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 (≥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
Deliurium 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.
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>
<thead>
<tr>
<th>Medication Class</th>
<th>Example of Specific Drugs</th>
<th>Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diuretics</strong></td>
<td>Thiazides</td>
<td>Renal potassium loss</td>
</tr>
<tr>
<td></td>
<td>Furosemide</td>
<td>Renal potassium loss</td>
</tr>
<tr>
<td><strong>Laxatives</strong></td>
<td>Phenolphthalein</td>
<td>Gastrointestinal potassium loss</td>
</tr>
<tr>
<td></td>
<td>Sodium polystyrene sulfonate</td>
<td>Gastrointestinal potassium loss</td>
</tr>
<tr>
<td><strong>COPD Medications</strong></td>
<td>Beta adrenergics</td>
<td>Shift of potassium from serum to cells</td>
</tr>
<tr>
<td></td>
<td>Theophylline</td>
<td>Shift of potassium from serum to cells</td>
</tr>
<tr>
<td></td>
<td>Steroids</td>
<td>Renal potassium loss</td>
</tr>
<tr>
<td><strong>Mineralocorticoids</strong></td>
<td>Fludrocortisone</td>
<td>Renal potassium loss</td>
</tr>
<tr>
<td><strong>Antimicrobials</strong></td>
<td>Penicillins (penicillin G, nafcillin, ampicillin, carbenicillin)</td>
<td>Renal potassium loss</td>
</tr>
<tr>
<td></td>
<td>Aminoglycosides</td>
<td>Renal potassium loss</td>
</tr>
<tr>
<td></td>
<td>Amphotericin B</td>
<td>Renal potassium loss</td>
</tr>
<tr>
<td><strong>Insulin</strong></td>
<td>High dose</td>
<td>Shift of potassium from serum to cells</td>
</tr>
<tr>
<td><strong>Other Medications</strong></td>
<td>Pseudoephedrine</td>
<td>Shift of potassium from serum to cells</td>
</tr>
<tr>
<td></td>
<td>Verapamil (in overdose)</td>
<td>Shift of potassium from serum to cells</td>
</tr>
<tr>
<td></td>
<td>Acyclovir</td>
<td>Renal damage and reduced flow</td>
</tr>
</tbody>
</table>

**References and Resources**
