

The role of medical assessment and intervention in the prevention of falls

CAMERON G. SWIFT

Department of Health Care of the Elderly, King's College School of Medicine, London, UK

Address correspondence to: C. G. Swift. Email: cameron.swift@kcl.ac.uk

Abstract

Evidence that falls amongst older people can be prevented now requires researchers and policy makers to elucidate the most comprehensive and cost-effective approach to implementation. The syndrome of falls and fractures in later life reflects the combined age-associated influences of cumulative susceptibility to health problems and reduced adaptive reserve. The major contribution of health factors to falling has long been recognised clinically and has also emerged clearly in epidemiological studies of risk. A fall in an older adult, especially if recurrent, may be a key signal of unmet medical need and should accordingly trigger an in-depth diagnostic process and clinical intervention by an appropriately skilled physician. Although well-designed controlled studies specifying this approach as part of a multifactorial intervention are comparatively few, recent published trials have confirmed the anticipated substantial returns in fall prevention achieved for community-dwelling patients with a history of falling. Larger-scale studies are now required, and further research is needed to achieve effective prevention strategies in institutional care. Combined calcium and vitamin D may act via neuromuscular and skeletal mechanisms in fracture prevention. The requirement for medical assessment has now appropriately been incorporated into national and international guidelines.

Keywords: *fall prevention, diagnosis, medical assessment, controlled studies, calcium and vitamin D*

Introduction

The strength of evidence that falls in later life can be prevented has grown to the point where it can no longer be ignored by health policy makers and providers. Across a wide range of controlled intervention studies, the most compelling results have been obtained from the application of a multifactorial approach to those at high risk of falling [1]. Consequently, organised health service delivery initiatives to deal with this major public health issue amongst older people are now strongly indicated. Inevitably, there is disparity in the range of service models being proposed, and a corresponding need for the development of consensus, driven by evidence, on the minimal requirements for maximal cost-effectiveness. Further 'best fit' implementation studies are urgently required.

Human ageing is in general characterised by random cellular error accumulation, by a corresponding predisposition to pathological change, by reduced adaptive reserve and by increasing inter-individual variability. Clinically, the late-life 'syndrome' of falls and fractures is an excellent exemplar of these phenomena, in particular, the summative interaction of pathologies with reduced adaptive reserve. There are age-associated reductions in the reserve capacity of any or all of the entire spectrum of mechanisms involved in orthostatic control; at the same time, there is progressive vulnerability to a growing

range of health-related perturbations (acute or chronic), perhaps especially those affecting central neurological control mechanisms. Examples include metabolic disturbance, reduced cerebral perfusion and its causes, small vessel disease, hypoxia, seizure-related problems, pyrexia and the effects of drugs. (Even uncontrolled, but otherwise uncomplicated, hypertension has been found to cause subtle perfusion-related decrements in psychomotor performance) [2]. These all vary between individuals, so that the relative contributions of each or any require careful analysis and dissection in any one case.

It is clear also from the epidemiological literature on risk factors that health related causes play a prominent part. These are sometimes specific (e.g. cardioinhibitory or vaso-depressor carotid sinus syndrome). More commonly, however, the effects of a combination of non-specific health problems summate with those of age-associated physiological change to cause falling [3–5].

Consequently, a fall in an older individual, though important in its own right, is potentially a vital signal of unidentified or unresolved medical need. It follows that recurrent falls or other indicators of high falls risk should prompt a rigorous diagnostic process by an appropriately skilled physician at an early stage in the care pathway. This is distinct from the mere assembling of a list of apparent risk factors because an iterative process of accountable clinical judgement, decision making on priorities, and even occasional unitary diagnosis is entailed.

Although there is broad consensus amongst physicians and gerontologists on this, it remains inadequately described in the literature. This is partly because of differences in patterns of clinical service delivery, the lack of formal coding for a 'fall' in systems of disease nomenclature and a failure to explore this domain in sufficient depth within many so-called multidimensional clinical studies. In particular, there have been comparatively few intervention studies explicitly based on such an approach, although several have included the itemisation of the so-called health risk factors as part of 'multidimensional' assessment.

UK-based studies incorporating in-depth physician assessment

Opportunities to carry out studies of this nature have been presented in recent years under policy initiatives taking place within the British National Health Service (NHS). Since 1990, there has been a Department of Health requirement (rather poorly evidence-based) for preventative health strategies for older people in primary care. At the same time, an NHS Research & Development (R&D) programme has invited bids for modest grants at regional and national level for health technology and health service evaluation studies. There is also a degree of uniformity in the extensively developed hospital-based geriatric medicine services, all of which undertake acute care with direct access to front-line facilities, including Accident and Emergency (A&E).

A&E departments are almost by definition fruitful territory for falls research. Eight per cent of adults over 70 attend A&E with a fall-related injury [6], of whom 30–40% are admitted [5]. About half of those sent home exhibit increased dependency [7–9]. The prevalence of under-diagnosis of problems in A&E has also been described [10, 11]. In particular, documentation has focused on the injury, and a 'fall' has not been identified as such, let alone its causes sought.

A modest regional R&D grant enabled our group to set up the 2-year PROFET study [12] as an experimental model of A&E-based multidimensional falls intervention incorporating in-depth physician diagnostic evaluation as a key element. Consecutive community-dwelling, cognitively intact A&E attendees over 65 were painstakingly identified by establishing a 'register' of all fallers, and randomised to control (usual care) ($n = 213$) and intervention ($n = 184$) groups. The intervention comprised specialist one-off physician (day-hospital) and occupational therapy (home) assessments using predetermined protocols and carried out within 3 weeks of the index fall.

Medical assessment comprised an in-depth diagnostic approach based on detailed and systematic history and examination of all relevant systems with investigation and/or referral as indicated by standard criteria (including tilt-table and carotid sinus studies for unexplained falls, syncope or postural hypotension). This was supplemented by measures of postural sway, cognition, anthropometric variables, balance testing and assessment of visual acuity and binocular vision.

Home assessment comprised home-safety analysis, functional assessment (FIM), falls handicap inventory and footwear with provision of minor home adjustments, and advice and/or referral for adaptations where indicated.

Of interest is that two-thirds of those randomised had fallen significantly during the previous year (population incidence usually one-third) and one-third were recurrent fallers—thus identifying the A&E attendees as a group at high risk.

There was a substantial yield of medical need. In addition to instances of a wide range of problems, including, for example, significant joint disease, impaired mobility or malignancy, this comprised the following:

- contributory circulatory disorders (e.g. postural hypotension, arrhythmias, carotid sinus syndrome, pacemaker failure) identified in 17%;
- visual problems (reduced acuity 59%, poor stereoscopic vision 62%, cataract 35%);
- leg weakness 28%;
- peripheral neuropathic signs 20%;
- balance impairment (one-leg stand) 72%;
- impaired cognition (Mini-Mental Status Examination—MMSE)(initial exclusion based on Abbreviated Mental Test <7) 34%;
- depression (Geriatric Depression Scale) 18%.

Alongside this yield, occupational therapy assessment identified a range of environmental and functional problems.

The results were fully reported elsewhere [12]. The primary endpoint of incidence of falls in the 12-month follow-up period was markedly reduced in the intervention group versus the control group (183 vs. 510), with evidence of early benefit within the first 4 months. The number and percentage of fallers were also reduced, as were the proportion of those experiencing three or more falls and the number of hospital admissions. In addition, functional ability (as measured by the Barthel ADL index) was significantly preserved in the intervention group versus the control group, in whom it declined. In a meta-analysis of falls prevention studies, the marker of outcome achieved by this approach sits well to the 'left' in favour of benefit compared with other trials of multifactorial intervention [1].

Subsequently, a further NHS A&E-based study of 313 cognitively intact recurrent fallers with physician assessment essentially replicated these findings [13]. In this study undertaken in Newcastle, the number of falls was fewer by 36% in the intervention group (387 vs. 617), though the reduction in the proportion of fallers did not achieve statistical significance. In addition, there was a 5-fold reduction in the number of hospital bed days (131 vs. 688) consumed by the intervention group during the 12-month follow-up period.

Taken alongside the sum of less direct evidence from other studies, these findings underpin the key role of in-depth medical assessment and the diagnostic process as a part of any effective multifactorial intervention approach. There is, however, a need for further studies. The limitations of the above evidence are emphasised below:

- Both were confined to 'cognitively intact', community-dwelling individuals. (Living in an institution was an exclusion criterion for the PROFET study and a similar exclusion occurred de facto in the Newcastle study.) These and other exclusion criteria meant that only 397 of 1,031

eligible A&E attendees (over 6 months) were randomised in PROFET and only 313 of 5,090 (over 12 months) in Newcastle, where those reporting a single previous fall only (1,911) were also excluded. Hence the data relate to a highly selected population group. This group is, however, an important one. It appears to be representative of a subset of community-dwelling older people presenting to the health service with health-related risk factors ripe for detection and fruitful intervention as part of a population-based opportunistic early case-finding strategy. The research potential of the group is also clearly very substantial.

- Both studies were local and of small numbers. Larger-scale implementation studies are required to establish whether the benefits shown are translated at a wider population level.
- Improvements in the elements of the medical, functional and environmental protocols are clearly possible to give an even greater yield, such as more sophisticated testing of visual function, physical ability and the living environment.

Medical assessment in the prevention of falls in those living in an institutional setting

The optimal approach to falls prevention in institutional settings and sheltered accommodation remains unclear. As yet, no single or multifactorial strategy has been proven to be reliably effective [14], although there is some evidence that interventions, such as hip protectors [15, 16], combined calcium and vitamin D [17, 18] and standard skeletal anti-resorptive therapy for those with established osteoporosis are beneficial in the prevention of fractures in this population of older people. The identification of effective measures to reduce falls in hospitals and in nursing and residential homes would be a major step forward.

The burden of health need in these settings is self-evident. It is therefore likely that skilled diagnostic evaluation would be an essential element of any such strategy for falls prevention, once identified. However, the simple translation of the procedures effective in community-dwelling older adults to this group has not been found to be effective on its own.

A study applying the same principles of A&E-based intervention (including diagnostic assessment) as those described above to 274 attendees with cognitive impairment was reported in 2003 [19]. In reality, the study sample turned out to be more than three-quarters institutionally based, and it is highly likely that this facet of those recruited contributed as much to the outcome as did their cognitive status. During the one-year follow-up, the 6% reduction in the proportion of patients falling (74%; 96/130 vs. 80%; 115/144) failed to achieve statistical significance, and no significant benefits in terms of secondary outcome measures were recorded.

The likelihood is, therefore, that the prevention of falls in this population of older people will entail very specific, as yet unidentified, approaches in terms of the built environment and multidisciplinary practice. These approaches will prove of central importance alongside the management of health-related problems.

The question of Vitamin D and calcium is worthy of specific comment. It is not clear in what proportion the fracture-reducing effects of combined calcium and vitamin D in institutionally living older people [17, 18] are due to direct actions on bone health or to correction of other consequences of calcium and vitamin D deficiency, such as impaired psychomotor performance and skeletal muscle weakness predisposing to falls. Deficiency of vitamin D has been found to be common in patients attending a falls clinic [20] and is virtually universal in older people in residential and nursing homes and in sheltered accommodation [21]. Administration of Vitamin D replacement to falls clinic patients was found to enhance psychomotor performance and reduce postural sway compared with a control group [22]. It is possible that at least some of its beneficial effect on fractures may be mediated via neuromuscular mechanisms.

Conclusions

The place of medical assessment and intervention as part of falls risk assessment and management is logical in terms of an understanding of ageing processes and of the epidemiology of risk factors for falling. Recent studies have confirmed the effectiveness of multifactorial interventions incorporating in-depth diagnosis and clinical management by specifically trained physicians; this approach is probably essential if the potential benefits of such interventions are to be fully realised. As with other elements of the multifactorial approach, the precise contribution of medical assessment to effective prevention in the case of high-risk individuals in institutional settings is yet to be quantified. The prominent role of physician diagnosis and management in fall- and fracture-prevention in older people is now rightly enshrined in international consensus guidelines [23–28].

Key points

- The place of medical assessment and intervention as part of falls risk assessment and management is logical in terms of an understanding of ageing processes and of the epidemiology of risk factors for falling.
- Recent studies have confirmed the effectiveness of multifactorial interventions incorporating in-depth diagnosis and clinical management by specifically trained physicians; this approach is probably essential if the potential benefits of such interventions are to be fully realised.
- As with other elements of the multifactorial approach, the precise contribution of medical assessment to effective prevention in the case of high-risk individuals in institutional settings is yet to be quantified.
- The precise mechanisms whereby combined calcium and vitamin D may reduce fractures in the institutional population remain unclear.
- The prominent role of physician diagnosis and management in fall- and fracture- prevention in older people is now rightly enshrined in consensus guidelines.

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Conflicts of interest

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