Errors in Treating Hyperkalemia with Insulin

Hyperkalemia, or high serum levels of potassium above normal range, is an electrolyte imbalance that can cause serious and lethal cardiac arrhythmias. Hyperkalemia is typically corrected with one or more intravenous (IV) doses of 50% dextrose and an IV bolus dose of 10 units of rapid-acting insulin or short-acting insulin.

There is a high risk for error when managing hyperkalemia. IV insulin is difficult to measure and administer and a dosing mistake may cause a significant drop in blood glucose. In addition, there are inconsistencies in dextrose and insulin dosing, the order in which dextrose and insulin should be administered, and patient variables such as renal failure.

Errors in treating hyperkalemia with insulin may result from:

- **Delay in treatment** due to transfer to another unit or no immediate signs of change in the patient's electrocardiogram (EKG). While EKG changes such as peaked T waves, prolonged PR-interval, and widened QRS-interval may help detect hyperkalemia, they do not accurately reflect severity. Patients with high serum potassium levels should be treated immediately even without EKG changes since lethal arrhythmias can develop quickly.
- **Wrong administration route** of insulin (i.e. given subcutaneously instead of IV). Insulin should be administered IV when treating hyperkalemia to promote consistent absorption. Standardized order sets should be developed for IV insulin and hyperkalemia protocols.
- **Wrong dose** might be administered if:
    - Insulin is measured in mL instead of units.
    - Measurement markings on syringes are misread.
    - Differences between insulin syringes and other parenteral syringes are not understood.
    - Failure to recognize that the U-100 strength indicates 100 units in each mL.
    - Clinicians administer insulin outside their scope of practice and/or without proper training and education.
- **Lack of luer-compatible insulin syringe** without a needle to administer IV via needleless access devices and lines. Most insulin syringes have a needle for subcutaneous administration and many hospitals only use insulin pens, which cannot be used to measure and administer IV insulin doses using a needleless system. Unsafe practices have arisen when:
    - Using hyperkalemia treatment kits that contain a vial of rapid- or short-acting insulin and a tuberculin syringe instead of an insulin syringe without a needle.
    - Calculating volume of insulin needed so a luer-compatible (non-insulin) syringe can be used, however this has resulted in calculation errors.
    - Measuring doses in an insulin syringe, then transferring the dose to a parenteral syringe to administer IV.

Recommendations to prevent hyperkalemia treatment errors

- Implement standardized hyperkalemia treatment protocols which include:

References

1. Institute for Safe Medication Practices. (2018). *Nurse Advise-ERR.* Retrieved from Institute for Safe Medication Practices: http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201803.pdf

  - Established potassium level that should be treated.
  - Pharmacologic and clinical interventions.
  - Parameters to assess patient response to treatment.
  - Monitor glucose levels and signs of hypoglycemia during and for several hours after insulin is given (hypoglycemia may occur 6 hours after dextrose and insulin administration).
  - Orders should specify:
    - Insulin type, dose, and route of administration.
    - Method to flush IV line to ensure entire insulin dose has been administered.
    - Dextrose concentration, volume, and route of administration.
    - Doses and administration information for other medications prescribed (i.e. sodium bicarbonate, calcium chloride/gluconate, furosemide).
- Develop and implement standard order sets:
  - Automatically populated with correct dose and route of administration for all medications, including insulin.
  - Include a reminder in the order set to use a luer-compatible insulin syringe without a needle if insulin should be given IV push.
  - Include instructions on flushing the IV line or access site.
- Treatment should not be delayed based on lack of symptoms or EKG changes. If patient must be transferred to another unit, complete the transfer as soon as possible to minimize delays.
- Utilize pharmacy kits which include
  - Insulin in ready-to-use form, either in a luer-compatible insulin syringe that can connect to a needleless system or diluted in a small bag of IV fluid.
  - 50% dextrose injection
  - 3 mL vial of rapid- or short-acting insulin
  - Luer-compatible needleless insulin syringe
  - Removable needle or transfer device to withdraw insulin from the vial
  - Label for the syringe
  - Vial or syringe of flush solution
  - Alcohol swabs
  - Directions for preparing and administering the dose

  If 24-hour pharmacy service is not available, stock these kits on patient care units in automated dispensing cabinets (ADCs).

- Luer-compatible insulin syringes may be stocked in critical care units and emergency departments, but use should be limited to pharmacy-dispensed insulin doses or in hyperkalemia kits to prevent subcutaneous insulin from being administered IV.
- Mandate an independent double check of all IV insulin doses to confirm patient, insulin type, concentration, dose, amount in the syringe, route of administration, and indication.

References

1. Institute for Safe Medication Practices. (2018). *Nurse Advise-ERR.* Retrieved from Institute for Safe Medication Practices: http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201803.pdf

- Provide education to all clinicians and students who may prescribe, dispense, and administer medications used to treat hyperkalemia. Be sure to provide the following information:
    - Types, concentration and safe dosage ranges of insulin used during treatment.
    - Use of luer-compatible needleless insulin syringes.
    - Differences between insulin syringes and other parenteral syringes.
    - How measure insulin doses.
    - How to administer IV insulin.

  Define the scope of practice for healthcare professionals including who may or may not administer IV insulin and restrict insulin preparation and administration to clinicians who are competent.

References

1. Institute for Safe Medication Practices. (2018). *Nurse Advise-ERR.* Retrieved from Institute for Safe Medication Practices: http://www.ismp.org/newsletters/nursing/issues/NurseAdviseERR201803.pdf