

Audiological Manifestations in VITILIGO – A Novel Study

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ABSTRACT

Background and Objectives: Vitiligo is common form of acquired localized depigmentation, resulting from progressive loss of melanocytes. Melanocytes in the skin, uveal tract and ear are similar in their physiology, morphology and share a common embryological origin. The association of cutaneous depigmentation with ocular and auditory dysfunction is well known. Aim of this study is to find the various audiological features in patients presenting with vitiligo. **Materials and Methods:** A case-control study where in all patients presenting with vitiligo and age and sex matched controls without vitiligo were included. Following BSA and VASI assessment, both groups were subjected to tuning fork tests and pure tone audiometry were carried out. Goodman's classification of hearing loss (HL) was followed to classify the severity. **Results:** Mean age of presentation was 27.33 years, with mean age of onset of 24.57 years, having a duration of 1-3 years, with a male preponderance. 36.67% of the patients had positive family history of vitiligo. Majority of patients had 1-5% body surface area involvement, with mean VASI of 3 at presentation. 13.33% patients had mild HL (26-40 dB) and 40% had minimal HL (16-25 dB) in the right ear. 46.67% patients had minimal HL (16-25dB) in the left ear. **Conclusion:** It is extremely important for all the vitiligo patients to undergo a complete audiological assessment at presentation to detect subclinical abnormalities at the earliest and to prevent the impending complications of sensorineural hearing loss.

Keywords: vitiligo, hearing loss, otologic manifestations, SNHL, mixed hearing loss.

INTRODUCTION:

Vitiligo is an acquired pigmentary disorder affecting 0.5%–2.0% of the population.

Worldwide, it can be seen at any age [1] and in both sexes, with a similar incidence [2]. Vitiligo can be associated with many comorbidities[3]. The exact aetiology of vitiligo is unknown. However, genetic, neural, immunological and self-destructive pathomechanisms are said to be involved. Autoantibodies directed against melanocyte antigens lead to the destruction of melanocytes [4].

In the cochlea, melanocytes are most conspicuous in the stria vascularis, in which they form the intermediate cell layer, but are also present in other parts and tissues of the cochlea.

Melanocytes are required for the maintenance of normal function of the stria vascularis and cochlea, for the development of endocochlear potentials, and for the ion and fluid gradient between the endolymph and the perilymph, all of which are critical for hair-cell survival[5].

The otic melanocytes are located in the stria vascularis, hair cells, endolymphatic sac, and vestibular organ[6]. In the stria vascularis, otic melanocytes modulate the function of Na⁺/K⁺-ATPase and potassium channels, which are essential for creating endocochlear electrical potential[7].

The theory to explain the pathogenesis of auditory findings in vitiligo is that an autoimmune mechanism may destroy melanocytes. The presence of various immunologic abnormalities in patients with vitiligo supports this

hypothesis. Pigment cells are widely distributed in the body, and the inner ear contains a substantial number of melanocytes[8].

Vitiligo is a multifactorial disorder related to both genetic and non-genetic factors. However, the exact aetiology of vitiligo is unknown. Vitiligo is one of the few autoimmune diseases in which environmental factors are well recognised.

A positive family history is seen in 7%–36% of cases. Around 20% of these cases have at least one affected first-degree relative, suggesting a role for genetic factors in the pathogenesis. A positive association between vitiligo and HLA-DR4 has also been reported. Other HLA associations linked to vitiligo include HLA-DR1, DR7, A2, B13, B21, and Cw6.

An important theory of vitiligo pathogenesis is the oxidative stress theory. This theory suggests intraepidermal accumulation of reactive oxygen species (ROS), the most notorious of which is H₂O₂.

Patients can present with vitiliginous patches over the pinna. Sensorineural hearing loss has been reported in 4–37% of patients with vitiligo. In most of these studies, patients were asymptomatic but on audiological evaluation were diagnosed with hearing loss[9,10,11]. Patients may experience significant hearing loss, especially at high and extended high frequencies. Conductive hearing loss was reported in two studies involving patients with vitiligo [12,13]. Conductive loss in vitiligo is unlikely, as melanocytes do not participate in the conductive mecha-

nism of hearing because they are only present in the inner ear. Conductive hearing loss can only be seen in vitiligo if there is any coexisting middle ear pathology[6].

This is a hospital-based case-control study aimed at examining various audiological features in patients presenting with vitiligo.

MATERIALS AND METHODS:

This study was conducted in the Department of Otorhinolaryngology at Dr. B. R. Ambedkar Medical College and Hospital, Bengaluru. A total of 30 cases of vitiligo and 30 age- and sex-matched controls, attending the outpatient and inpatient wards of the Department of ENT and Dermatology and consenting to the study between October 2020 and October 2021, were included and evaluated in this study. Patients who were unwilling to participate, those with pre-existing audiological abnormalities, and those with other causes of depigmentary disorders were excluded from the study.

Complete otological and audiological examinations of both ears were performed for all patients and the control group. Goodman's classification of hearing loss was used to classify the severity of hearing deficit.

Data were analysed using SPSS 22. The chi-square test was used to assess significance for qualitative data. Continuous data were reported as mean $\pm$ standard deviation. An independent t-test was used to test for significance and determine the mean difference between two quantitative variables and two qualitative variables, respectively.

A p-value of <0.05 was considered statistically significant after meeting all assumptions of statistical tests.



Figure 1. Focal vitiligo

RESULTS:

The mean age among cases and controls was 27.33 years, the mean age at onset of vitiligo lesions was 24.57 years, with a mean duration of 2.87 years, a mean BSA of 7.00%, and a mean VASI of 5.31.

Family history of vitiligo was found in 11 patients (36.67%), and 19 (63.3%) had a negative family history.

Among vitiligo patients, 25 patients (83.33%) were free from comorbidities, 1 (3.33%) had a history of hypertension, and 2 (6.67%) each had a history of type 2 DM and



Figure 2. Vitiligo patches over right ear

hypothyroidism, respectively and were on regular treatment. In the control group, no one had a history of comorbidities.

Table 1. Lesions over ears distribution between the two groups

		Vitiligo		Control	
		Count	%	Count	%
Lesions Over Ears	None	22	73.33%	30	100.00%
	Present	8	26.67%	0	0.00%

$\chi^2=9.231$, $df=1$, $p=0.002$

Table 2. Rinne distribution between two groups

		Vitiligo		Control	
		Count	%	Count	%
Right	Negative	1	3.33%	0	0.00%
	Positive	29	96.67%	30	100.00%
Left	Negative	1	3.33%	0	0.00%
	Positive	29	96.67%	30	100.00%

Right: $\chi^2=1.017$, $df=1$, $p=0.313$

Left: $\chi^2=1.017$, $df=1$, $p=0.313$

Table 3. Weber distribution between two groups

		Vitiligo		Control	
		Count	%	Count	%
Right	Centralised	27	90.00%	29	96.67%
	Lateralised	3	10.00%	1	3.33%
Left	Centralised	30	100.00%	29	96.67%
	Lateralised	0	0.00%	1	3.33%

Right: $\chi^2=1.071$, $df=1$, $p=0.301$

Left: $\chi^2=1.017$, $df=1$, $p=0.313$

Table 4. Absolute bone conduction distribution between the two groups

		Vitiligo		Control	
		Count	%	Count	%
Right	Reduced	3	10.00%	1	3.33%
	Same as Examiner	27	90.00%	29	96.67%
Left	Reduced	1	3.33%	1	3.33%
	Same as Examiner	29	96.67%	29	96.67%

Right: $\chi^2=1.071$, df=1, p=0.301Left: $\chi^2=0$, df=1, p=1.000**Table 5.** Pure tone audiometry distribution between two groups

		Vitiligo		Control	
		Count	%	Count	%
Right	Mild SNHL	4	13.33%	0	0.00%
	Minimal HL	12	40.00%	4	
	Normal	14	46.67%	26	86.67%
Left	Minimal HL	14	46.67%	3	10.00%
	Normal	16	53.33%	27	90.00%

Right: $\chi^2=11.6$, df=2, p=0.003Left: $\chi^2=9.932$, df=1, p=0.002**Table 6.** Association between vitiligo lesions over the ears and findings on tuning-fork tests and PTA

		None		Present		p value
		Count	%	Count	%	
Rinne Right	Negative	1	4.50%	0	0.00%	0.540
	Positive	21	95.50%	8	100.00%	
Rinne Left	Negative	1	4.50%	0	0.00%	0.540
	Positive	21	95.50%	8	100.00%	
Weber Right	Centralised	20	90.90%	7	87.50%	0.783
	Lateralised	2	9.10%	1	12.50%	
Weber Left	Centralised	2	9.10%	1	12.50%	0.783
	Lateralised	20	90.90%	7	87.50%	
Absolute Bone Conduction Right	Reduced	2	9.10%	1	12.50%	0.783
	Same as examiner	20	90.90%	7	87.50%	
Absolute Bone Conduction Left	Reduced	1	4.50%	0	0.00%	0.540
	Same as examiner	21	95.50%	8	100.00%	
Pure Tone Audiometry Right	Mild SNHL	2	9.10%	2	25.50%	0.515
	Minimal HL	9	40.90%	3		
	Normal	11	50.00%	3	37.50%	
Pure Tone Audiometry Left	Minimal HL	9	40.90%	5	62.50%	0.295
	Normal	13	59.10%	3	37.50%	

Table 7. Association between VASI and PTA findings on the right and left sides

		<3.2		>3.2		p value
		Count	%	Count	%	
Pure Tone Audiometry Right	Mild SNHL	3	18.8%	1	7.10%	0.474
	Minimal HL	7	43.8%	5		
	Normal	6	37.5%	8	57.10%	
Pure Tone Audiometry Left	Minimal HL	8	50.00%	6	42.9%	0.696
	Normal	8	50.00%	8	57.1%	

Table 8. Association between BSA and PTA findings on the right and left sides

		<4.15		>4.15		p value
		Count	%	Count	%	
Pure Tone Audiometry Right	Mild SNHL	2	13.30%	2	13.30%	1.000
	Minimal HL	6	40.00%	6		
	Normal	7	46.70%	7	46.70%	
Pure Tone Audiometry Left	Minimal HL	6	40.00%	8	53.30%	0.464
	Normal	9	60.00%	7	46.70%	

DISCUSSION:

Vitiligo is an acquired depigmentary disorder that destroys melanocytes in the skin, hair bulbs, mucous membranes, uveal tract, retinal pigment epithelium of the eyes, inner ear, and leptomeninges [14]. There is a paucity of literature on the various audiological abnormalities associated with vitiligo. Our study thus aims to contribute to this area.

In the present study, tuning fork tests, including Rinne's test, Weber's test, and the Absolute bone conduction test, were performed on all patients and controls. There was no significant difference in tuning-fork test results between the two groups in either ear.

However, in studies by KVT Gopal et al. [15], Pathak GK et al. [4], Dabbous et al. [4] and Prabha N et al. [4], all three tuning-fork tests were performed on all vitiligo patients. In none of these studies were the tuning-fork test results mentioned. Thus, our study contributes to the literature on tuning-fork test findings in patients with vitiligo.

In the present study, SNHL was noted in the right ear of 16 patients with vitiligo (53.33%) (4 had mild and 12 had minimal SNHL) and in the left ear of 14 patients with vitiligo (46.67%). However, SNHL was observed in only 4 healthy controls (13.33%) in the right ear and in 3 (10%) in the left ear. Thus, we noted a significantly higher prevalence of hearing loss in vitiligo patients compared to healthy controls, consistent with another case-control study by Genedy R et al. [16], which examined 40 vitiligo patients and 20 healthy controls (HCs).

Our observation is consistent with another case-control study by Genedy R et al. [16], in which 40 patients with vitiligo and 20 healthy controls (HCs) were examined. Based on the mean PTA, none of the HCs had hearing loss, but hearing loss was detected in 12 ears from 7 patients (17.5%). Five patients had bilateral hearing loss, and two had unilateral hearing loss (right-sided only). There was a significantly higher prevalence of hearing loss among patients than among HCs [16].

In another case-control study by Tosti et al. [8], the prevalence of hearing loss was significantly higher among patients with vitiligo (8/50, 16%) than in healthy controls.

An interesting finding across all the above studies, including the present study, is that none of these patients reported clinically reduced hearing. In most studies, SNHL is reported in patients with vitiligo. Conductive hearing loss is unlikely in patients with vitiligo, as melanocytes play no role in the conductive mechanism of hearing and are absent from the inner ear. Conductive hearing loss can be noted in vitiligo patients only when there is an associated middle ear pathology [4].

CONCLUSION:

A significantly higher prevalence of sensorineural hearing loss was noted in both ears among vitiligo patients in comparison to controls without vitiligo. An interesting finding in our study is that none of the vitiligo patients with audiological findings complained of clinical difficulty in hearing. Thus, a thorough audiological assessment is routinely recommended for all vitiligo patients to detect subclinical abnormalities, such as sensorineural hearing

loss, early. These patients should also be informed about the associated risks of exposure to loud noise and ototoxic drugs, which are detrimental to hearing.

REPORTING, DATA & REGISTRATION

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Clinical trial registration

Clinical trial registration is not applicable: this manuscript does not report a prospectively registered clinical trial.

DECLARATIONS

Conflict of Interest

The authors declare that they have no conflict of interest relevant to the content of this article.

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Ethical Clearance

This article does not contain any studies with human participants or animals performed by any of the authors; therefore, ethical clearance is not applicable.

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