Letters to the Editor

Additional Evidence for the Treatment of Potassium Disorders

To the Editor: I commend Dr. Kim and colleagues for addressing such a broad and important topic.[1] Deep tendon reflexes may be affected by extremes of potassium levels and are an important part of the physical examination. Calcium chloride must be administered through a central line, whereas 20 to 40 mEq per L of potassium per hour may be initially administered via two proximally placed, large-bore peripheral lines, if tolerated. However, the traditionally taught formula that 10 mEq per L of intravenous potassium replacement increases serum potassium by 0.1 mEq per L (0.1 mmol per L) is a great memory tool, it is not valid for extreme hypokalemia, as demonstrated by the Segal equation.

Although not currently in the guidelines, more recent data support the following:

- All hospitalized patients should maintain a potassium level between 3.5 and 5 mEq per L (3.5 to 5 mmol per L) instead of 4 to 5 mEq per L (4 to 5 mmol per L) based on large cohort studies showing no difference in all-cause in-hospital mortality, intensive care unit transfers, ventricular fibrillation, cardiovascular death, or cardiac arrest.[2-4]
- When hypokalemia is suspected, administer 1 to 2 g of magnesium sulfate in an intravenous bolus to decrease the risk of torsades de pointes because it is quicker than intravenous potassium and is analogous to administering calcium gluconate in the setting of hyperkalemia.
- For hyperkalemia, use 5 units of intravenous insulin because this is equally effective as 10 units, with a lower hypoglycemia risk.[5]
- For hyperkalemia with hypovolemia and without metabolic acidosis, use lactated ringers instead of normal saline to avoid further transcellular shifts from hyperchloremic metabolic acidosis.
- For hyperkalemia with hypovolemia and metabolic acidosis, consider the addition of isotonic bicarbonate solution.
- When contemplating between diuresis or dialysis for hyperkalemia, consider the "nephron bomb," which includes:
  - Loop diuretic (e.g., 160 mg intravenous furosemide or 4 mg intravenous bumetanide),
  - Thiazide diuretic (500 to 1,000 mg intravenous chlorothiazide or 5 to 10 mg metolazone),
  - As needed, acetazolamide (250 to 1,000 mg intravenously or orally),
  - As needed, fludrocortisone (0.2 mg orally), particularly in patients taking angiotensin-converting enzyme inhibitors or angiotensin receptor blockers.[6]

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In Reply: We thank Dr. Rebedew for his thoughtful comments. We agree that deep tendon reflexes may be depressed or absent on examination. Although not explicitly stated, calcium gluconate has some advantages over calcium chloride. Calcium gluconate can be administered through peripheral intravenous access, whereas calcium chloride should be administered through a

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central line or a deep vein due to the risk of tissue necrosis and thrombophlebitis.[1]

The literature does suggest differing recommendations for targeted goal serum potassium of 3.5 vs. 4 to 5 mEq per L. We chose to highlight the recommendation for patients with chronic kidney disease or heart failure because this is the area with the strongest available evidence; however, its limitations are reflected in the Strength of Recommendation evidence rating of B. The references used in your letter examined potassium levels in patients with myocardial infarction. One reference only included patients with acute heart failure exacerbation.

The literature on emergent management of hypokalemia is limited. During our review, we found no recommendations for an analogous hyperkalemia management technique to stabilize the cardiac membrane. Rather, electrolytes are aggressively corrected, and magnesium sulfate is administered as part of the comprehensive treatment of torsades de pointes, but not prevention.[2,3]

In treating hyperkalemia, 5 units of intravenous insulin are as effective as 10 units with a lower risk of hypoglycemia, but only for patients with renal insufficiency; this recommendation may not be generalizable to all patients with hyperkalemia. The most recent reviews support 10 units of intravenous insulin with 50 mL of dextrose.[4]

The current evidence does not definitively favor one resuscitative fluid for each clinical scenario. In the most critically ill adults, balanced crystalloids such as lactated ringers have favorable outcomes.[5]

The recommendation for dosing of isotonic bicarbonate in patients who have hyperkalemia with metabolic acidosis and other important considerations are provided in Table 6.

Although the described strategy of maximum dosing of three diuretics and fludrocortisone is aligned with the importance of kaliuresis in emergent hyperkalemia, the supporting article does not provide references for the specific recommendations. Fludrocortisone should be used with caution in patients with heart failure and is associated with significant long-term effects.[6]

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