



September 2019

# 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  $<3.0$  mm/L. Women, African Americans, those with higher body mass index (BMI), and cancer patients are more likely to have hypokalemia also. Additionally, polypharmacy ( $\geq 5$  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 in 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 chemotherapy  
Cushing syndrome  
Delirium tremens  
Diabetes mellitus, uncontrolled  
Dialysis/plasmapheresis  
Familial hypokalemic periodic paralysis  
Gastrointestinal infections  
Gastrointestinal tumors  
Gastrointestinal malabsorption  
Hyperaldosteronism  
Hyperthyroidism, thyrotoxicosis  
Hypomagnesemia  
Leukemia  
Malnutrition, severe (anorexia, dementia)  
Metabolic alkalosis  
Pernicious anemia  
Radiation enteropathy  
Renal tubular acidosis

This issue of Elder Care will review the most common hypokalemia-causing drugs. These and other medications are listed in 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 reduced to the point of disturbances in cardiac rhythm. 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 and is the most common cause of hypokalemia. It can occur with both thiazide-type diuretics and loop diuretics such as furosemide. With loop diuretics, hypokalemia can occur even when potassium supplementation is given.

#### 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 a repeat dose within an hour dropping levels of by nearly 1 mmol/L.

#### TIPS ABOUT MEDICATION-INDUCED HYPOKALEMIA IN OLDER ADULTS

- Keep in mind that older adults are at higher risk for medication-induced hypokalemia.
- 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, such as prednisone and hydrocortisone sometimes used to treat COPD, 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 causing renal sodium and fluid retention. A byproduct of sodium retention is renal potassium loss, which can cause hypokalemia.

## Antimicrobials

Most providers do not think of antibiotics as a cause of hypokalemia. In large doses, however, penicillin, ampicillin, nafcillin and carbenicillin can induce renal potassium excretion. Such effect can occur with aminoglycoside therapy and amphotericin B also.

## Insulin

Routine outpatient insulin treatment does not cause significant hypokalemia. But when administered in large doses, such as for treatment of the non-ketotic hyperosmolar state that sometimes occurs in older diabetics, insulin shifts potassium into cells and can result in marked serum hypokalemia. Intravenous potassium supplementation is often needed for treatment.

**Table 2. Medications that Cause Hypokalemia**

Medication Class	Example of Specific Drugs	Mechanism
Diuretics	Thiazides	Renal potassium loss
	Furosemide	Renal potassium loss
Laxatives	Phenolphthalein	Gastrointestinal potassium loss
	Sodium polystyrene sulfonate	Gastrointestinal potassium loss
COPD Medications	Beta adrenergics	Shift of potassium from serum to cells
	Theophylline	Shift of potassium from serum to 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 to cells
Other Medications	Pseudoephedrine	Shift of potassium from serum to cells
	Verapamil (in overdose)	Shift of potassium from serum to cells
	Acyclovir	Renal damage and reduced flow

## References and Resources

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**Published by:** The University of Arizona, PO Box 245027, Tucson, AZ 85724-5027 | (520) 626-5800 | <https://uofazcenteronaging.com>