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

Patient death after inadvertent infusion of PRN medication hanging on bedside IV pole

Problem: A prescriber ordered albumin 5% (12.5 grams/250 mL) solution for a patient in the intensive care unit (ICU) who was 4 days post-cardiovascular (CV) surgery and experiencing hypotension due to hypovolemia. A nurse removed a carton from an automated dispensing cabinet (ADC) that contained two 250 mL bags of albumin. Both bags were brought into the patient's room and were hung on the intravenous (IV) pole; only one was administered to the patient as ordered. Later in the day, the prescriber ordered a second dose of albumin. The nurse used the albumin bag that had been left in the room on the patient's IV pole. She scanned the barcode on the patient's identification band and scanned the albumin bag but needed to get new IV tubing. Upon return, the nurse spiked what she thought was the albumin bag and started the infusion. Although the organization had implemented interoperability between the electronic health record (EHR) and the smart infusion pump to allow for automatic programming of the pump (e.g., medication, dose, infusion rate), the nurse manually selected the albumin option in the smart pump drug library, and programmed the solution to infuse over 1 hour, bypassing pump scanning and auto-programming. The nurse did not trace the line from the bag to the pump, or from the pump to the patient, before starting the infusion. Her attention was drawn away from the task due to the need to respond to multiple phone calls/issues, and receiving a second critically ill patient with acute needs. About 30 minutes later, the nurse was alerted by the monitor at the nurse's station that the patient's blood pressure had significantly dropped, so she returned to the room. She discovered that a ni**CAR**dipine 40 mg/200 mL infusion that had been placed on the IV pole postoperatively, and remained there for 4 days, had been inadvertently spiked and was infusing instead of the albumin. The ni**CAR**dipine had been ordered through the postoperative CV surgery order set with parameters to initiate if the patient experienced a systolic blood pressure of greater than 130 mm Hg. Approximately 140 mL (28 mg) of the ni**CAR**dipine infused over 30 minutes. The ni**CAR**dipine infusion was immediately stopped; however, the patient continued to decline, went into cardiac arrest, and was unable to be resuscitated.

In a previous newsletter article (*Latent and active failures perfectly align to allow a preventable adverse event to reach a patient*, www.ismp.org/node/57727), we discussed how James Reason's "Swiss cheese" model is used to describe how latent failures (e.g., system failures such as lack of, inaccurate, or incomplete policies or procedures) and active failures of individuals, such as human error (e.g., misprogramming a pump) or at-risk behaviors (e.g., choosing to bypass auto-programming), lead to preventable adverse events. Each slice of Swiss cheese represents a part of the organizational system designed to defend against errors. A hole or gap in one slice of cheese represents a latent failure that may allow an active failure to get through to the patient. However, in the subsequent layers, if the holes are not aligned (i.e., the latent system gaps are addressed), the error may be prevented before it reaches a patient. As with most serious preventable adverse events like this one, many latent system issues (holes in the cheese) need to align perfectly with the active failures of individuals to reach the patient. As you read additional details about the event, notice how a series of latent and active failures can be identified at multiple steps in the medication-use process and consider if these latent failures are present in your organization.

PRN medication (niCARdipine) was stored on the bedside IV pole (latent failure). Historically, the cardiac surgeons' practice for all postoperative CV patients was to leave the operating room (OR) with a ni**CAR**dipine infusion bag hanging on the IV pole "in case" it was

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SAFETY briefs

Delay finding calcium chloride syringe due to yellow color association. During a pediatric code, a nurse had difficulty finding a 10% calcium chloride (1,000 mg/10 mL) syringe in the code cart because she was looking for the typical yellow packaging. Due to a drug shortage from their usual manufacturer, the pharmacy purchased Medefil calcium chloride syringes. Medefil changed the color of the packaging from yellow to dark brown (**Figure 1**, page 2) following mix-ups between their sodium chloride injection 0.9%, heparin lock flush 500 units/5 mL, and 10% calcium chloride syringes which were all packaged in yellow overwraps (see our September 8, 2022 newsletter, *Scan before you flush* [www.ismp.org/node/37117]). The pharmacy was unaware of the color change, and

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IMPORTANT! Read and utilize the Acute Care Action Agenda

One of the most important ways to prevent medication errors is to learn about problems that have occurred in other organizations and to use that information to prevent similar problems at your practice site. To promote such a process, selected items from the **January – March 2024** issues of the ***ISMP Medication Safety Alert! Acute Care*** newsletter have been prepared for use by an interdisciplinary committee or with frontline staff to stimulate discussion and action to reduce the risk of medication errors. Each item includes a brief description of the medication safety problem, a few recommendations to reduce the risk of errors, and the issue number to locate additional information.

The **Action Agenda** is available for download as an Excel file (www.ismp.org/node/130201). **Continuing education** credit is available for nurses at: www.ismp.org/nursing-ce.

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needed. Practitioners were unaware of the risks and potential consequences of storing medications not in use at the bedside or hanging on an IV pole.

Lack of familiarity with medication access in ADC (active failure). Some nurses were concerned that ni**CAR**dipine would not be readily available should a patient need it urgently. Upon questioning, nurses were unaware ni**CAR**dipine was available in the ADC via override should it be needed emergently before the order was verified by pharmacy.

Prescriber did not reassess the patient or discontinue the order (active failure). The ni**CAR**dipine order remained active on the patient's profile for 4 days postoperatively without the medication being discontinued or removed from the patient's room when it was not needed.

Medication discontinuation responsibility was unclear (latent failure). Per the organization's Pharmacy and Therapeutics (P&T) Committee, pharmacists had the authority to discontinue orders for unused continuous medication infusions after 48 hours. However, this was an authority, not a responsibility, and a provision existed that excluded infusions ordered from an order set.

Choosing the wrong bag (active failure). The nurse selected the ni**CAR**dipine bag to spike instead of the albumin bag.

Interoperability was bypassed (active failure). The nurse did not scan the barcode on the pump, bypassing interoperability. She noted this was a deviation from her typical workflow, partially due to having to manage multiple tasks at the same time.

Failure to trace the line (active failure). The nurse did not trace the line. There was an expectation for nurses to trace lines with intravascular fluids outlined in the organizational vascular access policy, but the policy was not followed, and line tracing was not routinely performed by nurses.

Inadequate line tracing policy content (latent failure). The vascular access policy stated to trace the line from the bag to the pump, and from the pump to the patient. However, the policy did not specify for the nurse to verify the order in the medication administration record (MAR) and/or to require the medication label to match what is programmed in the pump when performing line tracing.

Similar-looking bags (latent failure). Premixed infusion bags of **CARDENE** (ni**CAR**dipine) 40 mg/200 mL by Baxter, and **FLEXBUMIN** (albumin human) 5% solution 250 mL by Shire, are similar sizes and have red and white labels (**Figure 1**). Albumin had previously been available in glass bottles, which looked much different from infusion bags.

Culture of intimidation (latent failure). Due to the surgeon's reputation of intimidating behavior, only a few nurses in the ICU were interested in acquiring the extra skills needed to care for CV surgical patients. As a result, support was less for nurses caring for CV patients. Any behavior that discourages the willingness of staff to speak up or interact with an individual because they expect the encounter will be unpleasant or uncomfortable is disrespectful behavior (www.ismp.org/node/29916) and often has latent effects on organizational processes.

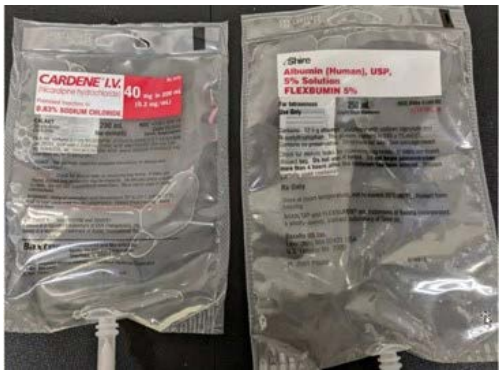

Figure 1. Look-alike Cardene (ni**CAR**dipine) 40 mg/200 mL (left) and Flexbumin (albumin human) 5% solution 250 mL (right) infusion bags.

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this information was not communicated to end users. While the color of medication labeling should not be relied on alone, staff provided feedback that due to products having yellow packaging for many years, there is a strong association between yellow packaging and the calcium chloride syringes, and they are concerned this will contribute to delays in care.

Figure 1. Medefil's 10% calcium chloride (1,000 mg/10 mL) syringe packaging is now brown (left), which caused a delay in treatment because practitioners associate calcium chloride with yellow packaging (right).

If your organization purchases 10% calcium chloride (1,000 mg/10 mL) syringes made by Medefil, notify staff of this color change. When the pharmacy receives a new product (e.g., new product added to formulary, drug shortage), conduct a proactive review of product characteristics that might cause confusion and lead to medication errors (www.ismp.org/node/71460). When problems are recognized, consider purchasing the product from a different manufacturer, and notify your group purchasing organization when appropriate. Communicate with staff when a new product is available in the code cart, and review the packaging, storage location, and other pertinent information. We have notified Medefil of this concern.

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Low lighting (latent failure). The adverse event described occurred during the night shift, where there was deliberate low-level lighting in the patient's room to encourage sleep. This normalized behavior can contribute to difficulty reading medication labels.

Perception that only certain nurses could care for CV patients (latent failure). There was an organizational perception that only certain specialty-trained nurses could help care for CV surgery patients. This resulted in an environment where staff did not feel supported when they felt overwhelmed.

Interoperability analytics were not monitored (latent failure). The organization did not have a system or process for nurse managers to monitor auto-programming compliance data, so they were unaware when it was being bypassed.

Safe Practice Recommendations: To minimize errors, evaluate your processes by considering the following recommendations:

Create a healthy workplace. A necessary first step involves establishing a code of conduct (or code of professionalism) that declares an organization's intolerance of disrespectful behaviors and serves as a model for interdisciplinary collegial relationships (different but equal) and collaboration (mutual trust and respect that produces willing cooperation). Validate that mutual respect regardless of rank or status is an organizational core value. Use a standard communication process, such as SBAR (situation, background, assessment, recommendation) (www.ismp.org/ext/902) or TeamSTEPPS (Team Strategies and Tools to Enhance Performance and Patient Safety) (www.ismp.org/ext/903), to aid in streamlining critical information that must be shared, thus limiting the opportunity for disrespectful behaviors. For additional recommendations, review our newsletter article, *Addressing disrespectful behaviors and creating a respectful, healthy workplace–Part II* (www.ismp.org/node/30320).

Reconcile medications. During care transitions (e.g., OR to postoperative unit, postoperative unit to ICU), a designated prescriber must review the patient's medication orders, considering the patient's current condition and plans for care.

Bring medications to the bedside only when needed. Develop a policy that does not allow practitioners to bring a medication to the patient's bedside until it is needed based on the prescribed order parameters (e.g., systolic blood pressure of greater than 130 mm Hg).

Conduct daily review of medications. Include a daily review of medications ordered and hanging on the patient's IV pole to determine if unneeded medications are ordered/present. Medications that are not needed should be immediately removed from the IV pole and discarded or returned to the pharmacy. We have previously shared risks with leaving unneeded medications at the bedside. For details, review our newsletter articles, *Leaving a discontinued fenta**NYL** infusion attached to the patient leads to a tragic error* (www.ismp.org/node/25585) and *Risks with leaving discontinued infusions connected to the patient* (www.ismp.org/node/29324).

Trace infusion lines and confirm the programming. When infusions are started, reconnected, or changed (i.e., new bag/bottle/syringe), trace the tubing by hand from the solution container to the pump (and channel), to the connection port, and then to the patient to verify the proper infusion, pump/channel, and route of administration. Confirm that the infusion dose and rate are programmed accurately; verify that the order in the MAR and the medication label match what is programmed in the pump when performing line tracing before starting the infusion.

Promote a safe environment. Consider creating an "on-call" staffing model based on defined conditions (e.g., nurse-to-patient ratio, patient acuity metrics), that would allow nurse managers/leaders to review the situation, gather feedback from frontline staff, and have an action plan to divert

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Sharing a good catch prevented a future error. A nurse reported a close call (i.e., good catch) after attempting to remove a vial of furosemide 20 mg/2 mL (Hospira) from an automated dispensing cabinet (ADC), and finding a vial of ketorolac 30 mg/mL (SOLA) had been placed in the wrong pocket during the ADC refilling process. Both products come in similar-sized brown, light-protected vials, with the drug names displayed in white font on orange banners near the top of the label (**Figure 1**). Due to a shortage, the pharmacy had recently purchased ketorolac from SOLA. At an interdisciplinary safety huddle, the good catch was shared with staff to alert them to the similar-looking vials. A few days later, when checking medications to be filled in an ADC, a pharmacist found a ketorolac vial mixed with furosemide vials. Since the nurse's good catch had been shared with the pharmacy staff, she was aware of the risk from the look-alike vials, which helped her identify the error.

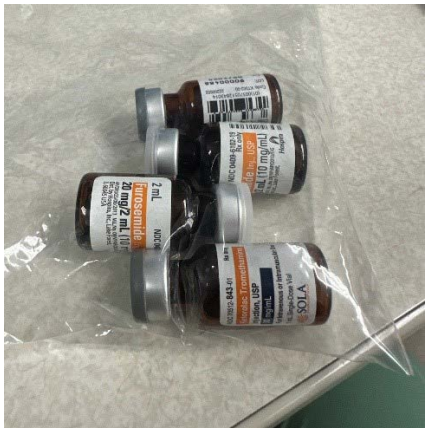

Figure 1. Similar-looking vials of furosemide (top three vials) and ketorolac (bottom vial) were found mixed together.

This serves as an example of how reporting and sharing close calls/good catches supports the development of a learning culture, in which individuals see value in sharing safety issues to prevent errors from reaching a patient. In addition, when the pharmacy receives a new product or a product from a different manufacturer (e.g., new product added to formulary, drug shortage), they will now conduct a review to identify potential risks with the product's design including look-

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or bring in additional resources, as needed. Encourage staff to speak up in situations where they feel that their workload and/or patient acuity is overwhelming or creating an unsafe environment in which an error may be more likely to occur. Ensure the physical environment offers adequate space and lighting and allows practitioners to remain focused on the medication-use process without distractions. For additional recommendations, review our newsletter article, *Minimizing distractions and interruptions during medication safety tasks* (www.ismp.org/node/101360) and *Selected medication safety risks to manage in 2016 that might otherwise fall off the radar screen – Part II* (www.ismp.org/node/261).

Manage similar-looking products. When the pharmacy receives a new product (e.g., new product added to the formulary, changes in manufacturer, during drug shortages), conduct a review to identify potential risks with the product's design including any look-alike labeling and packaging concerns with other products on the formulary. When problems are recognized, consider purchasing the product (or one product of a problematic pair) from a different manufacturer. Also, inform staff who will be using the new product that it is being changed. For additional recommendations, review our previous article, *Safety considerations during expedited product approval* (www.ismp.org/node/71465).

Educate staff. During orientation and ongoing training, review the organization's policy on auto-programming, and removing medications from the bedside that are not needed. Stress the need to trace infusion lines and practice tracing lines during periodic simulations. Educate nurses about the availability of medications in ADC locations, including those that are available via override for urgent or emergent situations. Also, provide mandatory hospital-wide education for all staff about disrespectful behaviors on an annual basis. The purpose is to raise awareness of disrespectful behaviors and the problems they create. Communicate mutual respect as an organizational core value; motivate and inspire staff to help create a healthy workplace; articulate the organization's commitment to achieving this goal; and create a sense of urgency around doing so. Measure the impact of this organizational training during annual culture surveys.

Use auto-programming. If your organization has implemented auto-programming of infusion pumps using interoperability, ensure its use is maximized. Nurse managers must have a system to monitor compliance and gather feedback from end users. Investigate instances where auto-programming was bypassed to understand barriers, correct system issues, and/or coach staff as needed. The organization that reported this event is planning to implement a data analytics tool that will generate reports for real-time compliance monitoring by nurse managers.

Monitor untraced lines. When a patient has an unanticipated event, adverse effect, or clinical deterioration, trace lines to investigate infusion misconnections.

Share good catches. Share impactful stories and recognize staff for good catches, including those caught through tracing the infusion line.

Confusion with preparation and infusion rates results in errors with bendamustine

Bendamustine, a chemotherapeutic agent, is available in varying intravenous (IV) formulations (**Table 1**, page 5), which can add to the risk of using an incorrect concentration or cause infusion rate errors. Chemotherapy medications often have specific administration instructions that must be followed to prevent infusion-related adverse drug reactions (e.g., phlebitis, injection site reactions) (www.ismp.org/ext/1302). There are four brand name products (**TREANDA**, **VIVIMUSTA**, **BELRAPZO**, and **BENDEKA**) and several generic bendamustine products available in the United States. They all need to be diluted prior to administration using either 0.9% sodium chloride or 2.5% dextrose/0.45%

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alike labeling and packaging concerns with other products in use (www.ismp.org/node/71460). When problems are recognized, consider purchasing the product (or one product of a problematic pair) from a different manufacturer. Use barcode scanning technology in the pharmacy to confirm that medications chosen for distribution to the ADC match the medications listed on the ADC fill report, before refilling the ADC. Determine if your ADC has the functionality for practitioners to scan individual products (e.g., each vial) when refilling the ADC, and consider requiring barcode scanning of each medication before placing it in the ADC. Communicate look-alike labeling and packaging concerns to staff, including any additional actions needed (e.g., use of auxiliary warning labels).

Error-prone abbreviation list updated

We recently updated the ***ISMP List of Error-Prone Abbreviations, Symbols, and Dose Designations***, which is now posted on our website and can be accessed at: www.ismp.org/node/8.

These abbreviations, symbols, and dose designations were reported to ISMP through the ***ISMP National Medication Errors Reporting Program*** *(ISMP MERP)* because they have been misinterpreted and involved in harmful or potentially harmful errors. Therefore, they should **NOT** be used in verbal, handwritten, and/or electronic communication. This includes all medication-related technologies, such as screens associated with pharmacy and prescriber computer order entry systems, automated dispensing cabinets, and smart infusion pumps.

Review ISMP's updated list to update your organization's "**Do Not Use**" list. ISMP's list points out the error-prone abbreviations, symbols, and dose expressions included on The Joint Commission's "**Do Not Use**" list, which must be included on an accredited organization's "**Do Not Use**" list.

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sodium chloride. Bendeka is the only product that can also be diluted in 5% dextrose. There are also variations in the final concentration (0.05 mg/mL to 5.6 mg/mL), final volume (50 mL to 500 mL), and infusion duration (10 minutes to 60 minutes) according to the prescribing information. Some packages contain specific dilution instructions on the cartons while others do not. The products also have different beyond-use dates once the products are prepared. While most bendamustine products are indicated for treating chronic lymphocytic leukemia (CLL) and indolent B-cell non-Hodgkin lymphoma (NHL), one generic product (NDC 60505-6228-0) made by Apotex only carries an indication for NHL. These differences create the potential for errors, especially during times of drug shortages, when organizations may purchase a different product that requires an alternative diluent, final volume/concentration, and/or duration of infusion.

Organizations have reported the need to substitute one bendamustine product for another, where they have not accounted for all of the formulation variables, resulting in an error. Most of these occurred when transitioning from Bendeka, which is diluted in a 50 mL bag and administered over 10 minutes, to another product that needs to be diluted in a larger volume and administered over a longer period of time. Recent examples are provided below.

A hospital changed bendamustine products from Bendeka to Vivimusta, but they continued to use the previous build in the electronic health record (EHR), smart pump drug library, and intravenous workflow management system (IVWMS). The systems had been set up with a final volume of 50 mL for Bendeka, but they were not adjusted to a 250 mL final volume for Vivimusta. This resulted in patients receiving the incorrect volume, concentration, and infusion duration.

An organization reported an error after changing from Bendeka to a generic bendamustine product after maintaining the 50 mL infusion volume and 10 minute infusion duration specific to Bendeka. The final volume should have been updated to 500 mL with an infusion duration of 30 or 60 minutes, depending on the indication.

Table 1. Comparison of bendamustine products

Brand	Formulation	Final Concentration	Final Diluent and Volume	IV Infusion Duration
Treanda*	Powder: 25 mg, 100 mg (Reconstitute to 5 mg/mL with sterile water for injection)	0.2 to 0.6 mg/mL	500 mL of any of the following: • 0.9% sodium chloride • 2.5% dextrose/0.45% sodium chloride	• 30 minutes for CLL • 60 minutes for NHL
Vivimusta	Solution: 100 mg/4 mL	0.1 to 1.36 mg/mL	250 mL of any of the following: • 0.9% sodium chloride • 2.5% dextrose/0.45% sodium chloride	20 minutes for CLL and NHL
Belrapzo*	Solution: 100 mg/4 mL	0.05 to 0.7 mg/mL	500 mL of any of the following: • 0.9% sodium chloride • 2.5% dextrose/0.45% sodium chloride	• 30 minutes for CLL • 60 minutes for NHL
Bendeka	Solution: 100 mg/4 mL	0.49 to 5.6 mg/mL	50 mL of any of the following: • 0.9% sodium chloride • 2.5% dextrose/0.45% sodium chloride • 5% dextrose	10 minutes for CLL and NHL

*Generic products also available for chronic lymphocytic leukemia (CLL) and indolent B-cell non-Hodgkin lymphoma (NHL)

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A pharmacy switched from Bendeka to Belrapzo but did not realize the products had different preparation and infusion recommendations. This resulted in four patients receiving a total of 11 Belrapzo infusions that had been incorrectly diluted to 50 mL and administered over 10 minutes (instead of 500 mL over 30 to 60 minutes) before the error was discovered.

Organizations should be aware of differences in the various bendamustine products and develop a comprehensive plan when selecting and evaluating the appropriateness of interchanging products. Review prescribing information for differences in indication, preparation (e.g., diluent, final volume, concentration, beyond-use date), and administration (e.g., infusion duration). If a new product is purchased, make corresponding system updates including configuration settings in systems such as the EHR, IVWMS, and smart pump drug library. Consider including the brand name in the drug description, when applicable. Build order sentences based on indication that automatically default to the product's concentration and infusion rate. Educate staff when new products are being used including any changes in preparation or administration. For additional recommendations, review our previous articles, *A comprehensive, proactive plan is needed to mitigate risk when changing drug concentrations* (www.ismp.org/node/32208) and *Safety considerations during expedited product approval* (www.ismp.org/node/71465).

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