Falls prevention in older adults with diabetes: A clinical review of screening, assessment and management recommendations

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Older adults with diabetes have an increased rate of falls, recurrent falls and rate of fracture following a fall. Falls can contribute to a heightened fear of further falling, social isolation, avoidance of daily activities, and can increase the likelihood of premature admission to residential aged-care facilities. The most common risk factors for falls within this population group include peripheral neuropathy, foot complications, impaired postural control, polypharmacy and insulin use, sub-optimal glycaemic control and hypoglycaemia, as well as vision and cognitive impairment. Falls risk screening should be undertaken every 12 months for all older people with diabetes, followed by a more detailed falls assessment for those deemed high risk to identify the contributory risk factors and management strategies. Individualised strategies should be co-designed with individuals and where appropriate, their carer(s), may involve referral to other health professionals, and should be monitored and reviewed at regular intervals.

Falls are a complication of diabetes and are being increasingly acknowledged as impacting the overall health and wellbeing of older adults (International Diabetes Federation [IDF], 2013). Within the general community-dwelling population of older adults, approximately one in three people fall per year (Moyer, 2012). The combination of age (≥65 years) and diabetes increases the risk of recurrent falls by 67% (Pijpers et al, 2012); and older adults with diabetes are twice as likely to have injurious falls (Roman de Mettelinge et al, 2013). At the individual level, falls can contribute to a loss of confidence and reduced activity levels, loss of lower-limb muscle and bone strength (Karinkanta et al, 2010), and a heightened fear of further falling (Zijlstra et al, 2007). For the public health system, there are expanding costs associated with falls-related hospitalisations (Bradley, 2012).

Key to the prevention of falls is the identification of at-risk individuals and the implementation of appropriate interventions. Given the increased prevalence and negative consequences associated with falls among older adults with diabetes, falls prevention should be considered an integral component of diabetes care, and primary care practitioners are well-placed to offer proactive, comprehensive and individualised falls prevention strategies. This article will assist primary care practitioners in this role, providing an overview of potential screening tools and outlining falls-related risk factors pertinent to an older person with diabetes. In addition, this paper will consider the evidence and recommend actions for older adults with diabetes, specifically for the community-dwelling population (rather than the hospital or residential aged-care setting).

Falls risk screening

Falls risk screening refers to the process of identifying individuals who are at-risk of a fall, to determine if a detailed falls assessment is appropriate. To be effective, screening tools need

Article points

1. Falls-related risk factors for older people with diabetes include peripheral neuropathy, impaired postural control, polypharmacy, visual impairment, cognitive impairment, foot complications, and sub-optimal glycaemic control.

3. Valid and reliable risk screens exist to identify individuals at-risk of falls. As with all older adults, individuals with diabetes should be screened for falls at least once every year.

4. Individuals at increased risk of falls require a multifactorial assessment that examines the wide range of falls-related risk factors.

5. Falls prevention interventions should systematically address the risk factors identified and should be developed with the older person with diabetes, and where applicable their carer(s).

Key words

– Falls
– Older people

Authors

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to be validated, quick and easy to administer, cost-effective and clinically relevant. The selection of a screening tool should complement the setting (community, hospital or residential aged-care) and the older adult being screened, particularly with regard to age, ethnicity, as well as cognitive and functional status.

The *Global Guideline for Managing Older People with Type 2 Diabetes* recommends that falls risk screening be performed during an initial visit to a health care provider, reviewed annually at a minimum and additionally following a fall event (IDF, 2013). Falls risk screening should be incorporated into routine consultations, involving assessment of an individual's falls history over the last 12 months (frequency of falls, circumstances surrounding each fall, and number of injurious falls), together with examination of balance and mobility. *Table 1* provides a summary of available tools and tests for use in the primary care setting. As with any screening procedure, all falls risk screening outcomes should be documented and discussed with the older person and their carer(s), and information provided to individuals.

Falls risk assessment to identify falls-risk factors

Falls risk screening identifies individuals at high risk of falls. When classified as such, individuals should undergo a comprehensive falls assessment in a timely manner to guide appropriate and individualised falls prevention strategies.

A recommended falls assessment tool can be used to assess the overall risk of falls (as summarised in *Table 2*). In addition, specific assessment of individual factors known to contribute to falls risk among older adults with diabetes can be undertaken. It is important to acknowledge, that although falls-related risk factors are often referred to independently, most falls occur as a result of the interaction between intrinsic and extrinsic risk factors (Tinetti et al, 1986). A description of the specific risk factors that are primarily targeted for further assessment with older adults with diabetes are discussed below with assessment and management recommendations provided (Australian Commission on Safety and Quality in Healthcare, 2009; American Geriatrics Society and British Geriatrics Society, 2010).

Table 1. Summary of validated tools and tests recommended for screening of falls risk.

Falls risk screen	Description	Time to implement	Scoring interpretation*
Balance and mobility tests			
Timed Up and Go (TUG) test (Podsiadlo and Richardson, 1991)	A measure of dynamic balance that assesses the time taken for an individual to rise from a chair, walk 3 metres, turn around, walk back to the chair, and sit down. Requires a stop-watch and a 43 cm-high straight-backed chair with solid seat.	1–2 minutes	≥12 seconds is indicative of an increased risk of falling.
Five Times Sit To Stand (FTSTS) test (Tiedemann et al, 2008)	A measure of lower-limb strength that assesses the time taken for an individual to stand up and sit down as quickly as possible five times, with their arms folded across their chest. Requires a stop-watch and a 43 cm-high straight-backed chair with solid seat.	1–2 minutes	≥12 seconds is indicative of an increased risk of falling.
Alternate Step Test (AST) (Tiedemann et al, 2008)	A measure of lateral stability that involves weight shifting. An individual is required to alternately place the right and left feet (no shoes) as fast as possible on a step that is 18 cm high and 40 cm deep, for a total of eight steps. A stop-watch is required.	1–2 minutes	≥10 seconds is indicative of an increased risk of falling.
Multi-item screening tool			
Falls Risk for Older People in the Community (FROP-Com) Screen (Russell et al, 2009)	A 3-item screening tool that addresses 12-month falls history, self-perceived need for assistance to perform activities of daily living, and the objective assessment of steadiness through the observation of an individual standing, walking a few metres, turning and sitting. Available at: http://bit.ly/2m6PXZX	1–2 minutes	Responses for each item are scored from 0–3. A total score between 0–3 indicates low-risk. Scores between 4–9 indicate high-risk.

*Scoring criterion based on cut-off scores specified within best practice guidelines for falls prevention (Australian Commission on Safety and Quality in Healthcare, 2009).

Note: Above mentioned tools not specifically validated for older adults with diabetes.

Table 2. Summary of recommended falls assessment tools.

Falls assessment tool	Description	Time to implement	Scoring interpretation*
FallScreen©: Physiological Profile Assessment (Lord et al, 2003)	The short form is a validated five-item instrument that includes a single assessment of vision, peripheral sensation, lower-limb strength, reaction time and body sway. There is an associated cost for the purchase of the tool. Available at: http://bit.ly/2lYqPU7	15–20 minutes	≥1 is indicative of an increased risk of falling.
FROP-Com (Russell et al, 2008)	A detailed falls risk factor assessment tool that includes 26 items that address 13 falls-related risk factors. The tool includes guidelines for scoring, and evidence-based referrals and interventions. No equipment is required and the tool is available at no cost. Available at: http://bit.ly/2mFR8mD	10–15 minutes	Total score range is 0–60. Scores >18 is indicative of high risk.
QuickScreen© (Tiedemann et al, 2008)	A multifactorial falls assessment tool comprised of the following items: previous falls, medication usage, vision, peripheral sensation, lower-limb strength, balance and co-ordination. Minimal equipment is required. There is an associated cost for the purchase of the tool. Available at: http://bit.ly/2mlM7P5	10 minutes	≥4 is indicative of an increased risk of falling.

*Scoring criterion based on cut-off scores specified within best practice guidelines for falls prevention (Australian Commission on Safety and Quality in Healthcare, 2009). The above scores should be used for the purpose of assessment and re-assessment over time.

Note: Above mentioned tools not specifically validated for older adults with diabetes.

Peripheral neuropathy

The most common falls-related risk factor related to diabetes is peripheral neuropathy, present in approximately 50–70% of older adults with diabetes (Kirkman et al, 2012). Peripheral neuropathy results in changes to the motor and/or sensory components of the foot and ankle, potentially leading to postural instability, foot complications, altered walking function and muscle atrophy (Boulton, 2004; Palma et al, 2013; Brown et al, 2015). Clinical emphasis is placed on the prevention of peripheral neuropathy by means of optimal glycaemic control, as well as the early recognition of the condition (Royal Australian College of General Practitioners [RACGP], 2016). Peripheral neuropathy should be assessed annually using either the Diabetic Neuropathy Symptom (DNS) score (Meijer et al, 2002) and/or routine sensory tests (i.e. a 10-g monofilament and palpating foot).

Postural instability

An increase in postural instability is a risk factor for falls (Ganz et al, 2007; Drootin, 2011), which is particularly important for people with diabetes who experience a decrease in the functioning of the neuromuscular and sensorimotor systems (Crews et al, 2013). Control of balance to maintain postural stability involves a complex interplay of the sensory and motor systems and integration of, and reaction to, this information by the central nervous system.

In the primary care setting, the assessment of postural stability can be easily performed by balance and mobility tests (e.g. *Table 1*). To address postural instability, falls prevention exercise programs are encouraged (Australian Commission on Safety and Quality in Healthcare, 2009; Gillespie et al, 2012). Exercise interventions have recently been found to be effective for older adults with diabetes with regard to lower-limb strength, static balance and gait measures (outcomes vital in the maintenance of postural stability; Chapman et al, 2016). In particular, individuals are likely to benefit from exercise programs that incorporate a challenge to balance, when delivered with sufficient frequency (e.g. total of 50 hours, preferably at least 2 hours per week). It should also be noted that walking programs, although beneficial for metabolic control and improvement of cardiovascular disease risk, have been associated with an increased risk of falls (Sherrington et al, 2011). Exercise programs should be tailored to existing levels of fitness and should consider an individual's lifestyle and any medical contraindications. Referral to an appropriate health professional (e.g. a physiotherapist or exercise physiologist) may be

warranted for a detailed assessment of balance, and the design of challenging, yet safe exercise programs (Australian Commission on Safety and Quality in Healthcare, 2009).

Foot complications

Foot complications, including foot pain, foot ulceration and consequent amputations, are common among older adults with diabetes and are significant contributors to increased falls risk (Al-Rubeaan et al, 2015). In brief, foot-care education should be provided to all people with diabetes to assist in the prevention of foot complications. Education should consist of basic foot-care recommendations and, of particular relevance to falls, advice regarding appropriate footwear. Screening and risk stratification for potential foot complications should also be performed for all adults with diabetes, with the intensity of monitoring and review dependent on the associated level of risk. For individuals classified as being at intermediate or high risk, a podiatry assessment is an integral component of a foot protection program (Menz et al, 2006; RACGP, 2016).

Diabetes-related foot ulcers deserve specific mention when considering falls risk. Offloading footwear is a common recommendation for foot ulcers, yet it has a negative effect on postural stability (van Deursen, 2008). In particular, total contact casts and removable or non-removable cast-walkers are problematic for falls. Given their rigid nature, they do not allow the foot to make its usual adjustments on uneven terrain.

Sub-optimal glycaemic control and hypoglycaemia

Hypoglycaemia, hypoglycaemic unawareness and severe hyperglycaemia are well-established risk factors for falls among older adults with diabetes (Jafari and Britton, 2015; Sinclair et al, 2015). Optimising an individual's glycaemic control can reduce short- and long-term complications of diabetes, and can improve quality of life, and functional and cognitive ability. However, the potential harmful effects of hypoglycaemia should be considered when setting individual glycaemic targets. Targets

need be personalised and balanced against factors such as an individual's capabilities, life expectancy, medical comorbidities, and the potential risk of severe hypoglycaemia, especially among frail, older adults with an increased risk of falls (RACGP, 2016). For older adults with diabetes who have a life expectancy >10 years and are functionally independent and fit, an HbA_{1c} target of 53 mmol/mol (7.0%) is often appropriate. However, less stringent HbA_{1c} targets (i.e. 64 mmol/mol [8%]) are appropriate for those with long-standing diabetes, a history of severe hypoglycaemia, limited life expectancy, advanced complications, and/or extensive comorbid conditions (RACGP, 2016).

Medication and polypharmacy

Older adults with diabetes are often required to take multiple medications in an effort to control diabetes-related outcomes and other comorbidities, and a significant proportion of individuals take upwards of eight medications (RACGP, 2016). Falls risk among adults with diabetes has been found to increase steadily at four or more prescription medications (Huang et al, 2010). Falls risk can be heightened as a result of medication interaction, medication side effects (e.g. dizziness) and even the intended effects of medications (e.g. glucose-lowering leading to hypoglycaemia). Certain classes of medication are more likely to increase the risk of falls, and those commonly implicated in falls related to older people with diabetes include insulin, psychoactive medications (in particular benzodiazepines), diuretics, antiarrhythmics (class 1a), digoxin, and antidepressants (Berlie and Garwood, 2010; Huang et al, 2010).

It is important that primary care practitioners comprehend the overall medication burden as it has the potential to lead to medication-related problems including non-adherence, hypoglycaemia and increased risk of falls. Medication use (both conventional and complementary), should be reviewed at least once per year as part of the annual cycle of care (RACGP, 2016). Referral for a Home Medicines Review has the potential to identify medications implicated in falls and consider the ongoing need for these medications.

Vision impairment

Vision impairment is an important risk factor for falls in community-dwelling older adults, with vision being a key sensory input for the maintenance of balance and the avoidance of obstacles. Diabetic retinopathy, occurring as a result of microvascular disease of the retina, causes visual impairment and blindness, and affects more than 30% of adults with diabetes (Dirani, 2013).

All older adults with diabetes should have a visual acuity assessment at diagnosis, and at least every 2 years (more frequently if vision noted to have concerns). Primary care practitioners can monitor individuals for retinopathy via retinal photography or by examining the eyes through dilated pupils. If practitioners are not confident with fundoscopy and assessment of the retina, referral to an eye specialist is recommended. Older people may additionally benefit from an assessment by an eye specialist for the provision of appropriate spectacle correction (RACGP, 2016). The use of bifocal or multifocal lenses by older people in the community is associated with a doubled risk of falls as a result of tripping. Individuals with an increased risk of falls or established falls history are, therefore, recommended to wear single-vision distance spectacles when walking and negotiating steps (Australian Commission on Safety and Quality in Healthcare, 2009; Haran et al, 2010). Other effective fall prevention strategies for vision include maximising vision through cataract surgery on the first eye (Lord et al, 2010).

Cognition

Cognitive impairment is a risk factor for falls, with 50–80% of people with dementia falling in a given year (Allan et al, 2009), and mild cognitive impairment linked to greater risk of injurious and multiple falls (Delbaere et al, 2012). There appears to be a crucial link between the decline of cognition and the use of executive functioning for the purposes of balance, with this decline evident in decreasing ability to control and integrate cognitive abilities related to attention and perception (Liu-Ambrose et al, 2008). People with cognitive impairment may have difficulty with planning and executing movements related to balance and mobility, and may have difficulty limiting sensory input which affects attention to a task (e.g. walking while talking; Liu-Ambrose et al, 2008). Medication use in people with cognitive impairment also impacts falls risk, particularly psychotropic medications that may magnify side effects of other medications (Hill and Wee, 2012).

There is no specific literature relating falls, diabetes and cognitive impairment. There is, however, an emerging body of evidence for effective falls prevention strategies for people with dementia (Drootin, 2011), with studies showing "traditional" falls prevention programs to be unsuccessful with people with dementia (Shaw et al, 2003). However, a different approach to adoption of falls prevention strategies may be beneficial with elements of health professional involvement, inclusion of the caregiving dyad and accommodation of individual needs and preferences likely to be important (Meyer et al, 2013).

Built environment

Environmental hazards are considered a risk for falls: clutter can be a tripping hazard; lighting should be sufficient in order to prevent shadows; flooring should be clear of rugs and provide a contrast to furniture; and bathroom setup needs to prevent slippage on wet surfaces, with grab rails provided as needed. Home safety assessment and modification interventions are effective in decreasing falls risk and rates, especially for people with severe visual impairment, which is of relevance to the person with diabetes (Gillespie et al, 2012).

Adaptation and modification of the environment with an occupational therapist who is trained to identify and maximise the benefits of the person–environment fit is the crucial factor in reducing risk (Clemson et al, 2014). Shared decision-making processes with the person with diabetes, and with their carer(s) if appropriate, will most likely enhance the uptake of environmental modifications.

Conclusion

Reducing the number of falls among older adults with diabetes is dependent upon the identification of at-risk individuals and the coordination of

Page points

1. Vision impairment is an important risk factor for falls in community-dwelling older adults, with vision being a key sensory input for the maintenance of balance and the avoidance of obstacles.

2. There appears to be a crucial link between the decline of cognition and the use of executive functioning for the purposes of balance.

3. Environmental hazards are considered a risk for falls, and efforts should be made to avoid them where possible.

> *"All primary care practitioners should have access to education about falls prevention, and every attempt should be made to provide comprehensive and individualised education about falls to older adults with diabetes and where appropriate, their caregivers and family."*

appropriate preventive strategies. A diagnosis of diabetes in an older adult should trigger to primary care practitioners the potential for increased falls risk. Systems need to be established in the diabetes care pathway to enable falls risk screening to be performed annually. All primary care practitioners should have access to education about falls prevention, and every attempt should be made to provide comprehensive and individualised education about falls to older adults with diabetes and where appropriate, their caregivers and family. ■

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