Acute Care ISMP Medication Safety Alert!®
Educating the Healthcare Community About Safe Medication Practices

LATEST HEPARIN FATALITY SPEAKS LOUDLY–WHAT HAVE YOU DONE TO STOP THE BLEEDING?

From the April 8, 2010 issue

The deadly effect of a heparin error made the headlines again, this time claiming the life of a toddler about to celebrate her second birthday. The child was born in Texas with gastroschisis (protrusion of the intestines) and had undergone various procedures and hospitalizations before her physicians determined that a transplant was necessary. The child was brought to a Nebraska hospital in early December 2009 where she underwent transplantation of the small bowel, liver, and pancreas. She progressed satisfactorily and was discharged in February 2010 but readmitted about a week later with a viral illness and infection that resulted in renal failure. The child's condition was critical, and she required renal dialysis and an intravenous infusion of heparin to prevent clotting. During the infusion, the child received a large overdose of heparin, which led to cerebral bleeding and subsequent brain death.

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News reports about this error suggest that hospital leaders plan to share the details of the event with the healthcare community nationwide to help prevent this from happening to another child.(1–3) While the investigation may take several weeks to complete, here is what we can piece together from the media reports so far.

The overdose occurred due to an infusion pump setting error that was not detected during a verbal checking process. The wrong dose of heparin infused for about 5 hours before the error was noticed. Exactly how the verbal check occurred and why it did not uncover the error have not been made public. Things we have learned from our error-reporting program suggest that failed double-checks happen most often when: the check does not occur independently; the process is informal and lacks the highest regard for the substantial responsibility the checker takes on; both the initiating person and checker fall victim to the same external conditions causing the error (e.g., look-alike packaging); or distractions and other environmental conditions reduce staff attention to detail.

The pump involved in the event was a smart pump with a drug library and dose-checking capabilities, but apparently this feature was not being utilized at the time of the event, or at least not used to its fullest extent so an error of this nature could have an opportunity to be quickly recognized. Although the reasons for not employing the technology are unclear, studies about smart pump implementation have provided some insight into why clinicians bypass the dose-checking technology: falsely low perceptions of risk; failure to make adjustments in the drug library when alerts are not credible; extra work needed to use the technology; lack of standard drug concentrations and dosage methods; time constraints; clinical emergencies; and a culture that inadvertently supports technology workarounds.(4–6)

Heparin is a high-alert medication

ISMP identified heparin as a high-alert medication more than 20 years ago, when it appeared on our very first list of high-alert medications.(7) Just a year later, the drug was again identified during a national benchmarking study as one of six drugs most frequently involved in serious and fatal events.(8) Since 1996, we have published more than 100 reports in our acute care newsletter alone about errors with heparin, many fatal, all serious. Errors with heparin gained widespread media attention 4 years ago after several infants in Indiana died from an overdose of heparin during routine flush procedures, and after newborn twins of actor Dennis Quaid could have died from a similar overdose caused by mix-ups between vials containing 10,000 units/mL and 10 units/mL. In January 2009, our QuarterWatch program identified that heparin has repeatedly been among the top 10 drugs involved in serious, preventable injuries, disabilities, and deaths reported to the FDA.(9) The types and causes of errors associated with heparin are varied (see Table 1); the one constant you can depend on is that errors with heparin typically harm patients, so prevention requires your full attention!

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Enhance perception of risks

Most health professionals are quite familiar with heparin, having prescribed, dispensed, and/or administered it many times. From the smallest doses associated with heparin flushes to the largest doses associated with therapeutic uses, familiarity with heparin has led to a faded perception of the risks associated with its use and misuse. Those familiar with the drug may forget that even a slight mistake can lead to patient harm. Thus, attention is needed to enhance staff perception of the risks associated with heparin, and to remind staff that heparin is a high-alert drug—regardless of the concentration or dose—and that safeguards must always be employed.

Remedy workarounds

Next, it is not enough to purchase smart pumps, program the library to enable the technology, distribute the pumps, educate users, and hope that the dose-checking feature is fully functional and will always be used. A culture of safety must exist that drives clinicians to avoid bypassing such a safety feature, or to report conditions that encourage workarounds so they can be remedied. Additional measures that can nurture compliance with smart pump technology and attention to the alerts include: setting up the infusion pumps so they turn on and default to the dose-checking mode; analyzing pump logs and making necessary adjustments to the drug library; evaluating all overrides; publicizing "good catches;" and conducting focus groups and satisfaction surveys to solicit nursing feedback. Compliance with the technology should be measured and any barriers to using it should be identified and removed.

Safety team examination

ISMP strongly urges all medication safety teams/committees to examine internal errors associated with heparin as well as the problem areas described in Table 1 to identify weaknesses in the organization that could lead to errors. Table 1 also includes examples of key improvements to enhance safety when using heparin. We also offer the ***ISMP Medication Safety Self Assessment for Antithrombotic Therapy in Hospitals*** (www.ismp.org/selfassessments/asa2006/Intro.asp) to help organizations analyze current safeguards and improve medication safety with heparin and other antithrombotic agents. A **free webinar** to discuss the aggregate data received by ISMP to date will be held on **April 27** and **April 29** (register at: www.pharmacyadvisor.com). Please don't wait to take action until a harmful event occurs in your hospital. There's no saying when that could happen—only the certainty that it will happen without safeguards in place to prevent it.

Table 1. Common Risks with Heparin	Key Improvements with Heparin
■ Using U for units on orders, labels, computer screens, or MARs ■ Failing to use commas when expressing large doses (1000, 10000) ■ Using potentially confusing symbols > and < in protocols, nomograms, orders	■ Do not use error-prone abbreviations (e.g., U for units, "hep" for heparin) ■ Use commas appropriately for doses that exceed 999 units ■ Spell out "greater than" and "less than" on protocols, nomograms, and orders ■ Employ computerized prescriber order entry order sets
■ Using stated, estimated, or unverified weights to calculate heparin doses	■ Obtain actual measured weight in kg of patients (or ideal body weight if indicated) to determine heparin doses
■ Failing to obtain baseline lab tests, verify recent lab values, or act upon abnormal lab values before prescribing, dispensing, and administering heparin	■ Obtain baseline lab tests (e.g., hemoglobin, hematocrit, platelet count, aPTT) before prescribing heparin ■ Make coagulation lab test results available in 2 hours or less ■ Verbally report critical values to the professional caregiver ■ Evaluate latest lab results before prescribing, dispensing, or administering therapeutic doses of heparin ■ Establish protocols for standard (before procedures) and rapid (emergency) reversal of anticoagulation
■ Miscalculating the dose or infusion rate ■ Programming the infusion pump incorrectly (e.g., wrong concentration, infusion rate); mixing up access lines ■ Miscalculating the volume of heparin to be added to TPN or neonatal solutions	■ Use weight-based heparin infusion charts or dosing nomograms ■ Employ strategically placed independent double-checks before dispensing and administering IV heparin (e.g., a second pharmacist checks all admixtures of heparin; a second nurse checks the patient, drug, line attachment, and pump settings) ■ Employ smart pumps and utilize drug library settings
■ Preparing heparin infusions incorrectly ■ Failing to use commercially available premixed solutions ■ Mix-ups between different concentrations (premixed and pharmacy prepared)	■ Use only commercially prepared, premixed IV heparin solutions ■ Standardize to one or two concentrations for all therapeutic IV heparin infusions (including OR, interventional radiology) ■ Require pharmacy to dispense all inpatient heparin and verify orders for therapeutic use before removal from ADCs
■ Mix-ups between pharmacy prepared or commercially available bags that look alike (e.g., heparin, lidocaine, Hespan [hetastarch], dopamine) ■ Mix-ups between heparin prefilled syringes and look-alike prefilled syringes ■ Mix-ups between vials of heparin, vials of insulin, vials of normal saline ■ Mix-ups between 1,000 units/500 mL heparin bags (adult arterial line) and 25,000 units/500 mL bags ■ Confusing the unit/mL strength as the full dose in vials	■ Safely select, procure, and store heparin away from other drugs with look-alike names or packaging ■ Use tall man letters on labels, order screens, and computer-generated MARs to differentiate HeSpan and hEParin ■ Dispense heparin flush solutions from the pharmacy in the exact concentration required for the patient population (e.g., neonates) and/or parenteral access device in use ■ Apply auxiliary labels for diluted/concentrated preparations ■ Use only saline flushes (not heparin flushes) for peripheral venous access catheters (reflect this on order sets) ■ Restrict access to multiple concentrations (in vials/syringes) in both the pharmacy and on patient care units ■ Employ bar code scanning technology
■ Unrecognized concurrent administration of more than one heparin-type product (e.g., unfractionated heparin and low molecular weight heparin)	■ Provide a copy of ED or cath lab orders to the pharmacy for admitted patients to monitor use of all anticoagulants ■ Enable duplicate therapy computer alerts for heparin products ■ Provide reminders on protocols to avoid concomitant use of heparin products or discontinue other anticoagulants as appropriate ■ Review all medications administered during handoffs
■ Forgetting to set the proper dose or volume limit when administering a bolus dose from an infusion bag; forgetting to reset the pump after the bolus dose	■ Administer bolus doses from pharmacy-prepared syringes ■ Use IV pumps to administer continuous and bolus doses from the same container only when a bolus dose can be programmed with limits on total dose and minimum infusion time, and pump automatically converts to continuous infusion rate after bolus is given
■ Forgetting to resume a heparin infusion	■ Establish and follow a procedure for "hold" orders
■ Failing to detect, quickly treat, and document heparin-induced thrombocytopenia (HIT)	■ Use a protocol/order set for HIT evaluation and treatment ■ Develop a process to ensure prominent documentation of HIT on the patient's record
■ Using the wrong protocol or drug nomogram for the patient's condition (e.g., stroke vs. deep vein thrombosis)	■ Develop and follow standard, weight-based heparin protocols for each indicated use of a heparin infusion; label protocols prominently by indication to promote correct selection ■ Conduct prospective failure mode (FMEA) of protocols
■ Other risks associated with preventable adverse drug events with heparin	■ Establish inpatient clinical pharmacy anticoagulation services ■ Use subcutaneous low molecular weight heparin when appropriate (based on indication/patient variables) as an alternative to unfractionated heparin

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