Potassium on the Wards

Quick Potassium Basics
98% Intracellular. Driven there by Na-K-ATPase pump in the cell membrane.
2% Extracellular and tightly controlled at ~3.7-5.2 mEq/L. K levels outside of this range potentially life-threatening.

<table>
<thead>
<tr>
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<th>Mild-to-Moderate</th>
<th>Severe</th>
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<tbody>
<tr>
<td>Hyperkalemia</td>
<td>6-7 mEq/L</td>
<td>&gt;7 mEq/L and/or symptomatic</td>
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<tr>
<td>Hypokalemia</td>
<td>3-3.4 mEq/L</td>
<td>&lt; 2.5-3 mEq/L and/or symptomatic</td>
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Is it Real? Pseudohyperkalemia
Pseudohyperkalemia: lab findings of falsely ↑ serum K due to K movement out of the cells during or after a blood draw. Suspect in an asymptomatic patient with no apparent cause for K elevation:
1. Lysis of rbc
2. Specimen deterioration (cooling, prolonged storage)
3. ↑wbc, ↑plt
4. Drawing blood downstream from a vein into which K is infusing
5. Trauma: forcible expression of blood (milking a heel stick)
6. Exercise: fist clenching with blood draws

Hyperkalemia Causes
I. Shifting of K into extracellular space
   A. Tissue (lots of cells) damage: burns, crush injury, rhabdo, tumor lysis
   B. Acidosis
   C. Hyperosmolar states
   D. Insulin deficiency

II. Impaired Renal Excretion (↑ total body K)
   A. Renal insufficiency/failure
   B. Endocrine: ↓ renin, ↓ aldosterone, adrenal insufficiency, pseudohypoaldosteronism

III. Iatrogenic
   A. K in IVF/TPN
   B. Lots of meds (NSAIDS, ACE inhibitors, beta blockers, K sparing diuretics, trimethoprim)

Hyperkalemia Signs/Symptoms
Resolve with hyperkalemia correction
I. Muscle: ascending weakness and paralysis
   spincter tone, cranial nerves, and respiratory muscles typically preserved

II. Cardiac
   A. Conduction abnormalities and arrhythmias
   B. EKG changes
      1. Peaked T waves → Loss of P wave → Widened QRS → Sine wave pattern
      2. Rough (NOT perfect) correlation b/w EKG changes and ↑K
         Hyperkalemia can be life-threatening even if EKG nl
         Any EKG changes should be treated as an emergency

Hyperkalemia Treatment
4 Basic Approaches
1. Do no harm: remove any exacerbating factors: K containing IVF, TPN, meds known to cause hyperkalemia
2. Stabilize cell membranes: Calcium
3. Drive K into cells: insulin/glucose, Beta2 agonist (albuterol)
4. Remove excess K from the body: furosemide, Kayexalate, dialysis

Monitoring: continuous cardiac monitors, serial EKG’s, and q1hr K for pt’s who require rapidly acting therapies

Marta King, MD
POTASSIUM ON THE WARD

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MEDITATION DOSING MECHANISM NOTES

Calcium IV 10-20mg/kg Stabilizes myocardium
-Give if any EKG changes and/or K is rapidly increasing (if peaked T waves alone and rapidly acting methods being initiated could consider holding Ca)
Onset: immediate
Duration: up to 1hr

Insulin/Glucose Insulin: 0.1 units/kg + D 25W 2m/kg or D10W 5m/kg Drives K into cells
↑ activity of the Na-K-ATPase pump
Onset: minutes
Duration: Peak ~1hr. Lasts 4-6hrs

Beta2 agonist (Albuterol) 10-20mg neb
Onset: minutes
Peak: ~90 min

Loop diuretic (furosemide) 1mg/kg/dose ↓ total body K by ↑ renal K excretion
Consider adding NS bolus to maximize distal sodium delivery and flow
Onset: 15 min to 1hr

Cation exchange resin Sodium polystyrene sulfonate (Kayexalate) 1-2g/kg PO/NG/PR ↓ total body K by ↑ GI K excretion
Binds K in the colon in exchange for Na
-PO/NG: Peak 4-6hrs
Enema 1-2hrs

Dialysis ↓ total body K Use if:
1) anuric
2) K ↑ rapidly
3) Above measures ineffective

HYPOKALEMIA CAUSES

I. Shifting of K into intracellular space
   A. Alkalosis
   B. Insulin
   C. ↑ Beta-adrenergic activity

II. ↑ K losses (↓ total body K)
   A. GI track
   B. Urine

HYPOKALEMIA SIGNS/SYMPTOMS

Resolve with hypokalemia correction

I. Muscle
   A. Ascending weakness and paralysis. Can include respiratory muscles→resp failure, and GI muscles→ileus
   B. Ischemia: cramping, rhabdomyolysis, myoglobinuria

II. Cardiac
   A. Conduction abnormalities and arrhythmias
   B. EKG Changes (not seen in all pts): ST segment depression and prominent U wave

TREATMENT OF HYPOKALEMIA

I. Investigate and manage any underlying causes
II. Investigate and manage any coexisting alkalosis and/or ↓ Mg
III. Replace K
   A. Enteral (preferred unless pt symptomatic or unable to tolerate)
      1-4 mEq of K/kg/day divided QID-BID
   B. Parenteral: 0.3mEq/kg per dose. Worry about over-correcting and causing hyperkalemia. Pt needs to be on a CR monitor during K bolus infusion. Recheck K following infusion.