

Medicines and Falls in Hospital

All patients should have their drug burden reviewed with respect to its propensity to cause falls. The history should establish the reason the drug was given, when it started, whether it is effective and what its side effects have been.

An attempt should be made to reduce the number and dosage of medications and ensure they are appropriate, and not causing undue side effects.

Falls can be caused by almost any drug that acts on the brain or on the circulation. Usually the mechanism leading to a fall is one or more of:

- **sedation**, with slowing of reaction times and impaired balance,
- **hypotension**, including the 3 syndromes of paroxysmal hypotension – OH, VVS and VD-CSH
- **bradycardia, tachycardia or periods of asystole**

Falls may be the consequence of recent medication changes, but are usually caused by medicines that have been given for some time.

Red: High risk: can commonly cause falls alone or in combination

Amber: Moderate risk: can cause falls, especially in combination

Yellow: Possibly causes falls, particularly in combination

Drugs acting on the brain (aka psychotropic drugs)

There is good evidence that stopping these drugs can reduce falls (1).

Taking such a medicine roughly doubles the risk of falling. There is no data on the effect of taking two or more such tablets at the same time. (2)

Sedatives, antipsychotics, sedating antidepressants cause drowsiness and slow reaction times. Some antidepressants and antipsychotics also cause orthostatic hypotension.

Sedatives: Benzodiazepines	Temazepam, Nitrazepam Diazepam, Lorazepam Chlordiazepoxide, Flurazepam, Lorazepam, Oxazepam, Clonazepam	Drowsiness, slow reactions, impaired balance. Caution in patients who have been taking them long term
Sedatives: "Zs"	Zopiclone, Zolpidem	Drowsiness, slow reactions, impaired balance.
Sedating antidepressants (tricyclics and related drugs)	Amitriptyline, Doxepin Imipramine, Doxepin Clomipramine, Lofepramine, Nortriptyline, Trimipramine Mirtazapine, Mianserin Trazodone	All have some alpha blocking activity and can cause orthostatic hypotension. All are antihistamines and cause drowsiness, impaired balance and slow reaction times. Double the rate of falling
Monoamine Oxidase Inhibitors	Phenelzine, Isocarboxazid, Tranylcypromine	MAOIs are little now used; all (except moclobemide) cause severe OH
Drugs for psychosis and	Chlorpromazine, Haloperidol,	All have some alpha receptor

Agitation	Fluphenazine, Risperidone Quetiapine, Olanzapine	blocking activity and can cause orthostatic hypotension. Sedation, slow reflexes, loss of balance.
SSRI antidepressants	Sertraline, Citalopram, Paroxetine, Fluoxetine	Cause falls as much as other antidepressants in population studies.
Several population studies have shown that SSRIs are consistently associated with an increased rate of falls and fractures, but there are no prospective trials. The mechanism of such an effect is unknown. They cause OH and bradycardia only rarely as an idiosyncratic side effect. They do not normally sedate. They impair sleep quality.		
SNRI antidepressants A combination of an SSRI and a noradrenaline re-uptake inhibitor	Venlafaxine, Duloxetine	As for SSRIs but also commonly cause orthostatic hypotension (through noradrenaline re-uptake blockade)
Opiate analgesics	All opiate and related analgesics – Codeine, Morphine, Tramadol	Sedate, slow reactions, impair balance, cause delirium,
Anti-epileptics	Phenytoin	Phenytoin may cause permanent cerebellar damage and unsteadiness in long term use at therapeutic dose. Excess blood levels cause unsteadiness and ataxia.
	Carbamazepine Phenobarbitone,	Sedation, slow reactions. Excess blood levels cause unsteadiness and ataxia.
	Sodium valproate, Gabapentin	Some data on falls association.
	Lamotrigine, Pregabalin Levetiracetam, Topiramate,	Insufficient data to know if these newer agents cause falls
Parkinson's disease: Dopamine agonists	Ropinirole, Pramipexole	May cause delirium and OH
MAOI-B inhibitors	Selegiline	Causes OH
The subject of drugs and falls in PD is difficult, as falls are so common, and OH is part of the disease. In general only definite drug related OH would lead to a change in medication		
Muscle relaxants	Baclofen, Dantrolene	Sedative. Reduced muscle tone.
No falls data on these drugs. Tend to be used in conditions associated with falls.		
Vestibular sedatives Phenothiazines	Prochlorperazine	Dopamine antagonist – may cause movement disorder in long term use. Alpha receptor blocker and antihistamine.
Vestibular sedatives Antihistamines	Cinnarazine, Betahistine	Sedating. No evidence of benefit in long term use.
Sedating Antihistamines for allergy	Chlorphenamine, Hydroxyzine, Promethazine, Trimeprazine	No data, but sedation likely to contribute to falls. Long half lives.
Anticholinergics acting on the bladder	Oxybutinin, Tolterodine, Solifenacin	No data, but have a known CNS effects

Drugs acting on the heart and circulation

Maintaining consciousness and an upright posture requires adequate blood flow to the brain. This requires an adequate pulse and blood pressure. In older people a systolic BP of 110mmHg or below is associated with an increased risk of falls.

Any drug that reduces the blood pressure or slows the heart can cause falls (or feeling faint or loss of consciousness or “legs giving way”) (3). In some patients the cause is clear – they may be hypotensive, or have a systolic drop on standing. Others may have a normal blood pressure lying and standing, but have syncope or pre-syncope from carotid sinus hypersensitivity or vasovagal syndrome. Stopping cardiovascular medication reduces syncope and falls by 50%, and reduces the prevalence of these 4 syndromes (4, 5).

Alpha receptor blockers	Doxazosin, Indoramin, Prazosin, Tamsulosin, Terazosin, Alfuzosin	Used for hypertension or for prostatism in men. They commonly cause severe orthostatic hypotension. Stopping them may precipitate urinary retention in men.
	Sedating antidepressants	See above.
	Drugs for psychosis and agitation	Orthostatic hypotension.
Centrally acting alpha 2 receptor agonists	Clonidine, Moxonidine	May cause severe orthostatic hypotension. Sedating
Thiazide diuretics	Bendroflumethiazide, Chlorthalidone, Metolazone	Cause OH, weakness due to low potassium. Hyponatraemia
Loop diuretics	Furosemide, Bumetanide	Dehydration causes hypotension. Low potassium and sodium
Angiotensin converting enzyme inhibitors (ACEIs)	Lisinopril, Ramipril, Enalapril, Captopril, Perindopril	These drugs rely almost entirely on the kidney for their elimination and can accumulate in dehydration or renal failure.
	Fosinopril, Trandolapril, Quinapril	Excreted by liver and kidney

Symptomatic hypotension in systolic cardiac failure

- ACEIs and beta blocker have a survival benefit in systolic cardiac failure and should be maintained whenever possible.
- NICE recommends: stop nitrates, calcium channel blockers and other vasodilators. If no evidence of congestion, reduce diuretics. If problem persists, seek specialist advice.
- The mortality risk from a fall at age 85 is about 1% per fall. The frequency of falls determines the balance between risk and benefit.
- Most cardiac failure in older people is diastolic (preserved left ventricular function). ACEIs and beta blockers have little survival benefit in diastolic failure.

Angiotensin receptor blockers (ARBs)	Losartan, Candesartan, Valsartan, Irbesartan, Olmesartan, Telmesartan, Eprosartan	May cause less OH than ACEIs. Excreted by liver and kidney.
Beta blockers	Atenolol, Sotalol - Renally excreted. May accumulate	Can cause bradycardia, hypotension, CSH, OH and VVS
	Bisoprolol, Metoprolol, Propranolol, Carvedilol, Timolol eye drops	
Antianginals	GTN	A common cause of syncope due to sudden BP drop
	Isosorbide mononitrate, Nicorandil	Cause hypotension and paroxysmal hypotension
Calcium channel blockers that only reduce blood pressure	Amlodipine, Felodipine, Nifedipine, Lercanidipine	
Calcium channel blockers which slow the pulse and reduce BP	Diltiazem, Verapamil	May cause hypotension or bradycardia
Other antidysrhythmics	Digoxin, Amiodarone, Flecainide	May cause bradycardia and other arrhythmias. Data on digoxin and falls probably spurious due to confounding by indication
Acetylcholinesterase inhibitors (for dementia)	Donepezil, Rivastigmine, Galantamine	Cause symptomatic bradycardia and syncope

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