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ISMP Institute for Safe Medication Practices
An ECRI Company

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

MCB-PN—specialized therapy calls for strong systems and specialized expertise

Problem: Compared to patient-specific custom-compounded parenteral nutrition (PN), commercial multi-chamber bag parenteral nutrition (MCB-PN) offers a streamlined approach for delivering essential nutrients to patients who cannot tolerate oral or enteral feeding. In the United States, MCB-PN products are available in two- or three-chamber bags. The two-chamber products include one chamber containing dextrose, with or without calcium, and the other containing amino acids, with or without electrolytes. The three-chamber products contain separate chambers of dextrose, amino acids and electrolytes, and intravenous lipid emulsion (ILE). MCB-PN products are available in different volumes and concentrations of macronutrients. When using MCB-PN, practitioners should choose the MCB-PN product that requires the least amount of manipulation to meet the patient's nutrient requirements.

MCB-PN is designed to simplify preparation and reduce prescribing and compounding errors compared to custom-compounded PN. Advantages include cost savings, reduced pharmacy preparation time, less manipulation, reduced infection risks, and availability of PN during times of macronutrient or additive shortages and for emergency preparedness.[1-4] Despite these benefits, MCB-PN presents unique safety challenges requiring careful consideration across the PN-use process to optimize patient outcomes and minimize risks. MCB-PN-related errors reported to ISMP range from improper activation (not breaking the seal[s] between chambers), mix-ups among the various MCB-PN formulations, failure to include required additives (e.g., multivitamins and trace elements), and infusing MCB-PN bags beyond the maximum recommended duration (i.e., 24 hours).

MCB-PN Errors May Be Hard to Spot

Similar to any PN formulation, MCB-PN is considered a high-alert medication that is susceptible to errors that can result in significant patient harm. Depending on the situation, practitioners may easily be able to identify a dose that could cause a catastrophic error with some high-alert medications. For example, most would be able to recognize that an order for 10 mg digoxin intravenously (IV) represents a significant overdose. However, practitioners may be less familiar with the appropriate macronutrient and micronutrient amounts that are needed to meet the patient's nutrient needs, and errors may be less obvious. For example, without clinical decision support, not all practitioners may easily detect if too much calcium or phosphorus was added to an MCB-PN product that already contains these electrolytes. Due to the complexity of MCB-PN orders, practitioners need to be knowledgeable about available formulations and how to calculate that the prescribed preparation is safe and appropriate for the patient.

A recent ISMP survey[5] revealed that nearly one-third of respondents had experienced or were aware of MCB-PN-related errors, yet most (66%) indicated that their organizations lacked competency assessments for staff managing these products. These findings highlight the need for robust safeguards, clear processes, and ongoing practitioner training to ensure patient safety when using MCB-PN.

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HIGH-ALERT

ICU Medical extension set can foster filtration bypass with ILE. A pharmacist reported concerns about the ability to bypass filtration when administering intravenous lipid emulsions (ILEs) using an ICU Medical extension set with a 1.2-micron filter. This product (item number B9516) was purchased by materials management for parenteral nutrition (PN) infusions, without consulting pharmacy. During rounds, the pharmacist identified that the injection port on this extension set is located below the filter (**Figure 1**). The concern with using this extension set for PN is that ILEs infused via this injection port will not be filtered. After investigation, the pharmacy identified that this product had previously been used at the hospital for infusion of both ILE and other intravenous (IV) medications by connecting the infusion through this port (i.e., below the filter). Fortunately, they are not aware of any impact on clinical outcomes with the cases they have identified.

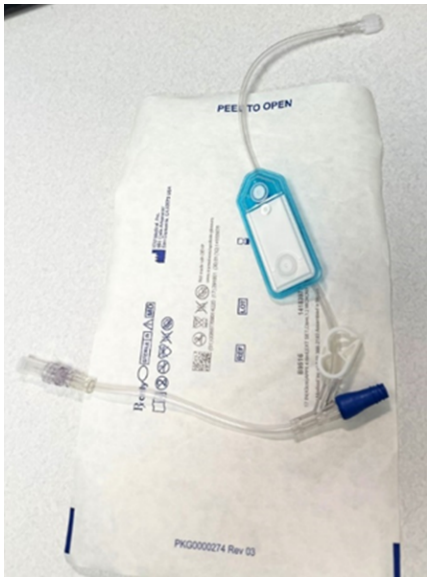

Figure 1. An extension set with a 1.2-micron filter located above the injection port should not be used to administer ILE with PN. Using the injection port via the Y-site will bypass filtration.

We have reached out to ICU Medical about this concern and recommend a warning on

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Consensus-Building National Stakeholder Meeting

In September 2025, clinical experts from around the United States were invited to attend an MCB-PN stakeholder meeting, led by ISMP and the American Society for Parenteral and Enteral Nutrition (ASPEN), to discuss priority MCB-PN-related safety topics. The goal of the stakeholder meeting was to create consensus statements to guide practitioners on the safe use of MCB-PN. Prior to the meeting, participants were asked to vote on 18 statements covering various aspects of MCB-PN therapy, including general use, ordering/order review, preparation, labeling, administration, documentation, monitoring, and handling during transitions of care. During the meeting, clinical experts provided dialogue on priority topics, including input on modifications to the statements. A final vote on the modified statements was conducted after the meeting. All 18 statements achieved consensus (80% or greater agreement) and can be found here: ISMP/ASPEN Multi-Chamber Bag Parenteral Nutrition Consensus Statements.

Safe Practice Recommendations: Each consensus statement offers important guidance to reduce potential harm from MCB-PN use. Organizations should review the document, assess gaps, and act to improve safety. During the entire consensus-building process, including planning, data and literature review, and the stakeholder meeting, two recurring themes were identified: 1) the importance of comprehensive clinical decision support to guide practitioners, and 2) concerns regarding the lack of available training programs and education for practitioners in this area, given the complexity and high-alert nature of MCB-PN therapy. Based on these findings, organizations should consider the following recommendations as a starting point.

Optimize clinical decision support. ISMP Guidelines for Sterile Compounding and the Safe Use of Sterile Compounding Technology call for organizations to implement automated compounding devices that are interfaced with the electronic health record (EHR) to eliminate transcription errors. EHR functionality should include clinical decision support (e.g., dose range checking, compatibility, drug-drug interaction checking, duplicate therapy alerts, maximum concentrations for central versus peripheral line administration, maximum osmolarity) to guide practitioners. Evaluate available clinical decision support (in the EHR and automated compounding device) and ensure there are soft warnings and hard stops to alert practitioners when approaching or exceeding limits (e.g., single dose, daily dose, infusion rate, maximum solubility of calcium and phosphate, osmolarity) or omission of an essential component (e.g., ordering a non-electrolyte containing MCB-PN product without the addition of electrolytes). Regularly review alert overrides to determine appropriateness and to improve the safety of MCB-PN practices.

Educate practitioners and assess competency. Given the complexity and high-risk nature of PN, including MCB-PN, specialized practitioners—such as prescribers, pharmacists, pharmacy technicians, nurses, and dietitians, with advanced training—are essential. These practitioners must possess the expertise to write and/or interpret complex nutrition orders, identify potential stability concerns and incompatibilities, and ensure safe preparation and administration. To maintain safety standards, competency assessments for practitioners working with MCB-PN should be rigorous and ongoing. Provide initial and annual training and competency assessments for any practitioners who prescribe, activate, compound, dispense, or administer MCB-PN. Consider including the following in your educational program:

- Educate practitioners about how to calculate the amount of macronutrients, electrolytes, and additives patients will receive from the MCB-PN bag, based on the ordered rate of infusion.
- Educate prescribers how to enter orders for MCB-PN in the EHR using order sets.

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the product label (and in the description in the product catalog) that this extension set is not appropriate for PN use if ILEs are infused via the injection port, as this will bypass filtration. The American Society for Parenteral and Enteral Nutrition (ASPEN) recommends using a 1.2-micron in-line filter for the administration of total nutrient admixtures (TNAs), dextrose-amino acid admixtures, and ILEs. For TNAs, place the filter as close to the catheter hub as possible. For dextrose-amino acid admixtures, place the filter below the Y-site where the dextrose-amino acid admixture and ILE co-infuse (Worthington P, Gura KM, Kraft MD, et al. Update on the use of filters for parenteral nutrition: an ASPEN position paper. *Nutr Clin Pract.* 2021;36[1]:29-39). Organizations must have a policy and procedure to ensure a pharmacist approves medication-related products/devices. No new drug-related item (e.g., filter, tubing) should be purchased without pharmacy involvement/approval. When receiving a new medication-related device, the organization should have a process to conduct a review, which should include practitioner feedback and education to identify potential risks with the product's design prior to distribution to patient care areas.

HIGH-ALERT

Patient unknowingly received a paralytic agent. A pharmacist reported an event in which a patient did not regain consciousness and had no response to stimuli after a routine colonoscopy. According to the patient's medical record, they had received propofol and lidocaine, neither of which would be likely to cause these symptoms. The anesthesiologist called a stroke code and intubated the patient. The anesthesiologist ordered a computed tomography (CT) scan, which showed no evidence of stroke. The patient began regaining consciousness a few hours later and returned to baseline function within 12 hours.

The anesthesiologist believed the patient's symptoms aligned with the administration of a neuromuscular blocking agent. They discussed their concerns with the certified registered nurse anesthetist (CRNA) who had administered the lidocaine. They did not think they had administered an incorrect medication, but stated it was possible they may have mixed up the lidocaine 100 mg/5 mL and rocuronium

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- Teach practitioners how to evaluate stability data for additives.
- Establish a formal training process and validate competency for pharmacy technicians and pharmacists who prepare or activate MCB-PN, and for pharmacists who verify the final MCB-PN preparation.
- If compounding services are provided for neonatal and pediatric patients, include age-specific training emphasizing weight-based dosing, and validate the competency of all who may prepare or verify pediatric MCB-PN.
- Educate nurses about available technology and safe workflows for MCB-PN administration, including safeguards to ensure that the bag has been properly activated prior to administration, and that the prescribed volume is infused over the appropriate timeframe (i.e., not to exceed 24 hours).
- Encourage practitioners to report close calls (i.e., near misses) and errors that reach the patient related to the MCB-PN-use process internally and to ISMP for shared learning.

References

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4) Ireton-Jones C, Nishikawa K, Nishikawa R. Home parenteral and enteral nutrition during natural disasters: a guide for clinicians and consumers. *Nutr Clin Pract.* 2019;34(2):216-9.
5) Institute for Safe Medication Practices (ISMP). Survey exposes risks with custom and multi-chamber bag parenteral nutrition – part I. *ISMP Medication Safety Alert! Acute Care.* 2025;30(5):1-5.

More concerns about mix-ups with tranexamic acid injection

Problem: Tranexamic acid injection is an antifibrinolytic indicated for patients with hemophilia for short-term use (2 to 8 days) to reduce or prevent hemorrhage and reduce the need for replacement therapy during and following tooth extraction. It is used off-label for a variety of hemorrhagic conditions to control bleeding, including postpartum hemorrhage. ISMP has previously shared and continues to receive error reports related to actual and potential errors involving tranexamic acid, often involving the incorrect route of administration.

Recent Event Reported to ISMP

A hospital reported concern with Epic's "line linking function," which prompts the nurse to select from a list of the patient's infusion lines (e.g., nasogastric tube right nostril, epidural catheter, peripheral IV anterior left forearm) in the electronic health record (EHR) before administering the medication. A nurse became concerned when documenting the site of tranexamic acid injection for a patient in the labor and delivery unit who had also been prescribed an epidural infusion. She noted that epidural catheter should not be an option for

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50 mg/5 mL syringes because they look similar (**Figure 1**). The pharmacy was unable to determine if there was a missing rocuronium syringe from the anesthesia tray. The patient made a full recovery after a short stay in the intensive care unit.

Figure 1. Syringes of lidocaine (left) and rocuronium (right) by Fagron.

The medication safety committee, anesthesiology, pharmacy, and operating room (OR) team conducted an investigation. The lidocaine and rocuronium syringes, both by Fagron, a 503B outsourcing facility, were stocked in an anesthesia tray side-by-side. The rocuronium syringes were the first item in the tray (positioned closest to the end user). Anesthesia staff reported relying on tray location to identify medications. The rocuronium syringe label had a statement "WARNING: Paralyzing Agent, Causes Respiratory Arrest," in small font, which can be easily overlooked. Barcode scanning had not been implemented for use prior to medication administration in the OR. The pharmacy did not have a process to review neuromuscular blocking agent packaging before purchasing or stocking new products, or to assess potential look-alike packaging and labeling concerns when assembling trays. In the OR satellite pharmacy, both syringes were stored in adjacent, open-top bins.

The hospital has since rearranged the layout of the anesthesia trays to separate neuromuscular blocking agents from all other medications packaged in syringes. These agents were also moved to the back of the tray. The pharmacy developed a workflow for pharmacy technicians to record the location of each serialized tray, allowing for pharmacy monitoring of high-alert medication use. Neuromuscular blocking agents stored in the OR satellite pharmacy were moved to secure, lidded bins separate from other medications. In addition, the OR

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tranexamic acid, as this is a potentially fatal route of administration. The hospital reported this safety concern to Epic, who told them that there was no option to restrict the line type, even if the medication/formulation is contraindicated by a displayed route of administration.

ISMP has met with representatives from Epic about this critical concern and has been told that they do not have the ability to restrict by line type. We have recommended that Epic urgently make a system enhancement to mitigate this serious risk by allowing the ability to restrict line options based on appropriateness (i.e., do not display epidural line for tranexamic acid, do not display IV/epidural/intrathecal line for a nasogastric feeding). Epic is escalating this concern, and we hope to provide an update soon.

Other Events

A prescriber provided a nurse with a verbal order for topical tranexamic acid for a patient for perioperative prevention of blood loss (an off-label use) during a procedure in the operating room. The nurse removed a vial of 100 mg/mL tranexamic acid from an automated dispensing cabinet (ADC) via the override function. The nurse prepared the dose using a parenteral (luer lock) syringe and administered the tranexamic acid intravenously (IV) instead of topically. After administration, the nurse immediately identified the error and notified the prescriber. The nurse monitored the patient's vital signs, and no harm was reported. In the organization, almost a quarter of the tranexamic acid used is obtained from the ADC via override with an unknown route of administration documented upon ADC removal.

*Another hospital reported concerns about the risk for practitioners to mix up similar-looking bags of 1,000 mg/100 mL tranexamic acid with 100 mL bags of 0.9% sodium chloride (**Figure 1**). A pharmacy technician was refilling these products in a preoperative ADC and noticed how similar the packaging and labeling were. Both bags, manufactured by Fresenius Kabi, come in a transparent overwrap and are clear 100 mL bags with black font*

Figure 1. Similar-looking 1,000 mg/100 mL tranexamic acid bag (left) and 100 mL 0.9% sodium chloride (right).

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pharmacy satellite implemented a new process for the medication safety team to review all new neuromuscular blocking agent product packaging when they arrive in the pharmacy to assess if there are any look-alike issues. Finally, anesthesia and pharmacy staff received education about neuromuscular blocking agent safety and the risk of look-alike product packaging and labeling.

The US Food and Drug Administration (FDA) require commercial manufacturers to follow USP General Chapter <7> Labeling, which calls for all injectable neuromuscular blocking agents to be packaged in vials with a cautionary statement printed on the ferrules and cap overseals. Both the container cap ferrule and the cap overseal must bear in black or white print (whichever provides the greatest color contrast with the ferrule or cap color) the words, "Warning: Paralyzing Agent" or "Paralyzing Agent" (depending on the size of the closure system). Alternatively, the overseal may be transparent and without words, allowing for visualization of the warning labeling on the closure ferrule. Although 503B outsourcing facilities are not required to follow USP <7>, an article we published on March 22, 2018, FDA Guidance Needed to Assure Safe Labeling Practices by 503A and 503B Compounders, included our recommendation, *The goal should be to publish a guidance that calls upon compounders to follow the same safety standards required of commercial manufacturers, including a requirement for 503B compounders, which are regulated by FDA under the Act [referring to the Federal Food, Drug, and Cosmetic Act], to submit their labels to FDA for review.* While regulatory changes are considered, compounders should voluntarily comply with the same labeling standards currently required for commercial manufacturers. At a minimum, comply with the ISMP Targeted Medication Safety Best Practices for Hospitals, Best Practices 7, and ensure the final containers contain a prominent warning (e.g., auxiliary label) on all final medication containers of neuromuscular blocking agents that state, "WARNING: CAUSES RESPIRATORY ARREST – PATIENT MUST BE VENTILATED." We have reached out to FDA and Fagron and recommend that both commercial manufacturers and 503B

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on the container label. The hospital stored both bags in the same open cabinet in an ADC tower. They were concerned that a nurse could mistakenly select a tranexamic acid bag instead of a 0.9% sodium chloride bag from the bin in the open cabinet, reconstitute it with a medication vial using a vial-to-IV bag transfer device, and infuse it into a patient. After identifying the issue, the hospital moved tranexamic acid into a locked-lidded pocket in the ADC and separated their storage in the pharmacy.

Safe Practice Recommendations: Healthcare organizations should meet with key stakeholders to review their workflow when ordering and administering tranexamic acid injection to fully understand usage (e.g., indication, dose, concentration, route). If the concentrated tranexamic acid injection (i.e., 100 mg/mL vial or ampule) is being used for an off-label treatment within the organization, consider completing a failure mode and effects analysis (FMEA) to identify potential failure modes and mitigation strategies, such as restricting access. Build a hard stop in the EHR so that prescribers cannot order medications/formulations that are contraindicated for specific routes of administration (e.g., the epidural/intrathecal route should **NOT** be an option for tranexamic acid). Similarly, work with the EHR vendor if necessary to ensure only lines that are appropriate can be selected by nurses for particular medications/formulations such as tranexamic acid.

When pharmacy receives a new product, conduct a standardized proactive risk assessment to identify potential risks with the product's design, including look-alike labeling and packaging. If risks are identified, consider purchasing the product (or one product of a problematic pair) from a different manufacturer. Store look-alike products separately. Maximize the use of locked-lidded pockets and store infusion bags with look-alike packaging in different matrix drawers or different compartments of towers. Optimize bedside barcode scanning technology to verify that it is the correct medication for the patient prior to administration. If using a vial-to-IV bag transfer device, ensure the system is set up to require scanning of both the drug vial barcode and the diluent barcode (e.g., sodium chloride bag). Educate practitioners to carefully review individual product labels at multiple points, after removing the medication from the ADC, before spiking an IV bag, prior to administration, and when discarding or replacing it in storage.

For additional information review the ISMP Targeted Medication Safety Best Practice for Hospitals, Best Practice 20, and the recently published ISMP and the Anesthesia Patient Safety Foundation (APSF) joint announcement Preventing Wrong Drug–Wrong Route Errors Involving Tranexamic Acid and Local Anesthetics, which calls for removing tranexamic acid vials and ampules from perioperative areas.

Survey on IV workflow management systems

Med Safety Board, an ISMP company, is conducting a survey on the use of intravenous workflow management systems (IVWMS) regarding the adoption, features, and medication safety concerns. This survey is for all healthcare professionals involved with IVWMS. Please take 5 to 10 minutes to complete the survey by **January 16, 2026**. Thank you!

Report medication and vaccine errors to ISMP: Please visit www.ismp.org/report-medication-error or call 1-800-FAIL-SAF(E). ISMP guarantees the confidentiality of information received and respects the reporters' wishes regarding the level of detail included in publications.

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outsourcer-prepared syringes of neuromuscular blocking agents contain the same paralytic warning on the syringe cap.

This case serves as a reminder of the rationale behind Best Practices 7 and 18. Maximize the use of barcode verification prior to medication administration by expanding use beyond inpatient care areas. Specifically target clinical areas with an increased likelihood of a short or limited patient stay, including perioperative areas. Segregate, sequester, and differentiate all neuromuscular blocking agents from other medications, wherever they are stored in the organization. Limit availability in automated dispensing cabinets (ADCs) to areas where they are needed, and in those areas, store them in locked-lidded ADC pockets/drawers or in a kit in a secure location. Segregate neuromuscular blocking agents from all other medications in the pharmacy by placing them in separate lidded containers in the refrigerator or other secure, isolated storage area. Place auxiliary labels on all storage bins (both refrigerated and non-refrigerated) and/or ADC pockets and drawers that contain neuromuscular blocking agents as well as all final medication containers of neuromuscular blocking agents (including 503B outsourcer syringes that do not have a warning on the syringe cap) that state, "WARNING: CAUSES RESPIRATORY ARREST – PATIENT MUST BE VENTILATED," to clearly communicate that respiratory paralysis will occur and ventilation is required.

This also speaks to the importance of reading the product label three times (when obtaining the item, just prior to use, and when discarding it or returning it to stock). Upon receiving a new product, the pharmacy should conduct a proactive review of product characteristics that might cause confusion and lead to medication errors (e.g., similar-looking packaging or labeling). If problems are identified, consider purchasing the product from a different manufacturer. Communicate with staff when a new product is available and review the packaging, storage location (e.g., anesthesia trays, ADCs), and other pertinent information. During initial and ongoing competency assessments, educate practitioners about high-alert medications, including paralytic agents, and the safeguards the organization has in place to prevent errors with these drugs.

SHARING A SAFETY MISSION

ISMP 28TH ANNUAL CHEERS AWARDS

Tuesday, December 9, 2025

House of Blues – Las Vegas, NV 6:00 pm

The 28th Annual ISMP Cheers Awards will celebrate individuals and organizations on a mission to make strides in medication safety. Support ISMP's ONLY annual fundraising event or attend the awards dinner to honor them and advance our shared goal of preventing errors and protecting patients!

For support opportunities and/or to register for the dinner, visit: https://home.ecri.org/pages/cheers-event

The Michael R. Cohen Lifetime Achievement Award Winner:
Martin J. Hatlie, JD
Founding Member, Director for Policy & Advocacy, Patients For Patient Safety US

ISMP will be at the 2025 ASHP Midyear Clinical Meeting
Educational Sessions with ISMP Speakers:

Sunday, December 7, 2025

How Smart Are Smart Infusion Pumps in Preventing Medication Errors?
9:00 am – 10:15 am PT

ISMP Medication Safety Update 2025
3:30 pm – 5:00 pm PT

Tuesday, December 9, 2025

A Winning Strategy: Confronting the Top 10 Patient Safety Challenges of 2025 with ISMP
10:00 am – 11:00 am PT

Symposium: Safety Considerations for IV Push Amid Drug Shortages
11:30 am – 1:00 pm PT
Mandalay Bay Convention Center - South Pacific D - Lower Level
Preregister here: https://home.ecri.org/blogs/ismp-upcoming-events/safe-iv-push-practices-amid-drug-shortages

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