their only hearing ear, and concluded that they may be treated the same way as those with normal contralateral ear. However, treatment regimens other than conventional ones may have to be considered in those who do not recover. Therefore, we aimed to determine the outcome of this specific patient group and to define the timing to consider other treatment regimen such as cochlear implantation.

## MATERIALS AND METHODS

### Patients

Medical records of ISSNHL patients who were admitted to Chonnam National University Hospital, Gwangju, Korea, from August 1999 to June 2006 were retrospectively analyzed. The study was approved by Hospital Ethics Committee prior to commencement. The study group comprised 25 patients who confronted ISSNHL in their only hearing ear. The control group consisted of 192 patients having ISSNHL in one ear and normal contralateral ear. They were given prednisolone (Solu-dacortin®, Hanall, Seoul, Korea) starting from 1-1.5 mg/kg/day and tapered for next 12 days. MgSO<sub>4</sub> (4 g/day), dextran 40-dex® (10 mL/kg in 5% dextrose) and carbogen inhalation were also given for 7 days with prednisolone. Complete blood cell counting, routine serum chemistry, immunologic markers, viral markers, temporal magnetic resonance imaging or computed tomography were taken.

Patients were encouraged to be relaxed physically and psychologically. Antacids or sedatives were given as needed. If the patient did not recover until the day of discharge, he/she

was then given intratympanic steroid injection once a week for 3 weeks. The intratympanic injection was started with local anesthesia by placing cotton pledget soaked with Xylocaine® (10% lidocaine, 10 mg/dose; Astrazeneca, TX, USA) at the tympanic membrane. After 15 min, the cotton pledget was removed, and 0.3-0.4 mL dexamethasone (5 mg/mL) solution was injected by puncturing the anterosuperior aspect of tympanic membrane with 25-gauge spinal needle.

### Study parameters

Patients' age, sex, underlying diseases, the degree of hearing loss, and the presence of dizziness or tinnitus were reviewed. The duration from the attack of ISSNHL to the first hospital visit, recovery rate, duration until the recovery, and follow-up period after discharge were compared between the groups.

The degree of hearing loss was defined as mild (26-40 dB), moderate (41-55 dB), moderate-severe (56-70 dB), severe (71-90 dB), and profound (91 dB or worse) using the mean level of 3 frequencies (500, 1,000, 2,000 Hz). The patients were divided into two groups according to the degree of hearing loss: one group included mild, moderate and moderate-severe losses, and the other severe and profound losses. The recovery rate was determined by Siegel's criteria (2): complete,

**Table 1.** Demographics and clinical characteristics of idiopathic sudden sensorineural hearing loss patients

Parameters	Only hearing ear group (n=25), (%)	Normal opposite hearing group (n=192), (%)
Sex (M:F)	14:11 (56:44)	95:97 (49:51)
Age (yr)	47.8 ± 15.8 (9-64)	51.0 ± 15.3 (9-83)
Underlying diseases		
Diabetes mellitus	1 (4)	60 (32)
Hypertension	2 (8)	86 (45)
Associated symptoms		
Vertigo	4 (16)	49 (25)
Tinnitus	17 (68)	165 (86)
Degree of hearing impairment		
≤ Moderate-severe	8 (32)	79 (41)
≥ Severe	17 (68)	113 (59)

**Table 2.** Treatment related duration and outcomes

	Only hearing ear group (n=25)			Normal opposite hearing group (n=192)			P value*
	≤ Moderate-severe	≥ Severe	Total	≤ Moderate-severe	≥ Severe	Total	
First visit from attack (days)	5.1	3.9	4.2	7.3	4.5	5.7	NS
Duration of follow up (days)	269.4	329.8	313.7	62.7	89.7	78.6	<0.05
Recovery rate (%)	87.5 (7/8)	52.9 (9/17)	64.0 (16/25)	69.6 (55/79)	58.0 (65/113)	62.5 (120/192)	NS
Duration for the recovery (days)	14.1 (11-17)	20.2 (5-90)	17.6 (5-90)	9.6 (1-116)	12.0 (2-69)	11.0 (2-116)	NS

\*P value is comparison between the total of only hearing ear group and normal opposite hearing group. NS, non significant.

partial, and slight recovery, and no improvement. In those who could not recover and finally received cochlear implantation, the ability of sound perception and the time elapsed to recover the communication were also determined. The ability of sound perception was examined using Category Auditory Performances (CAP) scores (4) : 0, No awareness of environmental sounds; 1, Awareness of environmental sounds; 2, Response to speech sounds; 3, Identification of environmental sounds; 4, Discrimination speech sounds; 5, Understand common phrases, no lip-reading; 6, Understand conversation, no lip-reading; 7, Use of telephone with known speaker.

### Statistical analysis

Statistical analysis was performed using SPSS 12.0 (Chicago, IL, USA). The statistics included chi-squared test for the analysis of demographic parameters, and independent sample t-test for the duration or recovery rates. The criterion for statistical significance was set at  $P < 0.05$ .

## RESULTS

Patients' age was  $47.8 \pm 15.8$  yr in the study group, and  $51.0 \pm 15.3$  yr in the control. Underlying diseases included mostly diabetes mellitus and hypertension, and associated symptoms were dizziness and tinnitus; with no significant differences between the groups. There were no significant differences of the initial degree of hearing loss between the groups (Table 1). Among the 25 patients in the study group, 14 patients (56%) did not recover the hearing at the time of discharge, 4 of which (29%) received the intratympanic injection of steroids. In the control, 59% did not recover the hearing at the time of discharge, 24% of which received the intratympanic injection. The underlying entities of deafness on contralateral ear in the study group were ISSNHL in 4, chronic otitis media in 7, enlarged vestibular aqueduct syndrome in 2, acoustic schwannoma in 1, acoustic trauma in 1, temporal bone fracture in 1, and unknown in 8.

Table 2 shows the time elapsed from the attack of ISSNHL to the hospital visit. In the study group, it was 5.1 days in

those showing less than moderate-severe degree, and 3.0 days in those showing severe or profound degree. In the control group, it was 7.3 days in those showing less than moderate-severe degree, and 4.5 days in those showing severe or profound degree ( $P>0.05$ ).

The total follow-up period was longer in the study group than in the control. In the study group, it was 269.4 days in those having smaller than moderate-severe degree and 329.8 days in those having severe or profound degree. In the control group, it was 62.7 days in those having less than moderate-severe degree and 89.7 days in those having severe or profound degree.

The recovery rate was quite similar between the groups: 64.0% in the study group and 62.5% in the control group ( $P>0.05$ ). In the study group, according to Siegel's criteria, 3 were completely recovered (12%), 6 partially recovered (24%), 7 slightly recovered (28%), and 9 were not (36%). In the control group, there were 43 showing complete recovery (22%), 36 showing partial recovery (19%), 41 showing slight recovery (21%), and 72 showing no recovery (38%). The recovery rate of those who had ISSNHL worse than severe degree was 52.9% in the study group and 58.0% in the control group, being not significantly different between the groups. When

the initial hearing loss was severer, the recovery rate was lower. The time duration until recovery was 17.6 days in the study group and 11.0 days in the control group, the difference being not statistically significant ( $P>0.05$ ). In both groups, recovery patterns were similar and the recovery was achieved mostly within 1-2 weeks after the initiation of the treatment (Fig. 1). All the recovery was achieved before 12 weeks (3 months), with only one patient recovering after that time (116 days).

Among 8 of those who did not recover in the study group and ended with total deafness in both ears, 6 patients underwent cochlear implantation. Most of the patients reached CAP score 5 within 2-3 months and could communicate without visual help (Table 3). And about in an year they could talk on the telephone with a familial speaker (CAP score 7). Note that the duration to reach CAP score 7 were longest in patients who received their cochlear implantation latest after sudden deaf attack (patient #1 & #2 in Table 3).

## DISCUSSION

ISSNHL occurring in the only hearing ear is a quite important issue because it can cause a sudden blockade of entire

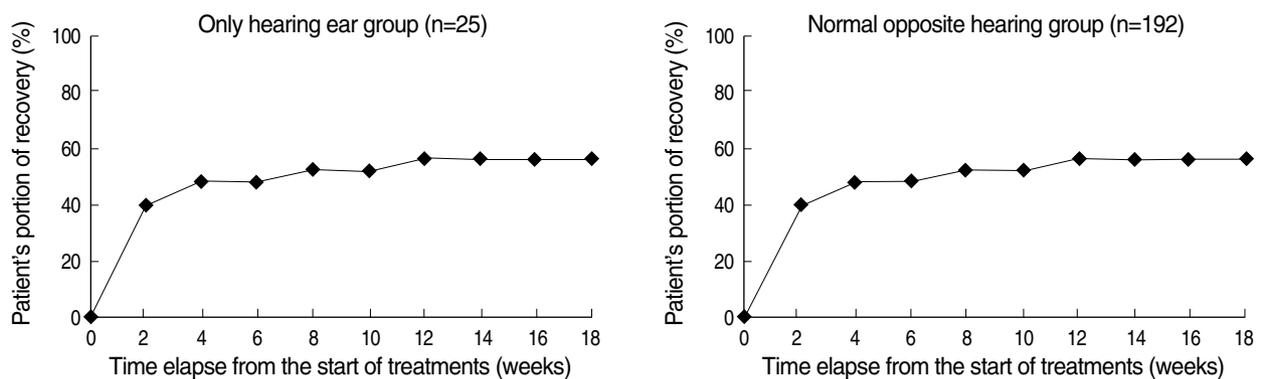


Fig. 1. Graph showing the recovery from idiopathic sudden sensorineural hearing loss (ISSNHL) over time. The recovery patterns were similar between two groups and the largest portion of the recovery was gained within 2 weeks. After 12 weeks, the recovery curve shows a plateau.

Table 3. Demographics and results of patients who underwent cochlear implantation

Patient number	Age (yr)/sex	Site	Original deaf ear		Recent sudden deaf ear		Site of CI	Duration from ISSNHL to CI (months)	Duration for reaching CAP 5 after CI (months)	Duration for reaching CAP 7 after CI (months)
			Etiology	Duration (yr)	Degree of hearing loss	First visit from attack (days)				
# 1	32/M	L	TB Fx	4	Profound	4	R	36	5	35
# 2	56/M	R	Unknown	20	Profound	3	L	24	2	36
# 3	52/F	L	ISSNHL	4	Severe	12	L	12	3	12
# 4	61/M	L	Unknown	15	Severe	5	R	6	3	13
# 5	23/F	R	ISSNHL	8	Profound	2	L	5	2	14
# 6	56/M	L	COM	20	Profound	5	R	3	2	9

L, left; R, right; TB Fx, temporal bone fracture; COM, chronic otitis media; CAP, category of auditory performance; CI, cochlear implantation; ISSNHL, idiopathic sudden sensorineural hearing loss.

verbal communication. However, very few studies have documented its outcomes. The prognostic factors include age, treatment fastness, degree of hearing loss, and presence of dizziness (5). Although it was not the main aim of our study, we also observed that the degree of hearing loss was an important factor of the recovery.

The hearing recovery following the treatment was similar between these two groups: 64.0% of recovery in the study group and 62.5% in the control group. We could see that conventional treatment strategy also worked with ISSNHL patients on their only hearing ear since demographic properties, recovery rate and recovery pattern (Fig. 1) were similar between these two groups. It is suggested that patients with ISSNHL in their only hearing ear may be treated the same way as ISSNHL patients with normal opposite hearing ear.

The follow-up duration in the study group was far longer than in the control group. It is likely that the patients with the only hearing ear would more eagerly seek a professional consult. They may be more nervous and worried about their outcomes, even in those who have mild or moderate degree hearing loss.

The recovery was achieved mostly within 1-2 weeks after the start of treatments. The longest duration caused for recovery was 90 days in the study group and 116 days in the control group. Most of the patients in both groups achieved recovery within 3 months and the recovery curve showed a plateau after that time (Fig. 1).

Among 8 patients who did not show hearing recovery in the study group, 6 patients underwent cochlear implantation. One of the postoperative performance prognostic factors of cochlear implantation is the duration of deafness (6). Although there may be some environmental or genetic differences, the time needed for the patient to communicate verbally without visual help was longest in patients who got their implantation after 2-3 yr from ISSNHL attack (Table 3). The over-

all outcome of cochlear implantation was satisfactory. Most of the patients could communicate without visual help within 2-3 months (CAP score 5). And finally they could hear and talk on the telephone with an known speaker about in an year. Similar as in previous reports, we could see that the duration of deaf is an important prognostic factor in cochlear implantation of sudden deafened only hearing ear patients.

For those who do not attain a hearing recovery from ISSNHL in the only hearing ear, it may not be proper just to wait and hope for a recovery. Because for more the duration of deafness occurs, the poorer result of cochlear implantation might happen. An active treatment such as cochlear implantation may be considered as early as 3 months in order to return the patient to daily verbal communication.

## REFERENCES

1. Zadeh MH, Storper IS, Spitzer JB. *Diagnosis and treatment of sudden-onset sensorineural hearing loss: a study of 51 patients. Otolaryngol Head Neck Surg* 2003; 128: 92-8.
2. Siegel LG. *The treatment of idiopathic sudden sensorineural hearing loss. Otolaryn Clin North Am* 1975; 8: 467-73.
3. Stahl N, Cohen D. *Idiopathic sudden sensorineural hearing loss in the only hearing ear: patient characteristics and hearing outcome. Arch Otolaryngol Head Neck Surg* 2006; 132: 193-5.
4. Archbold S, Lutman ME, Marshall DH. *Categories of auditory performance. Ann Otol Rhinol Laryngol Suppl* 1995; 166: 312-4.
5. Wilson WR, Byl FM, Laird N. *The efficacy of steroids in the treatment of idiopathic sudden hearing loss. A double-blind clinical study. Arch Otolaryngol* 1980; 106: 772-6.
6. Leung J, Wang NY, Yeagle JD, Chinnici J, Bowditch S, Francis HW, Niparko JK. *Predictive models for cochlear implantation in elderly candidates. Arch Otolaryngol Head Neck Surg* 2005; 131: 1049-54.