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The evaluation of dizziness in elderly patients

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Summary: Twenty-one elderly patients with dizziness underwent a comprehensive medical and otoneurological evaluation. The majority had vertigo, limited mobility and restricted neck movements. Poor visual acuity, postural hypotension and presbyacusis were also frequent findings. Electronystagmography revealed positional nystagmus in 12, disordered smooth pursuit in 18, and abnormal caloric responses in nine. Magnetic resonance imaging showed ischaemic changes in six out of eight patients. Although dizziness in the elderly is clearly multifactorial, the suggested importance of vertebrobasilar ischaemia warrants further consideration as vertigo has been shown to be a risk factor for stroke.

Introduction

More than one third of individuals over the age of 65 years experience recurrent attacks of dizziness.[1] Serious consequences include a high incidence of falls in patients with non-rotating dizziness, and an increased risk of stroke in those with vertigo (a sensation of movement relative to surroundings).[1,2]

The causes of dizziness are legion.[3] Its diagnosis, therefore, presents the clinician with a considerable challenge particularly in old people in whom ageing of the vestibular neuroepithelium or other components of the balance mechanism may be responsible for the symptom.[4] A further problem is that adequate investigation may require expertise in a wide range of disciplines including geriatrics, neurology, neurophysiology, radiology and otology. Techniques implemented have included questionnaire surveys, clinical assessment of gait and balance, force platform measurements,[5,6] echocardiography,[7] electronystagmography (ENG)[8] and imaging of the cental nervous system.[9–12] The latter two tests are time consuming and their diagnostic value has yet to be fully established.

The aim of this study was to compare the clinical evaluation of elderly patients with dizziness by a geriatrician with an otolaryngology (ENT) assessment and the results of electronystagmography and, where possible, magnetic resonance imaging (MRI).

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Patients and methods

The subjects were 21 patients who had been referred to either the care of the elderly unit or ENT Department in Edinburgh for the investigation of dizziness. There were five males and 16 females aged 68–95 years (median = 81 years). A carefully structured history was used to evaluate indoor and outdoor mobility, and symptoms of lightheadedness, vertigo and unsteadiness. Physical examination by a physician included measurement of passive movement in the neck, hips and knees, and of lower limb muscle power, tone and reflexes. Peripheral cerebellar signs were sought and measurement of supine and standing (at 2 minutes) blood pressures performed. A Snellen chart was used to test visual acuity. Balance was graded on a 7-point scale ranging from being unable to sit steadily, to being able to stand steadily for 20 seconds with no aid, with a long base and with eyes closed.[13] Cognitive function was evaluated by completing a brief mental status questionnaire.[14]

Otolaryngological examination was performed independently by a second observer and included a further clinical assessment, otoscopy and a brief neurological examination including corneal reflex testing. Pure tone audiometry was carried out using a Kamplex AC3 audiometer. Threshold measurements were performed at octave frequencies from 250 Hz to 8 kHz by air conduction and 500 Hz to 4 kHz by bone conduction. Air conduction thresholds at 0.5, 2, 4 and 8 kHz were averaged. Where indicated, acoustic admittance measurements were performed using a Gray Stad GSI-33; and brainstem electrical response (BSER) audiometry using an Amplopid Mk10 system (stimulus 11 clicks/

second and 70 clicks/second at 90 dB nHL intensity).

In all the vestibular tests, ENG was performed with a Peters AP210 recorder. Where practicable, recordings were made (with eyes open and with eyes closed) of spontaneous nystagmus, positional nystagmus and pendulum tracking. Bithermal caloric testing (again using ENG) was performed, in most cases using water at 44°C and at 30°C, with 30 seconds irrigation. In cases where a perforated drum was present or suspected, air at 50°C and 24°C was used with 50 seconds irrigation. Caloric responses were recorded with the patient's eyes closed, and after about 60 seconds recording the patient was instructed to open the eyes to assess the effect of optic fixation (OF) on thermally induced nystagmus.

MRI was performed using a 0.08 Telsa resistive system situated in the Royal Infirmary, Edinburgh[15] in those patients where a central causative factor was suspected from clinical or ENT findings. Transverse and sagittal T_1- and T_2-weighted images were obtained on all subjects. (T_1-weighted images from an interleaved saturation recovery + inversion recovery sequence with $T_R = 1$ second, $TI = 200$ milliseconds, T_2-weighted images from a spin echo sequence with $T_R = 1.4$ seconds, $T_E = 96$ milliseconds).

Results

Of the 21 patients recruited, 19 completed all parts of the study. One patient defaulted from the ENT clinic and a second during the course of her investigation was admitted as an emergency with drowsiness following a fall. A CT scan revealed a space occupying lesion with midline shift and hydrocephalus. The lesion, a meningioma, was subsequently excised with good postoperative recovery.

Table I gives details of the clinical features identified in the 21 patients while Table II gives details on a clinical evaluation of balance in all but one of them.

The results of pure tone audiometry showed an average threshold of 50 dB HL (range 29 to 100, SD = 18 dB) in the right ear with similar readings for the left side. In most patients the pattern was consistent with simple presbyacusis but three patients' average thresholds at the frequencies tested showed an interaural asymmetry of greater than 15 dB. BSER audiometry on one of these showed an N5 wave interaural latency difference greater than our upper limit of normal of 0.3 milliseconds. In accordance with our routine clinical practice, therefore, a CT scan was performed. No intracranial lesion was detected. One patient had a slight low tone component on the right side associated with a flat tympanogram. A right myringotomy was performed but the middle ear space was found to be dry and the dizziness was unaltered after this procedure. The ENG results are summarized in Table III. Four patients had limited examinations, two because of restricted head movements and two because of nausea and vomit-

Table I Clinical features of 21 dizzy elderly patients. Only abnormal features are noted

Feature	*Number of patients*
Symptom	
vertigo	15
falls	6
deafness	3
nausea and vomiting	2
tinnitus	1
diplopia	1
Walk with aid (zimmer/stick)	10
Mobile indoors only	7
Mobile <300 yards outdoors	6
Limitation of neck movements	12
with pain	3
with dizziness	2
Visual acuity >N18	
bilateral	3
unilateral	3
Postural systolic BP drop of >20 mmHg	5
symptomatic	2
Abnormal lower limb findings	0
Truncal ataxia	1
Horizontal jerk nystagmus	3
Mental test score <8/10	2

Table II Balance gradings recorded during clinical examination of patients

Balance characteristics	*Number of patients*
Unsafe seated	0
Safe seated, unsafe standing	2
Steady standing for 20 seconds with aid	4
Steady standing for 20 seconds with no aid on wide base	7
Steady standing for 20 seconds with no aid on narrow base	1
Steady standing for 20 seconds with no aid on long base	4
Steady standing for 20 seconds with no aid	2
Total	20

Table III Electronystagmographic findings in 20 patients

Observation	*Number of patients*
Calibration overshoot	1
No overshoot	19
Positional nystagmus absent	8
Amplitude	
<2 0/s	2
2–4 0/s	7
>5 0/s	1
test restricted	2
Pendulum tracking normal	2
mild disorder	5
gross break-up	13
Caloric responses normal	9
unilateral canal paresis	7
bilateral canal paresis	2
not tested	2
Effect of optic fixation on caloric nystagmus	
total suppression	9
variable/partial suppression	3
no effect	7
enhancement	1

0/s = degrees per second.

ing during any caloric testing. The patient with gross calibration overshoot had the meningioma described above. The other clear central ENG signs included a gross break-up of pendulum tracking, and the failure of OF to suppress caloric nystagmus. Ten patients were referred for MRI, but two defaulted. Two of the scans were normal but the other six showed vascular type lesions – three periventricular diffuse, one parietal, one temporoparietal with global atrophy and one leucoencephalopathy. None showed cerebellar or brainstem lesions but one of the normal scans was of poor quality due to movement. A week later the patient died and an autopsy identified a medullary infarction. There were no significant movement artefacts in the remaining scans.

When ENG and MRI scan findings were compared with clinical observations, it emerged that the two patients with bilateral canal paresis had clinical evidence of peripheral vestibular dysfunction (one labyrinthitis, one Ménière's syndrome). Five of the seven patients with unilateral canal paresis had the clinical diagnosis of vertebrobasilar ischaemia, and the other two were thought initially to have Ménière's disease. There was a good correlation between abnormalities in MRI scans, and clinical evidence of cerebrovascular disease. An exception was that two patients with normal scans had signs and symptoms of vertebrobasilar ischaemia.

Discussion

Dysequilibrium in old people is linked to damage to vestibular end organs or to their central control[16] and to a multiplicity of sensory defects such as impaired vibration sense, which is closely correlated with ataxia.[17,18] Falls are also associated with many causes of ataxia or dizziness, whose relative importance can be hard to determine.[19] In the present study a detailed clinical assessment was accompanied by an otoneurological and neuroradiological work-up. As in many previous studies, we found a high prevalence of postural hypotension[20] but this was symptomatic in only two patients which emphasizes the variable causal association of postural hypotension and dizziness. The severity of the drop, the absolute level of the steady systolic pressure, and the presence of cerebral atherosclerosis may all be critical determinants of this relationship.[21]

It is noteworthy that almost one third of patients had major visual defects (Table I). Poor vision interferes with visuo-vestibular interactions and may have been a major contributory factor to the finding that only two of our patients had a normal ENG response to the pendulum test (Table III).[22] Further information on the vestibulo-ocular reflex was elicited by assessing suppression of caloric nystagmus by optic fixation. Abnormalities were elicited in more than half the patients. While these could have been linked to the visual defects elicited in many of the subjects, similar changes could have been the result of mid-brain ischaemia.

The vestibular changes reported to be associated with ageing include the observation that caloric testing induces nystagmus with a higher frequency, but lower amplitude, and with greater lateral asymmetry.[23] The cause of the combination of impaired suppression of nystagmus by OF and the high prevalence of both canal paresis and positional nystagmus in the present series may have been due to transient central (vertebrobasilar) ischaemia, to cervical vertigo associated with spondylosis, or to benign paroxysmal positional nystagmus in the present series. Cervical spine radiography is unhelpful in this situation.[24,25] The importance of brainstem ischaemia as a cause of dizziness in our subjects is supported by the higher incidence of rotatory vertigo (Table I) identified as an important risk factor for stroke in the United Kingdom.[1] A recent clinical review attests that the only certain way of establishing this diagnostic is to perform

four vessel angiography.[26] There are clear logistic and ethical objections to this diagnostic approach in our group of frail elderly subjects in whom surgery is inappropriate. In a previous study of MRI scans, limited cooperation by the elderly patients resulted in many poor quality examinations.[12] We obtained good quality images in all but one subject whose suboptimal scan may account for the failure to identify a brainstem infarct. When interpreting the high prevalence of infarction demonstrated in the remaining MRI scans it should be remembered that we did not have a control group, and that there may be an equal prevalence of MRI abnormalities in elderly patients with dizziness and age-matched controls.[12]

This first few months' experience of a multidisciplinary approach to the investigation of elderly patients with dizziness suggests that it is practical and that it provides a high diagnostic yield of neuro-otological and radiological abnormalities.

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