Preventing Errors When Drugs Are Given Via Enteral Feeding Tubes

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PROBLEM: Giving medications through a feeding tube can be fraught with errors that occur more often than they are reported or recognized. These mistakes are often the result of administering drugs that are incompatible with administration via a tube, of not preparing the medications properly, and of using faulty techniques. These inaccuracies can result in an occluded feeding tube, a reduced drug effect, or drug toxicity. These potential adverse outcomes can lead to patient harm or even death.

INCOMPATIBLE ROUTE

Health care practitioners should not assume that a 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 specific delivery mechanisms may be altered or destroyed if the drug is given through a feeding tube, reducing its effectiveness or increasing the risk of toxicity.

Oral quinapril (**Accupril,** Pfizer) tablets, for example, contain the excipient magnesium carbonate (a nontherapeutic filler, binder, buffer, and preservative). Crushing a quinapril 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 ABSORPTION

Drug absorption depends on the drug's solubility and ability to permeate the intestinal mucosa. The distal end of the feeding tube can be in the stomach, duodenum, or jejunum. Many drugs must be administered into the stomach or duodenum so that they can be properly dissolved by gastric juices, bile, and pancreatic enzymes and can be fully absorbed through the intestines. Thus, drugs like warfarin (which is absorbed high up in the small bowel) and oral iron (which is dissolved in the stomach and absorbed in the duodenum) might not be properly absorbed if they are administered via a jejunostomy tube.

FAULTY PREPARATION

Oral medications that are 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 should be further diluted before being administered enterally—a practice not well known to all practitioners.

Many immediate-release tablets can be safely crushed into a fine powder and diluted before they are administered. However, sublingual, enteric-coated, and extended-release (ER) or 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, ER, or delayed-release drugs can lead to dangerous and erratic blood levels as well as dangerous side effects. Unfortunately, the variety of suffixes that manufacturers use to denote ER and delayed-release formulations (CD, CR, ER, LA, SA, SR, TD, TR, XL, and XR)—or the absence of these suffix designations, such as with morphine sulfate ER capsules (**Avinza,** Pfizer**)** and oxycodone controlled release (**OxyContin,** Purdue Pharma)—makes it difficult to quickly determine whether a drug can be safely crushed. In these examples, the medications should not be crushed or dissolved.

Crushing drugs such as bosentan (**Tracleer,** Actelion) or finasteride (**Proscar,** Merck**)** or opening miglustat (**Zavesca,** Actelion) capsules may expose pregnant nurses to powder that can cause serious birth defects. Some orally disintegrating tablets, such as lansoprazole (**Prevacid SoluTab,** Takeda) must not be crushed because they contain enteric-coated microgranules. Some capsules contain both immediate-release and ER or delayed-release granules. With liquid-filled capsules, it is difficult to ensure that all the liquid has been removed so that the correct dose can be given.

Using commercially available liquid forms of drugs or other preparations used to make oral suspensions may seem like a safe alternative, but some forms, such as **Prevacid Oral Suspension Packets,** might not be appropriate when given by a feeding tube. Also, excipients in some oral solutions and suspensions, such as sweeteners, gums, stabilizers, and suspension agents, can increase viscosity and osmolality, which can lead to side effects (e.g., diarrhea) as well as other problems, such as clogging of the tubes or undelivered medication left in the tube.

WRONG ADMINISTRATION TECHNIQUE

Most nurses rely primarily on their own experience and on that of their coworkers for information about preparing and administering enteral medications. Because few nurses rely on pharmacists, nutritionists, or printed guidelines, a variety of improper techniques and an overall lack of consistency have often been the result. The most common improper administration techniques include mixing multiple drugs together to give at the same time and failing to flush the tube before giving the first drug and between giving subsequent drugs.

Appropriate administration techniques must be used to prevent incompatibility (between medications and the feeding formula) and tube occlusions. However, information about drug compatibility with feeding formulas is limited and might 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 precipitate, but a 20-mg/mL concentration does not. Problems of compatibility between the formula and the drug can result in tube occlusions.

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

SAFE PRACTICE RECOMMENDATION: Within each organization, an interdisciplinary team of nurses, pharmacists, nutritionists, and physicians should work together to develop protocols for administering drugs through enteral feeding tubes. Protocols should address using appropriate dosage forms; preparing the drugs for enteral administration; administering each drug separately; diluting the drugs as appropriate; and flushing the feeding tube before, between, and after drug administration.

The Enteral Nutrition Practice Recommendations, a comprehensive guide developed by an interdisciplinary task force in 2009,[1] is available on the American Society for Parenteral and Enteral Nutrition's (A.S.P.E.N.) Web site.[2] This information is of great value if it is read in its entirety. A step-by-step guide of safe recommendations follows.

1. **Establish the suitability of the route.** Health care professionals who administer enteral medications should determine the location of the distal end of the feeding tube and should consult with a pharmacist to ensure that the medication will be properly dissolved and absorbed.

2. **Establish the suitability of the drug and the dosage form.** Practitioners should ensure that the drug and the formulation are appropriate for enteral administration. Only immediate-release solid dosage forms or liquid dosage forms should be used. For solid dosage forms, the staff can refer to the current "do not crush list"[3] to help determine suitability. Nurses should consult with the pharmacist if they have questions or to see whether liquid dosage forms are available and appropriate. The pharmacist can also contact the prescriber to switch to a product that is more suitable for enteral tube administration if necessary.

3. **Prepare each drug separately.** Each medication should be prepared individually so that it can be administered separately.

4. **Open the capsules.** Immediate-release gelatin capsules should be opened to remove the powder or to crush the solid contents.

5. **Crush solid dosage forms.** Whenever possible, the pharmacy staff should crush tablets into a fine powder using a fully self-contained, pill-crushing device (such as Links Medical's Silent Knight). This practice prevents residue from one medication from being mixed with another medication. Allergenic, cytotoxic, carcinogenic, or teratogenic drugs should be crushed by a pharmacist under highly controlled conditions and only when necessary.

6. **Dilute medications.** The crushed drug, as well as liquid medications, should be diluted. Purified (sterile) water is the preferred diluent for most drugs. Tap water is not advised, because it often contains chemical contaminants (e.g., heavy metals and medications) that might interact with the drug. The diluted medication should be drawn up into an oral syringe and dispensed to the nursing unit ready for administration.

7. Don't mix medications with feeding formulas. Medications should not be added directly to the feeding formula. Mixing a drug with a formula could cause drug–formula interactions, leading to tube blockages, altered bioavailability, and changes in bowel function.

8. **Flush.** After the drug is delivered, the feeding should be stopped and the tube should be flushed with at least 15 mL of purified water before and after each medication is given.

9. **Administer each drug separately.** Each medication should be given separately through the feeding tube. A clean 30-mL or larger oral (non-Luer tip) syringe should be used.

10. **Flush the tube again.** The tube should be flushed again with at least 15 mL of purified water to ensure that the drug has been delivered and the tube is clear.

11. **Restart the feeding.** The feeding can usually be restarted after the drug has been given and the tube has been flushed. For some drugs, a delay of 30 minutes or more is required.

12. **Report problems.** Any occlusion of a feeding tube or unexpected response to drug therapy should be documented and investigated to determine the cause.

REFERENCES

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