



Canadian Geriatrics Society

INTERVENTIONS TO REDUCE MEDICATION-RELATED FALLS

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Introduction

Falls are a common event in older adults. It is estimated that, in Canada, between 20 to 30% of seniors fall each year, and half of those who fall will have a repeat fall the next year.^{1,2} The rate of falls is higher with increasing age, with those aged 75 years and over being at highest risk.²⁻⁴ The perception of what constitutes a fall varies with the individual and can be interpreted as anything from unsteadiness or imbalance to an event that causes injury or results in seeking medical attention.⁵ However, the officially accepted definition by The World Health Organization (WHO), American Geriatric Society (AGS), and British Geriatric Society (BGS), is “an event which results in a person coming to rest inadvertently on the ground or floor or other lower level.”⁶

Falls are not benign events. They are the leading mechanism of injury causing death in the elderly population, as well as the leading cause of nonfatal injuries and traumatic hospital admissions in the elderly.⁷ Five to 10 percent of falls result in serious injury, including fracture, head injury, or laceration.⁸ Ninety-five percent of hip fractures are caused by falls. Of those patients who suffer a hip fracture, 20% will die within one year and another 20% are newly institutionalized.^{9,10} In addition to injury, fear of falling can result in decreased activity, social isolation, and further functional decline.¹¹

Falls occur across the spectrum of settings, including the community, home, seniors' homes, long-term care, and acute care. Falls are more frequent in acute care, with three times as many seniors falling in hospital, compared to the community, although rates are variable based on the type of unit and reason for admission.^{12,13}

Falls and near falls are known to be multifactorial in nature. Medications are one of the most common modifiable risk factors attributed to falls. The AGS practice guidelines state, “Patients who have fallen should have their medications reviewed and altered or stopped as appropriate in light of their risk of future falls. Particular attention to medication reduction should be given to older persons taking four or more medications and to those taking psychotropic drugs.”¹⁴ Ideally, it is important to target both patients who have had falls as well as those experiencing near falls, in order to prevent future falls and the adverse outcomes associated with falling.

This article reviews the common medications implicated in falls in the elderly and barriers to stopping these medications and provides clinicians with direction and tips on how to manage a complex senior with multiple comorbidities and on many medications who is falling.

Résumé

Les chutes sont courantes chez les personnes âgées. On estime que chaque année, au Canada, 20 % à 30 % des aînés font une chute, et que la moitié de ceux-là tombent de nouveau dans l'année qui suit.^{1,2} Le risque de chute augmente avec l'âge et atteint son maximum à partir de 75 ans.^{2, 3, 4} La définition de ce qui constitue une chute varie selon les personnes – de la simple perte d'équilibre à l'incident qui entraîne des blessures ou nécessite une consultation médicale.⁵ Selon la définition officielle utilisée par l'Organisation mondiale de la santé (OMS), la American Geriatric Society (AGS) et la British Geriatric Society (BGS) : « une chute est un événement à l'issue duquel une personne se retrouve, par inadvertance, sur le sol ou toute autre surface située à un niveau inférieur à celui où elle se trouvait précédemment »⁶.

Une chute n'est pas un événement anodin; chez les personnes âgées, c'est la première cause de blessures entraînant la mort, ainsi que la première cause de blessures non mortelles et d'hospitalisation pour traumatisme⁷. De 5 % à 10 % des chutes entraînent des blessures graves, notamment des fractures, des blessures à la tête ou des lacerations⁸; 95 % des fractures de la hanche sont causées par une chute. Parmi les patients qui subissent une fracture de la hanche, 20 % décèdent dans l'année qui suit, et 20 % doivent être placés dans un établissement spécialisé^{9,10}. En plus des blessures subies, la peur de tomber de nouveau peut causer une réduction des activités, un isolement social et un déclin fonctionnel accru¹¹. Les chutes se produisent dans toutes sortes de contextes – à la maison, dans les établissements communautaires, dans les maisons de retraite, dans les établissements de soins de longue durée et à l'hôpital. C'est dans les hôpitaux que les chutes sont les plus fréquentes : trois fois plus de personnes âgées tombent à l'hôpital que dans les établissements communautaires, même si les taux varient selon le service et le motif d'hospitalisation^{12,13}.

On sait que les chutes et les quasi-chutes ont plusieurs causes; les médicaments comptent parmi les principaux facteurs de risque modifiables. Selon les guides de pratique de l'AGS, il faut revoir la liste des médicaments prescrits à un patient qui a fait une chute et la modifier en fonction du risque de tomber de nouveau. Il faut notamment envisager une réduction des médicaments chez les personnes âgées qui prennent quatre médicaments ou plus et chez celles qui prennent des psychotropes¹⁴. Idéalement, il faut cibler aussi bien les patients qui ont fait une chute que ceux qui expérimentent des quasi-chutes afin de prévenir les chutes et leurs conséquences négatives.

L'article passe en revue les médicaments souvent mis en cause dans les chutes touchant les personnes âgées ainsi que les inconvénients liés à la suppression de ces médicaments, et donne aux cliniciens des directives et des trucs pour prendre en charge une personne âgée au dossier compliqué, qui souffre de plusieurs maladies, qui prend plusieurs médicaments et qui a fait une ou des chutes.

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Case

Ms. P is a woman aged 84 years who presents to your office with complaints of hip pain. Through a detailed history, you discover she has had five falls in the past month, the latest one being the previous day. Her medical history includes osteoporosis, osteoarthritis, hypertension, type 2 diabetes mellitus, depression, and insomnia. She tests her blood sugars periodically and reports that her sugars are "good." Her last HbA1c was 6.3%. In your office, her blood pressures (BPs) are 135/80 mmHg sitting and 105/70 mmHg standing.

Ms. P's medications include the following: ramipril 10 mg daily, enteric coated acetylsalicylic acid (ECASA) 81 mg daily, furosemide 40 mg daily, temazepam 30 mg every night at bedtime (qhs), paroxetine 20 mg daily, glyburide 5 mg twice daily (bid), risedronate 35 mg weekly, diphenhydramine 50 mg qhs, naproxen 500 mg bid, vitamin D 1000 units daily, calcium carbonate 1250 mg daily, multivitamin 1 tablet daily.

Interventions to Reduce Falls

[The Public Health Agency of Canada's Second Report guidelines](#) echoes the [AGS guidelines](#) in suggesting a multifactorial falls risk assessment for seniors who have fallen two or more times in the past 12 months, those who have had an acute fall, and those with gait or balance difficulties.

Accordingly, interventions should be multifactorial. **Table 1** lists suggested components of a multifactorial approach to fall prevention.⁹ A similar comprehensive falls prevention model has been developed as part of the Canadian Falls Prevention Curriculum, using the acronym

"BEEACH Model," to address Behaviour Change, Education, Equipment, Environment, Activity, Clothing and Footwear, and Health Management.¹⁵ A regional multifactorial approach to falls and near falls assessment and prevention can be found at www.stopfalls.ca.

Medication Role in Falls

Medications can contribute to falls through various mechanisms.¹⁶ Certain medications can contribute to orthostatic hypotension, cognitive impairment (from delirium), motor retardation, parkinsonism, balance problems, dizziness, and drowsiness. In addition, medications can indirectly contribute to falls. For instance, a patient who is taking a diuretic may experience increased urgency and fall in the process of rushing to the bathroom or changing their gait while rushing to avoid incontinence. Visual changes can occur with anticholinergic medications and neuroleptics, leading to an increased risk of falling. Recreational drug use can also contribute to falls. For example, alcohol can affect balance and judgement, which increases the risk of falling, and can potentiate these adverse effects in medications the person may be taking.

Impact of Polypharmacy

Polypharmacy, defined as the use of four or more chronic medications, is a risk factor for falls in the elderly.⁵ In a cross-sectional observational study, polypharmacy increased the risk of falling only if one or more of the medications taken was a fall-risk medication (e.g.,

Table 1. Multifactorial Interventions for Fall Prevention^{9,15}

	Examples
Ambulatory Assistive Devices and Protective Equipment	Ensure proper use of cane and walker; proper footwear, hip protectors (liaison with physiotherapist, occupational therapist)
Clinical Disease Management	Optimize cardiovascular disorders , hypotension, chronic conditions
Education	Availability of resources, including medical equipment and exercise programs, safe practices for transferring, safe behaviours, footwear choices
Environmental modification	Home assessment, remove scatter rugs, install grab bars in bathroom, stair lift (liaison with occupational therapist, outreach assessors)
Exercise Programs	Targeting gait, balance, strength training (liaison with physiotherapist)
Medication Review and modification	Structured medication reviews, adjustment and removal of unnecessary medication, especially those known to contribute to falls (liaison with pharmacist) Adjustment of medications to improve management of underlying conditions
Nutrition and Supplements	Ensure adequate protein intake, hydration, vitamin D supplementation (liaison with dietician)
Vision Referral and Correction	Correction for low vision; remediable problems should be corrected, and patient should be linked to Canadian National Institute for the Blind

benzodiazepine).¹⁷ More recently, research has focused on using excessive or inappropriate medications. Different screening tools, such as the Beers' Criteria and the STOPP (Screening Tool of Older Persons' potentially inappropriate prescriptions), have been used to help identify inappropriate medications in the geriatric population, with specific reference to medications that can increase fall risk.^{18,19} Other articles reviewing such inappropriate medications in this journal include the following:

1. [Better Prescribing in the Elderly](#)
2. [How Not To Harm Your Patients: Tips On Prescribing For The Elderly](#)
3. [Anticholinergic Medications In The Older Adult: A Hidden Burden](#)
4. [Strategies For Discontinuing Psychotropic Medications](#)
5. Please see Hart and Giancroce in this journal edition (p.5)

Targeted medication “deprescribing” is important in reducing a senior's risk of falling. **Table 2** describes some of the more common offending classes of medications and the magnitude of their impact on falls. Recently initiated medications (versus a remote history) are a concern, and once the possible offending agents have been identified, the logical next step would be to attempt to reduce or stop the medications most likely to be contributing to falls. Prioritizing which medications to address first is challenging, but it's a necessary component of the review. It is critical to have your patient engaged and agreeable to the deprescribing process. This is consistent with the approach to multimorbidity, which emphasizes starting with the patient's preferences and goals.²⁴ Education regarding the rationale and negotiation of the plan are important steps in reducing medications. If the patient understands the risks and the reason for discontinuing the medication, they will be more likely to follow through. This can still be a challenging

endeavour, depending on the dose and duration of therapy and the patient's perception of care and need for pharmacologic treatments. [There are processes and trials that have been evaluated and found to be effective at addressing deprescribing in polypharmacy cases.](#)^{25–28}

Benzodiazepines

Benzodiazepines have been consistently found to be associated with falls, whether they are used as needed (PRN) or regularly scheduled, long- or short-acting, and for any indication. Benzodiazepines can increase the risk of falling through activation of the GABA receptor, causing muscle weakness, dizziness, incoordination, somnolence, and confusion. They are also associated with other adverse effects, in addition to falls, making them an important target for deprescribing.²⁹ For patients who have been chronically taking benzodiazepines and who agree to a weaning plan, a gradual taper over at least six weeks is recommended, depending on the dose. A schedule of decreasing 25% the first week, 25% the second week, and 10% weekly thereafter has been suggested. Longer intervals are recommended in patients who have taken the benzodiazepine for prolonged durations.³⁰ An anecdotal approach that has been used in psychiatric patients is to switch therapies to ease tapering. For example, if a short-acting benzodiazepine is being used (e.g., triazolam), substitution with diazepam (long-acting) has been suggested to allow for a smoother decrease in blood level. However, diazepam use in older adults is associated with significant risk; excess sedation with long-acting benzodiazepines should be monitored, and this approach is not supported by trials.³¹ A recent community-based intervention trial allowed for patient-tailored reduction, with the discontinuation measured at six months, indicating the time frame should be flexible and patient success should be balanced with the

Table 2. Risk of Falling with Drug Use²⁰⁻²³

Class	Drugs	Odds Ratio (95%CI)
Psychotropics	Any	1.72 (1.52, 1.97)
	Antipsychotics	1.50 (1.25, 1.79)
	Sedatives, hypnotics	1.54 (1.40, 1.70)
	Benzodiazepines (any)	1.48 (1.23, 1.77)
	Short-acting	1.44 (1.09, 1.90)
	Long-acting	1.32 (0.98, 1.77)
	Antidepressants	1.66 (1.41, 1.95)
	TCAs	1.30 (1.23, 1.38)(HR)
	SSRIs	1.66 (1.58, 1.73)
	Others	1.39 (1.28, 1.52)
	Combination	1.70 (1.42, 2.05)
Cardiovascular	Type 1a anti-arrhythmics (e.g., quinidine, disopyramide, procainamide)	1.59 (1.02, 2.48)
	Digoxin	1.22 (1.05, 1.42)
	Diuretics (any)	1.08 (1.02, 1.16)
Analgesics	Opioids	0.97 (0.78, 1.12)%
	NSAIDs	1.16 (0.97, 1.38)%
Antidiabetics	Sulfonylureas	1.09 (0.52, 2.30)%(RR)
	Insulin	2.76 (1.52, 5.01)(RR)
Anticonvulsants	Any	1.75 (1.13, 2.71)

%—nonsignificant, HR—expressed as hazard ratio, RR—expressed as relative risk; TCA = tri cyclic antidepressant, SSRI= selective serotonin reuptake inhibitor; NSAIDs = non-steroidal anti-inflammatory drugs.

Table 3. Benzodiazepine Comparison Chart^{33,34}

	Available strengths	Split-able Y/N	Daily Dosage Range (mg)	Comparative Equivalent (mg)	Parent Drug t _{1/2} (h)	Active Metabolites (t _{1/2} – h)
Alprazolam (tablet)	0.25, 0.5, 1, 2 mg	Y	0.5–4	0.5	6–27	Y Minimal activity
Bromazepam (capsule)	1.5, 3, 6 mg	N	6–30	3	8–30	Y
Lorazepam (tablet)	0.5, 1, 2 mg	Y	1–10	1	8–24	N
Oxazepam (tablet)	10, 15, 30 mg	Y	15–120	15	3–25	N
Temazepam (capsule)	15, 30 mg	N	7.5–30	10	3–25	N
Triazolam (tablet)	0.125, 0.25 mg	Y	0.125–0.5	0.25	1.5–5	N
Chlordiazepoxide (capsule)	5, 10, 25 mg	N	15–100	25	4–29	Y (28–100)
Clonazepam (tablet)	0.25, 0.5, 2 mg	Y	0.5–20	0.25	19–60	N
Clorazepate (capsule)	3.75, 7.5, 15 mg	N	15–90	10	Inactive	Y (1.3–120)
Diazepam (tablet)	2, 5, 10 mg	Y	4–40	5	14–80	Y (30–200)
Flurazepam (capsule)	15, 30 mg	N	15–30	15	0.3–3	Y (40–250)
Nitrazepam (tablet)	5, 10 mg	Y	5–10	2.5	15–48	N

Table 4. Anticholinergic Risk Scale^a

3 Points	2 Points	1 Point
Amitriptyline hydrochloride	Amantadine hydrochloride	Carbidopa-levodopa
Atropine products	Baclofen	Entacapone
Benzotropine mesylate	Cetirizine hydrochloride	Haloperidol
Carisoprodol	Cimetidine	Methocarbamol
Chlorpheniramine maleate	Clozapine	Metoclopramide hydrochloride
Chlorpromazine hydrochloride	Cyclobenzaprine hydrochloride	Mirtazapine
Cyproheptadine hydrochloride	Desipramine hydrochloride	Paroxetine hydrochloride
Dicyclomine hydrochloride	Loperamide hydrochloride	Pramipexole dihydrochloride
Diphenhydramine hydrochloride	Loratadine	Quetiapine fumarate
Fluphenazine hydrochloride	Nortriptyline hydrochloride	Ranitidine hydrochloride
Hydroxyzine hydrochloride and hydroxyzine pamoate	Olanzapine	Risperidone
Hyoscyamine products	Prochlorperazine maleate	Selegiline hydrochloride
Imipramine hydrochloride	Pseudoephedrine hydrochloride–triprolidine hydrochloride	Trazodone hydrochloride
Meclizine hydrochloride	Tolterodine tartrate	Ziprasidone hydrochloride
Oxybutynin chloride		
Perphenazine		
Promethazine hydrochloride		
Thioridazine hydrochloride		
Thiothixene		
Tizanidine hydrochloride		
Trifluoperazine hydrochloride		

^a To calculate the Anticholinergic Risk Scale score for a patient, identify medications the patient is taking and add the total points for each medication.

urgency of tapering.³² It has been shown that tapering combined with cognitive-behavioural therapy (CBT) is more effective at achieving long-term discontinuation than tapering alone (70% vs. 38%, respectively, achieved complete withdrawal).³⁰ If withdrawal symptoms develop (tremors, tachycardia, sweating, perceptual disturbances, anxiety, dysphoria, altered mental status, and seizures), reverting to the previous dosage for a longer duration is advisable; then proceed with the taper at a slower pace. With the goal being to completely stop the high-risk medication, switching to a different benzodiazepine may be considered in the weaning process and allow for a more gradual taper if the current benzodiazepine dosage formulations are limited and do not allow for splitting (as is the case with temazepam capsules). For example, oxazepam would be a suitable alternative because it is fairly similar to temazepam in its half-life and is available in multiple tablet strengths, which can be split. This topic is reviewed in a previous publication [in this journal](#).

Antipsychotics

Antipsychotics are commonly used in the elderly population to help control behavioural and psychological symptoms of dementia (BPSD). Both typical (e.g., haloperidol and perphenazine) and atypical (e.g., risperidone and olanzapine) antipsychotics carry serious risks and must be monitored to ensure that potential benefit outweighs the risk of using these medications. Antipsychotics are associated with increased risk of falls and fractures.³⁵ In addition to falls, Health Canada issued a black box warning that cites increased risk of mortality with atypical antipsychotic use.³⁶ As such, regular monitoring of adverse effects and need is recommended. Antipsychotics should be reserved for situations where the patient is in significant distress or at risk of harm to himself or others. Use of the smallest effective dose and for the shortest duration of time is always encouraged. This topic is reviewed in a previous publication [in this journal](#).

Anticholinergics

Anticholinergic medications block acetylcholine peripherally and/or

Table 5. Fracture Risk with Select Opiates^{33,54}

Opiate	Adjusted Odds Ratio (CI)	Equivalent Oral Dosages
Morphine	1.47 (1.37, 1.58)	20–30 mg
Fentanyl	2.23 (1.89, 2.64)	Not used orally
Methadone	1.39 (1.05, 1.83)	20 mg
Oxycodone	1.36 (1.08, 1.69)	10–15 mg
Codeine	1.16 (1.12, 1.20)	200 mg
Tramadol	1.54 (1.49, 1.58)	100–300 mg

centrally, which can contribute to cognitive impairment and balance problems, which can lead to falls. The Anticholinergic Risk Scale (see table 5 of <http://www.canadiangeriatrics.ca/default/index.cfm/linkservid/86F27E6A-B4AE-C03B-7BC1839EF84D70A1/showMeta/0/>) is a three-point system that has been used to classify various medications based on their level of anticholinergic activity. As can be seen in **Table 4**, many medications under a variety of pharmacologic classifications also possess anticholinergic activity.³⁷ For instance, Ms. P's paroxetine primarily works on the neurotransmitter serotonin; however, it also possesses some anticholinergic properties that could be contributing to Ms. P's falls.

Also, over-the-counter sleep aids frequently contain diphenhydramine, which is a first-generation antihistamine that has significant anticholinergic and sedative properties. Due to ease of access to these agents, education regarding their risks and liaison with Ms. P's community pharmacist would be key strategies in mitigating Ms. P's risk.

Antidepressants

Most antidepressants, regardless of class, can increase the risk of falls.²³ Some studies have suggested that selective serotonin reuptake inhibitors (SSRIs) might actually pose a greater risk than tricyclic antidepressants (TCAs).^{22,23} Although the newer antidepressants (e.g., serotonin norepinephrine reuptake inhibitors [SNRIs]) have not consistently been found to increase fall risk, there is general consensus that these medications are independent risk factors for falls³⁸ and should be monitored carefully for patients with a history of falls or near falls and those at risk of falls.^{39–41}

Different antidepressants can contribute to falls through different mechanisms. Sedation, sleep disturbances, balance impairment, and orthostatic hypotension are some adverse effects that can lead to falls in the elderly.⁴² When initiating therapy, lower starting dosages and gradual titration is recommended to minimize risk of adverse effects. If falls occur in patients currently taking antidepressants, dosage reduction could have a positive impact. If withdrawal of the antidepressant is desired, tapering should occur over a period of 2–6 weeks, depending on the class of antidepressant, to prevent withdrawal symptoms.^{30,43,44}

Case

Ms. P is taking paroxetine, which has moderate anticholinergic properties. Determining the need for antidepressant therapy will, in turn, determine whether Ms. P should be weaned off her SSRI, have her dosage decreased, or be switched to a different agent with less anticholinergic activity.

Antihypertensives

In one of the original meta-analyses, Leipzig and colleagues found that most antihypertensives trended towards an increased odds ratio

for falls; however, diuretics were the only class that was statistically significant.⁴⁵ One recent Canadian analysis found there was an increased risk of fractures after starting antihypertensives,⁴⁶ but other studies have found protective effects from some antihypertensives.⁴⁷ These conflicting data and the conundrum of preventing cardiovascular events using antihypertensives, while balancing dizziness in fall risk are challenging. The approach must be individualized and may require re-evaluation of therapeutic goals to ensure patient safety (please refer to the Goodarzi and Burbach article on antihypertensive therapy in this issue (p.9) as well as <http://www.canadiangeriatrics.ca/default/index.cfm/linkservid/6D259B0A-D460-FFD1-303F80CCCC089CDE9/showMeta/0/>.⁴⁸

Tinetti and colleagues recently looked at the association between antihypertensive medications and serious fall injuries (such as traumatic brain injury and hip fracture). They determined that both moderate- and high-intensity antihypertensive treatment was associated with adjusted hazard ratios of 1.44 (95%CI, 1.03–1.90) and 1.28 (95%CI, 0.91–1.80), respectively.⁴⁹

The AGS/BGS Clinical Practice Guidelines for Prevention of Falls in Older Persons recommends monitoring postural BP as an important strategy in identifying risk factors,¹⁴ thereby determining whether antihypertensive therapy could be contributing to falls. A significant orthostatic drop, which causes dizziness, would warrant a decrease in dosage. Obtaining BP readings at different times of the day will also be helpful in determining if her postural hypotension varies. This is particularly helpful for patients taking multiple antihypertensives, whose administration could then be separated to minimize the variation in BP.

It is important to consider other classes of medication that can also worsen postural hypotension or cause dizziness, including medications used for benign prostatic hypertrophy (BPH) (e.g., tamsulosin and terazosin) or treatments for angina (e.g., nitroglycerin).

To review contributors to postural hypotension, see [Box 1](#) page 1126 of the following article: Approach to assessing fitness to drive in patients with cardiac and cognitive conditions.

Case

You discover that Ms. P takes her furosemide with supper. Ms. P reports that some of her falls have been at night, on the way to the bathroom. Nocturnal urgency can increase the risk of falling, as Ms. P may not be as careful getting out of bed as she is afraid of having an incontinence episode. In this case, suggesting changing her furosemide to morning dosing is an appropriate intervention.

Analgesics

There have been conflicting studies published with respect to opioids and falls.^{50,51} This has produced a clinical dilemma in treating our

geriatric patients who have pain but are at risk of falling. Having pain itself can increase fall risk by impairing mobility. AGS guidelines recommend use of nonpharmacological modalities, such as exercise, physiotherapy, and patient education in concert with appropriate pharmacological treatment to reduce pain and improve function.⁵²

As different opiates possess different pharmacokinetic and pharmacodynamic properties, selecting which analgesic to prescribe to your patient could lessen the risk of adverse effects, including falls. **Table 5** lists some opioids and corresponding fracture risks as published by Vestergaard in 2009. Unfortunately, hydromorphone, an opiate used commonly in the geriatric population, was not reported.

There have been conflicting studies with regard to NSAIDs and falls.^{45,53} In a systematic review in 2009, a trend toward NSAIDs increasing the risk of falls was found, but the quality of the studies included in the analysis were questionable. There were no randomized controlled studies, the statistical methods used in the remaining studies were not complete, and there was significant variation in the reporting of effect. The higher-quality studies analyzed showed that community-dwelling elderly people appear to be at higher risk of falls.⁵³ Topical agents were not included in these analyses and have minimal systemic absorption, making them reasonable options for pain management in this population.

As with most medications, use of the smallest effective dose for the shortest period of time will help balance the risks and benefits of treatment.

Case

In the case of Ms. P, it is possible her naproxen could be causing fluid retention, which could be impacting her mobility. Also, decreasing her naproxen might decrease or eliminate her need for furosemide. Acetaminophen at a moderate dosage would be a safe alternative for Ms. P. If it is determined that the naproxen is to be decreased or stopped, BP should be monitored because naproxen can elevate BP, and its removal could worsen Mrs. P's hypotension.

Fall risk factors in elderly patients with diabetes include hypoglycemia, peripheral neuropathy, retinopathy, and increased frailty.⁵⁵ Oral hypoglycemics have not been shown to be independent risk factors, per se, but hypoglycemia, which is a common adverse effect of insulin secretagogues, and a risk of tight diabetes control, has been shown to increase the risk of falling.^{56,57} Gliclazide has been shown to be associated with less hypoglycemia than glyburide.⁵⁸ Glyburide is also listed as a high-risk medication to avoid, based on the AGS Beers criteria.¹⁸

Insulin has been associated with an increased risk of falls,⁵ the mechanism of which has not been determined. It could be related to hypoglycemia, or it could be a marker of disease progression and associated complications mentioned above.^{55,57}

Metformin has not been associated with hypoglycemia but is

contraindicated in renal dysfunction and thus needs to be considered before starting this medication in elderly patients.

For more information regarding safe diabetes management see the link to [McMillan and Holroyd](#).

Case

Mrs. P's low HbA1c leads us to believe she is tightly controlled and may be at risk of episodes of hypoglycemia. It would be valuable to ask her to record blood sugars twice daily for two weeks to determine if she is having hypoglycemic periods. In addition, blood sugars should be read any time she feels symptomatic (e.g., dizzy). If she is having periods of hypoglycemia, reducing or changing her sulfonylurea is advised.

Anticonvulsants

Anticonvulsants have been associated with an increased risk of falling.^{22,60} In one study evaluating falls in older women, women taking anticonvulsants were 75% more likely to experience a fall, compared with nonusers, and more than twice as likely to experience frequent falls. The negative impact of anticonvulsants was significantly greater in patients with a history of previous falls.²² Notably, most anticonvulsant users were taking phenytoin, phenobarbital, or carbamazepine, and more recently introduced anticonvulsants have not been evaluated for safety over as many decades. The effect of pregabalin and gabapentin on fall risk has not been well studied. Monitoring drug levels in patients taking traditional anticonvulsants is important in minimizing the risk of adverse drug events, such as sedation, dizziness, and ataxia, which can lead to falls. As well, it is important to calculate the corrected phenytoin levels for patients with albumin levels < 35 g/L, because phenytoin is highly protein-bound. Low serum protein levels can result in a higher free phenytoin concentration, which can in turn result in phenytoin toxicity, despite a phenytoin level in the traditional therapeutic range (40–80 μmol/L). $\{C_{corr} = C_{obs} / [(0.025) (Alb) + 0.1]\}$. In some older patients, a phenytoin level in the upper therapeutic range (e.g., 60–80 μmol/l) can lead to side effects.

Case

Ms. P is taking multiple medications, which could be contributing to her falls. Taking a stepwise approach in optimizing her medication regimen will minimize the risk of adverse effects and help identify causes if withdrawal symptoms develop. Understanding the impact of taking her diuretic in the evening on her sleep pattern, and having the risks of using diphenhydramine as a sleep aid explained to her, Ms. P is willing to consider decreasing their use. However, she does express concern about having difficulty sleeping, which is an opportunity to discuss non-pharmacologic options and good sleep hygiene. She also agrees to a slow taper of her benzodiazepine, as long as she can have some say in when the next decrease in dose can be implemented. As it

is a capsule formulation with limited strengths available, it is decided to switch to oxazepam 22.5 mg (1.5 x 15 mg) for 1 week, then propose the following taper of 15 mg for 1 week, 10 mg for 1 week, 7.5 mg for 1 week, 5 mg for 1 week, 2.5 mg x 1 week, then stop. Intervals will be extended if needed at the discretion of the prescriber and patient. After discussing the plan with the community pharmacist, there is agreement that the oxazepam can be blister packed weekly for this tapering. In the future, once benzodiazepine tapering is completed, reassessment of the need for her paroxetine should be considered.

Summary

Many medications can contribute to falls in the elderly. A detailed history, including prescription and over-the-counter medications, is an important component in a multipronged fall risk assessment. Details regarding the time frame of starting new medications and dosage changes in the context of falls are important clues in identifying offending agents.

Deprescribing can be a challenging but worthwhile task in decreasing your patients' fall risk. Including your patient in discussions surrounding the risks of medication and rationale for systematic deprescribing will increase the chance of success. When appropriate, slow tapering will decrease the risk of withdrawal symptoms and subsequent dose escalation. Inclusion of allied healthcare professionals can be helpful in identifying individualized strategies for decreasing fall risk.

Useful Resources

[Seniors Falls in Canada Second Report 2014](#)

Anticholinergic Risk Scale

(see table 5 of <http://www.canadiangeriatrics.ca/default/index.cfm/linkservid/86F27E6A-B4AE-C03B-7BC1839EF84D70A1/showMeta/0/>)

[The Regional Geriatric Program of Eastern Ontario Safer Health Care Now!](#)

Key Points

- Conduct a thorough medication history including prescription, over the counter, and natural health products.
- Focus on timing of addition and dosage changes of medications in relation to falls.
- Prioritize deprescribing based on the risk posed to the patient and their willingness to stop.
- Consider stopping one medication at a time.
- Taper medications that may cause withdrawal symptoms.
- Involve other team members in managing your patient's fall risks.

www.saferhealthcarenow.ca

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