Magnesium, Calcium, and Bicarbonate

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Mastering Emergency Medicine

• Secure the ABC’s
• Consider or give NGT
  • Five Causes
  • Five Steps
  • Five Reasons for almost everything
SECURE THE ABC’S
Hyperkalemia is the Most Dangerous Acute Electrolyte Emergency
The first sign of Hyperkalemia is... DEATH!
Hyperkalemia 1

Tall Peaked T Wave
Hyperkalemia 2

Loss of P Wave

Tall Peaked T Wave
Widened QRS Merging
With Tall T Wave

Hyperkalemia 3
What is calcium’s effect on serum potassium?
Calcium = Emergency = Wide QRS

- Calcium Tricks Cells
- Calcium Does NOT Affect Levels
Calcium in Hyperkalemia

- Tricks Cell
- Recreates Electrical Gradient
- Temporary, lasts only 5-20 minutes
- Dose is 5-20 cc CaCl IV
- Potentially Dangerous

Be sure before using!
CaCl \times 1,000,000 = \text{Ca Gluconate}
Only give calcium if . . .

a wide QRS
Driving K into the Cell

• Glucose & Insulin
• Bicarbonate
• Beta Agonists
• Volume
• Magnesium
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Bicarbonate For Hyperkalemia

(1) As HCO₃⁻ is added to serum
(2) H⁺ from cell will move extracellularly to buffer alkali load
(3) K⁺ will move intracellularly to maintain the cell’s electroneutrality.
Bicarbonate is Great in Hyperkalemia

but only if:

The Patient is Acidotic
Magnesium
<table>
<thead>
<tr>
<th>Disease</th>
<th>Use</th>
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<tbody>
<tr>
<td>Eclampsia</td>
<td>15/24</td>
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<tr>
<td>Asthma</td>
<td>9/24</td>
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<tr>
<td>Torsades</td>
<td>17/24</td>
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</tbody>
</table>
Magnesium Dosing

Loading Dose:

- 1 – 2 Grams over 0 – 60 minutes

Maintenance Dose:

- ½ - 1 Gram/hour (4-8 meq/hr)
Magnesium For:

- Alcoholics
- Prolonged QT
- Cardiac Arrest
- Cardiac Arrhythmias
- Asthma
Is Magnesium Indicated In Cardiac Arrest?
Magnesium in Cardiac Arrest
Magic Trial

- 156 Cardiac Arrests at Duke
- Randomized to Magnesium or placebo
- 2 grams MgSO$_4$ push; drip if successful
- No difference in survival taking all rhythms
- No difference in VF and VT arrests
MAT and MgSO$_4$

- An excellent antiarrhythmic
- Helps cure bronchospasm
- Helps treat hypokalemia
- Treat underlying cause of MAT
- 2 grams over 5-10 minutes
• Magnesium used to lower HR in Afib

• All patients also received Digoxin

• Lowered HR < 100 in 65% (vs. 34% for placebo)

• 4 pts. got hypotension
Eclampsia

- Calcium Mediated Vasospasm
- Drug of Choice is Magnesium
- 4 - 6 grams of IV or IM
- MgSO$_4$ Blocks Vasospasm
Do women with pre-eclampsia, and their babies, benefit from magnesium sulphate? The Magpie Trial: a randomised placebo-controlled trial

The Magpie Trial Collaborative Group*

Lancet 2002;359:1877-1890

- 10,141 women; Magnesium vs. placebo
- BP ↑ 140-90 and 1+ proteinuria
- Mg decreased eclampsia by 58%
- Decreased seizures by 69%
- Decreased mortality by 45%
Acute Asthma Therapy
First Five Drugs

- $O_2$
- Continuous Beta Agonist
- Anticholinergic Agent
- Steroids
- Magnesium
Conclusions on Magnesium

- Works the best in the worst patients
- 2 grams IV over 1-5 minutes
- Add to 100 cc D$_5$W, run wide open
- Do not forget epi 0.3 SQ or IM
<table>
<thead>
<tr>
<th>Be Suspicious of</th>
<th>Wide QRS</th>
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<tbody>
<tr>
<td>Calcium Only if</td>
<td>Wide QRS</td>
</tr>
<tr>
<td>Bicarbonate Only if</td>
<td>Acidotic</td>
</tr>
<tr>
<td>Magnesium Only if</td>
<td>Severe</td>
</tr>
<tr>
<td>In Eclampsia, Magnesium:</td>
<td>↓ BP + ↓ Seizures</td>
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</tbody>
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