Top Gun Phlebotomy
Pseudohyperkalemia

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Disclosure

• Relevant Financial Relationships
  • None

• Off-Label Usage
  • None

Question

• We have a physician that is continuously saying our K+ are too high
• We know the basics (pumping fist, tourniquet on too long, etc.), is there anything else we are missing?
• We have 3 off-site facilities that we have specimens transported from, as well as a tube system within our facility
Data demonstrates that all of the following may reduce the rate of pseudohyperkalemia at an outpatient draw site except…..

1. Preventing fist pumping
2. Preventing temperature extremes during transport
3. Repeating centrifuge SST tubes upon arrival in lab
4. Centrifuging whole blood onsite

CLSI Guidelines

- CLSI GP41-ED 7, Collection of diagnostic venous blood specimens
- Tourniquet time <1 minute
- OK to make fist but do not “vigorously open and close hand” (pumping)
- Allow disinfectant to dry
- For syringe draw, don’t pull back too forcefully
- Gently and thoroughly invert blood tubes
Falsely Elevated K (Pseudohyperkalemia)

- Very common problem with many potential causes
  - Hemolysis from
    - Syringe use, IV start or line draws, small or large diameter needle, inverting tube too vigorously or not enough, underfilling tube
  - K leak from RBC from patient condition
    (familial pseudohyperkalemia, chemical or physical agents)
  - K leak from WBC from patient condition

- Analytical interference
  - Povidone-iodine, benzalkonium-heparin bonded catheters
- Preanalytical variables (non-hemolytic)
  - Fist pumping, tourniquet time, transport temp or conditions, improper or repeat centrifugation, delayed clotting, delayed serum/plasma separation, specimen contamination (order of draw)
Falsely Elevated K (Pseudohyperkalemia)

- Effects of fist pumping
    - Evaluated fist pumping intervention on plasma K, as function of transport temp
    - Mean plasma K from 2 satellite hospitals within 5 miles main lab
    - Mean % plasma K above RR
    - Jan 2002 thru Aug 2005
    - Fist pumping education intervention Aug 2003

Preintervention: Mean monthly K ~4.7 when monthly temp 4 C, down to ~4.4 when monthly temp 19 C
Postintervention: Mean monthly K ~4.5 when monthly temp 4, down to ~4.4 when monthly temp 19 C

Monthly % plasma K above RR
- Pre: Hyperkalemia 13% cold 8% warm
- Post: Hyperkalemia 8% cold 5% warm
Falsely Elevated K (Pseudohyperkalemia)

- Seasonal hyperkalemia Part 1
  - Interaction of tourniquet time, fist pumping, and temperature
  - Fist pumping and tourniquet time >1 min elevate K thru multiple mechanisms
    - Hemolysis, release K muscle, pH changes, hemoconcentration, water shift into cells
  - Cold weather may affect K in 2 ways
    - Make veins harder to find (fist pumping, prolonged tourniquet time)
    - Release K from whole blood during transport
  - Good phlebotomy practice can mitigate seasonal hyperkalemia

Falsely Elevated K (Pseudohyperkalemia)

- Seasonal hyperkalemia Part 2
    - Serum K values from 87 GP practices in UK
    - Aug 2010 thru March 2011
    - 109,177 samples centrifuged at GP office vs. 51,935 sent as whole blood (8-10 hr)
    - Samples centrifuged on site ran 10% lower than those sent as whole blood
      - Aug-Jan whole blood 4.3 → 4.8
      - Aug-Jan onsite 4.3-4.4 all year
Falsely Elevated K (Pseudohyperkalemia)

• Other issues
  • Pneumatic tubes
    • Function of length, pressure, speed (accel/decel), path
    • Do studies on K and H index
  • Improper/repeat centrifugation
    • Don’t repeat centrifuge, fixed angle rotors can distort gel at wrong RPM

Questions or requests…
Email to: MMLHotTopics@mayo.edu

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