A Clinical Reminder About The Safe Use of Insulin Vials

Matthew Grissinger, RPh, FASCP

Mr. Grissinger, an editorial board member of P&T, is Director of Error Reporting Programs at the Institute for Safe Medication Practices in Horsham, Pennsylvania (www.ismp.org).

PROBLEM: In the past, the Institute for Safe Medication Practices (ISMP) has suggested that hospitals strongly consider transitioning away from insulin pen use in the acute-care setting, with a few exceptions.1 Given reports of ongoing misuse of insulin pens—in particular, the sharing of insulin pens with multiple patients after changing only the needle, as well as needlestick injuries, user technique errors, and pen design flaws as first described in 2008—believe the risk associated with cross-contamination is best mitigated by removing insulin pens from use in hospitals.

While we stand firmly behind our recommendation on this issue, we want to take this opportunity to point out that simply replacing insulin pens with insulin vials may result in unintended vulnerabilities that can result in errors.

First, for staff members who have been using insulin pens for any length of time, transitioning back to insulin vials may uncover knowledge deficits that could lead to errors and patient harm. Edrees et al. described such an event in 2011.3

A physician had ordered a “stat” dose of intravenous (IV) insulin aspart, 10 units, along with a dextrose infusion to treat a patient with hyperkalemia. Several years before, the hospital had begun using insulin pens. Since graduation, the nurse who needed to give the insulin had only used the pens and had forgotten that only insulin syringes should be used when measuring an insulin dose from a vial. She felt stressed to give the insulin quickly and became momentarily distracted and, when returning to the task, she accidentally picked up a nearby vial of Lantus that also had its cap removed and looked very similar to the Protonix—both vials have a distinctive, elongated shape. She withdrew and administered all 10 mL of Lantus.

To cite another example, similar labeling of insulin and heparin in 10-mL vials and the fact that both drugs are dosed in multiples of bolus increments, elongated shape. She withdrew and administered all 10 mL of Lantus.

Dosing Errors
With insulin, it should not be assumed that all health care professionals are knowledgeable and skilled when it comes to measuring doses and recognizing doses that exceed safe limits. For example, the U-100 designation on insulin vials has been misunderstood to represent 100 units per vial, leading to 10-fold overdoses. Taking into consideration that the label of virtually every other injectable drug notes both the “per mL” and “per total volume” amounts, one can understand how this inconsistency might contribute to such an error with insulin. The availability of 10-mL vials of insulin makes very large overdoses possible.

Another error that occasionally occurs is that the dose in units has instead been measured in milliliters (4 mL versus 4 units) using a syringe with mL increments. Errors of this type suggest that some health care professionals do not fully understand the differences between an insulin syringe and other parenteral syringes. Adding to the risk of dosing errors is insulin’s availability in two concentrations (U-100 and U-500), whereas insulin syringes are best suited to measure the most common concentration (100 units/mL).

Look-Alike Vials
Some manufacturers have crafted distinctive labeling to help reduce confusion between various types and concentrations of the insulin they manufacture. However, ISMP still receives reports of serious mix-ups between insulin types and concentrations, and between insulin and other medications in similar-looking vials.

For example, a patient recently received 1,000 units of Lantus (insulin glargine) IV instead of Protonix (pantoprazole). A nurse had removed the vial cap and reconstituted Protonix with 0.9% sodium chloride as directed. She was momentarily distracted and, when returning to the task, she accidentally picked up a nearby vial of Lantus that also had its cap removed and looked very similar to the Protonix—both vials have a distinctive, elongated shape. She withdrew and administered all 10 mL of Lantus.

Beyond Use Expiration Dating
Health care professionals may forget to document an expiration date on an insulin vial once it has been punctured. Alternatively, staff may not discard the vial upon the expiration date, thus allowing use of a product that may no longer be safe or fully potent.

Cross-Contamination
The risk of a health care professional using the same insulin syringe and needle
to draw up and administer insulin to multiple patients is extremely low, particularly given that most insulin syringes come with a permanently attached needle that cannot be changed between uses (changing needles is never enough to prevent cross-contamination). Further, while a 2010 survey revealed an alarming lapse of basic infection-control practices associated with the use of syringes, needles, and multiple-dose vials, insulin is not as vulnerable to cross-contamination compared with a drug that often requires multiple entries into the vial to treat a single patient, such as lidocaine. (When multiple entries into a vial are required to treat a single patient, a mental lapse could result in using the same syringe and needle—because it is intended for the same patient—thereby contaminating the product.) However, any time multiple-dose vials are used, the risk of contamination is present.

In addition to these safety issues, it takes more time to prepare insulin doses from a vial than from a pen. Also, waste may be an issue if 10-mL vials are dispensed for individual patients.

**SAFE PRACTICE RECOMMENDATIONS**

When transitioning away from insulin pen use in hospitals, consider these recommendations to reduce the risk of errors:

**Re-educate the Staff**

Before transitioning away from insulin pens, alert all clinicians to the change and re-educate the staff regarding the processes associated with using insulin syringes, preparing doses (e.g., rolling insulin syringes or vials between the hands to mix suspensions), measuring doses, and injection techniques (e.g., pen needles usually do not require pinching of the skin prior to injection, while traditional insulin syringe needles are typically longer and require pinching of the skin).

Don’t assume all staff members will recall these procedures correctly without review. Conduct initial training and verify competencies before making a change.

**Dispense From Pharmacy**

To preserve an independent double-check, wherever possible, the pharmacy should prepare, label, and dispense patient-specific insulin doses in insulin syringes, particularly for basal and other long-acting insulin. For rapid-acting insulin that is not dispensed in unit-dose syringes, provide a vial of insulin—preferably a 3-mL vial—labeled for a specific patient. Labeling by the pharmacy should make it clear that the 3-mL vial is a multiple-dose, not a single-dose, vial from which the patient’s dose should be measured. This will help to avoid errors that might be caused by unfamiliarity with the 3-mL vial size, which might be new at your institution.

**Stock the Smallest Vials**

Consider stockling patient-care units and treatment kits (e.g., hyperkalemia kits) that require rapid-acting insulin with 3-mL vials of insulin to reduce the risk of catastrophic dosing errors. (Although 3 mL of insulin represents a catastrophic overdose, the risk of a massive overdose is lessened with each correct dose removed from the vial.) Ideally, the hyperkalemia kit would include insulin syringes so that they are readily available. The kit might also prominently display the fact that 10 units = 0.1 mL, a typical dose to treat hyperkalemia (for adults). This may also decrease the possibility of mistaking the entire 3-mL insulin vial as the “dose” for hyperkalemia.

**Stock Appropriate Syringes**

Provide insulin syringes (available in three barrel sizes: 1 mL, 0.5 mL, and 0.3 mL) to all patient-care units where the drug may be administered, and in any treatment kits that require insulin administration (e.g., hyperkalemia kits). The risk of dosing errors can be reduced if only the smaller-barrel insulin syringes are available in units where insulin doses rarely exceed 30 units (0.3-mL barrel) or 50 units (0.5-mL barrel). Remove tuberculin syringes from patient-care areas if they are rarely needed, and dispense a tuberculin syringe only with a product that requires its use.

**Label Vials and Syringes**

Vials of insulin dispensed from the pharmacy should be labeled appropriately and include the patient’s name. Tadpole labels (a label with a clear “tail” that wraps around the vial and a “head” on which patient information can be documented) or label flags can be used on the small 3-mL vials; however, care must be taken not to obscure important product information on the vial.

The pharmacy should provide labels for the nurse to complete and affix to insulin vials that are stocked in automated dispensing cabinets (ADC) or refrigerators. These labels should be available in the same cabinet pocket as the insulin vial and should be stocked with the same diligence as the insulin itself to ensure accuracy. Labels that can be completed and affixed to an insulin syringe should also be readily available in all patient-care units.

**Separate and Verify Drugs**

Do not leave vials of insulin on counters or on top of drug carts. Return them to the appropriate storage location after use. If insulin vials are stored in ADCs, place each type of insulin in a separate pocket or lidded bin to help avoid mix-ups. Use prefilled syringes of heparin for essential central line flushes and, when possible, have pharmacy dispense heparin loading doses. When available, use bar-code scanning during product selection when stockling, dispensing, and administering medications. If pharmacy-prepared, bar-code-labeled syringes containing patient-specific insulin doses are not provided, it may be necessary to bring the patient’s vial of insulin to the bedside to scan before preparing the patient’s dose.

**Don’t Rule Out Problems**

When you transition away from using insulin pens, it may be helpful to first conduct a failure modes and effects analysis so you can proactively anticipate and address problems that are sure to arise. During transition, audit health records for episodes of hypoglycemia and hyperglycemia to monitor for system barriers. Encourage staff to report any confusion or hazard. Enhance ongoing surveillance of proper technique for withdrawing and measuring insulin doses. And don’t let your guard down with this high-alert medication.

**REFERENCES**

