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Development and Validation of a Hearing Screening Checklist for Women During Menopause Stage: A Cross-Sectional Study

Mayank Mehra[1], Sandeep Kumar[2], Anoop Kumar Singh[3], Omprakash Preyadarshi[4]

[1]Research Scholar, Department of Audiology & Speech-Language Pathology, School of Allied Health Sciences, Shree Guru Gobind Singh Tricentenary University, Gurugram, Haryana, India
[2]Audiologist, Gentle Speech and Vertigo Clinic, Gaya , India
[3]Assistant Professor, Department of Audiology & Speech-Language Pathology, Maa Baliraji sewa sanstha Mirzapur Uttar Pradesh
[4]Senior Audiologist, Gentle Speech and Vertigo Clinic, Gaya , India

Abstract

Background: Menopause is associated with hormonal alterations that may affect auditory functioning. Evidence suggests that estrogen deficiency may influence cochlear physiology and hearing sensitivity.

Objective: To develop and validate a hearing screening checklist for women during different stages of menopause and compare checklist findings with audiological evaluation.

Methods: Sixty women aged 35–52 years were categorized into pre-menopause, peri-menopause, and post-menopause groups. A 25-item hearing screening checklist was developed, validated, and administered. Participants underwent otoscopic examination, Pure Tone Audiometry (PTA), and Transient Evoked Otoacoustic Emission (TEOAE) testing.

Results: Significant differences were observed among menopausal groups for questionnaire scores ($p=0.007$) and PTA findings ($p=0.023$). Hearing difficulties were more frequently reported in post-menopausal women. The checklist demonstrated excellent reliability (Cronbach's alpha = 0.935).

Conclusion: The developed checklist is a reliable and clinically useful screening tool for early identification of hearing difficulties among menopausal women.

Keywords: Menopause, Hearing Loss, Hearing Screening, Audiology, Estrogen, Questionnaire Validation, Women's Health

Introduction

Menopause is a natural biological process characterized by the permanent cessation of menstruation due to loss of ovarian follicular activity. It is accompanied by substantial hormonal changes, particularly a reduction in estrogen and progesterone levels. These hormonal alterations affect multiple physiological systems including cardiovascular, skeletal, neurological, and sensory functions.

The auditory system contains estrogen receptors in both peripheral and central pathways. Several studies have reported that estrogen may have a protective effect on cochlear structures and auditory neural

pathways. Consequently, hormonal decline during menopause may contribute to deterioration in hearing sensitivity, difficulties in speech perception, tinnitus, and communication challenges. Despite increasing evidence linking menopause and hearing decline, hearing-related concerns among menopausal women remain under-recognized. Screening tools specifically designed for this population are scarce. Therefore, the present study aimed to develop and validate a hearing screening checklist for women during menopause and examine its effectiveness by comparing screening outcomes with audiological assessments.

Review of Literature

Previous investigations have highlighted the relationship between hormonal status and auditory functioning. Hederstierna et al. reported that post-menopausal women demonstrate poorer hearing thresholds compared with pre-menopausal women. Curhan et al. identified associations between menopause, hormone therapy, and hearing loss risk. Kilicdag et al. observed improvements in hearing following estrogen therapy, supporting the role of hormonal influence on auditory function. Trott et al. emphasized the role of hormones in central auditory processing, while Zhang et al. demonstrated associations between ovarian reserve and hearing sensitivity. Collectively, these studies indicate that menopause may contribute to age-related auditory decline and justify the development of screening approaches targeted toward this population.

Aim and Objectives

Aim:

1. To develop and validate a hearing screening checklist for women during menopause.

Objectives:

1. To develop a screening checklist for assessing hearing sensitivity during menopause.
2. To compare hearing sensitivity among women in pre-menopause, peri-menopause, and post-menopause stages.
3. To determine the reliability and clinical utility of the checklist by comparing it with audiological evaluation.

Methodology

A cross-sectional research design was adopted. Sixty female participants aged 35–52 years were recruited and divided equally into three groups: Pre-Menopause (n=20), Peri-Menopause (n=20), and Post-Menopause (n=20).

Inclusion criteria included women within the target age range without significant medical, neurological, psychological, or audiological disorders. Participants with previous ear surgery, chronic ear infections, surgical menopause, PCOS/PCOD, hysterectomy, oophorectomy, or significant hormonal disturbances were excluded.

A 25-item hearing screening checklist was developed through literature review, expert consultation, pilot testing, and linguistic validation. The checklist consisted of demographic information, medical and audiological history, menstrual status, and hearing-related questions.

Audiological evaluation included otoscopic examination, Pure Tone Audiometry (250–8000 Hz), and TEOAE assessment. Testing was conducted in a sound-treated environment using calibrated equipment.

Statistical Analysis

Data were analyzed using descriptive and inferential statistics. One-way Analysis of Variance (ANOVA) was used to compare questionnaire and PTA scores among the three menopausal groups. Tukey post-hoc analysis was performed for pairwise comparisons. Reliability of the questionnaire was assessed using Cronbach's alpha coefficient. Statistical significance was considered at $p < 0.05$.

Results

The ANOVA analysis revealed significant differences in questionnaire scores among menopausal groups ($p = 0.007$), indicating increased hearing-related complaints in peri-menopausal and post-menopausal women. PTA results also demonstrated significant group differences ($p = 0.023$).

Post-hoc analysis showed significant differences between pre-menopausal and post-menopausal groups for both questionnaire responses and PTA findings. No statistically significant differences were observed between pre-menopausal and peri-menopausal groups or between peri-menopausal and post-menopausal groups in some comparisons.

A total of ten participants demonstrated hearing loss, with a higher prevalence observed among post-menopausal women. TEOAE findings were largely normal across groups. Reliability analysis yielded a Cronbach's alpha value of 0.935, indicating excellent internal consistency of the checklist.

Discussion

The findings support the hypothesis that hearing sensitivity may decline during and after the menopausal transition. Reduced estrogen levels may affect cochlear metabolism, vascular supply, neurotransmission, and neural synchrony within the auditory system. These physiological changes may contribute to subtle hearing difficulties that become more apparent during peri-menopause and post-menopause.

The present findings are consistent with previous reports showing poorer hearing thresholds among post-menopausal women. The observed differences between pre-menopausal and post-menopausal groups further support the role of hormonal influences in auditory functioning.

The high reliability score obtained in the present study demonstrates that the developed questionnaire provides a stable and consistent measure of hearing-related difficulties. The checklist may therefore serve as a practical screening tool in community health programs, audiology clinics, and primary healthcare settings.

Clinical Implications

The developed checklist can facilitate early detection of hearing difficulties among menopausal women. It can be administered in community-based screening programs, outpatient clinics, telehealth services, and preventive healthcare initiatives. Early identification may improve referral pathways and reduce delays in audiological intervention.

Limitations

The study was conducted on a relatively small sample and participants from limited geographical regions. Hormonal assays were not included. Longitudinal follow-up was also not performed. Therefore, causal relationships between hormonal changes and hearing decline could not be established.

Future Directions

Future studies should include larger and more diverse samples, objective hormonal measurements, longitudinal follow-up, and advanced audiological tests such as ABR, ASSR, speech-in-noise assessment, and cortical auditory evoked potentials. Multicentric studies may further improve the generalizability of findings.

Conclusion

The study successfully developed and validated a hearing screening checklist for women during menopause. Significant differences in hearing-related complaints and audiological findings were observed across menopausal stages. The checklist demonstrated excellent reliability and showed good clinical utility as a screening instrument. Early hearing screening among menopausal women may contribute to timely diagnosis and intervention, thereby improving quality of life and communication outcomes.

Ethical Considerations

Written informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity of participant information were maintained throughout the study.

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