ORIGINAL ARTICLE

Sudden Sensorineural Hearing Loss in the Elderly: Characteristics and Outcome

Michael Drendel, Eldar Carmel, Noga Lipschitz, Michael Wolf, Lela Migirov

Department of Otolaryngology - Head and Neck Surgery, Sheba Medical Center, Tel Hashomer, Israel (MD, EC, NL, MW, LM)
Sackler Faculty of Medicine, Tel-Aviv University, Tel-Aviv, Israel (MD, EC, MW, LM)

Background: The data on idiopathic sudden sensorineural hearing loss (SSNHL) in the elderly patients are very limited.

Objectives: To evaluate the characteristics and outcome of SSNHL in elderly patients.

Materials and Methods: The medical charts of patients aged over 65 years admitted for ISSNHL to our department between 2004 and 2009 were retrospectively reviewed.

Results: Fifty-three patients with a mean age of 72 ± 6.29 years met the study criteria. Thirty-one patients received oral prednisone, and 17 patients received intratympanic dexamethasone injections, and five didn't get any treatment. The admission average pure tone audiometry (aPTA) was 71 dB for the frequency range of 500-3000 Hz and 79 dB for higher frequencies (4000 and 8000 Hz). The average endpoint aPTAs were 52 dB and 70 dB, respectively. The rates of complete and partial improvements of the aPTAs were 21.6% and 37.3% for the speech frequencies compared to 13.3% and 17.8% for the high frequencies, respectively. Age, diabetes mellitus, audiometric curve shape, accompanying symptoms (tinnitus, aural fullness, vertigo), time of onset of treatment and treatment modality did not significantly influence hearing outcome.

Conclusions: Elderly patients with idiopathic SSNHL had poor rates of hearing restoration, especially in the high frequencies, in spite of cortisone and steroid treatment.

Introduction

Idiopathic sudden sensorineural hearing loss (SSNHL) is defined as hearing loss of at least 30 dB in 3 sequential frequencies occurring within 72 hours [1]. Its estimated incidence ranges from 5 to 20 cases per 100,000 population [2], lowest in individuals aged 20-30 years (4.7 per 100,000), and highest in those aged 50-60 years (15.8 per 100,000) [3]. Both sexes are equally affected and about 95% of the cases are unilateral [4]. The elderly population is characterized by a high prevalence of presbycusis, with a 40% rate in individuals older than 65 years [5]. Hearing impairment reduces the ability to understand speech and later to detect and localize sounds, thus affecting patients psychosocially and contributing to social isolation, depression, senile dementia and loss of self-esteem [6, 7]. The higher rate of systemic diseases, such as diabetes mellitus, hypertension and dyslipidemia associated with microangiopathy, may negatively influence the course of SSNHL. Surprisingly, the data on idiopathic SSNHL in the elderly patients are very limited [8, 9].

The present study was designed to evaluate the characteristic and audiological outcome of idiopathic SSNHL in patients aged over 65 years. The need for proper counseling for providing them with realistic expectations prompted this investigation.

Materials and Methods

This retrospective study was conducted in a tertiary care university-affiliated, medical center and approved by the Sheba Medical Center Institutional Review Board. The study cohort included all the patients aged 65 years or older who were admitted for an SSNHL to the Sheba Medical Center during 2004-2009. Their medical records were reviewed for demographic data, presence of tinnitus, aural fullness, vertigo, imbalance,

Corresponding address:
Dr. Michael Drendel
Department of Otolaryngology – Head and Neck Surgery,
Sheba Medical Center, Tel Hashomer, 52621, and Sackler Faculty of medicine, Tel-Aviv University, Tel-Aviv, Israel.
Phone: 972-3-5302442, Fax: 972-3-5305124
E-mail: drendel_michael@yahoo.com

past hearing loss or oto-surgery, background diseases, audiometric findings upon presentation and at follow-up visits, mode of treatment, and magnetic resonance imaging (MRI) results when available.

A minimum of a 15 dB increase in the average hearing levels evaluated at the different time points was considered as a partial improvement. Complete improvement was defined as restoration of hearing to a level of at least 10dB less than the intact ear or documented pre-admission hearing loss in the affected ear. The audiometric results were calculated separately for the speech frequencies (500, 1000, 2000, 3000 Hz) and for two high frequencies (4000 and 8000 Hz) [10]. Five configurations of audiometric curves were defined: upward slope, downward slope, "U" shape, inverted-U shape, and flat. The outcome of similar audiometric configurations was evaluated and compared.

The treatment protocol changed over the study period: oral treatment with prednisone 1 mg/kg/daily for one week with tapering was administered between 2004-2006) and it was replaced by 4-6 consecutive intratympanic injections of 0.4 ml dexamethasone 4 mg/ml daily as primary or salvage therapy between 2006-2009. Bedrest was advised for all the patients. The pure tones averages (PTA) and discrimination scores between these two treatment groups were also compared.

Statistical Analysis

We attempted to predict the improvement of hearing loss according to the patient's background characteristics using different statistical techniques as appropriate for different variable types. Assessment of the continuous variables (age and duration from onset of hearing loss to initiation of treatment), was done by regressing the PTAs of the speech and high frequencies at the follow-up on the same variables at admission and the background characteristic. The same procedure was used for the dichotomous variables (gender, background diseases such as hypertension and diabetes mellitus), side of hearing loss, presence of tinnitus, fullness of ear, vertigo or unsteadiness on the admission, while the background variables were dummy-coded for use in the regression analysis. Finally, for the discrete variables, treatment modality

and type of audiometric curve, we employed the analyses of covariance (ANCOVA), in which the follow-up values of the PTAs for the speech and high frequencies served as the dependent variables, their values at admission as covariates, and the background characteristics as independent variables. To test the hypothesis that the greater the initial hearing impairment, the more limited would be the improvement at the end of follow-up, we computed Pearson correlation coefficients between the PTAs of the speech and high frequencies at admission and the differential between the follow-up and the admission values.

Results

A total of 418 patients were admitted due to SSNHL during the study period in our department, and 53 of them (29 males and 24 females) with a mean age of 72 ± 6.29 years (range 65-86 years) met the study criteria. The left ears were affected more frequently than the right ones (28 vs. 24), and one patient had a bilateral SSNHL. The average duration from the onset of the hearing loss to the initiation of treatment was 5.2 days (range 0-21 days). Tinnitus, aural fullness, imbalance and vertigo was associated with the SSNHL in 39 (73.6%), 36 (67.9%), 15 (28.3%) and 8 (15%) cases, respectively. The otoscopic findings were normal in all but three patients: one had bullous myringitis, one had a dry radical cavity, and the third had an aural polyp.

The following co-morbidities were associated the SSNHLs: diabetes mellitus in 13 patients (24.5%), essential hypertension in 31 (58%), dyslipidemia in 15 (28.3%) and hypothyroidism in 6 (11.3%). One patient underwent radical mastoidectomy in the affected ear many years prior to the onset of the SSNHL. One patient had a history of a partially recovered SSNHL in the contralateral ear a few years prior to the present admission. Only 18 of the 53 study patients had undergone audiometric testing before the onset of the current SSNHL, and downsloping SNHL curves compatible with presbycusis were found in all 18 audiograms, also reflecting hearing in the non-affected by the SSNHL ears of 49/53 (92%) patients upon admission.

The admission aPTAs of four speech frequencies (500, 1000, 2000, 3000 Hz) and two high frequencies (4000

and 8000 Hz) were 71 dB and 79 dB, respectively, and the average speech reception threshold (aSRT) and speech discrimination scores (aSDS) were 77 dB and 34%, respectively. Flat, downsloping, upsloping, U-shaped and inverted U-shaped audiograms were recorded in 59.2%, 25.9%, 7.4%, 3.7%, and 3.7%, respectively. Table 1 demonstrates the severity of the SN component in these audiograms.

Table 1. Admission Hearing Levels of the 53 Study Patients (54 Ears).

Hearing loss	500-3000 Hz No. ears (%)	4000-8000 Hz No. ears (%)
Mild (26-40 dB)	8 (14.8)	3 (5.6)
Moderate (41-55 dB)	12 (22.2)	6 (11.1)
Moderate-Severe (56-70 dB)	8 (14.8)	12 (22.2)
Severe (71-90 dB)	12 (22.2)	16 (29.6)
Profound (>90 dB)	14 (25.9)	17 (31.5)

Oral prednisone was prescribed to 31 patients, while 17 patients were managed by intratympanic dexamethasone injections as a primary treatment (12 patients) or as salvage therapy after oral prednisone treatment failure (4 patients), and in one diabetic patient after glucose level elevation and aborted oral prednisone treatment. Five patients with contraindication to the administration of systemic steroids received no treatment at all since they presented with their SSNHLs before the intratympanic treatment option had been introduced.

Oral prednisone treatment resulted in blood pressure elevations in one patient who had previously well-controlled essential hypertension and in elevations of blood glucose levels in three previously well-controlled diabetic patients (the oral treatment was stopped in two of them). One patient suffered mild vertigo that lasted a few hours after the first intratympanic dexamethasone injection and did not recur during the subsequent injections.

The mean follow up was 8.97 ± 10.03 weeks (range 0-36 weeks). Two patients were lost to follow-up and the only available audiograms for them were ones performed upon admission so their data were not included in the final analyses. In 16 (30.2%) patients, the endpoint audiogram was the one performed between 4-6 weeks following admission, and the endpoint audiogram at three months following admission was available in only in 16 patients (30.2%).

Table 2 displays the characteristics of the admission audiograms and those done at the various endpoints. The rates of complete and partial improvement were 21.6% (11/51 patients with available follow-up) and 37.3% (19/51 patients) in the aPTAs of the speech frequencies, and 13.3% (6/45 patients) and 17.8% (8/45 patients) in the aPTAs of the high frequencies, respectively (Table 3).

Table 2. Mean Audiological Characteristics for the Entire Cohort.

Characteristic	On Admission	At Endpoint
Four-Frequency aPTA	71 dB	52 dB
High-Frequency aPTA	79 dB	70 dB
SRT	77 dB	52 dB
SDS	34%	62%

aPTA = average pure tone eudiometry for four frequencies (500, 1000, 2000, and 3000 Hz);

high frequencies = 4000 and 8000 Hz; SRT = speech reception threshold;

SDS = speech discrimination score.

There were no significant relations (all with a p value > .10) between the improvement of hearing and the patients' background characteristics (age, presence of essential hypertension and diabetes mellitus), admission parameters (duration from onset of hearing loss to initiation of treatment, shape of audiometric curve), accompanying symptoms (tinnitus, aural fullness, vertigo and imbalance), and treatment modality (oral vs. intratympanic steroid injections). As expected, a negative and significant coefficient was obtained using Pearson correlation coefficients for hearing loss in the speech frequencies (r = -.33, p < .05), and this differed for the high frequencies (r = -.20, p > .10).

Table 3. Hearing Levels in 51 Patients with available follow-up data.

Hearing Status	500-3000 Hz No. Ears (%)	4000 and 8000 Hz No. Ears (%)
Normal Hearing (0-25 dB)	10 (19.6)	0 (0)
Mild Loss (26-40 dB)	10 (19.6)	5 (9.8)
Moderate Loss (41-55 dB)	12 (23.5)	10 (19.6)
Moderate-Severe Loss (56-70 dB)	7 (13.7)	13 (25.5)
Severe Loss (71-90 dB)	6 (11.8)	13 (25.5)
Profound Loss (>90 dB)	6 (11.8)	10 (19.6)

Only 24 of the 53 patients followed our recommendation to undergo magnetic resonance imaging (MRI) enhanced with gadolinium contrast of the brain and internal auditory canals in order to identify the possible causes of their SSNHL. Fourteen of these 24 images showed chromic ischemic changes in white matter, and accidental meningioma was diagnosed in two others. A 1.5-cm intracanalicular vestibular schwannoma was diagnosed in a 65-year-old patient who presented with a severe flat-shaped SSNHL and whose hearing showed no improvement at the 6-week follow-up. The latter patient preferred once-yearly MRI follow-up to surgery.

Discussion

Several studies have addressed a number of prognostic factors for the occurrence of SSNHL, among them age, the presence of tinnitus or vertigo, the delay in the initiation of treatment, the type and severity of hearing loss, and an already existing loss in the opposite ear.[2,11-16]

We looked at the demographics and clinical findings of SSNHL in an elderly population and failed to show any influence of vertigo, tinnitus, and shape of audiometric curve on whether or not the hearing improved after oral treatment with prednisone 1 mg/kg administered daily for a week with tapering or 4-6 consecutive intratympanic injections of 0.4 ml dexamethasone 4 mg/ml in this population. Moreover, more advanced age did not affect prognosis. The presence of vertigo was reported to be a negative prognostic factor in many previous studies [3, 11, 14, 15], while the role of tinnitus is still being debated [12, 14, 16, 17]. The delay in treatment onset and the presence of a hearing loss in the opposite ear negatively influenced the prognosis of the SSNHL in some studies, and the severity of hearing loss in the affected ear correlated directly with a poorer recovery in others [3, 11, 13 - 16, 18, 19]. Consistent with the results of previous reports, the severity of the hearing loss in the speech frequencies influenced the prognosis in our elderly patients as well. Ascending and flat curves have been associated with a better prognosis compared to the down-sloping curves [11, 20]. There is no consensus on the influence of advanced age on the outcome of an SSNHL [11, 14, 21, 22].

Around 69% (37/54) of our study patients had some contraindication to oral prednisone treatment (e.g., essential hypertension or diabetes mellitus), and they received primary oral steroids (21 patients),

intratympanic treatment (12 patients), or no treatment (4 patients), while side effects of oral treatment led to its being stopped in two patients and switched to intratympanic injections in one patient. The presence of essential hypertension or diabetes has to be taken into consideration when deciding upon the mode of treatment for an individual patient.

Our study demonstrated a relatively low recovery rate (58.9%) of SSNHLs in the elderly population compared with the spontaneous recovery rates (56-75%) reported by various authors [23-25]. The low rate of complete improvement (21%) in our series may be explained by the presence of a contralateral hearing impairment in most of the elderly patients that resulted in a combination of auditory dysfunction and a decreased potential to recovery [14].

The short follow-up, that either ended with the patient's discharge from hospital, or shortly after that for most of our patients is the main limitation of the current investigation. There were several reasons for their not returning to the hospital outpatient clinic. Elderly patients are usually poorly equipped to deal with insurance claims for reimbursement for the visits to a hospital outpatient clinic, and thus are more inclined to visit the nearby family physician instead. In addition, many of them have problems with transportation to the hospital.

The average hearing levels of our elderly population with SSNHL dropped to severe-to-profound levels in 26/54 (48.1%) ears in the speech frequencies and in 33/54 (61%) ears in the high frequencies. Moreover, 12/51 ears and 26/51 remained with severe to profound hearing loss in the speech and high frequencies, respectively, at the end of follow-up. Early advice on the use of hearing aids following the occurrence of an SSNHL can be helpful to elderly patients whose hearing had not been restored in order to avoid the social isolation associated with hearing impairment. Hearing aids can be especially beneficial for patients who already have hearing impairment in the ear that had not been affected by an SSNHL.

Conclusion

Elderly patients with an SSNHL represent a unique group with a low recovery rate unaffected by potential prognostic factors, such as tinnitus, vertigo, the period between the onset of the attempt and the initiation of treatment, mode of the treatment and audiometric curve shape. Since most of these patients already have

some hearing impairment due to presbycusis, the possibility of hearing rehabilitation with assistive hearing devices should be brought up and discussed with these patients and their caregivers during the first follow-up visits, before the final results are in.

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