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MEDICATION ERROR PREVENTION

Neonatal Heparin Overdose—A Multidisciplinary Team Approach to Medication Error Prevention

Jason Arimura, PharmD,[1] Robert L. Poole, PharmD,[1] Michael Jeng, MD,[2] William Rhine, MD,[2] and Paul Sharek, MD[2]

[1]Pharmacy Department, Lucile Packard Children's Hospital at Stanford, [2]Department of Pediatrics, Stanford University School of Medicine, Palo Alto, California

Despite the efforts of many hospitals, system failures can result in medication errors that may be life threatening. During 2006 and 2007, nine neonates received potentially fatal doses of heparin. This paper will review contributing factors to the heparin medication errors and ways to minimize the risk of heparin overdose.

KEYWORDS heparin, medication error, medication safety, neonate

J Pediatr Pharmacol Ther 2008;13:96-98

INTRODUCTION

Medication errors that involve the use of heparin are well-described in the medical literature.[1,2] Heparin is on the Institute for Safe Medication Practice's (ISMP) high alert medication list and can cause significant patient harm when used in error. Ten-, 100-, and 1000-fold errors have been observed.[1,3-5] Two recent related heparin medication errors in neonates demonstrated the vulnerability of this patient population.[4,5] Health care providers should work together to do everything possible to prevent this type of error from happening again.

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Heparin Overdose – Recent Case Reports

During September of 2006, six premature infants in the Neonatal Intensive Care Unit (NICU) at a hospital in Indiana were inadvertently administered a 1000-fold higher heparin dose than what was intended as a line flush. Three of six infants died. A similar incident occurred in November of 2007 in southern California. Three infants also received heparin for an intravenous line flush that was 1000-fold higher than what was intended. Fortunately, all of these infants survived. This incident received more media attention because it involved the twin babies of a famous actor.

ABBREVIATIONS ISMP, Institute for Safe Medication Practice; LPCH, Lucile Packard Children's Hospital; NICU, Neonatal Intensive Care Unit

Contributing Factors to the Heparin Medication Errors

As frequently occurs, all of these heparin-associated medication errors happened when a number of system failures occurred simultaneously. System failures included: 1) failure to carefully and accurately read the label on the medication vial prior to administering the drug to the patient; 2) inaccurate filling of automated drug-dispensing cabinets (substituting 10,000 units/mL 1-mL vials for 10 units/mL

Address correspondence to: Robert L. Poole, PharmD, Director of Pharmacy, Lucile Packard Children's Hospital at Stanford, 725 Welch Road, Palo Alto, CA 94304, email: rpoole@lpch.org

1-ml vials); 3) non-distinct "look-alike" labels on the heparin vials; 4) similar size of the heparin vials as both were 1-mL vials; and 5) "factor of ten" dosing errors.

Immediately after the first incident in Indiana, the ISMP released a report on September 21, 2006, cautioning hospitals about the potential to repeat this medication error.[4] In this report, the ISMP recommended that hospitals re-evaluate their stocking process and reassess what should be removed from automated drug-dispensing cabinets. Other ISMP recommendations included minimizing look-alike packages & look-alike labels and move toward implementation of bar code verification prior to drug administration.

In response to the first heparin medication error, the heparin manufacturer (Baxter in both incidents) released a medication safety alert on February 6, 2007. In this safety alert, Baxter acknowledged the Indiana incident and stated it was considering ways to differentiate the packaging of the two heparin solutions. By October 2007, Baxter had revised the packaging and labeling of its 1,000 units/mL, 5,000 units/mL, and 10,000 units/mL heparin 1-mL vials. Unfortunately, some hospitals had not removed the old vials of heparin and replaced them with vials with the new labels when the second heparin error occurred.

Minimizing the Risk of Heparin Overdose

The same day the heparin overdose incident in Indiana was reported, members of the Pharmacy Department at Lucile Packard Children's Hospital (LPCH) at Stanford immediately took steps toward minimizing the risk of this error occurring at our institution. Pharmacy personnel quarantined all 10,000 units/mL heparin solutions in the pharmacy. All of the hospital's automated drug-dispensing machines (PYXIS) were checked for 10,000 units/mL heparin vials and none were found. At the next meeting of the Pharmacy & Therapeutics Committee, 10,000 units/mL heparin solutions were removed from the formulary, thus eliminating its use and availability in the hospital. LPCH leadership added heparin to the hospital's "High Risk Medication List" and policy. All heparin flush solutions (10 units/mL and 100 units/mL) supplied by the pharmacy in automated drug-dispensing machines were changed to pre-filled syringes, thus minimizing the risk of "look-alike" vials. Nursing staff were immediately informed about the errors and educated about the changes at LPCH to prevent this type of error locally. All of these process improvements were rapidly reviewed and approved by all appropriate committees at LPCH. Medical, nursing, and pharmacy staffs were educated on these changes. LPCH will continue to minimize the risk of medication errors with plans to implement a barcode verification system for drug administration in the near future.

In addition to reviewing hospital-wide procedures, continued training of pharmacy and nursing staffs should reemphasize reading every part of a medication label as initial and final checks before a patient receives any medication. An overview of how and where the most common medication errors occur is also an important part of nursing and pharmacy education.

Neonates are the most vulnerable patient population with respect to medication errors. Within most NICUs, there is a ten-fold difference in the size of the patient, resulting in a ten-fold potential for error. We hope this reminder will encourage all organizations to review their medication processes to prevent this error from being repeated again.

DISCLOSURE The authors declare no conflicts or financial interest in any product or service mentioned in the manuscript, including grants, equipment, medications, employment, gifts, and honoraria.

ACKNOWLEDGMENTS This paper was developed by a multidisciplinary group consisting of the Director Pharmacy, Director of the Neonatal Intensive Care Unit, Chair of the Pharmacy and Therapeutics Committee, Director of Quality Management and Chief Clinical Patient Safety Officer.

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