

The Decision Making Role of Audiological Tests in ENT Practise

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Abstract

Objective This study aims to determine to what extent audiological test data effected on decision-making in the diagnosis process of patients who have hearing loss. **Design** Survey study **Setting and Participants** The audiological test results of six pathologies (auditory neuropathy spectrum disorder-ANSD, Meniere’s Disease-MD, superior semicircular canal dehiscence-SSCD, large vestibular aquaduct syndrome-LVA, chronic otitis media-COM, and secretory otitis media-SOM) belonging to five different patients with a definite diagnosis were presented to 87 otolaryngology (ENT) physicians. The physicians were not informed about patient histories and otoscopic findings. The breakdown of the physicians according to their specialization was as follows: 19 were residents, 53 were ENT specialists, 6 were associate professors, and 9 were professors. The participant physicians were asked to indicate possible pathologies (one or more) for each audiological outcome. The answers given were classified as “correct,” “undefined” and “incorrect.” **Main outcome measures** To determine how effective only audiological reports are for the diagnostic decision-making role was evaluated by analysing the percent of “correct” answers according to their work place and title. **Results** The mean “correct” response rate for all pathologies was 19.2%, and the ” incorrect” response rate was 38%. The ratio of “undefined” answers was 41.8. The “correct” prediction rates for each pathology, were 26% for ANSD, 32% for SOM, 19% for MD, 16% for COM and 14% for SSCD. There was no “correct” prediction for LVA. **Conclusion** Audiological tests are likely to support the decision-making process for the ENT physician when they are accompanied by other (case history, otoscopic examination, radiological findings etc.) The audiological report content may increase the diagnostic value of audiological tests.

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Conclusion

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KEY POINTS

1. The participants were asked to identify the pathology that caused hearing loss in patients by referring to their audiological tests. The results showed that 19% of the participants’ predictions were correct, 38% of them were wrong, 36% of the participants named the type of hearing loss rather than the pathology, and 7% did not respond.
2. The group of participants with the highest number of incorrect (42.6%) but also the highest number of correct predictions (31.2%) were physicians working in university hospitals.
3. It was found that audiological tests were the least helpful in diagnosing SSCD, LVA and ANSB.
4. If the audiological reports only mention the type of hearing loss, pathologies such as SSCD and LVA can go unnoticed.
5. All audiological tests should be considered in the decision-making process to increase the reliability of the diagnosis.

INTRODUCTION

Patient history, physical examination, audiological, radiological, and other laboratory tests have an important place in ENT diagnosis. The diagnostic value of these tests varies according to the pathology. For example, otoscopic examination and tympanometric findings in middle ear infections [1,2], patient history in Menière’s disease (MD) [3], auditory brainstem response (ABR) test in auditory neuropathy spectrum disorder (ANSD) [4], and radiological findings in cerebellopontine angle tumors. For example, otoscopic examination and tympanometric findings in middle ear infections [1,2], patient history in Menière’s disease (MD) [3], auditory brainstem response (ABR) test in auditory neuropathy spectrum disorder (ANSD) [4], and radiological findings in cerebellopontine angle tumors play an important role in diagnosis. For this reason, ENT physicians are expected to have knowledge and experience in evaluating different tests and interpreting them together to decide on a patient’s diagnosis.

The diversity of testing methods prompts ENT physicians to cooperate with healthcare professionals in different disciplines, such as audiology, radiology, hematology, neurology, and oncology. Drawing up information from these various fields for one patient is crucial to diagnose the problem correctly. Detection of the pathology is the responsibility of the ENT doctor. However, the test results obtained from the disciplines for which consultation is requested draw attention to possible pathologies, which will help the diagnosis to be fast and reliable.

Hearing tests are among the tools most commonly used by ENT physicians in the diagnosis process. Hearing test batteries play an essential role in distinguishing diseases with similar auditory configurations (e.g., MD, Superior Semisircular Canal Dehiscence (SSCD), and otosclerosis) and in the diagnosis of diseases that do

not provide overt symptoms on otoscopic examination (e.g., third window syndromes (SSCD) and ANSD). Audiological tests are also indispensable in hearing aid and auditory implant decisions.

The type of hearing loss (sensory-neural, mixed or conductive) is usually emphasized in the reporting of the audiological tests. Although the type of hearing loss is an important finding, it is not sufficient to understand the pathology. For example, the expression “sensory neural hearing loss” indicates that the pathology is in the cochlea or the auditory nerve [5]. However, this expression may indicate many pathologies such as MD, acoustic trauma, presbycusis, or vestibular schwannoma. The scope of the definition of “mixed hearing loss” is much broader: it includes multiple pathologies starting from the outer ear and extending to the brain stem [5]. Therefore, audiological reports limited to specifying the type of hearing loss may cause inadequacy in diagnosing the pathology.

Mortality and morbidity rates seen in ENT clinics due to human factor errors have been demonstrated in various studies after 2004 [6,7,8]. The source of errors has been determined as diagnostic, treatment, surgical, communication, and administrative components [6]. In the same study, the ratio of errors resulting from the execution and evaluation of diagnostic tests to total errors was 10.4%. However, those studies did not specify the role of audiological tests in diagnostic illusion.

Our study aims to investigate to what extent audiological findings solely guide ENT physicians in determining pathology when other essential diagnostic tools (history, physical examination, radiologic test, etc.) are absent.

MATERIAL AND METHOD

This study used audiological findings of six different pathologies belonging to five patients with a definitive diagnosis. Pathologies were selected according to their incidence rates. Chronic otitis media (COM), secretory otitis media (SOM) and Meniere’s disease (MD) were classified as common pathologies, while SSCD, large vestibular aqueduct syndrome (LVA) and auditory neuropathy spectrum disorder (ANSD) were classified as rare pathologies. Pure tone threshold, speech, and tympanometric test results in all pathologies were marked on the audiogram form. The ANSD patient also had otoacoustic emission and auditory brainstem response (ABR) test results (Table 1). Audiograms were prepared in the form of a questionnaire. Apart from audiological findings, no additional information such as audiology report, patient history, otoscopic or radiological findings was included in the questionnaire. The answers accepted as correct according to the pathologies are given in Table 2.

Questionnaires were filled with the face-to-face interview technique. The interviewers were selected from among the final year students of the received training on survey interviews. Ethical approval (02.05.2019-710) was obtained from Ethics Committee of the University

Participants

The survey was conducted with 87 ENT physicians during the three separate national ENT meetings held in 2019. The participants were randomly selected among physicians attending the meeting. Age, gender, institution, and titles of the participants were recorded as demographic information. The question “which pathology do the audiological findings suggest?” was asked to physicians. Questions were open ended. It was stated that they could write possible pathologies without any number restriction.

Grouping of answers

If the participants’ answer included the correct pathology the answer was defined as “correct.” If more than one pathology was listed next to the correct answer, the others were ignored.

If the type of hearing loss was specified instead of the pathology causing the hearing loss, the response was classified as “undefined.” Responses that did not include the correct pathology and type of hearing loss were classified as “incorrect”. The audiological findings of the pathologies are given in Table 1.

Data analysis

The "correct," "undefined" and "incorrect" answers given by the participants were evaluated depending on the type of pathology presented in the audiogram, the professional titles of the participants and the institutions they work for.

RESULTS

The questionnaire was given to 87 ENT physicians (female: 21, male: 66). The mean age was 42.7 (the range was 27 - 68).

When classified according to their professional titles, 19 of the participants were residents, 53 were specialists, 6 were associate professors, and 9 were professors. Associate professors and professors were gathered in a single group under the name of faculty members. Of the participants, 28 were working in a state hospital (SH), 31 at a state university (SU), 14 at a private hospital (PH), and 5 at a private university (PU). Nine participants did not specify the institution where they worked.

The response rates of participants to pathologies according to their professional titles are given in Table 3. The highest number of "correct" responses was given to the SOM audiogram with 41%, and the lowest was given to the LVA audiogram with 0%. The highest number of "incorrect" responses were seen in the SSCD audiogram (82%) and the lowest in the SOM and MD audiogram (13%). Only the answers indicating the type of hearing loss ("undefined" answers) were seen the most in the MD audiogram (61%) and the least in the SSCD audiogram (2%). Approximately one-third (35.7%) of the participants expressed the type of hearing loss, not the pathology name. This ratio was almost the same in all groups.

The rate of the correct association of audiological findings with the pathology ("correct") was 19.2% on average. Faculty members gave the highest number of "correct" answers with 26.7%, and experts gave the lowest (16.5%).

The mean of "incorrect" response was found to be 38%. The highest "incorrect" response rate was seen in faculty members (40.2%). This rate was 37.3% for specialists and 29.3% for residents. The rate of unanswered (NR) questions was 7.2%. This rate was 10.4% for specialists and 8% for residents. The only group that answered all the questions was the faculty members.

When the answers were evaluated according to the hospitals, the highest number of "correct" answers came from SU (27.8%) and the lowest from SH (16.2%). The highest rate of "incorrect" answers came from those working in PU (60%), and the lowest among those working in PH and SH (36.8% and 37%, respectively). "Undefined" response rates were the lowest in PU (20%), and the highest in SH (38.2%) (Table 4).

When we grouped pathologies according to their frequency of occurrence (frequent: COM, SOM, MD; rare: ANSD, SSCD, LVA), the rate of "correct" response was found to be approximately 2.5 times higher in common pathologies than in rare pathologies (27.3% vs. 11%). On the other hand, the rate of "incorrect" response in rare pathologies was three times higher than in common pathologies (57% vs. 18.7%) (Table 5).

DISCUSSION

Although the diagnostic importance of audiological tests is well known, the extent to which they guide ENT physicians correctly has not been studied much. In our study, the effect of audiological findings was investigated in isolation from all other tools commonly used by ENT physicians (otoscopic examination, patient history, radiological tests, etc.). Therefore, "incorrect" or "undefined" answers by physicians should not mean that audiological tests that are not interpreted correctly will lead to the misdiagnosis of patients. When evaluated together with other diagnostic tests, audiological findings are more likely to guide physicians more accurately.

One of the difficulties in making a diagnostic evaluation with audiological findings is that the same pathology can yield distinct findings in patients. In addition, similar audiological findings may suggest different pathologies. Therefore, the expectation in our study was that the physicians examining the audiogram would state the "correct" pathology among the possible pathologies. Hence, if there is a "correct" pathology among all the pathologies that come to mind, the answers were accepted as "correct". However, the average of the

"incorrect" answers was higher than the "correct" answers. Especially in rare pathologies (ANSD, SSCD, and LVA), "incorrect" response rates were approximately five times higher than "correct" responses. This result shows that in rare pathologies, most of the participants did not associate the features of the pathology with the audiological findings well enough. In pathologies such as COM, SOM and MD, since the otoscopic examination and patient history play an important role in the physician's determination of the pathology, the relationship between these pathologies and audiological findings may be easier to establish.

The fact that "incorrect" answers were more than "correct" answers was valid for all participant groups (faculty members, ENT specialists and residents). Interestingly, the faculty members gave the highest ratio of both "correct" and "incorrect" answers. Whereas, it was expected that faculty members gave the highest "correct" answer. The high rate of "incorrect" answers can be interpreted as the audiological test battery not being evaluated holistically.

One of the difficulties in interpreting audiological tests is that different pathologies may yield similar audiological configurations. For example, hearing loss, which more often occurs at low frequencies, may resemble MD, SSCD and otosclerosis at first glance. In such a case, the relationship of air/bone conduction thresholds, acoustic reflex test and speech comprehension score gain importance in determining the diagnosis from an audiological point of view. Therefore, it is important to evaluate audiological tests holistically. The lack of holistic assessment was evident in the COM/SOM distinction. Of the 26 participants, 18 (69%) who responded "incorrect" on the COM audiogram evaluated the pathology as OME. Interpretation of COM findings as SOM is most likely related to missing the ear canal volume indicated in the tympanometric test.

Another common mistake is defining LVA and SSCD audiograms as conductive or mixed hearing loss. The audiogram configuration and the air/bone gap seen at low frequencies may suggest a conduction component in these patients. However, obtaining acoustic reflexes should have brought the inner ear anomaly to the physician's mind.

The audiogram configuration of third window syndromes such as SSCD and LVA appears to be conductive or mixed hearing loss. However, in these pathologies, hearing loss occurs due to inner ear anomalies. Classification of these pathologies according to the type of hearing loss is another matter of debate. It is generally accepted that the terms "conductive" or "mixed type" indicate that outer or middle ear diseases are effective in hearing loss. Because the middle ear does not show a pathological effect in the third window syndrome, the definition of "third window syndrome" as "conductive" or "mixed hearing loss" according to the audiological configuration was accepted as an "incorrect" answer in our study.

Responses that correctly stated the type of hearing loss, but not the pathology causing the hearing loss, were classified as "undefined". About one-third of the subjects preferred to specify the type of hearing loss, even though the questionnaire was asking "name of possible pathology." These responses were not unexpected, as the classification most frequently encountered by ENT physicians in audiological reports is for the type of hearing loss. However, it did not help us much to answer our research question about the importance of audiological findings in diagnosis.

When the results were evaluated according to the institutions where the physicians worked, it was seen that there were more "incorrect" answers in private and state universities. The results are instrumental in that they show the decision-making augmentation of ENT tests for clinical practice

CONCLUSION

When ENT physicians evaluate the results of the audiological findings independent from all other diagnostic tools (otoscopic examination, patient history, radiological tests, etc.), they can predict the actual pathology, but it turns out that error rates are higher than hit rates. The incomplete interpretation of audiological tests, emphasizing the type of hearing loss rather than possible pathology in audiological reports, and the incidence of pathologies can be considered as potential factors in increasing the error rate.

One of the critical results of the study is that more emphasis should be placed on audiological evaluation in the training of ENT residents. Another significant result is that audiological reports should be designed

to remind the ENT physician of possible pathologies. The format and the content of the audiological report may be the subject of another study. However, the indication of only the type of hearing loss in the reports does not have a crucial role in detecting the pathology.

Although not a focal point in this study, another important point to be considered is the risk created by the fact that audiological reporting is limited to the tests requested by the ENT physician. For the audiologists to clarify the possible pathology, applying additional tests on their initiative or clearly stating in their report that further tests are required will increase the reliability of the diagnosis.

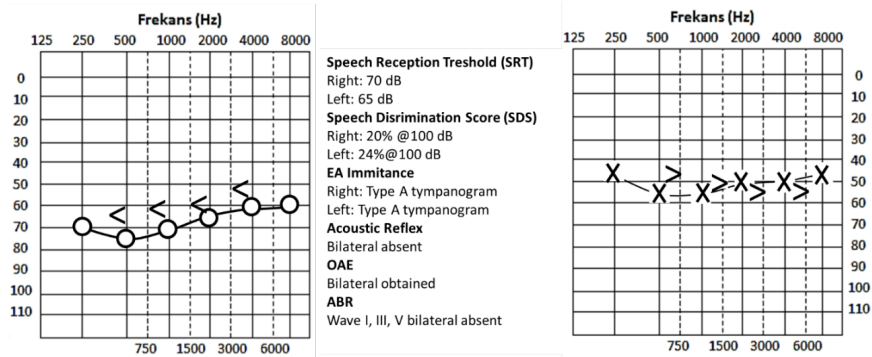
Responsibilities of audiologists and otologists and reporting of audiological tests may vary from country to country. Therefore, the instrumental value of audiological reports may differ. For example, in countries such as the USA, audiology is considered as an independent science, and in Germany, ENT physicians are more dominant in the audiological field [8]. Examining these different schools in terms of the instrumental value of audiological tests may provide effective results in the field, enhancing the critical decision making process.

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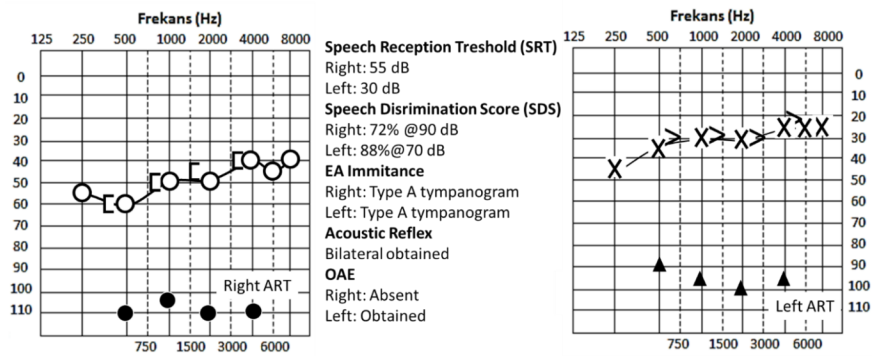
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Appendix 1: Audiometric results for six pathologies

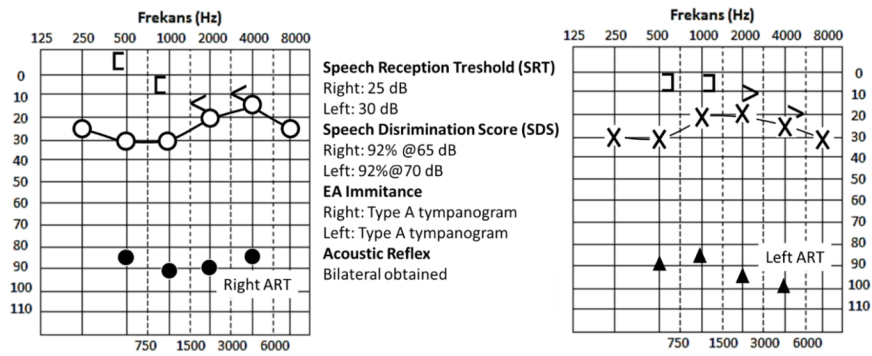
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Meniere Disease:

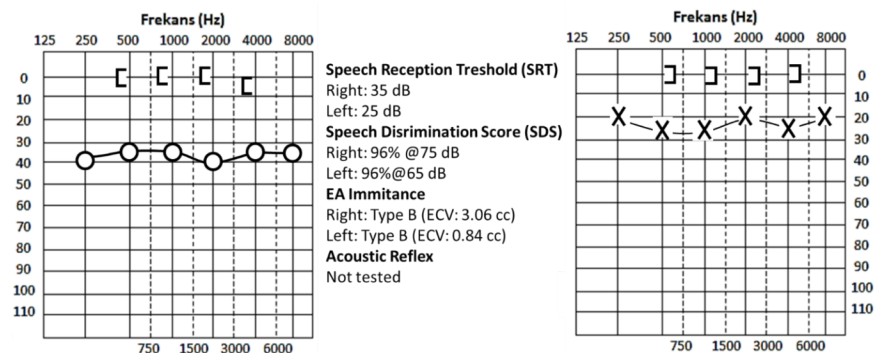


Semicircular Canal Dehiscense

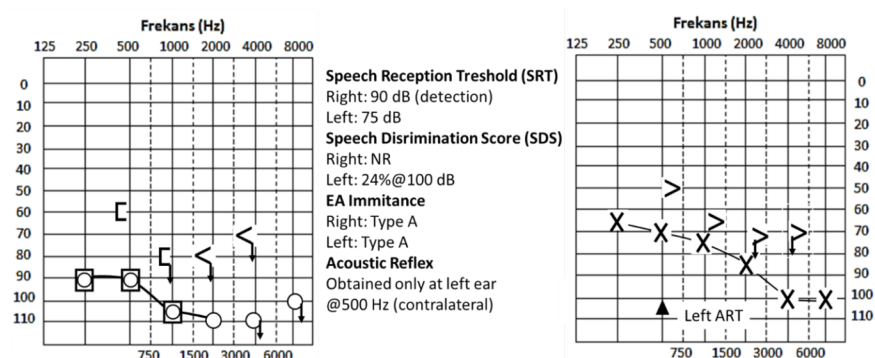


Chronic Otitis Media (left)

Secretory Otitis Media (right)



Large Vestibular Aqueduct Syndrome



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