

Electrolyte Imbalance

Patient Profile

E.G. is a 73-year-old woman whose daughter brings her to see the health care provider because she has had a case of the “stomach flu,” with vomiting and diarrhea for the past 3 to 4 days and is now experiencing occasional light-headedness and dizziness. Her medical history includes hypertension, hypercholesterolemia, and mild heart failure. She is taking:

- Digoxin 0.125 mg po daily
- Captopril 25 mg po twice daily
- Furosemide 40 mg po daily
- Potassium chloride 20 mEq po daily
- Atorvastatin 20 mg po at bedtime

Subjective Data

- Has been following a low-sodium diet
- States her abdomen feels bloated and she has been constipated since the onset of the “flu”
- Has been taking her medications except for the potassium chloride pill because it upsets her stomach.
- Occasionally takes an extra “water pill” when her ankles are swollen

Objective Data

Physical Examination

- Temperature 98.2°F, pulse 88, respirations 20, BP 138/86
- Lungs clear to auscultation, breathing regular and unlabored
- +1 edema bilaterally in ankles
- Muscle strength in upper extremities normal and equal and in lower extremities weak
- Sensation to all extremities normal
- Abdomen distended with hypoactive bowel sounds

Diagnostic Studies

- Lab values
 - Sodium 139.0mEq/L
 - Potassium 3.0mEq/L
 - HCO₃⁻ 25.4mEq/L
 - Chloride 99.5 mEq/L

Discussion Questions

1. What is a possible pathophysiologic cause of E.G.’s muscle weakness and dizziness? What other symptom does E.G. have that may be related to this problem?

Answer: Potassium is critical for neuromuscular and cardiac function, and E.G.’s potassium is low. Low potassium (hypokalemia) is the pathophysiologic cause of E.G.’s muscle weakness and dizziness. Another of E.G.’s symptoms that may be caused by the hypokalemia is the abdominal distension and constipation as the intestines are a muscle and the low potassium may be affecting the peristalsis of the GI tract as well as the muscle tone to defecate.

Rationale: Because the ratio of ECF potassium to ICF potassium is the major factor in the resting membrane potential of nerve and muscle cells, potassium imbalances often affect neuromuscular and cardiac function. Changes in smooth muscle function may lead to decreased gastrointestinal (GI) motility (e.g., constipation, paralytic ileus).

2. What factors contributed to the development of this electrolyte imbalance?

Answer: E.G. is on a diuretic (furosemide) that promotes loss of fluid as well as electrolytes and can cause hypokalemia. E.G. also has not been taking her potassium supplement. In addition, E.G. recently had the “stomach flu” with vomiting and diarrhea, which are additional sources for loss of potassium.

Rationale: The most common causes are abnormal losses from either the kidneys or GI tract. GI tract losses are associated with diarrhea, laxative misuse, vomiting, and ileostomy drainage. Renal losses occur when a patient is diuresing or has a low magnesium level.

3. What should you be on an alert for in a patient who is on furosemide and digoxin and why?

Answer: Furosemide promotes loss of fluid and electrolytes and can result in hypokalemia. Although hypokalemia can cause dysrhythmias in anyone, patients taking digoxin are at increased risk because hypokalemia increases the digoxin-induced inhibition of the Na^+ , K^+ -ATPase, which in turn leads to increased automaticity of Purkinje fibers. Because low potassium can precipitate dysrhythmias, it is important that serum potassium levels be kept within a normal range.

Rationale: Because patients on digoxin therapy have an increased risk of toxicity if their serum potassium level is low, monitor the patient for digitalis toxicity. Patients who have confusion, lethargy, or GI problems, including nausea or vomiting or poor appetite, may have digitalis toxicity. Visual problems, including blurred vision and changes in color vision, may be seen in digitalis toxicity.

4. What additional signs and symptoms should you assess E.G. for?

Answer: Because E.G. has a 3-day history of vomiting and diarrhea, you should assess for manifestations related to a potential fluid volume deficit. This includes assessing the adequacy of urinary output, determining the presence of postural hypotension, assessing the moistness of the mucous membranes, obtaining a weight, evaluating skin turgor, and checking capillary refill.

Rationale: *Fluid volume deficit* can occur with abnormal loss of body fluids (e.g., diarrhea, vomiting, hemorrhage, polyuria), inadequate fluid intake, or a plasma to interstitial fluid shift. The patient with fluid volume deficit is at risk for falls because of orthostatic hypotension, muscle weakness, and changes in level of consciousness. Assess level of consciousness, gait, and muscle strength.

5. What diagnostic test is indicated and why?

Answer: An electrocardiogram (ECG) should be done to identify the presence of any dysrhythmias associated with the hypokalemia. If changes were noted on E.G.'s ECG, she likely would be admitted to the hospital for treatment of her low potassium level.

Rationale: Hypokalemia alters the resting membrane potential, resulting in hyperpolarization (an increased negative charge within the cell) and impaired muscle contraction. Therefore, the manifestations of hypokalemia involve changes in cardiac and muscle function (Table 16.5). The most serious clinical problems are cardiac changes, including impaired repolarization, resulting in a flattened T wave, depressed ST segment, and the presence of a U wave. The P waves peak and the QRS complex is prolonged (Fig. 16.14). There is an increased incidence of heart block and potentially lethal ventricular dysrhythmias.

6. Write three nursing diagnoses that are appropriate for E.G.

Answer:

- Risk for electrolyte imbalance *related to* excess potassium loss
 - Deficient fluid volume *related to* excess ECF losses and decreased fluid intake
 - Risk for activity intolerance *related to* muscle weakness
 - Risk for injury *related to* muscle weakness and hyporeflexia
 - Potential complication: dysrhythmias

Rationale: Nursing diagnoses and collaborative problems for the patient with a fluid imbalance include: *ECF volume deficit*: Fluid imbalance, Impaired cardiac output, Acute confusion, Potential complication: hypovolemic shock.

7. What interprofessional care would you anticipate for E.G.?

To address any fluid volume deficit, you would anticipate E.G. receiving IV replacement therapy. Initiate IV access and begin fluid replacement therapy. Obtain vital signs per protocol. Initiate daily weights and intake and output. Administer any as-needed antiemetic medications. To address hypokalemia, anticipate E.G. receiving potassium supplementation. Initiate ECG monitoring and assess the results of periodic electrolyte measurements.

Rationale: Give IV fluids as ordered. Carefully monitor the rates of infusion of IV fluid solutions, especially when you are giving large volumes of fluid. Fluids should be easily accessible. Monitor laboratory results when available and calculate the serum osmolality. The patient with a fluid volume deficit often has increased BUN, sodium, and hematocrit levels with increased plasma and urine osmolality. Intake and output records give valuable information about fluid and electrolyte problems. An accurately recorded intake and output will identify sources of excess intake or fluid losses. Daily weights are the most accurate measure of volume status. Obtain the weight under standardized conditions. Patients who are critically ill and those at risk for hypokalemia should have continuous ECG monitoring to detect cardiac changes. Monitor serum potassium levels and urine output as appropriate.

8. What instructions should you give E.G. regarding the signs and symptoms of this electrolyte imbalance and how to prevent it?

Answer: Because potassium is critical for neuromuscular and cardiac function, E.G. should be instructed to watch for such things as muscle weakness, leg cramps, and an irregular pulse and to notify the health care provider if these occur. To prevent this, E.G. should also be instructed to take her potassium supplement and/or eat foods high in potassium such as bananas, apricots, avocado, broccoli, and squash and have her serum potassium level checked regularly.

Rationale: Consuming potassium-rich foods can usually correct mild hypokalemia. See Table 16.6 for foods that are high in potassium.

Teach patients ways to prevent hypokalemia (Table 16.7).