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ISMP
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Acute Care
ISMP Medication Safety Alert!®
Educating the Healthcare Community About Safe Medication Practices

Incorrect use of smart infusion pump in the OR leads to milrinone overdose

PROBLEM: An anesthesia resident wanted to start a milrinone infusion on a perioperative patient who required inotropic support. Milrinone is used in patients with acute decompensated heart failure with reduced ejection fraction, as well as before and after cardiac surgery. The typical dose range is between 0.1 to 0.75 mcg/kg/minute. The resident was unfamiliar with the smart infusion pump available for use in the operating room (OR). He subsequently entered an incorrect milrinone concentration of 200 **mcg** in 100 mL, when the infusion bag he was hanging contained 20 **mg** in 100 mL of 5% dextrose. He then programmed the infusion pump to deliver the intended dose-rate of 0.25 mcg/kg/minute.

The resident was using the pump in "anesthesia mode." Milrinone was not listed in the anesthesia drug library because it was rarely used. Thus, he entered the drug concentration and dose manually. However, if the resident had used the "All Drugs" option available in "anesthesia mode," he would have been able to access a milrinone infusion entry, which included preestablished low and high concentration limits. Prior to this incident, the resident was not aware of this function. Since the pump did not alert him to the erroneously low concentration entry, the resident initiated the infusion. As an aside, for this pump vendor, hard stops transitioned to soft stops in "anesthesia mode," thereby allowing overrides of established dosing/concentration limits, even catastrophic limits.



Figure 1. Hospira premixed milrinone lactate injection label contributed to a pump programming error because of the emphasis on 200 mcg per mL, not 20 mg/100 mL.

Since the resident did not use milrinone frequently, he was unfamiliar with the Hospira packaging of the premixed infusion. During investigation of the event, the resident felt as though the label on the Hospira premixed bag of milrinone also contributed to the error. The per mL concentration, 200 mcg (0.2 mg)/mL, is the most prominent expression of the drug concentration, listed in large text right below the drug name at the center of a blue background on the label (**Figure 1**). The total amount per total volume (20 **mg**/100 mL), which should be the most prominent concentration expression following the drug name, is instead listed on the label in smaller print above the blue background. Thus, the resident mistakenly thought the bag contained a total of 200 **mcg**/100 mL.

Hypothetically, for an 80 kg patient, the infusion rate to deliver a dose of 0.25 mcg/kg/minute would be 6 mL per hour, using a 20 mg/100 mL milrinone infusion bag. If the pump was programmed with an erroneously low milrinone concentration of 200 **mcg** in 100 mL, the drug would infuse at a rate of 600 mL per hour. In this case, the 100 mL bag of milrinone completely infused in a very short time, leading the anes-

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Special Alert!

Short period of Surescripts medication history inaccuracies

We learned this week that Surescripts may have sent inaccurate medication history data to prescribers who requested information for medication reconciliation. Surescripts supports electronic transmission of patient medication history from pharmacies and pharmacy benefit managers to prescribers who request the information. The company determined that some medication history responses sent between April 21 at 4:02 p.m. and April 22 at 6:45 p.m. EDT may have included medications that had not been prescribed for the patient, in addition to those that had. The problem occurred when an update deployed by Surescripts inadvertently caused their Master Patient Index to incorrectly match some patients. As a result, incorrect medications may have been added to patients' medication history response messages and might have been included on patients' "home medication" lists.

The issue affected all electronic health record (EHR) vendor users of Surescripts Medication History (version 2017071, also known as v3). Immediately upon identifying and resolving the issue, Surescripts communicated with EHR vendors and health system customers through specified contacts on organization-identified lists. EHR vendors may have also communicated with their customers' information technology departments. However, some internal pharmacy departments and prescribers may not have been immediately notified about this issue and are still unaware of the problem.

In its communication to customers, Surescripts recommended that EHR vendors and health systems immediately communicate this potential risk to all who utilize Surescripts Medication History. To remediate the issue, Surescripts recommended that any prescriber who submitted a medication history request or received a medication

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thesia resident to realize that an error had been made. Due to the milrinone overdose, the patient required observation and supportive care in an intensive care unit but did not suffer serious adverse effects (e.g., cardiac arrhythmia, significant hypotension).

Safe Practice Recommendations: Leadership must establish that the use of smart infusion pumps with an engaged drug library is an expected practice in the OR for all continuous medication infusions, intermittent and secondary infusions, loading and bolus doses, patient-controlled analgesia infusions, epidural and nerve block infusions, and infusions of hydrating solution (except when the hydrating fluid administration rate is greater than the pump allows). In the hospital where this error occurred, the anesthesia department chair has taken the important step of understanding why smart infusion pumps with an engaged drug library were not being correctly used in the OR by some anesthesia providers, including residents. An initiative was implemented to reduce these barriers, including:

- Providing educational programs such as "anesthesia grand rounds," which included discussions about this event and "hands on" education about smart infusion pump capabilities (e.g., dose/concentration limits and warnings, bolus dose feature)
- Performing standardized competency assessments for the use of smart infusion pumps with an engaged drug library for all anesthesia residents, as well as anesthesia providers and other OR practitioners
- Opening the lines of communication about future barriers to using smart infusion pumps so they can be addressed rather than result in unsafe practices (e.g., failing to engage the library)
- Reissuing a leadership-driven requirement to use smart infusion pumps with an engaged drug library in the OR

When creating the anesthesia drug library, implement upper and lower hard limits whenever possible for medication doses, concentrations, infusion rates, and loading and bolus doses (often different than hard limits for maintenance infusions) used in the OR. The use of hard stops can serve as a forcing function and reduce the incidence of incorrect infusion pump programming. We also recommend limiting the use of "anesthesia mode" in smart pumps that change hard limits to soft limits, to ensure that catastrophic limits produce a hard stop. Use of smart pumps that default to, or require programming within the drug library, can also improve safety in the OR. For additional recommendations, please see the ***ISMP Guidelines for Optimizing Safe Implementation and Use of Smart Infusion Pumps*** (www.ismp.org/node/972).

ISMP has contacted Hospira about the milrinone labeling problem, and the company is currently revising the label to present the concentration as the total amount of drug in the container per the total volume, following USP <7> standards.

Patients who come to the hospital with unit-of-use-type packaging

There was recent discussion on our Medication Safety Officers Society (MSOS) listserv (www.medsafetyofficer.org) about hospitalized patients who arrive with their own medications dispensed by companies such as Amazon PillPack or CVS SimpleDose. These are individual "unit-of-use-type" packets that may contain multiple medications for a given administration time. The packets list the medications contained within, and the day and time the packet of medications should be taken by the patient (**Figure 1**, page 3). Many patients find this type of packaging convenient, especially when they need to take their chronic medications while at work or when traveling. A roll of these packets is contained within a carton that is labeled with additional information (**Figure 2**, page 3), similar to some information you

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history response for a patient on April 21 or 22 should submit a new medication history request to replace the previous medication list. The new list will not include the erroneous extra medications.

Health systems should also investigate whether patients treated on April 21 or 22 had medication histories requested through Surescripts, and whether they received the wrong medications due to an inaccurate listing of prior medications. They should also determine whether any hospitalized patients may have been discharged with erroneous medication lists or were given prescriptions for the wrong medications. Potential long-term consequences of including the wrong medications on a patient's "home medication" list include: 1) Erroneous medications will again show up in EHRs during the next patient encounter; 2) The patient may be discharged on the wrong medication; and 3) Any erroneously filled medications will feed back to Surescripts as a correct medication and be included on any updated medication history query. It will likely take time to straighten out medication histories that have been affected by this issue.

ISMP has communicated with Surescripts about the situation. Surescripts customers should contact their Account Manager and end-users should contact their EHR vendor if they have any questions. An important lesson learned from this is how critical it is to verify electronic medication histories with the patient (or caregiver) directly during medication history collection and reconciliation in both inpatient and ambulatory settings. Pharmacies should also ensure that someone within the department is listed as a contact for Surescripts safety communications.

SAFETY briefs

Selenious acid product labeled in terms of active moiety. Last year, American Regent launched a new presentation of selenium to reflect the American Society for Parenteral and Enteral Nutrition (ASPEN) recommendations for trace element supplementation for adults (60-100 mcg/day) and children (1-2 mcg/kg/day, maximum 100 mcg/day). The US Food and Drug Administration (FDA)-approved product, labeled "Selenious Acid," is equivalent to 60 mcg

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would see on the pharmacy label affixed to a plastic prescription vial, as required by the state pharmacy act and board of pharmacy. Many long-term care pharmacies also use this type of packaging.

One obvious problem with unit-of-use-type packets for patients involves what to do when the prescription for one of the medications contained in the packets is changed (e.g., dose changed, discontinued), or a new medication is added to the patient's regimen. However, a significant issue with unit-of-use-type packets for hospitals is that patients sometimes arrive with the individual packets but not the outer labeled carton in which they were mailed. The labeling on the individual packets tends to be the minimum amount necessary for the patient to know what they are taking and when; the packets do not include the pharmacy phone number and address, prescription number, full regimen instructions, prescriber name, manufacturer name, and beyond-use (discard after) date, as would be available on a prescription vial label or the outer carton. The lot number and manufacturer's expiration date generally do not appear on either carton labels or traditional prescription vial labels as they are not required and might be difficult to include on vial labels due to space limitations.



Figure 1. Individual "unit-of-use" packet, containing one dose of several medications for a patient.

This unit-of-use-type packaging can present difficulties for inpatient pharmacy personnel if one or more of the medications is non-formulary and necessary for the patient to take during hospitalization. If the patient's own supply of medication is needed during hospitalization, the medication must be reviewed by a pharmacist and be identifiable, just as it would be if the patient brought the medication in a prescription vial or bottle. If the patient brought in the entire carton, then pharmacists should be able to find the needed information or could call the dispensing pharmacy to retrieve any additional information they require. If the carton is not available, family members may be able to provide information over the phone, or scan or take a picture of the label and email or text it to the pharmacy staff. Keep in mind, though, any medication in the packet used during hospitalization still requires pharmacy verification using tablet and/or capsule imprints, even though the carton label displays the appearance of each product (**Figure 2**).



Figure 2. Carton label for a roll of "unit-of-use" packets of medications.

Using the patient's own medication provided in a unit-of-use-type package presents additional difficulties. The medications are not in separate plastic vials, but rather they are mixed in the same packet for administration at a given time. If only one of the medications contained within the unit-of-use packet is needed, the remaining drugs would need to be destroyed or retained for later return to the patient. Fortunately, most (if not all) controlled substances are taken as needed (PRN) and, thus, are not dispensed in this type of packaging, which is intended for routinely scheduled medications, not PRN medications. Also, highly regulated Schedule II medications (e.g., oxy**CODONE**, dextroamphetamine, and amphetamine) are not available in unit-of-use-type packets such as PillPack (www.ismp.org/ext/470).

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of selenium per mL and is available in a 600 mcg per 10 mL vial (**Figure 1**). Previously, only an unapproved American Regent selenium product (400 mcg per 10 mL, 40 mcg/mL) was available. The concentration of the FDA-approved selenious acid injection allows delivery of the recommended dose of selenium in a smaller volume compared to the unapproved product.



Figure 1. Selenious acid injection is equivalent to 60 mcg of selenium per mL, which is present as 98 mcg of selenious acid per mL. The words "of selenium" may be missed on the label.

A compounding pharmacy received an order for parenteral nutrition (PN) in which 60 mcg of selenious acid was ordered but 60 mcg of selenium was intended. At first, pharmacy staff thought this product contained 60 mcg/mL of selenious acid, even though it is labeled in terms of the active moiety, or the elemental selenium content of the product. The principal display panel on the vial label notes "of selenium," and labeling on a side panel further explains that each mL contains 60 mcg of selenium, present as 98 mcg of selenious acid. This was initially missed, but a pharmacist noticed it when checking the ingredients before the PN was compounded. The previous product was labeled as selenium 400 mcg/10 mL, and the selenious acid content was listed on the side panel as 65.4 mcg. Confusion could be reduced by expressing the dose on the label as "600 mcg*/10 mL **of selenium** (60 mcg*/mL), using boldface type to draw attention to "**of selenium**." At present, people may simply read "600 mcg/10 mL" and think it indicates the amount of selenious acid, not selenium.

American Regent is advising customers that "*All future orders will be filled with FDA-approved Selenious Acid Injection, USP (NDC 0517-6560-25). NDC 0517-6510-25 [selenium] can remain in your inventory. There is no need to return the product and it is suitable for use through expiry unless a situation arises to warrant a return.*"

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Unit-of-use-type packaging is being heavily advertised and, no doubt, more patients will be bringing them into the hospital. It is probably a good time to review your policy and procedure on how to handle medications brought from home and to specifically address how to handle medications contained in unit-of-use-type packaging. If you allow patients to use their own medication from home, remind patients to bring the outer carton with them if their medications are dispensed together in unit-of-use-type packaging. After pharmacy has gathered the necessary information, the carton should be sent home with a family member.

Rabies immune globulin carton label improved

In our August 23, 2018 newsletter, we noted that the 300 units (1 mL) and 1,500 units (5 mL) cartons of Grifols **HYPERRAB** (rabies immune globulin, human) look very similar (**Figure 1**). We were glad to learn that the company addressed our request to better differentiate these products. In addition to the 300 units (1 mL) and 1,500 units (5 mL) presentations, the company has added a third presentation of 900 units (3 mL) (**Figure 2**). All three presentations and vial sizes are color differentiated, which minimizes the former look-alike problem.

Unfortunately, the strength listed on the carton labels retains the error-prone abbreviation, IU (international units), which has been mistaken at times for IV (intravenous). Rabies immune globulin is indicated for post-exposure prophylaxis, along with the rabies vaccine, for all persons suspected of exposure to rabies. The full calculated dose is infiltrated thoroughly in the area around and into the wound(s), if anatomically feasible, with the remainder injected intramuscularly. In several locations, labeling states that the product should not be injected IV. When given IV, rabies immune globulin increases the risk for severe allergic or hypersensitivity reactions, including anaphylactic shock.

Both ISMP and The Joint Commission include IU as an error-prone abbreviation that should be eliminated. Instead, "international" should be dropped when possible, and "units" should be written fully. A US Food and Drug Administration (FDA) Center for Drug Evaluation and Research (CDER) guidance (www.ismp.org/ext/473) also states the abbreviation should not be used. However, inconsistency exists within the FDA; the product is a biologic and, therefore, falls under the FDA Center for Biologics Evaluation and Research (CBER), which unfortunately permits the abbreviation.



Figure 1. It may take a while to notice the difference between these two presentations of rabies immune globulin.



Figure 2. Carton contents are now readily distinguishable, although the continued use of the error-prone abbreviation IU is worrisome. IU is sometimes misread as IV, a route that is not indicated for this product.

Special Announcements

ECRI-ISMP free webinar

Join us on **May 12** for ***Medication Safety During COVID-19: What Have We Learned?*** ECRI and ISMP are partnering to deliver a compelling webinar on the impact of medication safety adaptations used during the COVID-19 pandemic. Experts from both organizations, along with medication safety practitioners involved during the pandemic's surge, will share essential learnings from practice changes, such as relaxed independent double checks. The moderators and panelists will discuss where we go from here to monitor medication safety moving forward. For more information and to register, visit: www.ismp.org/ext/477.

ISMP survey on Best Practices reopened

Due to the COVID-19 pandemic, our survey on the level of implementation of the two new **2020-2021 Targeted Medication Safety Best Practices (TMSBPs) for Hospitals** was put on hold. As crisis mode begins to diminish, we would appreciate your participation in this survey regardless of whether you have implemented the Best Practices. You can view all the TMSBPs by going to: www.ismp.org/node/160. The survey is available at: www.ismp.org/ext/350 and will be open through **July 17, 2020**. Since we are only conducting the survey on the two new Best Practices, it should only take you about 5 minutes.

To subscribe: www.ismp.org/node/10

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