Patient Safety Tip of the Week

May 8, 2018 Heparin Overdose

It's been 10 years since we had lots of headlines about deaths related to inadvertent overdosing with heparin. Most of the cases discussed back then pertained to accidental use of high-dose heparin "flushes" in children and infants (see the list of prior columns at the end of today's column).

A recent report from the California Department of Public Health (CDPH 2018) brings the heparin issue back into the spotlight. A patient with chronic renal failure requiring dialysis was admitted with altered mental status, worsening renal failure, and a clotted A-V fistula. She was sent to the Interventional Radiology Department for a procedure to declot the A-V fistula. During the procedure she received 25,000 units of heparin diluted in a 250 milliliter bag of saline. She subsequently developed internal bleeding that led to her death.

The CDPH report notes that a physician asked for a heparin drip in a pressure bag. The nurse said she asked the physician "do you want 25,000 units in a 250 milliliter bag of saline?" and he responded "yes". The nurse connected the IV tubing to the 250 milliliter bag of concentrated heparin and the physician manually controlled the rate of infusion with a roller clamp. No double checks were performed. The nurse later stated she did not think the physician intended to infuse the entire bag, otherwise she would never have "spiked" it (connected the IV tubing to the bag).

After the procedure a radiology technician showed the empty bag to a second nurse, who recognized that this was a much higher dose of heparin than usually used. Apparently, the normal dose for this procedure is 1,000 units of heparin in 500 milliliters of saline. That nurse informed the other nurses, the physician, and the radiology technician of the situation.

Upon return to the ICU the patient was noted to have bleeding from her arm and lab studies revealed a prolonged PTT and that her hemoglobin had dropped from 10 to 5.9. The patient subsequently died of hypovolemic shock.

In a subsequent interview with the CDPH, the physician recalled the nurse asking if he wanted a heparin drip but did not recall discussing the dosage. He recalled answering "yes, heparin in saline" and that his usual practice was to use 500 units of heparin per liter of saline for the drip.

The CDPH report and hospital response focus largely on the fact that no double check was performed before the heparin dose was administered. The hospital's policy did call for a double check of IV heparin doses by two qualified health care professionals. A

second RN was expected to validate and document the correct dosage. But in this case there was no double check by either another nurse or the physician.

The hospital's plan of correction (POC) did focus on the issue of double checks, requiring that checks be done by two qualified health care professionals for all high-alert medications (of which heparin is one).

Double checks do have problems of their own (see our October 16, 2012 Patient Safety Tip of the Week "What is the Evidence on Double Checks?") but note that we still consider double checks to be an action of intermediate strength worth using in multiple situations, particularly for all high-alert medications. But they need to be truly "independent" double checks.

But there are several other factors that contributed to this adverse event. First, and foremost, this was a **verbal order**. Verbal orders are prone to error (see our January 10, 2012 Patient Safety Tip of the Week "Verbal Orders"). Verbal orders should only be used in emergency circumstances or in circumstances where it is impractical for a physician to enter the order. When verbal orders are used, there must be "**readback**" where the nurse receiving the order specifically reads back all the information pertinent to dosing. That did not happen in this case. In fact, this was **really a "reverse verbal order"!** Though the physician had requested a heparin drip, it was really the nurse who initiated the specific order. Hence, the required "readback" would have fallen to the physician.

The fact that the whole process really took place verbally also bypassed several patient safety tools we use in medication safety. No order was placed in a CPOE system, which could have provided clinical decision support tools to ensure proper dosing. Also, the lack of input into an IT system precluded use of a barcoding system that also could have served as another line of defense against medication error.

Remember, this event took place in an interventional radiology suite. Not all hospitals have all their individual units connected to the hospital-wide electronic medical record and, hence, do not have integration with tools like barcoding and CPOE with clinical decision support. In some cases, it is truly a lack of IT integration, In others, it is a matter of culture.

In this hospital's POC, they began using an upgrade of their EMR in the interventional radiology area and cath lab. This included a one-step medication order entry section and a section for documentation of administration. It requires entry of concentration for all high-alert medications. They note the physician can review all in one screen.

We've also pointed out in other columns the tendency to consider heparin not as a medication, particularly when heparin "flushes" are being used to keep IV lines open. Unfortunately, that cavalier attitude to heparin is all too widespread.

And then there is the question we always ask "**why are formulations of such high-dose, concentrated heparin available on the unit in the first place?**". Does the

interventional radiology unit do any procedures that would require such high-dose, concentrated formulations? If not, such formulations should be available only in the pharmacy, so that staff on the units cannot inadvertently administer overdoses. This is akin to the old problem of patients dying from injection of concentrated potassium chloride on patient care units. That problem was only solved when we removed vials of concentrated KCl from units other than the pharmacy. In this hospital's POC their Pharmacy did an audit of medication cabinets in the Angio Lab and removed all 25,000 units/250 milliliter heparin bags. They also now have Pharmacy affix a high-alert double check sticker on all 25,000 units/250 milliliter heparin bags.

Removal of the high-dose formulations from "floor stock" is what we consider a strong intervention. It fits in the category of a constraint or forcing function, which are the strongest action steps (see our March 27, 2012 Patient Safety Tip of the Week "Action Plan Strength in RCA's" and our slide show "Weak vs. Strong Responses to an RCA").

Have you done an inventory to ensure you have no "floor stock" of high-dose heparin formulations? And are all your units, including your OR and radiology and procedural units, integrated with your EMR or at least have their own IT systems that utilize CPOE, clinical decision support, and barcoding?

Perhaps the biggest lesson from the California case is that facilities are still vulnerable to this sort of preventable error.

See some of our prior columns on inadvertent heparin overdoses:

December 2007	"1000-fold Heparin Overdoses Back in the News Again"
May 2008	"UK NPSA Alert on Heparin Flushes"
July 15, 2008	"Heparin Flushes.....Again!"

References:

CDPH (California Department of Public Health). 2018. Intake Number CA00512428. Accessed April 21, 2018 https://www.cdph.ca.gov/Programs/CHCQ/LCP/CDPH%20Document%20Library/Hospital%20Administrative%20Penalties/Stanislaus/Memorial-MC-2567-Redacted.PDF

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