Original Article

# Analysis of Vestibular Evoked Myogenic Potentials in Migrainous Individuals

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## Abstract

Migraine is a neurologic disease, often associated with a unilateral throbbing pain, which is categorized under primary headache disorder according to the International headache society (ICHS – 3)beta edition. Vestibular abnormalities are common in migraine. Vestibular Evoked Myogenic Potential (VEMP) amplitudes can be used as independent quantitative measures of otolith function. VEMP studies on migraine patients may shed new light on its pathophysiology as well as management and prognosis. In this study only p13 and amplitude were considered N23 or N1 potential was used for only identifying p13.

AIM AND OBJECTIVE: To analyse the vestibular evoked myogenic potentials in migraine in individuals attending a tertiary care hospital to identify the potential changes and abnormalities if any which could be specific to migraine.

METHODS AND MATERIALS: The cross observational study was done among the patients who had migraine in a tertiary care hospital. A number of 58 participants who fulfill the international classification of Headache Disorders criteria were recruited from the Neurology OPD. Subjects are enquired about their history of diagnosis, Family history, Investigations and diagnostic tests such as cVEMP.

RESULT: VEMP study of 58 Migrainous individuals show, abnormal findings in 65% of patients and normal findings in 34% of patients by proving cVEMP as a useful tool in diagnosing migraine.

CONCLUSION: This study proved VEMP to be a useful tool in helping in the diagnosis of migraine. At the same time not able to correlate with location of headache and intensity of pain. Further studies with larger sample sizes preferably with case and controls are required to corroborate the findings of this study

KEYWORDS: Migraine, Headache, cVEMP

## Introduction

Migraine is a neurological condition, characterized by episodic varying intensity headaches which usually lasts for hours to days, begins unilaterally, but may spread bilaterally. Migraine may be accompanied by anycombination of symptoms such as visual disturbances, hypersensitivity to light, sound and smell, inclination to vomit, vomiting and vestibular manifestations. These manifestations will differ from individual to individual and persons may have different symptoms during different episodes. Each episode may vary in duration and occurrence. The ICHD – 3 (International Classification of Headache Disorders) classify several types of headaches that includes different manifestations.[1] Migraine is categorized under primary headache disorder according to ICHD -3 with subdivisions under two major group

## Migraine with Aura

The aura indicates "Warning sign", is the multiplex of neurological symptoms such as sensory, speech, visual, motor and other central nervous symptoms, which can exist for minutes in length and is reversible. The auras can be unilateral, that usually happens before the headache. The term "Silentmigraine" defines aura which may be experienced by individuals without headache episodes.

## Migraine without Aura

The episodes of migraine attacks without warning signs, which generally lasts for 4 – 72 hours when it is treated or unsuccessfully treated. Manifestations include unilateral throbbing or pulsating pain accompanied with vomiting or inclination to vomit, hyper-

sensitivity to smells, sounds and light, mood changes, fatigue, confusion and visual disturbances. The investigations may be needed for exclusion of other medical conditions that causing secondary-headaches by imaging like MRI or CT or lab investigations.

## Cervical Vestibulo Evoked Myogenic Potentials

The cervical Vestibular Evoked Myogenic Potentials ( cVEMP) is one of the vestibular function test used for assessing the saccular and inferior vestibular nerve function, through vestibule-collic reflex. The VEMP stimulus reaches vestibulocochlear pathway involves receptors (Saccule), the afferent pathway (the inferior vestibular nerve), the efferent pathway the lateral vestibular nucleus, the medial vestibule-spinal tract to the sternocleidomastoid muscle.[2,3] cVEMP is performed by applying sound stimulation to one ear through headphones.

Recording of surface electrode was placed over the ipsilateral sternocleidomastoid muscle, reference-electrode on the anterior margin of the clavicle and the ground electrode on the forehead. Patients weretested in a lying position byflexing the head ~30° forward and rotate it~30° to the opposite side, while holding the head and jaw with the hand. Stimulus intensity was 95 dB n HL. Analysis time for each-stimulus was 100 ms. Responses up to 150 stimuli were averaged for each test and band- pass filtered-from 10-1500 Hz. Sound-responsive vestibular cells, mainly within the inner ear saccule, momentarily inhibit ipsilateral muscle tone via the cervical vestibulocollic pathway. Responses from the tonically-contracted ipsilateral sternocleidomastoid muscle are averaged to yield a biphasic waveform response.[4,5] A biphasic positive- negativity waveforms (p13-n23) were termed on the basis of their respective latencies. Vestibular dysfunctions are frequently associated with migraine including the common type.

Prolonged latencies are likely due to the degradation of central vestibular processing of otolith signalsrather than a decline in peripheral vestibular function. VEMP amplitudes can be used as independent quantitative measures of otolith function.

## Materials and Methodolgy

This study is an observational cross-sectional study. The aim is to analyse the vestibular evoked myogenic potential changes in migraine individuals attending a tertiary care hospital and establishing it as a diagnostic helping tool in migraine. A total of 58 patients presenting with complaints of migraine in tertiary care hospital and research institute was included. Patients more than the age of 18 years and patients who fulfill ICHD-3 diagnostic criteria for migraine were considered. Patients with pericranial, neck and shoulder muscle tenderness and/or associated myofascial pain syndrome and patient having a chronic neurological, systemic or inner ear / auditory condition indicating an otological disorder were excluded from thisstudy. Descriptive statistics were applied to calculate demographic variables like Mean, Median, Standard Deviation, Confidence interval. P values are calculated. Pie chart /Bar graph will be used to explain the cVEMP changes in migrainous individuals.

## Result and discussion

In this study 66 percent of the migraine patients showed positive VEMP study, which is a significant percentage.

Among 58 patients, incidence of migraine is maximum in age group of 21 - 30 years. 48 % of Migraine with aura and 45 % of Migraine without aurawere in this age group.

This study shows out of 58 participants, 50 % of male and 48 % of female had migraine with aura and 50% male and 48 % of female had migraine without aura.

Based on gender analysis, the increased incidence of migraine is noted in female population.

Based on pain severity, increased incidence of severe pain was seen in 70 % of migraine patients with aura and 48 % of migraine patients without aura.

Based on location of headache, the increased incidence of bilateral headache 46 % in migraine with aura patients and increased incidence of right sided headache 46 % in migraine without aura patients was noted.

In right side unilateral headache, 50 % of unilaterally Right-side prolonged latencies, nil % of latency prolongation on contralateral side, 9% of bilaterally prolonged latencies and 41 % of normal latencies seen. In left side migraine, 50 % of unilaterally left sided prolonged latencies, nil % of latency prolongation on contralateral side, nil % of bilaterally prolonged latencies and 50 % of normal latencies seen. In bilateral headache 8 % of latencies prolonged on right side, 12 % of latencies prolonged on left side, 13 % of latency prolonged on both sides and 67 % of normal latencies were observed.

On the whole, out of 58 participants, in unilateral headache, maximum number of VEMP latency prolongation is noted on same side. Right sided

headache - 50 %, left sided headache - 50 %. Normal latency was noted in patients with bilateral headache.

Out of 58 participants, no significant latency prolongation based on pain severity was noted.

On analyzing the amplitude asymmetry with pain severity in unilateral headaches, right side shows 50 % of amplitude reduction and left side shows 75 % reduction.

In bilateral headaches 75 % of normal amplitudes is noted.

Allena and Roceana (2007 ) reported deficit of habituation and reduced amplitudes in migraine patients, which suggested reduced serotogenic control of VEMP pathways. Bier et al (2009) also noted reduced VEMP amplitudes in vestibular migraine. The findings of the present study tend to lean towards central vestibular disorders in this disease. In this study, 22 migraine patients with Right side pain, 12 patients with left side pain and 24 patients with bilateral pain participated. Based on VEMP latencies correlation headache location, right sided headache shows high significant percentage of latency prolongation on unilateral side compared to both left and bilateral. Based on VEMP latencies correlation with pain severity - No significant latency prolongation is noted. Based on VEMP amplitude correlation with location of headache – Unilateral headaches showed significant amplitude reduction on ipsilateral side compared to bilateral headaches, may be due to lower threshold levels at the headache site. Based on VEMP findings right sided headache showed more VEMP abnormality 42%.

## Conclusion

Migraine is a clinical diagnosis most of the time. No definite diagnostic tool is available so far. VEMP study of 58 migrainous individuals shows, abnormal findings in 65% of patients and normal in 34% of patients. Though 65% of patients had abnormal VEMP findings, there is no statistically significant correlation with location of headache or pain intensity. Further studies with larger sample sizes, preferably with case and controls are required to corroborate the findings of this study and VEMP can be used as a part of definite diagnostic modality in future.

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