World Journal of Otorhinolaryngology-Head and Neck Surgery (2016) 2, 168–174

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.keaipublishing.com/WJOHNS; www.wjent.org

Research Paper

Improvement in word recognition following treatment failure for sudden sensorineural hearing loss

Taha A. Jan, Elliott D. Kozin, Vivek V. Kanumuri, Rosh K. Sethi, David H. Jung*

Department of Otolaryngology, Massachusetts Eye and Ear Infirmary, Harvard Medical School, Boston, MA 02114, USA

Received 9 May 2016; received in revised form 20 June 2016; accepted 29 June 2016
Available online 24 November 2016

KEYWORDS
Sensorineural hearing loss;
Sudden sensorineural hearing loss;
Word recognition score;
Pure tone average

Abstract *Objectives:* Patients with sudden sensorineural hearing loss (SSNHL) may have word recognition scores (WRS) that correlate with pure tone average (PTA). We hypothesize that there is a subset of patients with SSNHL who have improved WRS despite stable PTA.
Methods: Retrospective case review at a tertiary otolaryngology practice.
Results: We identified 13 of 113 patients with SSNHL whose WRS increased despite overall stable pure tone averages. There was an observed average improvement in WRS by 23.8 points in this patient cohort at follow-up, with mean initial PTA in the affected ear at 48.7 dB.
Conclusions: We identify a novel cohort of SSNHL patients that have failed treatment as measured by PTA, but who have increased WRS over time. These data have implications for patient counseling and lend insight into the pathophysiology of SSNHL.

* Corresponding author. Department of Otolaryngology, Massachusetts Eye and Ear Infirmary, Harvard Medical School, 243 Charles Street, Boston, MA 02114, USA. Fax: +1 617 573 3914.
E-mail address: David_Jung@meei.harvard.edu (D.H. Jung).
Peer review under responsibility of Chinese Medical Association.

Production and Hosting by Elsevier on behalf of KeAi

http://dx.doi.org/10.1016/j.wjorl.2016.06.002

Introduction

Sudden sensorineural hearing loss (SSNHL) occurs with an incidence of 5–20 cases per 100,000 persons per year.[1] Classically, it is defined as new onset unilateral hearing loss that occurs within a time period of three consecutive days.[2,3] In addition to sensorineural hearing loss (SNHL), patients can report aural fullness, tinnitus, and vestibular symptoms.[4–6] One of the leading theories regarding the etiology of SSNHL includes an inflammatory insult related to a viral infection.[7–14]

Numerous studies have investigated treatment options for SSNHL. Steroid therapy, via either oral corticosteroids or intratympanic injection, is the current standard of care for treatment of SSNHL.[3,15–19] Formally speaking, however, the efficacy of steroid treatment for SSNHL has never been proven with a randomized, placebo-controlled trial.[20] Further confounding the picture, it has also been reported that 32%–65% of cases recover without any treatment.[3,5,16]

Prior studies have principally utilized audiometric data, including pure tone averages (PTA) and word recognition scores (WRS) to quantify audiometric outcomes following SSNHL. In brief, the PTA is considered as the hearing sensitivity averaged over four standard frequencies: 500, 1000, 2000, and 4000 Hz.[21,22] WRS is a measure of intelligibility of a standard list of monosyllables, measured as a percentage of correctly recognized words.[3,23] In some studies, PTA and WRS have been found to track one another; WRS typically improves with decreasing PTA thresholds.[15] Few studies, however, have addressed whether the converse clinical scenario may be true: can WRS significantly improve in the absence of PTA improvement?

Herein, we examine the hypothesis that there may be a subset of patients with SSNHL who have improved WRS despite stable PTA. Identification of this novel patient population has implications both for patient counseling and for the pathophysiology of SSNHL.

Materials and methods

Basic inclusion and exclusion criteria

We retrospectively analyzed patients with an ICD-9 code diagnosis of SSNHL (388.2) treated at our tertiary care center between 2011 and 2014. Inclusion criteria included at least 10 dB or greater difference in sensorineural hearing loss as measured by PTA in affected versus unaffected ears and follow-up of at least 60 days later with an audiogram. Exclusion criteria included first audiogram greater than 30 days post symptoms, Meniere's disease, otosclerosis, immune mediated SNHL, perilymph fistula, non-SNHL, ototoxicity, bilateral severe SNHL, congenital SNHL, mixed SNHL with conductive components, fluctuating SNHL, ipsilateral vestibular schwannoma, or patients without available audiograms from our institution. This study was approved by our Institutional Review Board (IRB), protocol #14-116H.

Out of the overall sample of patients with SSNHL, we aimed to identify patients who had stable PTA and improving WRS. To identify this cohort of patients, only patients with at least 10 dB difference between affected versus non-affected ears' PTAs was examined. Additionally, we required patients to have follow-up in a 2–18 month period.

Audiometric data

Audiologists from our institution conducted all audiograms analyzed in this study. PTA was calculated in the standard method with averaging of thresholds at 500, 1000, 2000, and 4000 Hz.[24] WRS here were calculated based on four sets of 50 word monosyllable sets (CID W-22),[3,24] which at our institution is presented in a pre-recorded format. An abbreviated version of these lists was utilized at our institution with a list of 10 words out of the 50 from each of the four sets that have been found to be highly predictive of a subject's WRS. If all 10 words were answered correctly, then a score of "pass" is registered. However, if one out of ten answers is incorrect, then the full 50-word list is tested as a default. This method involving an abbreviated list has been internally validated by our audiologists. Patients with WRS recorded as "pass" were therefore designated a value of 100% while those recorded as below threshold or no words recognized as 0%. All words used in the lists are open-set male English speakers tested usually at a threshold of 70 dB. PTAs recorded as above threshold were assigned a value of 100 dB.

Statistical analysis and reporting of audiometric data

We utilized a standardized method for reporting collective audiometric data as agreed upon by the Hearing Committee of the American Academy of Otolaryngology-Head and Neck Surgery.[25] Statistical analyses were carried out using Microsoft Excel (Redmond, Washington). Two tailed, paired student's *t*-test was utilized to generate *P*-values. We consider *P*-value less than 0.05 to be statistically significant. All $\pm$ refer to standard deviation (SD) unless otherwise specified.

Results

Baseline sample of patients with SSNHL

We queried all electronic medical records at the study institution from 2011 to 2014 for patients with a primary or secondary ICD-9 diagnosis of 388.2, which generated a list of 569 patients. Fig. 1 is a flow chart that demonstrates inclusion and exclusion of study patients. Patients without study institution audiograms were excluded ($n = 74$). Any patient with an audiogram greater than 30 days from onset of symptoms and/or treatment was excluded ($n = 112$). Additionally, patients with Meniere's disease (or "cochlear hydrops") ($n = 16$), immune mediated SNHL ($n = 1$), ototoxicity ($n = 1$), vestibular schwannomas ($n = 2$), perilymph fistula ($n = 2$), otosclerosis ($n = 6$), bilateral severe SNHL ($n = 6$), congenital SNHL ($n = 2$), mixed SNHL and conductive hearing loss ($n = 8$), and fluctuating SNHL ($n = 10$) were all excluded (Fig. 1).