Hypokalemia in Acute Coronary Syndromes and Acute Decompensated Heart Failure

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Disclosures

• No conflicts of interest.
Objectives

1. Describe the impact of lack of potassium replacement guidelines in patients with CVD.

2. Describe the relationship of patient characteristics on the incidence of hypokalemia in ACS and ADHF.

CVD = Cardiovascular disease
ACS = Acute coronary syndromes
ADHF = Acute decompensated heart failure
Potassium Homeostasis

Causes of Hypokalemia

Comorbidities

• Aldosteronism
• Cushing’s syndrome
• Bartter syndrome
• Liddle syndrome
• Hypomagnesemia
• Diarrhea
• Vomiting

Medications

• Diuretics
• Mineralocorticoids
• Glucocorticoids
• β₂-adrenergic agonists
• Aminoglycosides
• Amphotericin B

**Potassium Replacement Guidelines**

- Strategies to achieve/maintain normokalemia must consider:
  - Baseline potassium values
  - Underlying medical conditions
  - Medications
  - Diet and salt intake
  - Adherence to therapeutic regimen

- Lack specific recommendations and goals

Significance in CVD

- Predisposition to hypokalemia
  - Neuroendocrine response
    - ↑ Sympathetic nervous system
    - ↑ Renin-angiotensin-aldosterone system
  - Medications altering serum potassium

- Predisposition to arrhythmias

## Potassium Goals in CVD

<table>
<thead>
<tr>
<th>Disorder</th>
<th>Goal (mEq/L)</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Myocardial Infarction</td>
<td>4.5-5.5</td>
<td>↓ ventricular arrhythmias</td>
</tr>
<tr>
<td>Heart Failure</td>
<td>4.5-5.5</td>
<td>↓ ventricular arrhythmias, ↓ QT, ↓ QTd, Improve prognosis</td>
</tr>
</tbody>
</table>

Evolving Potassium Goals

In-Hospital Mortality According to Serum Potassium in AMI

Implications for Patient Care

- Potassium homeostasis is multifactorial
- Current recommendations are non-specific and evolving
- Recommendations for potassium replacement may not reflect needs of patients with CVD
  - Suboptimal potassium replacement
  - Increased risk of arrhythmias
  - Increased risk of mortality
Study Site

- OU Medical Center – Presbyterian
  - OUHSC campus
  - Academic medical center
  - Total ≈ 325 beds
  - CCU ≈ 30 beds
Methods

Retrospective, descriptive study

Inclusion Criteria

• Admission from July 31, 2010 to July 31, 2013
• ≥18 years of age
• Principal admission diagnosis
  • Unstable angina
  • Non-ST elevation myocardial infarction
  • ST-elevation myocardial infarction
  • Acute decompensated heart failure

Exclusion Criteria

• <18 years of age
• Cushing’s/Addison’s disease
• Corticosteroid use
• Illicit drug use
Methods

- **Primary Objective**
  - Incidence of hypokalemia (K+ <3.5 mEq/L)
  - Descriptive statistics

- **Demographics**
  - Age
  - Gender
  - Ethnicity
  - Comorbidities
  - Charlson comorbidity index score
  - Renal function (Cockcroft-Gault creatinine clearance)
  - Medications
Methods

• Secondary Objective
  – Describe the relationship of the following variables on the incidence of hypokalemia:
    • Principal admission diagnosis
    • Age
    • Gender
    • Ethnicity
    • Renal function
    • Charlson comorbidity index score
    • Medications → β-adrenergic antagonists, RAAS antagonists, diuretics

  – Multiple linear regression ($\alpha = 0.05$)
Preliminary Results

Incidence of Hypokalemia (K+ <3.5 mEq/L)

- USA: 25%
- NSTEMI: 15%
- STEMI: 35%
- ADHF: 30%
Conclusions

• Risk of developing hypokalemia
  – ACS vs. ADHF
  – Comorbidities
  – Renal function
  – Medications

• Potassium replacement protocol
  – Individualized to patients with ACS and ADHF
Which of the following is a consequence of hypokalemia?

A. Hypotension
B. Arrhythmias
C. Angina
D. Hypervolemic
Which of the following predisposes patients to the development of hypokalemia?

A. Cushing’s syndrome
B. Addison’s disease
C. Hypermagnesemia
D. Renin-angiotensin-aldosterone antagonism
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