

Oral Liquid Medications: More Vulnerable to Errors Than Previously Recognized

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PROBLEM: Inappropriate dosing, incorrect or misunderstood directions for use, improper compounding, and inaccurate measurements of liquid oral medications have led to many errors.

In one case, the Institute for Safe Medication Practices (ISMP) received a report of a 12-month-old infant in the emergency department (ED) with a gastrointestinal virus. The child had received a wrong prescription and was given two overdoses (2.5-fold) of belladonna alkaloids with phenobarbital elixir (Donnatal®, PBM Pharmaceuticals) (2.5 ml instead of 1 ml). The infant also received two 12.5-mg doses of promethazine (Phenergan®, Wyeth) suppositories, which are contraindicated in children younger than two years of age. Later that day, after discharge from the hospital, the unconscious infant was readmitted and suffered permanent anoxic brain injury, resulting in delayed speech, seizures, and palsy of the lower extremities.



At another time, a pharmacist received an order from an office nurse for albuterol (Ventolin®, GlaxoSmithKline) syrup 2 mg/ml, 1½ teaspoons (not ½ teaspoon as intended) three times daily for a five-month-old infant. Although the pharmacist counseled the mother that the drug could cause hyperactivity or insomnia, the dosing instructions were not reviewed and the error was not detected. After two doses, the infant was shaking uncontrollably and was admitted to the ED with a pulse of between 140 and 200. Fortunately, no permanent harm resulted.

In five other reported cases, the prescriber correctly ordered the weight and volume of medication, but the pharmacist dispensed the solutions with the wrong directions, most of the time because the prescribed volume in milliliters was confused with teaspoons.

For example, amoxicillin/clavulanate potassium (Augmentin®, GlaxoSmithKline) was dispensed with directions to take 2½ teaspoons instead of 2½ ml. In each case, the directions for use were not reviewed with the caregivers before the prescription was dispensed.

Errors also have been reported when caregivers mis-

understood prescription labels, even when the labels were accurate. In one case, the mother of an infant did not receive instructions or a calibrated dropper to measure the prescribed dose of theophylline. The infant was hospitalized with seizures after the mother measured the doses inaccurately.

One time a pharmacist dispensed metoclopramide syrup (e.g., Reglan®, Wyeth) for an infant. The bottle was labeled correctly, with instructions to give 0.7 ml (0.7 mg) every six to eight hours. After misreading the directions, the mother asked a pharmacy clerk how to measure 7 ml of the drug. The clerk, unaware that she was providing information about an incorrect dose, gave the mother an oral syringe and showed her the 7-ml marking. The child was admitted to the hospital for two days after receiving several 7-ml doses.

These cases highlight a problem that should be of the utmost concern: oral liquid medications are associated with errors more often than we would expect.

Similar problems were noted in a survey of caregivers, most of whom had a high school education.¹ When demonstrating how they measured and administered the liquid form of albuterol to their children, 22% of the caregivers

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measured an improper dose, 17% inaccurately measured the intended dose, and all who used a household teaspoon measured the intended dose incorrectly.

Finally, giving patients “sample” oral liquid medications multiplies the risk of dosing errors because directions are often absent from the bottles and the products may need to be reconstituted before use.

SAFE PRACTICE RECOMMENDATION: Although it is commonly thought that oral agents generally have less potential to cause harm than parenteral medications do, oral liquid medications, which

are the least likely to be dispensed in unit doses, are prescribed most often for pediatric and geriatric patients. Patients in these age groups are quite vulnerable to the effects of medication errors. For these reasons, special care is needed, as follows:

1. When writing prescriptions in inpatient and outpatient settings, prescribers should include both the calculated dose (by metric weight) and its milligram-per-kilogram (mg/kg) basis. This strategy facilitates independent recognition of recalculations and errors by pharmacists and nurses.

2. Whenever possible, pharmacists should calculate the volume to be administered and should provide clear instructions to those who will be giving the medication.

3. Setting weight-based dose limits in the pharmacy computer system for oral liquid medications also can help to alert the staff when the volume selected exceeds a safe dose for the patient.

4. In retail pharmacies, all new prescriptions for oral liquid medications (and other new prescriptions warranting some education) should be placed in a separate area, away from other prescriptions. This step would help to ensure that pharmacists will review the instructions with customers, that they will provide an appropriate measuring device, and that they will demonstrate the use of the device before dispensing the drug. Simply asking customers whether they have any questions is insufficient.

5. Reviewing the product’s instructions with customers can also alert pharmacists to the existence of inaccurate label directions that might have been overlooked during the checking process.

6. When possible, in inpatient settings, oral liquid medications should be dispensed in unit doses in oral syringes. Before patients are discharged from the hospital or facility, caregivers should be taught about proper measurements. Patients should be given an oral syringe when feasible, and they should be reminded to bring the syringe to the pharmacy and to ask for a demonstration of how to measure liquids accurately.

7. If the physician’s office dispenses sample oral solutions, arrangements should be made with a hospital or a retail pharmacy that would allow patients to

bring in samples to be properly labeled with instructions.

REFERENCE

1. Simon HK. Caregiver knowledge and delivery of a commonly prescribed medication (albuterol) for children. *Arch Pediatr Adolesc Med* 1999;153(6):615–618.

The reports described in this column were received through the USP-ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP (www.ismp.org) or the USP (www.usp.org) Web site or communicated directly to ISMP by calling 1-800-FAIL SAFE or via e-mail at isminfo@ismp.org.

In 2004, ISMP is celebrating the 10th anniversary of its incorporation as a non-profit organization. The Institute represents more than 20 years of experience in helping health care practitioners keep patients safe and continues to lead efforts to improve the medication-use process.