PSNet
PATIENT SAFETY NETWORK

Duplicate Insulin Order

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The Case

A 45-year-old man with a history of insulin-dependent diabetes mellitus was seen in the emergency department (ED) for complaints of lethargy and decreased oral intake. Tests revealed blood glucose levels in the 800s with an anion-gap acidosis and positive beta hydroxybutyrate. The patient stated he had not been able to afford insulin and had not taken any for the last 3 days. A bed was requested in the intensive care unit (ICU) for treatment of diabetic ketoacidosis.

After administration of fluids, an insulin drip was started and blood sugars were monitored hourly. The patient was more awake and able to ask for food after a few hours in the ED awaiting the ICU bed. His blood sugar levels were slowly normalizing and the gap acidosis improving. Once the acidosis normalized, the team decided to convert the patient's insulin drip to subcutaneous long-acting insulin ("bridging").

The fellow asked the resident to place an order for 50 units of insulin. The resident called the ED and asked if the insulin was given. A covering nurse answered the phone and said she had not given any insulin. The resident instructed the nurse to administer 50 units of insulin and stop the insulin drip in about 1 hour. After about 30 minutes, the patient's nurse came back from break and found him to be lethargic. She immediately called the ICU team. The team instructed her to get a stat blood glucose level, which was found to be in the 30s. The insulin drip was stopped and IV dextrose pushes were given. The patient was started on dextrose 10% IV solution and blood glucose levels were monitored every 15 minutes. Within about 1 hour, the patient's blood glucose levels stabilized (> 75 mg/dL), and he became more alert.

*Chart review revealed that **both** the resident and the intern had placed orders for 50 units of insulin without either of them cross-checking the orders. In addition, the patient's assigned nurse did not communicate to the covering nurse that she had given a dose of insulin, nor had the covering nurse checked the chart to see if any other doses of insulin had been given. The pharmacy noted the duplicate order, but by the time they called the ED and spoke with the patient's nurse, the patient had already received the two 50-unit doses while still on the insulin drip.*

The patient recovered from the incident without apparent adverse effects. After this event, the team received training on the ED's insulin protocol for diabetic ketoacidosis and adjustments were made to the pharmacy protocol for checking duplicate orders and dispensing insulin.

The Commentary

Commentary by Nicole M. Acquisto, PharmD, and Daniel J. Cobaugh, PharmD

The patient in the case above received a duplicate dose of insulin. The Institute for Safe Medical Practices (ISMP) categorizes insulin as a high-risk medication in acute care settings.(1) Approximately 98,000 emergency department (ED) visits for insulin-related hypoglycemia and errors occur annually, with 30% resulting in hospital admission.(2) One report described 16,600 insulin-related patient safety incidents, with 24% resulting in patient harm.(3) Insulin errors are reported across all phases of the medication-use process (prescribing, transcribing, storage/dispensing, administering, and monitoring) with the majority occurring during administration (61%) or prescribing (17%).(3,4) The main causes of subcutaneous insulin administration errors are incorrect monitoring of blood glucose, poor documentation, and duplicate dose administration.(3,4)

Although insulin errors occur in all hospital settings, the ED is a particularly high-risk environment. Table 1 lists factors that may contribute to insulin-related errors in the ED. A cross-sectional evaluation of all ED errors (from 496 EDs) reported over a 4-year period found nearly 14,000 medication errors, with an error rate of 78 per 100,000 visits.(5) Errors often occurred in the administration phase (36%), most were committed by nurses (54%), many were associated with the wrong dose (18%), and many were attributed to poor communication, not following procedure/protocol, distractions, emergency situations, and workload increases. A prospective, observational study found 178 medication errors in 192 patients over 28 observed provider shifts.(6) At least one error occurred in almost 60% of patients (37% reaching the patient), most often during the prescribing (54%) and administering (35%) phases.

In the case described, several factors contributed to the error at each phase of the medication-use process, including drug prescribing, pharmacist verification, dispensing, and administration. Finally, some factors specific to insulin itself contributed to the error. The main contributors to the error during the prescribing phase were duplicate orders and lack of a duplicate-order alert. Although computerized provider order entry (CPOE) systems and electronic health records (EHRs) have reduced medication errors in hospitals and improved communication among health care providers, these technologies can introduce unintended consequences.(7,8) Duplicate medication ordering errors and problems with alert fatigue have increased with the implementation of CPOE.(9,10) Computerized provider order entry can contribute to errors through several mechanisms, including multiple pathways to write orders (e.g., two providers ordering from two different computers at the same time), confusing alert content (e.g., multiple alerts in one panel, unclear severity), clinical decision support systems missing true duplicate orders, confusing data displays (difficulty reviewing existing orders), and design issues like order defaulting for certain medications.(9)

Duplicate orders, as seen in this case, have also been found to be higher during handoff times.(9) One study described an 84% reduction in duplicate orders following optimization interventions.(10) These included drug-related interventions such as identifying common medications accounting for duplicate

orders and removing them from order sets; disabling previously defaulted medications in order sets; activating alerts on targeted and high-risk medications; and allowing the pharmacy to censor alerts on certain medications. Prescriber-related interventions included raising awareness through emails describing duplicate events; reminders in staff conferences or meetings; one-on-one CPOE/EHR training for individuals; computer-based retraining, lectures, and training sessions; and weekly emails to heads of departments and training programs.

In this case, the main contributors to the error during the pharmacist verification and dispensing phase were the pharmacy delay in error interception and lack of the medication availability in the ED. In this case, the pharmacist recognized the duplicate order, but actions to prevent the error from reaching the patient were delayed. Having pharmacists physically present in the ED has been shown to reduce medication errors and may have prevented the delay in interception.(11,12) Two prospective multicenter studies found ED pharmacists intercepted 364 and 504 medication errors during a 1000-hour and 800-hour study period, respectively.(11,12) Incorrect dose was the most common error, and errors were identified during pharmacists' consultative activities at the bedside or review of medication orders. Importantly, almost half of intercepted errors in these studies were categorized as serious (having potential to cause organ injury or alter life function).(12)

Because of the pace required in the ED, most medications are available in ED automated dispensing cabinets (ADCs) to reduce time to retrieve medications, ensure storage safety, and provide inventory tracking.(7) Many safeguards are lost by using features such as (i) placing the entire machine on "override status" (e.g., verified medication orders will not populate the ADC patient profile and will not alert when duplicates are removed), (ii) making selected medications available on "override," or (iii) using "auto-verify" to bypass the requirement for pharmacist verification. In this case, the duplicate order was not verified by the pharmacist, but the nurse was still able to obtain the medication. It is likely that the medications were not included on the patient's profile and did not trigger a duplicate alert at the ADC level. Ensuring the ADC is set up to profile patient medications and that nonemergent medications are not available on override would have produced an ADC alert notifying the nurse that the second dose of insulin was being ordered too soon after the previous administration.

The main contributors to the error during the administration phase included the lack of a barcode medication administration system, handoff communication, and discussion about drug administration with the patient prior to administration. The administration phase is an important area to target for improved drug administration safety. Barcode medication administration systems work by placing an identifier on every medication and patient to provide a double check for right patient, drug, route, and time.(7) In this case, had barcode medication administration been used, it would have alerted the nurse that the pharmacist had not verified the second insulin order, which may have raised a question. Even if the alert was overridden, it would have indicated in the EHR that the second dose was being ordered too soon after the previous insulin dose.

A Joint Commission Sentinel Event Alert highlighted inadequate handoff communication as a contributor to patient harm and a longstanding problem in health care.(13) Several standardized handoff methods and tools are available, such as forms and checklists, face-to-face and electronic communications, and frameworks like SBAR (Situation, Background, Assessment, Recommendation) or I-PASS, which have

reduced adverse events, medical errors, and readmissions.(13) The Joint Commission Targeted Solutions Tool can be used to examine current handoff communications, identify areas of focus, and provide guidance on the most appropriate handoff communication.(13) In this case, a discussion regarding administration of the subcutaneous insulin, the plan for glucose monitoring, and discontinuation of the insulin infusion may have prevented the error. Furthermore, a conversation with the patient regarding the insulin plan may have alerted the patient that the second subcutaneous insulin dose was incorrect.

Lastly, several recommended safeguards specific to insulin may have prevented this error (4,14), including the development and utilization of standardized protocol, order set, or clinical decision support for transition from intravenous to subcutaneous insulin; additional verification and safety checks; and additional education and competency assessment for personnel (Table 2).

Take-Home Points

- Insulin is a high-risk medication and safe practice recommendations from the American Society of Health-System Pharmacists and Institute for Safe Medication Practices should be implemented in the emergency department and hospital settings.
- The emergency department is an area of high risk and having pharmacists physically present can decrease medication errors.
- Computerized provider order entry modifications and streamlining alerts can identify duplicate orders and reduce alert fatigue.
- When implemented appropriately, automated dispensing cabinets and barcode medication administration can prevent medication errors.
- Good communication and handoffs are important factors in averting errors.

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Tables

Table 1. Contributors to Insulin-Related Errors in the Emergency Department.(5-7)

Environmental contributors
Fast pace
Emergent nature of care
Unpredictability
Diversity in patient care
High rate of interruptions
Reliance on verbal orders
Overcrowding
System-level contributors
Understaffing
Medications often being readily available and dispensed without pharmacist review
Lack of independent double checks of nurse-prepared medications
Lack of barcode medication administration
Absence of standardized handoff communication
Patient-specific contributors
Undifferentiated and unfamiliar patients
Minimal past medical history or information known at the time of ED presentation
Incomplete medication history

Table 2. Recommended Insulin Safeguards.(4,14)

Development and utilization of standardized protocol/order set/clinical decision support for transition from intravenous to subcutaneous insulin
Communication of all patient-specific information related to diabetes care in one designated EHR location
Pharmacist confirmation of the indication before verifying initial insulin orders
Ensuring all insulin vials have ready-to-apply barcoded labels to apply to clinician-prepared syringes
Dose/volume double-check for all clinician-prepared syringes
Barcode scanning to verify correct insulin to the correct patient
Confirmation of appropriate indication, current blood glucose value, and last insulin dose and inform patient their most current blood glucose level and their dose, full name of the product, and the insulin's intended action prior to administration
Standardized education and competency assessment required for all health care professionals with insulin responsibilities
Process for real-time surveillance of unexpected hypoglycemia events for review by health care team members and implement systems changes to prevent future errors

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