Preventing catheter/tubing misconnections:
Much needed help is on the way!

Catheter/tubing misconnections remain a serious problem in healthcare. Earlier this year, we learned of another fatal event. A 19-month-old child who was receiving treatment for a chronic gastrointestinal disorder died at a pediatric care center. A suspension of QUESTRAN (cholestyramine) was accidentally given via a central line intravenous catheter instead of through an enteral feeding tube.

In May 2010, another report was published about an incident where barium sulfate was administered to a 17-month-old child via the superior vena cava during an upper gastrointestinal study (Soghoian S, Hoffman RS, Nelson L. Unintentional IV injection of barium sulfate in a child. Am J Health-Syst Pharm. 2010;67:734-36). The patient had a central venous catheter (CVC) in place for antibiotic therapy. As the procedure began, approximately 3 mL of barium sulfate was injected into the CVC, which was mistaken as the child’s gastrostomy tube. Fortunately, no respiratory distress or other major problems developed, and the child was discharged 4 days later.

Luer connector systems, common to many healthcare catheters, tubes, administration sets, extension sets, and syringes, have been at the heart of many catheter/tubing misconnections. One of the most commonly reported problems is that some manufactured enteral catheters still have ports that only accept parenteral administration sets and syringes. So, even if a liquid medication is prepared in an oral syringe, the medication must be transferred to a parenteral syringe for administration, risking the accidental administration of the drug via a parenteral line.

Below are examples of the type of events associated with catheter/tubing misconnections reported to the ISMP Medication Errors Reporting Program (MERP), all of which we’ve described in past ISMP newsletters:

- Peripheral IV infusions connected to epidual lines, and epidural solutions connected to peripheral IV lines
- Vinca alkaloids (e.g., vinCRISline) in a syringe given via an intrathecal catheter
- IV tubing connected to the inflation balloon port of an endotracheal tube or tracheostomy tube
- Sequential compression device tubing or pneumatic blood pressure cuff tubing attached to the port of an IV administration set
- Oxygen tubing connected to port of an IV administration set
- Breast milk accidentally administered intravenously into neonates
- Bladder irrigation solutions given IV, or TPN solutions administered via a foley catheter port
- An enteral nutrition container spiked with an IV administration set resulting in administering the enteral solution intravenously
- Topical solutions intended to be used with the V.A.C. (Vacuum Assisted Closure) Instill System (used for wound healing) prepared in "IV" bags that accommodate IV tubing which could be inadvertently connected or attached to an IV catheter or line
- Albuterol meant for continuous inhalation setup using an IV bag

Follow these recommendations to prevent catheter/tubing misconnections.

- Perform a Failure Mode Effects Analysis (FMMEA) to identify the various types of catheters and connectors used in your organization. Identify the possibility for misconnections, assess the potential frequency and severity of misconnections, and address process changes that need to be made. Be sure to include frontline staff who use the equipment.

- Provide education to staff before using new tubes, catheters, or connectors. Include discussion about possible sources of errors uncovered during the risk assessment and steps to avoid these errors. Also, use tubing misconnections in simulation training during orientation and annual safety competencies. (Go to www.fda.gov/downloads/MedicalDevices/Safety/AlertsandNotices/UCM134873.pdf for examples.)

- Limit the staff who are allowed to connect or disconnect tubing from medication devices to licensed healthcare professionals who have been educated and are knowledgeable about the serious risks associated with misconnections. During orientation include prohibitions to connecting/disconnecting tubing so all hospital staff are aware of who may perform this task.

- Always trace from the source to the connection port to verify attachments before connecting or reconnecting tubing, and/or administering drugs or solutions. This action is particularly important, as awareness of each tube’s location and insertion site is easily lost if tubing is obscured by protective coverings, bedclothes, and sheets. Adjust lights or use flashlights if necessary.

- Recheck connections and trace all connections on page 2—check/it out!
The International Organization for Standardization (ISO) has been working on a standard (ISO/IEC/FDIS 80369-1, “Small-bore connectors for liquids and gases in healthcare applications”) that will make various healthcare catheter connections and associated tubing sets or syringes incompatible with one another. The standard will include connectors for the flow of gases, enteral feedings, liquid medications via an intravenous route, gastric tube, limb cuffs (e.g., sequential compression devices, pneumatic tubes to blood pressure cuffs), urological access (e.g., bladder irrigation), and neuraxial access (e.g., epidural, intrathecal, intracranial). In addition, the current Luer connector standard (ISO 594) will be updated.

Designs for the connectors for enteral tubes and catheters, as well as containers, administration sets, and syringes, are expected to be finalized by early 2011, with clinical testing by manufacturers accomplished during the standards development process. As part of the new enteral standard, a female Luer connector will not be present on feeding tubes, except for the inflation balloon that anchors some long-term use feeding devices. A final version of the standard should be completed by 2013. Although compliance with the standard will be voluntary, product vendors should have revised devices available soon after that.

On July 9, 2010, the US Food and Drug Administration (FDA) sent a letter (www.fda.gov/downloads/MedicalDevices/ResourcesforYou/Industry/UCM218631.pdf) to product manufacturers, healthcare practitioners, and hospital purchasing departments, which offered advice regarding the prevention of catheter/tubing misconnections, which are similar to recommendations you will find in the check!out! column to the right, starting on page 1. FDA also mentioned that the agency is considering recognizing the ISO/IEC/FDIS 80369-1 standard when it is published, due to the significant impact it will likely have on the safety of these devices. If this happens, the FDA will provide guidance to manufacturers regarding issues such as whether there will be a set period of time for currently marketed devices to come into compliance and the effect of the standard on new devices. The standard will be a much-welcomed addition toward improved patient safety. Coupled with additional safety measures found in the check!out! column, we are optimistic that patient harm from tubing misconnections will be greatly reduced.

**CNO Leadership Congress.** If you are a nurse executive who is interested in learning how nurse and physician executives can lead together to create a collaborative culture of change, please join us February 10-11, 2011, at the 6th Annual Nursing Leadership Congress (NLC), Shared Leadership Strategies: Transforming Clinical Quality and Care Delivery, in Charleston, SC. For the first time, the NLC will include a day of clinical leadership collaboration with physician peers. Together, you will focus on shared clinical leadership strategies to shape the future of patient care. This free conference is sponsored by the American Association of Nurse Executives, National Patient Safety Foundation, ISMP, McKesson, and Intel. To register, visit: http://mckesson.cvent.com/EVENTS/Info/Summary.aspx?e=23c5548e-79cc-4df1-91c8-5365f2ff63d. For more information about the physician leadership congress, go to: http://mckesson.cvent.com/EVENTS/Info/Summary.aspx?e=c7f4a02f-cb45-44d4-8921-3fb3d819c8f7.

**check!out!** continued from page 1

- Never attempt to force or use a makeshift connection that does not fit easily and securely into an access port.
- Affix labels on lines near insertion sites if the patient has more than one connection to a port of entry into the body (e.g., IV, arterial, umbilical, enteral, epidural, bladder balloon port, tracheostomy balloon port).
- Avoid using a dual channel pump for infusions via different routes of administration. For example, use pumps for epidural infusions that look different than pumps for IV infusions, if available. Label the epidural pump as “EPIDURAL ONLY.”
- Place pumps on opposite sides of the bed when administering infusions via different routes of administration; when possible, do not keep them next to each other or place them on the same pole.
- Use equipment the way it is intended to be used. For example, only use yellow-lined tubing without injection ports for epidural infusions and only use oral syringes for oral medications.
- Always hang infusion bags with labels facing out so they can be read. Make sure labels are on the same side of the infusion that includes any other important preprinted information.
- Do not use parenteral syringe pumps to administer breast milk enterally; nasogastric tubes should only connect to oral syringes via syringe extension sets (e.g., CORFLO by Corpak Medsystems).
- Limit the frequency of disconnecting and reconnecting tubing (particularly IV tubing) to reduce the risk of misconnections and infections.
Epidural analgesia administered intravenously can be deadly


In May 2010, news media from the United Kingdom reported on the criminal sentencing of a health system after one of its own nurses died when she was given intravenous bupivacaine instead of saline shortly after giving birth to her son (www.nursingtimes.net/whats-new-in-nursing/news-topics/ethical-and-law/nursing/trust-facing-sentence-after-nurse-error/5014772/article). An inquest into the nurse’s death suggested that drug storage in the delivery suites was “chaotic.” In this case, the health system was found to be criminally negligent. In both cases, young mothers lost their lives and newborn infants lost their mothers.

Recently, we received a near miss report that is chillingly similar to these two fatal errors. A young mother who needed an IV antibiotic prior to delivery was almost given epidural analgesia by the IV route. In this case, the primary nurse started the patient’s IV and performed an assessment while another nurse helped prepare the room and medications. An order had been written for an antibiotic and epidural analgesia, so the nurse gathered the solutions and brought them into the room.

She used a bar-coding system to scan each of the medications and solutions. However, she inadvertently spiked the bag of epidural analgesia instead of the antibiotic. When the primary nurse went to connect the tubing to the patient’s IV, she fortunately noticed that the wrong bag had been spiked.

Obstetrical units need to evaluate and address the risk of epidural-IV mix-ups and bupivacaine toxicity that results from IV injection. Two changes have been made in the hospital where the latest near miss happened: all epidural solutions are now placed in yellow zip-lock bags to help differentiate the solutions from standard IV solutions; and the set-up of epidural analgesia is now a separate, dedicated process conducted immediately before the infusion is started—much like a “time out.”

Strategies to prevent epidural-IV mix-ups include requiring anesthesia staff to gather or bring to the unit all epidural medications for the patient; applying boldly colored “Epidural Use Only” warning stickers to both sides of the epidural bag; and having pharmacy spike epidural bags with epidural tubing prior to dispensing (when possible). ISMP also suggests establishing a protocol to help recognize and treat bupivacaine toxicity. A boxed warning in bupivacaine prescribing information mentions cardiac arrest with difficult resuscitation following accidental IV injection, although successful treatment using a 20% lipid emulsion following cardiac arrest has been reported (Rosenblatt MA, et al. Successful use of a 20% lipid emulsion to resuscitate a patient after a presumed bupivacaine-related cardiac arrest. Anesthesiol. 2006; 105:217-218).

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Our 2010 Nurse Advise-ERR Clinical Advisory Board

Production of this peer-reviewed newsletter would not be possible without the assistance of a reliable and talented clinical advisory board. As 2010 nears an end, we want to thank each of the following members of the advisory board for their dedication to making this newsletter a valuable medication safety resource for clinicians.

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