Issue 7
February 2014

Distributed to:

- Chief executive officers
- Chiefs of staff
- Board chairs
- Quality/patient safety leads
- Directors of pharmacy

Suggested action items:

- Circulate bulletin to front-line staff for review and comment on pump usability and programming concerns
- Refer bulletin to interdisciplinary safety committee(s) for review of processes for updating infusion pump libraries and auditing utilization of safety features, and to investigate real-time, enterprise-wide remote updating of pumps
- Use bulletin as an educational resource in your hospital's safety huddles or rounds

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Smart Pumps Need Smart Systems

The availability of programmable infusion pumps has contributed to the precision of the administration of parenteral medications. Smart infusion pumps that incorporate drug error reduction software (DERS) offer dose-limit functionality, but the specific limits must be programmed by individual facilities. "Soft" dose limits alert users when maximum dosing is inadvertently exceeded, but they can be overridden. "Hard" limits prevent the user from administering a dose that is beyond the predetermined range. Medication incidents with smart pumps can occur when the pumps are not used to their full capability or are not subjected to continuous quality improvement efforts. In particular, opportunities for errors exist when pump parameters must be input manually or when calculations must be performed before programming. Keys to the safe use of infusion pumps involve consistent use of preprogrammed drug libraries, including the use of safety limits, and availability of resources and processes to ensure that pump libraries are up to date.[1]

Call to Action for Hospitals

Make medication safety a strategic priority:

- Prioritize capital purchase of infusion pumps with DERS that support simultaneous wireless updates.
- Make an organizational commitment to fully operationalize the DERS in all care areas and work toward longer-term goals of barcoding and automation so that smart pumps become part of a closed-loop medication system.

Make system-based changes to enhance safety:

- Ensure that programming of smart pumps is consistent in all areas of the hospital.
- Program drug libraries with "hard" stops for high-alert medications (i.e., whereby overrides are not allowed).
- Ensure that high-alert medications given by continuous infusion are restricted to patient care units with appropriate healthcare staff, staffing ratio, and monitoring equipment.
- For high-alert medications for which electronic drug libraries are not available or do not match the drug and concentration ordered, ensure that an independent double-check process and a review mechanism are in place for pump programming.[2]

Sustain high-quality practice:

- Ensure that staff have the supporting resources needed to use,[3] maintain, and update pumps.
- Regularly audit infusion pump libraries and ensure compliance with alerts (by reviewing overrides).
- Actively solicit feedback from pump users as part of continuous quality assessment.
- Report incidents internally and to patient safety organizations (e.g., ISMP Canada).

Case Summary

A propofol infusion was prescribed for sedation of a patient in the emergency department. The nurse obtained a bottle of propofol 1000 mg/100 mL (10 mg/mL) and initiated the infusion using an IV pump with "smart" pump technology. About 20 minutes later, the nurse observed that the entire bottle of propofol had been administered. The patient, already critically ill from septic shock, died despite resuscitation efforts.

Learning from Analysis

An analysis of the pump showed that the medication was part of the drug library, but a standard concentration had not been pre-programmed for use in the Emergency Department. The concentration had been entered manually as 10 mg/100 mL, instead of the actual concentration of 1000 mg/100 mL. Using the concentration entered, the pump had calculated a rate of delivery that was 100-fold faster than expected.

A contributing factor was a shortage of propofol in the vials usually procured by the organization. This shortage had necessitated obtaining this drug from another manufacturer. The new manufacturer's label displayed total volume, total dose, and concentration in different locations than where these details appeared on the usual vial label. The labelling of the substitute product showed "100 mL" (total volume) with "10 mg/mL" (concentration) directly below, whereas the usual product label showed "1000 mg" (amount) and "100 mL" (volume) along with the concentration ("10 mg/mL"). The potential for misreading the label was increased because the pump was programmed with the bottle hanging upside down (for the infusion).

After an internal review, the facility developed an auxiliary label to assist nurses in programming pumps for propofol, which was used until the facility-wide pump library could be updated with standard propofol concentrations, thereby eliminating the need to manually enter that drug parameter. The facility further revised its processes to optimize the use of smart pumps through a program of regular updating and auditing of the pump library and assessment of compliance with alerts. Additionally, a medication safety committee was formed, and an independent double-check process was implemented for high-alert medications given by infusion.

Conclusion

The use of infusion pumps with a drug library and corresponding DERS can provide safeguards for the administration of parenteral medications. This software must be fully operational and continually updated. To promote safe and effective care, Ontario healthcare facilities are encouraged to closely examine their continuous quality improvement processes for infusion pumps and to optimize the safety features.

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[1] Proceedings from the ISMP summit on the use of smart infusion pumps: guidelines for safe implementation and use. Institute for Safe Medication Practices (ISMP); 2009 [cited 2014 Jan 8]. Available from: http://www.ismp.org/tools/guidelines/smartpumps/printerversion.pdf

[2] Infusion pump project: survey results and time for action. ISMP Can Saf Bull. 2004 [cited 2014 Jan 8];4(1):1-2. Available from: http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2004-01InfusionPump.pdf

[3] Infusion pumps training. In: 2013 required organizational practices handbook. Ottawa (ON): Accreditation Canada; 2013 [cited 2014 Jan 8]. p. 39. Available from: http://www.accreditation.ca/sites/default/files/rop-handbook-en.pdf

Collaborating parties of the Ontario Critical Incident Reporting program