Preventing errors when administering drugs via an enteral feeding tube*

Did you know administering drugs through a feeding tube can be prone to errors? Medication errors related to this route of administration happen more often than reported or recognized. These errors are often the result of administering medications that are incompatible with administration via a tube, preparing the medications improperly, and/or administering a drug using improper administration techniques, which can lead to an occluded feeding tube, reduced drug effect, or drug toxicity. These potential adverse outcomes can lead to patient harm or even death.

Incompatible route
Nurses should not assume an oral medication intended to be taken by mouth can be safely administered through a feeding tube. The drug’s physical and chemical properties control its release and subsequent absorption. These very specific delivery mechanisms may be altered or destroyed if the drug is administered through a feeding tube, reducing its effectiveness or increasing the risk of toxicity. For example, oral tablets of ACCUPRIL (quinapril) contain the excipient (non-therapeutic fillers, binders, buffers, preservatives) magnesium carbonate. Crushing an Accupril tablet and dissolving it in water for enteral administration allows the carbonate to increase the pH of the solution, causing the drug to rapidly degrade into a poorly absorbed metabolite.

Improper preparation
Oral medications intended to be taken by mouth must be prepared for enteral administration. Tablets must be crushed and diluted, capsules must be opened so the contents can be diluted, and even many commercially available liquid forms of drugs that can be administered enterally should be further diluted before administration—a practice not known to all nurses.

Many immediate-release tablets can be safely crushed into a fine powder and diluted prior to administration. But, sublingual, enteric-coated, and extended/delayed-release medications should not be crushed. In addition to destroying the drug’s protective coating, crushed enteric-coated tablets tend to clump and clog feeding tubes. Crushed sublingual or extended/delayed-release medications can lead to dangerous and erratic blood levels as well as dangerous side effects. Unfortunately, the variety of suffixes manufacturers use to denote an extended/delayed-release formulation—CD, CR, ER, LA, SA, SR, TD, TR, XL, XR—or the absence of these suffix designations, such as with AVINZA (morphine sulfate extended release capsules) and OXYCONTIN (oxyCODONE controlled release), make it difficult to quickly determine whether a drug can be safely crushed. In these examples, the medications should not be crushed or dissolved.

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Check it out! ✔✔✔

Follow these guidelines for administering medications via an enteral feeding tube:

- **Establish route suitability.** Determine the location of the distal end of the feeding tube and consult with a pharmacist to ensure the medication(s) will be properly dissolved and absorbed.

- **Establish drug and dosage form suitability.** Ensure that the drug and formulation are appropriate for enteral administration. Use only immediate-release solid dosage forms or liquid dosage forms. For solid dosage forms, an up-to-date Do Not Crush list (Mitchell, JF. Oral dosage forms that should not be crushed. Retrieved March 2010 from www.ismp.org/Tools/DoNotCrush.pdf) can help determine suitability. Consult with a pharmacist if you have questions or to see if liquid dosage forms are available and appropriate.

- **Crush solid dosage forms.** Have pharmacy crush tablets into a fine powder using a fully self-contained, pill-crushing device (e.g., the Silent Knight), which prevents residue from one medicine being mixed with another. Allergenic, cytotoxic, carcinogenic, or teratogenic drugs should be crushed by the pharmacist under highly controlled conditions, and only when necessary.

- **Open capsules.** Open immediate-release gelatin capsules to remove the powder contents or to crush the solid contents.

- **Dilute the medication.** Dilute the crushed drug as well as liquid medications. Purified water (e.g., sterile water) is the preferred diluent for most drugs. Tap water is not advised, as it often contains chemical contaminants (e.g., heavy metals, medications) that might interact with a drug.

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Crushing drugs such as TRACLEER (bosentan) or PROSCAR (finasteride), or opening ZAVESCA (miglustat) capsules, can expose nurses to powder that can cause serious birth defects. Some orally disintegrating tablets, such as PREVACID ( Lansoprazole) SOLUTABS, must not be crushed because they contain enteric-coated microgranules. Some capsules contain both immediate- and extended-delayed-release granules. With liquid-filled capsules, it is difficult to ensure that all the liquid has been removed to give the correct dose.

Using a commercially available liquid form of the medication or other preparations used to make oral suspensions may seem like a safe alternative, but some, such as Prevacid Oral Suspension Packets, may not be appropriate for administration via feeding tubes. Also, excipients in some oral solutions and suspensions, such as sweeteners, gums, stabilizers, and suspension agents, can increase viscosity and osmolality, causing diarrhea, clogged tubes, and/or undelivered medication left in of the tube.

Improper administration technique

Most nurses rely chiefly on their own experience and that of coworkers for information regarding the preparation and administration of enteral medications; few rely on pharmacists or printed guidelines, which has resulted in a variety of improper techniques and an overall lack of consistency. The most common improper administration techniques include giving multiple drugs at the same time and failing to flush the tube before administering the first drug and between each drug.

Appropriate administration techniques must be used to prevent compatibility issues (between the medication and the formula) and tube occlusions. Information about drug compatibility with feeding formulas is limited and may not be applicable to different formulations of the same drug or drugs within the same class. For example, liquid morphine in a 2 mg/mL concentration decreases the pH of the feeding formula and results in a visible precipitate, but a 20 mg/mL concentration does not. Compatibility issues between the formula and drug are likely to result in tube occlusions.

Compatibility between multiple drugs being administered together can also be a problem, particularly if two or more drugs are crushed and mixed together before administration. Mixing two or more drugs together, whether solid or liquid forms, creates a brand new, unknown entity with an unpredictable mechanism of release and bioavailability. Proper flushing of the tube before, between, and after each drug can help avoid problems.

Safe practice recommendations

Within each organization, an interdisciplinary team of nurses, pharmacists, and doctors should work together to develop protocols for administering drugs through enteral tubes. Protocols should address using appropriate dosage forms, preparing drugs for enteral administration, administering each drug separately, diluting drugs as appropriate, and flushing the tube before, between, and after drug administration. The Enteral Nutrition Practice Recommendations, a comprehensive guide developed by an interdisciplinary task force in 2009, is available on the American Society for Parenteral and Enteral Nutrition’s (A.S.P.E.N.) website, www.nutritioncare.org/safety. A synopsis of these recommendations can be found in the checkitout! column starting in the right column on page 1. However, the A.S.P.E.N. resource is of greatest value if employed in its entirety.

*We thank Joseph Boullata, PharmD, RPh, BCNSP, for providing ISMP with the information necessary for this article, which was adapted from a comprehensive article he authored on the subject: Boullata, JI. Drug administration through an enteral feeding tube. Am J Nurs 2009;109(10):34-42.

Don’t mix medications. Do not add medication(s) directly to the formula. Mixing drugs with the formula could cause drug-formula interactions, leading to tube blockages, altered bioavailability, and changes in bowel function.

Flush. Stop the feeding and flush the tube with at least 15 mL purified water before and after administering each medication.

Administer separately. Administer each medication separately through the feeding tube using a clean 30 mL or larger oral (non-luer tip) syringe.

Flush again. Flush the tube again with at least 15 mL purified water to ensure drug delivery and clear the tube.

Restart the feeding. The feeding can usually be restarted after drug administration and flushing (some drugs require a delay of 30 minutes or more).

Report and investigate. Any occlusion of a feeding tube or unexpected response to drug therapy should be reported and investigated to determine the cause.

Adapted from the Boullata article and the A.S.P.E.N. Enteral Nutrition Practice Recommendations.

Root cause analysis published. On July 5, 2006, a 16-year-old pregnant patient at a hospital in Wisconsin was inadvertently and tragically given an infusion of epidural bupivacaine and fentanyl intravenously. Within minutes, the patient experienced cardiovascular collapse. Although a healthy infant was delivered by cesarean section, the medical team was unable to resuscitate the mother. The event led to the dismissal of the nurse involved, Julie Thao, who was later charged with a felony criminal offense. The hospital invited ISMP to conduct an independent root cause analysis continued on page 3 — SafetyWires
The danger with cutting medication patches

A physician instructed staff from a hospice healthcare agency to cut a 50 mcg/hour fentaNYL transdermal system patch and apply it to a patient to deliver a 25 mcg/hour dose. Soon after, a visiting nurse discovered the cut patch, immediately removed it, and called the agency to notify the physician about the risk of an overdose with this practice, and to order a supply of 25 mcg/hour patches. Fortunately, the patient had no adverse effects. However, serious harm, including fatalities, has been reported under similar circumstances.

In the US, several transdermal drug delivery systems exist for various products (Ball AM, Smith KM. Optimizing transdermal drug therapy. Am J Health-Syst Pharm July 15, 2008; 65:1337-46.) and are described below.

Reservoir membrane-modulated systems: The drug is contained in a reservoir between an impermeable backing layer and a rate-controlling microporous membrane. Drug release is controlled by the membrane. Cutting the patch makes the entire dose available immediately, potentially leading to an overdose.

Microreservoir systems: The drug is contained in multiple, smaller drug reservoirs. Cutting the patch destroys some of the reservoirs, although most remain intact. The number of reservoirs that remain may not be proportionate to the surface area of the patch. So, cutting a patch in half does not guarantee that the amount of drug in each half is equal, resulting in improper drug dosing.

Drug-in-adhesive layer systems: The drug is homogeneously mixed with a polymer-based adhesive, which is applied to an impermeable backing. The amount of drug delivered is diffusion controlled and directly proportionate to the surface area of the patch. Cutting the patch decreases the amount of drug delivered without presenting a hazard. (LIDODERM [lidocaine] patches are an example and can be safely cut to deliver a smaller dose of medication.)

Matrix systems: The drug is evenly distributed throughout a drug-in-adhesive matrix similar to the drug-in-adhesive layer system. The amount of available drug is directly proportionate to the surface area of the patch. Cutting the patch is possible but the manufacturer’s recommendations should be followed because efficacy of the adhesive may decrease.

Most fentaNYL patches are available in a reservoir membrane-modulated system. Product labeling clearly notes these patches should never be cut or altered prior to application. A fentaNYL transdermal system patch is also available (Mylan). However, labeling for this product specifically warns users not to divide, cut, or damage the patch before application. No formal studies have been done to determine the clinical effectiveness of cut fentaNYL matrix patches. Thus, no type of fentaNYL transdermal patches should ever be cut. Prescribers should provide patients with a new prescription for a lower strength, if needed. Patients should be warned about the risks of cutting patches, and instructed to properly dispose higher strength patches if a lower strength patch has been prescribed. For other patches, always refer to the package insert and follow the manufacturer’s recommendations regarding the safety and efficacy of cutting patches.
ISMP’s Action Agendas, presented quarterly in its acute care newsletter, give hospitals information on current medication safety problems, prevention recommendations, and a framework to create an ongoing process for reviewing risks and avoiding harmful events.

Now an ongoing series of ISMP Action Agenda webinars led by ISMP’s President Michael R. Cohen can help you bring your medication safety review process to life and support your existing medication safety agenda. These webinars are designed for entire safety committees, pharmacy and therapeutics committees, and other organizational quality/risk management committees to join ISMP as we tackle the most difficult medication safety risks together each quarter. The webinars will offer participants an opportunity to:

- Learn about the most serious safety risks reported to ISMP each quarter
- Identify how your organization can implement the error-prevention recommendations presented in ISMP’s Action Agendas
- Meet The Joint Commission standards (see below)
- Ask questions and learn what other attendees are doing to prevent errors through real-time polling during the webinars
- Obtain slides with pictures of problematic products, devices, environmental conditions, and order communications, for use at committee or staff meetings

Meet Joint Commission Standards
ISMP’s Action Agenda webinars can help satisfy:

- **MM.08.01.01, EP 4 and 5**: Review literature for best practices, identify improvement opportunities
- **LD.03.01.01, EP 8**: Provide patient safety literature/advisories to staff
- **LD.04.04.02, EP 3, 4, and 5**: Incorporate current information about sentinel events in process design

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<th>Who Should Participate?</th>
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<tr>
<td>April 22, 2010</td>
<td>Committee/team members from all areas of practice—nurses, pharmacists, physicians, leadership, medication safety officers, patient safety officers, and quality improvement/risk management staff—are encouraged to participate. The registration fee includes all committee/team members listening via a single phone line. Slides of the webinar will be available post-webinar for committee members of registrants who were unable to attend. For a small fee, registrants can also purchase a recording of the webinar.</td>
<td>Check out the first Action Agenda webinar at a discounted rate—just $100. Register soon because space is limited. If you find the first webinar helpful, your committee can commit to a yearlong subscription to the ISMP Action Agenda webinar series (4 quarterly webinars) for just $795. To register, please visit: <a href="http://www.ismp.org/educational/webinars">www.ismp.org/educational/webinars</a>. Free CE credit is available for pharmacists and nurses.</td>
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