

# Prognostic indicators of management of sudden sensorineural hearing loss in an Asian hospital

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## ABSTRACT

**Introduction:** This retrospective review evaluates the prognostic indicators in the management of sudden sensorineural hearing loss (SSNHL) in otorhinolaryngology patients admitted to Brunei RIPAS Hospital.

**Methods:** The review covered data collected from 1996 to 1998, and included patients who were treated with naftidrofuryl and dexamethasone. Their hearing improvement (more than 20 dB) in relation to pure tone audiogram patterns, hearing loss severity, vertigo, age of the patients and duration from symptom onset to time of treatment, were evaluated.

**Results:** After exclusion of three patients with known causes of hearing loss, 50 patients with idiopathic SSNHL were reviewed. Six audiogram patterns were observed with good prognostic indicators in patterns 1 and 4, where respectively, 95 percent and 100 percent of the patients improved. The hearing improvement was noted in the majority of the patients with mild or moderate degree of hearing loss, especially noticeable in audiogram patterns 1 and 4. Initial vertigo gave poor prognosis in hearing (more than 33 percent patients with vertigo improved versus 88 percent patients without vertigo improved). Patients aged between 21 and 60 years appear to have better prognosis of hearing improvement compared to those who are outside of this age range. 92 percent patients whose treatment started within the first week of onset of hearing loss experienced hearing improvement compared to 84 percent patients whose treatment started in the second week after onset.

**Conclusion:** Fairly consistent with the previously-reported prognostic indicators are hearing loss severity, vertigo, age and duration of onset to treatment, though there was reasonably good prognosis when the patients were treated in the second week from hearing loss onset. Further findings of note were the six audiogram patterns and the good prognostic indicators in patterns 1 and 4.

**Keywords:** diagnosis, hearing loss, otorhinolaryngology, sudden sensorineural hearing loss, therapy

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## INTRODUCTION

Sudden sensorineural hearing loss (SSNHL) is a symptom<sup>(1)</sup>. It is defined as a sudden onset occurring over a period of up to three days and is sensorineural of more than 30dB over three contiguous pure tone frequencies<sup>(2)</sup>. The incidences are variable, up to 20 in 100,000 population<sup>(3)</sup>, often with no known causes, referred to as idiopathic SSNHL. In the majority of the patients with SSNHL, no causes were found and the treatments are based on many theories and have various outcomes<sup>(3,4)</sup>.

This review aims to evaluate the treatment outcomes of the otorhinolaryngology patients admitted in RIPAS Hospital, Brunei, based on the standard treatments for SSNHL in the Department of Otorhinolaryngology at the hospital. The treatment outcomes may help determine the good and bad prognostic indicators of hearing improvement on the standard treatments available at the hospital.

## METHODS

From the Medical Records and the Department of Otorhinolaryngology, 53 patients who were admitted during a period of three years from 1996 to 1998 in RIPAS Hospital, Brunei, were reviewed, and the data collected

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included demographics; initial symptoms of hearing loss; tinnitus; vertigo and any associated conditions; investigations of pure tone audiograms and any associated conditions; duration of onset of hearing loss to the time of treatment; patterns of hearing loss and the audiometric progression of hearing while on treatment; and the medications used during treatment or specific treatments for the causes if any.

Patients with SSNHL received the following treatment regimes with naftidrofuryl and dexamethasone. Naftidrofuryl was given orally 200mg three times a day until time of discharge from the hospital. Dexamethasone was administered intravenously over a period of seven days while the patient was warded in the hospital, on reducing dosages, 8 mg three times a day for two days, 4mg three times a day for two days, 4 mg twice a day for two days, and 4mg once a day for one day. Those patients with known causes were treated specifically for the causes.

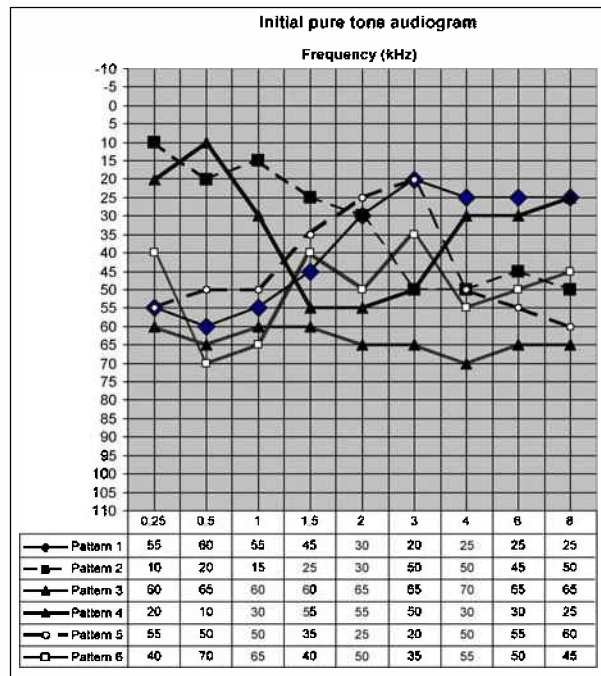
All patients were followed-up progressively over periods ranging from 3 months to 12 months, and pure tone audiograms were done during each of the follow-up visits. During the period of hospital admission, the audiograms were done every two to three days and those who failed to improve were further investigated by computed tomography or magnetic resonance imaging for organic causes, such as acoustic neuroma<sup>(5)</sup>. The audiograms were done on the thresholds of hearing on increments of 5dB and the frequencies in KHz 0.25, 0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 6.0 and 8.0.

The hearing improvement in the review was taken as improvement in hearing from initial thresholds by more than 20 dB in at least two contiguous frequencies. This hearing improvement was evaluated in relation to pure tone audiogram patterns, severity of hearing loss, vertigo, age, duration from symptom onset to in-patient treatment, and associated conditions.

**RESULTS**

Of the 53 patients reviewed, three were found to have known causes, which were cholesteatoma, syphilis and herpes zoster oticus, and these three patients were excluded from the analysis. The remaining 50 patients did not have any known causes upon investigation and their condition was known as idiopathic SSNHL. Patient ages ranged from 12 to 79 years of age, with a mean of 49 years. The number and percentage of patients with hearing improvement according to the age group distributions are shown in Table I. Patients aged between 21 and 60 years of age had a very high chance of experiencing hearing improvement.

The ratio of male to female patients was 25 to 28, and ratio of right to left ears was 23 to 30. There were



**Fig. 1** Examples of the six patterns of initial pure tone audiograms.

two patients with bilateral hearing loss and they did not experience any hearing improvement. The duration from symptom onset to inpatient treatment ranged from one day to two months, and the main presenting symptoms were deafness (40 patients), tinnitus<sup>(38)</sup>, and vertigo<sup>(12)</sup>, with some patients having more than one presenting symptom.

Various patterns of initial pure tone audiograms on admission were noted and could be generalised into six patterns: (1) sloping-up pattern of low tone loss only; (2) sloping-down pattern of high tone loss only; (3) crossing-horizontally pattern of all tones loss; (4) mid-dipping pattern of mid-tones loss only; (5) mid-humping pattern of high/low tones loss only; and (6) bizarre curve pattern of any tones loss. Examples of each of these six patterns of initial pure tone audiograms are illustrated in Fig. 1.

The number and percentage of patients experiencing hearing improvement are shown in Table I. The results showed that audiograms for sloping-up pattern and mid-dipping pattern (patterns 1 and 4) have a much better chance of hearing improvement than the other patterns. The hearing improvement in relation to the severity of hearing loss (Table II) was shown in the majority of the patients with mild or moderate degree of hearing loss, especially noticeable in audiogram patterns 1 and 4.

There were 43 patients in this review who had no vertigo, seven patients with mild/moderate vertigo and three with severe vertigo. The percentages of patients having the hearing improvement were found to be:

**Table I. Hearing improvement of patients with sudden sensorineural hearing loss in relation to the prognostic indicator.**

Prognostic indicator	No. of patients	No. of patients with hearing improvement (%)
Age distribution range (years)		
11–20	3	2 (67)
21–30	3	3 (100)
31–40	8	8 (100)
41–50	14	13 (93)
51–60	13	12 (93)
61–70	7	3 (43)
71–80	2	0 (0)
Audiogram patterns		
1. Sloping-up pattern of low tone loss only	24	23 (95)
2. Sloping-down pattern of high tone loss only	12	8 (67)
3. Crossing-horizontally pattern of all tones loss	6	4 (67)
4. Mid-dipping pattern of mid-tones loss only	4	4 (100)
5. Mid-humping pattern of high/low tones loss only	2	1 (50)
6. Bizarre curve pattern of any tones loss	2	1 (50)
Vertigo		
None	43	38 (88)
Mild/moderate	7	2 (29)
Severe	3	1 (33)
Duration from onset to treatment (days)		
1–7	24	23 (92)
8–14	12	11 (84)
15–20	11	6 (50)
21–60	3	1 (33)
Associated conditions		
Diabetes mellitus	16	9 (56)
Hypertension	7	3 (43)
Hyperlipidaemia	12	5 (42)

**Table II. Hearing improvement (>20dB) in relation to severity of initial hearing loss.**

Audiogram pattern	No. of patients improved / total with hearing severity (%)		
	Mild	Moderate	Severe
Pattern 1	14/14 (100)	8/8 (100)	1/2 (50)
Pattern 2	4/5 (80)	3/4 (75)	1/3 (33)
Pattern 3	2/3 (67)	1/2 (50)	0/1 (0)
Pattern 4	3/3 (100)	1/1 (100)	-/-
Pattern 5	1/1 (100)	0/1 (0)	-/-
Pattern 6	0/0 (0)	1/2 (50)	-/-

Hearing severity: mild 30–40dB; moderate 50–70dB; severe ≥80dB

88% for those with no vertigo, 29% for those with mild/moderate vertigo, and 33% with severe vertigo. It appeared that patients with no vertigo seem to have a higher chance of experiencing hearing improvement (Table I).

The duration of onset of hearing loss to the time of treatment varied from one day to 60 days. In this review, the range of duration in days from onset to treatment were 1–7 days, 8–14 days, 15–21 days, and 21–60 days. It was

observed that the best prognosis of patients with hearing improvement of more than 20 dB were most likely to occur in patients treated in the first two weeks from the onset of hearing loss (Table I), bearing in mind that spontaneous hearing improvement or recovery without treatment could occur anytime after onset in 47% to 63% of cases<sup>(2)</sup>.

In this review, 16 patients were found to have associated conditions of diabetes mellitus, seven with hypertension, and 12 with hyperlipidaemia. The percentages of these patients encountering hearing improvement were: 56% (or nine patients) with diabetes mellitus, 43% (or three patients) with hypertension, and 42% (or five patients) with hyperlipidaemia (Table I). Regarding the three patients with known causes (i.e. one syphilis, one herpes zoster oticus and one cholesteatoma), only the one with herpes zoster oticus experienced hearing improvement.

In summary, hearing improvement in this review was found in 41 out of a total of 53 patients (77.4%), of which 40 out of the 50 patients (80%) with idiopathic SSNHL, and one out of three patients (33.3%) with known causes of the hearing loss.

## DISCUSSION

Prognostic indicators or factors have been published in the past decades in many countries. However, no such report based on Brunei data is known to exist. There is one Malaysian report by Amin who reviewed 32 patients treated at the University Hospital at the University of Malaya, Kuala Lumpur. He found good prognostic indicators when treatment started within five days of onset of hearing loss and bad prognostic indicators in bilateral hearing loss with vertigo or in profound hearing loss<sup>(4)</sup>. Review of the literature has shown no set threshold of hearing improvement as it varies individually from more than 10dB<sup>(6)</sup> to 20 dB<sup>(7)</sup>. Using the method mentioned in this review, as the increments during audiogram testing are in 5 dB steps, the minimal threshold of hearing improvement is 25dB.

In 1984, Byl published a prospective study conducted over eight years on 225 patients with sudden hearing loss and found four main factors, including time since onset of hearing loss, age, vertigo and audiogram. The results mentioned in this review addressed all four factors. Byl reported audiogram findings of patients with profound hearing loss to have significantly decreased recovery rates but no audiogram patterns in relation to hearing improvement. However, in this review, six audiogram patterns were observed and the results showed significant hearing improvement in more than 96% of the patients with audiogram patterns 1 and 4. Moreover, it is worthwhile to note that 100% of patients (though the number of patients is small) with audiogram pattern 4 experienced hearing improvement. This result is comparable to the findings by

Laird and Wilson whose patients with the same audiogram pattern also had excellent hearing prognosis<sup>(8)</sup>. Regarding the age factor in this review, patients aged between 21 and 60 years appeared to have a better prognosis of hearing improvement than those who are outside of this age range, a finding which correlated to that of Byl<sup>(9)</sup>.

Severity of initial hearing loss is a main prognostic indicator of hearing improvement in SSNHL. Bad prognosis has been found in patients with severe or profound SSNHL by Byl<sup>(9)</sup>, Amin<sup>(4)</sup>, Mosnier et al<sup>(10)</sup>, and Sano et al<sup>(11)</sup>. The same observations were found in the results of this review, which also showed that hearing improvement was seen in patients with mild or moderate sensorineural hearing loss. Regarding the audiogram patterns, for patients with audiogram patterns 1 and 4, the hearing impairment appeared to be further enhanced when the hearing loss was mild or moderate. The two patients with bilateral hearing loss did not have any hearing improvement and this finding had also been reported by Amin<sup>(4)</sup>. The initial symptom of vertigo is found in this review to be a bad prognostic indicator and this observation was also made in other studies by Byl<sup>(9)</sup>, Amin<sup>(4)</sup>, and Nakashima and Yanagita<sup>(12)</sup>; and the likely extensive damage of the cochlea to involve the vestibular apparatus had been suggested.

Another well-known prognostic indicator is the duration of the onset of hearing loss to treatment, where a duration of one week would yield a good hearing improvement<sup>(4,9)</sup>. However, in this review, the hearing improvement was also found in patients who were treated between day 8 and 14 after the onset of hearing loss, with a 84% success rate. Most of the patients who had associated conditions of diabetes mellitus, hypertension and hyperlipidaemia had poor hearing improvement of less than 56%. This suggests that the associated conditions could be contributory factors to poor prognosis, and the prognostic factors of management of SSNHL should take the associated conditions or comorbidities into consideration.

Regarding the three known causes treated for SSNHL, the number of cases in this review is too small for analysis, though it may be said that the relatively acute case of herpes zoster oticus would do better than chronic cases like cholesteatoma and syphilis. The overall results of hearing improvement of 77.4% for all cases and 80% for the idiopathic cases compared favourably with the generally accepted results of up to 63% of untreated cases or those with spontaneous recovery.

In summary, 53 patients with SSNHL were reviewed in an Asian hospital, where 50 who had idiopathic SSNHL were included in the analysis. The results of hearing improvements in relation to age, audiogram patterns, severity of hearing loss, initial symptom of vertigo, duration of onset of hearing loss to time of treatment,

associated conditions, and treatment outcomes were presented and discussed. Fairly consistent with the previously-reported prognostic indicators are age, severity of hearing loss and vertigo, and to some extent the duration of the onset of hearing loss to treatment, though this review also showed reasonably good prognosis when the patients were treated in the second week from the hearing loss onset. Further findings of significance are the audiogram patterns where the good prognostic indicators are found in patients with only low tone loss and those with only mid-tone loss.

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