



## Preventing magnesium toxicity in obstetrics

Nurses who work in obstetrical units may feel comfortable administering IV magnesium sulfate, which is used to treat preterm labor and preeclampsia. Yet, many errors have been reported with this medication, some fatal. ISMP has received numerous error reports over the last 9 years in which obstetrical patients suffered respiratory arrest after overdoses of magnesium sulfate. Most errors were due to unfamiliarity with safe dosage ranges and signs of toxicity, inadequate patient monitoring, pump programming errors, and mix-ups between magnesium sulfate and oxytocin.

In 2004, a detailed account of errors with this drug was published (Simpson KR, Knox GE. Obstetrical accidents involving intravenous magnesium sulfate. *Am Jour of Maternal Child Nurs.* 2004;29:161-71). In the span of a few years, the authors, who review obstetrical accidents in the US, accumulated 52 reports of accidental overdoses of magnesium sulfate. In the article, they described a dozen cases in detail, revealing common precipitating events. Examples from the article follow:

■ A nurse accidentally restarted an infusion of magnesium sulfate instead of starting a new infusion of oxytocin after a mother had delivered. The magnesium sulfate had been administered during preterm labor, but it remained connected at the Y-site to the patient although it had been discontinued and was no longer infusing. The oxytocin was connected to the patient, but the magnesium sulfate was actually started by mistake. The mother was found unresponsive and remains in a persistent vegetative state.

■ Due to fluid restrictions, a physician gave a verbal order for a double-strength solution of magnesium sulfate to be administered at 2 g/hour. The nurse forgot to transcribe the verbal order and did not re-label the single-strength bag to

which she had added additional magnesium sulfate. The change-of-shift report was hurried due to an emergency cesarean section. The oncoming nurse subsequently increased the rate of infusion because she was unaware the patient was receiving a double-strength solution. The patient developed signs of magnesium toxicity, but the error was discovered before further harm resulted.

■ A nurse retrieved two bags of lactated Ringers (LR) from unit stock and added 40 g of magnesium sulfate to one bag. After administering a 6 g bolus dose, she started the infusion at 3 g/hour and hung a maintenance solution of LR at 300 mL/hour. Hours later, the patient reported feeling flushed and nauseated. The nurse told her these symptoms were expected and, soon after, she observed the patient sleeping. Family members later found the patient breathless and pulseless. Resuscitation efforts were unsuccessful. Analysis of the solutions revealed that the maintenance solution (300 mL/hour) contained 40 g of magnesium sulfate, and the bag labeled as magnesium sulfate contained only LR. The admixture label had been placed on the wrong bag of LR.

Simpson and Knox noted that the most common factors associated with errors resulting in death were units with lower staffing levels and chaotic environments in which nursing assignments changed during the shift of work.

Magnesium sulfate injection is on the ISMP *List of High-Alert Medications* ([www.ismp.org/Tools/highalertmedications.pdf](http://www.ismp.org/Tools/highalertmedications.pdf)) because it bears a heightened risk of causing significant patient harm when used in error. Although mistakes may not be more common than those with other medications, the consequences of error are more devastating. To improve safety with magnesium sulfate, see the recommendations in **check/tout!** at right.

### check/tout! ✓✓✓✓

To reduce the risk of harm when administering magnesium sulfate to obstetrical patients, consider the following:

- ✓ **Premixed solutions.** Use a standard concentration of premixed solutions for bolus doses and maintenance infusions. Administer bolus doses via premixed piggybacks, not from the infusion.
- ✓ **Labels.** Label the IV tubing near the IV pump. When starting infusions or changing bags, trace the tubing by hand from the IV bag, to the pump, and then to the patient for verification.
- ✓ **Protocols.** Work with an interdisciplinary team to establish dosing and administration protocols and standard order sets for magnesium sulfate. Always require administration via an infusion pump, preferably one with dose range alerts. Immediately discard the infusion bag upon discontinuation to prevent accidental infusion later.
- ✓ **Double checks.** Require an independent double check of the drug, concentration, infusion rate, pump settings, line attachment, and patient before administering the drug, and upon transfer of the patient to another unit. Point-of-care bar-code systems can also be used to verify the drug, strength, and patient.
- ✓ **Monitoring.** Frequently monitor patients' vital signs, oxygen saturation, deep tendon reflexes, and level of consciousness (also fetal heart rates and maternal uterine activity if the drug is used for preterm labor). Assess patients for signs of toxicity (e.g., visual changes, somnolence, flushing, muscle paralysis, loss of patellar reflexes) or pulmonary edema. When giving a bolus, remain at the bedside to monitor the patient continuously, and then in intervals of 15 minutes for the first hour, 30 minutes for the second hour, and then hourly.

continued on next page

## Carpject syringe mix-ups: It isn't easy being green!

ISMP continues to receive reports about errors with look-alike Carpject syringes, all with identical green caps (figure 1). To help differentiate the products, the manufacturer, Hospira, uses a variety of colors for the drug name on the syringe and the background shading on the outer carton. Unfortunately, some colors used to



Figure 1. Syringes have identical green caps.



Figure 2. Red fentanyl (top) and orange midazolam (bottom) syringes look alike.

differentiate the products are close in appearance, making the syringes look similar. For example, the drug name and strength is printed in red for fentanyl and orange for midazolam, but the syringes look alike (figure 2). The midazolam information is boxed to further differentiate the products, however errors have still occurred.

In a busy ambulatory surgery center, patients received two doses of fentanyl instead of one dose each of fentanyl and midazolam. The errors were found when counting narcotics. Luckily, no patient harm occurred.

On the unit where these errors occurred, nurses typically applied an orange "Versed" sticker or a blue "Fentanyl" sticker on the Carpject after loading the syringe. In these cases, nurses thought they had selected midazolam syringes, but they had actually selected and placed "Versed" stickers on fentanyl syringes. The two products, available in tamper-resistant Slim-Packs, were also stored together, as they were the only controlled substances available in the unit's floor stock. This packaging makes any illicit attempt to access the syringe obvious, but the risk of errors during drug selection, narcotic counts, or when replacing unused syringes is heightened if the person is observing only the bottoms or tops of the tubes.

To reduce the risk of errors with Carpject syringes:

- Identify Carpject products that look alike and are prone to mix-ups, and separate the storage of these products in pharmacies and patient care units.
- Place Carpject products stored in automated dispensing cabinets in discrete pockets, never together.
- Ask pharmacy staff to apply auxiliary labels to the outer cartons (visible on the carton end viewed during storage).
- If the syringes are stored in the carton, leave the carton flap that list the drug name and strength intact after opening the carton so that the drug name (and auxiliary label) is visible when drug supplies are accessed.
- Consider requiring an independent double check of selected Carpject narcotics prone to mix-ups.

### check it out! continued

- ✓ **Assessing toxicity.** If concerned about toxicity, lab testing may be needed. However, toxic levels vary among people, so a clinical assessment is as important as serum magnesium levels. Teach patients and families the signs of toxicity to report.
- ✓ **Staffing ratios.** Ensure that staffing patterns allow time for proper monitoring on antepartum and postpartum units.
- ✓ **Emergency preparedness.** Establish standard procedures to respond to emergencies caused by overdoses. Stock calcium gluconate on the unit with directions for use as an antidote for respiratory depression.

### safety wire

- ⚡ **15 misheard as 50 during readback.** An on-call pharmacist received a call during the night from a nurse working on the ventilator unit of a long-term care hospital. The nurse told the pharmacist that she had a new order for 50 mEq of potassium phosphate for a "now" dose. When the pharmacist questioned the dose, the nurse stated that she was sure the prescriber had ordered that much when he called. Because of the error-prone nature of ordering phosphate salts, especially via a telephone order, the nurse called the prescriber to clarify. As it turns out, the physician had ordered 15 mEq, but the nurse had heard "50" mEq. Although the nurse had read back the order to the physician, this error serves as a good lesson to read back all oral orders, stating numerical doses in single digits such as "one-five" for 15 and "five-zero" for 50 to ensure understanding.

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### to the point

- ➔ **There are risks and costs to a program of action. But they are far less than the long-range risks and costs of comfortable inaction.**  
~ John F. Kennedy