

Vertigo: Incidences, Diagnosis and Its Relations with Hearing Loss

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Abstract Vertigo is one of the most common complaints in our regular practice. Vertigo is of peripheral or central cause. The association of vertigo with or without hearing loss helps to narrow the differential diagnosis. The aim of the study is to evaluate the various causes of vertigo based on the vertigo attacks and hearing loss.

Keywords Vertigo · Hearing loss

Introduction

An accurate diagnosis and correct treatment in patients with dizziness is a real challenge. This is because the patient's presentation is not very specific and is misleading at times. Patients may describe this as vertigo, dysequilibrium, light-headedness or syncope. The clinical presentations may not be typical in vertigo too.

Vertigo is defined as an illusion of either oneself or the environment rotating [1]. Vertigo can occur due to peripheral or central vestibular disorders. Peripheral vertigo is due to vestibular dysfunction involving the vestibular receptors and the vestibular nerve. The central vertigo is due to lesions of the vestibular nuclei in the brainstem and the vestibulocerebellum.

Vertigo can last for few seconds, minutes to hours or for many days. Triggering factors such as changes in head position or to loud noise may worsen the vertigo. Associated symptoms such as hearing loss, tinnitus or aural

fullness indicate peripheral involvement. Facial numbness/weakness, dysarthria, posture and gait disturbances indicate central involvement. The patient history regarding all these details and clinical neurootological examination is of utmost importance for diagnosis of causes of vertigo.

The most common causes of peripheral vertigo are BPPV, Meniere's disease, vestibular neuritis, labyrinthitis. Central causes of vertigo are vestibular migraine, vertebrobasilar insufficiency, cerebellopontine angle tumours, multiple sclerosis, episodic ataxia. Based on vertigo attacks and the associated hearing loss, a study was done to evaluate the various causes of vertigo.

Materials and Methods

A prospective study of 150 patients presenting with dizziness in the department of ENT from July 2015 to June 2016 were studied. The patient's history was obtained based on the questionnaire prepared by us. The clinical examination included checking of blood pressure, tuning fork test, spontaneous and gaze induced nystagmus, head thrust test, Dix–Hallpike maneuver, Romberg's test, Unterberger's test, focal neurological signs. Audiological evaluation was done in all the cases. Caloric test was done depending on the patient's presentation. Brainstem evoked response audiometry (BERA), vestibular evoked myogenic potential (VEMP), CT and MRI scan with Doppler were done in selected individuals. After an accurate diagnosis, patients were treated accordingly.

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Observations

104 vertigo subjects had been analyzed and interpreted according to their age and gender at the time of incidence (Table 1).

In both gender the maximum of incidence was 40–49 years. The mean age of incidence in female was 43.7 ± 12.7 years and male was 46.1 ± 14.2 years. The total subjects' mean age was 44.8 ± 13.3 years with range of 20–78 years.

The most common presenting symptom was vertigo followed by hard of hearing, headache, unsteadiness, nausea, vomiting, tinnitus, and aural fullness, loss of consciousness, ear discharge as in Table 2. The other symptoms were upper respiratory tract infection, trauma, syncope.

45 (43.3%) patients were diagnosed to have Benign paroxysmal positional vertigo (BPPV), of which 43% male and 57% female patients. The age group of the patients were between 22 and 75 years. These patients presented with history of vertigo on head position changes such as on lying down, getting up from supine position, bending over or on looking up. Vertigo lasts less than a minute.

Among 42 patients with posterior semicircular canal (SCC) BPPV, diagnosed by Dix–Hallpike manoeuvre, 53% cases positive on the right side. Epley's maneuver relieved BPPV in 40 patients. In 2 patients the procedure had to be repeated. Two patients with bilateral BPPV were treated with betahistine and cinnarizine given for 5 days each. One patient had lateral SCC BPPV diagnosed by supine roll test. Treated with barbecue roll maneuver.

9 (8.7%) patients were diagnosed with Vertebrobasilar insufficiency. This is usually transient ischemic attack. These patients presented with history of vertigo lasting for less than a minute and in some up to 30 min. These patients had a central type of nystagmus, postural instability and other neurological signs. MRA scan was helpful in the diagnosis. These patients were treated with antiplatelet therapy.

7 (6.7%) patients were diagnosed to have Vestibular neuronitis. The age group of the patients were between 20 and 45 years. These patients presented with history of sudden and severe vertigo lasting for more than 24 h with nausea, vomiting and upper respiratory tract infection. Head thrust test was positive in these cases. Symptomatic treatment with antiemetics and vestibular suppressants. Also were treated with methylprednisolone.

4 (3.8%) patients were diagnosed to have Vestibular migraine. These patients presented with vertigo which lasts for seconds to few days. It is associated with headache with aura, photophobia, phonophobia. Patients were treated with flunarizine and prophylactic therapy with beta blockers.

2 (1.9%) patients had Migraine with brainstem aura (previously Basilar migraine). These patients presented with history of vertigo, tinnitus, headache, ataxia, dysarthria, diplopia. Treatment in consultation with neurologist with antiepileptics or betablockers.

14 (13.5%) cases had cervical vertigo. These patients had history of vertigo, neck pain. X-ray cervical spine and in 4 cases MRI cervical-spine were helpful in the diagnosis. Patients were treated in consultation with orthopaedician. Also physical therapy given.

Meniere's disease was seen in 7 (6.7%) patients. These patients presented with episodic vertigo lasting from few minutes to hours, tinnitus, aural fullness and hearing loss. Pure tone audiometry showed sensorineural hearing loss. Hyporesponse was seen in caloric test. Electrocochleography and VEMP showed abnormal response in these patients. These patients responded to salt restriction, diuretics, and vasodilators.

Cholesteatoma was seen in 4 (3.8%) patients. One patient had a fistula in the lateral semicircular canal due to cholesteatoma. Cholesteatoma removal and modified radical mastoidectomy with closure of fistula in the lateral semicircular canal using temporalis fascia graft was done. Post-op vertigo was seen in 3 patients. These patients had absence of foot plate with cholesteatoma and exposed oval window. The foot plate was closed using tragal cartilage

Table 1 Age and gender wise distribution of vertigo subjects

Age group (years)	Female		Male		Total	
	Frequency	%	Frequency	%	Frequency	%
20–29	6	10.3	7	15.2	13	12.5
30–39	17	29.3	8	17.4	25	24.0
40–49	19	32.8	12	26.1	31	29.8
50–59	8	13.8	11	23.9	19	18.3
60–69	6	10.3	5	10.9	11	10.6
70–79	2	3.4	3	6.5	5	4.8
Total	58	100.0	46	100.0	104	100.0

Table 2 Chief complaints

Complaints	No. of cases
Vertigo	104
Hard of hearing	33
Tinnitus	14
Aural fullness	7
Nausea, vomiting	24
Ear discharge	4
Trauma	5
URI	9
Headache	32

with perichondrium in two patients and in another with autologous incus. Symptoms of vertigo reduced within 3 days.

Labyrinthitis was seen in 2 (1.9%) patients. These patients presented with vertigo with hearing loss, nausea and vomiting. History of upper respiratory infection was present in one patient. It was diagnosed by pure tone audiometry and caloric test which showed no response. Antiemetics and vestibular suppressants were given. Antibiotics were given.

2 (1.9%) patients were diagnosed to have Vestibular schwannoma. These patients presented with history of vertigo, tinnitus and hearing loss. Pure tone audiometry was done. BERA showed wave V latency delay and interaural latency difference of > 0.3 ms. MRI scan was done. These patients were referred to neurosurgeon.

5 (4.8%) patients had Posttraumatic vertigo. CT scan showed no fracture of temporal bone. The treatment includes antivertigo drugs and rehabilitation therapy.

Dead labyrinth was seen in 1 (1%) case. The patient had deaf ear.

1 (1%) patient had bilateral vestibulopathy. Presented with history of postural imbalance, unsteadiness of gait and oscillopsia. Head shake test showed catch up saccade. VEMP showed absent response. Carotid Doppler was normal. CT brain showed dilated ventricles. The patient was given adequate vestibular rehabilitation exercises.

Vestibular paroxysmia was seen in 1 (1%) patient. This patient presented with vertigo lasting from few seconds to minutes, associated with decreased hearing and unsteady gait. MRI showed compression of eighth cranial nerve by the anteroinferior cerebellar artery. The patient was treated with carbamazepine.

The associations between vertigo with or without hearing loss were analyzed and interpreted by χ^2 (Chi square) tests. The above statistical analysis and interpretations were performed with the help of the statistical package namely

IBM SPSS statistics-20. The *P* values less than or equal to 0.05 ($P \leq 0.05$) were treated as level significance.

The diagnosis and hearing loss was associated in Table 3. The results revealed that the Labyrinthitis was associated with acute and others are associated with recurrent of vertigo among the hearing loss subjects ($P < 0.01$).

The diagnosis and absence of hearing loss was associated in Table 4. The results revealed that the Vestibular neuronitis was associated with acute and others are associated with recurrent of vertigo among the absence of hearing loss subjects ($P < 0.01$).

Discussion

The presence of vertigo with sensorineural hearing loss narrows down the differential diagnosis [2–4]. Also based on acute and recurrent attacks of vertigo and hearing loss [5, 6]. In our study, vertigo with hearing loss is seen in 22% of the patients, and Meniere's disease being the most common cause. Vertigo without hearing loss is seen in 78% of the patients with BPPV as the most common cause.

BPPV is the most common cause of vertigo accounting for 43.3% of the cases followed by vertebrobasilar insufficiency in 8.7%, Meniere's disease in 6.7%, vestibular neuronitis in 6.7%, vestibular migraine 3.8%, basilar migraine in 1.9%, vestibular paroxysmia 1%, bilateral vestibulopathy in 1% of the cases. In a study by Michael Strupp the frequency for BPPV is 17.1%, central vestibular syndromes is 12.3%, Meniere's disease 10.1%, vestibular neuritis 8.3%, bilateral vestibulopathy 7.1%, vestibular paroxysmia 3.7%, vestibular migraine 11.4% [7].

Posterior semicircular canal BPPV is seen in 93% of the cases. 53% cases positive on the right side and Modified epley's manouver relieved BPPV in 95% of the cases similar to a study by Wolf et al. [8]. In 5% of the patients the procedure had to be repeated. Bilateral BPPV was seen in 4.4% of the patients similar to a study by Pollak et al. [9]. Lateral semicircular canal BPPV was seen in 2% of the patients and is less than 5% in a study by Parnes et al. [10].

Vestibular neuronitis is due to viral infection of the vestibular nerve, commonly superior vestibular nerve. Head thrust test is positive in these cases [11]. Treatment with methylprednisolone has improved the recovery. [12].

The diagnosis of Meniere's disease was based on history, sensorineural hearing loss on pure tone audiometry, hypocaloric response [13]. Electrocochleography and VEMP showed abnormal responses. Patients were relieved with vasodilators and diuretics.

In elderly patients, Vertebrobasilar insufficiency is a common cause of vertigo, diagnosed based on history.

Table 3 Association between diagnosis and hearing loss

Diagnosis	Acute		Recurrent		Total (n = 23)		Results
	No	%	No	%	No	%	
Meniere's disease	–	–	7	33.3	7	30.4	$\chi^2 = 23.00$
Post traumatic vertigo	–	–	5	23.8	5	21.7	$df = 5$
Cholesteatoma	–	–	4	19.0	4	17.4	$P < 0.01$
Labyrinthitis	2	100.0	–	–	2	8.7	
Vestibular schwannoma	–	–	2	9.5	2	8.7	
Bilateral vestibulopathy	–	–	1	4.8	1	4.3	
Vestibular paroxysmia	–	–	1	4.8	1	4.3	
Dead labyrinth	–	–	1	4.8	1	4.3	

Table 4 Association between diagnosis and absence of hearing loss

Diagnosis	Acute		Recurrent		Total (n = 81)		Results
	No	%	No	%	No	%	
BPPV	–	–	45	60.8	45	55.6	$\chi^2 = 81.000$
VBI	–	–	9	12.2	9	11.1	$df = 5$
Vestibular neuronitis	7	100.0	–	–	7	8.6	$P < 0.001$
Vestibular migraine	–	–	4	5.4	4	4.9	
Basilar migraine	–	–	2	2.7	2	2.5	
Cervical vertigo	–	–	14	18.9	14	17.3	

MRA is useful in establishing the diagnosis [14]. Treatment is with antiplatelets.

Cervicogenic vertigo is still controversial. However the neck afferents contribute to eyes, head trunk coordination and postural control. These patients however improve after physiotherapy.

Conclusion

An elaborate and thorough history of vertigo is important. Also the severity of the attack of vertigo, acute or recurrent and presence or absence of hearing loss helps to narrow the differential diagnosis. A detailed clinical neurootological examination is of utmost importance. Apart from pure tone audiometry, caloric test and investigations such as BERA, CT scan or MRI, VEMP are required depending on the provisional diagnosis. With an accurate diagnosis, treatment provided accordingly cures the patient symptoms.

In peripheral vestibular disorders, video head impulse test and subjective visual vertigo will help in identifying the site of lesion, whether from the semicircular canal and utricle or saccule respectively.

Compliance with Ethical Standards

Conflict of interest There was no conflict of interest in this study.

Ethical Standards The study was approved by the Institutional Ethical committee.

Informed Consent Informed consent obtained from the patients during the study.

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