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High Risk Medication Errors - Part 1

Session Overview

The Emergency Department is a fast-paced environment in which important treatment decisions are sometimes made with limited time. Medication mistakes, particularly those with high-risk drugs, can increase morbidity and mortality. The goal of this two-part talk is to introduce several high-risk medications and provide practical pearls to help avoid common, potentially serious mistakes.

Objectives

1) List the five high-risk medications/medication classes that make up the PINCH acronym.
2) When treating a hyperkalemic patient with insulin, design a dextrose regimen to avoid hypoglycemia.
3) Utilize a low-dose naloxone dosing scheme for select opioid overdoses.
4) Identify 3 factors that make heparin a high-alert medication.
5) Identify the two most critical pieces of information needed on syringes labeled in the ED

Background

- Medication errors are common. In one academic medical center's evaluation of medical resuscitations, 1 out of 2 doses was administered in error. 14% were considered at least moderate in severity. 46% were prescribing errors, 28% administration technique, 14% mislabeling, 10% preparation, and 2% improper doses. (Gokham 2012)
- The Institute for Safe Medication Practices (ISMP) defines high-alert medications as "drugs that bear a heightened risk of causing significant patient harm when they are used in error."
    - ISMP maintains a comprehensive, updated list of high-alert medications
- An easy acronym to remember high-risk medications: PINCH. P - Potassium, I - Insulin, N - Narcotics, C - Chemotherapy, H - Heparin

Potassium

- Concentrated potassium formulations are not stocked on most patient care units, but errors still occur (ISMP 2007)
- Most institutions have detailed guidelines for IV potassium administration, including maximum concentrations and infusion dose limits
- Treating Hyperkalemia with Insulin
    - How insulin works
        - Temporarily shifts potassium intracellularly through a complex process of activating Na+-K+ ATPase and by recruitment of intracellular pump components into the plasma membrane. Insulin binding to specific membrane receptors results in extrusion of Na+ and cellular uptake of K+. (Hundal 1992)
    - The right insulin dose
        - 5 unit boluses up to 20 unit/hr infusions have been used (Blumberg 1988). Most common dose is 10 units IV regular insulin bolus (lowers K+ ~ 0.5-1 mEq/L).

- Preventing hypoglycemia
  - Incidence of hypoglycemia
    - A 10 unit dose of IV regular insulin has an onset of action ~5-10 minutes, peaks at 25-30 minutes, and lasts 2-3 hours. IV dextrose lasts < 1 hour.
    - Overall incidence of hypoglycemia appears to be ~10%, but could be higher (Allon 1990; Schafers 2012; Apel 2014, Scott 2019)
  - Risk factors for developing hypoglycemia (Apel 2014)
    - No prior diagnosis of diabetes
    - No use of diabetes medication prior to admission
    - Lower pretreatment glucose (104 mg/dL vs 162 mg/dL, P = 0.04)
    - Renal dysfunction (insulin may be partially renally metabolized) (Dickerson 2011)
    - Higher insulin dose (LaRue 2017)
  - Strategies for avoiding hypoglycemia
    - Here is a suggested strategy for administering enough dextrose to counter the initial insulin bolus of 10 or 20 units. It is loosely based on the Rush University protocol. (Apel 2014)
- ISMP highlighted this issue in a February 2018 Safety Alert

Insulin

- Insulin has been on the ISMP High Alert list for decades. There are multiple products, each with different kinetic profiles, that can cause confusion.
- Most insulin products are 100 units/mL; some are 200, 300, and 500 units/mL (Kalra 2018)
- In addition, we are now using insulin for non-diabetic treatments, such as calcium channel blocker poisoning. Doses of IV insulin can be up to **10** units/kg/hr. This presents unique challenges in that we potentially need non-standard concentrations of IV insulin infusions to avoid volume overload with the standard 1 unit/mL infusion used for most purposes.
- ISMP published guidelines in 2017 for Optimizing Safe Subcutaneous Insulin Use in Adults

Narcotics

- Opioids are a frequent cause of litigation in ED cases, particularly hydromorphone
  - Some EDs are becoming 'opioid free,' and instead utilizing acetaminophen, NSAIDs, and even ketamine and lidocaine for acute pain control.
  - Hydromorphone 1 mg IV = Morphine 7 mg IV
    - It seems odd that morphine 10 mg seems like a lot to us, yet hydromorphone 2 mg is prescribed with little concern
    - An appropriate starting dose of morphine is 0.1 mg/kg, assuming normal kidney function and age < 65 years
    - A good strategy is start low, go slow (or consider opioid alternatives)
  - Naloxone

        - Patients typically receive 2-4 mg in the prehospital setting, a dose often too high for patients chronically taking opioids. This dose can precipitate withdrawal. [The important caveat is that with fentanyl (and fentanyl derivatives) mixed with heroin, a high dose of naloxone (up to 10 mg) may be needed]
        - A more conservative strategy is to start with 0.04 mg and administer 0.04-0.08 mg increments to achieve desired respiratory rate (Kim 2016)
        - Here is a trick-of-the-trade for preparing naloxone to give these smaller doses

- Heparin is fraught with errors (Grissinger 2010)
    - So many factors are in play when utilizing heparin, such as:
        - Indication (ACS, VTE/PE, etc)
        - Bolus vs. no-bolus vs. infusion
        - Dosing (weight-based vs. non-weight-based)
            - Dosing in obesity (actual vs adjusted)
        - Monitoring frequency
        - Prophylaxis vs. treatment
        - Utilization with other anticoagulants, antiplatelets, or blood-altering drugs (eg, tPA)
        - Multiple concentrations and vial/bag sizes
    - Avoiding errors
        - EMR order sets
        - Nurse-driven adjustments
        - Double checks
        - Barcode scanning
        - Infusion pumps

Second Antibiotic Dose in Sepsis

- Most studies evaluating early antibiotic administration in sepsis patients focus on timing of the first dose. But, what about the second dose? We get it wrong, a lot. PharmERToxGuy.com highlights this issue and offers some potential solutions.

Syringe labeling in the ED

- We frequently draw up medications for administration, but most IV meds are clear liquids. How can we tell the difference between a BP med and a neuromuscular blocker? What if a syringe has a dose written on it, but someone gives half and puts the syringe back down? How will the next person know how much is actually in there?
- The two critical pieces of information that must be on every syringe are: **drug name** and **concentration** (Kothari 2013)
- Further reading from Academic Life in EM