



Nurse Advise-ERR™

Educating the healthcare community about safe medication practices

January 2004 ■ Volume 2 Issue 1

Hazard alert! Don't give large volumes of sterile water IV

The treatment of severe hypernatremia can be challenging, especially in patients with diabetes or cardiac conditions for whom the choice of an IV solution may seem limited. Under these conditions, a physician made an ill-conceived decision to administer bags of plain sterile water intravenously to an elderly patient with severe hypernatremia, hyperglycemia, and congestive heart failure. His reluctance to give his patient IV solutions containing sodium or dextrose led him to order "free water" IV at 100 mL/hr.

"Free water" refers to water not associated with organic or inorganic ions (plain water). Because hypernatremia usually results from a deficit of "free water," it's likely that the physician intended to replace this loss. But while "free water" can be replaced orally, it should never be given IV as plain sterile water for injection without additives to increase osmolarity; otherwise hemolysis (destruction of red blood cells) will occur. Normal saline (0.9%) has the same osmotic pressure as human blood (about 308 mOsm/L), but sterile water for injection has zero osmotic pressure. It's intended to be used in small quantities to dissolve or dilute drugs or electrolytes, which then contribute the necessary osmotic pressure to make the solutions safe for IV administration. Giving bags of plain sterile water IV puts patients at risk.

Just before writing the order, the physician involved in the error called a pharmacist to ask if "large bags of sterile water for injection"

were available. Without giving it much thought, the pharmacist confirmed availability, as the bags were typically used in the pharmacy for preparing TPN. After the order was sent to the pharmacy, a technician retrieved a 2 liter bag of sterile water, labeled it with the patient's name, and sent it to the ICU.

The nurse began the infusion without question because she was aware of the patient's severe hypernatremia, and she had overheard the physician ask the pharmacist if bags of sterile water were available. She failed to see a red statement on the bag, "Pharmacy Bulk Package, Not For Direct Infusion," because the label that the technician had applied was on the opposite side of the bag. The label imprinted on the bag also stated that the product was not suitable for intravenous injection without first being made approximately isotonic by addition of a suitable solute. However, this warning blended in with the other text and was not seen. Another nurse noticed the problem and stopped the IV, but not before 550 mL had infused. The patient developed a hemolytic reaction, acute renal failure, and died.

ISMP has learned of additional errors like this, some leading to patient demise. But a generalized knowledge deficit about the hazards of IV administration of sterile water is not the only reason that these potentially tragic errors occur. We've also received reports in which bags of sterile water have been mistaken for a different IV solution and

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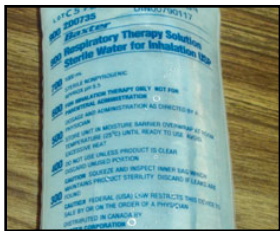
Hemolysis will occur if you give plain sterile water IV without additives to increase osmolarity.

check it out! ✓✓✓✓

Follow these suggestions to prevent IV administration of sterile water:

- ✓ **Educate clinicians** about the physiology behind infusing hypotonic, isotonic, and hypertonic solutions in context of osmolarity and hemolysis.
- ✓ **Develop protocols** to guide safe and effective treatment of hypernatremia. Severe hypernatremia is generally treated with infusions that contain low concentrations of sodium to reduce blood levels slowly; too rapid correction may lead to cerebral edema, seizures, or death. Excess fluid volume and elevated blood sugar can be managed with diuretics and insulin.
- ✓ **Never administer** plain sterile water IV; it will likely cause hemolysis.
- ✓ **Ask pharmacists** to use 2 liter containers (or larger) of sterile water in the pharmacy (for preparing solutions) to reduce the risk of confusion with 1 liter IV bags. The difference in size will also alert nurses if the bag is mistakenly dispensed from the pharmacy.
- ✓ **Review the list** of floor stock items that nursing units can order from the pharmacy or central supply to ensure that sterile water bags cannot be accidentally requested.
- ✓ **For malignant hyperthermia boxes**, consider replacing the liter sterile water bags with 50 mL vials, as some hospitals have done.
- ✓ **Use humidification units** for ventilated gases that don't use sterile water bags (some use plastic bottles). If not, alert respiratory staff that the bags should never be left in medication or patient rooms, or hung on an IV pole. Use 2 liter bags to differentiate them from IV solutions.

Don't give sterile water IV continued administered unknowingly to patients. Just last month, a hospital's central supply department accidentally received 1 liter bags of sterile water for injection instead of 1 liter bags of 5% dextrose and 0.45% saline with 20 mEq of potassium chloride, as ordered. The error went unnoticed and the sterile water bags were loaded in an automated dispensing cabinet on a medical oncology unit. In the course of one evening, two nurses retrieved bags of sterile water and administered the solution to patients. The red lettering on the bag did not help the nurses notice the error because it looked similar to the red lettering they expected on IV fluids containing potassium chloride. One patient received 600 mL and the other 300 mL before the error was noticed. Both patients suffered a reduction in red blood cells but recovered.



Sterile Water for Inhalation

for treatment. Any unused bags of the solution may find their way into IV stock or be hung as an IV solution during emergency treatment.

Respiratory therapy staff may also store bags of sterile water in patient care units or bring them to patient rooms if they are needed for humidification devices used with ventilators or continuous positive airway pressure devices. These bags are labeled in blue print as "Respiratory Therapy Solution, Sterile Water for Inhalation" (see photo). Unfortunately, the bags easily attach to IV tubing and may look similar to IV bags labeled in blue print.

In one reported error, a respiratory therapist left a liter bag of sterile water unwrapped in the patient's room, as the current bag attached to the ventilator was due to run out. A nurse, responding to an IV pump's low volume alarm, replaced the empty IV bag with the sterile water bag, believing it had been left as a replacement. The patient received 500 mL before the error was noticed, but he recovered.

See **Check it Out!** for suggestions to prevent the IV administration of sterile water in your facility.

There are several other ways that sterile water bags could end up on patient care units, and be mistaken as IV solutions. In surgical areas, emergency boxes for malignant hyperthermia are often stocked with liter bags of sterile water for diluting the many vials of **DANTRIUM** (dantrolene) Intravenous required

All is not as it seems...



Is this heparin order for 25 units per hour?

25 u/hr



The order was initially interpreted as 25 "u" (units) per hour, but that wasn't the physician's intent. He'd actually written 25 cc/hour, intending a 1,000 unit/hour dose using the hospital's standard heparin concentration of 20,000 units/500 mL (40 units/mL). Certainly, prescribing the dose in units would have been safer. Fortunately, the rate in mL/hour was so low that the mistake was quickly recognized. If only 25 units/hour had been given, the patient would have received a mere 2.5% of the prescribed dose. However, confusing "cc" with units could prove disastrous. For example, if a concentration of insulin 100 units/500 mL is prepared for infusion, misreading "15 cc/hr" (3 units/hr) as 15 units/hr could lead to severe hypoglycemia. Likewise, the opposite interpretation of an order could result in a patient receiving a subtherapeutic dose, contributing to ketoacidosis. Always use "mL" to indicate volume; it is the official terminology in the metric system and a safer alternative than "cc." And, of course, the word "units" should be written fully and considered unacceptable if abbreviated as "U."

► Special Announcements

Free CE Credit for Nurse Advise-ERR.

Twice a year, ISMP will offer 1 hour of Continuing Education (CE) credit covering the prior six issues of the newsletter. To obtain CE credit, nurses must read the issues and answer questions posted on our website. For the nine issues published in 2003 (publication began in April), 1 hour of CE credit is now being offered at www.ismp.org/nursingce. For 2004 issues, 1 hour of CE credit will be available in June and December.

Don't miss our next teleconference.

"Eliminating reliance on the 'rule of six' for drug dosing in neonatal and pediatric care," is scheduled for January 29, 2004, from 1:30 to 3:00 pm EST. This teleconference offers practical assistance with converting from the "rule of six" dosing for pediatric patients to using standard drug concentrations. Clinical pharmacists and a neonatologist from Albany Medical Center (AMC) in NY will speak about their success with using standardized IV solutions for more than 7 years in their level IV neonatal ICU. Slides, handouts, and CE credit will be provided. Visit www.ismp.org/ro6/ to register.

to the point

➔ In a November 2003 Gallup poll, the public rated nurses as the most honest and ethical professionals.

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To report medication errors to ISMP, please call 1-800-FAIL-SAF(E).