

Research article

A study of auditory brainstem response in vitiligo patients

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ABSTRACT

Introduction and Aim: Vitiligo is a hypomelanotic, idiopathic disease influencing entire pigmentary system which includes stria vascularis of internal ear described by depigmented patches in the skin because of absence of melanin and functioning melanocytes in the epidermis. The aim of this study was to assess the audiological irregularities by assessing the brain stem auditory evoked potential in vitiligo patients and comparing with the healthy controls.

Materials and Methods: Forty clinically confirmed vitiligo patients of 20 to 40 years of both genders, with or without therapy were enlisted from the Dermatology and cosmetology outpatient clinics, Government Stanley Hospital. Forty controls with similar ages and genders were chosen. The Neuro perfect Medicaid polyrite instrument was used in recording Brainstem Evoked Reaction Audiometry (BERA) in both vitiligo individuals and controls. Inter-Peak Latencies (IPL) and Absolute Wave Latencies (AWL) were measured and analysed by using SPSS version 17. Student's independent 't' test was done for comparing the groups.

Results: AWL and IPL of the two ears were measured and both were compared in the study and control groups. In the left ear, AWL III of study subjects had a significant increase 3.34 ± 0.16 than that of controls 3.27 ± 0.19 ; IPL I-III also significantly increased in the study subjects 1.91 ± 0.16 than the controls 1.77 ± 0.17 . In the right ear, AWL III of study subjects had a significant increase 3.18 ± 0.17 than the controls 3.06 ± 0.15 ; IPL I-III also significantly increased in the study subjects 1.79 ± 0.17 than the controls 1.64 ± 0.16 .

Conclusion: BERA findings were abnormal in clinically asymptomatic research subjects, suggesting that this test should be included in the routine follow-up of vitiligo patients to detect audiological subclinical involvement.

Keywords: Vitiligo; brainstem evoked response audiometry; inter peak latency; absolute wave latency.

INTRODUCTION

The term 'vitiligo' refers to a systemic, mostly acquired, hypomelanotic condition affecting all pigmentary regions, including the stria vascularis of the internal ear. It is frequently associated with leukotrichia. Histologically, it is defined as the degeneration and disappearance of melanocytes in the affected skin, as well as the pigment epithelium of the inner ear and eyes (1). Commonly starts in adolescence or young adults, with its peak of onset being 10 - 30 years, yet it may appear at any age. Several theories like hereditary, neural, cytotoxic and autoimmune explain destruction of melanocytes. Other melanocyte organs may also be affected by the mechanism that kills melanocytes in the skin. There have been reports of abnormalities in the ears. As a result, quantitative measures of minimal initial damage to the eighth cranial nerve's peripheral and central components may be obtained through physiological testing of its function. As a result, people with vitiligo can be identified by BERA, which is a method used for identifying subclinical audiological changes. Brainstem auditory evoked potentials are recorded in response to a brief auditory stimulus from the vertex and ear. This consists of five or more peaks that occur within 10 milliseconds of the stimulus (1). It is used to measure how fast sound travels to the midbrain via the auditory pathway. In

this study, we wanted to assess the conduction in vitiligo patient's auditory pathways, and to compare it to that of control subjects.

MATERIALS AND METHODS

The institutional ethical committee gave its approval. The study was done for six months and had a sample size of 80. From the dermatology and cosmetology departments of Stanley Medical College and Hospital, 40 people with vitiligo, ranging in age from 20 to 40, with or without treatment were chosen. From the healthy people who accompanied the patients and volunteers from the hospital staff, 40 individuals of the same age and gender were chosen.

Inclusion criteria

Forty clinically confirmed vitiligo individuals (male and female) with or without treatment aged between 20 and 40.

Exclusion criteria

Individuals with depigmentation disorders and ear diseases or who have undergone otoscopic ear surgery or having comorbid conditions such as hypertension, thyroid disease, diabetes mellitus, anaemia, autoimmune diseases and who have taken drugs causing ear toxicity and with nerve deafness were excluded.

After taking a history, a thorough clinical and dermatological examination was carried out. Each of the subjects was examined under daylight. After being informed about the study, each participant gave the written consent. Pure tone audiometry was used to determine the subject's hearing threshold. The Neuro Perfect Plus Medicaid Polyrite Hardware, Solokraft machine was used for BERA. Both the ears were tested independently in every one of the subjects. Conducting jelly was applied to the scalp to secure the disc electrodes. On both of the mastoid processes, the recording electrodes were kept. Cz was the name given to the location of the reference electrode, which was positioned at a point in front of the vertex. The ground electrode was put before the Cz and was mentioned as Fz. The impedance of the skin and electrodes was verified. The low-cut filter was set to 10 KHz, and the high cut filter to 100 Hz. The Brainstem Auditory Evoked Potential (BAEP) was generated using a 0.1 millisecond square wave pulse and a brief click stimulus. The sweep speed was one millisecond. The ear was stimulated with a click rate of 11 Hz and an intensity of 90 dB through a headphone. The duration of the click was 0.1 msec. The continuous 1000 responses to auditory clicks were summated. The average of them was displayed. The contralateral ear was masked with 40 dB of white noise.

Statistical analysis

The Statistical Package for the Social Sciences (SPSS), version 17, was used to analyse the data. The independent student t test was used in finding significant differences between two groups. A p value of less than 0.05 was considered significant while a p value of less than 0.01 was highly significant.

RESULTS

The average left ear Absolute Wave Latencies III (AWL) of vitiligo patients and control subjects was 3.34±0.16 and 3.27±0.19, respectively (Table 1). The increase of value in the study individuals was found to be statistically significant. The comparison of the left ear mean Interpeak Latencies (IPL) is shown in Table 2. A statistically significant difference (p-value of <0.001) was seen for the mean left ear IPL I-III (1.91±0.16) of the study subjects in comparison to that of the control subjects (1.77±0.17).

Table 1: Comparison of Left ear absolute wave latencies (AWL) of vitiligo patients and control subjects

AW forms	Left Ear AWL (ms)		P- value
	Vitiligo patients (n=40) Mean ±SD	Controls (n=40) Mean ±SD	
I	1.43 ± 0.08	1.46 ± 0.07	0.37
II	2.29 ± 0.18	2.27 ± 0.15	0.57
III	3.34 ± 0.16	3.27 ± 0.19	0.01*
IV	4.20 ± 0.19	4.19 ± 0.17	0.67
V	5.11±0.13	5.09 ± 0.13	0.38

Student's independent 't' test; *p value <0.05 is significant.

Table 2: Comparison of the left ear Inter peak latencies (IPL) of vitiligo patients and control subjects

IP Waveforms	Left Ear IPL (ms)		P- value
	Vitiligo patients (n=40) Mean±SD	Controls (n=40) Mean± SD	
I – III	1.91 ± 0.16	1.77 ± 0.17	< 0.001**
I – V	3.69 ± 0.15	3.62 ± 0.12	0.06
III – V	1.78 ± 0.19	1.85 ± 0.17	0.07

Student's independent 't' test; **p value<0.01 is highly significant.

The vitiligo patient's mean AWL III (3.18±0.17) for the right ear is shown in Table 3, and it is significantly higher than that of the control subjects (3.06±0.15). Compared to the control group, there was a statistically significant increase in the right ear's mean among individuals in the IP waveforms IPL I-III group (Table 4).

Table 3: Comparison of Right ear absolute wave latencies of vitiligo patients and the control subjects

AW forms	Right Ear AWL (ms)		P- value
	Vitiligo patients (n = 40) Mean ±SD	Controls (n =40) Mean ±SD	
I	1.39 ± 0.06	1.41 ±0.07	0.19
II	2.13 ± 0.14	2.15 ± 0.13	0.69
III	3.18 ± 0.17	3.06 ±0.15	0.001**
IV	4.04 ± 0.14	4.03 ± 0.14	0.72
V	4.97 ±0.13	4.91 ± 0.15	0.09

Student's independent 't' test; **p value<0.01 is highly significant.

Table 4: Comparison of Inter peak latencies in the left ear of vitiligo patients and control subjects

IP Waveform ms	Right Ear IPL (ms)		P- value
	Vitiligo patients (n=40) Mean ± SD	Controls (n=40) Mean ± SD	
I – III	1.79 ± 0.17	1.64 ± 0.16	< 0.001**
I – V	3.57 ± 0.16	3.50 ±0.18	0.06
III – V	1.78 ± 0.21	1.86 ± 0.20	0.117

Student's independent 't' test; **p value<0.01 is highly significant.

DISCUSSION

The eighth cranial nerve's vitiligo-related changes were the focus of this investigation. Wave latency is a measure of how long it takes to evaluate an event or stimulus.

The Brainstem Auditory Evoked Potential (BAEP) is a surface recording of the endogenous electrical activity of the underlying auditory pathway of the brain. BAEPs measure the impulse's conduction from the auditory pathway to the midbrain. Action potentials are produced in the auditory pathway by a brief auditory stimulation. This procedure is safe, non-invasive and simple. Studies on normal subjects demonstrated that latencies and waveforms are constant, indicating that this method of recording BAEP is reliable. However, BAEP reliability is

influenced by the temperature of the laboratory, the auditory threshold level, the frequency and intensity of the stimuli, the position of the electrodes, and other factors.

Melanocytes can be found in the vestibular organ, the inner ear's endolymphatic sac, auditory receptors or hair cells, and the stria vascularis (3,4). Melanocytes also aid in the formation of endocochlear potentials and the ion and fluid gradient between the endolymph and perilymph, both of which are required for hair cell survival. Anomalies in hearing might result from pigment cell's diminished activity (5-7). Melanin has been shown to have semiconductive properties and to have the ability to respond to acoustic, electrical, and phonic stimulation. Additionally, it can transform energy states into molecular rotation and vibration and vice versa. In addition to acting as a calcium buffer within the cell, melanin in the inner ear serves as a reservoir for vital metal ions that regulate enzyme activity and metabolic processes (4,6-9). Few studies have also shown that vitiligo is linked to some BERA abnormalities (10-12).

Various studies of BERA in vitiligo have shown wave I absolute latency to decrease, while wave III absolute latency, wave V absolute latency, and Inter Peak Latency I-III to increase (10,12,13). The primary parameters studied in BERA are AWL and IPL. As a result, in this study we compared the AWL I, II, III, IV, and V as well as the IPL I-III, I-V, and III-V in control and study subjects.

Left ear absolute wave latencies

In this study, in contrast to the controls, vitiligo patients had a significant increase in left ear AWL-III (Table 1). Aydogan *et al.*, (12) also found audiological abnormalities in patients with vitiligo and reported that increased AWL III could be caused by an irregularity in synaptic action and action potential transmission from the eighth cranial nerve to the cochlear nucleus and then to the supraoptic nucleus and inferior colliculus. As a result, the action potential synchronisation getting delayed in these nuclei could be associated with vitiligo.

Left ear inter peak latencies

As per Table 2, there was an appreciable increase ($P < 0.01$) in the IPL I-III of the left ear in vitiligo patients, with a mean higher value of 1.91 ± 0.16 ms contrasted with 1.77 ± 0.17 ms for controls. Aydogan *et al.*, in their study produced comparable results (12). According to a study conducted by Bassiouny *et al.* (13) and Nikifordis *et al.*, (10), vitiligo patients had a longer duration of IPL I-III than the control group. The decrease in AWL I was responsible for the increase in IPL I-III, resulting in a decrease in the active melanocyte population in the inner ear, which in turn could have hampered ionic exchange between the endolymph and perilymph.

Right ear absolute wave latencies

In this study, the AWL III of right ear in vitiligo patients increased significantly ($P > 0.01$) in contrast to the control's (Table 3). Similar results were reported by Aydogan *et al.*, (12) who attributed the increase in Absolute Wave Latency III to prolonged synchronization of action potentials in the auditory pathway.

Right ear interpeak latencies

IPL I-III of the right ears showed a statistically significant increase in vitiligo patients, with mean values of 1.79 ± 0.17 ms in comparison to 1.64 ± 0.16 ms in controls (Table 4). Our findings are consistent with similar results reported by Aydogan *et al.*, (12). Bassiouny *et al.*, (13) and Nikifordis *et al.*, (10) who reported prolonged IPL I-III in their studies. However, in a study by Ozuer *et al.*, (11) no statistically significant difference between the vitiligo patients and the controls in terms of the AWL or IPL in BERA was reported.

An abnormality in synaptic activity and the transmission of action potentials from the auditory nerve to the cochlear nucleus, and subsequently to the supraoptic nucleus and inferior colliculus, could explain the prolonged IPL I-III in both ears. As a result, vitiligo may be associated with a delay in action potential synchronisation in these nuclei and the auditory pathway.

CONCLUSION

This study found that people with vitiligo have abnormalities in the Brainstem Auditory Evoked Potential latency parameters, indicating that the auditory pathway has a conduction delay. Patients can undergo the Brainstem Evoked Response Audiometry (BERA) procedure, which is a simple and non-invasive test, to gain an early understanding of the potential involvement of the eighth cranial nerve and the brainstem auditory pathway in vitiligo. Since the BERA results seem to be abnormal in patients with clinically asymptomatic vitiligo, this test can be used to screen for subclinical audiological involvement in vitiligo patients.

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CONFLICT OF INTEREST

Authors declare no conflicts of interest.

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