

Significance of Audiovestibular Evaluation in Identifying Neurovascular Loop Involving VIIth-VIIIth Cranial Nerve Complex - A Case Study

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Abstract: *The etiology of symptoms such as giddiness/vertigo/dysequilibrium can be varied. It could be due to conditions affecting ear, central nervous system or cardiovascular system. A thorough audiological evaluation including Videonystagmography could help in differential diagnosis of these disorders. This study unravels how possibility of neurovascular loop in a case was identified by audiological evaluation and later confirmed by radiological investigation.*

Keywords: Vertigo, Balance Disorders, Audiological evaluation, Videonystagmography, Neurovascular Loop

1. Introduction

The discipline of audiology deals with hearing and balance disorders. Giddiness is a sensation of feeling light-headed or unsteady. Vertigo is characterised by a false sensation of motion; people feel as though they are spinning or environment around them is spinning. Dysequilibrium is a sensation of being off-balance. Causes could range from inner ear disorders, neurological conditions, variations in blood pressure etc. Audiologists have pivotal role in diagnosing patients with these disorders.

In some patients, a single vessel loops around the vestibulocochlear and facial nerves at the Cerebellopontine Angle (CPA) cistern, which may extend into the Internal Auditory Canal. The culprit vessel commonly identified is the Anterior Inferior Cerebellar Artery (AICA). It could cause audiological and vestibular symptoms. Videonystagmography (VNG) could give indication regarding irritation of the nerve.

Neurovascular cross-compression of the root entry zone of the Vth, VIIth and IXth cranial nerves causes symptoms of trigeminal neuralgia, hemifacial spasm and glossopharyngeal neuralgia. Similarly, the diagnosis of 'vestibular paroxysmia' secondary to neurovascular cross-compression of the VIIIth Cranial Nerve is based on four characteristic features: (1) short attacks of rotational to-and-fro vertigo lasting seconds to minutes; (2) attacks frequently dependent on particular head positions and modification of the duration of the attack by changing head position (3) hyperacusis or tinnitus permanently or during the attack and (4) measurable auditory or vestibular deficits by neurophysiological methods. Carbamazepine is the most effective drug. In medically intractable cases, retromastoid craniotomy and microvascular decompression is a recommended procedure once the side of disorder has been identified (Brand, Dieterich, 1994).

2. Case Report

A 38 year old female presented with complaints of giddiness on 13/1/2023. First episode reportedly occurred 2 years back

while walking. It was true rotatory giddiness and lasted for 1 day. Second episode recurred after 7 months while sleeping. The presentation was again true rotatory and it lasted for 1 hour, associated with left ear blocking sensation. Presently, the patient complains of light headedness & dysequilibrium while walking. She also reported slight discomfort while lying down in bed, looking up and with reduced sleep. She was taking Vertin for past 2 years with no significant relief.

Reportedly, she sleeps only for 5 hours since 2 years. Studying for Chartered Accountancy since 1 year in addition to regular working schedule between 9-5.30 a.m (Paint colour technician). She is hypertensive since 2 years. She also met with a Road Traffic Accident one year back.

Ear Nose Throat consultations on various dates at different places suggested possibilities of various disease conditions such as: On 04/07/2022- Benign Paroxysmal Positional Vertigo (BPPV) was suspected; on 11/07/22- Meniere's disease was suspected; on 19-07-2022- Vestibular neuronitis was suspected. Non contrast Computed Tomography of Head done on 24-07-2022 revealed normal study. Puretone audiometric evaluation done from outside centre on 07/2/22 revealed Normal hearing sensitivity bilaterally. Audiological evaluation done from outside centre on 15/07/22 revealed Normal hearing sensitivity bilaterally with Bilateral A type tympanogram indicated normal conductive pathway.

Evaluations done from Decibel Institute of Hearing, Balance and Speech Sciences:

Physical Examination:

Blood Pressure (millimetres of Mercury) & Pulse (beats/minute): Lying: 158/106 & 72; Standing (1 minute): 162/108 & 75; Standing (5 minutes): 162/107 & 67.

Walking was slightly staggering. Tandem standing: Swaying to right; Tandem walking: swaying (+); Fukuda: She moved forward; When she was asked to stand in a foam bed, she swayed.

Videonystagmographic evaluation (Cyclops Medtech VNG equipment was used for the study):**Findings:**

Nystagmus: Spontaneous in dark: Up and right beating nystagmus. High frequency head shake & Hyperventilation: Right beating nystagmus.

Gaze (without fixation): Right: Right beating nystagmus.

Positional test: Dix Hallpike right: Sit head right, Sit head right: Right beating nystagmus. Supine head extension & right: Right & up beating nystagmus. Dix Hallpike left: Supine head extension & left, Sit head left: Right beating nystagmus. McClure-Pagnini: Sit to supine, Supine head neutral: Up & right beating nystagmus. Right lateral: Up beating nystagmus. Supine head neutral, Left lateral: Right beating nystagmus. Head position: Yaw left, Pitch forward, Roll left: Right beating nystagmus. Roll right: Up beating nystagmus.

Recommendation: Magnetic Resonance Imaging of brain to rule out conditions such as vascular loop around VIIIth Cranial nerve.

Magnetic Resonance Imaging of brain done on 20/1/23 revealed:

Protocol: Axial - T2, T2*, T1 FLAIR, Sagittal – T2, Coronal – T2, DWI, CISS 3D AXIAL. Contrast given: Nil

Imaging impression:

No significant neuroparenchymal abnormality at present.

A neurovascular contact seen between a vascular loop and the right cisternal segment of VIIth-VIIIth nerve complex without significant thinning.

Small (1-2 mm) cystic spaces that follow Cerebrospinal Fluid (CSF) on all sequences are located at the lateral aspect of the hippocampal region bilaterally -possibly hippocampal sulcus remnant cyst.

T2 hyperintense mucosal thickening involving right frontal sinus -possibly inflammatory sinus disease

3. Discussion

This patient was consulted by Audiology team at Decibel Institute of Hearing, Balance and Speech Sciences, Kerala, India. The patient had visited us after multiple consultations with various professionals at various institutes with no significant cure for her symptom of giddiness and dysequilibrium. She was in a state of devastation unable to carry on with her work and day-to-day activities due to the disabling giddiness and dysequilibrium.

A thorough case history of the patient was taken. Symptom presentation of the patient was complex. She had episodes of true rotatory vertigo in the past and her latest symptom presentations were light headedness and dysequilibrium

while walking. ENT consultations earlier had suspected probability of BPPV/Meniere's disease/Vestibular neuronitis.

Considering her latest symptomatology of light-headedness and dysequilibrium while walking, BPPV was an unlikely etiology as far as we were concerned. Meniere's disease was also unlikely as she did not have true rotatory vertigo/tinnitus/blocking sensation of ear lately. Her puretone audiometric findings also revealed normal results. Vestibular neuronitis was also unlikely considering that her symptoms were not very severe off-late.

Considering her life style and discomfort with reduced sleep, probability of Migraine Associated Vertigo was in our mind. Hypertension was also another concern as her Blood Pressure levels were high. Considering dysequilibrium while walking, probability of any neurovascular conflict at VIIIth Cranial Nerve level was also considered. Possibility of any Cerebellopontine Angle tumor or VIIIth Cranial Nerve tumor was also given less chances as Computed Tomography of head was normal.

Her VNG findings did not give any specific indications of BPPV. She had consistent right beating nystagmus, which probably indicated irritation of Cranial Nerve VIII. No other definite signs and symptoms of unilateral vestibular hypofunction of left ear was also noted.

Hence, the case findings were discussed thoroughly by the Audiology team of Decibel Institute and our vastly experienced vestibular and balance ENT specialist (honorary consultant). Probable likelihood of neurovascular compression around VIIIth Cranial Nerve was considered. It was decided to send the patient for Magnetic Resonance Imaging of brain evaluation to rule out conditions such as neurovascular compression around VIIIth Cranial Nerve. As considered, MRI results revealed A neurovascular contact seen between a vascular loop and the right cisternal segment of VIIth-VIIIth nerve complex without significant thinning.

She was immediately started on Tab Carbamazepine 100 mg Tid. The results were excellent. The patient had good relief of her symptoms.

In summary, giddiness/vertigo/dysequilibrium can be due to a variety of etiological factors. Patients should undergo thorough medical, audiological and radiological evaluation to accurately diagnose the pathophysiology behind the symptom presentation. Treatment protocol should be planned only after accurate diagnosis. Otherwise, patients will suffer long time without cure of symptoms. Videonystagmography is a very efficient tool to diagnose diseases conditions associated with vestibular (both peripheral and central) as well as balance system. Medical professionals should take utility of such advanced diagnostic tools in accurately diagnosing the disease conditions. Consultation by experienced well equipped audiology team is crucial for differential diagnosis of vertigo/giddiness/ balance disorders.

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Compliance with ethical standards: Yes

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Informed Consent: Informed consent was obtained from the participant.

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