



SAFE USE OF INSULIN AND INSULIN PENS

In the last issue we discussed utilization of insulin (with a focus on insulin pens) for treatment of type 2 diabetes. This issue of the *Tablet* will focus on the safe use of insulin.

BACKGROUND

Although insulin effectively manages diabetes, it is also considered one of the top five “high alert” medications by the Institute for Safe Medication Practices (ISMP).¹ This is because insulin has a narrow therapeutic index (i.e., the dose that may cause harm is relatively close to the dose that is used for treatment), and it is used frequently. Excessive doses can quickly lead to low blood glucose levels (hypoglycemia)—which may lead to seizure, coma, or even death—while underdosing can lead to hyperglycemia—which may lead to ketoacidosis as well as increased risk of developing long-term complications of diabetes.¹

HIGH-PRIORITY INSULIN ERRORS

Understanding the potential for errors that could occur is an important step in identifying and addressing those errors. Following is a summary of some common high-priority insulin errors as identified by an expert panel convened by the American Society of Health-System Pharmacists:²

- **Prescribing**
 - Incorrect dosage/irrational insulin orders
 - Nomenclature-related errors
- **Transcribing**
 - Incorrect transcription of verbal or telephone orders
 - Transcription of an incorrect dose
- **Dispensing and storage**
 - Failure to double-check insulin products (i.e., preadministration)
 - Look-alike products
 - Unsecure and/or nonsegregated storage in patient care areas
- **Administering**
 - Administration of incorrect doses
 - Incorrect use of insulin pens
 - Name confusion
 - Relationship of insulin administration to nutrition
- **Monitoring**
 - Failure to appropriately monitor for insulin effects and adjust dose accordingly

ARE INSULIN PENS SAFER THAN MULTI-DOSE VIALS PLUS SYRINGES FOR ADMINISTRATION OF INSULIN?

Many healthcare professionals are now prescribing insulin pens instead of multi-dose vials for administration of insulin. However, despite the assumption of increased safety and convenience associated with insulin pen use, there have been reports in healthcare settings of the same insulin pen being used for more than one patient.³ This is not a safe practice, because with each injection a small amount of biological fluid may backfill into the pen cartridge. Therefore, the cartridge is no longer sterile, and insulin pens used by one individual should not be used by another due to the risk of transmitting blood-borne pathogens.

WHAT INSULIN USE SAFETY PROTOCOLS ARE RECOMMENDED?¹

1. Place patient-specific insulin labels only on the barrel of the insulin pen, never on the cap.
2. A single brand of insulin should be used for each insulin type.
3. Insulin should never be borrowed from or shared with another resident.
4. Only short- or rapid-acting insulins are to be used for adjustment, supplemental, or correction doses.
5. Hypoglycemia “rescue” agents (dextrose and glucagon) should be readily accessible throughout the care centres. A standard method for initial management should be readily available.
6. Use insulin cartridges only with an insulin pen. Do not withdraw insulin from a cartridge with a needle and syringe.
7. Educate all healthcare providers who are expected to use insulin pens on best practice techniques and potential risks associated with insulin pens prior to insulin pen implementation, and at orientation of new staff, and repeat this education on a regular basis.
8. All insulin orders should follow a “Do Not Use” dangerous abbreviations list that includes the following:
 - a. The word “unit” is always spelled out completely (u and U are not allowed).
 - b. Insulin doses included on labels are listed in “units” or “units = mLs” but not in “mL” alone.
 - c. Leading zeroes are always used before all decimal points.
 - d. Trailing zeroes are never used following decimal points.
9. Whenever there is a change in insulin dose, the physician should rewrite the prescription in full.
10. Report medication incidents to identify ongoing system issues related to the administration of insulin. **MPT**

Glucagon (Glucagon for Injection, rDNA origin)⁴

Glucagon is a hormone made by recombinant DNA technology that is identical to human glucagon. It causes an increase in blood glucose concentration.

Glucagon is indicated for emergency treatment of severe hypoglycemia in patients treated with insulin when they are unconscious and cannot take anything by mouth. Severe hypoglycemia should be treated with intravenous glucose if possible. Elderly patients using insulin or oral hypoglycemic agents may be candidates for glucagon, as they also may have hypoglycemic unawareness due to the aging process.

Glucagon should be given only if patients are unconscious or unresponsive and unable to ingest oral glucose. After intramuscular injection, the patient will normally respond within ten minutes. If there is no response within ten minutes and IV access is not available, the patient is sent to hospital where intravenous glucose must be administered as soon as an IV access can be established.

Because glucagon is of little or no help in states of starvation, adrenal insufficiency, or chronic hypoglycemia, intravenous glucose should be used for treatment of hypoglycemia in these conditions.

Dosage

Glucagon should be reconstituted with the accompanying diluent following the detailed directions contained within the *Directions for the User* package insert.

Glucagon should be used immediately after reconstitution. Discard any unused portion.

1. Dissolve the lyophilized glucagon in the accompanying diluent.
2. Glucagon should not be used at concentrations greater than 1 mg/mL (1 unit/mL).

3. Glucagon solutions should not be used unless they are clear and of a water-like consistency.
4. For adults and for children weighing more than 20 kg, give 1 mg (1 unit) by subcutaneous, intramuscular, or intravenous injection.
5. The patient will usually awaken within 15 minutes. If the response is delayed, there is no contraindication to the administration of one or two additional doses of glucagon; however, in view of the deleterious effects of cerebral hypoglycemia, and depending on the duration and depth of coma, the use of parenteral glucose must be considered by the physician.
6. Intravenous glucose must be given if the patient fails to respond to glucagon.

Adverse Reactions

Severe adverse reactions to glucagon are rare, because it is quickly broken down and excreted. Treatment is mostly symptomatic, primarily for nausea, vomiting, and possible hypokalemia. **DN**

This review is not comprehensive. Please refer to Glucagon product monograph for more comprehensive information, including precautions, adverse reactions, and drug interactions.

References:

1. ISMP Canada. Report to Ontario Ministry of Health and Long-Term Care. KnowledgeTranslation of Insulin Use: Interventions/Safeguards. June 2012. Available at <http://www.ismp-canada.org/download/insulin/KnowledgeTranslationInsulinInterventions.pdf>. Accessed Oct. 27, 2014.
2. Cobaugh DJ, Maynard G, Cooper L, et al. Enhancing insulin-use safety in hospitals: Practical recommendations for an ASHP Foundation expert consensus panel. *Am J Health-Syst Pharm* 2013;70:e18-e27.
3. CSHP Ontario Branch – ISMP Canada. Safe Delivery of Insulin: Summary Report and Recommendations. April 30, 2014. Available online at http://www.ismp-canada.org/download/insulin/SafeDeliveryOfInsulinReport_09Jun2014.pdf. Accessed Oct. 27, 2014.
4. Glucagon (rDNA origin) Product Monograph. 2012.