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Association Between Vitiligo and Auditory Functions: A Comparative Study

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Abstract

AIMS & OBJECTIVES OF THE STUDY:

1. To assess auditory functions in vitiligo patients.
2. To evaluate the frequency and characteristics of hearing loss by means of audiometry.

MATERIALS and METHODS: The study was conducted at PES Institute of Medical Sciences and Research (PESIMSR), Kuppam. The study population comprised two distinct groups: individuals diagnosed with vitiligo (study group) and age- and gender-matched healthy individuals without vitiligo (control group).

RESULT: This comparative observational study demonstrates a higher prevalence of mild sensorineural hearing loss (SNHL) in individuals with vitiligo compared to healthy controls.

Audiometric analysis showed elevated hearing thresholds, particularly at low and high frequencies.

Although SNHL was more common in males, no strong gender association was established.

The chronicity of vitiligo underscores the need for long-term monitoring. These results highlight the importance of routine audiological evaluation in vitiligo patients.

CONCLUSION: The study highlights the presence of mild sensorineural hearing loss in vitiligo patients, particularly at lower and mid-range frequencies. The findings suggest that vitiligo may be associated with subtle auditory dysfunction, with a higher prevalence of SNHL among vitiligo patients.

KEYWORDS: Vitiligo, Sensorineural Hearing loss, Melonocytes, Pure tone audiogram, Stria vascularis

Introduction:

Vitiligo is an acquired disorder characterized by the progressive destruction of melanocytes, the pigment-producing cells, resulting in clearly demarcated white patches on the skin. Although the exact etiology remains uncertain, a combination of genetic predisposition, autoimmune dysregulation, and environmental triggers is believed to contribute to its development.

Though vitiligo is primarily cutaneous, melanocytes are also present in other parts of the body, including the eyes, leptomeninges, and inner ear. Within the auditory system, these pigment cells are notably located in the basal region of the cochlea, where they are essential for the perception of high-frequency sounds.[1] Melanocytes play a vital role in sustaining the electrochemical gradient of the endolymph, a critical factor for optimal cochlear hair cell function and auditory signal transduction.[2]

Aim:

1. To assess auditory functions in vitiligo patients.
2. To evaluate the frequency and characteristics of hearing loss by means of audiometry.

Study Design: A Prospective study

Method: This study was designed as a comparative study to evaluate hearing function among individuals with vitiligo in comparison to healthy controls.

The study was conducted at PES Institute of Medical Sciences and Research (PESIMSR), Kuppam. The study population comprised two distinct groups: individuals diagnosed with vitiligo (study group) and age- and gender-matched healthy individuals without vitiligo (control group).

A purposive sampling method was employed to select participants who met the inclusion and exclusion criteria.

Observations:

Inclusion Criteria-

1. **Study Group**: Individuals of either sex, aged between 18 and 40 years, with a confirmed clinical diagnosis of vitiligo.
2. **Control Group**: Healthy volunteers without any clinical evidence or history suggestive of vitiligo.

Exclusion Criteria-

1. Active or past middle ear disease
2. History of ear surgery
3. Family history of hearing impairment
4. Use of ototoxic medications
5. Prolonged exposure to loud environmental noise
6. History of head injury
7. Presence of chronic systemic illnesses

Frequency	Vitiligo_Mean	Vitiligo_SD
R250	25.48	8.48
L250	20.48	7.00
R500	21.69	5.43
L500	18.23	7.69
R1000	17.0	5.77
L1000	21.53	6.05
R2000	14.11	7.55
L2000	17.82	6.75
R4000	18.23	8.05
L4000	18.63	8.50
R8000	20.97	13.55
L8000	18.71	9.10

Table 1: Mean Hearing Thresholds in Vitiligo patients

Discussion:

Vitiligo is an acquired pigmentary disorder characterized by the appearance of distinct, depigmented macules and patches on the skin due to the dysfunction or loss of melanocytes in the epidermis.

Globally, it affects approximately 1% of the population. An Indian epidemiological survey conducted on November 20, 2012, across four major geographical zones—North, South, East, and West—reported a point prevalence of 9.98%[3]. While vitiligo affects individuals of all ages and genders, a higher incidence among females has often been reported, potentially due to sociocultural stigma surrounding skin discoloration in women.

Around 50% of vitiligo patients begin to show symptoms before the age of 20, and nearly 70–80% are diagnosed by age 30. Although the precise etiology remains unclear, a combination of genetic, immunological, and neurogenic factors—alongside self-destructive processes—is believed to contribute. A widely accepted hypothesis involves autoimmune mechanisms, where melanocyte-specific antigens are targeted by autoantibodies, leading to melanocyte destruction[4].

Melanocytes are present not only in the skin but also in hair follicles, the uveal tract, the retinal pigment epithelium, the leptomeninges, and inner ear structures. This widespread distribution raises the possibility that the melanocytic damage seen in vitiligo may extend to other organs. Scientific literature remains divided on whether vitiligo has a direct influence on auditory function; some studies indicate a correlation, while others report no significant link[5].

Given this ambiguity, the present study was designed to evaluate auditory function in vitiligo patients compared to healthy, age- and gender-matched controls. Otologic melanocytes—located in the stria vascularis, cochlear hair cells, endolymphatic sac and vestibular organs—play a role in hearing, likely through ion transport mechanisms, including Na^+/K^+-ATPase and potassium channels. These systems are essential for generating the endocochlear potential, which underpins hair cell activity and, consequently, auditory and vestibular signaling to the brain.

This study was a comparative observational investigation conducted at PES Institute of Medical Sciences and Research (PESIMSR), Kuppam. Participants were divided into two groups: a study group comprising vitiligo patients and a control group of individuals without vitiligo.

The audiometric analysis conducted on vitiligo patients in the present study reveals elevated hearing thresholds across a broad range of frequencies, suggesting the presence of sensorineural hearing loss (SNHL), even if subclinical in some individuals. The highest mean hearing threshold was noted at R250 Hz (25.48 dB), followed closely by R8000 Hz (20.97 dB).

This pattern indicates that hearing impairment in vitiligo may be more pronounced at both low and high frequency ranges. On the left side, a similar trend is observed, with L250 Hz recording a mean threshold of 20.48 dB, pointing toward bilateral involvement. Furthermore, the presence of relatively high standard deviations, such as 13.55 dB at R8000 Hz, suggests substantial inter-individual variability in hearing sensitivity among vitiligo patients. These findings collectively point to a mild to subclinical degree of SNHL, with greater thresholds observed at the frequency extremes, potentially reflecting cochlear involvement.

Comparable observations have been reported in previous research. For instance, Lien et al.[6]conducted a meta-analysis evaluating pure tone hearing thresholds at various frequencies in vitiligo patients versus healthy controls. Their findings demonstrated significantly higher thresholds at 2000 Hz, 4000 Hz, and 8000 Hz in the vitiligo group, particularly emphasizing the risk of high-frequency SNHL. This suggests that the cochlear base, which is responsible for processing high-frequency sounds, may be especially susceptible in individuals with vitiligo, possibly due to melanocyte loss affecting cochlear function.

Additionally, the current study observed a statistically significant positive correlation between age and hearing loss in both the vitiligo and control groups. This correlation is consistent with known patterns of

age-related auditory decline but also raises the possibility that vitiligo may accelerate or exacerbate age-related cochlear degeneration. These findings further strengthen the hypothesis that melanocyte dysfunction in the inner ear—a characteristic feature of vitiligo—may contribute to early-onset or progressive hearing impairment, even in the absence of overt symptoms.

The audiometric data from this study aligns with existing literature in demonstrating that vitiligo patients are at an increased risk for subtle to mild forms of SNHL, particularly affecting high and low frequencies. This underscores the need for routine audiological screening and long-term auditory monitoring in patients diagnosed with vitiligo, especially as they age.

The study analysed the hearing thresholds of vitiligo patients and healthy controls, revealing significant differences at most frequencies. The results showed that vitiligo patients had higher (worse) hearing thresholds than healthy controls, particularly at lower and mid-range frequencies. The pure tone average (PTA) values for the healthy control group indicated normal hearing thresholds, with the mean R_PTA (right ear) being 14.81 dB and L_PTA (left ear) being 14.75 dB. These values serve as a reliable baseline for comparison with vitiligo patients when evaluating the impact of vitiligo on auditory function.

The vitiligo group showed elevated PTA values in both ears, suggesting a trend toward mild sensorineural hearing loss, especially in the left ear among vitiligo patients. The higher standard deviations in the vitiligo group indicate more variability in hearing thresholds. Overall, these results point to a statistically and clinically relevant auditory impact associated with vitiligo.

These observations are in agreement with previous studies. For instance, Sima Tajik et al[7] reported SNHL in 14 vitiligo patients (53.8%) compared to 5 patients (19.2%) in the control group. The statistical analysis revealed a significant association between vitiligo and SNHL with an odds ratio of 4.9 and a p-value of 0.010, indicating that vitiligo patients were nearly five times more likely to develop SNHL than controls. Furthermore, their study offered a detailed breakdown of hearing loss types: 38.4% of vitiligo patients had bilateral hearing loss, and 15.4% had unilateral hearing loss. In terms of frequency-specific impairment, low-frequency hearing loss (250–500 Hz) was noted in 5 patients, mid-frequency (1000–2000 Hz) in 4 patients, and high-frequency loss (4000–8000 Hz) in 13 patients, suggesting a predilection toward high-frequency SNHL. The most severe degree of hearing loss observed in their cohort was moderate (up to 55 dB HL). Additionally, they reported significantly higher rates of bilateral hearing loss at 8000 Hz in vitiligo patients than in controls ($P = 0.017$, $P = 0.048$), and elevated hearing thresholds in the right ear at 500 and 2000 Hz ($P < 0.05$), further pointing to localized cochlear involvement.

Similarly, the study by Hari Bhaskar et al. identified mild SNHL in 30% of vitiligo patients, with a distinct predominance at higher frequencies. Their findings are consistent with the notion that autoimmune mechanisms, potentially shared between vitiligo and auditory system pathologies, may contribute to inner ear damage.[8]

Conclusion:

This comparative observational study demonstrates a higher prevalence of mild sensorineural hearing loss (SNHL) in individuals with vitiligo compared to healthy controls.

Audiometric analysis showed elevated hearing thresholds, particularly at low and high frequencies.

The findings indicate subtle auditory dysfunction in vitiligo patients, supporting a potential link between vitiligo and cochlear involvement.

Although SNHL was more common in males, no strong gender association was established.
The chronicity of vitiligo underscores the need for long-term monitoring. These results highlight the importance of routine audiological evaluation in vitiligo patients.

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