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Steady the dizzy child

Dizziness in children can be caused by a variety of peripheral and central vestibular disorders. Although less frequent in children than in adults, these disorders often pose a diagnostic challenge.

Dizziness is the feeling of unsteadiness or distorted sense of one's relationship to space. Vertigo is an illusionary sensation of revolving.

Vertigo occurs less frequently in childhood than in adulthood and can be caused by a variety of peripheral and central vestibular disorders. Because children often lack the communication skills necessary to describe their symptoms accurately, this article will consider all childhood disorders of balance as variants of vertigo.

Reviews on the frequency and most common causes of vertigo in childhood differ according to whether they originate from ENT or neurology departments (Table I). This underlines the importance of a multidisciplinary approach. Bower and Cotton,[1] in their study of outpatients in an ENT clinic, found that the majority of children had vertigo caused by otitis media (OM) and middle-ear effusion (MEE), benign paroxysmal vertigo of childhood, migraine or vestibular neuronitis. Eviater and Eviater[2] found vertiginous seizures and Fried[3] cerebral concussion to be the most common aetiologies in their neurological clinics. According to Brandt[4] benign paroxysmal vertigo of childhood, a basilar migraine variant, epileptic aura or vestibular epilepsy, perilymph fistula, secondary Ménière's disease and familial episodic ataxia are the most common conditions in his neurology department.

When assessing the dizzy child it is important to consider the mechanism of normal balance control (Fig. 1).

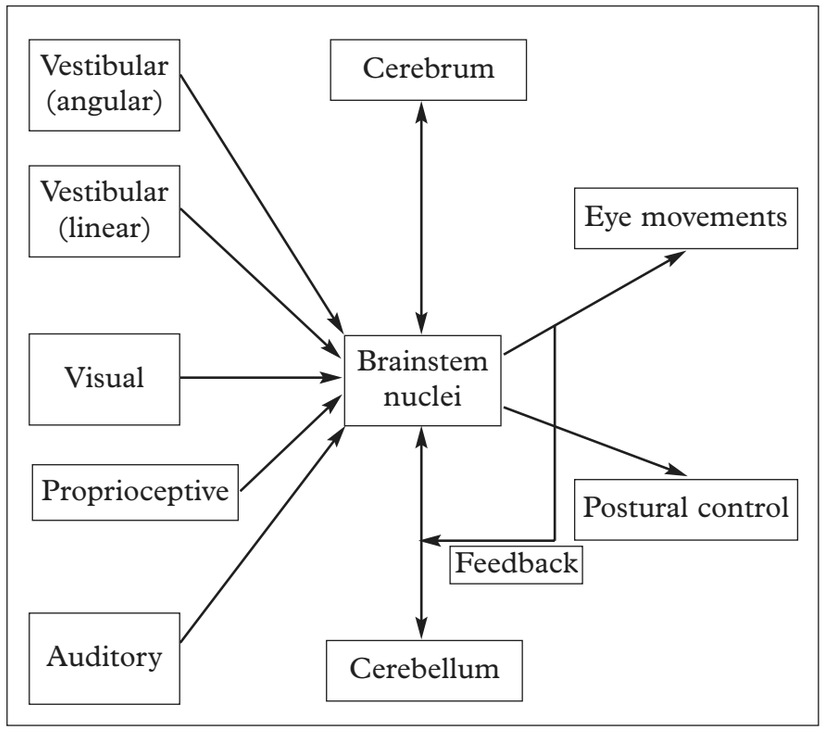

Fig 1. The mechanism of normal balance control.

Table I. **Differential diagnosis of vertigo in children**

Peripheral
- Cerumen impaction
- Acute and chronic otitis media
- Cholesteatoma
- Benign paroxysmal vertigo of childhood
- Benign paroxysmal positional vertigo
- Labyrinthitis
- Ménière's disease
- Perilymph fistula
- Temporal bone trauma
- Labyrinthine malformation (e.g. Mondini dysplasia)
- Vestibular neuronitis

Central
- Epilepsy
- Migraine
- Trauma
- Tumour
- Demyelinating diseases (multiple sclerosis)
- Familial episodic ataxia
- Hydrocephalus
- Meningitis and encephalitis
- Transient ischaemic attack and cerebrovascular accident
- Dandy Walker syndrome
- Arnold-Chiari malformation

Other
- Metabolic causes (thyroid, hypo- and hyperglycaemia, Addison's disease)
- Cardiovascular abnormalities
- Hypoperfusion and anaemia
- Vasculitis, auto-immune disease
- Drugs
- Motion sickness
- Psychological

APPROACH TO THE DIZZY CHILD

History

A good clinical history forms the basis of the approach. Owing to the child's lack of communication skills, the parent or caretaker should provide key observations regarding symptoms. Perinatal infections such as syphilis, toxoplasmosis, rubella, cytomegalovirus or herpesvirus (STORCH disease), HIV and other perinatal incidents are of importance. A history of delayed motor development, head trauma, recurrent otitis media, allergy and immune disorders may be contributory. Exposure to ototoxic drugs such as aminoglycosides and cytostatics should be looked into (Tabe II). A family history must be checked for hearing loss, vertigo, migraine, seizure and other inheritable syndromes. Be sure to describe the vertigo as clearly as possible and include factors such as time of onset, frequency, duration, associated hearing loss, loss of consciousness or postural control, other neurological symptoms and aggravating and relieving factors. In many balance clinics standard questionnaires are used to obtain the history of the patient.

Physical examination

The general examination is performed first. The physical examination should begin by observing the child's gait and stance. The Romberg test and tandem gait test where the child walks blindfolded on a straight line assess the general balance function. This can demonstrate a chronic vestibular disorder, with the patient swaying in the direction of the affected labyrinth. Heel gait, toe gait, hopping and skipping are good tests for gross motor co-ordination evaluation in children older than 4 years.

Rule out cardiac irregularities, orthostatic blood pressure changes, head and neck bruits, abnormal neck motion, respiratory abnormalities, café au lait spots, neurofibromas and craniofacial or congenital abnormalities.

After this an otological and neurological examination is performed. Otoscopy and tuning fork testing are also performed. Audiology and tympanometric evaluation is important in all children and auditory brainstem response (ABR) or otoacoustic emissions (OAE) may be necessary.

Table II. **Drugs with peripheral vestibular effects (ototoxic drugs)**

Aminoglycocides
Loop diuretics (ethacrynic acid and furosemide)
Vancomycin
Anti-neoplastics (cisplatin and cyclophosphamide)
Quinine and quinidine
Non-steroidal anti-inflammatory drugs (NSAIDs)
Tetanus antitoxin – rare
Erythromycin – rare

With the neurological examination emphasis is put on the cranial nerves, visual fields, spontaneous and induced nystagmus. Except for physiological nystagmus which occurs at a 40° lateral deviation of the eyes, all other nystagmus should be investigated. Finger-to-nose and heel-to-knee tests are abnormal with the eyes open and closed in cerebellar and movement disorders, whereas these tests may be abnormal only with the eyes closed in pure vestibular dysfunction.

Vestibular function testing

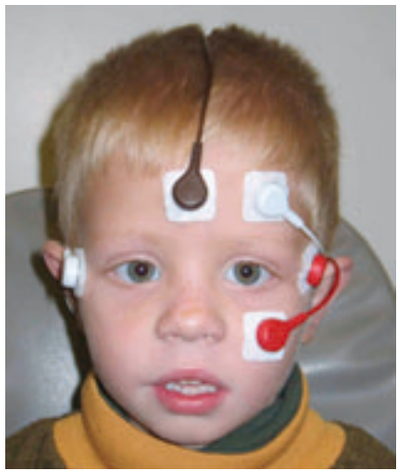

Fig. 2. Electronystagmography (ENG).

Electronystagmography (ENG), infrared videonystagmography (VNG), magnetic scleral coil systems and video-based systems are used to record nystagmus (Figs 2 and 3). VNG objectively records eye movements during testing (Fig. 4). Positional, positioning, caloric and rotation testing are used (Fig. 5). Platform posturography evaluates the vestibular system as well as its integration with the proprioceptive and ocular motor system (Fig. 6).

Other special tests

Electroencephalography (EEG) is important to rule out seizures in patients and those with associated loss of consciousness. Up to 10% of children with seizures have been reported to have intracranial tumours. Magnetic resonance imaging (MRI) with intravenous gadolinium contrast is the preferred imaging study because of its high resolution in detecting brainstem and cerebellopontine angle lesions. Metabolic screening including a syphilis test, glucose level, thyroid and immunological screen may further help to make a diagnosis.

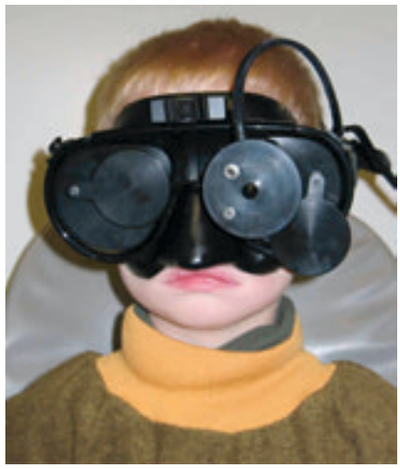

Fig. 3. Videonystagmography (VNG).

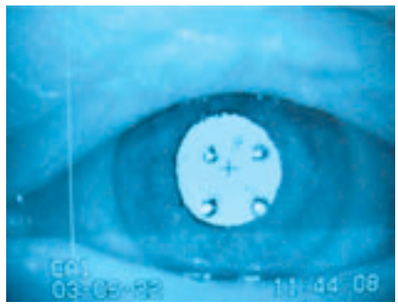

Fig. 4. Videonystagmographic recording of eye movements.

OTITIS MEDIA AND MIDDLE-EAR EFFUSION

These conditions are the most common otological diseases of childhood and are often considered to be the most frequent causes of vestibular disturbances in children. Exactly how eustachian tube dysfunction and otitis media with effusion affects the vestibular system is still unclear. One theory is that the transfer of middle-ear pressure via the labyrinthine windows causes inner-ear fluid movements. Toxins from OM and MEE can lead to serous labyrinthitis and ionic transfer through the semipermeable round window membrane, altering the endolymph composition are other proposals. Koyuncu's study[5] revealed the vestibular system to be affected in 33% of children with otitis media with effusion as determined by Romberg and past pointing tests. Vestibular functions returned to normal following myringotomy and ventilation tube insertion, and the symptoms of imbalance and vertigo improved.

BENIGN PAROXYSMAL VERTIGO OF CHILDHOOD AND BASILAR MIGRAINE

This syndrome is characterised by sudden transient attacks (lasting seconds to minutes) of incapacitating vertigo, postural imbalance and gait ataxia associated with nystagmus, pallor, nausea and vomiting. Headaches and impairment of consciousness are absent. Age of onset is usually between ages 1 and 4 and rarely above 10 years. There is an equal sex distribution and the personal and family history of migraine is positive in 66% of cases. The pathomechanism is that of a migraine equivalent. Resolution of symptoms is spontaneous by 8 - 10 years of age. There is no controlled study available on effective prophylaxis and attacks are usually brief and self-limiting, not necessitating any treatment.

ACUTE UNILATERAL VESTIBULAR LOSS

Sustained or transient rotational vertigo due to an acute unilateral vestibular loss may be present with labyrinthitis, vestibular neuronitis, Ménière's disease, perilymph fistula and following head trauma. In the latter, post-concussional otolith vertigo and typical benign paroxys-

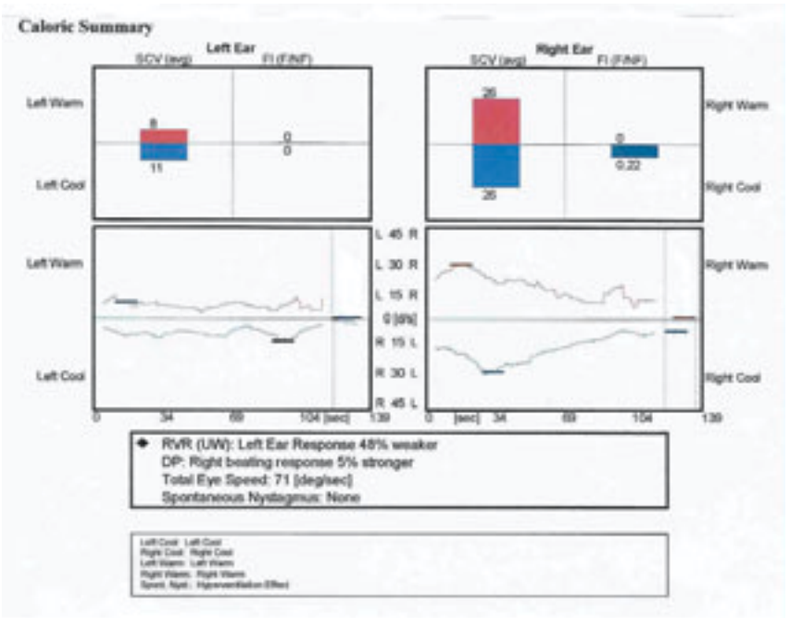

Fig. 5. A caloric response in a patient with left vestibular neuronitis.

mal positioning vertigo (BPPV) may occur (Fig. 7). Although BPPV is the most common cause of peripheral vertigo in adults, it is rare in children. A sound history and proper examination (taking into account whether hearing is affected) are required to determine the diagnosis. Special investigations may be necessary and management may include the administration of antivertiginous drugs, bedrest, liberating and repositioning manoeuvres for BPPV, vestibular rehabilitation exercises and surgery.

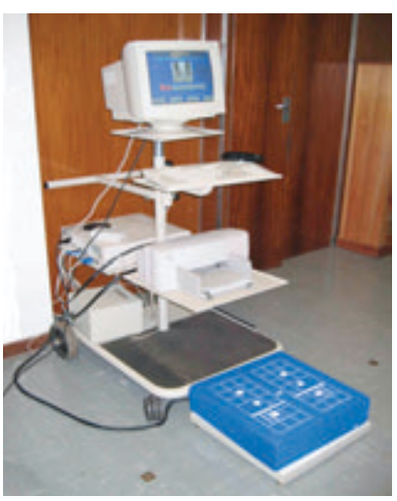

Fig. 6. Platform posturography.

BILATERAL VESTIBULAR LOSS

Various rare genetic and embryopathic labyrinthine malformations as well as multiple hereditary diseases can cause congenital and early acquired unilateral or bilateral loss of auditory and/or vestibular function. Oscillopsia (jumbling of the panorama) with head motion and gait imbalance in darkness are typical symptoms of bilateral vestibular failure. Typical vertigo is rare. Bilateral acoustic neuroma, bacterial meningitis, inner ear auto-immune disease and ototoxic drugs are examples of causes of bilateral vestibular failure. Caloric and rotational testing are important in making a diagnosis. Management is not always easy and the cornerstone of treatment is rehabilitation. Optimising the usage of visual and somtosensory cues to augment the failing vestibular system should be aimed for.

CENTRAL VESTIBULAR SYNDROMES

Cerebellar and brainstem tumours (medulloblastoma, astrocytoma, meningioma and epidermoid cysts) typically manifest with fluctuating progressive vertigo, ataxia and ocular motor abnormalities (Fig. 8). They are even more common in children than in adults and should always be considered as a significant differential diagnosis for dizziness, vertigo and disequilibrium in infancy. These tumours affect intra-axial structures of the vestibulocerebellum and the vestibular nuclei more often than peripheral nerves. Other rare conditions that cause central vertigo syndromes are congenital or toxic upbeat/downbeat nystagmus and epidemic vertigo secondary to viral infections. After careful history and examination a CT and MRI scan will help to distinguish infratentorial tumours from other central conditions like basilar migraine, familial episodic ataxia and the Arnold-Chiari malformation. It is imperative that patients should be seen as part of a multidisciplinary team since encephalitis, meningitis, epilepsy and trauma are all possible causes of central dizziness in children.

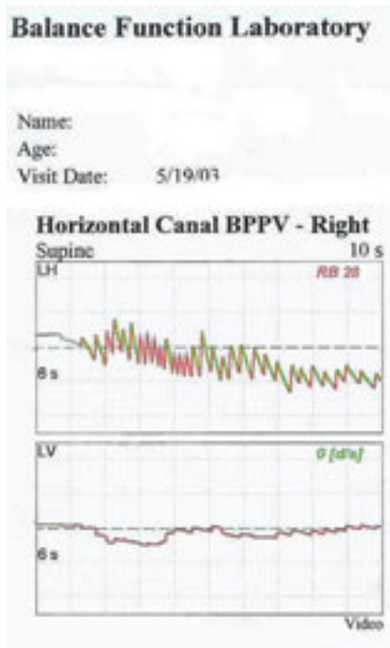

Fig. 7. Nystagmus recording in horizontal canal BPPV.

MOTION SICKNESS

Children between 2 and 12 years of age are very susceptible to motion sickness and especially car sickness. The exact pathomechanism is unclear. Mismatch between actual and expected motion stimuli as well as intrasensory conflict (visual and vestibular) are interesting theories. Vestibular hyperexcitability with migraine may also play a role and it is interesting that susceptibility to motion sickness seems to be higher among sufferers from benign paroxysmal vertigo of childhood[6] and in children with other forms of migraine.[7] The management of motion sickness entails physical prevention when travelling and medical prevention with antivertiginous drugs.

References available on request.

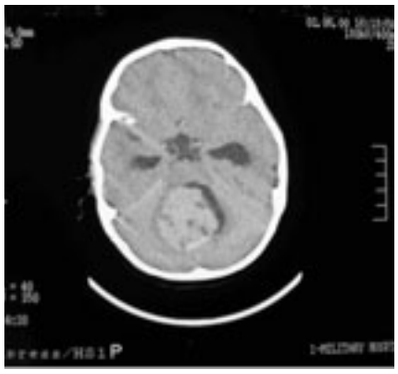

Fig. 8. A CT scan of a medulloblastoma in a 2-year-old child presenting with vertigo.

IN A NUTSHELL

Dizziness in children can be caused by central and peripheral disorders.

A thorough clinical history and physical examination highlighting the otological and neurological systems remains the cornerstone of diagnosis.

Videonystagmography (VNG) is an excellent method of recording nystagmus.

Magnetic resonance imaging (MRI) with intravenous contrast is the preferable imaging method to detect brainstem and cerebellopontine angle pathology.

Otitis media (OM) and middle-ear effusion (MEE) are the most common causes of dizziness in children as seen in ENT clinics.

Benign paroxysmal vertigo of childhood is a self-limiting disease which does not necessitate any treatment.

The most common cause for peripheral vertigo in adults, benign paroxysmal positional vertigo (BPPV), is much less common in childhood.

Oscillopsia (jumbling of the panorama) is a sign of bilateral vestibular failure.

Midline cerebellar and brainstem tumors often cause progressive vertigo, ataxia and oculomotor abnormalities.

SINGLE SUTURE

Diabetes in Pacific populations

Urbanised Pacific populations have a high incidence of diabetes and also experience greater morbidity and more complications than white people with diabetes. Behaviour change, particularly involving weight management, rather than expensive drugs, can prevent the development of diabetes and help those with established disease. But how can this be achieved in these populations? Most health intervention programmes in the Pacific focus on health promotion, with little emphasis on health protection. Politico-economic policies and social structures conducive to healthy lifestyles must be ranked above health promotion and pharmacological interventions to control diabetes in Pacific people.

(Editor's note: Some lessons for southern Africa as well.)

(Foliaki S, *et al. BMJ* 2003; **327:** 437-439.)