ISMP Medication Safety Alert!®

Nurse Advise-ERR®

Educating the healthcare community about safe medication practices

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Lack of standard dosing methods contributes to IV infusion errors

Improvements in drug infusion technology have enhanced our ability to dose parenteral medications very precisely. However, it's common to find multiple dosing methods—such as mcg/kg, mcg/kg/min, mcg/kg/hour, and many others—used for a single drug (see Table 1 for examples).[1] The lack of standardization makes selection of the proper dosing method error-prone. In some cases, the wrong dosing method has been used when prescribing the drug; Lesar found this to be the case in 29.5% of 200 consecutive prescribing errors, particularly with pediatric patients.[2] In other cases, the wrong dosing method has been selected when programming an infusion pump. A few examples of error reports we have received follow.

An 80-year-old comatose man (80 kg) from a long-term care facility was taken to an urgent care center for treatment of urosepsis and septic shock. Based on the patient's weight, IV DOPamine (400 mg/500 mL) was started to treat persistent hypotension. The infusion, ordered in mcg/kg/minute, was to be titrated to maintain his blood pressure. Over the next hour, the infusion was titrated upward twice in 5 mcg/kg increments with no response. A critical care transport service was then called to take the patient to a nearby hospital for admission to a critical care unit.

When the transport team arrived, one of the paramedics reviewed the patient's IV infusions and, per protocol, independently calculated the rate of infusion for each IV solution. While reviewing the pump settings, the paramedic noticed that the DOPamine dose had been programmed in mcg/kg/HOUR, rather than mcg/kg/MINUTE. Although a Baxter Colleague smart pump was used to program the initial infusion, the nurse elected to bypass the pump library and programmed the rate using the pump's dose calculator mode. The nurse accidentally selected mcg/kg/hour, which appeared on the pump's screen on an alphabetical list before mcg/kg/minute. This is a potential error-promoting pump feature; the more frequently used mcg/kg/minute dosing method should appear as a choice before the lesser used mcg/kg/hour. After the pump was reprogrammed to deliver the correct dose, the patient's blood pressure increased, and he became responsive.

To cite another recent example—this one from the Pennsylvania Patient Safety Reporting System—an order for propofol 80 mcg/kg/HOUR for an elderly man was administered at 80 mcg/kg/MINUTE due to a pump programming error, resulting in oversedation. In a mix-up between a mcg dose and mcg/kg dose, a 3 kg infant received a 36 mcg bolus dose (12 mcg/kg) of fentanyl instead of a 12 mcg dose (4 mcg/kg). Using a Smiths Medical Medfusion 3500 Syringe Pump with smart pump technology, the nurse had not noticed that the pump prompted for a mcg/kg dose, not a total dose. She subsequently entered "12" into the pump, which calculated a dose of 36 mcg for

Table 1. Dosing Variability for Calcium and Magnesium[1]

calcium gluconate	magnesium sulfate
mcg/kg/hour	grams/hour
mEq/hour	grams/kg/hour
mEq/kg/hour	grams/minute
mEq/minute	mcg/kg/hour
mg/hour	mcg/minute
mg/kg/hour	mEq/hour
mg/minute	mEq/kg/hour
	mg/hour
	mg/kg/hour
	mg/minute

continued on page 2

check it out! ✓✓✓✓

Consider the following to reduce the risk of IV infusion dosing errors:

✓ **Standardize dosing methods.** Look for variable dosing methods for the same medication in your hospital, and work with a multidisciplinary team to select a standard way to dose the drug for adults and a standard way to dose the drug for pediatric patients. Include the approved dosing method on preprinted or electronic order sets.

✓ **Use smart pumps.** Use smart pumps with functional dosage error-reduction software. Heed pump alerts as they often signal that the wrong dosing method has been selected from the pump's library. Other safety features include unchangeable dosing units once a drug is selected.

✓ **List dosing methods.** Display the drug's dose on the drug label and medication administration record the same way it is needed to program the pump.

✓ **Verify dosing methods.** Prescribers should list the dosing method (e.g., 10 mcg/kg; 1 g/m^2) along with the calculated dose when prescribing drugs at risk for error (e.g., drugs for pediatric patients, chemotherapy). Nurses should verify both the dosing method and calculated dose before drug administration.

✓ **Verify pump settings.** Have a second nurse independently verify pump settings when starting infusions with selected high-alert drugs, changing infusion rates, transferring the patient, and at the beginning of each shift. Be sure the dosing method and total dose make sense for the patient given his or her weight, age, and condition.

✓ **Suspect an error.** If a patient is not exhibiting the expected physiologic results, consider the possibility of an error, and verify the order and pump settings.

Baxter

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McKESSON Empowering Healthcare

Nitroglycerin: One tiny bottle does not equal a single dose

A graduate nurse was assigned to care for a patient with angina. When the patient complained of chest pain, the nurse poured the entire contents (25 tiny tablets) of a bottle of sublingual nitroglycerin into the patient's hand, believing all were needed to provide the prescribed dose of 0.4 mg. The patient questioned the large number of tablets, but the nurse assured him the dose was correct. The patient swallowed all the tablets. Soon after leaving the room, the nurse realized her error. The patient's blood pressure dropped to 80/40, necessitating transfer to ICU for monitoring, but he recovered fully.

You might think this is an unlikely error, but it has happened before in hospitals! One patient spit out all 25 tablets because of the intense burning sensation under his tongue, but most patients who were given 25 tablets swallowed them rather than placing them under their tongue.

Figure 1. Label without a per-tablet dose listing has caused confusion.

Unlike most oral medications in hospitals, nitroglycerin tablets are dispensed in bulk bottles of 25 tablets rather than in small unit-dose packages because of stability issues. Nurses who are accustomed to unit-dose packages may not be expecting more than a single dose in such a small medication container like the nitroglycerin bottle. Another contributing factor that has led to errors is related to the way that some nurses have interpreted the strength on the bottle's label (see Figure 1 for an example). The label includes the brand name and states: "Nitroglycerin Sublingual Tablets, USP, 0.4 mg (1/150 gr) 25 tablets." However, the label does not clearly state that each tablet contains 0.4 mg.

ISMP contacted the makers of **NITROSTAT** and **NITROQUICK** to ask them to list "0.4 mg per tablet" on the carton and bottle label (and to eliminate the apothecary designation of 1/150 gr since it is outdated and prone to misinterpretation). Meanwhile, ask your pharmacy to package the nitroglycerin bottle in a plastic bag or prescription vial, and to affix a label listing the per-tablet strength and standard dosing information. Remember the mantra, "**If you need more than 3, check with pharmacy**." Most doses do not require more than 3 tablets (or capsules, vials, ampuls, or other dosing units).

Dosing methods continued from page 1

the 3 kg infant. In this case, a dose-limit alert displayed on the pump but was overridden. A second nurse who double-checked the final pump settings also failed to detect the error. Later that day, the same infant received a 1.8 mg bolus dose of midazolam instead of the intended dose of 0.6 mg when the same programming error was made.

The variability of dosing methods contributes to the risk of pump programming errors. Two years ago, a review of smart pump drug library sets from more than 100 independent hospitals revealed the magnitude of this problem.[1] In fact, variability of dosing methods for the same drug was also revealed within individual hospitals—sometimes within a single unit (excluding differences explained by adult and pediatric dosing).

See **check***it***out!** (on page 1) for suggestions to reduce the risk of IV infusion dosing errors caused by the variability of dosing methods.

References: 1) Bates DW, Vanderveen T, Seger DL, et al. Variability in intravenous medication practices: implications for medication safety. *Jt Comm J Qual Pat Saf* 2005;31:203-10. (Table reprinted with permission.) **2)** Lesar TS. Errors in the use of medication dosage equations. *Arch Pediatr Adolesc Med* 1998;152:340-44.

safetywire

Sleep or psychosis? A nurse took a verbal order from a physician for "Risperdal 15 mg at bedtime prn sleep." The pharmacist, aware that **RISPERDAL** (risperidone) is an antipsychotic, recognized that the order did not make sense. When questioned by the pharmacist, the nurse confirmed that she heard the doctor say "Risperdal." However, she could not remember whether she had read the order back to the physician. The nurse was aware of The Joint Commission's National Patient Safety Goal 2A, which outlines the read-back requirement for accepting verbal orders. But she was very busy that morning and thought she might have forgotten to follow through on this important safety step. When the physician was called, it was learned that the doctor had actually communicated an order for "**RESTORIL** (temazepam) 15 mg," which the patient eventually received. Old habits die hard, but consistent use of the read-back process will strengthen the habit and reduce the risk of sliding back into unsafe practices.

Special Announcements

Nurses are #1! Nurses again top the Gallup Poll as the most honest and ethical profession. For details, please visit: www.gallup.com/poll/103123/Lobbyists-Debut-Bottom-Honesty-Ethics-List.aspx.

Celebrate! Begin planning activities to celebrate ***Patient Safety Awareness Week***, which takes place on **March 2-8**. Learn more about this year's theme, *Patient Safety—A Road Taken Together*, by visiting: www.npsf.org/hp/psaw/.

ISMP teleconference. Join ISMP for its next teleconference, ***Reducing the Risk of Patient Harm with Opiates***, to be held on **March 26**. For details, please visit: www.ismp.org/teleconferences/tcMulti.asp?tcID=38.

Job openings. ISMP has two full-time nurse/pharmacist positions available at its PA office. We're seeking a ***Medication Safety Specialist*** to join the ISMP consultant team, and a ***Managing Editor*** for ISMP publications. For details, please visit: www.ismp.org/jobline/joblist.asp?mode=I.

Learn Work Grow

Now accepting applications for the 2008-2009 ISMP Safe Medication Management Fellowship

The **Institute for Safe Medication Practices**
Safe Medication Management Fellowship *is sponsored by*

Cardinal Health Foundation

Location and Term: The 12-month Fellowship commences summer 2008 at the Pennsylvania (near Philadelphia) office of the Institute for Safe Medication Practices (ISMP). Relocation to the area is required.

Fellowship Description: Because of the Institute's years of experience and solid reputation within the medication safety field, the ISMP Safe Medication Management Fellowship offers an experienced healthcare provider an unparalleled opportunity to learn from and work with some of the nation's experts in medication safety. Now in its 16th year, the Fellowship allows the candidate to work collaboratively with practitioners in every kind of healthcare setting in developing and implementing interdisciplinary medication error-prevention strategies. The Fellow also works on broad-based communication about medication errors and their prevention, and education initiatives that reach healthcare professionals and the public with crucial information. Graduates of the program have been sought for employment in medication safety positions in healthcare systems, regulatory agencies, the pharmaceutical industry, and ISMP.

Fellowship Opportunities: As part of his/her year at ISMP, the Safe Medication Management Fellow:

- Gains valuable experience through site visits to various healthcare delivery settings and extensive networking within the nation's pharmaceutical, healthcare, and legislative and regulatory communities
- Assists in investigating medication errors reported to national and state error-reporting programs
- Helps provide follow-up to product manufacturers and regulatory authorities after learning about medication safety hazards
- Gains exposure to medication-system problems and error-prevention program development in countries around the globe
- Participates in original research and surveys on medication errors and prevention
- Learns and applies the techniques of failure mode and effects analysis while assisting MedERRS, a subsidiary of ISMP, in evaluating new medical products for safety
- Develops verbal and writing skills while collaborating with ISMP staff on educational events and publication of newsletters and journal columns.

Candidate Qualifications and Compensation: Pharmacists and physicians who have completed a residency program, and nurses with risk management, quality improvement, or patient safety experience, may apply. A generous stipend, 2 weeks vacation, and full health benefits are provided.

How to Apply: Information and application can be found at www.ismp.org/profdevelopment/managementfellowship.asp. Applications can also be requested by calling 215-947-7797 or via fellowship@ismp.org. All applications must be received by **March 31, 2008**.