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Neurological aspects of falls in older adults

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In this conference summary the contribution of neurological impairments to the pathophysiology and management of falls, with focus on two conditions illustrating the complexity of postural instability, will be briefly discussed. About one third of older people in the UK fall each year, half recurrently. Advancing age and co-mordidity increase the incidence and the severity of consequences, which include severe injuries (70,000 hip fractures annually), disabling fear of falling, functional dependency and care home admissions.[1] Healthcare costs are also staggering, at nearly £1 billion per annum.

The general clinical model

Falls are complex events involving individuals in action. The relevant factors include specific physiological impairments, particularly gait and balance, individual behaviour and environmental context. All three are amenable to assessment and potentially to interventions. Physiological impairments result from both age/lifestyle effects and medical conditions. Behaviour is impacted by habits, perception, judgement and so on. Environmental hazards become risky in inverse proportion to an individual's capacity for specific behaviours. The attributable contribution of each aspect to falls risk is highly variable between individuals and may vary for any individual faller. Falls risk assessment has been systematised in a variety of ways, and neurological factors are prominent. For example, regression analysis from a broad multi-domain array of impairment risk factors showed prediction depended on five domains – contrast vision sensitivity, lower limb proprioception, quadriceps strength, reaction time and sway.[2] In our clinic population, in whom we have assessed these risk factors systematically on over 1,000 patients, reaction time and sway which reflect complex integrative function are the most prevalent and the most severely impaired, compared to age-matched controls.

As usual in geriatric medicine, clinical strategies to reduce falls or injuries combine condition specific, diagnosis-dependant elements plus generic non-specific interventions focused on impairment modification. In addition, the relevance and details of behavioural and environmental modification also have condition specific and generic aspects. Clinical guidelines from the National Institute for Health and Clinical Excellence[3] (2004) and the American and British Geriatrics Societies[4] (2009) emphasise general population preventative measures, such as promoting physical activity and safer environments, but also the need for case finding, multi-domain risk assessment and targeted multi-component interventions for high risk fallers, for whom research-based interventions can reduce incidence by 20–30% or more.[5] Progressive strength and balance exercise training of adequate dosage is the most efficacious intervention. This may be sufficient as a single measure for many individuals, but may be impossible, ineffective or insufficient for patients with significant neurological illness.

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Parkinsonism and falls

Falls incidence rates in Parkinsonian syndromes are high, up to 68% in idiopathic Parkinson's disease (PD).[6] The pattern and falls risk profile varies according to condition, occurring often and typically early in the course of dementia with Lewy bodies (DLB). In a one-year prospective study of PD patients with a mean age of 75 years, median duration of disease three years and median modified Hoehn and Yahr 2.0, the minority (32%) who did not fall had shorter disease duration, and a lower prevalence of dementia and lack of arm swing (bradykinesia) but did not differ significantly in medication type or dosage, tremor, orthostatic hypotension or other autonomic cardiovascular impairment. Orthostatic hypotension may however be an important contributor in mobile patients with autonomic failure, so may predominate in multiple system atrophy or later stages of PD, but may also be caused or exacerbated by medications including levodopa and by physiological deconditioning or volume depletion resulting from physical disability and inactivity.

Non-specific features which are predictive in general populations, such as reduced muscle power, slower gait and fear of falling are also risk factors in PD. Attentional deficits are also important[7] and together with a deficit of postural awareness[8] may explain the repetitive almost impulsive 'unwise' actions which often precipitate falls in PD patients. Fracture risk is particularly high in PD probably because of high osteoporosis prevalence and impaired protective arm responses.

Can these falls be reduced? A review of eight trials including 203 participants doing treadmill training showed improved gait speed, stride length and walking distance but no conclusive evidence yet for falls reduction.[9] A subsequent randomised controlled trial (RCT) of 10 weeks (2/wk) group exercise programme showed only transient reduction in falls despite enduring improvements in balance (Goodwin V, unpublished PhD). Since the causation of falls in any individual PD patient may be multifactorial, complex interventions including behavioural modification in addition to addressing motor impairments may be needed if possible. This suggests that a more complex approach may be needed. A RCT testing an eight-week programme of strength/balance exercise with a hazard avoidance

strategy in PD patients with recurrent falls, mean disease duration of eight years, independently mobile and not cognitively impaired, produced a non-significant falls reduction, with greater benefit in less impaired patients.[10] Further trials are in progress. Meanwhile, the best approach is probably to optimise therapy to reduce bradykinesia while avoiding excessive dyskinesia or orthostatic hypotension, combined with gait and functional mobility training and hazard reduction.

Gait, cognition and falling

Older people with dementia have a twofold higher rate of falls and sustain more fractures. Paradoxically, gait speed, while slow, may be fast relative to the gait quality in dementia, perhaps due to frontal lobe disinhibition and lack of insight. Dementia complicates falls reduction strategies and may limit the applicability of otherwise efficacious intervention. Higher level gait disorders, with increased step-to-step variability, reduced step length and cadence are all associated with more falls, as well as with increased functional dependency and death. There is growing evidence of a close link both phenomenologically and pathophysiogically between progressive gait disorders and cognition, including subtle non-memory cognitive impairments, such as executive function, visuospatial orientation and judgement.[11,12] The link pathophysiogically is with small vessel disease and other contributing factors to deep white matter damage. There is also evidence of these changes and increased vascular events in late-onset depression, another falls risk factor.

These inter-relationships raise the possibility of new preventative strategies aimed at limitation of white matter damage. Further, it suggests that new cognitive or behavioural strategies may provide additional benefit to the more established approach of strength and balance exercise to improve mobility performance.

References

1 Masud T, Morris RO. Epidemiology of falls. *Age Ageing* 2001;30-S4:3–7.
2 Lord SR, Menz HB, Tiedemann A. A physiological profile approach to falls risk assessment and prevention. *Phys Ther* 2003;83:237–52.
3 National Institute for Health and Clinical Excellence. *Guidelines on the prevention of falls and injuries in older people.* London: NICE, 2004.
4 American Geriatrics Society and British Geriatrics Society. *Clinical practice guideline: prevention of falls in older persons.* New York and London: AGS and BGS, 2010. www.americangeriatrics.org/health_care_professionals/clinical_practice/clinical_guidelines_recommendations/2010/
5 Gillespie LD, Robertson MC, Gillespie WJ *et al.* Interventions for preventing falls in older people living in the community. *Cochrane Database Syst Rev* 2009;(2):CD007146.
6 Wood BH, Bilclough JA, Bowron A, Walker RW. Incidence and prediction of falls in Parkinson's disease: a prospective multidisciplinary study. *J Neurol Neurosurg Psychiatry* 2002;72:721–5.
7 Allcock LM, Rowan EW, Steen IM *et al.* Impaired attention predicts falling in Parkinson's disease. *Parkinsonism Relat Disord* 2009;15:110–5.
8 Kamata N, Matsuo Y, Yoneda T *et al.* Overestimation of stability limits leads to a high frequency of falls in patients with Parkinson's disease. *Clin Rehabil* 2007;21:357–61.
9 Mehrholz J, Friis R, Kugler J *et al.* Treadmill training for patients with Parkinson's disease. *Cochrane Database Syst Rev* 2010;(1):CD007830.
10 Ashburn A, Fazakarley L, Ballinger C *et al.* A randomised controlled trial of a home-based among people with Parkinson's disease exercise programme to reduce the risk of falling. *J Neurol Neurosurg Psychiatry* 2007;78:678–84.
11 Alexander NB, Hausdorff JM. Linking thinking, walking, and falling. *J Gerontol A Biol Sci Med Sci* 2008;63:1325–8.
12 Van Iersel MB, Kessels RPC, Bloem BR, Verbeek ALM, Olde Rikkert MGM. Executive Functions Are Associated With Gait and Balance in Community-Living Elderly People. *J Gerontol A Biol Sci Med Sci* 2008;63:1344–9.

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