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Abstract

It is a common symptom in at least one-third of the patients over the age of 65 years. Benign positional vertigo, vestibular neuronitis and Meniere's diseases are the commonest causes of vertigo. Other causes include vertebrobasilar insufficiency, migraine, multiple sclerosis and cerebellar neoplasms.

Keywords

Vertigo · Migraine · vertebrobasilar insufficiency · vestibular neuronitis · benign positional vertigo

Introduction

The overall incidence of dizziness, vertigo and imbalance is 5–10% and reaches 40% in patients over the age of 40 years [1]. It is a common symptom in at least one-third of the patients over the age of 65 years [2]. One-year prevalence was 48.3% for vertigo, 39.1% for unsteadiness and 35.6% for dizziness [3]. Vertigo accounts for 52% of all cases [4, 5] and up to 56.4% in the elderly [6]. Overall prevalence in a rural community was 0.17% [7]. The prevalence of vertigo secondary to cardiovascular disease was 0.32%,

for neurological disease 0.14% and otologic disease 0.08% in a study of vertigo in an adult rural population [7]. In a study of 187 Chinese patients with vertigo, posterior circulation ischaemia was 59.8% followed by BPPV with 16.04%, and less affected were migraine, Meniere’s disease and vestibular neuronitis, among others [8]. Epidemiological studies indicated that a quarter of the dizziness were central, and the most common central causes were cerebrovascular disease, migraine, multiple sclerosis and tumours of the posterior fossa [9] (Table 1).

Causes of Vertigo

Benign positional vertigo, vestibular neuronitis and Meniere’s diseases are the commonest causes of vertigo. Other causes include vertebrobasilar insufficiency, migraine, multiple sclerosis and cerebellar neoplasms [10].

Benign Positional Paroxysmal Vertigo (BPPV)

BPPV is a common cause of vertigo in the elderly and becomes more frequent as age advances [11] and is most prevalent in those above the age of 50 years [12]. It is most common among peripheral vestibular disorders [13]. About 9% of a group of urban-dwelling elderly were found to have undiagnosed BPPV [14]. It is nearly always a benign condition [15]. BPPV causes nausea, vertigo, light-headedness and imbalance brought about by change in the position of the head [16], for instance, turning over in bed or getting out of bed. Tipping the head backwards as to reach for the upper shelf may precipitate it. Symptoms can be subjective or objective [12].

Degeneration of the vestibular system is the most common cause. Two basic theories of the pathology in BPPV are cupolithiasis and canalithiasis [17]. Other causes are infection,

Table 1 Guidelines for the differential diagnosis of vertigo [16, 23]

	Vestibular neuronitis	Benign positional vertigo	Meniere’s disease	Acoustic neuroma	Vertebrobasilar disease
Onset	Sudden	Sudden	Sudden	Insidious	Sudden
Severity	Severe	Severe	Severe	Mild-moderate	Moderate-severe
Quality	True Vertigo	True Vertigo	True Vertigo	Dizziness/unsteadiness	Dizziness/vertigo
Duration	7–10 days	<3 s	Few to 24 h	Unremitting	Lasts several minutes
Triggers	Virus infection	Certain head position			
Associated symptoms	Nausea and vomiting	Nausea and vomiting	Nausea and vomiting		Visceral sensations
Neurologic					
Nystagmus	+	+Direction fixed	During attacks	Occasional	0
Hearing loss	+	0	+(worsening)	+	+
Tinnitus	0	0	+	+	Drop attacks, diplopia, visual field deficits
Long tracts	0	0	0	V nerve, VII compression of the brain stem and cerebellum	
Progression	Self-limiting	Subsides	Subsides	Progresses	

head injury, minor strokes involving the anterior inferior cerebellar artery and medications such as gentamicin [18], but in more than half of the cases, the cause is unknown. Small crystals of calcium carbonate (otoconia), derived from the utricle as the result of damage to the utricle by injury, infection or degeneration because of advancing age, migrate into the canal system.

The history of vertigo or dizziness brought on by lying down or rolling over in bed together with the physical findings and auditory and vestibular tests helps in the diagnosis. The only diagnostic test that confirms the diagnosis of BPPV is Dix-Hallpike manoeuvre [16]. The individual is brought from a sitting position to the supine with the head turned 45° to the side and extended about 20° backwards. A positive response would be after a short latent period; there is a burst of rotating nystagmus. When the individual is brought up to the sitting position, there will be a reversal of the nystagmus. Fatigue of the nystagmus occurs when the procedure is repeated. Electronystagmography (ENG) may be needed to look for the character of the nystagmus induced by this manoeuvre. The vertigo is intermittent and is self-limiting and usually subsides in about 2 months but could last longer. The Epley manoeuvre and the Semont manoeuvre are intended to move the otoconia out of the sensitive part of the ear to less sensitive location with a cure rate of approximately 80% [19]. Positional restriction after canalith reposition manoeuvres for BPPV has been shown to be of no proven benefit [20].

Vestibular Neuronitis

Vestibular neuronitis is a benign disorder characterized by sudden onset of severe vertigo with nausea and vomiting and ataxia [21]. Hearing loss (unilateral) may be present [16]. It is often preceded by a viral illness which may be subclinical and all common viruses have been implicated. The virus selectively affects the inner ear neurosensory structures. Gradual resolution occurs over few days and complete recovery within 3 months. The elderly however could have exacerbations, usually less severe, and the conditions may be

recurrent. Treatment is symptomatic with stabilizing measures and vestibular suppressant medication and rehabilitation exercises [22].

Meniere's Disease

Meniere's disease commonly presents in the 40–69 years of age. It is caused by idiopathic endolymphatic hydrops causing swelling of the semicircular ducts and damaging the hair cells. There is fluctuating hearing loss, tinnitus with vertigo and aural fullness and pressure [23]. Vertiginous episodes are paroxysmal lasting minutes to hours and decrease in frequency after multiple attacks only to recur months or years later, eventually with the hearing loss becoming permanent. The first line of treatment is medical which includes a low-salt diet, diuretic (thiazide) [18] and a betahistine, although the efficacies of these treatments have not been proven [24, 25]. Surgical treatment includes labyrinthectomy, vestibular nerve section, endolymphatic sac surgery and chemical ablation using intratympanic gentamicin in patients who have failed medical treatment.

Vertebrobasilar Insufficiency

Abrupt onset with nausea and vomiting and vertigo is the initial symptom in half of the cases. Other symptoms include drop attacks, diplopia, visual hallucinations and visual field defects in conjunction with dysarthria, dysphagia, sensory loss and hemiparesis. It rarely causes isolated vertigo attacks [26]. In impending infarction in the territory of the anterior inferior cerebellar artery, a transient vertigo may be the initial and only complaint. The risk of cerebral infarction following a vertebrobasilar TIA is much less than in the carotid circulation.

Acoustic Neuroma

Acoustic neuroma comprises about 90% of all cerebellopontine angle tumours. It arises from the eighth nerves and is retrocochlear in location.

The symptoms begin insidiously with mild hearing loss, tinnitus, vague dizziness, disturbance of balance and asymmetric hearing loss. In a small number of patients, the onset is sudden [27]. The cranial nerves, facial and trigeminal (diminished corneal reflex), may be involved by the tumour extending in the cerebellopontine angle, and brain stem compression may occur if untreated. Bilateral acoustic tumours are rare except in patients with neurofibromatosis.

Multiple Sclerosis

Multiple sclerosis is an important cause of central vertigo. Because of the transient nature of these attacks, days to weeks [16], it may be mistaken for one of the self-limiting peripheral causes of vertigo such as vestibular neuronitis [16]. The patients affected are younger than those with benign positional vertigo. The first symptom is often an acute optic neuritis with loss of central vision in one eye, which in most instances resolves. Involvement of the brain stem may produce double vision, dizziness, cerebellar ataxia, dysarthria, dysphagia, numbness of one side of the face and an unsteady gait.

Migraine-Associated Vertigo

This is an atypical form of aura and the dizziness antedates the headache. Individuals with basilar migraine may complain of recurring headaches associated with visual aura followed by vertigo, dysarthria, tinnitus, visual disturbances and unsteadiness in walking [16]. At times, there may be no headache, making the diagnosis difficult. Dietary changes and tricyclic antidepressant generally improve vertiginous migraine headaches [22].

Evaluation

The evaluation of vertigo involves (1) medical history including a drug history, (2) physical examination, (3) laboratory evaluation, (4) vestibular function tests and (5) other diagnostic tests as

needed. The medical history is important since the description of each symptom together with the duration and precipitating factors is crucial in establishing the diagnosis. In more than three-quarters of the cases of vertigo, the diagnosis can be made on the history alone. Recurrent vertigo is more suggestive of BPPV, Meniere's disease or migraine, whereas a single attack lasting for days or more is due either to cerebellar infarction or vestibular neuronitis [26]. Physical examination would include examination of the ear and a neurological examination.

If the patient has true vertigo, the task is one of determining whether it is central or peripheral. Box 1 shows some of the distinguishing characteristics of central and peripheral vertigo [16, 28]. Evidence of brain stem symptoms rules out a peripheral lesion. However, the absence of brain stem symptoms does not exclude a central lesion. Multiple sclerosis and vertebrobasilar insufficiency presenting with isolated vertigo evolve gradually, and the diagnosis may not be apparent at the time of initial presentation. In one study, seven patients had sudden bilateral hearing loss, tinnitus and vertigo, and the initial diagnosis was acute labyrinthitis or Meniere's disease, until the other brain stem and cerebellar signs appeared [29]. In multiple sclerosis, there are recurrent episodes, with remissions, and in the case of vertebrobasilar insufficiency, prior history of cerebrovascular disease or cardiovascular disease will be helpful in making the distinction. Episodes of vertigo, hearing loss and tinnitus associated with Meniere's disease can mimic those of acoustic neuroma, and the distinction between them before the appearance of brain stem symptoms can be difficult. The hearing loss with acoustic neuroma however is steadily progressive, whereas it is fluctuating or episodic with Meniere's disease. Triggering factors and duration of the attacks can help in determining the peripheral causes of the vertigo. In BPPV, the vertigo is with changes in the position of the head and neck, lasts only a few minutes and is recurrent daily. A single severe episode of vertigo after a viral illness is usually due to vestibular neuronitis.

Neurological and audiological testing can be helpful in making the distinction. Routine

Box 1 Some Characteristics of Peripheral Vertigo and Central Vertigo

Symptoms and signs	Peripheral	Central
Severity	Severe	Less severe
Nystagmus	Always present	Less often
	Horizontal	Multidirectional
	Plane, usually	Pure vertical
	Mixed ^a	
Hearing	Common	Rare
Tinnitus	May occur	Rare
Vomiting/nausea	Virtually always	Less frequent
	Present and severe	
Neurological	Rare	Common

Information sources: Chan [16] and Eggenberger and Lovell [28]

^aHorizontal and rotational

laboratory tests would include a full blood count, sedimentation rate and thyroid function tests, among others. The Dix-Hallpike manoeuvre should be done if the history is suggestive of benign positional vertigo or if the nystagmus is inducible. Vestibular function tests are the Dix-Hallpike manoeuvre, electronystagmography and the rotational chair testing. Audiometry, electronystagmography and brain stem evoked potentials are most useful. The sensitivity of brain stem evoked auditory potentials to detect retrocochlear lesions for acoustic tumours >2 cm is 100% as with MRI [30]. The MRI is used to exclude retrocochlear pathology. To ensure the diagnosis of acoustic neuroma, T1-weighted magnetic resonance imaging with gadolinium (Gd-DTPA) is the gold standard [31], is sensitive and will detect extremely small tumours of 2 mm in size. This technique also identifies other intracranial tumours, meningiomas and demyelinating lesions in the central nervous system. More recently, MR protocols have been used for fast-spin-echo (FSE) imaging [31, 32] for internal auditory canal structures and do not require contrast medium. Three-dimensional fast

imaging employing steady-state acquisition (3D-FIESTA) MRI is a sensitive method for the diagnosis of cochlear or retrocochlear lesions and is useful as a screening tool in patients with unilateral ear symptoms [33]. CT scan may be used for inner ear pathology when MRI is not available or when MRI is contraindicated or when tumours more than 1.5 cm in diameter are excluded. Acoustic neuromas are isodense with the brain tissue and intravenous contrast enhancement should be used.

Impact

Dizziness is common in medical practice and is known to impair the health-related quality of life (HR-QoL) [34–36]. It affects daily functioning and is associated with functional disability, falls,

Box 2 Key Points: Vertigo

Epidemiological studies indicated that a quarter of the dizziness were central, and the most common central causes were cerebrovascular disease, migraine, multiple sclerosis and tumours of the posterior fossa [9].

BPPV is a common cause of vertigo in the elderly and becomes more frequent as age advances [11].

The only diagnostic test that confirms the diagnosis of BPPV is Dix-Hallpike manoeuvre [16].

In Meniere’s disease, there is fluctuating hearing loss, tinnitus with vertigo and aural fullness and pressure [23].

Vertebrobasilar insufficiency rarely causes isolated vertigo attacks [26].

In a small number of patients with acoustic neuroma, the onset was found to be sudden [27].

Multiple sclerosis is an important cause of central vertigo.

Dietary changes and tricyclic antidepressant generally improve vertiginous migraine headaches [21].

social isolation and institutionalization [37, 38]. In a study to determine the impact of dizziness and balance disorders in persons >65 years old, balance problems were seen to be associated with unsteadiness, vertigo and faintness and difficulty in walking on uneven surfaces [39]. Approximately in one in five patients, medication triggered the balance problem [39] (Box 2).

Multiple Choice Questions

1. The following relating to vertigo are correct except:
 - A. Benign positional paroxysmal vertigo (BPPV) is a common cause of vertigo in the elderly and becomes more frequent as age advances.
 - B. Meniere's disease eventually results in permanent deafness.
 - C. A transient vertigo may be the only complaint in impending infarction in the territory of the anterior cerebellar artery.
 - D. Migraine-related vertigo is always accompanied by headache.
2. The following are true in relation to the different causes of vertigo except:
 - A. The only diagnostic test that confirms the diagnosis of benign paroxysmal positional vertigo (BPPV) is Dix-Hallpike manoeuvre.
 - B. The Epley and the Semont manoeuvres have a cure rate of approximately 80% in patients with BPPV.
 - C. The MRI is used to exclude retrocochlear pathology.
 - D. Bilateral acoustic neuromas are common.
3. The following symptomatology in relation to causes of vertigo are true except:
 - A. In BPPV, the vertigo is with changes in the position of the head and neck and lasts for several hours and is not recurrent.
 - B. A single severe episode of vertigo after a viral illness is usually due to vestibular neuronitis.
 - C. In Meniere's disease, the hearing loss is fluctuating and episodic.
 - D. The hearing loss in acoustic neuroma is steadily progressive.

MCQ Answers

1 = D; 2 = D; 3 = A

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