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ELDER CARE

A Resource for Interprofessional Providers

Medication-Induced Hypokalemia: A Common Problem

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Hypokalemia is one of the most common electrolyte disorders seen in both outpatient and inpatient care. It is common among older adults, and increasing age is associated with a marked increase in the incidence of hypokalemia. In fact, compared with younger adults, an 80-year-old has more than triple the risk of having a potassium level <3.0 mmol/L. Women, African Americans, those with higher body mass index (BMI), and cancer patients are more likely to have hypokalemia also. Additionally, polypharmacy (≥ 5 drugs) use increases risk. A variety of medical conditions can cause hypokalemia (Table 1). Providers should screen for these conditions when evaluating patients who have hypokalemia. However, more commonly and particularly in older adults, hypokalemia is medication-induced. Multiple medications, even at therapeutic doses, can induce hypokalemia.

Table 1. Medical Conditions Causing Hypokalemia

Bartter's Syndrome and Gitelman's Syndrome (inherited disorders of renal tubule function)
Cancer
Cushing's syndrome
Delirium tremens
Diabetes mellitus, uncontrolled
Dialysis/plasmapheresis
Familial hypokalemic periodic paralysis
Gastrointestinal infections
Gastrointestinal tumors
Gastrointestinal malabsorption
Hyperaldosteronism
Hypercalcemia
Hyperthyroidism, thyrotoxicosis
Hypomagnesemia
Leukemia
Malnutrition, severe (anorexia, dementia)
Metabolic or respiratory alkalosis
Pernicious anemia
Radiation enteropathy
Renal tubular acidosis

This issue of Elder Care will review the most common hypokalemia-causing drugs that are often used in those over the age of 65 (Table 2). In addition to medications, hypokalemia can also be caused by the ingestion of large quantities of caffeine or licorice.

Hypokalemia is usually asymptomatic, though there have been reports of older adults experiencing profound weakness. Low potassium levels are most often discovered incidentally during routine blood tests. In the absence of blood testing, low potassium levels may go undetected and progress further, eventually leading to cardiac rhythm disturbances. Therefore, when patients are using medications known to cause hypokalemia, interval monitoring of potassium levels should be performed, especially upon initiation and dose changes.

Diuretics

Diuretic therapy causes renal loss of potassium in a dose-dependent manner and is the most common cause of hypokalemia. With loop diuretics, such as furosemide, hypokalemia can occur even when potassium supplementation is given. Even though loop diuretics are more potent natriuretics, thiazide diuretics can cause hypokalemia more frequently which may be explained by their ability to inhibit calcium excretion.

Laxatives and Enemas

Large doses of laxatives and enemas – particularly phenolphthalein laxatives and/or sodium polystyrene sulfonate – can cause loss of potassium in the stool. It is important to question patients about laxative use because they may not report it unless asked.

COPD Medications

Sympathomimetic drugs, such as beta-adrenergic bronchodilators, cause a shift of potassium from the serum into cells, thereby lowering serum potassium levels. The effect is potent, with a single nebulized albuterol treatment lowering potassium levels by 0.2-0.4 mmol/L, and by 1 mmol/L if the dose is repeated within an hour.

TIPS ABOUT MEDICATION-INDUCED HYPOKALEMIA IN OLDER ADULTS

- Keep in mind that older adults are at higher risk for medication-induced hypokalemia and that effects on potassium levels are additive so exercise extra caution in this population.
- Be alert for hypokalemia when patients are taking common offending drugs - diuretics, laxatives, COPD medications, mineralocorticoids, high-dose antibiotics, or high-dose insulin - regularly monitor potassium level.

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Theophylline, also sometimes used for COPD treatment, stimulates release of sympathetic amines. Thus, similar to beta adrenergics, they cause a shift of potassium into cells and can lower serum potassium levels.

Oral or IV steroids with glucocorticoid properties used for COPD treatment, such as prednisone and hydrocortisone, can increase renal potassium excretion. When used chronically, potassium levels can fall by up to 0.4 mmol/L.

Mineralocorticoids

The mineralocorticoid fludrocortisone is used to treat orthostatic hypotension due to autonomic dysfunction in Parkinson's disease or other conditions by enhancing renal sodium and fluid retention. A byproduct of sodium retention is renal potassium loss, which can cause hypokalemia.

Antimicrobials

In large doses, penicillin, ampicillin, nafcillin, carbenicillin, aminoglycosides, and amphotericin B can induce renal potassium excretion.

Insulin

Ongoing insulin therapy rarely causes hypokalemia in the outpatient setting. However, if given in large doses to older patients who are admitted for treatment of hyperosmolar hyperglycemic syndrome, insulin can have a profound effect on the amount of potassium being shifted into cells from the serum. Accordingly, hypokalemia results and may necessitate treatment with intravenous potassium supplementation.

Table 2. Medications that Cause Hypokalemia

Medication Class	Example of Specific Drugs	Mechanism
Diuretics	Thiazides	Renal potassium loss
	Furosemide	Renal potassium loss
Laxatives	Phenolphthalein, polyethylene glycol	Gastrointestinal potassium loss
	Sodium polystyrene sulfonate	Gastrointestinal potassium loss
COPD Medications	Beta adrenergics	Shift of potassium from serum into cells
	Theophylline	Shift of potassium from serum into cells
	Steroids	Renal potassium loss
Mineralocorticoids	Fludrocortisone	Renal potassium loss
Antimicrobials	Penicillins (penicillin G, nafcillin, ampicillin, carbenicillin)	Renal potassium loss
	Aminoglycosides	Renal potassium loss
	Amphotericin B	Renal potassium loss
Insulin	High dose	Shift of potassium from serum into cells
Other Medications	Pseudoephedrine	Shift of potassium from serum into cells
	Verapamil (in overdose)	Shift of potassium from serum into cells
	Acyclovir	Renal damage and reduced flow
	Vitamin B-12, folic acid	Shift of potassium from serum into cells

References and Resources

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