CRRT Interactive Hyperkalemia Cases AKI & CRRT conference 2018

Case 1 Potassium Clearance

A 70 kg male is placed on CVVH with a total ultrafiltration rate (effluent rate) of 20 ml/kg/hr. The Blood Flow Rate is 200 ml/min and the Replacement Fluid is administered Post Filter. The patient's potassium is 5.0 meq/L.

What will be the percent change in rate of potassium clearance with increasing the CVVH dose to 25 ml/kg/hr?

A. 10%
B. 15%
C. 20%
D. 25%
E. 30%

Case 2: Hyperkalemia

- An 82-year-old man with diabetes, coronary artery disease, and CKD is admitted to the intensive care unit with hypotension from a lower GI bleed attributed to ischemic colitis. He is resuscitated with blood and intravenous (IV) fluids, with improvement in his blood pressure to 108/70 mmHg. However, over the ensuing 24 hours he becomes anuric, and his ECG shows peaked T waves with a prolonged QRS of 140 ms.
- Laboratory studies show the following: Serum
  - Sodium 138 mEq/L
  - Potassium 7.5 mEq/L
  - Chloride 102 mEq/L
  - Total CO2 17 mEq/L
  - BUN 84 mg/dl
  - Creatinine 3.2 mg/dl
  - Calcium 9.4 mg/dl
  - Arterial pH 7.25
- He is initiated on CVVH with an effluent dose of 2500 ml/h. Blood flow is set to 150 ml/min, and the replacement fluid potassium is 2.0 mEq/L. After 12 hours, his serum potassium remains elevated at 7.2 mEq/L.

Case 2

Which of the following is the MOST appropriate next step to correct his persistent severe hyperkalemia?

A. Change to intermittent hemodialysis

B. Administer two ampules (100 mEq) of sodium bicarbonate

C. Change to CVVHDF

D. Increase the blood flow to 200 ml/min

E. Increase effluent dose to 3000 ml/h

Case 3 Hyperkalemia

- A 60 year old patient with ESRD due to DM, also with ileostomy, afib on warfarin, is admitted to the ICU for severe hyperkalemia complicated by bradycardia and hypotension. He missed HD x 2 d/t AVG malfunction. Initial labs: K 7.5, Cr 14, Na 140, Cl 120, CO2 9, CK 48, LA 5, vbg 7.13, 34/39/11, Hb 11 INR 6. He is treated with 1 amp calcium gluconate x 2, regular insulin 10 U IV + D50, albuterol 20 mg inhaled, bicarbonate and a temporary pacer, which is not capturing. He remains hypotensive on epinephrine. DW 80 kg. He now has a 24 cm femoral dialysis catheter. The on-call dialysis nurse is a 1.5 hours away.

- You have decided to start with CRRT while waiting for the intermittent nurse.

- Your pharmacy stocks the following fluids for RF or dialysate and the night pharmacist is willing to compound something for you.

-Ca 0, K 2, HCO3- 22
-Ca 3.5, K 4, HCO3- 32
-Ca 3.5, K 2, HCO3- 32

Case 3 Hyperkalemia

- Which of the following is the best prescription?

A. Regional citrate anticoagulation + prefilter CVVH 1600 ml/hour (dose 20 ml/kg/hr) using Ca 0, K 2, HCO3- 22
B. Regional citrate anticoagulation + CVVHD 1600 ml/hour (dose 20 ml/kg/hr) using Ca 0, K 2, HCO3- 22
C. No citrate + CVVHDF with 2000 ml/hour prefilter and 200 ml/hour post filter (dose 50 ml/kg/hr) using Ca 3.5, K 2, HCO3- 32
D. Give 60 grams of kayexlate po and wait for the hemo nurse.
E. No citrate + CVVHDF with 2000 ml/hour prefilter and 200 ml/hour post filter (dose 50 ml/kg/hr) using Ca 3.5, K 0, HCO3- 32 that the pharmacist compounds for you

Answers

Case 1

- The K will be removed 25% faster (There is a 25% change from 20 to 25 ml/kg/hr)
- An increase in dose of 5 ml/kg/hr over 20 ml/kg/hr is a 25% change
- 5 ml/kg/hr divided by 20 ml/kg/hr is 0.25

Case 2

- The etiology for his hyperkalemia is multifactorial: he is receiving potassium with the blood transfusions, there is potassium shift out of cells from both his acidemia and ischemic bowel, and he is not able to excrete this potassium load because he is anuric
- Increasing the effluent rate of CVVH would be of limited benefit. Assuming a constant plasma K of 7.2 mEq/L and an effluent flow rate of 2500 ml/h, 18 mEq K will be removed per hour
  - 7.2 mEq/L X 2.5 L/h = 18 mEq/h However, the replacement fluid contains 2 mEq/L potassium, so he will receive 5 mEq K per hour, for a net K removal of 13 mEq/h. Increasing the effluent dose to 3000 ml/h would only improve this to 15.6 mEq/h of K removed (7.2 X 3 L/h = 21.6 mEq/h) – 2 mEq/h X 3 L/h) = 15.6 mEq/h.
- Another option is to use 0 K solution with CVVHD and effluent rate 8 L/hr. K removed would be 7.2 mEq/L x 8 L/hr = 58 mEq K removed per hour.

Case 3 Hyperkalemia

- A. Incorrect. Would use higher delivered dose d/t life threatening hyperkalemia. He also is already anticoagulated with INR of 6 and hx of warfarin use. Either high dose CVVH or CVVHD is acceptable
- B. Incorrect. Would use higher delivered dose d/t life threatening hyperkalemia. He also is already anticoagulated with INR of 6 and hx of warfarin use. Either high dose CVVH or CVVHD is acceptable
- C. Correct. Given hyperkalemia and acidosis, would use higher than standard CRRT dose to more quickly correct the electrolyte abnormality. He is already anticoagulated with INR of 6 and hx of warfarin use so no compelling need for citrate
- D. Incorrect. Kayexlate would be minimally effective in this situation as he has an ileostomy. Also, it would take hours to be effective. He has life threatening hyperkalemia despite aggressive medical management. Would not wait an additional 1.5 hours for the nurse to arrive + at least 0.5 hours for the nurse to get the machine to the ICU and prime before starting treatment.
- E. Incorrect. In general, it is preferred to use commercially available fluids. These are standard preparations with a quality control process as part of the manufacturing of the fluid. It will take time to determine how to write & enter compounding orders into EMR and for the pharmacist to compound this for you. There may not be a quality control process after compounding. Prolonged use of zero K bath is dangerous esp at a high CRRT dose.