

Research Article

Vitiligo associated hypoacusis: a case control study

Abhishek Maheshwari¹, Rajlaxmi Panigrahi^{2*}, Shruti Mahajan¹

¹Department of Otorhinolaryngology, Pravara Institute of Medical Sciences, Loni, Maharashtra, India

²Department of Otorhinolaryngology, Hi-Tech Medical College and Hospital, Bhubaneswar, Odisha, India

Received: 18 January 2016

Accepted: 04 February 2016

*Correspondence:

Dr. Rajlaxmi Panigrahi,

E-mail: drrajalaxmient@gmail.com

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ABSTRACT

Background: Vitiligo is a progressive depigmenting cutaneous disorder, resulting from the loss of melanocytes. In the inner ear, melanocytes are believed to play an important role in development and normal functioning of stria vascularis. Acoustic abnormalities in vitiligo patients remain obscured for long durations. This study was carried out to determine the prevalence of subclinical sensorineural hearing loss in vitiligo patients, if any, in comparison with controls and to detect any relevant demographic or clinical finding characteristic of hypoacusis in vitiligo patients.

Methods: A prospective case control study was undertaken in 50 vitiligo patients (case group), who were compared with another 50 age and sex matched healthy volunteers (control group). All cases underwent detailed dermatological and ENT examination and were subjected to tests like pure tone audiometry, transient evoked otoacoustic emission (TEOAE).

Results: A statistically significant (p value = 0.039), higher average pure tone hearing threshold (APT-HT) was noted in vitiligo patients in comparison with the control group. Vitiligo originating at the head and neck was strongly associated with hypoacusis (54.55%, 6 of 11 cases). TEOAE reproducibility % was reduced to 42.6% in the vitiligo group.

Conclusion: Vitiligo is associated with subclinical sensorineural hypoacusis. Vitiligo with its primary site in head and neck region and co-existing leucotrichia shows a strong association with asymptomatic sensorineural hypoacusis in such patients. Pure tone audiometry and TEOAE can be effectively used to assess and follow up vitiligo patients for asymptomatic subclinical sensorineural hypoacusis.

Keywords: Audiometry, Hypoacusis, Melanocyte, Vitiligo

INTRODUCTION

Vitiligo is a progressive depigmenting cutaneous disorder. Approximately 1-2% of the world population is affected with it.¹ It is clinically characterized by the presence of white macules of different shapes and sizes over the body in either symmetric or asymmetric distribution. Even after decades of research, its aetiopathogenesis remains an enigma. Various theories explaining the probable pathomechanism have been

proposed, like genetic, autoimmune, neural and autocyctotoxic hypothesis.²

There is an increasing argument that describes vitiligo as a systemic disorder and not merely a pure cutaneous disorder.³ These arguments are based upon the finding of several auditory, ocular and neurological abnormalities in vitiligo patients.⁴⁻⁶ Hence a theory of 'melanocyte organ' has been hypothesized, which entails simultaneous destruction and loss of melanocyte function in skin and other organs.⁷ Melanocytes located in retinal pigment

epithelium, uveal tract, leptomeninges and inner ear may also be affected.⁸

In the inner ear, melanocytes are believed to play an important role in development and normal functioning of stria vascularis. Their role in endocochlear electrophysiology has been stated.⁹ Association of acoustic abnormalities with certain hypopigmentary disorders like Wardenburg's syndrome, albinism, Alzandrini syndrome and Vogt-Koyanagi-Harada syndrome has been described.¹⁰ White and black skinned individuals differ in levels of noise induced hypoacusis, owing to the quantitative differences in pigment cells in inner ear.¹¹ Acoustic abnormalities in vitiligo patients remain obscured for long durations.¹² Numerous reports elucidating the association of sensorineural hearing loss with vitiligo have come up in recent years.^{4,10,13} Therefore a case control study using conventional audiological tests was carried out to explore this proposed association. To prove the hypothesized association of hypoacusis in vitiligo patients, a prospective case control study was carried out with the following objectives.

1. To determine the prevalence of subclinical sensorineural hearing loss in vitiligo patients, if any, in comparison with controls.
2. To detect any relevant demographic or clinical finding characteristic of hypoacusis in vitiligo patients.

METHODS

Considering the varied causes which may amount to hearing loss, the selection of study cases was based on following criteria:

Inclusion criteria

Vitiligo patients without any age and sex bias

Exclusion criteria

- Hearing loss due to a known cause (drug induced, noise induced, trauma, otitis media, barotrauma, ear surgery, meningitis, Meniere's disease, labyrinthitis)
- Autoimmune/neurological/vascular/metabolic disorders
- Familial hypoacusis
- Systemic disorders- diabetes mellitus, hypertension

With prior Institutional ethical committee approval, a prospective case control study was undertaken in 50 vitiligo patients (case group), who were compared with another 50 age and sex matched healthy volunteers (control group), who fitted well with the inclusion and exclusion criteria's from August 2012 to November 2014 at Hi-Tech Medical College and Hospital, Bhubaneswar. Vitiligo patients were randomly recruited from patients who were treated at the dermatology department of the same hospital. A fully informed written consent was

obtained from all the study subjects (both case and control group) following a detailed discussion about the study purpose and involved methodology. Demographic details of all patients were recorded on a predesigned proforma. All patients underwent a dermatological examination to determine the site of first appearance, type, distribution of vitiligo spots, treatment received and its co-existence in other family members.

Following dermatological evaluation all patients underwent complete ENT examination, along with tuning fork tests, pure tone audiometry, tympanometry, speech reception threshold evaluation and transient evoked otoacoustic emission (TEOAE). The conducting audiologist was unaware of the allotted patient group. Average pure tone hearing threshold (APT-HT) for frequencies (250–8000 Hz) were calculated for both ears in each patient. We used the following scale of degree of hearing loss: minimal >16–25 dB; mild >25–40 dB; moderate >40–55 dB; moderate to severe >55–70 dB; severe >70–90 dB, and profound >90 dB hearing loss (Clark, 1981). Transient Evoked Otoacoustic Emissions (TEOAE's) were recorded. The amplitude of TEOAE's in three frequency bands (1, 2, 3 KHz) was analyzed and reproducibility percent were recorded. All the data collected was analyzed statistically using a two tailed student's- t test. A p value of 0.05 or less was considered statistically significant.

RESULTS

Age and gender distribution of vitiligo patients is depicted in Table 1. There were 50 study subjects in each group (age and sex matched). There were 20 male and 30 female in each group. Male to female ratio was 1:1.5.

Table 1: Age and gender distribution of vitiligo patients.

Patient age at onset (years)	Gender		Total	Percentage
	Male	Female		
0-20	8	16	24	48
21-40	6	8	14	28
41-60	4	5	9	18
61-80	2	1	3	6
Total	20	30	50	100

Clinical type and acoustic characteristic of vitiligo patients is depicted in Table 2. Incidence of hypoacusis in case group (vitiligo) was 32% (16 patients) and in control group was 4% (2 patients). Unilateral and bilateral involvement was noted in 31.35% (5 cases) and 68.75% (11 cases) respectively. Hypoacusis in all cases was sensorineural type. Conductive deafness was not found in either of the study subjects. Vitiligo vulgaris was the most frequent type of vitiligo encountered 52% (26 cases). Leucotrichia was found in 38% of vitiligo

patients. Family history of vitiligo was found in 34% (17 patients) of vitiligo cases.

Association between hypoacusis and vitiligo origin site is depicted in Table 3. Most common site of origin was

mucosal associated (15 cases). Vitiligo originating at the head and neck was strongly associated with hypoacusis (54.55%, 6 of 11 cases).

Table 2: Clinical type and acoustic characteristic of vitiligo patients.

Vitiligo type	Hypoacusis			Total			
	Bilateral	Unilateral		vitiligo with hypoacusis	Vitiligo with normal hearing	Frequency of vitiligo type	Percentage of hypoacusis in each type
		Right	Left				
Focal	2	1	1	4	11	15	26.67
Segmental	1	-	-	1	2	3	33.33
Vitiligo Vulgaris	6	-	2	8	18	26	30.77
Acrofacial	1	1	-	2	2	4	50
Universal	1	-	-	1	1	2	50
Total	11	2	3	16	34	50	
	11	5		16	34	50	

Table 3: Association between hypoacusis and vitiligo origin site.

Vitiligo origin site	Total vitiligo patients		Total	
	With hypoacusis (n=16)	With normal hearing (n=34)	Frequency at origin site (N=50)	Incidence at each site (%)
Head and neck	6	5	11	54.55
Upper limb	1	4	5	20
Upper limb	2	6	8	25
Mucosa	4	11	15	26.67
Chest and back	3	8	11	27.27

Table 4: Average pure tone hearing threshold in each ear of study subjects.

Frequency	Right ear (n=50)		Left ear (n=50)		P value
	Mean ± SD		Mean ± SD		
	Vitiligo	Control	Vitiligo	Control	
250 – 8000 Hz	15.93 ± 6.17	10.52 ± 2.29	16.79 ± 5.36	9.93 ± 6.10	0.039
500 – 2000 Hz	10.26 ± 2.23	10.13 ± 2.12	10.32 ± 3.59	10.19 ± 2.43	0.067

Average pure tone hearing threshold in each ear of study subjects is depicted in Table 4. A statistically significant (p value = 0.039), higher APT-HT was noted in vitiligo patients in comparison with the control group. In speech

frequencies, the difference in APT-HT was statistically insignificant when comparing the two groups. TEOAE reproducibility % was reduced to 42.6% in the vitiligo group, while it was 97% in the control group.

DISCUSSION

The melanocytes originate from the neural crest of the embryonic epithelium and are located in the epidermis, hair bulbs of the skin, retinal pigment epithelium of the eye, uveal tract, leptomeninges and inner ear.^{14,15} In vitiligo patients these functional melanocytes are lost from the involved skin by certain proposed mechanisms.^{2,16} Within the inner ear melanocytes are present in the stria vascularis, hair cells, endolymphatic sac and vestibular organ.^{14,17}

Detailed studies of melanin has brought out its certain characteristics, like semiconductive property, ability to convert energy states into molecular rotation and vibration and its responsiveness to phonic, acoustic and electrical stimulation.¹⁸ Steel & Barkway, have propagated that melanocytes have a crucial role in the production of the endocochlear potentials and in normal development of stria vascularis.⁹ Conlee et al, have described the angioprotective function of melanocytes in the cochlea, which plays a crucial role in maintaining endolymphatic homeostasis, that is necessary for hair cell survival.¹⁹ LaFerriere et al, have highlighted the racial and individual variation in the inner ear melanocyte melanosome content, in relation with the skin pigmentation.²⁰

It is hypothesized that in vitiligo patients, there occurs a synchronous loss of melanocytes, both in skin and in

inner ear, with the resultant loss of their homeostatic and protector function, and increased vulnerability of inner ear to various damaging forces.^{9,21} Garber et al have reported an association of reduced cochlear melanin level with increased susceptibility to noise-induced hearing loss, audiogenic seizures and increased levels of auditory fatigue.²²

In the present study there was a slight female predominance in the prevalence of vitiligo, Table 1. Male female ratio observed was 1:1.5. This is probably related to higher disagreement in cosmetic outlook and treatment need in females. Hann et al²³ reported a M:F ratio of 1:1.6, while others have observed it to be 1.2:124 and 1.1:2. In this study, 48% were affected in first two decades of life. While it was 80% in under 19 years of age in the study of Akay et al, Arican et al, noticed 67% of his study population to lie in under 30 year age group.^{10,25} These findings support the idea that vitiligo predominantly affects younger population.

Most common type of vitiligo noticed in our study was vitiligo vulgaris (52%, 26 cases), Table 2. While we noticed a 50% incidence of hypoacusis in acrofacial and universal types of vitiligo, Hong et al noticed an association of hypoacusis with nonsegmental vitiligo and Sharma et al have reported generalized vitiligo as a risk factor.^{4,26}

In the present study 32% of vitiligo patients were found to be suffering from subclinical sensorineural hypoacusis. Incidence of hypoacusis in control group was 4% (2 patients). Hypoacusis in all cases was sensorineural type. Conductive deafness was not found in either of the study subjects. The incidence of sensorineural hearing loss in vitiligo patients, reported by other researchers is 18.89%, 16%, 68%, 38%.^{4,10,27,28} Unilateral and bilateral involvement was noted in 31.35% (5 cases) and 68.75% (11 cases) respectively. Unilateral and bilateral involvement as reported by other researchers is 25% & 75% and 36.9% & 63.1% respectively.^{29,30}

Mucosa was identified as the most common site of origin of vitiligo in our study (30%, 15 cases) (Table 3). However, vitiligo originating at the head and neck was strongly associated with hypoacusis (54.55%, 6 of 11 cases). While we noticed leucotrichia in 38% of vitiligo patients, Akay et al found it in 44.3% of vitiligo patients.¹⁰ We also noticed that all cases of sensorineural hypoacusis had leucotrichia. This finding probably tags leucotrichia as a marker for suspecting hypoacusis in vitiligo patients. While we found a Family history of vitiligo in 34% (17 patients) of vitiligo cases, other workers have found it in 37.5%, and 27.5% respectively.^{10,28} This finding adds some impetus to the genetic basis of vitiligo origin.

In our study, a statistically significant (p value =0.039), higher APT-HT was noted in vitiligo patients in comparison with the control group, in frequency width of

250-8000 Hz. However In speech frequencies (500-200 Hz), the difference in APT-HT was statistically insignificant when comparing the two groups. Similar findings were obtained by Fleissig et al and Sharifian et al.^{28,30} The relative sparing of speech frequencies (500-2000 Hz) explains the asymptomatic hypoacusis in vitiligo patients.

In our study, TEOAE reproducibility % was reduced to 42.6% in the vitiligo group, while it was 97% in the control group. Studies of Shalaby et al and Bassiouny et al have also recorded a TEOAE reproducibility % reduction to 33.3% and 49% respectively.^{27,31} These results indicate a loss of cochlear emission in patients of vitiligo. Outer hair cells of cochlea undergo degeneration in cases of long standing pigmentary disorders.³²

CONCLUSION

Vitiligo is not merely a cutaneous hypopigmentary disorder but is also responsible for subclinical sensorineural hypoacusis. Vitiligo with its primary site in head and neck region and co-existing leucotrichia shows a strong association with asymptomatic sensorineural hypoacusis in such patients. It is probably related to the loss of protective function of melanocytes in inner ear, synchronous with cutaneous hypopigmentation. Pure tone audiometry and TEOAE can be effectively used to assess and follow up vitiligo patients for asymptomatic subclinical sensorineural hypoacusis. These patients should be appropriately informed regarding the associated risk with noise exposure and use of ototoxic drugs.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Maheshwari A, Panigrahi R, Mahajan S. Vitiligo associated hypoacusis: a case control study. *Int J Otorhinolaryngol Head Neck Surg* 2016;2:77-81.