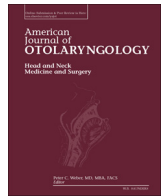




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## The role of explorative tympanotomy in patients with sudden sensorineural hearing loss with and without perilymphatic fistula

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## ABSTRACT

**Purpose:** The purpose of this study was to describe the role of explorative tympanotomy in patients with Profound Sudden Sensorineural Hearing Loss (SSNHL) without clinical evidence of perilymphatic or labyrinthine fistula and to compare intraoperative findings with the postoperative hearing outcome.

**Study design:** Retrospective study of all patients diagnosed with SSNHL who underwent explorative tympanotomy between 2002 and 2005.

**Settings:** Tertiary care university-affiliated hospital.

**Subjects and methods:** Eighty-two patients were diagnosed with unilateral profound SSNHL and underwent tympanotomy with sealing of the round and oval windows. Values of pure tone audiograms and percentage hearing loss of patients with and without intraoperative diagnosed perilymphatic fistula (PLF) were compared and analyzed.

**Results:** PLF was diagnosed in 28% cases intraoperatively. In most cases, hearing improved significantly after surgery. Interestingly, patients with PLF had a 2.4 times greater decrease of percentage hearing loss compared to patients without PLF.

**Conclusions:** Explorative tympanotomy seems to be useful in patients with profound SSNHL. Patients with PLF benefit more from the surgical procedure and have better outcome than patients without PLF.

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## 1. Introduction

Sudden Sensorineural Hearing Loss (SSNHL) is defined as a unilateral decrease in pure tone audiogram of >30 dB in at least 3 continuous

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frequencies over 3 days or less [1]. The estimated incidence varies from around 5–20 up to 160 per 100,000 people per year [2,3].

There are many different treatment regimens. Widely accepted are steroids as systemic or intratympanic application, local anesthetics, plasma expanders, vasodilators, or hyperbaric oxygen therapy, among many more infrequent agents [4–8].

The causes of SSNHL are speculative and may be multifactorial. Latent viral infection, tumors, vascular impairment, or autoimmune genesis are described, in addition to many other possible origins [9–12]. Ruptures of the round or oval window membranes are also described as a possible cause of sudden hearing loss. Causes can be malformation (middle ear: abnormal stapes superstructure and/or footplate, round window, or promontorium; inner ear: Large Vestibular Aqueduct or Mondini malformation, for example), iatrogenic procedures, pressure alterations or trauma, but spontaneous ruptures are possible without additional reasons. Loss of perilymphatic fluid can cause hearing loss, vertigo, or tinnitus, each on its own or combined [13,14].

The role of explorative tympanotomy has been discussed as a possible surgical therapeutic option for decades [15,16]. This led to explorative tympanotomy, primarily after barotrauma, but no consensus exists as to whether tympanotomy and sealing of the round window should be routinely performed in cases of acute unilateral profound SSNHL. Recently this procedure has also been applied in patients without clinical evidence of perilymphatic fistula [17,18].

In our department, patients with severe to profound hearing loss that does not respond to conservative intravenous steroid treatment within three days are advised to undergo tympanotomy with sealing of the round and oval windows. Tympanotomy is performed even if there is no anamnestic hint of a trigger [19].

The aim of our study is to analyze the role of tympanotomy in patients with and without clinical evidence of perilymphatic fistula and to compare the outcome in terms of the hearing and intraoperative findings.

## 2. Patients and methods

Files of all patients with confirmed severe to profound SSNHL, who were admitted to the Department of Otolaryngology–Head & Neck Surgery between 2002 and 2005, were reviewed. Severe to profound SSNHL was defined as a hearing impairment of >70 dB in three contiguous frequencies; data regarding patient characteristics were also collected.

All patients underwent a temporal bone high-resolution computed tomography; in all cases there was no radiological evidence of PLF or other pathology explaining the hearing loss; patients with retrocochlear lesion were excluded.

All patients were treated with intravenous steroid (500 mg SDH) for three days, a Pure Tone Audiogram was performed at the third day; patients without improvement of hearing underwent an explorative tympanotomy.

### 2.1. Surgical technique

All patients underwent a tympanotomy via enaural approach under general anesthesia; the round window niche was removed and the round window and the oval window were visualized. Patients were ventilated with positive end-expiratory pressure to provoke perilymphatic efflux in case of a fistula. Furthermore, the ossicle chain was moved, whereupon the round window was inspected to see indirectly whether the cochlea was filled with fluid. Irrespective of these findings, both windows were obturated with temporal fascia and fibrin glue.

### 2.2. Audiometry

Pure tone audiometry was performed 1 day prior or on the day of surgery. Measurements at 0.25, 0.5, 1, 2, 4, and 8 kHz were used for the analysis. In addition, percentage hearing loss was calculated after a table by Boenninghaus and Röser [8] (Table 1) regarding hearing loss at 0.5, 1, 2, and 4 kHz.

Postoperative measurements were performed at different time points. For comparison, measurements that were done closest to day 28 after surgery were used. The time between surgery and postoperative control was 27 days ( $\pm 22$  SEM).

### 2.3. Statistical analysis

Mean results for pure tone audiometry and percentage hearing loss before and after surgery were compared using Wilcoxon test for pair differences. To compare the difference of percentage hearing loss before and after surgery of patients with or without PLF, the Mann-Whitney *U* test was applied.

To avoid systematic errors due to the heterogeneous collection of patients, 14 pairs of patients with and without PLF were matched by similar preoperative hearing loss. Group differences were considered significant if  $p < 0.05$ .

## 3. Results

### 3.1. Patient demographics

Between 2002 and 2005, 82 patients, 50 (61%) male and 32 (39%) female, underwent explorative tympanotomy in our department due to unilateral acute profound sensorineural hearing loss.

The age varied from 13 to 92 years with an average of 58 years ( $\pm 19$  SEM). In 35 (43%) the right ear was affected, in 47 (57%) the left ear.

In 21 cases we identified a possible reason for SSNHL: 4 named work in a bent-over position, 3 named sneezing, 2 named a fall on the head and 2 borreliosis. Ten additional reasons were named; most were associated with pressure alterations or external force to the head. Sixty-one patients (84%) could not name a reason for the hearing loss.

### 3.2. Surgery

Surgery was performed at the early onset of SSNHL. Thirty-eight (46%) of the patients enrolled in this study underwent tympanotomy in general surgery while 44 (54%) received local anesthesia.

**Table 1**  
Table of Boenninghaus and Röser [8].

Hearing threshold level in dB	500 Hz	1000 Hz	2000 Hz	4000 Hz
10	0	0	0	0
15	2	3	2	1
20	3	5	5	2
25	4	8	7	4
30	6	10	9	5
35	8	13	11	6
40	9	16	13	7
45	11	18	16	8
50	12	21	18	9
55	14	24	20	10
60	15	26	23	11
65	17	29	25	12
70	18	32	27	13
75	19	32	28	14
80	19	33	29	14
$\geq 85$	20	35	30	15

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