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Evaluation and assessment of roles of neurootological examinations, vestibular tests, and videonystagmography in patients with dizziness

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Abstract

Background Vertigo and dizziness are frequent clinical symptoms. Peripheral vertigo and central vertigo are two different types of vertigo that result from a disrupted vestibular system. Imbalance and dizziness are frequent initial complaints. It is common for improper diagnosis and subpar treatment to result from a lack of a systematic approach to the examination and laboratory evaluation of the vestibular system. A correct diagnosis can be made with a fundamental knowledge of vestibular physiology and the right examination methods.

Objectives The current study was done to evaluate and assess the roles of neuro-otological examinations, vestibular tests, and videonystagmography among patients with dizziness visiting a tertiary care centre.

Methodology An analytical cross-sectional study was conducted among patients complaining of vertigo at a tertiary care centre for the duration of 18 months. A total of 64 patients were included according to inclusion and exclusion criteria. Various diagnostic tests were applied and correlated with the complaints of the patients.

Result Forty-two percent of patients with dizziness had hearing loss, and 26.5% had tinnitus. 57.8% had the PTA test within the normal limit, and the head shake test (videonystagmography) was positive among 39.1%. Caloric test abnormality was seen in 53.1% of patients with dizziness. Neuro-otological examination of the head shake test was found positive in 29.7% of cases. 79.7% of cases show a positive Fukuda test. SP > AP is seen among 9.4% of cases in EchoG. 67.1% show a positive Romberg test. The Dix-Hallpike test was positive among 31.2% of dizziness patients.

Conclusion In conclusion, history and neuro-otological testing can aid in the diagnosis of vertigo, but they cannot be relied on if the vertigo is complex. Only symptomatic history and neuro-otological tests are helpful in cases like a simple unilateral posterior canal BPPV, but in a complex case with tinnitus, aural fullness, Romberg positivity, or Fukuda positivity, we need the assistance of additional investigations such as vestibular tests such as ECochG and VNG.

Keywords Dizziness, Caloric test, Head shake test, Romberg test, Neuro-otological examination, PTA, Videonystagmography

Background

Dizziness is defined as the sensation of being lightheaded, woozy, or off-balance. Because it is connected to the sensory organs, notably the eyes and hearing, it may sometimes induce fainting. Dizziness is not an illness in and of itself, but rather a symptom of many conditions.

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There are two categories of vertigo: central and peripheral [1, 2].

Dizziness can result from an issue with almost any bodily system. Careful inquiry is necessary because patient accounts of the condition are frequently hazy and inconsistent. The physical examination is carried out by keeping an eye on the patient while they are at rest and doing quick movements or at-the-bed checks. Typically, no specialized equipment is needed. The characteristics that set them apart from one another can be subtle, and the reasons for dizziness can range from harmless to life-threatening illnesses. Parsimony should be the guiding principle while considering diagnostic testing. Priority is given to identifying typical peripheral vestibular diseases. It may be essential to eliminate these "low-hanging fruits" before ruling out more serious systemic causes of dizziness [3].

According to Neuhauser et al. [4], dizziness or vertigo had a prevalence of 22.9% and an incidence of 3.1%. The prevalence of vestibular vertigo was 4.8%, and the incidence was 1.4%. A medical consultation for incident dizziness or vertigo was reported by 1.8% of unselected people who contacted a physician in the previous 12 months (0.9% for vestibular vertigo). Medical consultation (70% vs. 54%; $P=0.001$), sick leave (41% vs. 15%; $P=0.001$), suspension of daily activities (40% vs. 12%; $P=0.001$), and avoidance of leaving the house (19% vs. 10%; $P=0.001$) were all more frequently used as a response to vestibular vertigo. However, more than half of those who had vestibular vertigo also had a non-vestibular diagnosis. Individuals experiencing dizziness and vertigo had worse age- and gender-adjusted health-related quality of life than dizziness-free control participants [4].

According to research by Kerber and Baloh [3], identifying the symptom is the first step in examining a patient who complains of dizziness. Because the patient's report is subjective, it could be inconsistent and inaccurate. Vertigo, for instance, which is characterized as an illusion of movement, denotes a vestibular system imbalance. However, just because a patient reports experiencing vertigo does not necessarily suggest that a vestibular condition is to blame; conversely, just because a patient denies experiencing vertigo does not necessarily rule out a vestibular disorder. Even patients who have clear vestibular nystagmus during caloric testing may deny experiencing vertigo and claim to feel dizzy, woozy, or lost [3].

Vertigo is frequently brought on by an issue with how the inner ear regulates balance, but it can also be brought on by issues with specific brain regions. In addition to migraines (strong headaches), labyrinthitis (an inner ear infection), and vestibular neuritis, which is an inflammation of the vestibular nerve, which goes into the inner ear and provides signals to the brain that assist with balance, there are other possible causes of vertigo. Additional symptoms, such as a fever, ringing in the ears (tinnitus), and hearing loss, can occur depending on the illness producing vertigo [5].

Dizziness is not an issue by itself but is often a symptom of an underlying health issue. When it occurs very frequently or over longer periods of time, it could indicate an underlying health issue for which one should consult a qualified medical professional. The development of such modern diagnostic tools sparked a paradigm shift in clinical vestibular diagnostics, which has had a growing impact on accepted medical practices for the identification of vertigo and balance problems [6]. Because there are many causes of dizziness or vertigo in patients, we attempt to evaluate and assess the role of neuro-otological examinations, vestibular tests, and videonystagmography in dizziness patients. The rationale of the study is to narrow the diagnostic window and increase diagnostic accuracy. History, neuro-otological examination, vestibular tests, and videonystagmography tests are simply tools for providing a probable working diagnosis, which eventually leads to a final working diagnosis, after which patients can be better managed without putting a strain on the health infrastructure or the patient.

Method

The cross-sectional study was conducted among patients with complaints of dizziness, vertigo, and imbalance who came to the outpatient department of otorhinolaryngology at Sri Aurobindo Medical College and Post Graduate Institute, Indore, for the duration of 18 months, from April 2021 to September 2022. A total of 64 patients with complaints of dizziness, vertigo, and imbalance were selected for the study. The aim of the study was to evaluate and assess the roles of neuro-otological examinations, vestibular tests, and videonystagmography in patients with dizziness visiting a tertiary care centre. Patients were enrolled according to the inclusion and exclusion criteria of the study. Informed written consent was taken from all the patients, relatives, and guardians after the approval of the institutional ethics committee for the data collection. Inclusion criteria were patients with a chief complaint of dizziness and an age greater than 18 years; patients or relatives who denied enrolling were excluded from the study along with those patients who had a history of psychiatric disorders, patients with severe spinal disorders (kyphosis, scoliosis, or cervical spondylitis), known cases of head injury, all patients with severe ear infections and tympanic membrane perforations, patients who had undergone major neurosurgical procedures, and patients who were known

Fig. 1 The demonstration of Romberg's test

Fig. 2 The demonstration of Fukuda's test

cases of head and neck malignancies. An examination of the ears, nose, and throat, along with a general physical and systemic examination, was carried out to rule out any other cause of dizziness. Neuro-otological examinations of the head shake test, pure tone audiometry, Romberg test (Fig. 1), Fukuda's test (Fig. 2), Dix-Hallpike test (Fig. 3), videonystagmography positional test (Figs. 4 and 5), electrocochleography, and caloric test (Fig. 6) were performed. After all tests were performed on patients with dizziness, the data was entered into Excel and imported into SPSS version 25 for further analysis. The chi-square test was applied to evaluate the association between two groups of patients with different test results. A 95% confidence interval was taken with a p value less than 0.05 for statistical significance.

Fig. 3 Demonstration of the Dix-Hallpike test

Fig. 4 VNG-guided positional test being conducted in vestibular lab set up

Results

Forty-two percent of patients with dizziness had hearing loss, and 26.5% had tinnitus. 57.8% had the PTA test within the normal limit, and the head shake test (videonystagmography) was positive among 39.1%. A caloric test abnormality was seen in 53.1% of patients with dizziness. Neuro-otological examination of the head shake test was found positive in 29.7% of cases. 79.7% of cases show a positive Fukuda test. SP > AP is seen among 9.4% of cases in EchoG. 67.1% show a positive Romberg test. The Dix-Hallpike test was positive among 31.2% of dizziness patients. Among 37 patients whose result of PTA was WNL, 4 (36.4%) had bilateral weakness, 8 (72.7%) had left weakness, and only 1 (8.30%) had right-side weakness. Out of 5 patients (7.80%) whose result of PTA was right-side moderate SNHL, only 1 (3.3%) had normal and 4 (33.3%) had right-side weakness.

According to our findings, out of the 30 patients (46.90%) whose Fukuda's test result was right-side positive, 6 patients (54.50%) had a caloric test result of

Fig. 5 VNG guided horizontal canal test being conducted in vestibular lab set up

Fig. 6 Caloric test being performed on a patient

"bilateral hypoactivity," 13 patients had a normal caloric test result, 11 had "right hypoactivity," no patients were found with "left hypoactivity," 3 had bilateral weakness, and 10 had left-sided weakness on the caloric test.

Out of 6 patients (9.40%) whose ECoch-G test result was SP > AP, 1 patient (9.10%) had bilateral hypoactivity, 3 patients (27.30%) had left-side weakness, and 2 (16.70%) had right-side weakness. Out of 58 patients (90.60%) whose result of the ECoch-G test was normal, 10 patients (90.90%) have bilateral hypoactivity, 8 patients (72.70%) have left weakness, 30 patients (100%) are normal, and 10 patients (83.30%) have right weakness.

As seen in Table 1, among the 18 patients (28.10%) whose results of the Romberg test were right-side positive, 3 patients had bilateral hypoactivity, 5 had right-side weakness results, 10 had normal caloric test results, and no patient had left-side weakness results.

There was a significant association found for caloric test results with the Fukuda test, EchoG, videonystagmography head shake test, and Romberg's test. It indicates and affirms that the Fukuda test, EchoG, videonystagmography head shake test, and Romberg's test result in dizzy patients contribute to the diagnosis of broadly vestibular asymmetry and finally help canal paresis side determination. Along with lateral semi-circular canal abnormalities that can be detected by caloric testing in patients with dizziness, other tests like the Fukuda test, EchoG, videonystagmography head shake test, and Romberg's are also sensitive to rule out other causes.

As seen in Table 2, among the 18 patients (28.10%) whose result of the Romberg test was right-side positive, 8 patients had a negative and 10 patients had a positive videonystagmography positional test. Out of the 25 patients (39.10%) whose result of the Romberg test was left-side positive, 15 had a negative and 10 had a positive videonystagmography positional test.

As per Table 2, among the 25 patients (39.10%) whose results of the videonystagmography head shake test were positive, 21 had a videonystagmography positional test that was negative and 4 were positive.

Out of 10 patients (15.60%) whose results of the neuro-otological examination of the head shake test were left side+, 6 had a negative videonystagmography head shake test, and among the 9 patients whose results of the neuro-otological examination of the head shake test were right side+, all had a positive videonystagmography head shake test.

Among 30 patients (46.90%) whose Fukuda's test results were right-sided, 17 patients had negative videonystagmography positional test results and 13 patients had positive results. Fukuda's test results were "left side positive" in 21 (32.80%), among whom 11 had negative videonystagmography positional test results and 10 had positive results.

There was no association between the videonystagmography positional test and Fukuda's test or Romberg's test. There was a significant association found between the videonystagmography head shake test and the neuro-otological examination head shake test and the videonystagmography positional test. Patients complaining of dizziness with nystagmus had positive test finding in videonystagmography head shake test, neuro-otological examination head shake test, and videonystagmography

Table 1 Association of caloric test with Fukuda, audiological and vestibular tests, videonystagmography head shake test, and Romberg's test

Test		Caloric test			
		Bilateral weakness (*n* = 11)	**Left-side weakness (*n* = 11)**	**Normal (*n* = 30)**	**Right weakness (*n* = 12)**
Fukuda's test	Right side + (*n* = 30)	6	0	13	11
		54.50%	0.00%	43.30%	91.70%
	Left side + (*n* = 21)	3	10	8	0
		27.30%	90.90%	26.70%	0.00%
	Negative (*n* = 13)	2	1	9	1
		18.20%	9.10%	30.00%	8.30%
Chi-square value: 24.086			*p* value: 0.001*		
Audiological and vestibular tests ECochG	Positive (*n* = 6)	1	3	0	2
		9.10%	27.30%	0.00%	16.70%
	Normal (*n* = 58)	10	8	30	10
		90.90%	72.70%	100.00%	83.30%
Chi-square value: 8.003			*p* value: 0.046*		
Videonystagmography head shake Test	**Positive (*n* = 25)**	9	6	0	10
		81.80%	54.50%	0.00%	83.30%
	Negative (*n* = 39)	2	5	30	2
		18.20%	45.50%	100.00%	16.70%
Chi-square value: 38.667			*p* value: < 0.05*		
Romberg's test	Right side + (*n* = 18)	3	0	10	5
		27.30%	0.00%	33.30%	41.70%
	Left side + (*n* = 25)	5	11	8	1
		45.50%	100.00%	26.70%	8.30%
	Negative (*n* = 21)	3	0	12	6
		27.30%	0.00%	40.00%	50.00%
Chi square value: 24.086			*p* value: 0.001*		

*Statistically significant

positional test which infers that chronology of testing is important to develop an algorithm which best suits and serves the patient's presentation (acute /chronic) and socioeconomic status.

As per Table 3, 18 patients (28.10%) had Romberg's test results that were right-side positive; among them, 1 (16.70%) had Dix Hallpike test results that were bilaterally positive; 14 (31.8%) had a negative result; 3 (37.5%) had a right-side positive result; and none had a left-side positive result. Twenty-five patients (39.10%) had positive Romberg's test results for the left side; among them, 4 (66.70%) had Dix-Hallpike test results that were bilaterally positive, 15 (34.10%) had Dix-Hallpike test results that were negative, no patients had Dix-Hallpike test results that were right side positive, and 6 (100%) had Dix-Hallpike test results that were left side positive.

According to data seen in Table 3, among the 27 patients (42.2%) with positive videonystagmography positional tests, 6 patients had bilateral, left-side, and right-side positive Dix-Hallpike tests and 9 patients (20.50%) had negative Dix-Hallpike test results. There was a significant association found for Romberg test result and the videonystagmography positional test and the Dix-Hallpike test result.

Discussion

The current study included all patients with dizziness. One-fourth of them were over the age of 50. In this age, hearing loss is also more prevalent, so it is very confusing to differentiate patients with dizziness from those with ear problems or other clinical problems. The peak of dizziness in our study occurred between the ages of 30 and 50, whereas in a similar study conducted by Alexander et al., 33.7% of patients with dizziness were older than 65 years, with the peak occurring between the ages of 50 and 60 [7].

In the current study, out of 64 participants, 27 had hearing loss. The majority of them were over the age of 61. According to NIDCD statistics, approximately 2% of people aged 45 to 54 have a disabling hearing loss. For

Table 2 Association of videonystagmography positional test with Romberg's test, videonystagmography head shake test, neuro-otological examination of head shake test, and Fukuda test

Test		Videonystagmography positional test	
		Negative (*n* = 37)	**Positive (*n* = 27)**
Romberg's test	Right side + (*n* = 18)	8	10
		21.60%	37.00%
	Left side + (*n* = 25)	15	10
		40.50%	37.00%
	Negative (*n* = 21)	14	7
		37.80%	25.90%
Chi-square value: 2.043		p value: 0.36	
Videonystagmography head shake Test	Positive (*n* = 25)	21	4
		56.80%	14.80%
	Negative (*n* = 39)	16	23
		43.20%	85.20%
Chi square value: 11.536		*p* value: 0.001*	
Neuro-otological examination of head shake test	Right side + (*n* = 9)	0	9
		0.00%	36.00%
	Left side + (*n* = 10)	6	4
		15.40%	16.00%
	Negative (*n* = 45)	33	12
		84.60%	48.00%
Chi-square value: 16.949		*p* value: < 0.05*	
FUKUDA'S TEST	Right side + (*n* = 30)	17	13
		45.90%	48.10%
	Left side + (*n* = 21)	11	10
		29.70%	37.00%
	Negative (*n* = 13)	9	4
		24.30%	14.80%
Chi-square value: 0.965		*p* value: 0.617	

*Statistically significant

Table 3 Association of the Dix-Hallpike test with Romberg's and videonystagmography positional test

Test		Dix-Hallpike test			
		Bilateral + (*n* = 6)	**Left side + (*n* = 6)**	**Negative (*n* = 44)**	**Right side + (*n* = 8)**
Romberg's test	Right side + (*n* = 18)	1	0	14	3
		16.70%	0.00%	31.80%	37.50%
	Negative (*n* = 21)	1	0	15	5
		16.70%	0.00%	34.10%	62.50%
	Left side + (*n* = 25)	4	6	15	0
		66.70%	100.00%	34.10%	0.00%
Chi-square value: 17.325			*p* value: 0.008*		
Videonystagmography positional test	Positive (*n* = 27)	6	6	9	6
		100.00%	100.00%	20.50%	75.00%
	Negative (*n* = 37)	0	0	35	2
		0.00%	0.00%	79.50%	25.00%
Chi-square value: 28.497			*p* value: < 0.05*		

*Statistically significant

people aged 55 to 64, the percentage rises to 8.5%. Disabling hearing loss affects over 25% of people aged 65 to 74 and 50% of those aged 75 and beyond [8].

In the study, Zhentange et al. included 553 dizziness and vertigo patients who could walk freely. Patients with balance issues were older ($P=0.045$) and had higher risk factors for atherosclerosis (AS) ($P=0.0001$) than those with normal balance. Balance problems were associated with risk variables for AS, subjective imbalance, and abnormalities of optokinetic nystagmus [6].

When the caloric test findings were considered, normal results were observed in 512 (57.4%) and abnormal values in 42.6%. The most common outcomes from the changed test results were unilateral weakness (UW) 255 (28.6%) and bilateral hyperreflexia 48 (5.4%).

The caloric test findings were correlated with various forms of dizziness to discover that vertigo was infrequent in the central syndromes ($P=0.02$) and that the complaint of instability related to bilateral weakness ($P=0.02$). Presyncope and lightheadedness had no correlation with a particular caloric test outcome. Caloric tests with peripheral aberrant findings were significantly associated with vertigo, tinnitus, and/or hearing loss ($P=0.008$; OR = 2.68; CI = 1.25–5.82) [9].

In the Kang et al. (2021) study, PTA testing revealed that hearing thresholds at all frequencies were considerably greater in noise-induced presbycusis patients than in presbycusis patients (p 0.05). Tinnitus was less frequent in individuals with presbycusis than in those with noise-induced hearing loss, although the difference was not statistically significant ($p > 0.05$). Noise-induced presbycusis patients had considerably more loudness than presbycusis patients [10].

BPPV and positional test

Positional vertigo lasting only a few seconds without any hearing loss or other neurological symptoms is one of the classic symptoms of BPPV. BPPV is primarily diagnosed clinically [11].

These tests are used to look for unusual eye movements. By detecting involuntary eye movements when your head is in various postures or your balance organs are stimulated with water or air, ENG (which uses electrodes) or VNG (which uses small cameras) might assist in identifying whether dizziness is brought on by inner ear disorders. In our study, out of the twenty-seven patients whose videonystagmography positional test results were positive, six (100.0%) had bilateral positive Dix-Hallpike test results, six (100.0%) had left-side positive results, six (75%) had right-side positive results, and nine (20.50%) had a negative result. There was an association between the videonystagmography positional test and the Dix-Hallpike test, which was without VNG.

BPPV and head shake test

A thorough history of the patient's health is necessary for the diagnosis of BPPV, and on the other hand, the head shake test tells us about vestibular asymmetry. Chronic BPPV also causes vestibular asymmetry. So, the head shake test can be used as a quick test for screening. It also tells us which side of the patient is involved. Catch-up saccades will be present on the opposite side from the side that is involved. However, the head shake test should be avoided in the acute phase of BPPV. In our study, a significant association was found between the Romberg test and the Dix-Hallpike test.

BPPV and Fukuda test

One test that can be done as part of the vestibular and balance examination is the Fukuda stepping test. The test is done to find out if one side of the body has a weak vestibular system and on which side the lesion is present. Fukuda's test is not a very accurate test, but it is an indicative test. It is used for the assessment of vestibulo-spinal tracts [12].

Taylan et al. discovered the Fukuda stepping test to be extremely useful in the diagnosis of benign paroxysmal postural vertigo because the ratio of Fukuda stepping test positivity and negativity was similar in patients with benign paroxysmal postural vertigo. However, patients with a positive Fukuda test result required considerably more canalith repositioning manoeuvres ($p=0.0103$). Furthermore, the recurrence frequency was observed to be considerably lower in patients with a negative Fukuda test result ($p=0.0441$) [12].

In a study conducted by Min Beom et al., the clinical characteristics of benign paroxysmal positional vertigo (BPPV) with idiopathic sudden sensorineural hearing loss (ISSHL) were compared to those of idiopathic BPPV (i-BPPV). Of the 519 ISSHL patients, secondary BPPV (s-BPPV) was observed in 63 patients (12.1%). Patients with s-BPPV experienced multicanal involvement more frequently than those with i-BPPV (P.001). For effective repositioning, an average of 4.28 canalith repositioning procedures (CRPs) were needed in the s-BPPV and 1.34 in the i-BPPV (P.001). Similar correlations were found between canal paresis and the greater number of CRPs required for s-BPPV (P.02) [11].

Meniere's and ECochG

The electrocochleography examines how the inner ear reacts to noises. It is not unique to Meniere's disease but may be useful in determining whether there is an abnormal buildup of fluid in the inner ear. A high SP/AP ratio and high SP are suggestive of endolymphatic hydrops. The pitfall is that in early Meniere's disease, hydrops may not be present. In our study, all the six patients who were

diagnosed to be suffering from Meniere's disease showed positive finding in ECochG test.

Meniere's and caloric test

The first technique for evaluating the vestibular system's functionality is the caloric test (CT), which solely assesses the lateral semicircular canals (SCCs) using low-frequency stimuli (0.002–0.004 Hz). This allows for the distinct identification of the labyrinth that is compromised. There is no pathognomonic sign of Meniere's disease on the caloric test, which can reveal normal responses, hyperreflexia, hyporeflexia, unilateral areflexia, or bilateral areflexia. Hyporeflexia of the afflicted labyrinth is, however, the most frequent outcome [13].

In our study, out of six patients (9.40%) whose result of the audiological and vestibular tests (ECoch-G) was SP > AP, one patient (9.10%) has a bilateral weakness caloric test, three patients (27.30%) have left-side weakness, and two patients (16.70%) have right-side weakness. There was an association between the audiological and vestibular tests (ECochG test) and the caloric test results.

For the diagnostic matrix for hearing loss and tinnitus, we need a definitive diagnosis at the same time we need C-VEMP to rule out semicircular canal problems, and electrocochleography is more important with PTA and VNG.

The caloric test will prognosticate the future of patient management in Meniere's, as if hyporeflexia is found and the patient has chronic vestibular asymmetry; then, we need to do vestibular rehabilitation therapy (VRT). In the early stages, we find it out with low frequency, but if we leave it on PTA only, we may miss the caloric test finding, and we know that PTA and caloric testing are significantly associated. So just doing the PTA is not sufficient in Meniere's; we need to rule out the causative factors and prognosticate the cause. In the era of medicolegal aspects, we need evidence-based case management and to counsel patients about realistic treatment goals with proper documentation.

Vestibular neuritis and head-shake test

Although monophasic head-shaking nystagmus (HSN) is frequently observed in patients with dizziness of unknown cause, biphasic HSN is a basic response to head shaking in patients with unilateral vestibular loss. In our study, out of the seventeen patients who had vestibular neuritis, six had a positive head shake test.

Vestibular neuritis and caloric test

Testing the peripheral vestibular system using bithermal caloric stimulation is a common and traditional method. Caloric irrigation uses temperature stimulation in the semicircular canals, which causes the endolymph to flow, to evaluate the VOR for mostly horizontal canal function. Caloric testing enables both the assessment of the disease's severity and the distinction between peripheral and central lesions. When a horizontal canal or vestibular nerve is damaged, a caloric test reveals hyporesponsiveness or unresponsiveness, and this abnormal finding typically lasts for more than a year. With this supporting evidence, unilateral caloric positivity has been accepted as a useful diagnostic indicator of vestibular Neuritis.

Vestibular neuritis and PTA test

If patients have hearing loss in PTA along with vertigo as a secondary symptom, we will consider vestibular neuritis as a diagnosis.

But if hearing loss and vertigo, along with aural fullness symptoms, are present, we go for the diagnostic matrix for Meniere's disease. But if hearing loss is absent and only vertigo is present along with aural fullness symptoms, then we go with BPPV as the diagnosis.

Vestibular paresis/unilateral or bilateral vestibular paresis/vestibular asymmetry

Julie et al. discovered that the standard Fukuda Stepping Test (FST) and the FST after a head shake task are insensitive to identifying mild to moderate peripheral vestibular paresis. Patients with severe canal paresis (> 76% unilateral weakness (UW)) had improved test performance; nevertheless, discrepancies in the direction of severe unilateral vestibular impairment remained. They found that, when utilized in the vestibular bedside assessment, the FST offers minimal help to doctors [14].

Neuro-otological examination

We check for nystagmus among patients with dizziness. It is a stepping stone for neuro-otological examination for evaluating patients with dizziness. Nystagmus must be observed in both the lateral and primary gazes. It is important to notice the nystagmus' fast component and its orientation during lateral gazing. While direction-changing nystagmus and a purely vertical or purely horizontal nystagmus suggest a central aetiology, horizontal nystagmus with a fast-beating component that is unidirectional and opposite to the site of the lesion and that increases when looking towards the side of the fast component suggests a peripheral cause.

The Romberg test is a precise clinical instrument that determines if a patient is unable to maintain an upright posture in the absence of light or in the dark, as discussed previously.

The head shake test works by testing the vestibulo-ocular reflex (VOR). This reflex is helpful to maintain corrective eye position during any change in head position

and to correct the eye movement rapidly so that vision remains on target, as highlighted earlier.

The Dix-Hallpike manoeuvre can be used to pinpoint the troublesome side before performing the Epley technique. If the Dix-Hallpike test did not trigger any symptoms, we will need to do other tests to figure out what is causing your issues. If it did, move the patient's head in certain ways to help get the crystals out of his semi-circular canals and into a place where they can be reabsorbed. It has also been discussed earlier.

For all patients presenting with dizziness, vestibular testing assists in diagnosis by assisting the clinical history and examination and identifies unilateral vestibular loss, bilateral vestibular loss, and superior canal dehiscence. In a developing country, it saves a lot of time and resources if an algorithm is followed to manage the patient in an effective manner.

Algorithms reduce variations in clinical care, to produce optimal health outcomes for patients, and to minimize morbidity. Evidence-based approach to guideline development requires that the evidence is identified and summarized. However, guidelines are never intended to bypass professional experience and judjement. Current study contributes to act as a benchmark for developing similar strategies.

Conclusions

In conclusion, neuro-otological testing can aid in the diagnosis of vertigo, but it cannot be relied on if the vertigo is complex. Only symptomatic history and neuro-otological tests are helpful in cases like a simple unilateral posterior canal BPPV, but in a complex case with tinnitus, aural fullness, Romberg positivity, or Fukuda positivity, we need the assistance of additional investigations of vestibular tests such as ECochG and VNG. Although we do not want to burden the patients, an accurate test and final diagnosis need handholding by an objective test for documentation purposes.

Vestibular testing supports clinical history and examination by identifying superior canal dehiscence, unilateral vestibular loss, and bilateral vestibular loss. When comprehensive vestibular testing is all normal, it excludes the main peripheral vestibular illnesses that cause persistent impairment. Hearing testing and vestibular testing are used to identify Ménière disease.

Both in the lab and at the bedside, vestibular examinations show normal results for disorders including vestibular migraine, anxiety-related dizziness, cardiovascular disturbance-related dizziness (such as orthostatic hypotension), and conditions like chronic postural perceptual dizziness.

A clinician may be helped by conclusive vestibular tests, a thorough medical history, and VNG performed methodically in accordance with an algorithm to prevent ineffective management techniques like vestibular-suppressant medicine or vestibular rehabilitation for patients who have no vestibular disturbance.

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Authors' contributions
MJ: Literature search, data acquisition, manuscript preparation, manuscript editing, manuscript review, AS: Concepts, design, manuscript preparation, manuscript editing, guarantor. NKK: Data analysis, statistical analysis, manuscript review. VRM: Concepts, design, manuscript preparation, guarantor. RP: Literature search, data acquisition, statistical analysis, manuscript editing.

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Availability of data and materials
The datasets during and/or analysed during the current study available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional ethical committee. The name of the body that gives ethical clearance is SRI AUROBINDO MEDICAL COLLEGE & PG INSTITUTE INSTITUTIONAL ETHICS COMMITTEE. Informed Consent: An informed written consent was taken from all the patients, relatives, and guardians after the approval of the institutional ethics committee for the data collection.

Consent for publication
The patient gave written consent for the publication of identifiable details, which included photograph(s) and/or videos and/or case history and/or details within the text to be published in the journal.

Competing interests
The authors declare that they have no competing interests.

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