Audiological Abnormalities in Vitiligo Patients: A Hospital-Based Cross-Sectional Study

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Abstract

Introduction There are some discrepancies in the literature about the influence of vitiligo on auditory functions. According to some authors, vitiligo influences hearing, whereas others question such influence. Therefore, we conducted a study to evaluate audiological functions in vitiligo patients.

Objectives To determine the effect of vitiligo on auditory functions.

Methods A hospital-based observational study was done from January 2017 to July 2017. Clinically diagnosed cases of vitiligo were enrolled for the study. A complete otological examination was conducted in all patients.

Results Fifty-two patients (male: female 28:24) were included in the study. Ten patients (19.2%) had sensorineural hearing loss (SNHL). Seven patients (13.5%) had bilateral and 3 (5.7%) had unilateral SNHL. High frequency loss was seen in 17 out of 20 ears (10 affected patients), 6 ears had both low and high-frequency hearing loss. Of 12 ears with speech frequency involvement, mild hearing loss was seen in 5 and moderate to severe in 1 ear. Most cases of SNHL were detected in the age group 41 to 60 years old (63.6%), which was statistically significant (p-value 0.00).

Conclusion The results of this study suggest that vitiligo patients require routine monitoring for auditory functions for early identification of SNHL. Older subjects with vitiligo might be at a higher risk for audiological abnormalities. These patients should also be informed regarding the associated risk with noise and ototoxic drug exposure.

Keywords
- vitiligo
- sensorineural hearing loss
- audiological functions

Introduction

Vitiligo is an acquired discoloration of skin caused by loss or damage of epidermal melanocyte and characterized by well-defined depigmented macules. It occurs worldwide with an overall prevalence of1%.[1] In a study from India, the point prevalence was 9.982 from four zones of India namely North, South, East and West on 20 November 2012.[2] Adults and children of both genders are equally affected, and the greater number of reports among females could be explained by the social consequences to females affected by vitiligo.[1] Almost 50% of vitiligo patients present with symptoms before 20 years of age and nearly 70 to 80% before 30 years of age.[1]

The exact etiology of vitiligo is not known. However, genetic, neural, immunological and self-destructive patho-mechanisms are said to be involved. Autoantibodies are directed against the antigens of melanocytes, which lead to the destruction of melanocytes. Melanocytes are located in the epidermis, hair bulbs, uveal tract, retinal pigmented epithelium, leptomeninges, and inner ear.

Hence, the mechanisms responsible for the destruction of melanocyte in the skin affect melanocytes in other locations as

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well. There are some discrepancies in the literature about the influence of vitiligo on auditory functions. According to some authors, vitiligo influences hearing,[3–9] whereas others question such influence.[10–13] Accordingly, this study was designed to evaluate the audiological functions in vitiligo patients.

Materials and Methods

A hospital-based prospective observational study was done from January 2017 to July 2017 after obtaining permission from the institutional ethics committee. After obtaining a written informed consent, clinically diagnosed cases of vitiligo patients were enrolled for the study. The demographic profile, duration and evolution of vitiligo, personal and family history, medical history, cutaneous and otological examination were recorded in a predesigned proforma. Pregnant females, history or evidence of otological disease, documented hearing loss, familial hearing loss, ototoxic drug intake, chronic exposure to noise, neurological, vascular, or systemic diseases, such as diabetes and hypertension, were excluded.

A complete otological examination was conducted in all patients by an otorhinolaryngologist. Otological examination included external examination, tuning fork and pure tone audiometry. Audiological evaluation was performed in a sound-treated room using a single-channeled audiometer. The audiometer, which was used for threshold estimation, was Triveni-TAM-500ME (Andheri, Mumbai, India). Both air-conduction thresholds and bone-conduction thresholds were measured. The thresholds (minimum level of hearing) for air conduction were estimated using standard headphone TDH39 (770 Park Ave, Huntington, NY11743, US), from frequency range 250 Hz to 8 KHz, with intensity level −10 dBHL to 120 dBHL, and the pure tone average was measured using an average of three frequencies, that is, 500 Hz, 1 KHz, and 2 KHz. Bone conduction was tested with test frequencies from 250 Hz to 4 KHz, with intensity level from −10 dBHL to 70 dBHL (with standard bone conductor B71, Radio ear, Audiometer alle1, 5500 Middelfart, Denmark). For measuring hearing thresholds at higher frequencies above 8 KHz, MAICO MA 42 (Sicklinggenstr. 70–71, 10553 Berlin, Germany), a dual channel audiometer was used. The MAICO MA42 audiometer delivers test frequencies from 125 Hz to 20 KHz, with intensity levels from −10 dBHL to 120 dBHL.

For degree of hearing loss, the following scale was used:

minimal > 16 to 25 dB; mild > 25 to 40 dB; moderate > 40 to 55 dB; moderate to severe > 55 to 70 dB; severe > 70 to 90 dB; and profound > 90 dB hearing loss

The data analysis was done with the help of the statistical software SPSS version 25 (IBM Corp., Armonk, NY, USA). The data was summarized using descriptive statistics, frequencies, and percentage. Statistical differences between categorical variables were assessed using the Chi-square test. A *p*-value < 0.05 was considered statistically significant.

Results

Fifty-two patients (male: female 28:24) were included in the study. The clinico-epidemiological profile of vitiligo patients is shown in ►**Tables 1** and **2**. The mean age of patients was 26.7 years, ranging from 7 years to 60 years. The mean age of onset of vitiligo was 21.7 years, ranging from 4 years to 50 years. Eight patients (15.3%) had positive family history and included first-degree relatives in 4 (7.6%), second-degree relatives in 3 (5.7%) patients, and

Table 1 Sensorineural hearing loss in relation to age, age of onset, gender, vitiligo type and site of onset

Age group	Number of cases with SNHL (%)	Number of cases without SNHL (%)	*p*-value = 0.00
1–20 years	1 (5.3)	18 (94.7)	
21–40 years	2 (9.1)	20 (90.9)	
41–60 years	7 (63.6)	4 (36.4)	
Age of onset			*p*-value = 0.598
1–10 years	1 (7.7)	12 (92.3)	
11–20 years	2 (11.1)	16 (88.9)	
21–30 years	0 (0)	6 (100)	
31–40 years	2 (28.6)	5 (71.4)	
> 40 years	5 (62.5)	3 (37.5)	
Gender			*p*-value = 0.065
Male	8 (28.6)	20 (71.4)	
Female	2 (8.3)	22 (91.7)	
Vitiligo type			
Vitiligo vulgaris	4 (21.1)	15 (78.9)	*p*-value = 0.863
Acrofacial	2 (20.0)	8 (80.0)	
Facial	1 (11.1)	8 (88.9)	
Acral	2 (28.6)	5 (71.4)	
Focal	0 (0)	3 (100)	
Mucosal	0 (0)	1 (100)	
Vitiligo universalis	1 (50)	1 (50)	
Segmental	0 (0)	1 (100)	
Site of onset			*p*-value = 0.791
Head and neck	3 (13.6)	19 (86.4)	
Lower limb	2 (16.7)	10 (83.3)	
Upper limb	2 (22.2)	7 (77.8)	
Trunk	2 (33.3)	4 (66.7)	
Mucosa	1 (33.3)	2 (66.7)	

Abbreviations: F, female; M, male; SNHL, sensorineural hearing loss.

Table 2 Duration of vitiligo

Duration of vitiligo	Number of cases (%)
1–6 months	11 (21.1)
6 months–1 year	6 (11.5)
1–5 years	17 (32.7)
5–10 years	9 (17.3)
≥ 10 years	9 (17)

both first and second-degree relatives in 1 (1.9%) patient. Fifty-one patients (96%) had non-segmental vitiligo, and vitiligo vulgaris was the most common clinical type.

Audiological examination was done in all patients. Ten patients (19.2%) had sensorineural hearing loss (SNHL). Details of vitiligo patients with SNHL are shown in ►**Table 3**. Seven patients (13.5%) had bilateral and 3 (5.7%) had unilateral SNHL. High frequency loss was seen in 17 out of 20 ears (10 affected patients), 6 ears had both low and high-frequency hearing loss. Of 12 ears with speech frequency involvement, mild hearing loss was seen in 5 ears and moderate to severe in 1 ear. The pattern of hearing loss and details of vitiligo are shown in ►**Table 3**.

Most cases of SNHL were detected in age group 41 to 60 years (63.6%), which was statistically significant (*p*-value 0.00). Sensorineural hearing loss was present in 5 out of 10 patients (66.7%) having vitiligo for less than 5 years, and 5 out of 32 (86.5%) for more than 5 years.

Discussion

The otic melanocytes are located in the stria vascularis, hair cells, endolymphatic sac, and vestibular organ.[14] The function of these melanocytes are not exactly known. In the stria vascularis, otic melanocytes modulate the function of Na^+/K^+-ATPase and potassium channels, which are essential for creating endocochlear electrical potential.[15] The electrical activity of ciliary cells in the labyrinth is closely connected with their physiological ability to send afferent information to brain areas involved in auditory and balance functions.

Ardic et al[16] noticed lower pure tone thresholds at higher sound frequencies (from 4,000–16,000 Hz) in patients with vitiligo. Based on their observations, as well as the fact that social and environmental damage affects hearing at the same sound frequencies, the authors suggested a preventive role of melanocytes for the sensitive inner ear cells. Murillo-Cuesta et al[17] also stated that otic melanocytes do not appear to be essential for normal hearing, but they are assumed to play a protective role against environmental damage. In the present study, lower pure tone thresholds at higher sound frequencies (from 4,000-8,000 Hz) were also found in 17 ears of 10 affected vitiligo patients, which also favors the theory of the protective role of otic melanocytes.

The exact site of damage that leads to hearing impairment in vitiligo is not known. Aydogan et al[5] observed that patients with vitiligo have disturbances in the upper part of the auditory pathway, in the cranial nerve VIII, and above the level of the cochlear nuclei in pons. Sydlowski et al[18] postulated that successful cochlear implantation in patients with auditory symptoms concurrent with autoimmune destruction of melanocytes might be the evidence for cochlear localization of hearing injury related to vitiligo. Anbar et al[19] found that 64 ears (60%) of patients with vitiligo had cochlear dysfunction. As observed in the present study as well as in various other studies, vitiligo patients display hearing loss at high frequency, which suggests that the basal turns of cochlea are probably affected more in

Table 3 Details of vitiligo patients with sensorineural hearing loss

Serial number	Age/ Year/ Gender	Duration of vitiligo	Type of vitiligo	Ear Affected	Degree of SNHL		Frequencies affected (Hz)	
					Right ear	Left ear	Right ear	Left ear
1	57/F	47 years	Vitiligo universalis	Both	Mild	Moderately severe	500, 1,000, 2,000, 8,000	25, 500, 1,000, 2,000, 4,000, 8,000
2	45/M	2 years	Vitiligo vulgaris	Both	High frequency loss	Mild	4,000, 8,000	1,000, 2,000,4,000
3	50/F	8 years	Vitiligo vulgaris	Right	Mild	Normal	1,000, 2,000, 4,000,8,000	
4	42/M	10 years	Vitiligo vulgaris	Both	High frequency loss	High frequency loss	4,000	4,000
5	36/M	5 years	Acral	Right	High frequency loss	High frequency loss	4,000	
6	49/M	8 years	Acrofacial	Both	Mild	Normal	1,000, 2,000, 4,000, 8,000	1,000, 2,000, 4,000
7	60/M	1 year	Acrofacial	Both	High frequency loss	High frequency loss	4,000	2,000,4,000, 8,000
8	35/M	23 years	Acral	Both	High frequency loss	High frequency loss	3,000,4,000, 6,000	4,000, 6,000
9	46/M	1 year 6 months	Vitiligo vulgaris	Left	Normal	Mild		1,000,2,000, 3,000,4,000
10	12/M	3 months	Facial	Both	High frequency loss	High frequency loss	4,000, 8,000	3,000,4,000, 6,000

Abbreviations: F= female; M= male; SNHL = sensorineural hearing loss.

vitiligo. Mahdi et al[20] and Dawoud et al[21] found, in addition to auditory affection, peripheral vestibular disorders in vitiligo patients.

Sensorineural hearing loss has been reported in 4 to 37% of patients with vitiligo.[3–9] In the present study, 10 patients (19.2%) had SNHL. These patients were asymptomatic but, on audiological evaluation, were diagnosed with hearing loss. Conductive deafness was found in two studies.[4,22] However, in the present and other studies, only SNHL was seen. Conductive loss in vitiligo is unlikely, as melanocytes do not take part in conductive mechanism of hearing since they are only present in inner ear. Conductive hearing loss can only be seen in a vitiligo if there is any coexisting middle ear pathology. On the other hand, other studies have not found audiological abnormalities in vitiligo patients.[10–13] This controversy could be due to the use of different selection criteria and methodology among studies.

Gopal et al[22] suggested that the hearing loss could result from other autoimmune diseases coexisting with vitiligo, such as diabetes mellitus and hypothyroidism. However, in the present study and other studies, hearing loss was seen in patients without autoimmune and/or other metabolic diseases.[13,14] In our study, SNHL was found to be significantly higher in the older age group (41–60 years). The minimum age of patients with SNHL was 12 years, and the maximum age was 60 years. Shankar et al[23] found that the $>$ 30 years old age group was significantly associated with abnormal auditory findings. However, Sharma et al did not observe any association between age and SNHL in vitiligo.[4] The association in our study could be due to the fact that we have included all age groups, unlike the study by Sharma et al[4], in which only the age group of 5 to 40 years was included.

Similar to the study by Ardic et al,[16] in our study, male subjects were predominantly affected by SNHL when compared with female subjects. Whereas other researchers found a higher incidence of hearing loss in female patients[24] or equal incidence in both sexes.[4,23] Similar to Maheshwari et al,[14] we also noticed a 50% incidence of SNHL in patients affected by vitiligo universalis. Hong et al[6] noticed an association of SNHL with non-segmental vitiligo, while Sharma et al[4] and Mohamed et al[9] reported generalized vitiligo as a risk factor.

Similar to other studies, we could not find any significant association between SNHL and duration of vitiligo.[4,9,20] According to Mahdi et al,[20] this could be explained by the possibility that otic melanocytes are affected at the start of vitiligo and then stabilize afterwards. However, in contrast to this, Aslan et al[8] and Ardic et al[16] found a statistically significant association between the duration of vitiligo and hearing loss.

Maheshwari et al[14] reported that vitiligo originating in the head and neck region was strongly associated with hearing loss (54.55%, 6 of 11 cases). In our study, the site of onset was the head and neck in 30% of the cases with SNHL; however, we could not find a statistically significant association.

Conclusion

The results of this study suggest that vitiligo patients require routine monitoring for auditory functions for early identification of sensorineural hearing loss. Older subjects with vitiligo might be at a higher risk for audiological abnormalities. These patients should also be informed regarding the associated risk with noise and ototoxic drug exposure.

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Conflicts of Interest
The authors have no conflicts of interest to declare.

References

1 Sehgal VN, Srivastava G. Vitiligo: compendium of clinico-epidemiological features. Indian J Dermatol Venereol Leprol 2007;73 (03):149–156
2 Kumar S, Nayak CS, Padhi T, et al. Epidemiological pattern of psoriasis, vitiligo and atopic dermatitis in India: Hospital-based point prevalence. Indian Dermatol Online J 2014;5(Suppl 1): S6–S8
3 Ozüer MZ, Sahiner T, Aktan S, Sanli B, Bayramoğlu I. Auditory evoked potentials in vitiligo patients. Scand Audiol 1998;27(04): 255–258
4 Sharma L, Bhawan R, Jain RK. Hypoacusis in vitiligo. Indian J Dermatol Venereol Leprol 2004;70(03):162–164
5 Aydogan K, Turan OF, Onart S, Karadogan SK, Tunali S. Audiological abnormalities in patients with vitiligo. Clin Exp Dermatol 2006;31 (01):110–113
6 Hong CK, Lee MH, Jeong KH, Cha CI, Yeo SG. Clinical analysis of hearing levels in vitiligo patients. Eur J Dermatol 2009;19(01): 50–56
7 Akay BN, Bozkir M, Anadolu Y, Gullu S. Epidemiology of vitiligo, associated autoimmune diseases and audiological abnormalities: Ankara study of 80 patients in Turkey. J Eur Acad Dermatol Venereol 2010;24(10):1144–1150
8 Aslan S, Serarslan G, Teksoz E, Dagli S. Audiological and transient evoked otoacoustic emission findings in patients with vitiligo. Otolaryngol Head Neck Surg 2010;142(03):409–414
9 Mohamed ES, Said EA, Sayed DS, Awad SM, Ahmed MH. Auditory system dysfunction in patients with vitiligo: is it a part of a systemic autoimmune process? Egypt J Otolaryngol 2017;33(03): 594–602
10 Tosti A, Bardazzi F, Tosti G, Monti L. Audiologic abnormalities in cases of vitiligo. J Am Acad Dermatol 1987;17(2 Pt 1): 230–233
11 Escalante-Ugalde C, Poblano A, Montes de Oca E, Lagunes R, Saúl A. No evidence of hearing loss in patients with vitiligo. Arch Dermatol 1991;127(08):1240
12 Elsaied MA, Naga YAA, Abdo IM. Evaluation of brain stem evoked response in vitiligo patients. J Pan Arab League Dermatol 2008; 19:91–97
13 AlGhamdi KM, Khurrum H, Al-Momani MO, Hagr A. Assessment of audiological abnormalities in vitiligo patients. Otorinolaringol 2017;67(02):39–43
14 Maheshwari A, Panigrahi R, Mahajan S. Vitiligo associated hypoacusis: a case control study. Int J Otorhinolaryngol Head Neck Surg 2016;2(02):77–81
15 Tachibana M. Cochlear melanocytes and MITF signaling. J Investig Dermatol Symp Proc 2001;6(01):95–98

16 Ardiç FN, Aktan S, Kara CO, Sanli B. High-frequency hearing and reflex latency in patients with pigment disorder. Am J Otolaryngol 1998;19(06):365–369
17 Murillo- Cuesta S, Contreras J, Zurita E, Cediel R, Cantero M, Varela-Nieto I, et al. Melanin precursors prevent premature age related and noise induced hearing loss in albino mice. Pigm Cell melanoma Res 2010;23(01):72–83
18 Sydlowski SA, Luffler C, Haberkamp T. Successful cochlear implantation in a case of Vogt-Koyanagi-Harada disease. Otol Neurotol 2014;35(09):1522–1524
19 Anbar TS, El-Badry MM, McGrath JA, Abdel-Azim ES. Most individuals with either segmental or non-segmental vitiligo display evidence of bilateral cochlear dysfunction. Br J Dermatol 2015; 172(02):406–411
20 Mahdi P, Rouzbahani M, Amali A, Rezaii Khiabanlu S, Kamali M. Audiological manifestations in vitiligo patients. Iran J Otorhinolaryngol 2012;24(66):35–40
21 Dawoud EAE, Ismail EI, Eltoukhy SA-G, El-Sharabasy AE-S. Assessment of auditory and vestibular functions in vitiligo patients. J Otol 2017;12(03):143–149
22 Gopal KV, Rama Rao GR, Kumar YH, Appa Rao MV, Vasudev P; Srikant. Vitiligo: a part of a systemic autoimmune process. Indian J Dermatol Venereol Leprol 2007;73(03):162–165
23 Shankar DS, Shashikala K, Madala R. Clinical patterns of vitiligo and its associated comorbidities. Indian J Dermatol 2012;3(02): 114–118
24 Sharifian MR, Maleki M, Honarvar H. The correlation between vitiligo and hearing loss. Iran J Otorhinolaryngol 2006;17(42):3–8