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Review

Cardiovascular dysautonomia as a cause of falls in Parkinson's disease

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Abstract

Parkinson's disease (PD) patients have a ninefold increased risk of recurring falls compared to healthy controls. The risk of falling due to cardiovascular dysautonomia (CVD) is not quantifiable. But, CVD is an integral part of the disease and at least 20% of PD patients suffer from orthostatic hypotension, an expression of CVD. One way to reduce falls due to CVD in PD patients could be to give adequate information on the relationship between falling risks and cardiovascular dysautonomia to patients and their caregivers. Moreover, drugs given for PD might contribute to OH and we propose that education and non-pharmacological strategies for its treatment might be preferable, especially because of the low efficacy of drugs available for the treatment of OH and the frailty of elderly PD patients.
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Keywords: Parkinson's disease; falls; Cardiovascular dysautonomia; Orthostatic hypotension; Postprandial hypotension

Contents

1. Introduction

Falls are among the most common and serious problems of the elderly [1,2], particularly in individuals over 65 years [3], as they can result in serious morbidity and, especially if

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Table 1
Reasons for falling in Parkinson's disease

Disease	Comorbidities	Environment
Postural instability	Sensory defects (visual, vestibular, proprioceptive)	Inappropriate footwear
Changing posture	Motor disorders	Slippery soles
Difficulty in turning	central or peripheral	high and narrow heels
Freezing	nervous system defects	open-toed shoes
Involuntary movements	orthopaedic problems	Slippery floor, loosing rugs and carpets
Hallucinations	Cognitive decline	Inadequate lightening
Inadequate control of walking aids	Drugs	Narrow doorways
Performing more activities	polipharmacy	Inadequate furniture positioning
Simultaneously	hypotensives	Absence of handrails in toilet and supporting devices
Hazardous behaviour	psychoactives	
Inadequate orthostatic tolerance	Anemia	
Orthostatic hypotension	Fever	
Postprandial hypotension	Infection	
	Known heart disease	
	Vasovagal syncope	
	Situational syncope	
	Carotid sinus syndrome	

repeated, in loss of independence, increasing immobility and reduced quality of life [4].

Falling and its consequences are magnified in patients with parkinsonism or Parkinson's disease (PD) [5–8]. They have a ninefold increased risk of recurrent falls compared to controls [7]. The problems connected with falls are important in the clinical management of PD; falls are responsible for more than 30% of the acute events bringing patients with PD to emergency departments [9]. Clinical experience suggests that PD patients can fall for numerous reasons (Table 1), not only linked to their disease. In addition, impairment of sensory input 'in general', motility, metabolic disorders or intercurrent diseases, play a part. But, in many cases falls remain unexplained.

The risk factors identified for falling in the general population include: female gender, increased age, abnormal balance and gait, cognitive impairment, arthritis, blindness, dementia, OH, parkinsonism, stroke, greater number of medications, antidepressants, antipsychotics, sedatives and a history of prior falls [10].

Most studies on falls in PD patients were conducted on patients aged 60–65 years. Age, therefore, and its attendant proneness to falls, is an added risk apart from factors directly related to their disease [7]. An example of the cumulative effect of age with disease-related impact is due to orthostatic hypotension (OH)—the best known form of cardiovascular dysautonomia (CVD) in PD. Orthostatic hypotension is found especially in PD patients older than 60 years [11,12]. The modifications of blood pressure (BP) and heart rate (HR) regulation with increasing age induce changes in the BP cyclic seasonal, diurnal and ultradian fluctuations, and include reduction of HR ultradian variability pattern and impairments in the responses to changes in BP and blood volume that may increase the risk of fainting and falling [13] due to OH. Also for PD, the main factor accounting for cardiovascular autonomic dysfunction is age [14]. Age alone explains up to 36% of the variance in HR variability, while the disease stage accounts for the 12.7% of the variance at the standing BP test, and medications account for 10.6% of the variance of the systolic BP change at the sustained handgrip test [14].

Here, we propose a role for the autonomic nervous system (ANS) in the genesis of falls in PD and plead for greater attention to dysautonomia as a causes of falling in such patients.

2. Relationship between body balance and autonomic functions

Neuropathological changes in PD are found in the brain, spinal cord, paravertebral and prevertebral autonomic ganglia and in gastrointestinal tract neurons [15]. Correlation between these sites of pathology and the clinical feature of PD suggest that body balance and autonomic functions are intimately linked.

Several lines of evidence [16–20] have identified a network of central neural circuits that integrate vestibular (the organ controlling balance) and autonomic information. This supports the concept that vestibular and visceral information, such as blood pooling during orthostasis and visceral proprioception, are also used for a central representation of gravitational-inertial parameters during movement [21].

In humans and animals, the vestibular system influences the control of BP and additional sensory inputs that appear to be integrated to produce cardiovascular adjustments during postural changes [22]. Moreover, vestibular damage results in parallel disturbances in autonomic function [23]. Changes in the perception of posture are influenced by both otoliths and the fluid distribution in such a manner that both interact in a compensatory way [24], making possible the

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