

Understanding Drug-Nutrient Interactions in tube-fed patients

Presented at the Oley
Conference June 2012



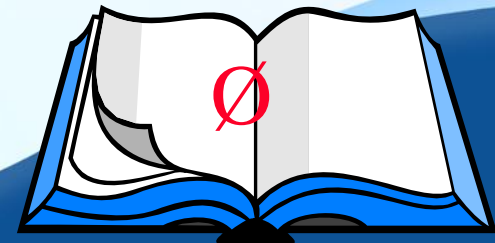
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Introduction

- Few drugs are tested for feeding tube route
 - Fewer are tested for exit site below stomach
- However FDA is increasingly aware of the feeding-tube route
 - Teva's ODT lansoprazole because it clogged FT.
 - (generic drugs retain package insert of trade-name, but lack studies supporting use and formulation)



FT Administration Perspectives

Clear Oral Liquids: **Preferred** (to avoid clogs)

- Suspensions are thick – need dilution to dissolve

Plain Tablets: Crush & Flush

- Some have coated shells which do not crush well
- Some drugs are poor water solubility and may fall out of solution when mixed with water – mix in syringe

Hard Gelatin Capsules: Open, Mix (powder), & Flush.

Soft Gelatin Capsules : Create pinhole and extract into syringe or squeeze into feeding tube. (Nifedipine)

This does not work for many liquid-filled capsule. The volume of liquid inside is very small- easier with two holes in capsule



Acidic drugs form clogs

- Standard nutrition clogs when passing into stomach
 - Acidic drugs will form clogs inside feeding tube
 - Depending on rate – clogs formation can be faster (<50 mL/hr)
- Liquid medications (syrups) are prone to clogs
 - Ferrous Sulfate Elixir is worst offender (Niferex is an alternative)
- Solid drugs can also react – Plavix, Aspirin

Physical Issues - Clogging

•Products that clog tubes:

DO NOT USE in feeding tubes !

- K Dur Tablets
- Biaxin Suspension
- Phenytoin capsules – Mylan (solid interior)
- Cipro Suspension
- Vancomycin Capsules (solid interior)
- Magnesium Oxide **
- Metamucil (Benefiber ok)
- Dyazide

**** Not a good source of Magnesium – yet is routinely ordered and forms clogs**

Pharmaceutical Issues:

Crushing Extended Release Drug Products

- Destroys Extended Release properties
- Increased risk of side effects and toxicities

Example: Trental Tablets

	<u>Intact Tab</u>	<u>Crushed Tab</u>
C_{max} :	184 ng/mL	1789 mg/mL
t_{max} :	2.25 hr	0.6 hr
S.E.:	none	Nausea, dizziness diaphoresis, vomiting

- **But – Make a liquid form, by crushing and mixing with water – give a lower dose, more frequently.**

Proton Pump Inhibitors

(**Prilosec**, **Prevacid**, **Nexium**, **Zegerid**)

- **Acid-labile enteric coated** dosage form
- Three methods of gastric feeding tube administration: *

 1. Flushing of intact granules with water (clogs easily)
 2. Administration of intact granules with fruit juice
 - Draw 30mL juice into syringe and flush FT – need about 120 ml total to give drug
 3. Use NaHCO₃-based suspension for Post-Pyloric
 - Does not apply to **Protonix** – solid tablet
 - Does not apply to Zegerid (already contains NaHCO₃)

* Zimmerman, et al: *Consultant Pharmacist* 12:990, 1997

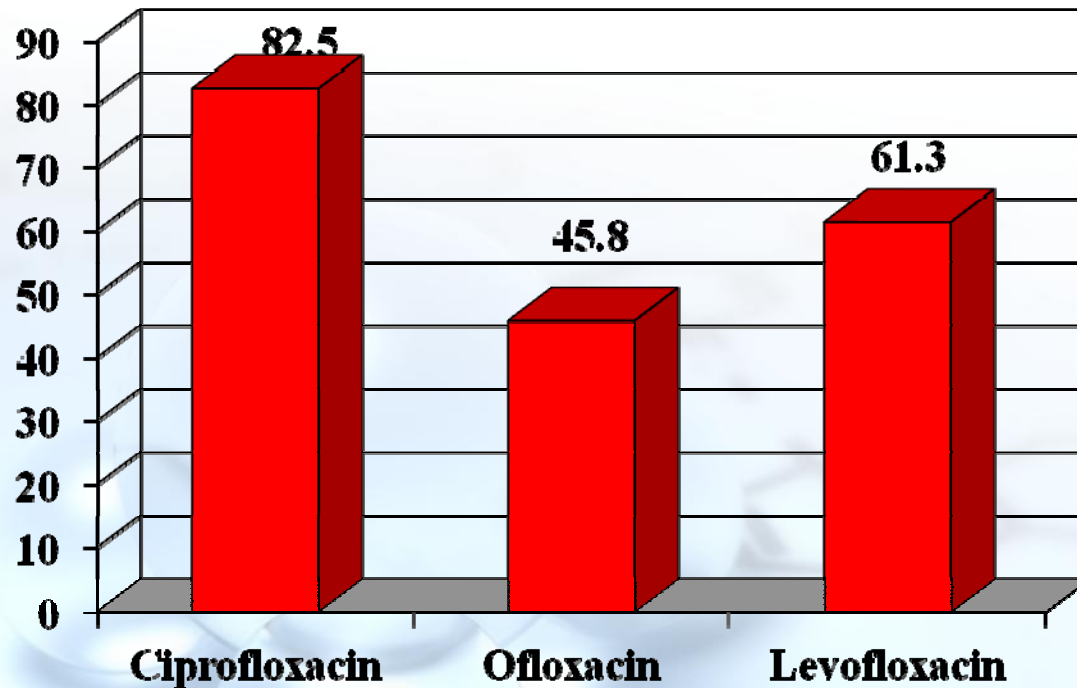
PPI (Prevacid) - ODT

- Orally Dissolving Tablet (ODT) – can be mixed with water 5-10 mL and work for gastric
 - Avoid ODT to get “under-the-tongue” absorption
 - Drug needs an intact GI tract to get drug to site of absorption
 - Although small pellets still forms clogs
- Also, AVOID mixing oral PPI capsule content with water – mixes better with acidic juice (apple juice is best)
 - The coating gets sticky when mixed with water

Holding Tube Feeding

- Major reason patients do not get goal nutrition is holding for drug administration
- Numerous reports – advise to improve absorption
 - Certification exams, textbooks articles
- Much is based on misconceptions of drug interaction and absorption
- Protein Binding – of drug to nutrition is cited
 - Many drugs bind to protein, but no change in absorption
- Interaction with activity – speculative based on animal research
- Drugs include Sinemet, Dilantin, Levofloxacin, Ciprofloxacin, Synthroid, Warfarin, Tegretol

% Drug Lost in Ensure compared to water



Wright et al *JPEN* Jan/Feb 2000; 24: 42

Osmotic Issues

Common Side Effects associated with Enteral Nutrition?

- 40% of TF Diarrhea caused by excipients

Diarrhea, Nausea, Vomiting, Cramping, Distention & Bloating

Is it caused by:

- The **Enteral Nutrition** ??
- The **Drug Therapy** ??
- Both ??



MSKCC - Liquid Medications

- Selected 70 liquid medications
 - Determined pH, Checked Osmolality
 - Did a test to combine with Osmolite
 - Placed in incubate shaker at 37°C
 - Some formed solid clogs in tube
 - Passed through 100 micron screen
 - Several left hard granules
 - Article submitted to JPEN
- If pH <4.0 clogged. All vehicles form clogs

Osmotic Issues

Inadequate dilution of electrolytes

- 60 mEq KCl requires 6-8 oz of water per 20 mEq

Injectables provide dose in small volume

- Osmolarity >1000
- MVI injection ordered for feeding tube

Salt and sugar packets can be given if diluted.

- Several orders for IV dextrose and saline ordered.

Generic liquid Lomotil – contains sorbitol –
oops!

Compounded Liquids for FT

- Many Pharmacies will prepare a liquid drug suspension only available as solid.
 - Few of these have been tested for stability.
 - Some have 0 effect as insoluble in water (these are best mixed inside syringe) (Emend, Spornox)
 - Look for co-precipitates i(povidone)
 - USP have guidelines for about 100.
 - Literature has many more – many that USP rejected (all with flavoring were rejected)
 - Most use a combination OraSweet/OraPlus 50/50. Acidic sorbitol containing syrup
- Advise staying with crushed tablet mixed in water

Crushing Syringe – Healthcare Logistics



Item Code:

7334-01

Description:

Crushing Syringe, 60mL

- Available individually.
 - Can be used as a regular irrigation 60mL syringe as well as for crushing, liquefying and dispensing medication.
 - Helps to insure administration of full dosage.
 - Sanitary single patient use helps eliminate cross-contamination.
- Product found on page(s) 684 of the Sand Piper Catalog.

Price:

\$1.90/Each

Crushing Syringe



Warfarin

- Nutrition Formulas were altered twice to reduce vitamin K content
- Presumed to bind to formula
 - Study used intestinal model at pH 8
- Holding tube-feeding will not alter effect of vitamin K or protein binding
- Drug binds to plastic
 - Minimize contact through rapid administration, rinses
- Don't expect any interaction with tube placed beyond stomach
- MSKCC policy – give same way every time. Check INR

Pancreatic Enzyme

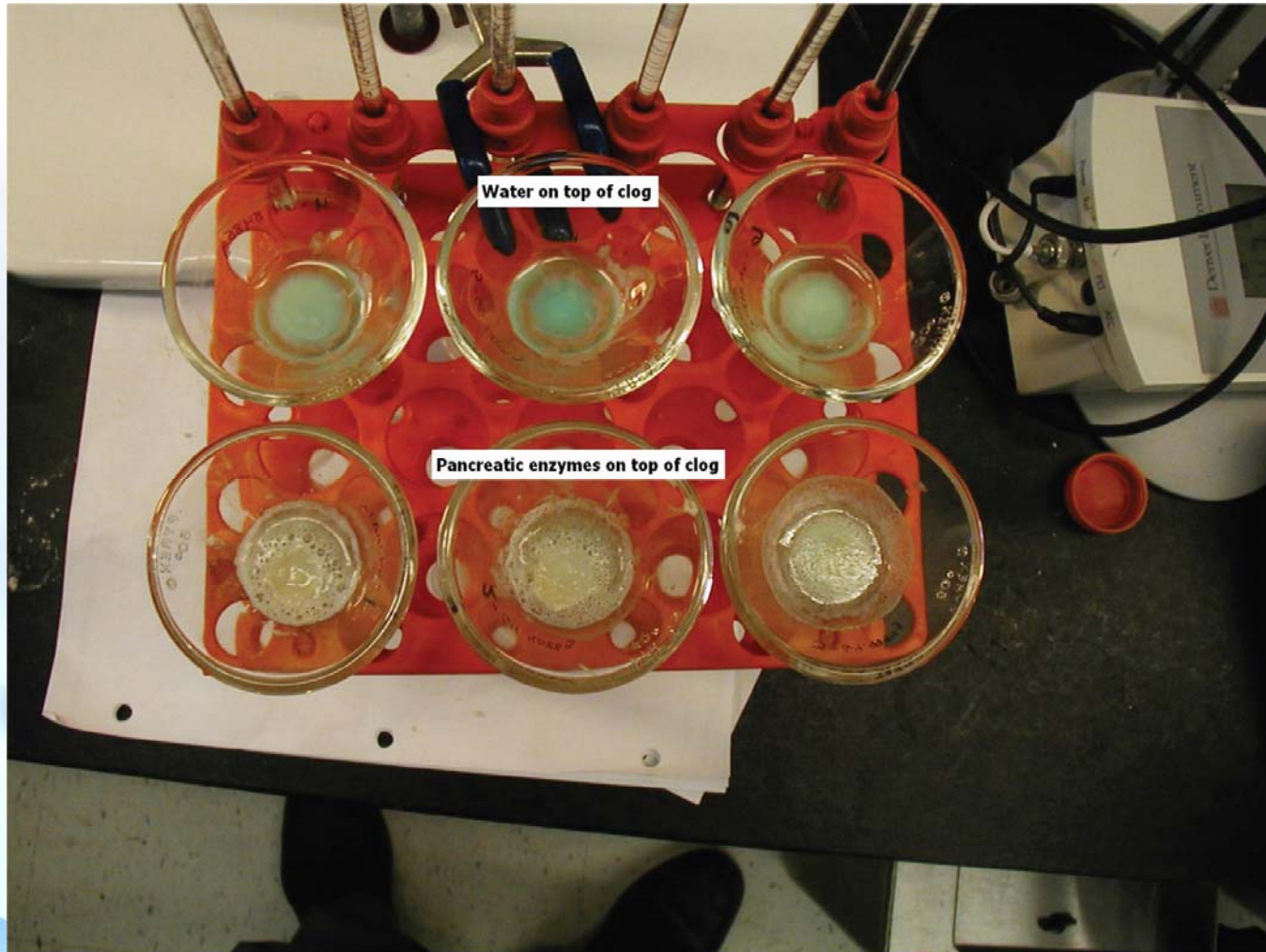
FDA removed pancreatic enzymes from market

- All manufacturers must conduct new validation of efficacy
- Feeding tube unclogging requires sodium bicarbonate and immediate-release enzymes
- Coating must be removed to allow enzymes to work.
- Viokace now replaces Viokase: soon to be released
 - Different Manufacturer, ingredient amounts, and indications (But – IDENTICAL according to new manufacturer at same address as old one)

Pancreatic Enzyme study

- Six glass funnels were clogged with calcium caseinate and HCl
- Zenpep (15,000 units lipase) in 5mL of NaHCO_3 37°C water bath (45 minutes to remove enteric coating – for 3 funnels
- Warm water 5 ml for the other 3.
- Blue dye was placed as a marker of movement through the clog

6 clogs



Recommendations

Liquid Drug forms preferred

- If hypertonic, viscous, thick dilute with 15-60mL water (3 times the volume)

Do NOT crush sustained-release drugs for one-time administration

Mix tablets / hard gelatin capsules with 10-15mL water

Most clogs are drugs

Recommendations (cont.)

Do not add drugs to container or formula
Continuous feeding stopped (0-30min.)
and tube flushed with 15-30mL water

Administer each dose separately and flush
with 3-5mL between doses

Flush tube with 15-30mL water after last
dose (flushing also provides water for
Sodium balance)

Questions?

