The Journal of Laryngology & Otology (2007), ***121***, *435–437*.

doi:10.1017/S0022215106004324
Printed in the United Kingdom
First published online 24 November 2006

Main Article

Can self assessment of communication predict hearing loss?

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Abstract

A total of 120 subjects with hearing loss (75 men, 45 women), within the age range 18–70 years (mean, 38 years), and 15 normal subjects were administered a modified Hindi adaptation of the 'self assessment of communication' hearing loss inventory. The study aimed to determine whether there was any correlation between subjects' average pure tone thresholds and their inventory scores. Data was analysed using the Pearson coefficient of correlation and regression analysis. A negative correlation was obtained stating that the greater the hearing loss, the lower the inventory score. An equation could also be derived for the bilateral symmetrical sensorineural hearing loss group and the bilateral symmetrical conductive hearing loss group to enable calculation of patients' average hearing loss from their inventory scores, in the absence of an audiogram. This could aid rehabilitation in cases with either type of hearing loss (in which no medical intervention was required) when pure tone audiometry is not possible.

Key words: Deafness, Sensorineural; Audiometry, Pure Tone; Disability Evaluation

Introduction

Hearing is perhaps humanity's most important sense, for without it our power to communicate is greatly diminished. It is, after all, this superior ability to communicate which sets humans above other animals. Unfortunately, hearing is frequently affected by disease, causing hearing impairment which results in hearing disability.

The 'gold standard' for clinical evaluation of hearing is pure tone audiometry. Schaw and Nerbonne (1980)[1] suggested that a hearing handicap measurement tool could be a valuable part of the audiologist's armamentarium, enabling communication of how an individual feels about hearing loss. A number of inventories[2,3] are available which aim to assess the communication impediment experienced by the hearing handicapped. However, to the best of our knowledge, no-one has previously attempted to use hearing handicap inventory scores to calculate the degree of hearing loss.

The present study aimed to assess the degree of correlation between subjects' scores obtained on the 'self assessment of communication' inventory and their pure tone averages (PTAs). We wanted to determine whether this knowledge could be used to assess the degree of hearing loss in situations in which proper facilities were unavailable, such as large camps and in the elderly population. This could in turn help with hearing aid fitting, especially for elderly patients who may not be in a condition to visit the clinic for detailed audiologic evaluation.

Materials and methods

A total of 120 subjects with hearing loss (75 men, 45 women), within the age range 18–70 years (mean, 38 years), were randomly selected from those reporting to the speech and hearing unit attached to the otolaryngology department of the Postgraduate Institute of Medical Education and Research, Chandigarh, for hearing evaluation. The subjects were broadly divided into three categories: sensori neural hearing loss (55 patients: group I-40 bilateral symmetrical, group II-5 bilateral asymmetrical, group III-10 unilateral); conductive hearing loss (30 patients: group IV-10 bilateral symmetrical, group V-20 unilateral); and mixed hearing loss (20 patients: group VI-10 bilateral symmetrical, group VII-5 bilateral asymmetrical, group VIII-5 unilateral). Fifteen subjects each constituted the miscellaneous group (group IX) and the normal controls (group X).

All the subjects were administered a Hindi adaptation of the 'self assessment of communication' inventory.[4] This contains 12 questions, with four options given for each answer. The patient is required to encircle the option which best explains their status. Possible scores range from 12 to 48. The greater the score, the less the hearing difficulty experienced, and vice versa.

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Accepted for publication: 15 July 2006.

Patients' scores were calculated. The data were analysed using the Pearson correlation coefficient, linear regression analysis, *t*-test and one-way analysis of variance, using the Statistical Package for the Social Sciences (version 11.5) software.

Results and analysis

To assess the degree of correlation between subjects' mean pure tone thresholds (right and left ears) and their hearing inventory scores, the Pearson correlation coefficient was calculated. The results are shown in Table I.

It is evident from Table I that there was a negative correlation between patients' hearing loss in both the right and left ears and their hearing inventory scores. This correlation was found to be statistically significant ($p < 0.001$) for group one (bilateral symmetrical sensorineural hearing loss). In group two (bilateral asymmetrical sensorineural hearing loss), group four (bilateral symmetrical conductive hearing loss) and group eight (unilateral mixed hearing loss), there was a statistically significant ($p < 0.05$) negative correlation between right ear hearing loss and subjects' inventory scores. In all other groups, the correlation was non-significant, although there was a general trend towards a negative correlation between hearing loss and hearing inventory scores, signifying increased communicative difficulty as hearing loss worsened (and inventory scores decreased).

Regression analysis was performed to predict mean threshold scores for the right and left ears. Four groups had a significant correlation between inventory scores and hearing thresholds. However, regression analysis was performed only for the bilateral symmetrical sensorineural hearing loss and the bilateral symmetrical conductive hearing loss groups, because the other two groups (Bilateral asymmetrical sensori neural hearing loss (group II) and Unilateral mixed hearing loss (group VIII)) included only five subjects, an insufficient number for statistical calculation (Table II).

The clinical groups were compared with the control group (normal hearing) using the *t*-test. The results are shown in Table III.

TABLE I

CORRELATION OF HEARING LOSS WITH HEARING INVENTORY SCORES

Group	Hearing	*n*	Ear R	Ear L
I	Bilat symm SN HL	40	−0.536†	−0.547†
II	Bilat asymm SN HL	5	−0.883*	−0.554
III	Unilat SN HL	10	−0.405	−2.56
IV	Bilat symm cond HL	10	−0.750*	−0.611
V	Unilat cond HL	20	−0.215	−0.118
VI	Bilat symm mixed HL	10	−0.421	−0.367
VII	Bilat asymm mixed HL	5	0.662	−0.180
VIII	Unilat mixed HL	5	−0.879*	−0.660
IX	Miscellaneous HL	15	−0.432	−0.211
X	Normal	15	−0.020	−0.051

*$p < 0.05$, †$p < 0.001$. R = right; L = left; bilat = bilateral; symm = symmetrical; SN = sensorineural; HL = hearing loss; asymm = asymmetrical; unilat = unilateral; cond = conductive

TABLE II

LINEAR REGRESSION EQUATION TO PREDICT HEARING INVENTORY SCORE

Group	Equation	Correlation	Regression coefficient
Bilat symm SN HL	Score = 41.310 − 0.290R	0.536*	−0.290†
	Score = 41.487 − 0.307L	0.547*	−0.290†
Bilat symm cond HL	Score = 52.717 − 0.512R	0.750*	−0.512†
	Score = 46.461 − 0.326L	0.611*	−0.362†

*$p < 0.01$, †$p < 0.0001$. Bilat = bilateral; symm = symmetrical; SN = sensorineural; HL = hearing loss; R = pure tone average for right ear; L = pure tone average for left ear; cond = conductive

One-way analysis of variance was carried out in order to compare groups one (bilateral symmetrical sensorineural hearing loss) and four (bilateral symmetrical conductive hearing loss) with group 10 (normal hearing) and to compare groups three (unilateral sensorineural hearing loss) and five (unilateral conductive hearing loss) with group 10 (normal hearing). The results are shown in Tables IV and V, respectively.

Tables IV and V show that the three groups (Table IV (groups I, IV and X); Table V (groups III, V and X) differed significantly. In order to compare these differences, a post hoc test based on least significant differences was carried out. Significant differences were found between groups one and 10 and between groups four and 10 ($p < 0.05$). That is, all the clinical groups differed significantly from the normal hearing group, but the differences between the clinical groups (one and four, and three and five) were not statistically significant. All clinical groups refer to GI, III, IV and V in Tables IV and V.

Discussion

The audiologist is concerned with human communication and the restoration of communication function to as near normal a state as possible. Obtaining numerical data is only part of this process. For

TABLE III

COMPARISON OF GROUPS' HEARING INVENTORY SCORES BY STUDENT *T*-TEST

Group	Mean score ± SD	*t*-test value
BSSN ($n = 40$) *vs* NH ($n = 15$)	30.75 ± 8.40 *vs* 43.2 ± 3.65	−7.644†
BSML ($n = 10$) *vs* NH ($n = 15$)	30.1 ± 4.63 *vs* 43.2 ± 3.65	7.525†
USN ($n = 10$) *vs* NH ($n = 15$)	37.1 ± 5.13 *vs* 43.2 ± 3.65	3.251*
UCL ($n = 20$) *vs* NH ($n = 15$)	34.4 ± 8.18 *vs* 43.2 ± 3.65	−3.877†

*$p < 0.005$, †$p < 0.0001$. BSSN = bilateral symmetrical sensorineural hearing loss; NH = normal hearing; BSML = bilateral symmetrical mixed hearing loss; USN = unilateral sensorineural hearing loss; UCL = unilateral conductive hearing loss

https://doi.org/10.1017/S0022215106004324 Published online by Cambridge University Press

TABLE IV

COMPARISON OF GROUPS I AND IV WITH GROUP X FOR HEARING INVENTORY SCORES, BY ANALYSIS OF VARIANCE

Score	Sum of squares	Df	Mean square	F	*p*
Between groups	1750.154	2	875.077	16.409	0.0001
Within groups	3306.400	62	53.329		
Total	5056.554	64			

Group I = bilateral symmetrical sensorineural hearing loss; group IV = bilateral symmetrical conductive hearing loss; group X = normal hearing; Df = degrees of freedom; F = F-ratio

TABLE V

COMPARISON OF GROUPS III AND V WITH GROUP X FOR HEARING INVENTORY SCORES, BY ANALYSIS OF VARIANCE

Score	Sum of squares	Df	Mean square	F	*p*
Between groups	672.700	2	336.350	8.339	0.001
Within groups	1694.100	42	40.336		
Total	2366.800	44			

Group III = unilateral sensorineural hearing loss; group V = unilateral conductive hearing loss; group X = normal hearing; Df = degrees of freedom; F = F-ratio

effective rehabilitation, assessment should also determine the communication handicap caused by auditory deficits. Evaluation of the effects of hearing impairment in different communication situations enables more effective rehabilitation. Various inventories have been used for this purpose. In our daily clinical work, we come across people, especially the elderly and those with multiple handicaps, who are unable to undergo the routine audiologic procedures which would supply information about their hearing deficits. In various rural and district clinical facilities, hearing assessment equipment may not be available. Thus, we investigated the use of a simple communication inventory as a source of information about patients' hearing handicaps.

- **Hearing inventories have been used to assess the communicative handicap experienced by individual patients**
- **This study aimed to assess the correlation between hearing loss and scores obtained on the 'self assessment of communication' inventory**
- **Correlation between inventory scores and pure tone audiometry was demonstrated, particularly in patients with bilateral sensorineural deafness**
- **This assessment tool could be used to estimate the amount of hearing loss present, in circumstances in which audiometry is not readily available; in turn, this could help with hearing aid fitting**

The results showed a negative correlation between inventory scores and hearing loss. That is, as a subject's hearing loss increased, their inventory score decreased. Regression analysis enabled us to establish an equation to predict the degree of impairment in patients with bilateral symmetrical sensorineural hearing loss (group one) and bilateral symmetrical conductive hearing loss (group two). That is, if we cannot administer pure tone audiometry and have only the hearing loss inventory (which is easy and quick to administer), we can still predict the patient's average hearing loss.

To assess the reliability and validity of the hearing loss inventory, 10 patients with bilateral symmetrical sensorineural hearing loss and 10 with bilateral symmetrical conductive loss were administered the inventory and their average hearing loss calculated. When pure tone audiometry was performed on these patients, the correlation between these results and the patients' inventory scores was very high.

We are hopeful that this hearing loss inventory can be of great use in assessing average hearing loss in the elderly and in aiding their rehabilitation, in the absence of conventional audiometry.

Acknowledgements

We are very thankful to Dr Suresh K Sharma, Reader, Department of Statistics, Punjab University, Chandigarh, India, for his valuable help.

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Dr A N Nagarkar takes responsibility for the integrity of the content of the paper.
Competing interests: None declared