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ACUTE GERIATRICS

Avoiding anchoring bias by moving beyond 'mechanical falls' in geriatric emergency medicine

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An 84 year old functionally independent man, presents with right-sided chest pain. His general practitioner prescribed rivaroxaban 9 months ago following a deep venous thrombosis. He was cleaning his garage and slipped from a small stool, falling backwards onto his bottom and then chest. He reports three other falls over the last year, but none of them were injurious and he has not sought medical care before today. His only other past medical history is hypertension for which his general practitioner recently added a third antihypertensive agent. He has blood pressure 105/73, heart rate 96, oxygen saturation 92% on room air and Glasgow Coma Scale 15. His chest wall is tender on the right without crepitus or palpable deformity. No traumatic injuries were found on imaging. The patient is eager to return home, as you contemplate an opportunity to prevent future injurious falls. Should emergency medicine's role include intervening in this sentinel event?

Definition and epidemiology

The Prevention of Falls Network Europe (ProFaNe) defines falls as 'an unexpected event in which the participant comes to rest on the ground, floor, or lower level'.[1] ED clinicians may be unaware that this definition includes not only trips, slips, and loss of balance, but also syncope, seizure and other illness-related causes. Trauma services are confronting a shift away from motor vehicle accidents and towards falls as a result of ageing populations.[2] Falls already represent the leading cause of trauma-related mortality and disability[3] and in Australia falls cause over three times the number of hospitalisations than motor vehicle accidents with 15% longer lengths of stay. ED clinicians should be aware of factors associated with differing fall risk among heterogeneous ageing populations. For example as a consequence of physical and cognitive frailty overlying comorbid diseases, the incidence of falls is associated with patients' living situations – 33% of community-dwelling older adults fall each year compared with 60% of aged care facility residents. Residents of Australian aged care facilities are five times more likely to be injured during a fall than are older residents living in the community.[4]

In frail older adults, falls often serve as a harbinger of functional decline. Half of fallers fall again within a year.[5] One-third of those discharged after a fall experience significant functional decline and loss of independence within 3 months, but identifying which patients and what interventions alter that trajectory remains challenging.[6,7] Similar to other older adult ED scenarios with non-specific chief complaints, most fall victims discharged home recover uneventfully.[8] However, many falls, even non-injurious falls, can lead to fear of falling with consequent curtailing of activities resulting in eventual balance and strength impairments that further increase the risk of future falls.[9]

Regrettably, people who fall and present to the ED rarely receive guideline directed screening or referral.[10–12] One charitable explanation is that ED-based falls research is limited, inconclusive and has yet to incorporate implementation science principles to catalyse practice uptake from research settings.[13] A more probable explanation is that falls unassociated with acute injury are given low priority by ED clinicians.[14] Assessing geriatric falls in a systematic way to identify remediable causes and anticipated future fall risk may prevent significant future morbidity and mortality.

Fall injuries and consequences

Generally speaking, the falls in older people we see in the ED are the tip

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of the iceberg, with less than one in 10 falls in the community associated with a fracture or hospitalisation.[15] Nevertheless, falls result in major trauma (Table 1) and both immediate and delayed adverse outcomes, notably:

1. Hip injuries, which represent a quarter of fall-related injury hospitalisations.[4] Hip fractures precipitate a downward spiral in health and quality of life for many frail older people with a high, 27% mortality at 1 year post-injury.[16] Up to 60% of those surviving 12 months do not regain pre-fracture function.[17]
2. Head injuries, which account for nearly half of fall deaths, most commonly from subdural hematoma.[18] Intracranial haemorrhage deaths predominate in anticoagulated fall victims, so computed tomography imaging in these patients is appropriate[19,20] if they present to the ED.
3. Rib fractures, with mortality associated with increasing age, increasing number of ribs fractured and underlying cardiac problems.[21]

The ED management of geriatric major trauma injuries was previously reviewed in this series and is the same for fall victims.[20]

Long lies or inability to arise following a fall are also associated with commonly overlooked metabolic and psychological injuries. Almost half of fallers report inability to be able to get up following at least one of their falls.[22] Prolonged time on the ground precipitates soft tissue injury and rhabdomyolysis. Falls are the leading cause of rhabdomyolysis in older people.[23] The post-ED consequences of long lies include fear of falling and consequential reduced levels of activity, which then increases the risk of subsequent falls via rapid deconditioning.[22,24]

Evaluating falls in the ED

A structured approach to search for the aetiology of fall(s) may guide assessment to simultaneously identify fall injuries and aetiology. The number of causes that need to be considered for falls and future falls is large and can appear overwhelming for the ED clinician with time limits on their assessment.[25] One method is to initially evaluate for three potential factors: (i) age-related and existing chronic health problems causing physiological and cognitive decline, (ii) acute illness, and (iii) medications and other substances.[26]

Table 2 is another suggested time based work-up for all fall patients. How much of this assessment is performed in the ED *versus* other environments (ward, community office) will depend on both patient factors and health system factors, but the principles of evaluation are the same. Detailed

TABLE 1. *Body region injured for hospitalised fall injury cases, by sex, Australia 2012–2013*†

	Men		Women		People	
Body region injured by principal diagnosis	Count	%	Count	%	Count	%
Injuries to the head	8652	27.3	12 813	19.1	21 465	21.7
Injuries to the neck	646	2.0	805	1.2	1451	1.5
Injuries to the thorax	3046	9.6	3857	5.8	6903	7.0
Injuries to the abdomen, lower back, lumbar spine and pelvis	3171	10.0	7881	11.8	11 052	11.2
Injuries to the shoulder and upper arm	2507	7.9	6691	10.0	9198	9.3
Injuries to the elbow and forearm	1843	5.8	7247	10.8	9090	9.2
Injuries to the wrist and hand	914	2.9	1196	1.8	2110	2.1
Hip fractures	5274	16.6	13 534	20.2	18 808	19.1
Other injuries to the hip and thigh	2042	6.4	4577	6.8	6619	6.7
Total injuries to the hip and thigh	7316	23.1	18 111	27.0	25 427	25.8
Injuries to the knee and lower leg	2655	8.4	6635	9.9	9290	9.4
Injuries to the ankle and foot	416	1.3	924	1.4	1340	1.4
Injuries involving multiple body regions	47	0.1	39	0.1	86	0.1
Injuries to unspecified parts of trunk, limb or body region	262	0.8	398	0.6	660	0.7
Other injuries	260	0.8	372	0.6	632	0.1
Total	31 735	100	66 969	100	98 704	100

†'Other injuries' includes all cases with a principal diagnosis that is not confined to a specific body region (e.g. multiple body regions or injuries not described in terms of body region).

TABLE 2. *Proposed timeline for ED approach to assessing falls*

Timeline	Risks	Examples of evaluation enablers
Initial assessment	Acute medical illness associated with fall, for example, dehydration, sepsis, acute vestibular dysfunction and cardiac disease	ECG, septic screen, orthostatic vital signs, fluid balance assessment
	Acute injury, for example, hip and back, face/head/neck, ribs	X-rays. Consider neuroimaging if indicated by Canadian CT rules
Within 3–4 h	Cognitive impairment including delirium	4AT/CAM
	Gait and balance disturbance	Current mobility, need for aids, feet and footwear assessment
	Discharge risk stratify	Home safety, escalation plan if falls again
Within 24–48 h	Bladder and bowel incontinence Functional decline and frailty, malnutrition Home environment modifications Depression Hearing and vision Medication review	Generally requires multidisciplinary assessment, for example, ADL assessment and OT review, social services referral, depression and anxiety screening tools and pharmacy review

methods of evaluating for delirium and orthostatic hypotension have been previously published in this series.[27,28] Falls evaluation, whether in the ED or following ED discharge, should objectively assess gait, balance, proprioception, vision, muscle strength and cognitive function. In the ED, the Aged Services Emergency Team nurses or multi-disciplinary team members can perform some of these evaluations. Short stay observation unit admissions are commonly used to facilitate this evaluation: providing access to multidisciplinary teams and a clearer plan for safe transition to home.[29]

Falls are generally multifactorial, but can be associated with specific acute or chronic medical issues (Table 3).[22] The term 'mechanical fall' has no place as an explanation for ED presentation. A retrospective audit of ED presentations showed no difference in associated outcomes between those patients labelled as 'mechanical fall' and those who were not labelled. The label 'mechanical fall' risks anchoring bias in the ED assessment.[30] Acute post-fall assessment should include medical and pharmacologic history, including recreational/illicit drugs and alcohol.[31,32] Whenever possible, family or reliable medical care partners should be involved in corroborating the history.

Of course, an initial priority of ED clinicians is to identify acute fall-related injuries, including intracranial haemorrhage, long bone fractures and solid organ injuries. Researchers have yet to assess the accuracy or reliability of bedside findings to distinguish fall patients with haemorrhage or fracture injuries from those who fell but do not have these potential life- or limb-threatening injuries.[33]

Post-discharge falls risk prediction tools

To date, no findings on history or physical exam accurately increase or decrease the risk of post-ED falls, including functional tests of balance or mobility like Get Up and Go[34] and the Timed Up and Go.[35] Many fall risk screening and assessment instruments exist for community, inpatient and institutionalised settings.[34] Fall risk screening tools usually have a two-to-five items that classify an individual's level of risk, but do not identify the range of contributory risk factors associated with increased risk. In contrast, fall risk assessment tools are more detailed and lengthy tools that identify contributory falls risk factors and can be used to determine risk factors for targeting with a falls prevention plan.[36]

Several ED fall risk assessment instruments have been prospectively derived, but await external validation (Table 4). The Tiedemann instrument is two questions and at a threshold score of >2 identifies older adults at increased risk of falls with positive likelihood ratio (LR+) 3.8 (95% CI 2.5–5.8) and negative LR (LR–) 0.46 (95% CI 0.34–0.64).[37] The Tiedemann instrument was derived in Australia and enrolled ED patients aged over 70 who presented with a fall or after two or more falls in the preceding year. The FROP-Com risk screening tool and an associated FROP-Com fall risk assessment tool are additional

TABLE 3. *Mechanisms of falls associated with medical conditions*

Mechanism of fall		Medical precipitants
Hypotension including postural hypotension	Autonomic dysfunction	• Parkinson disease • Multiple system atrophy • Peripheral neuropathies involving autonomic nervous system
	Intravascular volume depletion or redistribution	• Dehydration • Blood loss • Sepsis
	Cardiovascular	• Cardiac arrhythmias • Myocardial ischaemia • Valvular disease • Pulmonary embolism
	Drugs	• Alcohol • Antihypertensives • Antiarrhythmics • Diuretics
Gait or neurological disturbance	Focal neurological insults	• Cerebrovascular accidents • Subdural haemorrhage • Space occupying lesions
	Seizures	
	Vestibular dysfunction	
	Drugs	• Sedative medications • Medications associated with Parkinsonism
Conditions resulting in need to rapidly ambulate to the toilet		• Urinary tract infections where associated with urgency or frequency • Vomiting or diarrhoea
Conditions resulting in impulsive mobilisation and potential for reduced compliance with mobility aids	Cognitive impairment	• Dementia • Delirium
Perceptual disturbance	Vision impairment	• Occipital stroke • Ocular causes of blindness
	Hearing impairment	
	Hallucinations	• Delirium • Psychosis

instruments that have been validated on populations following an ED visit for a fall.[38,39] However, recent research questions the predictive utility of either screening tool when used in the ED.[40] The Carpenter instrument consists of four dichotomous questions that better identified non-high-risk fallers (LR– = 0.11 [95% CI 0.06–0.20]) then high-risk fallers (LR+ = 2.40 [95% CI 1.95–2.80]) at scores >1.[41] The Carpenter instrument was derived in one United States hospital and enrolled patients over age 65 who were in the ED for any reason other than a fall. In New South Wales, the Ontario Modified STRATIFY instrument is widely used despite the absence of ED studies validating this tool.[42]

The usefulness of any fall risk assessment instrument merits comparison with nurse and physician clinical intuition. Furthermore, previous fall prediction models assumed a static fall risk amenable to a one-time assessment. In reality, individual patient's fall risk can vary across the timeframe of an episode of care. Multiple brief assessments of fall risk noting antecedent medication exposures or treatment responses might provide more accurate prognostic models, albeit at the expense of feasibility.

Preventing subsequent falls

Identifying fall risk factors will only reduce subsequent falls and related injuries if effective interventions ameliorate fall risk for some patients.

TABLE 4. *ED falls risk screening and assessment tools*

Tool	Item	Interpretation	Prognostic accuracy for falls
Screening tools			
Carpenter	1. Presence of non-healing foot sore? 2. Any fall in last 12 months? 3. Inability to cut own toenails? 4. Self-reported depression?	>1 'yes' responses is a community-dwelling older adult at increased risk for falls	At >1, sensitivity was 93% (95% CI 89–96) and specificity was 61% (95% CI 54–65) At >2, sensitivity was 100% (95% CI 98–100) and specificity was 22% (95% CI 18–22)
Tiedemann	1. Two or more falls in the past year? (2 points). 2. Take 6 or more medications? (1 point).	Score >2 = older adult at increased risk for falls	At >0, sensitivity was 80% (95% CI 71–87) and specificity was 46% (95% CI 40–53) At >2, sensitivity was 61% (95% CI 48–73) and specificity was 84% (95% CI 76–89)
FROP-Com Screen	1. Number of falls in the past 12 months. 2. Observation of steadiness during walking and turning. 3. Assistance required to perform domestic ADLs.	All items assessed on a 0–3 scale Interpretation: Score >3 = older adult at increased risk for falls	At >3, sensitivity was 67.1% (95% CI 59.9–74.3) and specificity was 66.7% (95% CI 59.8–73.6) Intra-rater reliability was ICC = 0.87 (95% CI 0.70–0.95) and for inter-rater reliability was ICC = 0.89 (95% CI 0.75–0.96)
Ontario Modified STRATIFY	1. Fall on presentation or history of fall in the last 6 months (6 points). 2. Mental state: any confusion, disorientation, agitation (14 points). 3. Vision: glasses, blurred vision, glaucoma, cataracts, macular degeneration (1 point). 4. Toileting: any alteration in urination (2 points). 5. Transfer score: independent (0 points) to unable (3 points). 6. Mobility score: independent (0 points) to wheelchair dependent (7 points).	≥9 = high falls risk Study population included patients over the age of 65 years within 72 h of acute hospital admission, not the ED	At ≥9, sensitivity was 80% (95% CI 58.4–91.9) and specificity was 37.1% (95% CI 30.6–44.0) Positive predictive value 11.4% and negative predictive value 94.8%
Assessment tool			
FROP-Com	Comprehensive falls risk assessment tool that: 1. Covers 13 risk factors for falls. 2. Gives a score of severity for individual risk factors and overall falls risk. 3. Can be used to guide decision making regarding risk factors to target for intervention.	Requires approximately 20 min to complete • 0–11 Low risk • 12–18 Moderate risk • 19+ High risk	At the best cut-off, the FROP-Com successfully predicted 71.3% of fallers and 56.1% of non-fallers in a high falls risk sample of older people (fallers presenting to ED) The FROP-Com was a significantly stronger predictor of falls than the Functional Reach and Timed Up and Go tests Intra-rater reliability was ICC = 0.93 (95% CI 0.84–0.97), and inter-rater reliability was ICC = 0.81 (95% CI 0.59–0.92)

CI, confidence interval; ICC, intraclass correlation coefficient.

Multiple interventions to reduce falls and fall-related injuries exist including various forms of exercise prescription, correcting visual deficits, supplementation of vitamin D and calcium, environmental modifications, hip protectors, and pacemakers – or any combination of these interventions.[43] A 2017 network meta-analysis identified exercise as a key intervention to prevent injurious falls in community-dwelling older adults with additional benefit when exercise is combined with correcting vision and modifying the fall environment.[43] Balance training appears to be an essential component of effective exercise programmes.[44] These interventions occur after the ED visit, but should inform evidence-based fall prevention ED pathways for community referrals in conjunction with outpatient teams. Notably, efforts to prevent falls in aged care facility populations often require different and more complex interventions in association with additional staffing and resources.[45] The majority of falls prevention research pertains to community-dwelling older adults.

The Prevention of Falls in the Elderly Trial (PROFET) was initiated in the ED after evaluation for a fall and to date represents the most impressive intervention to reduce falls in this setting.[46] The intervention consisted of a day hospital medical evaluation by a geriatrician for visual acuity, postural hypotension, imbalance, depression and cognitive dysfunction in the days following the ED visit. An occupational therapy home visit followed to evaluate functional status and environmental fall hazards. Following these evaluations, referral for additional services occurred, if warranted. Compared with routine care, the PROFET intervention demonstrated a significant 20% absolute risk reduction in falls (Number Needed to Treat = 5 [95% CI 4–10]) to avoid one fall, as well as a statistically insignificant 4% reduction in reported injurious falls. Less intense ED fall prevention interventions such as educating patients with pamphlets or educating staff regarding guidelines did not reduce falls or injuries, but did transiently improve other outcomes.[47–49] Other simple interventions like stopping medications associated with falls have not reduced subsequent falls.[50] Acknowledging ED time, space, and personnel constraints, the primary focus after injury management for older fallers being discharged home should be to initiate the process of screening fall risk with immediate interventions for amenable risk factors (de-prescribing high-risk medications) and referral to the general practitioner for more detailed assessment and management. ED care coordination teams, often involving allied health professionals, are one approach to implement this multidisciplinary strategy.[29]

Looking forward

Emergency clinicians' core competencies and clinical guidelines will increasingly reflect the value of fall-risk screening and assessment and targeted patient-centred interventions, including better transitions to the community.[51,52] In addition, some settings continue to explore 'fall clinics' as an immediate access resource for higher risk patients,[53] but the efficacy and cost-effectiveness of this approach continues to be studied.[54] Adaptations for screening fall risk, detecting falls, and linking higher risk fallers with effective multi-disciplinary prevention strategies are likely.[55] For example, advancing technology includes smart phone applications to enhance clinician and family ability to detect falls real-time.[56] Challenges to implementing these interventions are predictable. Some emergency clinicians may view efforts to prevent future falls as mission creep for the specialty, detracting from the priority for assessment and management of patients with urgent medical or surgical conditions.[13] However, we do need better procedures and community linkage for patients who are at high risk of future injury.

Conclusion

Ageing populations worldwide continue to shift the aetiology of trauma towards falls, a trend expected to continue for decades. ED presentations by older people with falls are common and need to be considered part of the core emergency medicine expertise. Initial ED evaluation and disposition decisions of admission *versus* discharge should simultaneously focus on fall injuries, acute illness and the risk for future falls. Short stay observation units and multi-disciplinary fall assessments and commencement of associated intervention programmes have a part to play. It is important that all EDs identify their own community referral pathways for further falls assessment and prevention. Future research to externally validate ED fall risk screening and assessment tools are needed, as well as innovative approaches to reduce the physical and psychological trauma of falls.

Competing interests

None declared.

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