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*RESEARCH ARTICLE*

# MEASUREMENT OF CORRELATION BETWEEN DIZZINESS HANDICAPPED INVENTORY AND PURE TONE AUDIOMETRY FOR EARLY DIAGNOSIS OF MENIERE'S DISEASE

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## Abstract

**Background:** Meniere's Disease (MD) is a chronic, non-life threatening inner ear disease, with attacks of disabling vertigo, progressive hearing loss, and tinnitus as the major symptoms. All three symptoms, separately or in combination, cause great distress and have a considerable impact on the quality of life of the patients.

**Objective:** Aim of this study was to find out whether subjective assessment or objective assessment will be significant towards diagnosis of early Meniere's disease and to find out early diagnosis of Meniere's disease by comparision between Dizziness Handicapped Inventory (DHI) & Pure tone audiometry.

**Materials and Methods:** This hospital-based retrospective study was carried out at Al Ameen Medical College Hospital, Vijayapur, Karnataka, India. The study population was composed of 93 subjects referred to the audiology department of the ENT Hospital in 01 year period, between May 2021 to April 2022. All 93 subjects underwent the following diagnostic procedures: Collecting detailed clinical history, complete neuro-otological bedside examination and pure-tone audiometry. The inclusion criteria are the presence of complete symptoms compatible with MD (tinnitus, hearing loss and vertigo) associated by documented unilateral sensorineural hearing loss. The exclusion criteria are: incomplete presentation; complete presentation associated to conductive, mixed or retrocochlear hearing loss; complete presentation, characterized by vertigo syndromes that are not compatible for clinical features and duration for MD. Other clinical exclusion criteria are tympanic perforations, active infections, inflammatory and non-inflammatory stenosis (exostoses, osteomas).

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Dizziness handicapped inventory was utilized for subjective assessment of Meniere's disease whereas Pure tone audiometry was utilized for objective assessment of Meniere's disease. In the DHI questionnaire, the patient answered "yes", "sometimes" or "no" to each question and the strength of the responses were designated with numeric values of 0, 2, and 4. The questionnaire had 25 items, such that the total score ranges from 0 to 100, with a higher score indicating a higher handicap. The relevant data was collected using a pre-tested pro-forma and after collection it was entered in Microsoft Excel to maintain the quality of data.

**Result:**In our study, Forty-five (48.4%) patients were male, 48 (51.6%) were female and the mean age was 48.9±12.1 years. The mean duration of MD was 5.6±4.7 (min: 10 months; max: 14 years) years.The means of 0.5-2 kHz air conduction thresholds (dB HL) for unilateral MD in Pathological ear and Healthy ear were 46.8±21.4 and 15.6±13.9, respectively. Speech discrimination scores (%) for unilateral MD in Pathological ear and Healthy ear were 71.5±23.6 and 93.7±6.3, respectively. The mean scores for Physical subscore, Emotional subscore and Functional subscore as per Dizziness Handicap Inventory among the study population was 15.93±8.91, 7.3±4.78 and 16.62±8.85, respectively. The total mean score for all 25 items of DHI was 38.8±19.5.

**Conclusion:** In our study, There was a significant relationship between pure tone audiometry and DHI for some variables. As a part of a clinical follow-up tool for patients with MD, the DHI is a valid, early and reliable health-related, disease-specific QoL scale.



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## Introduction:-

Meniere's disease is a disease of the inner ear, characterized by the clinical triad of recurrent vertigo, fluctuating sensorineural hearing loss, and tinnitus.[1] The relapsing nature of the disease may significantly affect the patients' quality of life, especially during periods of acute symptomatology.[2]

The incidence of Meniere's disease (MD) in the general population is slightly above 0.2-0.4% with complete presence of the three characteristic symptoms (tinnitus, hearing loss and vertigo) in only 40% and a high prevalence of incomplete manifestations that make the disease harder to diagnose in early stages.[3] The presence of cochleopathy, often characterized by the association of sensorineural hearing loss and tinnitus, could raise the suspicion of endolymphatic hydrops, especially when there is evidence of fluctuations in the hearing.[4]

Pure tone audiometry is the basic test used in the process of diagnosis and follow-up. It also plays a determining role in disease staging and treatment decisions. Progressive and sensorineural hearing loss that affects low frequencies and displays fluctuation is typically observed in MD. Besides that, different audiometric patterns can be encountered and variations in hearing loss can be seen in association with the stage of the disease. Although low frequencies are generally affected to a greater extent, hearing loss influences all frequencies in the advanced disease, which causes a flat audiogram. In accordance with the AAO HNS CHE guidelines, the mean pure tone air conduction hearing threshold at the frequencies of 0.5, 1.2, and 3 kHz refers the stage of hearing level.[5]

The Dizziness Handicap Inventory (DHI), developed by Jacobson and Newman to assess disability grade is the most widely used scale to assess the self-perceived handicapping effects imposed by vestibular system diseases. The DHI consists of 25 items designed to determine dizziness-dependent changes grouped into three domains: Functional, emotional, and physical.[6]

Clinical symptoms and audiometric tests are the basis for the diagnosis; however, differential diagnosis may be extremely difficult, since most of the findings are subjective and not specific. Misdiagnosis is, therefore, probable, thus highlighting the great need for objective and reliable testing.[7]

The reasons for misdiagnosis are multiple: the finding of normal reflectivity in patient's vestibular tests (due to a transient labyrinthine hypofunction), the presence of co-existing diseases, the underestimation of the incidence of acute attacks not reported by the patient (because were attributed to other causes) and finally wrong diagnostic approaches.[8] Therefore, it is necessary a correct initial symptoms assessment for an early identification of MD. Currently the majority of audiological tests have negative or doubt results for a definite diagnosis in the initial stage, however early diagnosis make possible to treat the disease before becomes chronic.[9,10]

In view of the above, a hospital-based retrospective study was carried out at Al Ameen Medical College Hospital, Vijayapur, Karnataka, India between May 2021 to April 2022 on 93 patients who hadpresence of complete symptoms compatible with MD.

## Method:-

This hospital-based retrospective study was carried out at Al Ameen Medical College Hospital, Vijayapur, Karnataka, India. The study population was composed of 93 subjects referred to the audiology department of the ENT, Al Ameen Medical College Hospital in 01 year period, between May 2021 to April 2022. All 93 subjects underwent the following diagnostic procedures: Collecting detailed clinical history, complete neuro-otological bedside examination and pure-tone audiometry.Aim of this study was to find out whether subjective assessment or objective assessment will be significant towards diagnosis of early Meniere's disease and to find out early diagnosis of Early Meniere's disease. The inclusion criteria are the presence of complete symptoms compatible with MD (tinnitus, hearing loss and vertigo) associated by documented unilateral sensorineural hearing loss. The exclusion criteria are: incomplete presentation; complete presentation associated to conductive, mixed or retrocochlear hearingloss; complete presentation, characterized by vertigo syndromes that are not compatible for clinical features and duration for MD. Other clinical exclusion criteria are tympanic perforations, active infections, inflammatory and non-inflammatory stenosis (exostoses, osteomas). Dizziness handicapped inventory was utilized for subjective assessment of Meniere's diseasewhereas Pure tone audiometry was utilized for objective assessment of Meniere's disease. In the DHI questionnaire, the patient answered "yes", "sometimes" or "no" to each question and the strength of the responses were designated with numeric values of 0, 2, and 4. The questionnaire had 25 items, such that the total score ranges from 0 to 100, with a higher score indicating a higher handicap.

The relevant data was collected using a pre-tested pro-forma and after collection it was entered in Microsoft Excel to maintain the quality of data.

## Results:-

Forty-five (48.4%) patients were male, 48 (51.6%) were female and the mean age was 48.9±12.1 years. The mean duration of MD was 5.6±4.7 (min: 10 months; max: 14 years) years. Fourty-two cases were pathological in the right ear (n=42 patients, 45.2%), and in the left ear (n=45 patients, 48.4%). There were six (6.5%) bilateral cases. The mean attack time was 5.2±9.8 h. 40.9% of patients had one or more accompanying chronic diseases. The most common comorbidities were hypertension (8.6%), coronary artery disease (5.4%), thyroid related pathologies (5.4%), depression (3.2%), and hypertension plus diabetes mellitus (3.2%). The familial MD history was 8.6%. The description of at least one attack trigger was 77%; the highest values were stress (35.5%), stress plus seasonal changes (9.7%), seasonal changes only (5.4%), stress plus effort (4.3%), and stress plus sleepiness (3.2%). The audiological findings regarding patients with unilateral and bilateral MD are shown in Table 1.

**Table 1:-** Pure tone and speech audiometry means and standard deviations of the patients with unilateral and bilateral Meniere's Disease (MD).

| | Unilateral MD (n=87) | | Bilateral MD (n=6) | |
|---|---|---|---|---|
| | Pathological ear | Healthy ear | Right ear | Left ear |
| Means of 0.5-2 kHzair conduction thresholds (dB HL) | 46.8±21.4 | 15.6±13.9 | 58±14.4 | 46±14.7 |
| Means of 0.5-3 kHzair conduction thresholds (dB HL) | 47.4±22.3 | 18.8±15.1 | 54.8±19 | 49.5±21.4 |
| Speech discriminationscores (%) | 71.5±23.6 | 93.7±6.3 | 58.7±30 | 70.6±21.1 |

As per above Table 1, the means of 0.5-2 kHz air conduction thresholds (dB HL) for unilateral MD in Pathological ear and Healthy ear were 46.8±21.4 and 15.6±13.9, respectively. Similarly, the means of 0.5-2 kHz air conduction

thresholds (dB HL) for bilateral MD in Right ear and Left ear were 58±14.4and 46±14.7, respectively. Again as per above Table 1, the means of 0.5-3 kHz air conduction thresholds (dB HL) for unilateral MD in Pathological ear and Healthy ear were 47.4±22.3and 18.8±15.1, respectively. Similarly, the means of 0.5-3kHz air conduction thresholds (dB HL) for bilateral MD in Right ear and Left ear were 54.8±19and 49.5±21.4, respectively. Speech discrimination scores (%) for unilateral MD in Pathological ear and Healthy ear were 71.5±23.6and 93.7±6.3, respectively. Speech discrimination scores (%) for bilateral MD in Right ear and Left ear were 58.7±30and 70.6±21.1, respectively.

**Table 2:-** Dizziness Handicap Inventory-mean scores and standard deviations.

| Dizziness Handicap Inventory | Mean Scores±SD |
|---|---|
| Physical subscore (9 items) | 15.93±8.91 |
| Emotional subscore (7 items) | 7.3±4.78 |
| Functional subscore (9 items) | 16.62±8.85 |
| Total (25 items) | 38.8±19.5 |

Above Table 2 shows the Dizziness Handicap Inventory findings for MD patients. The mean scores for Physical subscore, Emotional subscoreand Functional subscoreas per Dizziness Handicap Inventory among the study population was 15.93±8.91, 7.3±4.78 and 16.62±8.85, respectively.The total mean score for all 25 items of DHI was 38.8±19.5.

**Table 3:-** The relations between Pure toneaudiometry and Dizziness Handicap Inventory scores (disability as percentage).

| **Pure tone audiometry** | | | | | | |
|---|---|---|---|---|---|---|
| | **Acute EpisodeSubscale** | | **Between the episodes subscale** | | **Total score** | |
| **DHI** | r | p | r | p | r | p |
| **Physical Subscale** | 0.220* | 0.034 | 0.263* | 0.011 | 0.292** | 0.004 |
| **Emotional Subscale** | 0.239* | 0.021 | 0.478** | 0.0001 | 0.487** | 0.0001 |
| **Functional Subscale** | 0.091 | 0.384 | 0.331** | 0.001 | 0.315** | 0.002 |
| **Total Score** | 0.196 | 0.06 | 0.39** | 0.0001 | 0.397** | 0.0001 |

Spearman's Correlation coefficients; r: correlation coefficients, p: significancy)
**Correlation is significant at the 0.01 level.
*Correlation is significant at the 0.05 level

In the above Table 3, pure tone audiometryand DHI scores were evaluated in relation to each other and a significant relation was found between them for few variables. Physical and emotional subscale of DHI showed significant correlation at 0.05 level with acute episode subscale of pure tone audiometry. While, physical subscale of DHI showed significant correlation at 0.01 level with between the episodes subscale of pure tone audiometry.Functional Subscale of DHI showed significant correlation at 0.01 level with between the episodes subscale of pure tone audiometry.

## Discussion:-

The main objective of the use of disease-specific QoL scales is to determine the effects of the disease on QoL.[11] It is difficult to measure the effects of MD because the severity of the symptoms and the disease characteristics vary over time and from patient to patient. In our clinical practice, we have realized that previously reported vertigo and/ or balance related QoL surveys are not completely compatible with MD characteristics. For MD, the questionnaire should be specific not only to the disease but also to the episodes and/or time between the episodes.

The AAO-HNS guide[12] suggests the use of audiometric findings, number of attacksfor reportingthe improvement of patients with MD.
The most popular survey, the DHI, is a reliable tool to assess patients with vestibular disorders, but not appropriate for the episodic structure of MD.[13,14,15,16] Items in the DHI are grouped with three scales. However, it is reported that the scale's scoring system might not be sufficiently sensitive to the minor changes and that Likert scales could be

more appropriate.[17] For this reason, in this study, a 1 to 5 Likert scale has been chosen as the scoring system for the DEU-MDDS.[7] In a study, the DHI total scores were 22.67±12.55 points in bilateral MD cases and 17.72±9.98 points in unilateral cases.[18] In another study, the DHI total score was 39±21 points.[19] In the present study, the mean total DHI score in unilateral MD patients was 38.8±19.5 points. The significance of the relationship between DEU-MDDS and DHI-T was also evaluated in this study. The correlation coefficients of the between the episode subscale were higher than those of the acute episode scale of the DEU-MDDS. This result is thought to originate from the limited capacity of the DHI to measure the symptoms in the acute stage. Moreover, the relatively low DHI-T scores could be a result of this condition.[20]

## Conclusion:-

There was a significant relationship between pure tone audiometry and DHI for some variables. As a part of a clinical follow-uptool for patients with MD, the DHI is a valid, early and reliable health-related, disease-specific QoL scale.

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**Conflict of interest:**
None declared.

**Ethical Approval:**
The study was approved by the Institutional Ethics Committee.

## References:-

1. Rizk HG, Mehta NK, Qureshi U, Yuen E, Zhang K, Nkrumah Y, Lambert PR, Liu YF, McRackan TR, Nguyen SA, Meyer TA. Pathogenesis and etiology of Meniere disease: a scoping review of a century of evidence. JAMA Otolaryngology–Head & Neck Surgery. 2022 Feb 10.
2. Naples JG, Soda D, Rahman K, Ruckenstein MJ, Parham K. Evaluating the role of otologic biomarkers to differentiate meniere's disease and vestibular migraine. Ear and Hearing. 2022 Mar 1;43(2):699-702.
3. Moleon MC, Torres-Garcia L, Batuecas-Caletrio A, Castillo-Ledesma N, Gonzalez-Aguado R, Magnoni L, Rossi M, Di Berardino F, Perez-Guillen V, Trinidad-Ruiz G, Lopez-Escamez JA. A Predictive Model of Bilateral Sensorineural Hearing Loss in Meniere Disease Using Clinical Data. Ear and Hearing. 2022 May 1;43(3):1079-85.
4. Mammarella F, Zelli M, Varakliotis T, Eibenstein A, Pianura CM, Bellocchi G. Is electrocochleography still helpful in early diagnosis of Meniere disease?. Journal of audiology & otology. 2017 Jul;21(2):72.
5. Vassiliou A, Vlastarakos PV, Maragoudakis P, Candiloros D, Nikolopoulos TP. Meniere's disease: Still a mystery disease with difficult differential diagnosis. Annals of Indian Academy of Neurology. 2011 Jan;14(1):12.
6. Güneri EA, Çakır A, Mutlu B. Validity and reliability of the diagnostic tests for Ménière's disease. Turkish archives of otorhinolaryngology. 2016 Sep;54(3):124.
7. Mutlu B, Kırkım G, Durankaya SM, Gürkan S, Başokçu TO, Güneri EA. The Reliability and Validity of "DokuzEylül University Meniere's Disease Disability Scale". The Journal of International Advanced Otology. 2018 Aug;14(2):304.
8. Zamyslowska-Szmytke E, Politanski P, Jozefowicz-Korczynska M. Dizziness handicap inventory in clinical evaluation of dizzy patients. International Journal of Environmental Research and Public Health. 2021 Mar;18(5):2210.
9. Polit DF, Beck CT. The content validity index: are you sure you know what's being reported? Critique and recommendations. Research in nursing & health. 2006 Oct;29(5):489-97.
10. Convert C, Franco-Vidal V, Bebear JP, Darrouzet V. Outcome-based assessment of endolymphatic sac decompression for Ménière's disease using the Ménière's disease outcome questionnaire: a review of 90 patients. Otology &Neurotology. 2006 Aug 1;27(5):687-96.

11. Ballard DP, Sukato DC, Timashpolsky A, Babu SC, Rosenfeld RM, Hanson M. Quality-of-life outcomes following surgical treatment of Ménière's disease: A systematic review and meta-analysis. Otolaryngology–Head and Neck Surgery. 2019 Feb;160(2):232-8.
12. Phillips JS, Westerberg B. Intratympanic steroids for Ménière's disease or syndrome. Cochrane Database of Systematic Reviews. 2011(7).
13. Söderman AC, Bagger-Sjöbäck D, Bergenius J, Langius A. Factors influencing quality of life in patients with Ménière's disease, identified by a multidimensional approach. Otology &neurotology. 2002 Nov 1;23(6):941-8.
14. Anderson JP, Harris JP. Impact of Meniere's disease on quality of life. Otology &neurotology. 2001 Nov 1;22(6):888-94.
15. Green Jr JD, Verrall A, Gates GA. Quality of life instruments in Meniere's disease. The Laryngoscope. 2007 Sep;117(9):1622-8.
16. Levo H, Stephens D, Poe D, Kentala E, Rasku J, Pyykko I. EuroQol 5D quality of life in Meniere's disorder can be explained with symptoms and disabilities. International Journal of Rehabilitation Research. 2012 Sep 1;35(3):197-202.
17. Duracinsky M, Mosnier I, Bouccara D, Sterkers O, Chassany O, Working Group of the Société Françaised' Oto-Rhino-Laryngologie (ORL). Literature review of questionnaires assessing vertigo and dizziness, and their impact on patients' quality of life. Value in health. 2007 Jul;10(4):273-84.
18. Park HJ, Migliaccio AA, Della Santina CC, Minor LB, Carey JP. Search-coil head-thrust and caloric tests in Meniere's disease. Actaoto-laryngologica. 2005 Jan 1;125(8):852-7.
19. Perez-Fernandez N, Montes-Jovellar L, Cervera-Paz J, Domenech-Vadillo E. Auditory and vestibular assessment of patients with Ménière's disease who suffer Tumarkin attacks. Audiology and Neurotology. 2010;15(6):399-406.
20. Stephens D, Kentala E, Varpa K, Pyykkö I. Positive experiences associated with Ménière's disorder. Otology &Neurotology. 2007 Oct 1;28(7):982-7.