Reducing fall risk while managing hypotension, pain, and poor sleep in an 83-year-old woman

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While medications might not be the sole contributor to fall risk, they are often a modifiable risk factor. Pain, which also affects mood, mobility, and sleep, can be successfully managed to reduce fall risk with the use of effective analgesics. Patients are often referred to the Bruyère Continuing Care Geriatric Day Hospital (GDH) in Ottawa, Ont, for management of these and other conditions over a 10- to 12-week admission period. During this time, medication review focuses on reduction of polypharmacy while maximizing effective therapy and minimizing medications that contribute to symptoms or that are no longer required.

This case illustrates how various cardiovascular therapies (eg, β-blockers, calcium channel blockers, loop diuretics) can contribute to dizziness, orthostatic hypotension, and subsequent falls in elderly patients. We describe how some of these medications were successfully tapered and discontinued with beneficial patient outcomes. Management of chronic pain is illustrated along with subsequent effects on mood, effects on sleep, and reduction in sedative use. Finally, the case demonstrates how 2 common undertreated conditions, anemia and low vitamin D levels, can contribute to falls.

Case

An 83-year-old woman was referred to the GDH for uncontrolled chronic pain and recurrent falls. Her pain was most pronounced in her low back, right hip, neck, and shoulder, hindering her sleep and affecting her ability to perform instrumental activities of daily living (IADLs), such as doing laundry. She had a history of falling about once per month, likely as a result of dizziness, loss of balance, and tripping over objects. Her medical history was relevant for rheumatoid arthritis, osteoporosis, osteoarthritis, and coronary artery disease (triple bypass 30 years previously), with a remote history of angina, pelvic fracture, depression, iron deficiency anemia, diet-controlled diabetes, gastroesophageal reflux pain, macular degeneration, insomnia, and previous minor stroke. Despite her medical history, she performed activities of daily living and IADLs independently (although with difficulty as indicated), with the exception of assistance for bathing. Bloodwork revealed a ferritin level of 18 µg/L, a hemoglobin level of 115 g/L, a vitamin D level of 76 nmol/L, and other results within the reference ranges; creatinine clearance was 31 mL/min (using the Cockcroft-Gault equation with ideal body weight). She organized her medications every night into a daily pill

EDITOR'S KEY POINTS

- By assessing each medication for indication, effectiveness, safety, and compliance, we were able to gradually taper and discontinue cardiovascular medications in order to improve balance and reduce fall risk. Gradual tapering of medications with monitoring for adverse drug withdrawal events was accomplished with biweekly visits to the Bruyère Continuing Care Geriatric Day Hospital over a 10-week period.
- Optimizing treatment of pain with adequate hydromorphone treatment (starting with a low dose and increasing it slowly) contributed to improvements in mobility, function, and sleep.
- Our experience is that interprofessional team members, working together, can contribute to reducing polypharmacy while optimizing symptom management.

POINTS DE REPÈRE DU RÉDACTEUR

- En évaluant l'indication, l'efficacité et la sécurité de chaque médicament, ainsi que l'observance de la pharmacothérapie, nous avons été en mesure de procéder à un sevrage graduel et de cesser les médicaments cardiovasculaires pour améliorer l'équilibre et réduire les risques de chutes. Le sevrage progressif des médicaments avec une surveillance des incidents indésirables associés à la cessation de la médication a été accompli dans le contexte de visites aux 2 semaines à l'Hôpital gériatrique de jour, Soins continus Bruyère, sur une période de 10 semaines.
- L'optimisation du contrôle de la douleur grâce à une thérapie adéquate aux hydromorphones (en débutant par une faible dose augmentée lentement par la suite) a contribué à des améliorations sur les plans de la mobilité, du fonctionnement et du sommeil.
- Notre expérience est que les membres d'une équipe interprofessionnelle, collaborant ensemble, peuvent contribuer à réduire la polypharmacie tout en optimisant la prise en charge des symptômes.

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organizer but was unaware of the reasons for each medication.

During the initial assessment, falls and pain management were highlighted. It was believed that multiple factors contributed to the falls, including poor vision, lower extremity weakness, hypotension (initial blood pressure was 92/52 mm Hg), orthostatic hypotension, pain, mildly depressed mood, and anxiety. Poor sleep might have been contributing, as well as medications such as antihypertensives and benzodiazepines. The GDH pharmacist, nurse, social worker, occupational therapist, and physiotherapist were consulted. The pharmacist conducted a medication assessment that included a 45-minute comprehensive patient interview, chart review, and communication with both the patient and the community pharmacist. Each medication was assessed for indication, effectiveness, safety, compliance, and patient understanding.[1] The results of the initial part of this assessment are outlined in **Table 1**.

Stop here. If you are using this case report for group discussion, you can obtain instructions, discussion questions, and a blank worksheet on identifying drug-related problems and developing an interprofessional medication care plan from **CFPlus**.* You might print out the above case description and **Table 1** for discussion before moving on to reading about the results of the medication assessment.

Signs and symptoms were assessed to determine potential drug causes, and drug-related problems were identified.[2] The complete medication assessment is outlined in **Table 2**.

Stop here. If you are using this case report for group discussion, you can obtain instructions, discussion questions, and a blank worksheet on planning interventions from **CFPlus**.* You might print out the above case description and **Table 2** for discussion before reading about how the care plan was implemented.

On review of the medications and considering the need to reduce fall risk; optimize pain control, mood, and sleep; and reduce pill burden, the following changes were made without exacerbation of existing cardiac history: metoprolol, amlodipine, and furosemide were discontinued and the nitroglycerin patch dosage was reduced. Opioids for pain were changed from codeine with acetaminophen to controlled-release hydromorphone. Pain improved with visual analogue scores improving from 9 out of 10, to 2 to 3 out of 10; her sleep improved (zopiclone was discontinued). Her balance and mobility improved substantially, with a change in Berg Balance Scale score from 30 out of 56 to 45 out of 56 and an increase in 6-minute walking distance from 61 m to 347 m. She reported a resolution of her dizziness and had no further falls during her GDH admission. Chronologic steps taken to implement the medication changes throughout the admission are outlined in **Box 1** *and a final medication list is presented in* **Box 2**.

Discussion

Falls. Low blood pressure and orthostatic hypotension might contribute to falls in elderly patients. Given the patient's history of cardiac disease and hypertension, it is easy to see how she initially began medications such as metoprolol, amlodipine, nitroglycerin patches, and furosemide, all of which can lower blood pressure. As people age, they might become more susceptible to adverse effects of cardiovascular medications, particularly orthostatic and postprandial hypotension.[3] In addition, the optimal blood pressure targets in this population are not known. We individualize blood pressure targets based on study data from octogenarian populations.[4] This patient's blood pressure was well below the target range, with concern rising especially from low systolic and diastolic readings (which can increase cardiovascular risk) and orthostatic hypotension.

Given that the patient's bypass and angina occurred many years previously, metoprolol was tapered first. Withdrawing β-blockers can cause potential adverse drug withdrawal events including recurrent or unstable angina, hypertension, exacerbation of congestive heart failure, tachycardia, and anxiety.[5] Therefore, we slowly tapered the dose (**Box 1**) and monitored for appearance of these symptoms; none was reported. Despite these changes, her blood pressure remained lower than the target level and this, along with her ankle edema, prompted discontinuation of amlodipine. The patient was happy that her chronic epigastric pain resolved following these changes. Her intermittent dizziness and low blood pressure persisted, with an automated blood pressure monitor reading of 86/53 mm Hg, and so furosemide was tapered and discontinued next, and the transdermal nitroglycerin patch dosage was reduced. These medication changes were not associated with any worsening of ankle edema, shortness of breath, or chest pain, and resulted in improved blood pressure readings of 94/54 mm Hg to 122/54 mm Hg (with only 1 systolic reading < 100 mm Hg in the last month of the program).

Other approaches to reducing fall risk included treating iron deficiency anemia (hemoglobin level increased to 126 g/L at discharge) and increasing vitamin D levels (subsequently increased to 131 nmol/L at discharge).[6]

*Instructions, discussion questions, and worksheets on **identifying drug-related problems and developing an interprofessional medication care plan** and **planning interventions** are available at **www.cfp.ca**. Go to the full text of the article online and click on **CFPlus** in the menu at the top right-hand side of the page.

Table 1. History of medication experience: *Medication history was relevant for amitriptyline and gabapentin, both of which were stopped in summer 2011 possibly to reduce fall risk, as well as iron supplements, which the patient had stopped taking on her own. The patient was allergic to acetylsalicylic acid (which caused a rash), possibly allergic to penicillin, and possibly allergic to rofecoxib (the patient said she was unaware of penicillin and rofecoxib allergies).*

MEDICATION	REASON FOR USE (IF KNOWN)	KNOWLEDGE, EFFICACY, COMPLIANCE, GOALS, SAFETY ASSESSMENT	DURATION (IF KNOWN)
5 mg of ramipril every morning	Hypertension	• BP at GDH in first 4 visits ranging from 92/52 mm Hg to 110/64 mm Hg; 1 episode of orthostatic hypotension (from 110/64 mm Hg lying down to 88/50 mm Hg standing) • No dry cough; has some ankle swelling	Many years
Half a 5-mg amlodipine tablet twice daily	Hypertension		Many years
Half a 50-mg metoprolol tablet twice daily	CAD and CABG (remote)	• Heart rate 56 beats/min at time of assessment • Is followed by cardiologist	About 30 y
0.4-mg nitroglycerin patch; 2 on at 9 AM and off at 10 PM, rotating site	Angina (remote)	• If forgets to remove, gets headache and is reminded to remove patch • Has difficulty differentiating chest pain and arthritis pain	About 30 y
0.4 mg of nitroglycerin spray as needed	Angina (remote)	• Last used previous summer, does not carry regularly • Has difficulty differentiating chest pain and arthritis pain	2.5 y
75 mg of clopidogrel every morning	CAD, CABG, possible mild stroke	• No bruising or bleeding reported	Many years
40 mg of furosemide every morning	Unknown	• Does not know why furosemide started (some ankle edema; sleeps with 2 pillows) • Potassium level 4.1 mEq/L (at GDH admission)	Unclear
80 mg of atorvastatin at bedtime	CAD, CABG, possible mild stroke	• Does not complain of muscle ache • Does not drink grapefruit juice	2 y (40 mg for many years previously)
10 mg of escitalopram every morning	Depression, possible anxiety	• Helps with mood; reports previous panic attack when old pharmacy would not refill; worries about stopping suddenly • Has nausea after lunch and sleep difficulties	About 6 mo
5 mg of zopiclone at bedtime	Insomnia	• Sleep not improving (reports going to bed at about 9 PM and waking at midnight with difficulty getting back to sleep) • Intends to try nonpharmacologic measures for sleep hygiene	1 y
2, 10-mg tablets of oxazepam at bedtime	Possible anxiety	• Patient thinks it was prescribed for anxiety after open-heart surgery	About 30 y
1000 IU of vitamin D daily	Osteoporosis (mid-thoracic vertebral compression)	• Is seen by specialist • Vitamin D level 76 nmol/L (at GDH admission)	NA
200 mg of hydroxychloroquine sulfate at supper	Rheumatoid arthritis	• Helps with arthritis but does not remove pain completely • Is seen by specialist	NA
30 mg of codeine with acetaminophen twice daily as needed	Pain	• Pain in left torso and ribs, radiating left hip pain • Throbbing pain throughout night; limits sleep, mobility, and function	NA
500 mg of acetaminophen 4 times daily	Pain	• VAS score of 9 out of 10 on admission and 6-7 out of 10 with acetaminophen and codeine in combination and regular acetaminophen • Patient states she "could not do without acetaminophen"	NA
40 mg of pantoprazole every morning	Nausea	• States it is helpful in reducing nausea	NA
Polyethylene glycol eye drops as needed	Eye lubrication	• Uses effectively for dry eyes	NA

BP—blood pressure, CABG—coronary artery bypass grafting, CAD—coronary artery disease, GDH—Bruyère Continuing Care Geriatric Day Hospital, NA—not available, VAS—visual analogue scale.

Table 2. Medication care plan

DRUG-RELATED PROBLEM	ACTION PLAN	MONITORING
Medications that might contribute to hypotension, dizziness, and falls: • Metoprolol (which might also contribute to bradycardia) • Amlodipine (which might also contribute to ankle edema) • Furosemide (also contributing to hypokalemia) • Nitroglycerin patch	One at a time: • Taper metoprolol to 25 mg/d, then to 12.5 mg twice daily, then stop • Taper amlodipine to 2.5 mg/d, then stop • Taper furosemide to 20 mg/d for 1 wk, then stop if no worsening of ankle edema (nurse to fit for compression stockings) • Taper nitroglycerin patch to a single 0.4-µg patch on for 12 h, off for 12 h • Nurse to provide education about behavioural strategies to manage orthostatic hypotension	HR BP (target 120/60 mm Hg to 140/90 mm Hg) Angina or shortness of breath Ankle edema Potassium level
Current analgesic regimen not controlling pain (VAS score 7-9 out of 10); consider increasing acetaminophen and switching to a different opioid	• Stop acetaminophen with codeine • Increase acetaminophen to 1000 mg 3 times daily • Try 30 mg of plain codeine 3 times daily as needed (with pain diary) • If not effective, stop codeine and try 0.5 mg hydromorphone 3 times daily and titrate up gradually • Start controlled-release hydromorphone when regular-release daily dose is equivalent to 3 mg	VAS Effect on function Nausea, constipation
Risk of falls increased with • Zopiclone • Oxazepam • Escitalopram	• Taper to 2.5 mg of zopiclone every night for 3 wk, then stop • Taper oxazepam to 15 mg every night for 2-3 wk, then to 10 mg every night for 2-3 wk, then to 5 mg every night for 2-3 wk, then to 5 mg at bedtime every other day or as needed until able to stop • Assess need for continuing escitalopram • Counsel patient on switching to decaffeinated drinks to make it easier to reduce need for sedatives	Rebound insomnia (tends to peak within a few days after dose reduction or stopping) Anxiety, mood
Known osteoporosis and history of vertebral fracture (only taking 1000 IU/d of vitamin D with continuing low vitamin D level); patient would benefit from the following: • increasing vitamin D dose (also reduces fall risk); • calcium supplementation; and • bisphosphonate therapy	• Increase vitamin D to 3000 IU/d • Assess calcium intake from diet and select supplement of patient's choice • Discuss with physician and patient benefit of bisphosphonate addition	Constipation, nausea Compliance and esophageal irritation with bisphosphonate
Anemia (hemoglobin 115 g/L) secondary to low ferritin levels (18 µg/L), might be contributing to fall risk, dizziness • Needs iron treatment	Restart polysaccharide iron complex 150 mg/d	Constipation, gastrointestinal side effects
Risk of bleeding with combination of clopidogrel and escitalopram	Reassess need for continuing escitalopram (discuss with patient before any changes)	Bruising, bleeding gums, blood in stool
Risk of developing serotonin syndrome with combination of escitalopram and hydromorphone	Reassess need for continuing escitalopram (discuss with patient before any changes)	HR, BP, pulse, hyperthermia, agitation, tremor
Pantoprazole might not be needed and might also decrease absorption of iron and increase atorvastatin levels	Switch to 10 mg/d of rabeprazole for 2 wk, then stop (provide written information about treating rebound heartburn)	Rebound heartburn (for up to 4 wk after stopping)
Vitamin C not adding benefit and contributing to pill burden	Stop vitamin C	NA

BP—blood pressure, HR—heart rate, NA—not applicable, VAS—visual analogue scale.

She reported that her fracture risk was being assessed by her rheumatologist and, therefore, we did not add a bisphosphonate.

During her admission, the patient participated in balance, strength, and mobility exercises with the physiotherapist. The nurse provided education on management of orthostatic hypotension. Equipment needs were addressed by the occupational therapist.

Box 1. Intervention timeline: *Initial pill burden = 21 pills daily; initial number of medications = 17; final pill burden = 21 pills daily; final number of medications = 14.*

Week 1
- Hold acetaminophen with codeine
- Increase acetaminophen to 1000 mg 3 times daily

Week 2
- Stop acetaminophen with codeine
- Start codeine 30 mg 3 times daily as needed
- Increase vitamin D to 1000 IU 3 times daily
- Add calcium carbonate antacid in the morning and at lunch

Week 3
- Change codeine to 30 mg 3 times daily regularly
- Decrease metoprolol to 12.5 mg twice daily

Week 4
- Stop codeine
- Start 3 mg/d of controlled-release hydromorphone
- Start polysaccharide iron complex 150 mg/d

Week 5
- Stop metoprolol
- Decrease amlodipine to 2.5 mg/d

Week 6
- Stop amlodipine
- Add 0.5 mg hydromorphone 3 times daily (total hydromorphone 4.5 mg/d)
- Patient asked to keep pain diary

Week 7
- Increase controlled-release hydromorphone to 4.5 mg/d (continue 0.5 mg 3 times daily as needed)
- Decrease zopiclone to 2.5 mg at bedtime

Week 8
- Decrease furosemide to 20 mg/d
- Stop controlled-release hydromorphone 4.5 mg and 0.5 mg of hydromorphone
- Start 3 mg of controlled-release hydromorphone twice daily (total hydromorphone 6 mg/d)
- Reduce nitroglycerin patch to a single 0.4-µg patch daily

Week 9
- Stop pantoprazole
- Start 10 mg/d of rabeprazole
- Stop zopiclone
- Stop furosemide
- Continue 20 mg of oxazepam at bedtime

Week 10
- Stop rabeprazole
- Restart 40 mg/d pantoprazole
- Stop vitamin C

Pain. Elderly patients commonly experience chronic pain. Worry over narcotic use and possible side effects in this population limits the use of potentially effective opioid therapy and leaves patients with inadequately controlled pain.[7] Both uncontrolled pain and opioid use have been associated with falls and risk of injury.[8,9] The latter might have prevented prescribers from considering stronger narcotics in this patient. The lack of effectiveness of codeine might have been an alert that this patient was unable to convert codeine to its active morphine metabolite. This case illustrates that a switch from codeine to an equivalent dose of controlled-release hydromorphone (titrated upward using regular hydromorphone) can be effective for pain in elderly patients. By reducing pain, resulting in improvements in balance, and by addressing safe transfers and facilitating walker use, fall risk was reduced. Improvement in pain scores from 9 out of 10, to 2 to 3 out of 10 using 3 mg of controlled-release hydromorphone twice a day also led to improvement in sleep. The patient did not report any substantial nausea or constipation and reported more independence and ease with activities of daily living and IADLs.

Poor sleep. Benzodiazepines and other sedative medications are associated with impaired balance and

Box 2. Medication schedule at discharge

Morning (around 9-10 AM)
- 5 mg of ramipril
- A single 0.4-mg nitroglycerin patch
- 75 mg of clopidogrel
- 40 mg of pantoprazole
- 10 mg of escitalopram
- 3 mg of controlled-release hydromorphone
- 1000 IU of vitamin D
- Calcium carbonate tablet

Lunch (around 12 PM)
- 2, 500-mg acetaminophen tablets
- 1000 IU of vitamin D
- Calcium carbonate tablet

Supper (around 5 PM)
- 200 mg of hydroxychloroquine sulfate
- 2, 500-mg acetaminophen tablets
- 1000 IU of vitamin D

Bedtime (around 10 PM)
- 80 mg of atorvastatin
- 2, 500-mg acetaminophen tablets
- 2, 10-mg oxazepam tablets
- 3 mg of controlled-release hydromorphone

Nitroglycerin spray when needed

Polyethylene glycol eye drops when needed

increased fall and fracture risk. Evidence for substantial improvement in sleep quality and quantity is limited.[10] We have found that with gradual tapering and team support, most patients can discontinue sleeping medications with no adverse effects and often with improved sleep.[11] With effective pain control, the patient's sleep improved and we were able to successfully taper and stop zopiclone (chosen first for tapering because of its awful taste for the patient) without any evidence of withdrawal. Following this, we planned to taper her oxazepam; however, she experienced a substantial life stressor toward the end of the program, and we recommended to the patient's family physician that oxazepam be tapered once her life circumstances had settled.

Other drug-related problems. The need for escitalopram was reviewed and it was believed that the benefit of mood improvement, particularly given the low dose, outweighed risk of falls, bleeding, or serotonin syndrome. Re-evaluating the ongoing need for this medication was to be pursued with the patient's family physician.

Once pain and falls were well controlled, we attempted to taper pantoprazole, as it was contributing to a high pill burden and did not have a clear indication once the patient's epigastric pain resolved (after stopping metoprolol and amlodipine). Pantoprazole might have been contributing to low ferritin levels and higher atorvastatin levels. Stopping proton pump inhibitors can result in rebound hypersecretion and thus we first switched 40 mg of pantoprazole to a lower dose of rabeprazole (the only low-dose proton pump inhibitor covered by the Ontario Drug Benefit program). However, the patient experienced nausea and nonspecific abdominal symptoms. While these might have been related to her new life stressors, we switched back to the original pantoprazole dose and recommended future tapering to the family physician.

Strategies for medication management. To organize her medications, the patient opted for a pharmacy-prepared pill organizer instead of preparing a pill organizer herself every night. Because of her low vision, the community pharmacist was asked to provide labels in a large font. To reduce pill burden, vitamin C was stopped. A medication chart outlining specific reasons for each medication, description of changes, and rationale for changes was prepared and reviewed periodically with the patient. A final copy was sent to her family physician with the discharge summary. The patient was encouraged to share this chart as a communication tool with all her health care providers.

Conclusion

This case highlights the importance of reviewing an elderly patient's medications, as they might be causing or aggravating existing symptoms. By assessing each medication for indication, effectiveness, safety, and compliance, we were able to gradually taper and discontinue cardiovascular medications in order to improve balance and reduce fall risk. Gradual tapering of medications with monitoring for adverse drug withdrawal events was accomplished with biweekly visits to the GDH over a 10-week period. Optimizing treatment of pain with adequate hydromorphone treatment (starting with a low dose and increasing it slowly) contributed to improvements in mobility, function, and sleep. This further highlights that even frail elderly patients can benefit substantially from opioid use. The reduction in sedative use further reduced her fall risk. Our experience is that interprofessional team members, working together, can contribute to reducing polypharmacy while optimizing symptom management.

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Competing interests

None declared

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