ISMP Medication Error Report Analysis

Posaconazole Dose Depends on Dosage Form

Limit Magnesium Sulfate Premix to 20 Gram Bags

Vancomycin Injection for Oral Use Given Intramuscularly

Phenylephrine Injection Needs Dilution for Intravenous Bolus Use

Similar Drug Names Confused

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These medication errors have occurred in health care facilities at least once. They will happen again—perhaps where you work. Through education and alertness of personnel and procedural safeguards, they can be avoided. You should consider publishing accounts of errors in your newsletters and/or presenting them at your inservice training programs.

Your assistance is required to continue this feature. The reports described here were received through the Institute for Safe Medication Practices (ISMP) Medication Errors Reporting Program. Any reports published by ISMP will be anonymous. Comments are also invited; the writers' names will be published if desired. ISMP may be contacted at the address shown below.

Errors, close calls, or hazardous conditions may be reported directly to ISMP through the ISMP Web site (www.ismp.org), by calling 800-FAIL-SAFE, or via e-mail at ismpinfo@ismp.org. ISMP guarantees the confidentiality and security of the information received and respects reporters' wishes as to the level of detail included in publications.

POSACONAZOLE DOSE DEPENDS ON DOSAGE FORM

A patient with acute myelogenous leukemia was severely neutropenic following induction chemotherapy. In this scenario, the risk of disseminated fungal infection is increased; therefore, prophylaxis is indicated to prevent invasive *Aspergillus* and *Candida* infections. In the past, this patient had experienced hallucinations when he took the triazole antifungal voriconazole (*Vfend*). As an alternative, an order was placed for “posaconazole 200 mg PO three times a day with meals.” No dosage form was specified.

The prescriber in this case believed that posaconazole (*Noxafil*) 200 mg/5 mL oral suspension would be used, because, in the past, that had been the only dosage form available. However, delayed-release tablets were made available late in 2013, and now there is also an injectable form. When transcribing the order, a practitioner on the unit entered posaconazole 100 mg delayed-release tablets, 2 tablets taken 3 times a day. The error was not detected during transcription verification.

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The delayed-release tablets of posaconazole represent a clinically relevant error, because these have substantially higher bioavailability than the oral suspension. The dose that was ordered was appropriate for the oral suspension (600 mg daily given in 200 mg doses 3 times a day). However, it was twice the recommended dose for posaconazole delayed-release tablets (300 mg x 2 loading dose [600 mg] on the first day, followed by a maintenance dose of 300 mg daily).

The error was detected by a clinical pharmacist during rounds, but not until the patient had received 6 days of therapy. Fortunately, the patient did not exhibit any signs of toxicity. His liver function tests were normal, and a 12-lead EKG showed no signs of QT prolongation. Upon discovery, the patient was converted back to posaconazole 200 mg/5 mL oral suspension twice a day with meals, as originally intended.

If this error had occurred in the reverse, with the correct dosing for tablets, and the patient had received posaconazole liquid 300 mg (7.5 mL) PO daily, the dose would have been subtherapeutic. If both oral products are available at your institution, you may want to install a clinical alert to appear at the time the drug is ordered as a reminder of the various dosage forms.

LIMIT MAGNESIUM SULFATE PREMIX TO 20 GRAM BAGS

An emergency department (ED) nurse received an order for a liter of 0.45% sodium chloride injection with 20 mEq potassium chloride. The nurse went to an automated dispensing cabinet (ADC) to retrieve the bag, which he then administered. During the infusion, the patient began to experience seizures that progressed to cardiac arrest. Fortunately, the patient was successfully resuscitated. When the cause of this reaction was investigated, an incorrect intravenous (IV) bag was discovered. The nurse stated that he had taken a liter bag of fluid “with red letters on it” from the ADC and did not realize it was actually a liter of magnesium sulfate 40 g in water for injection.

Pharmacy staff had recently added the 40 g magnesium sulfate bags to the ADC in response to an ED staff request. Some reshuffling of the ADC stock was required to fit the additional supplies into the limited space available. Thus, the magnesium sulfate bags were in an area that previously held bags of 0.45% sodium chloride injection with 20 mEq potassium chloride. When the error happened, a temporary “magnesium sulfate” label that had been applied to the storage bin by the pharmacy staff was no longer affixed. It has now been replaced with a permanent label.

Reading the label of any container removed from the ADC is key, but keep in mind that it is sometimes difficult to read labels when IV bags remain in their overwraps. This might increase the likelihood of staff relying on color and overall appearance of the container when storing or retrieving solutions. If needed, magnesium sulfate premixed solutions should be stocked in patient care units using the 20 g/500 mL bags, not the 40 g/1,000 mL bags. This applies to any area of the hospital that utilizes the drug, including labor and delivery. The 500 mL-volume bags are easier to differentiate from liter bags of hydrating solutions, and the smaller volume also helps limit the amount of magnesium a patient might receive if a rapid infusion or free-flow incident occurs accidentally. In the ED, hospitals may be able to stock only bags intended for bolus doses (eg, 2 g/50 mL, 4 g/100 mL).

For added safety, some organizations even use the 4 g minibags for maintenance infusions, which require frequent bag changes but help limit the amount of drug the patient could receive if an error occurs.

VANCOMYCIN INJECTION FOR ORAL USE GIVEN INTRAMUSCULARLY

We recently received a report from a long-term care (LTC) pharmacy that discovered administration errors at 2 of its LTC facilities. The pharmacy had received orders for vancomycin 125 mg orally every 6 hours to treat *Clostridium difficile*-associated diarrhea for residents at these facilities. Vancomycin is available in capsule form for oral use. However, the powder in vials of vancomycin injection can also be reconstituted with sterile water to make an oral solution. Due to the high cost of *Vancocin* brand capsules and occasional problems obtaining specific vancomycin products, the pharmacy elected to send the LTC facilities a supply of vials of the injectable form of vancomycin powder along with diluent for the nurses to reconstitute the powder to make an oral solution. The vials and diluent were provided in 2 separate bags, along with directions for mixing and storing the oral solution and the volume of solution to administer for each 125 mg dose. Soon after, a series of medication errors occurred.

The nurses at both facilities were unfamiliar with the practice of using injectable vancomycin for oral administration. Although nurses reconstituted the powdered drug correctly, they administered each dose intramuscularly (IM). The error was discovered when the director of nursing at one LTC facility mentioned to a consultant pharmacist that she was concerned the medication had not been provided

in capsule form and needed to be reconstituted by nurses at the facility. One patient received 5 doses of the drug IM before the error was detected. This resident experienced pain at the administration sites when the drug was injected (IM administration of the drug is not advised).

Unfortunately, parenteral vancomycin (IM or IV) does not treat a *C. difficile* infection in the bowel. This put the residents at risk for worsening infection, and the duration of oral therapy had to be extended to cover the missed treatment. It is also worth noting that parenteral vancomycin has been inappropriately prescribed for this purpose, and oral vancomycin has been prescribed or otherwise used erroneously to treat a systemic infection in other patients.

For the treatment of *C. difficile* diarrhea, oral metronidazole may be a viable alternative if the patient is experiencing their first episode and it is not a resistant case (<http://cid.oxfordjournals.org/content/46/10/1493.long>; <http://www.jstor.org/stable/10.1086/651706?origin=JSTOR-pdf>). If oral vancomycin is needed, and vancomycin injection will be reconstituted for oral use, pharmacists should prepare the solution in the pharmacy and provide each individual resident dose in an oral syringe, marked "FOR ORAL USE ONLY." Dispensing medications in the most ready-to-administer form should be the prevailing practice for all pharmacies that provide medications in hospitals and LTC facilities.

PHENYLEPHRINE INJECTION NEEDS DILUTION FOR INTRAVENOUS BOLUS USE

Phenylephrine hydrochloride injection 10 mg/mL, 1 mL vials are often available for emergency use as a vasopressor and are stored in ADCs, emergency kits, and crash carts. In most cases, the drug is prepared for continuous IV infusion by adding the vial contents to either 5% dextrose injection or 0.9% sodium chloride injection. There are certain situations in which phenylephrine is used as a bolus injection in doses from 50 mcg to 250 mcg (according to the December 2012 package insert). In these cases, doses cannot be drawn up and given accurately from a 10 mg vial and, therefore, dilution is needed. This can cause an error when the bolus dose is calculated and prepared during an emergency. Worse, there is also a risk that the dilution will not be made at all and that the entire vial might be used, especially since the vial is labeled, "Single Dose Vial." Thus, overdoses could result, especially in hectic, less-than-perfect situations such as during cardiac or respiratory arrests.

ISMP has received reports of several errors like this in the past year. For example, a pharmacist told us recently of a situation during a code she attended where phenylephrine 100 mcg was requested. She witnessed a nurse proceed to draw up the entire 10 mg vial. Fortunately, she was able to step in to prevent the error. Later she wrote to us about her concern that errors like this will be repeated. The current package insert (December 2012) gives instructions for diluting 10 mg (1 mL) with 99 mL of 5% dextrose injection or 0.9% sodium chloride injection to make a 100 mcg/mL solution. However, there is no room for this information on the 1 mL vial label (see **Figure 1**). Also, necessary supplies and instructions in the package insert may not be handy when dilutions are needed.

It should be noted that the US Food and Drug Administration (FDA) approved a new drug application (NDA) for phenylephrine injection in 2012. As part of the approval process, FDA asked West-Ward, the drug's sponsor, to develop an appropriate ready-to-use concentration and packaging configuration for administering approved IV bolus doses. This will hopefully mitigate the risk of errors and unsafe sterile technique and injection practices. The request

Figure 1. Label has insufficient space for instructions regarding dilution.

appeared in the NDA approval letter in 2012 (www.ismp.org/sc?id=375). So, we hope a new diluted product will be available in the future. The company is expected to submit a supplement to the NDA by the end of this month. Meanwhile, you should consider creating a dilution guideline or checklist for this drug and, if possible, have pharmacy attend codes to dilute the medication if needed for a bolus dose.

SIMILAR DRUG NAMES CONFUSED

A family medicine physician was attempting to electronically prescribe *Brintellix* (vortioxetine) 10 mg daily for major depressive disorder. After typing the first few letters of the brand name into the computer system, he incorrectly selected *Brilinta* (ticagrelor), an antiplatelet agent that is used in patients with acute coronary syndrome. The fact that *Brintellix* is a 10 mg tablet (also available in 5, 15, and 20 mg tablets) and *Brilinta* is a 90 mg tablet did not prevent this selection error.

The patient picked up the prescription from the pharmacy. Later, at home, she decided to read the

attached information regarding this new medication and realized that it did not sound like something she was supposed to take for depression. She then researched the medication further online and also contacted her physician to make sure this was the right medication. The physician realized the error, told his patient not to take *Brilinta*, sent the correct prescription for *Brintellix* to the pharmacy, and instructed the patient to take the original prescription (*Brilinta*) back to the pharmacy. The patient never took any doses of the *Brilinta*.

These rather new drug names share the same first 3 letters and other letters as well. Although this is the first report of an actual mix-up, ISMP received an earlier report where concern was expressed about the look-alike nature of these drug names. If these drugs are available at your facility or associated outpatient locations, take steps to reduce risk, including building software alerts to warn about possible confusion and reminding prescribers to use generic names (in addition to brand names) and list the indication when prescribing these drugs. ■