Current Controversies in the Management of Hyperkalemia

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Disclosure

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Blog post summarizing key points from today’s presentation

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Debates in the Management of Hyperkalemia: A Focus on Calcium and Insulin

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Ca

Calcium-rich foods include:
- Milk
- Yogurt
- Cheese
- Spinach
- Almonds
- Sardines
- Lentils
At what potassium concentration should calcium be administered?

A 9.0 mmol/L
B 7.1 mmol/L
C 5.3 mmol/L
D It depends
At what potassium concentration should calcium be administered?

A 9.0 mmol/L
B 7.1 mmol/L
C 5.3 mmol/L
D It depends
K⁺ 9.0 mmol/L
K⁺ 7.1 mmol/L
$K^+ \ 5.3 \ mmol/L$
≥ 2 gm

≥ 1 gm
Which calcium salt works faster?

- A Calcium chloride
- B Calcium gluconate
Onset: 3 min  
Duration: 30 min
Ionization and Hemodynamic Effects of Calcium Chloride and Calcium Gluconate in the Absence of Hepatic Function

Thomas J. Martin, M.D.,* Yoogoo Kang, M.D.,† Kerri M. Robertson, M.D., F.R.C.P.(C.),* Mohamed A. Virji, M.D., Ph.D.,† Jose M. Marquez, M.D.†

Equal rise in ionized Ca$^{2+}$
Calcium Chloride Versus Calcium Gluconate: Comparison of Ionization and Cardiovascular Effects in Children and Dogs

Charles J. Cote', M.D.,* Lambertus J. Drop, M.D.,† Alfred L. Daniels, M.S.,‡ David C. Hoaglin, Ph.D.§
Equal rise in ionized Ca$^{2+}$

CaCl\textsubscript{2} NOT faster
Which calcium salt works faster?

A Calcium chloride

B Calcium gluconate
5 cases
Flawed animal models
The effects of IV calcium in patients with digoxin toxicity.


<table>
<thead>
<tr>
<th>Calcium</th>
<th>No calcium</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 deaths (22%)</td>
<td>27 deaths (20%)</td>
</tr>
<tr>
<td>0 dysrhythmias</td>
<td></td>
</tr>
</tbody>
</table>
What is the most common insulin dose used for hyperkalemia?

A. 5 units IV
B. 10 units IV
C. 20 units IV
D. 20 units/hr IV
What is the most common insulin dose used for hyperkalemia?

A. 5 units IV
B. 10 units IV
C. 20 units IV
D. 20 units/hr IV
10 units IV insulin ↓ 1 mmol/L

~ 10%


Onset: 5-10
Peak: 25-30
Duration: 120-180
30-60 min
No DM

No DM meds

Lower glc (104 vs 162)

Renal


<table>
<thead>
<tr>
<th>Initial [glucose]</th>
<th>Initial Dextrose Dose</th>
<th>Supplemental Dextrose **</th>
<th>Glucose Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 200 mg/dL (&gt; 11.1 mmol/L)</td>
<td>None</td>
<td>50 mL (25 gm) of D50 if blood glucose &lt; 70 mg/dL</td>
<td>Hourly up to 3 hours</td>
</tr>
<tr>
<td>100-200 mg/dL (5.6-11.1 mmol/L)</td>
<td>50 mL (25 gm) of D50</td>
<td>50 mL (25 gm) of D50 if blood glucose &lt; 70 mg/dL</td>
<td>Hourly up to 3 hours</td>
</tr>
<tr>
<td>&lt; 100 mg/dL (&lt; 5.6 mmol/L)</td>
<td>100 mL (50 gm) of D50* OR 50 mL (25 gm) of D50 + D10 infusion 250 mL/hr for first hour</td>
<td>50 mL (25 gm) of D50 if blood glucose &lt; 70 mg/dL</td>
<td>q 30 minutes for first hour, then hourly up to 3 hours</td>
</tr>
</tbody>
</table>

D50 = dextrose 50%; D10 = dextrose 10%

Summary

1. ECG changes? Give calcium

2. Calcium gluconate = CaCl₂

3. Dig toxicity? Give antidote (+ calcium)

4. Anticipate hypoglycemia
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Debates in the Management of Hyperkalemia: Sodium “Redux” and Novel Therapies

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Sodium bicarbonate is frequently administered to hyperkalemic patients in my institution.

A  Yes
B  No
Preferred Therapy of Hyperkalemia in Renal Insufficiency: Survey of Nephrology Training-Program Directors

Sodium bicarbonate works in hyperkalemia because it:

A. Enhances K\(^+\) excretion
B. Shifts K\(^+\) to the intracellular space
C. Decreases H\(^+\) in the extracellular fluid
D. Works some other way that I learned about but cannot recall right now
Severe acidosis and hyperpotassemia treated with sodium bicarbonate infusion.
“We suggest that intravenous sodium bicarbonate infusion is not used routinely for the acute treatment of hyperkalemia.”

Hyperkalemia Guidelines, UK Renal Association 2014.

“Given this uncertainty we still use sodium bicarbonate to treat acute hyperkalemia in patient with a significant degree of acidosis, but not as the only emergency therapy.”

Management of severe hyperkalemia

Lawrence S. Weisberg, MD

Citations: 130 (as of October 2016)

Am Heart J 1962; 64:483-488.

Depolarization
Cellular perfusion
Afterload
Dilution

Code Name: Nav1.5

The dose of sodium polystyrene sulfonate routinely given for hyperkalemia within my institution is:

A 0 g
B 15 g
C 30 g
D 60 g
The use of polystyrene sulfonate in the inpatient management of hyperkalemia.

100 mg Na per g SPS

Aldosterone and ESRD

2009: Cathartic controversy: 33% / 70%?

Time / Replication

“In summary, we do not use resins for treatment of acute hyperkalemia. In the setting of chronic hyperkalemia, it seems that the addition of resins to cathartics adds little to the induction of diarrhea alone.”

I believe the novel therapies for hyperkalemia (patiromer and sodium zirconium cyclosilicate) may have a role in treating hyperkalemia.

A  Yes

B  No
"Me too"

CKD and CV

Long-term

BBW

Mg

Selectivity

Energy

ZS-9

Sodium Zirconium Cyclosilicate for Urgent Therapy of Severe Hyperkalemia.

<table>
<thead>
<tr>
<th>Time (')</th>
<th>Change in Serum K (mmol/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1'</td>
<td>0.4 mmol/L</td>
</tr>
<tr>
<td>2'</td>
<td>0.6 mmol/L</td>
</tr>
<tr>
<td>4'</td>
<td>0.7 mmol/L</td>
</tr>
</tbody>
</table>

Serum K 6.1 to 7.2 mmol/L + 10g ZS-9
1. Sodium bicarbonate: More than meets the eye for acute hyperkalemia.
2. Think twice about sodium polystyrene sulfonate.
3. Patiromer = Chronic.
4. Sodium zirconium cyclosilicate: Don’t jump on the bandwagon.
Debates in the Management of Hyperkalemia: Sodium “Redux” and Novel Therapies

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