Falls and fractures in older people

Identifying patients at high risk

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Falls are a major contributor to fractures in older people, yet most are preventable. A comprehensive risk-identification approach can help GPs identify older people at risk of falls and fractures and facilitate multidisciplinary, targeted intervention.

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Fragility fractures increase dramatically with advancing age, but bone mass does not show a comparable decline. This suggests that factors independent of bone loss contribute to the age-related increase in fracture risk. Falls appear a major contributor. For example, approximately 95% of hip fractures result from a fall, and fall risk factors such as prior falls and slow gait speed predict hip fracture independent of bone mineral density (BMD).

Most falls are preventable. GPs are pivotal in identifying and treating patients at risk of falls and fractures and facilitating a multidisciplinary approach to intervention. This article describes a comprehensive risk-identification approach for older patients at high risk that can facilitate intervention to help prevent both falls and fractures.

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Epidemiology and consequences of falls in older people

About one-third of people over the age of 65 years living in the community have a fall each year.[1] The risk of falls and fall-related injury increases with age.[2] With the ageing of Australia's population, falls and fall-related complications have increased despite increasing measures aimed at prevention.[3]

Falls result in significant morbidity and mortality.[4] Most fall-related injuries are minor, such as bruising, lacerations, skin tears, strains and sprains. However, approximately 10% of falls result in fracture.[5] About one-third of these fractures are of the hip and thigh, and many of these patients require extended hospitalisation and surgery.[3] Falls may also result in avoidance of activities, social withdrawal, reduced quality of life, need for increasing care, including residential care, and death.[6,7]

Osteosarcopenia and the relation between falls and fractures

There is significant overlap between the risk factors for falls and those for fractures in older people. Muscle and bone are connected physically, chemically and metabolically.[8] The term osteosarcopenia (the combination of osteopenia and sarcopenia) is applied to a subset of frailer individuals with both muscle and bone loss who are at higher risk of falls, fractures and subsequent complications.[9] Although the concept of osteosarcopenia may seem complex, its recognition in patients serves multiple purposes. It contributes to the development of a patient risk profile and also indicates the need for treatment that addresses both muscle and bone deficiencies.

How to assess falls risk

Most falls have multiple contributing factors, although a single major risk factor can be identified in about 20% of falls.[10] Individual risk factors have a cumulative effect on total risk; the more risk factors a patient has then the higher is their risk of falls and fractures. The strongest risk factor for a fall is a previous fall.[11] Most falls are caused by a combination of intrinsic and extrinsic factors (see Box 1 for examples).[12] Individually and in combination, risk factors reduce the falling threshold (Figure).[12]

GPs should undertake a thorough falls risk assessment when any risk factor is identified, the likelihood of which increases with age. The presence of multiple risk factors suggests a patient is at high risk of falls, allowing clinicians to individualise their approach to the assessment of falls risk. Assessment should be multifactorial and include history taking, physical examination and investigations. Recommended investigations are discussed below in

Key points

- **The numbers of falls and fractures in Australia are increasing with the ageing of the population.**
- **GPs play a key role in assessing and treating patients at risk of falls and fractures.**
- **A falls risk assessment should be multifactorial.**
- **Osteoporosis should be considered in any patient over the age of 50 years with a previous fracture or risk factors.**
- **Useful tools are available for rapid assessment of falls and fracture risk.**
- **Interventions to reduce falls and fractures should be targeted and individualised.**

regard to fracture risk assessment. The approach to falls risk assessment differs between people in the community and those in residential care facilities.[13] Given the time pressures faced by GPs, focusing on key risk factors as described below allows for an efficient, multifactorial assessment.

Importance of defining a fall

As the strongest risk factor for a fall is a previous fall, obtaining a clear history of any falls is vital.[11] The concept of a 'fall' may seem quite obvious to clinicians, but patients may have a different understanding.[14] Patients often focus on the consequences of falls and may not report events that have not led to injury. Clinicians should explain, using examples, that a fall is defined as any 'unexpected event in which the person comes to rest on the ground, floor or lower level'.[15] This would include events such as 'slipping backwards', even if this involved landing on an armchair.

History taking

A sound history of any falls should enable the doctor to clearly re-create the individual setting and circumstances of the fall. A history from 'significant others' is often required to complement the history given by the patient. Some patients may not recall or may deny having a fall, in which case the collateral history becomes even more important. Whether the fall is related to presyncope or syncope should be determined, as this may warrant specific cardiac or neurological investigation and specialist referral. Other high-risk features suggesting the need for specialist review in community-dwelling adults with falls are listed in Box 2.[16]

The history should also include information on comorbidities, medications, continence, vision and hearing impairment and cognition. Polypharmacy is a major risk factor for falls. Medications that independently

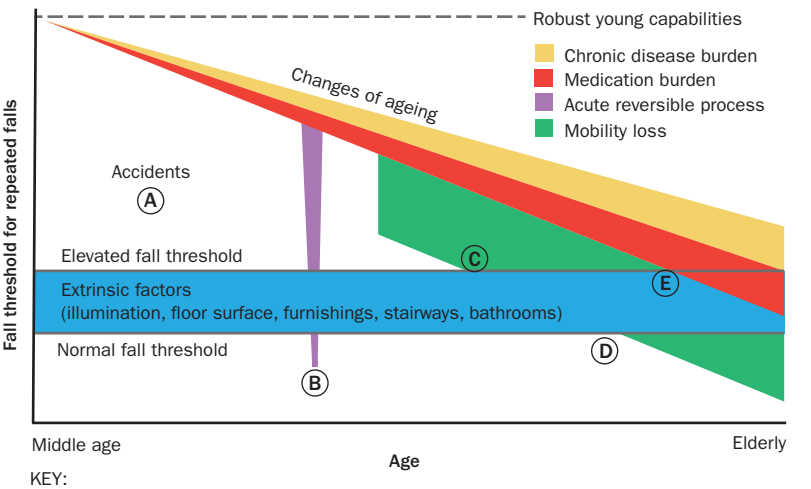
1. Some risk factors for falls

Intrinsic risk factors

- Osteosarcopenia
- Gait disorders
- Comorbidities
- Vision and hearing problems
- Cognitive impairment
- Acute illness
- Medications and polypharmacy

Extrinsic risk factors

- Flooring
- Type of dwelling
- Footwear
- Weather
- Presence of pets



KEY:
A = Patient with an accidental fall and no intrinsic or extrinsic risk factors
B = Patient with acute illness
C = Patient with moderate illness, loss of mobility and some prescription medications who falls because of an extrinsic factor
D = Severely ill patient with many medications who falls even without extrinsic factors
E = Elderly patient with numerous age-related changes who falls because of an extrinsic factor

Figure. Interplay of intrinsic and extrinsic factors in falls risk.

2. High-risk features of falls suggesting a need for review by a geriatrician or falls clinic[16]

- Two or more falls in the previous year
- Unexplained falls
- Syncope or dizziness (consider cardiology referral)
- Falls occurring during basic activities of daily living (Box 3)
- Falls with major injury or a long lie period (more than one hour)
- Gait disturbance or unsteadiness present (consider neurology referral)

3. Activities of daily living[18]

Basic activities

- Dressing
- Personal hygiene
- Toileting
- Eating and drinking
- Mobility

Instrumental activities

- Shopping
- Food preparation
- Housework
- Banking and finances
- Transport including driving

4. Useful screening tests for strength, gait and balance

Timed up-and-go test

Method: The patient stands from a seated position, walks 3 m and returns 3 m to a seated position.

Interpretation: Time taken longer than 15 seconds suggests an increased risk of falls.

Gait velocity

Method: The patient is instructed to walk at a comfortable pace, using any usual assistive device, over a standard distance such as 8 m. The patient is timed over the middle 5 m of the course (allowing for a 1.5 m turnaround at each end). Average speed is calculated over three repetitions.

Interpretation: A gait speed less than 0.8 m/s suggests sarcopenia.[19]

Grip strength

Method: Grip strength of the nondominant hand is assessed with a dynamometer. The patient should be shown how to use the dynamometer first. They should stand with arms at the side, not touching the body, and elbows slightly bent, and squeeze the dynamometer once with as much force as possible. Three trials should be made with pauses of 10 to 20 seconds in between to avoid muscle fatigue.

Interpretation: Average grip strength less than 30 kg in men and less than 20 kg in women suggests sarcopenia.[19]

increase the risk of falls include psychotropic medications, antidepressants and medications that increase the anticholinergic burden.[17]

The social and functional history is a vital element of falls risk assessment. The patient's function can be assessed through the activities of daily living (Box 3)[18] or can be described in terms of personal, domestic and community activities of daily living.

Physical examination

The physical examination should focus on identifying risk factors for falls. Useful screening tests for strength, gait and balance include the timed up-and-go test, gait velocity and grip strength (Box 4).[19] Gait velocity is as useful as the timed up-and-go test in predicting most geriatric outcomes and tends to be more efficient.[20] Gait velocity and grip strength measure muscle function and form part of the diagnostic criteria for sarcopenia, depending on the definition applied (Table 1).[19,21] Sarcopenia, defined as the generalised, gradual loss of muscle mass, is an independent risk factor for falls and fractures.[22]

The short physical performance battery (SPPB) is another simple, validated test for assessing risk of falls and fractures.[23] The SPPB examines the ability to stand with the feet together in the side-by-side, semi-tandem and tandem positions, time to walk 2 metres, and time to rise from a chair and return to the seated position five times.[24]

A neurological examination including assessment of visual acuity, hearing and peripheral sensation should be undertaken. If cognitive deficit is suspected then cognitive screening with a simple tool such as the Abbreviated Mental Test or the Standardised

Table 1. Definitions of sarcopenia[19,21]

Source	Criteria	
	Muscle mass	Muscle function
European Working Group on Sarcopenia in Older People (EWGSOP)[19]	Low muscle mass on DXA: appendicular skeletal muscle mass/height^2 <7.26 kg/m^2 in men and <5.5 kg/m^2 in women	Low muscle strength: grip strength <30 kg in men and <20 kg in women Low gait speed: <0.8 m/s
Foundation for the National Institutes of Health (FNIH)[21]	Low muscle mass on DXA: appendicular lean mass/BMI <0.789 in men and <0.512 in women	Low muscle strength: grip strength <26 kg in men and <16 kg in women

Abbreviations: BMI = body mass index; DXA = dual-energy x-ray absorptiometry.

Mini-Mental State Examination should be considered. The feet and footwear should always be examined in the falls risk assessment, as abnormalities are often readily reversible.

How to assess fracture risk

Given the relationship between falls, fractures and osteosarcopenia, it follows that patients at risk of falls are also at risk of fractures. The possibility of osteoporosis should be considered in all people over the age of 50 years. In addition, as 40% of all hip fractures occur in people living in residential care, a high index of suspicion for fracture risk should be applied to this population.[13] Risk factors for osteoporotic fractures are listed in Box 5.[25]

Fracture risk calculators

Simple, online tools that can help clinicians to identify and quantify fracture risk include the Fracture Risk Assessment Tool (FRAX; www.shef.ac.uk/FRAX) and the Garvan Fracture Risk Calculator (www.garvan.org.au/promotions/bone-fracture-risk/calculator). The Garvan tool was developed specifically for Australian GPs. One of these assessment tools should be applied to all patients suspected to be at risk of falls or fractures.

Dual-energy x-ray absorptiometry

Dual-energy x-ray absorptiometry (DXA) is the key investigation for determining BMD and fracture risk and diagnosing osteopenia and osteoporosis. It can also determine lean muscle mass, which is required for the diagnosis of sarcopenia.[26]

Osteoporosis is defined as a BMD that lies 2.5 standard deviations (SD) or more below the average value for young healthy women (T-score less than –2.5 SD) or a fracture due to low trauma.[27] DXA should be repeated every two years in patients with established osteoporosis, and every two to five years in patients with osteopenia or those at high risk of osteoporosis, osteopenia or sarcopenia.[28]

How to investigate for secondary causes of falls and fractures

A variety of metabolic and endocrine disorders can increase the risk of falls and fractures.[29,30] These disorders include vitamin D

5. Risk factors for osteoporotic fractures[25]

- Low bone mass (DXA or ultrasound)
- Female sex
- Age over 50 years
- Maternal history of fracture
- Previous fracture
- Fall in the previous year
- Low body weight and body mass index
- Oral glucocorticoid therapy (equivalent to >5 mg prednisolone daily for >3 months)
- Alcohol intake >30 g/day
- Current smoking
- Previous hyperthyroidism
- Diabetes mellitus
- Vision loss
- Psychotropic medication
- Postural instability
- Men living in residential aged care facilities
- Low serum vitamin D level
- Bowel or bladder incontinence
- Cognitive impairment
- Poorer balance
- Mobility

Abbreviation: DXA = dual-energy x-ray absorptiometry.

6. Blood tests to detect secondary causes of falls and fractures in patients at high risk[32]

- Vitamin D
- Calcium
- Parathyroid hormone
- Thyroid-stimulating hormone
- Creatinine and estimated glomerular filtration rate (eGFR)
- Serum testosterone (men)

deficiency, hyperparathyroidism, hypothyroidism, hypogonadism and vitamin B_{12} and folate deficiency.[30,31] These conditions may cause few or no symptoms or signs that point to the diagnosis, and thus screening investigations are recommended in patients at high risk of falls and fractures. Blood tests that can detect most secondary causes of falls and fractures are listed in Box 6.[32] These tests should not be applied universally but rather focused on patients identified as being at high risk of falls and fractures.

Management of patients with high falls or fracture risk

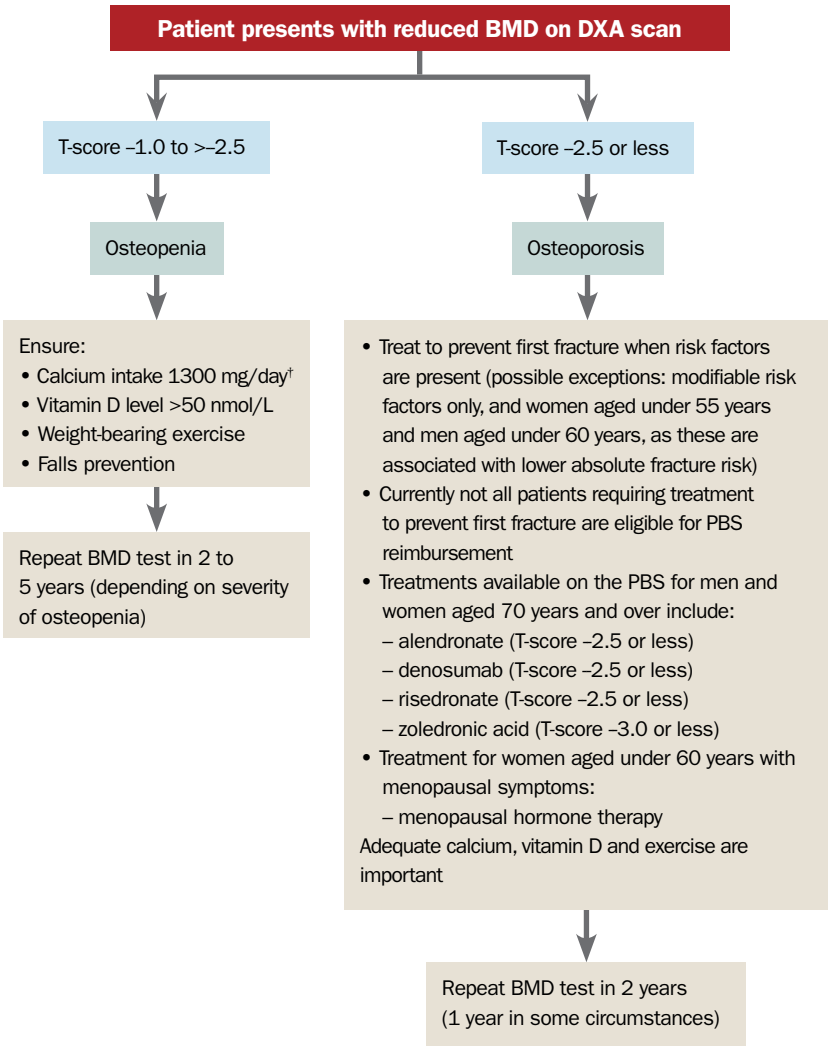
An evidence-based comprehensive care plan targeting all potential risk factors should be implemented for older patients with a high falls or fracture risk. The care plan should be individualised. Major components may aim to increase bone and muscle mass,

Table 2. Interventions to reduce falls and fractures and their effects[33]

Intervention	Reduces risk of falling	Reduces rate of falling	Reduces fracture risk
Multicomponent group exercise	++	+++	+++
Multicomponent home-based exercise	++	+++	+++
Tai chi	0	+	+++
Multifactorial interventions with risk assessment	0	+++	?
Occupational home assessment and modifications	++*	++*	?
Changing from bifocals to single lens in active people	+	+	?
Changing from bifocals to single lens in inactive people	–	–	?
First eye cataract surgery (not second)	0	+	?
Pacemaker in carotid sinus hypersensitivity	0	+++	?
Gradual psychotropic medication withdrawal	0	+++	?
GP prescribing modification program	+++	0	?
Podiatry in people with foot pain	0	+++	?
Knowledge and education alone	0	0	0
Vitamin D replacement	+†	+†	+++

Key: + = mild benefit; ++ = moderate benefit; +++ = marked benefit; 0 = no difference; – = negative effect; ? = unknown effect.
* Greater effect in patients with vision impairment.
† Vitamin D may reduce risk and rate of falling in people with low vitamin D levels before treatment.
Adapted from Gillespie et al. Cochrane Database Syst Rev 2012; (9): CD007146.[33]

Management of patients with osteopenia or osteoporosis on DXA[28]*



Abbreviations: BMD = bone mineral density; DXA = dual-energy x-ray absorptiometry.

* Adapted from Osteoporosis Australia. Think osteoporosis. 2nd ed. 2016.[28]

† A simple method to determine daily dietary calcium intake is to multiply the number of dairy servings by 300 mg. Guidelines on optimal daily calcium intake are highly varied and a source of ongoing debate.[35] The current recommendation from Osteoporosis Australia of 1300 mg/day calcium may change in future revisions of the guidelines. The benefit of dietary versus supplementary calcium on fracture risk has not been fully established.[35]

improve muscle strength and function, prevent secondary causes of osteosarcopenia and reduce intrinsic and extrinsic risk factors for falls.

Interventions to reduce falls and fractures

The most effective interventions targeting falls and fracture risk in older patients are individualised and multidisciplinary.[33] Thorough history taking, physical examination and appropriate investigations should guide the development of a multidisciplinary program of interventions. Not all seemingly helpful interventions have been proven effective, and thus the program should be tailored to meet individual needs. In addition, interventions aiming to optimise independence, the perception of improved mobility and quality of life tend to be adopted more readily.[34] The perception that one is 'frail' or a 'faller' can limit engagement with and adherence to interventions if they are not delivered in a manner acceptable to the patient.[34] A range of interventions and their effects on falls and fracture risk are shown in Table 2.[33]

Treatment of osteoporosis

The RACGP together with Osteoporosis Australia have developed concise guidelines for the treatment of patients with osteoporosis. A review of the medical treatment of osteoporosis in older people is beyond the scope of this article. However, a useful guide for GPs that includes PBS information is available from Osteoporosis Australia (www.osteoporosis.org.au/sites/default/files/files/GP_Snapshot_2nd_Ed_07-16.pdf).[28] Management actions, depending on the outcome of DXA, are outlined in the Flowchart.[28,35]

Conclusion

The number of osteoporotic fractures has dramatically increased in the ageing Australian population. A significant number of high-risk patients are not being assessed for falls and fracture risk. A comprehensive multidimensional assessment of common and specific risk factors for falls and fractures is recommended. Clinical assessment should include a comprehensive physical examination and functional assessment (muscle strength, gait and balance). In addition, a DXA scan should be performed not only to quantify BMD but also to identify changes in body composition (osteosarcopenia). Finally, an evidence-based comprehensive care plan targeting all potential risk factors should be implemented on a case-by-case basis. **ET**

References

A list of references is included in the website version of this article (www.endocrinologytoday.com.au).

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