Action Is Neeeded to Prevent Heparin–Insulin Mixups

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In 2007, the New Jersey Department of Health and Senior Services' Patient Safety Initiative issued an alert to hospitals in the state after learning of an incident involving a bag of total parenteral nutrition (TPN) that contained insulin instead of heparin.[1] A blood glucose level of 17 mg/dL was reported for a premature baby in the neonatal intensive-care unit six hours after a TPN infusion had been started. Despite multiple bolus doses of dextrose and an infusion of dextrose 20% in sodium chloride 0.45%, the hypoglycemia did not completely resolve until TPN was discontinued. The neonatologist asked that the remaining TPN be sent for analysis. It was subsequently revealed that the fluid contained insulin, not heparin.

The Institute for Safe Medication Practices (ISMP) has received multiple reports of similar events of mixups between heparin and insulin elsewhere. Some examples follow.

- Insulin was accidentally added to infant TPN in two other states, each with fatal outcomes.
- A 1991 article by Michael Cohen, currently President of the ISMP, described cases of severe hypoglycemia after a pharmacist added 200 units of insulin instead of heparin to TPN and another pharmacist added 1,000 units of insulin instead of heparin to TPN.[2]
- Two nondiabetic patients died after receiving insulin instead of heparin during a vascular catheter flush procedure.
- Another nondiabetic patient received 50 units of insulin (0.5 mL) subcutaneously instead of heparin 5,000 units (0.5 mL).
- A nurse flushed a patient's central line catheter with insulin instead of heparin.
- Another nurse erroneously transcribed a verbal order to resume an insulin drip as "resume heparin drip."
- A pharmacist entered an order for 500 units of heparin into the computer as regular insulin 500 units.
- A nurse transcribed a telephone order for 10 units of regular insulin by intravenous (IV) push for a blood sugar of 324 as 10 units of heparin IV push.

The most common factors associated with heparin–insulin errors seem to relate to:

- similar packaging of both products in 10-mL vials.
- placement of insulin and heparin vials, both typically used each shift or day, next to each other on a counter, drug cart, or under a pharmacy IV admixture hood.
- mental slips leading to confusion about the usage of the two drugs; each is administered in units. The risk of a mental slip may be increasing because insulin infusions have been used more frequently in recent years.

The New Jersey Department of Health and the ISMP recommend that hospital staff members check with suppliers (i.e., one's own pharmacy or an outside vendor) to inquire about steps to take to prevent similar errors. In cases of unexpected, unexplained hypoglycemia, staff members should consider the possibility of a medication error and should follow up by (1) discontinuing all current infusions and hanging new solutions, (2) administering dextrose as necessary; (3) checking for unintended additives by sending the infusion bag for analysis; and (4) identifying and treating iatrogenically induced hypoglycemia early in the process in order to mitigate harm.[3]

The ISMP recommends the following additional strategies to reduce the risk of mixups between heparin and insulin vials:

1. During drug preparation, insulin and heparin vials should not be kept next to each other on top of counters or drug carts or under the laminar flow IV admixture hood in the pharmacy. Many organizations do not allow insulin near the location where TPN is being prepared, and insulin is administered separately.
2. To avoid the use of similar-looking vials, staff can order heparin bags of 100 units/mL from vendors of IV solutions.
3. Heparin-prefilled syringes could be made available for admixture use.
4. Insulin could be delivered to patient-care units in pen devices rather than in vials.
5. When insulin is needed for an IV infusion, it should be retrieved and added separately from other ingredients and returned to the appropriate storage area immediately after use. Adding insulin to any IV solution should take place in the pharmacy.
6. An independent double-check of IV insulin and IV heparin doses and infusions should be made before the products are dispensed.
7. An independent double-check of all TPN solutions, as well as an initial independent check of the vials gathered for additives that must be added manually, should be performed. The vials should be checked again, and the syringes should be pulled back to the volumes of drug that were actually added to the solution. An independent check of the finished solution should be performed to compare the label and the original order. This double-check process is warranted even if a pharmacist prepares the TPN.
8. Bar-code scanning should be used for drug selection. If an automated compounder is used, bar-code scanning should be required during setup. However, many pharmacists do not use an

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automated compounder because of the small volumes typically required and the narrow therapeutic index of heparin and insulin.

Given the difficulty of adjusting insulin doses for patients receiving TPN, some hospitals no longer add insulin to the TPN solution; instead, they provide insulin in a separate injection. Although the ISMP agrees with this change in procedure, the organization also recognizes that adding insulin to the TPN container can help to ensure that the insulin is automatically discontinued along with TPN and that it is not overlooked when the infusion stops. Each hospital should decide which strategy works best.

REFERENCES

1. *Hypoglycemia Caused by Unintended Insulin in Total Parenteral Nutrition for an Infant in the Neonatal Intensive Care Unit*. Trenton, N.J.: New Jersey Department of Health, April 2007. Available at: www.state.nj.us/health/ps/documents/ps_alert_april07.pdf. Accessed March 2, 2011.
2. Cohen MR. Insulin overdoses that originated in the pharmacy IV admixture area. *Hosp Pharm* 1991;26:998–999.
3. Bates DW. Unexpected hypoglycemia in a critically ill patient. *Ann Intern Med* 2002;137:110–116.

The reports described in this column were received through the ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP Web site (www.ismp.org) or communicated directly to ISMP by calling 1-800-FAIL-SAFE or via e-mail at ismpinfo@ismp.org. ■