

Institute for Safe Medication Practices

Epidural-IV route mix-ups: Reducing the risk of deadly errors

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Problem: A number of risks have been associated with epidural injections and infusions. One of the most significant risks involves erroneous infusions of epidural medications—particularly epidural infusions containing bupivacaine—by the IV route of administration. IV bupivacaine can quickly lead to cardiotoxicity. A Black Box warning for bupivacaine notes that the drug can cause profound disturbances in cardiac rhythm and contractility that are resistant to typical resuscitation efforts, making these mix-ups particularly deadly.(1-3) Likewise, medications intended for IV administration—particularly morphine and vincristine—have been administered via the epidural or intrathecal route, also leading to fatal outcomes.(4-5)

ISMP and the National Patient Safety Agency (NPSA) in the United Kingdom (UK) have published numerous alerts regarding mix-ups between epidural and IV medications.(1-5) Much like the error we reported¹ in which a 16-year-old patient in labor died after receiving IV fentanyl and bupivacaine, the NPSA and British news media recently published information about another young woman who died after receiving IV bupivacaine.(2-6) In this case, the woman in labor should have received normal saline IV, but a nurse accidentally selected a virtually identical bag of bupivacaine located in the same unlocked drawer as the saline. (The bupivacaine infusion did not contain fentanyl, so the bag did not require locked storage.) Since the nurse thought she was hanging a bag of normal saline, she had no reason to consider asking another nurse to double-check the solution before administering it. The patient developed seizures and cardiac arrest that could not be treated successfully.

Unfortunately, these cases are not isolated events. Between 2000 and 2004, three additional deaths were reported in the United Kingdom following IV administration of epidural bupivacaine.(2) Between 2005 and 2006, another six events were reported in which epidural medications were given IV.(2) In the US, we are aware of three additional cases between 2004 and 2007, one fatal and two near fatalities. In one of the near-fatal cases, the patient received a small IV loading dose of bupivacaine and morphine intended for epidural patient-controlled analgesia. We have also published multiple cases in which IV medications, such as vincristine, were accidentally administered by the intrathecal route, again leading to fatalities.(5)

Safe Practice Recommendations: Unlike many threats to patient safety, those involving epidural-IV mix-ups are well understood and can be prevented by industry changes to make IV and epidural syringe and tubing connections incompatible with each other.

ISMP and other safety agencies, both in the US and internationally, continue to work toward that goal. Until then, we encourage you to evaluate the risks in your organization and implement the recommendations in the checklist found on pages 2-3. (Sadly, many of these recommendations were previously published by ISMP and NPSA well before the most recent tragic events, but action had not been taken to prevent these errors.)

It's important to note that individual recommendations in the checklist will not prevent all types of mix-ups between IV and epidural medications. A process that reflects careful consideration of all risk points in the medication system in your organization should be implemented to safeguard against both the accidental administration of an IV medication by the epidural route and administration of an epidural medication by the IV route.

Reduce the risk of epidural-IV route mix-ups(1-9)

Prescribing IV and epidural medications

- When appropriate, consider use of other agents for epidural administration that may be less cardiotoxic than bupivacaine (e.g., **NAROPIN** [ropivacaine]). (While there is evidence to suggest that newer agents have less cardiotoxicity than bupivacaine, controversy continues over whether bupivacaine should be replaced by the new agents.[2])
- Require the route to be clearly defined on all prescriptions/orders.
- To reduce the risk of tubing mix-ups, replace a peripheral IV infusion used only to keep a vein open with a saline lock to maintain IV access.

Dispensing IV and epidural medications

- Prepare infusions not available commercially in the pharmacy or outsource their preparation.
- Dispense epidural medications to clinical areas in the appropriate container needed for administration (e.g., properly labeled syringe, small volume bag).
- Use barcode technology when preparing and dispensing IV and epidural medications.
- Establish a process to ensure delivery of the correct epidural medication to the correct clinical unit. In low-volume use areas, dispense the epidural medication immediately before use and hand it to an authorized clinician. In high-volume areas (e.g., labor and delivery), place the epidural medication immediately in the appropriate storage location. Epidural medications should not be left in medication rooms for clinical staff to put away, or sent to units in pneumatic tubes.

Dispensing intrathecal medications

- Dispense intrathecal medications in overwraps that help differentiate these syringes and bags from other medications intended for IV administration.

Dispensing IV vincristine

- Dispense IV vincristine in a small volume bag to differentiate it from syringes used for intrathecal medications.

Labeling epidural medications

- Clearly label infusion bags and syringes that contain epidural medications with 'For Epidural Use Only' in a large font. Use color and design to differentiate these products from IV medications.

Storing IV and epidural medications

- Reduce the risk of mix-ups by separating the storage of epidural and IV infusions (including those stored among controlled substances).

Infusion pumps and administration sets

- For epidural infusions, use pumps that look different than pumps used for IV infusions.
- Clearly label pumps used to deliver epidural medications as "Epidural Only."
- When possible, use smart pump technology when administering epidural and IV medications.
- Avoid the use of dual-channel pumps for simultaneous administration of IV and epidural infusions.
- Use yellow-lined tubing without injection ports for epidural infusions to set its appearance apart from typical IV tubing. Never use yellow-lined tubing for anything other than epidural administration.(8)
- Place a neon sticker on the epidural tubing stating "Epidural" (which is often included with the special, yellow-lined tubing).
- Consider placing IV pumps and epidural pumps on opposite sides of the patient's bed to better separate the two infusion systems.
- Always trace a tube or catheter from the patient to the point of origin before connecting any new device or infusion or adjusting the infusion rate.
- Always hang epidural and IV bags in pumps with the labels facing out, so they can be read. (Pharmacy labels should be applied to accommodate loading syringes or bags in a pump with the labels facing out.)

Administering IV and epidural medications

- Require an independent double-check at the bedside of all epidural medications and IV opioid medications so that verification of the patient, pump settings, and line attachment can be included along with verification of the drug and dose/concentration.
- Require the receiving nurse and transferring nurse to verify pump settings and line attachments during change of shifts or patient transfers.

- Use barcode technology when administering medications to verify patient and product selection.
Monitoring patients
- Establish a resuscitation protocol to treat the effects of bupivacaine toxicity wherever this drug is administered. Make the protocol and required medications readily accessible to staff on code carts or with other secured emergency supplies. (There is some evidence that the use of lipid emulsion is of benefit to treat bupivacaine toxicity.[2,9])

Staff education and competencies

- Develop a credentialing process to ensure that all practitioners expected to hang epidural infusions and program pumps are competent.
- Heighten awareness of the risk for mix-ups between epidural and IV infusions among clinical staff.
- Educate staff who prescribe, dispense, and care for patients receiving bupivacaine to recognize and manage toxicity using the established resuscitation protocol.

Recommendations for the medical device and pharmaceutical industry

- Design and manufacture unique epidural connectors that cannot be connected to IV ports, or vice versa.
- Design pumps used to administer epidural medications in a way that clearly differentiates them from pumps used to administer IV infusions.
- Provide more commercially available epidural medications in ready-to-use, bar-coded containers that look different than IV medication containers.

References: 1) Institute for Safe Medication Practices (ISMP). More to the story. Safety Briefs. *ISMP Medication Safety Alert!* August 24, 2006:1-2. 2) National Patient Safety Agency (NPSA). Safer practice with epidural injections and infusions. **Patient Safety Alert.** March 28, 2007:1-8. Accessed on June 30, 2008, at: www.npsa.nhs.uk/patientsafety/alerts-and-directives/alerts/epidural-injections-and-infusions/. 3) NPSA. Stakeholder consultation summary; safer use of epidural medications. June 2008; personal communication from David Cousins to Michael Cohen. 4) ISMP. IV potassium given epidurally: getting to the route of the problem. *ISMP Medication Safety Alert!* April 6, 2006:1-2. 5) ISMP. Fatal administration of IV vincristine. *ISMP Medication Safety Alert!* December 5, 2005:1-2. 6) Hill M. Epidural drug drip ‘killed’ new mother. *BBC News.* February 5, 2008. Accessed on June 30, 2008, at: http://news.bbc.co.uk/2/hi/uk_news/england/wiltshire/7219434.stm. 7) The Joint Commission. Tubing misconnections—a persistent and potentially deadly occurrence. *Sentinel Event Alert.* April 3, 2006; Issue 36. Accessed on June 30, 2008, at: www.jointcommission.org/SentinelEvents/SentinelEventAlert/sea_36.htm. 8) ISMP. Don’t use epidural tubing for an IV solution. *ISMP Medication Safety Alert!* January 17, 2006:1-2. 9) ISMP. IV lipid emulsion for bupivacaine toxicity. *ISMP Medication Safety Alert!* December 14, 2006:3.

