WARNINGS AND PRECAUTIONS
- Patients with renal insufficiency are exempt from these guidelines (e.g., serum creatinine ≥ 2 mg/dL, or patients on any form of renal replacement therapy (intermittent or continuous)).
- These guidelines are meant to assist with empiric dosing of electrolytes for ICU patients; doses may need to be adjusted based on patient-specific factors and responses to initial doses.
- Goal serum concentrations may also need to be adjusted based on patient-specific factors.
- These guidelines are for routine supplementation of electrolytes; they are not meant for treatment in urgent or emergent situations.

POTASSIUM

Goal serum potassium concentration 4.0 – 5.0 mEq/L

Treatment of Hypokalemia

*RN to decide route based on available access.

Any dose above 20 mEq may be administered as a combination of oral & intravenous.

<table>
<thead>
<tr>
<th>Serum potassium concentration</th>
<th>Intravenous potassium dose†</th>
<th>Oral potassium dose</th>
<th>Recheck serum potassium concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.8 – 3.9 mEq/L</td>
<td>20 mEq IVPB</td>
<td>20 mEq (1 packet)</td>
<td>Within 2-4 hours of completing dose</td>
</tr>
<tr>
<td>3.5 – 3.7 mEq/L</td>
<td>40 mEq IVPB</td>
<td>40 mEq (2 packets)</td>
<td>Within 2-4 hours of completing dose</td>
</tr>
<tr>
<td>3.2 – 3.4 mEq/L</td>
<td>60 mEq IVPB</td>
<td>60 mEq (3 packets)</td>
<td>Within 2-4 hours of completing dose</td>
</tr>
<tr>
<td>&lt; 3.1 mEq/L</td>
<td>80 mEq and notify MD</td>
<td>80 mEq (4 packets) and notify MD Must be administered in combination with IV</td>
<td>Immediately after completing dose</td>
</tr>
</tbody>
</table>

† Rate of Intravenous Potassium Infusion
10 mEq potassium/hour; can increase to 20 mEq/hour, but continuous cardiac monitoring and infusion via a central venous catheter are recommended for infusion rates > 10 mEq potassium/hour. Maximum of 40 mEq potassium/hour in emergency situations.

Maximum Potassium Concentration
80 mEq/L via a peripheral vein; up to 120 mEq/L via a central vein (admixed in NS or ½ NS)

**Consider adding scheduled oral potassium chloride as indicated**

References:
CALCIUM

Goal serum ionized calcium concentration 1.12 – 1.3 mmol/L

Treatment of Hypocalcemia
Oral treatment preferred when possible.
IV treatment preferred whenever patient is symptomatic.

<table>
<thead>
<tr>
<th>Serum ionized calcium concentration</th>
<th>Oral Calcium Citrate dose</th>
<th>Intravenous Calcium Gluconate dose</th>
<th>Recheck serum calcium concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.05 – 1.11 mmol/L</td>
<td>2 tablets</td>
<td>1 g over 30 – 60 minutes</td>
<td>With next AM lab draw</td>
</tr>
<tr>
<td>0.99 – 1.04 mmol/L</td>
<td>3 tablets</td>
<td>2 g over 30 – 60 minutes</td>
<td>Within 4 – 6 hours of completing dose</td>
</tr>
<tr>
<td>0.93 – 0.98 mmol/L</td>
<td>Not recommended</td>
<td>3 g over 60 minutes</td>
<td>Within 4 – 6 hours of completing dose</td>
</tr>
<tr>
<td>&lt;0.93 mmol/L</td>
<td>Not recommended</td>
<td>4 g over 60 minutes and notify MD</td>
<td>Within 4 – 6 hours of completing dose</td>
</tr>
</tbody>
</table>

1 g calcium citrate = 10.5 mEq calcium.

Each tablet of calcium citrate + vitamin D contains 315 mg of calcium citrate (66 mg elemental calcium, 3.3 mEq calcium) and 250 units of vitamin D (cholecalciferol).

1 g calcium gluconate = 4.56 mEq calcium

Maximum rate of intravenous infusion = 1.5 mEq calcium/minute

Corrected serum [Ca++] (mg/dL) = measured serum [Ca++] (mg/dL) + [0.8 x (4 – serum albumin (g/dL))]

References:
MAGNESIUM

Goal serum magnesium concentration 2.0 – 2.4 mg/dL

**Intravenous Treatment of Hypomagnesemia**

<table>
<thead>
<tr>
<th>Serum magnesium concentration</th>
<th>Intravenous magnesium sulfate dose†</th>
<th>Oral magnesium oxide dose</th>
<th>Recheck serum magnesium concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6 – 1.9 mg/dL</td>
<td>2 g</td>
<td>800 mg</td>
<td>4 to 6 hours after dose if symptomatic otherwise with next AM lab draw</td>
</tr>
<tr>
<td>1.0 – 1.5 mg/dL</td>
<td>4 g</td>
<td>Not recommended</td>
<td>4 to 6 hours after dose if symptomatic otherwise with next AM lab draw</td>
</tr>
<tr>
<td>&lt; 1.0 mg/dL</td>
<td>6 g and notify MD</td>
<td>Not recommended</td>
<td>4 to 6 hours after dose if symptomatic otherwise with next AM lab draw</td>
</tr>
</tbody>
</table>

Rate of intravenous infusion of magnesium

Recommend infusing 1 g magnesium sulfate/hour (~8 mEq magnesium/hour), up to maximum of 2 g magnesium sulfate/hour (doses of up to 32 mEq magnesium can be given over 4 – 5 minutes in severe symptomatic hypomagnesemia) (urgent or emergent situation))

† 1 g magnesium sulfate = 8.1 mEq magnesium

**Consider adding scheduled oral magnesium oxide as indicated**

References:
Dickerson RN, Brown RO. Hypomagnesemia in hospitalized patients receiving nutritional support. *Heart & Lung.* 1985; 14:561-569.
PHOSPHORUS / PHOSPHATE

Goal serum phosphorus concentration 2.7 – 4.6 mg/dL

**Intravenous Treatment of Hypophosphatemia**

<table>
<thead>
<tr>
<th>Serum phosphorus concentration</th>
<th>Intravenous phosphate dose*†</th>
<th>Oral phosphate dose</th>
<th>Recheck serum phosphorus concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0 – 2.6 mg/dL</td>
<td>15 mmol over 2 hours</td>
<td>500 mg (16 mmol, 2 packets)</td>
<td>With next AM lab draw</td>
</tr>
<tr>
<td>1.5 – 2.0 mg/dL</td>
<td>30 mmol over 4 hours</td>
<td>1000 mg (32 mmol, 4 packets)</td>
<td>Within 4 – 6 hours of completing dose</td>
</tr>
<tr>
<td>&lt; 1.5 mg/dL</td>
<td>45 mmol over 6 hours</td>
<td>Not recommended</td>
<td>Within 4 – 6 hours of completing dose</td>
</tr>
</tbody>
</table>

*Maximum infusion rate = 7 mmol phosphate/hour.

Per protocol all intravenous doses will be replaced as sodium phosphate. If patient is hypernatremic or hypokalemic, contact physician regarding possibly replacing as potassium phosphate instead. A separate order will be needed for potassium phosphate.

1 mMol sodium phosphate = 1.33 mEq sodium
1 mMol potassium phosphate = 1.47 mEq potassium

Each packet of oral phosphate replacement contains 8 mmol phos, 7 mEq potassium, 7 mEq sodium

References:

Not in Omnicell.
Must call pharmacy to dispense.

Approved by: Critical Care Steering Committee, 3/2010
Pharmacy and Therapeutics Committee, 4/2010
Michigan Critical Care Collaborative Network

Material Attribution
Author(s): Adult ICU Directors and Nick Farinas
Institution or Source: Michigan Medicine

Notes/Summary