Gait Disturbance in Alzheimer's Disease: A Clinical Study

S. T. O'KEEFFE, H. KAZEEM, R. M. PHILPOTT, J. R. PLAYFER, M. GOSNEY, M. LYE

Summary

Gait disturbance is common in patients with Alzheimer's disease (AD). The aim of this study was to analyse the clinical gait syndromes of patients with AD using Nutt's classification. Fifty-five patients who satisfied the NINCDS-ADRDA criteria for probable AD and 55 controls were recruited from a geriatric and a psychogeriatric unit. Patients with classical musculoskeletal or neurological syndromes causing gait disturbance were excluded. A standardized neurological examination was carried out in all subjects. Twenty-two (40%) patients and ten (18%) controls had a higher level gait disorder (p < 0.01). The pattern of gait disturbance in AD patients varied according to the stage of the disease. Cautious gait was the commonest gait disorder in AD patients with mild dementia, while frontal gait disorder was the commonest disturbance in patients with severe dementia. The prevalence of frontal release signs (gegenhalten or any primitive reflex) was highest among patients with frontal gait disorder.

Introduction

Gait disturbance is a characteristic feature of patients with vascular dementia [1]. In contrast, the NINCDS-ADRDA criteria for Alzheimer's disease (AD) state that: 'gait disturbance at the onset or very early in the course of the illness' makes the diagnosis of probable AD uncertain or unlikely [2]. However, clinical studies suggest that gait disturbance is not restricted to the later stages of AD [3-6]. Also, studies in gait laboratories have identified abnormalities of gait and balance in patients with early AD [7-9].

Many of the gait disturbances found in elderly people and in those with dementia cannot be attributed to classical musculoskeletal, neuropathic, spastic, cerebellar or extrapyramidal syndromes [10]; these have been called higher-level gait disorders [11]. Terms used to describe these disorders include 'gait apraxia', 'senile gait', 'lower-half parkinsonism' and 'marche à petit pas'. Recently, Nutt et al. have attempted to bring some order to this terminological chaos by describing a clinical classification of higher-level gait disorders [11].

The clinical pattern of gait disturbance in patients with AD has attracted little attention to date. In this study, we used Nutt's classification to analyse higher-level gait disorders in patients with AD and controls.

Methods

Subjects: Patients with dementia and controls pair-matched for age (±2 years), sex and location were recruited from the clinics and day-hospitals of a geriatric and a psychogeriatric unit. Patients referred specifically because of mobility problems or falls, and those who were bed- or chair-bound, had a history of stroke or Parkinson's disease, a Hachinski Ischaemic Score more than 4 [12], had been treated with neuroleptic medications within the previous year or had musculoskeletal, neuropathic or spastic causes of gait disturbance were excluded.

All patients with dementia satisfied the criteria for the clinical diagnosis of probable AD proposed by the NINCDS-ADRDA work group [2] (for the purpose of this study, gait disturbance was not considered when applying these criteria). Severity of dementia was defined using the Clinical Dementia Rating (CDR) scale, a global rating instrument comprising cognitive and behavioural domains: CDR 1 corresponds to mild, CDR 2 to moderate and CDR 3 to severe dementia [13]. Falls within the previous year and the presence of hypertension (defined as at least three blood pressure readings greater than 160/90 or on treatment for hypertension) were determined from the medical chart and by questioning patients, carers and staff.

Physical examination: Patients were examined in a standardized manner by a single experienced examiner. Balance was assessed using the procedure described by Tinetti [14]. In brief, stability is rated while the patient is sitting in a chair, rising from the chair, standing with eyes open and eyes closed, following a nudge on the chest, turning through 360° and sitting down. The better a subject's performance during these manoeuvres, the higher the score; maximum score is 15.

Subjects used their usual walking aids. Initiation of walking, width of the base, step length, foot clearance, arm swing, cadence of gait and path deviation were assessed while subjects walked 50 feet, turning around a chair. While in a seated position, subjects were examined for apraxia by asking them to perform (without prior demonstration) the following movements. 'Salute with your right/left hand', 'Play a violin' (upper limb tests), 'Kick out with your right/left foot', 'Walk'
Table I. Classification of gait disorders

<table>
<thead>
<tr>
<th>Gait disorder</th>
<th>Able to complete course with minimal assistance</th>
<th>Disequilibrium*</th>
<th>Gait ignition failure b</th>
<th>Wide base</th>
<th>Shortened stride</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cautious gait</td>
<td>+</td>
<td>None/Mild</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Disequilibrium syndrome</td>
<td>−</td>
<td>Severe</td>
<td>+/−</td>
<td>+/−</td>
<td>+/−</td>
</tr>
<tr>
<td>Isolated gait ignition failure</td>
<td>+</td>
<td>None/Mild</td>
<td>+</td>
<td>−</td>
<td>+/−</td>
</tr>
<tr>
<td>Frontal gait disorder</td>
<td>+</td>
<td>Moderate/Severe</td>
<td>+/−</td>
<td>−</td>
<td>−</td>
</tr>
</tbody>
</table>

* Mild, moderate and severe disequilibrium are defined in the text.

Results

Fifty-five patients (34 women and 21 men) with dementia and 55 control subjects were recruited. Mean age (standard deviation) was 78(5) years. Twenty-one patients had mild dementia (CDR 1), 20 had moderately severe dementia (CDR 2) and 14 had severe dementia (CDR 3).

Gait features and associated findings in patients with dementia were compared with those in controls. Disequilibrium, short-stepping gait, gegenhalten, primitive reflexes and apraxia were more common in AD patients. With increasing severity of dementia, there was a significant increase in the frequency of disequilibrium (mild test or Wilcoxon signed rank test as appropriate. Chi-square or exact tests were used to compare the frequency of signs between patients with gait disturbance and those without gait disturbance and between patients with frontal gait disorder and those with other gait disturbance. Among patients with dementia, the relationship between neurological signs and the severity of dementia was examined using the chi-square test for trend or the Kruskal–Wallis test.

Table II. Gait features and associated findings in patients with AD and controls

<table>
<thead>
<tr>
<th></th>
<th>Patients with AD</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%) (n = 55)</td>
<td>No. (%) (n = 55)</td>
</tr>
<tr>
<td>Disequilibrium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mild</td>
<td>23 (42)</td>
<td>17 (31)</td>
</tr>
<tr>
<td>moderate</td>
<td>8 (15)</td>
<td>3 (5)</td>
</tr>
<tr>
<td>severe</td>
<td>1 (2)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>any</td>
<td>32 (58)</td>
<td>20 (36)*</td>
</tr>
<tr>
<td>Gait ignition failure</td>
<td>9 (16)</td>
<td>2 (4)</td>
</tr>
<tr>
<td>Wide-based gait</td>
<td>17 (31)</td>
<td>8 (15)</td>
</tr>
<tr>
<td>Short-stepping gait</td>
<td>19 (33)</td>
<td>9 (16)*</td>
</tr>
<tr>
<td>Gegenhalten</td>
<td>10 (18)</td>
<td>1 (2)*</td>
</tr>
<tr>
<td>Primitive reflex (any)</td>
<td>7 (13)</td>
<td>1 (2)</td>
</tr>
<tr>
<td>Webster score &gt; 5</td>
<td>13 (24)</td>
<td>2 (4)*</td>
</tr>
<tr>
<td>Median (range) apraxia score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower limb</td>
<td>1 (0–3)</td>
<td>0 (0–1)</td>
</tr>
<tr>
<td>Total</td>
<td>3 (0–8)</td>
<td>0 (0–3)*</td>
</tr>
</tbody>
</table>

*p < 0.05 (McNemar’s test or Wilcoxon signed rank test).
dementia 43%, moderate dementia 60%, severe dementia 79%; \( \chi^2 = 4.4, p < 0.05 \), gegenhalten (5%, 15%, 43%; \( \chi^2 = 7.6, p < 0.01 \)) and primitive reflexes (0%, 10%, 36%; \( \chi^2 = 9.0, p < 0.005 \)).

Overall, 22 (40%) patients and 10 (18%) controls had a recognizable higher level gait disorder (\( z^2 = 6.1, p < 0.02 \)) (Table III). Frontal gait disorder was particularly common in AD patients (15%) compared with controls (2%) (\( z^2 = 4.0, p < 0.05 \)). Also, the frequency of frontal gait disorder increased with increasing severity of dementia (\( \chi^2 = 3.8, p = 0.05 \)). The frequency of other gait disturbances did not differ significantly between patients and controls.

In the study population as a whole, the prevalence of frontal release signs (gegenhalten or any one primitive reflex) was significantly higher among patients with frontal gait disorder (7/9, 78%) than among patients with other gait disorders (3/23, 13%) (\( p < 0.001 \)) or those without gait disturbance (1/78, 1%) (\( p > 0.0001 \)). Extrapyramidal signs were more common among subjects with gait disorder (12/32, 38%) than those without gait disorder (3/78, 4%) (\( p < 0.0001 \)); however, there was no significant difference in the frequency of extrapyramidal signs between subjects with frontal gait disorder (5/9, 56%) and those with other gait disorders (7/23, 30%) (\( p = 0.2 \)).

Falls were noted in 14/32 (44%) patients with gait disturbance and 10/78 (13%) patients without gait disturbance (\( p < 0.001 \); there was no difference in the proportion of fallers between subjects with frontal gait disorder (4/9, 44%) and those with other gait disorders (10/23, 43%). There was no significant difference in the prevalence of hypertension between subjects with frontal gait disorder (2/9, 22%), other gait disorders (5/23, 22%) and those without gait disorder (26/78, 33%).

Discussion

Many writers have reported that gait and balance remain normal until the late stages of AD [10, 18, 19]. However, Molloy et al. reported gait abnormalities in 19% of 136 patients presenting with AD [3]; other studies have reported similar findings [4—6]. Our finding that the frequency of different gait disorders differs with the severity of dementia provides some explanation for the disagreement between previous reports.

A cautious gait is a nonspecific finding in diverse conditions including arthritis and peripheral sensory and motor abnormalities. In this study, cautious gait was the most common gait disturbance in patients with mild dementia (and in the control subjects). This disorder has been described as an appropriate response to 'real or perceived instability' [11]. Thus, our findings are consistent with gait laboratory studies which have shown that patients with mild dementia exhibit impaired static balance, slow gait speed and short stride length compared with age-matched controls [7, 8].

Our results suggest that frontal gait disorder is the most common gait disturbance in patients with moderate to severe AD. This disorder is characterized by prominent disequilibrium, short steps, shuffling and start and turn hesitation and has been reported as a consequence of multiple lacunar infarcts,Binswanger's disease, frontal lobe tumour and hydrocephalus [11, 20, 21].

Previous studies have reported that a substantial proportion of AD patients develop extrapyramidal and frontal release signs [3—6, 22]. These patients appear to have more severe cognitive impairment and more rapid cognitive decline and may represent a distinct neuro-pathological and clinical subtype of AD [23, 24]. Our results indicate that frontal gait disorder is particularly characteristic of such patients. Our results are similar to those of Sjögren who noted gait disturbance in 13 (72%) of 18 patients with histologically proven AD and noted progressive unsteadiness and asynchrony of gait and development of prominent extrapyramidal rigidity with increasing severity of dementia [25].

Strict diagnostic and exclusion criteria and standardized assessment instruments were used in this study. Although we excluded patients referred specifically because of difficulties with mobility, the recruitment of subjects in hospital clinics may have led to over-representation of patients with gait disturbance.
Nevertheless the prevalence of gait disturbance in this study is similar to that noted in other studies of AD patients [3–6]. Relatively few of the AD patients with gait disturbance had hypertension, the most important risk factor for vascular dementia and Binswanger's disease [1, 20].

Further studies are necessary to determine the clinical and neuropathological significance of abnormal gait patterns in AD patients. Nevertheless, our results suggest that diagnostic criteria for AD should take account of the frequency of different higher-level gait disorders at different stages of AD.

References

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