
Lamya Alnaim, PharmD

In one survey 74% of hospital staff

Increased toxicity

Possible problems

Some medications may be given through EN tube

Small-bore tubes

Flexible, Small bore
Nasoenteric tubes
Used for short-term feeding
Can be placed in stomach, duodenum at bedside
In duodenum, jejunum by fluoroscopy or endoscopy
Help maintain LES pressure
Tablets, lozenges, and crushed dosage form clog the tube
Use only liquid dosage forms

Methods of Enteral Feeding

Orally
Nasally
Percutaneously
Manual, surgical, or endoscopically
May be infused into
  –Stomach
  –Duodenum
  –Jejunum

Large-Bore Tubes

NG, OG, gastrostomy (G), jejunostomy (J)
Less likely to clog
Tube insertion is easier so tube replacement is lower cost
NG may compromise LES→ aspiration

Large-Bore Tubes

NG tube usually used for GI suction in patients with impaired gastric function e.g. gastric stasis.
Must clamp tube for 30 minutes after drug administration to ensure absorption and prevent suctioning
Medication Administration Plan
• Prioritize therapeutic goals
• Temporarily discontinue nonessential medication e.g. HRT
• Consider giving medications by an alternate route such as transdermal, rectal, inhaled, IM, SC, buccal, SL, or IV
  – Choose route based on patient’s clinical status and medication needs. (table 1)

Medication Administration Plan
• When drug not available in other route consider using a pharmacologically similar agent.
  – Dosage and frequency adjustment may be necessary
• Evaluate
  – tube type
  – tube location in the GIT
  – site of drug action and absorption
  – Effects of food on drug absorption

Enteral Administration of Medications
• Antacids, bismuth, sucralfate act locally in stomach and not suitable for intestinal feeding.
• Bioavailability of some drugs with extensive first-pass may be↑ if given by intrajejunal route. E.g opioids, TCA, beta blockers, nitrates

Enteral Administration of Medications
• Buccal or SL may be ineffective enterally
• Stop feeding 30 min before and after dosing for drugs that require administration on empty stomach. (if tube is placed in stomach)

Enteral Administration of Medications
• Liquid is preferred
  – Liquid for oral or IV may be used instead of solid dosage forms
  – Compressed tablets may be crushed to fine powder and mixed to slurry in water and given through large-bore tube.

Enteral Administration of Medications
• Content of most capsules may be administered same way
• In all cases tube should be flushed with at least 30 ml water before and after administration to clear any residual medication or formula.
**Enteral Administration of Medications**

- Medications should not be added to enteral formula
  - To reduce risk of microbial contamination
  - To avoid drug-nutrient incompatibilities

**Enteral Administration of Medications**

- Many oral products should not be crushed. (Table 2)
  1. Sustained release
  2. Microencapsulated
     - Crushing destroys the sustained release properties resulting in erratic levels

**Panel 2: Techniques for administering drugs via enteral feeding tubes**

- 1. Crush tablets or open capsules and mix in 10-15ml of tap water (5-10ml for children) Rinse the tablet crusher and flush washings down the tube
- 2. Dissolve dispersible tablets in 10-15ml of tap water
- 3. Shake liquid formulations in the bottle
- 4. Draw up medication into a 50ml needleless oral syringe
- 5. Flush the nasogastric tube with 30ml of water before drug administration
- 6. Administer each drug separately, flushing the tube with 5ml of water (3ml for children) in between each medication. Flush the syringe in between medications
- 7. Flush tube with water after administration is complete

**Proton-Pump inhibitors**

- Acid labile undergo gastric degradation
- Formulated as delayed-release capsules that contain enteric-coated drug granules in capsules or tablets
- Outer coating dissolves in stomach and drug is absorbed in intestine.
Proton-Pump inhibitors

- Correct administration
  - Granules mixed with apple or orange juice to ensure maximum amounts of drug reach duodenum
  - Different methods are used depending on type of tube and its location in GI.
  - For large NG tubes → mix granules with acidic juice and pour down and follow with extra juice.

Laxatives

- Bulk-forming laxatives should not be given via feeding tube
  - They form a semisolid mass that may occlude the feeding tube when mixed with < 250 ml fluid.
  - E.g. methylcellulose, psyllium, cholestyramine

Considerations with liquid medications.

- Liquid dosage form is preferable when giving medications via tube feeding
- Medication dosage and frequency may need to be adjusted.
  - Phenytoin suspension is immediate release and must be dosed 2-4 times a day, while capsules are sustained release given once daily.
  - Same for diltiazem

Proton-Pump inhibitors

- Correct administration
  - Intestine small bore tubes → oral PPI suspension prepared
  - Dissolve intact unencapsulated granules in 8.4% sod. bicarbonate
  - For maximum absorption → give intact granules into stomach and suspension into intestine

Laxatives

- Bulk-forming laxatives should not be given via feeding tube
  - Even when mixed well → viscous solution may block feeding tube.
  - Use a fiber-containing EN formula in patients who require additional fiber or laxative effect

Considerations with liquid medications.

- Feeding rate or schedule must be adjusted to maintain adequate nutrition especially if EN is interrupted several times daily for medication administration.
Considerations with liquid medications.
- Liquids with high osmolality cause diarrhea, cramping, abdominal distension, and vomiting. Table 3
- These effects may be reduced by diluting medication with 10-30 ml of sterile water before administration.
  - Osmolality of final solution = osmolality of drug x volume of drug/total volume of mixture.
  - Sterile water has no solutes and does not contribute to mix

Considerations with liquid medications.
- Ingredient-related diarrhea may occur in up to 50%
  - Inert ingredients such as mannitol, lactose, saccharin, sucrose
  - Sorbitol most likely to cause GI problems

Considerations with liquid medications.
Sorbitol:
- Used therapeutically as laxative in doses of 7.5-30g
- Added to many liquids as sweetener, improve stability, and provide vehicle.
- Causes gas and bloating at daily dose 10g

Considerations with liquid medications.
Sorbitol:
- Causes cramping and diarrhea with doses > 20g/g
- Its effects are cumulative (total daily doses from different drugs)
- Minimize risk by avoiding sorbitol-containing agents when possible

Drug interaction and incompatibility
- Table 5
- Some medication form precipitates and may clog the feeding tube and reduce drug absorption
- Syrups and other acidic medication may clump

Drug interaction and incompatibility
- These interactions can be avoided by stopping the EN for 1-2 hrs before and 2 hrs after drug administration.
- Minimize time of feeding interruption by using once or twice daily dosing
Phenytoin

- Absorption decrease when given with EN reducing serum conc by 50-75%
- Can be decreased by stopping feeding for 2 hrs before and after each dose. And flushing the tube before each dose.
- Use twice daily dosing and increase feeding rate.
- Monitor serum levels closely.

Warfarin

- Effects may decrease with EN
- Due to reduced absorption and vitamin K antagonism
- Absorption is decreased by drug binding to components in the feed.
- Vit K interaction at doses of 140-500 mcg/day that is found in most feeding formulas especially if patient is receiving large volumes.

Warfarin

- Monitor PT
- Consider ↑ warfarin dose or using alternate anticoagulants
- ↓ dose when patient is switched to oral or parenteral feeding

Fluoroquinolones

- PK are altered
- Absorption is decreased and peak conc ↓
- These changes may affect antimicrobial efficacy and patient outcomes.
- May be due to binding to covalent cations in the feed.
- To ↓ interaction they should be given 2 hrs before or 4 hrs after EN
- To ensure efficacy administer drug parenterally.

Fluoroquinolones

- If must be given by via feeding tube crush tablets and mix 20-60 ml sterile water immediately before giving
- Adjust feeding rate to compensate for lost time
- Ciprofloxacin suspension should never be given via feeding tube because
  - thick consistency that blocks the tube
  - Oil-based suspension does not mix with aqueous solution and not easily flushed with water

Clogged Feeding Tube

- medications cause occlusion in 15% of patients with EN
- See appendix B for managing clogged tubes.
- Attempt to clear tube with warm water and gentle pressure before removing.
- Flush with carbonated water or alkalinized enzyme solution
Clogged Feeding Tube

- Clog zapper: product containing papain, amylase, and cellulose.
  - May be used for occlusions caused by enteral formula
  - Not evaluated for drug related occlusions and should not be used
  - Alkalinized solution only can be used with drug occlusions
  - Made from crushing one sod. Bicarbonate tablet + viokase or cotazym (both contain lipase, amylase and protease)

Examples of drug interactions with enteral feeds

<table>
<thead>
<tr>
<th>Medication</th>
<th>Type of interaction</th>
<th>Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbenoxolone</td>
<td>Absorption decreased by a possible 25 per cent due to interaction with feeds; chelation with ions in tap water</td>
<td>Stop enteral feed for one hour before and two hours after dose; use sterile water if dissolving tablets</td>
</tr>
<tr>
<td>Fluoxetine</td>
<td>Decreased absorption and concentration</td>
<td>Monitor changes in blood pressure</td>
</tr>
<tr>
<td>Penicillin V</td>
<td>Unpredictable absorption (30 to 80 per cent)</td>
<td>Stop enteral feed for one hour before and two hours after dose; administer higher doses or use amoxicillin</td>
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<tr>
<td>Sucralfate</td>
<td>Binds to the protein in the feedings</td>
<td>Use alternatives, e.g. ranitidine because enteral feed has to be stopped for a total of 12 hours per day</td>
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<tr>
<td>Theophylline</td>
<td>Absorption decreased by 60 to 70 per cent; metabolism increased</td>
<td>Stop feed for one hour before and two hours after dose and monitor levels</td>
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<tr>
<td>Warfarin</td>
<td>May interact with vitamin K</td>
<td>Monitor international normalized ratios (INR) closely and use appropriate anticoagulants</td>
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Table 1: Drugs requiring dosage or frequency adjustments when administered via enteral feeding tubes

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<tr>
<th>Drug</th>
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<tr>
<td>Carbamazepine</td>
<td>Use suppositories, available as 125mg, 250mg (125mg, rectally, is approximately equivalent to 100mg carbamazepine orally)</td>
</tr>
<tr>
<td>Digoxin</td>
<td>Liquid has different bioavailability from tablets so dose adjustment may be necessary</td>
</tr>
<tr>
<td>Lithium</td>
<td>Total daily dose needs to be given in more frequent divided doses</td>
</tr>
<tr>
<td>Levodopa (Madopar, Sinemet)</td>
<td>When changing to dispersible tablets, total daily dose may need to be given more frequently. For controlled release formulations, 400mg levodopa is equivalent to 300-400mg levodopa in ordinary release or dispersible preparations. Hence, the dose may need to be adjusted according to response</td>
</tr>
<tr>
<td>Phenytoin</td>
<td>96mg phenytoin liquid is approximately equivalent to 100mg phenytoin sodium capsules. Higher doses may be required when administering liquid enterally (due to interactions)</td>
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<tr>
<td>Sodium fusidate/fusidic acid</td>
<td>500mg sodium fusidate tablets are approximately equivalent to 750mg fusidic acid suspension</td>
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| All "relare" formulations | Total daily dose may

MT 130-13  Medication with Special Considerations for Enteral Feeding Tube Administration

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<td>Feunin</td>
<td>Reduced bioavailability when administered enteral feeds. Data for intravenous use suggest that protein binding and calcium chloride may reduce protein bioavailability</td>
<td></td>
</tr>
<tr>
<td>Velozzol (revised)</td>
<td>Reduced bioavailability associated with food and piperazine, escitalopram, sertraline, and escitalopram. Abnormal bioavailability of the oral solution is also generally attributed to continuous tube feeding</td>
<td></td>
</tr>
<tr>
<td>Vafin</td>
<td>Pharmacokinetic interaction associated with warfarin and vitamin K. Warfarin is contained in enteral products in doses less than 200 mg as 100 mg of vitamin K. Use fortified vitamin K-containing product and monitor INR daily</td>
<td></td>
</tr>
<tr>
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<td>Absorption decreased by 60 per cent due to enteral feeding. Use fortified vitamin K-containing product and monitor INR daily</td>
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Clogged Feeding Tube

- Cranberry juice and carbonated colas should be used because they are acidic and may contribute to occlusion by denaturing proteins in the formula.
Panel 4: Minimising interactions between liquid phenytoin and enteral feeds

1. Give phenytoin as a single daily dose
2. Stop enteral feed two hours before administration of phenytoin and recommence two hours after dosing or
   Suspend feed between 10pm and 6am (that is, during sleeping hours) and give phenytoin as a single daily dose at midnight (this allows for six hours drug absorption)
3. Dilute phenytoin suspension with at least equal parts (dilution up to 1:3 has also been recommended) or at least 20ml water (remember to shake the bottle before use)
4. Flush enteral tube with plenty of water before and after administration

When phenytoin capsules are substituted for phenytoin liquid, serum level monitoring is advised and dose should be adjusted accordingly. The dosage form and volume of liquid should always be documented on the patient’s prescription chart to avoid confusion.