

*In the name of God*



# *ENTERAL NUTRITION*

- Providing of nutrients via the GI tract by a feeding tube



# INDICATIONS FOR ARTIFICIAL NUTRITION SUPPORT

- Preexisting nutritional deprivation
- Anticipated or actual inadequate energy intake by mouth
- Significant multiorgan system disease



# Anticipated or actual inadequate energy intake by mouth

- Well-nourished adults: 7 to 14 days
- Infants and children: 3 to 7 days
- Weight loss, prematurity, or low birth weight, or those subject to significant catabolic stress: earlier intervention

# Significant multiorgan system disease

- Significant renal, hepatic, cardiac, pulmonary, or hematologic disease or bone marrow transplantation which preclude adequate oral or enteral nutrient intake.

# Contraindications (absolute)

- Persistent Ileus
- Gastrointestinal ischemia
- Bilious or persistent vomiting
- Mechanical obstruction



# Contraindications (partial)

- Short bowel syn
- Insufficient absorptive capacity of the GI tract
- Severe GI hemorrhage
- High output GI fistula ( $> 500$  cc daily)
- GI fistula lower enteral access
- Patient failed tube feeding access
- Severe enterocolitis
- Sever acute pancreatitis
- Pancreatic pseudocyst



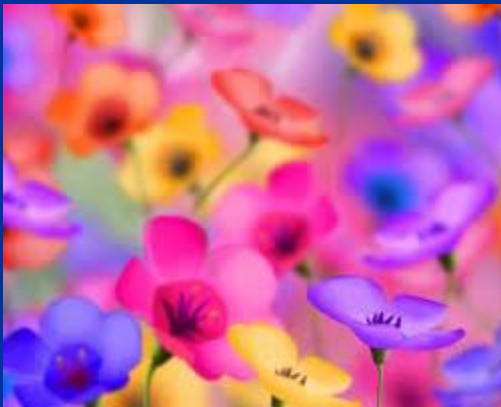
# Be careful in physical exam

Further assessment or delay in feeding is recommended

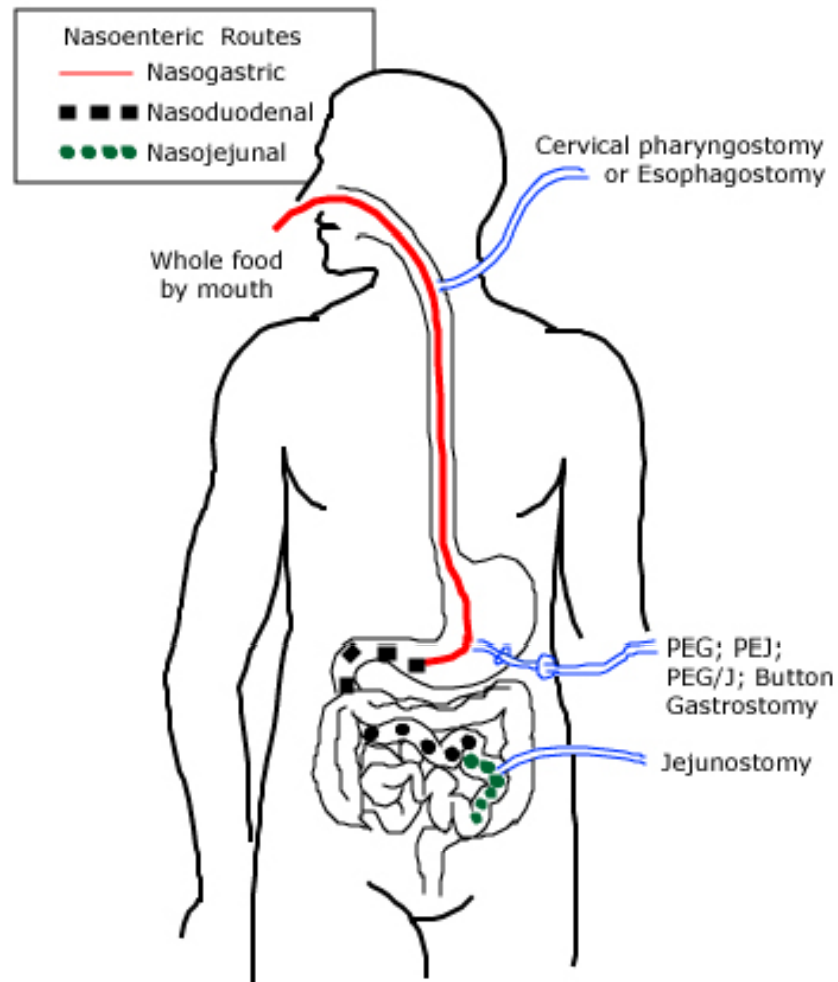
- Distended or tense abdomen
- High pitched bowel sounds
- RV > 500 mL/day
- Hypotension/Hemodynamic instability
- Cathecolamines, vasopressors, inotropic agents

# Access can be:

- **Intragastric**
  - Nasogastric (oral)
  - Gastrostomy
- **Transpyloric**
  - Nasoduodenal (oral)
  - Nasojejunal (oral)
  - Jejunostomy



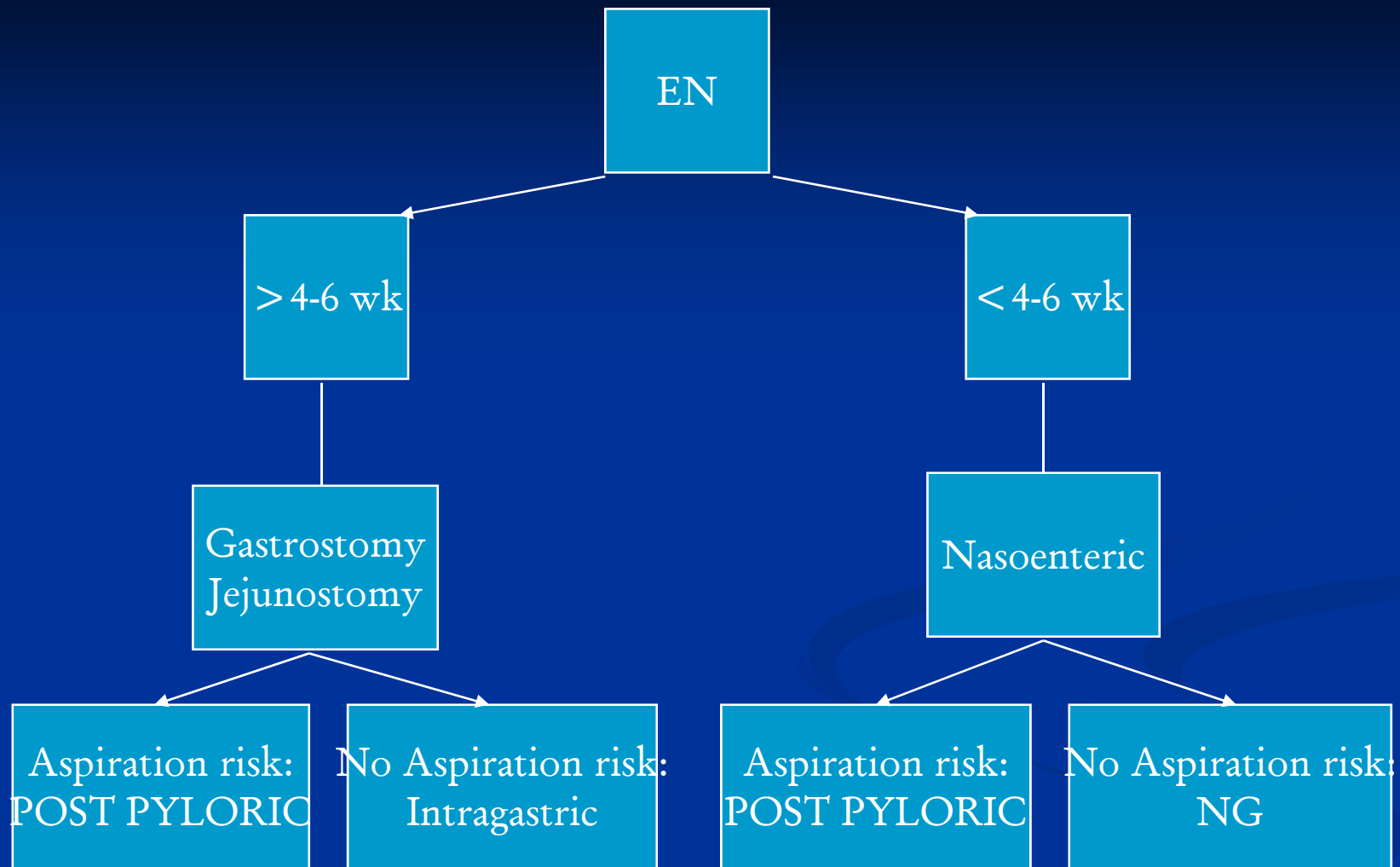
## Possible routes for feeding



*Adapted from Gastroenterology 1995;108:1280.*

# ENTERAL ACCESS SELECTION

- Length of time for EN
- Risk of aspiration
- Whether or not there is a planned surgical intervention



# Naso(oro) gastric access

is generally preferred :

- More physiologic nature
- Bactericidal
- Buffering of food
- Ease of insertion
- Low cost

# Postpyloric

- **Indications:**

Gastric motility disorders

Reflux

Continuous nausea & vomiting

Post surgery

Multiple Trauma



# Naso/oral enteric tube

- Large bore tube  $\geq 14$  F (polyurethane, Silicone)
- Small bore tube: 8-12 F (PVC)





# Large bore tube

- Lower incidence of malposition
- Lower incidence of clogging
- Reliable in aspirating



# Small bore tube

- More comfortable for patients



# Oral cavity inserting

- Sinusitis
- Sinus fracture
- Multiple facial fractures
- Skull fracture

# Complications of nasoenteric tubes

- Mucosal trauma
- Ulceration or perforation
- Vocal cord paralysis
- Rhinorrhea
- Sinusitis
- Otitis media
- Pneumothorax
- Pneumonia
- Empyema
- Esophageal stricture
- TE fistula
- GERD

# Complications of Gastrostomy

- Dislodgement
- Bleeding
- Infection
- Intra abdominal leak
- Site leak
- Fistula



# Complications of Jejunostomy

- Dislodgement
- Bleeding
- Infection
- Intra abdominal leak
- Site leak
- Fistula



# Administration of enteral feeding

- Bolus feeding
- Intermittent (gravity drip)
- Continuous (pump)



# Bolus feeding

- Best suited for gastric feeding
- Easy to administer
- More economical
- More physiologic
- Syringe





# Bolus infusion

- Infusion time: 3-20 minute
- 4-6 times/day
- Begin with 60-120 mL every 4-6 hs.
- Increase 30-60 mL every 8-12 hs.
- Flush with 30 CC of tap water before & after feeding.
- Volumes up to 720 mL per feeding may be tolerated.

# Intermittent feeding

- Best suited for gastric feeding
- Occasionally for enteral feeding
- Easy to administer
- More economical
- More physiologic
- Gravity tube or pump



# Intermittent infusion

- Infusion time: 20-60 minutes
- 4-6 times/day
- Begin with 60-120 mL every 4-6 hs.
- Increase 30-60 mL every 8-12 hs.
- Flush with 30 CC of tap water before & after feeding.
- Volumes up to 720 mL per feeding may be tolerated.

# Continuous

- Best suited for transpyloric feeding
- Choice for risk of aspiration
- Required a pump
- Limits patients mobility
- ↑ Absorption



# Continuous infusion

- Infusion time: 24 hours
- Begin with 20-40 mL/h
- Increase 10-20 mL/h
- Flush with 30 CC of tap water every 4 hs.
- When hyperosmolar or caloric dense formula are used, have a more gradual advancement.

# Cyclic feedings

- Infusion time: 8-20 hours
- Up to 150 mL/h is commonly tolerated.
- Need to tight glucose control in hyperglycemic patients.



# Patient Positioning for feeding

- Elevate the backrest 30° to 45°
- Reverse Trendelenberg position



# EN orders

- Should include 4 elements:
  - 1) patient identifiers
  - 2) the formula
  - 3) the enteral access delivery site/device
  - 4) the administration method and rate.



# Adult Enteral Nutrition Order Form

Patient Name: _____	Medical Record No: _____	DOB: _____
Room Number: _____	Dosing Weight: _____	
<b>FORMULA</b> [select one]		
<input type="checkbox"/> Standard	<input type="checkbox"/> Standard/Fiber	
<input type="checkbox"/> Protein-rich	<input type="checkbox"/> Reduced-calorie	
<input type="checkbox"/> Calorie-rich	<input type="checkbox"/> Peptide-based	
<input type="checkbox"/> Low Electrolytes	<input type="checkbox"/> Substrate-enriched	
<input type="checkbox"/> Modular Product: Pro: _____	CHO: _____	Fat: _____
<input type="checkbox"/> Other: _____		
<b>DELIVERY SITE</b> [select a route and an access]		
Route:	Access:	
<input type="checkbox"/> Gastric	<input type="checkbox"/> Nasogastric	<input type="checkbox"/> Oralgastric
<input type="checkbox"/> Post-pyloric	<input type="checkbox"/> Nasoduodenal	<input type="checkbox"/> Oralduodenal
	<input type="checkbox"/> Nasojejunal	<input type="checkbox"/> Oraljejunal
		<input type="checkbox"/> Jejunostomy
<b>METHOD OF ADMINISTRATION</b> [select a method and then a rate]		
Method:	Rate:	
<input type="checkbox"/> Pump-assisted	<input type="checkbox"/> Initial ___ mL/h	
	<input type="checkbox"/> Advance by ___ mL/h every ___ h to goal of ___ mL/h	
<input type="checkbox"/> Gravity-assisted (30-60 min)	<input type="checkbox"/> Initial ___ mL bolus over ___ min ___ times daily	
	<input type="checkbox"/> Advance by ___ mL each day to a goal of ___ mL feeding over ___ min ___ times daily	
<input type="checkbox"/> Bolus (Syringe) (10-20 min)	<input type="checkbox"/> Initial ___ mL bolus over ___ min ___ times daily	
	<input type="checkbox"/> Advance by ___ mL each day to a goal of ___ mL feeding over ___ min ___ times daily	
<b>OTHER ORDERS</b> [based on institutional protocol]		
(For example)		
<input type="checkbox"/> Flush the feeding tube with ___ mL of water every ___ hour		
<input type="checkbox"/> Keep head of bed elevated to 30°-45°		
<b>MONITORING</b> [based on institutional protocol]		
(For example)		
<input type="checkbox"/> Check GRV every ___ hour(s)		
If GRV greater than ___ mL → hold administration for ___ hour(s) and re-check		
If GRV greater than 500 mL → hold administration indefinitely (will require a new order to re-start feedings)		
<input type="checkbox"/> Confirm HOB elevation to 30°-45°		
<input type="checkbox"/> Observe for abdominal distension, firmness or discomfort every ___ hour(s)		
<input type="checkbox"/> Tube site care and assessment every ___ hour(s)		
<input type="checkbox"/> Intake and Output every ___ hour(s)		
<input type="checkbox"/> Weigh once daily		
<input type="checkbox"/> Labs: _____		
Prescriber: _____	Date: _____	Time: _____

# Pediatric Enteral Nutrition Order Form


Patient Name: _____ Medical Record No: _____ DOB: _____	
Room Number: _____ Dosing Weight: _____	
FORMULA: _____ at concentration: _____ kcal/30mL	
Additional Nutritional Additive: _____	
Final concentration: _____ kcal/30mL	
Other additives/medications: _____	
<b>DELIVERY SITE</b>	
Oral: PO ad lib or _____ mL	
Feeding tube: Nasogastric____ Gastrostomy____ Nasojejunal____ Gastrojejunal____ Jejunostomy____	
<b>METHOD OF ADMINISTRATION:</b> [select a method and then a rate]	
<b>Method</b>	<b>Rate</b>
<input type="checkbox"/> Pump-assisted	<input type="checkbox"/> Initial ___ mL/h <input type="checkbox"/> Advance by ___ mL/h every ___ hour(s) to goal of ___ mL/h
<input type="checkbox"/> Gravity-assisted (30-60 min)	<input type="checkbox"/> Initial ___ mL bolus over ___ min ___ time(s) daily <input type="checkbox"/> Advance by ___ mL each day to a goal of ___ mL feeding over ___ min ___ time(s) daily
<input type="checkbox"/> Bolus (Syringe) (10-20 min)	<input type="checkbox"/> Initial ___ mL bolus over ___ min ___ time(s) daily <input type="checkbox"/> Advance by ___ mL each day to a goal of ___ mL bolus over ___ min ___ time(s) daily
<input type="checkbox"/> Oral	Offer PO every _____ minute(s), then give remaining via tube
<b>OTHER ORDERS</b> [based on institutional protocol]	
(For example)	
<input type="checkbox"/> Flush the feeding tube with ___ mL of water every ___ hour(s)	
<input type="checkbox"/> Keep head of bed elevated to 30°-45°	
<b>MONITORING</b> [based on institutional protocol]	
(For example)	
<input type="checkbox"/> Observe for abdominal distension every ___ hour(s)	
<input type="checkbox"/> Tube site care and assessment every _____hour(s)	
<input type="checkbox"/> Intake and Output every _____hour(s)	
<input type="checkbox"/> Weigh daily	
<input type="checkbox"/> Labs:	
Prescriber: _____	Date: _____ Time: _____

# Labeling of Enteral Nutrition



A label should be affixed to all EN formula administration containers:

- Bags
- Bottles
- syringes used in syringe pumps
  
- The label should reflect the four elements of the order form

# Standard Enteral Nutrition Label Template (Adult Patient)

<b>ENTERAL USE ONLY</b>		
<i>Institution and Department Name—Contact Information</i>		
Patient Name _____	Patient ID _____	
Room Number _____		
<b>Generic (Brand) Formula Name</b>		
Formula: _____		
_____ grams of protein / _____ kcal / container		
_____ mL / container		
Prepared by: _____	Date: _____	Time: _____
<b>Delivery Site</b>		
Route of Delivery: _____		Enteral Access Site: _____
<b>Administration</b>		
	Method of Administration: Bolus    Intermittent    Continuous	
	Rate of Administration: _____ mL/h	
Formula Hung by: _____, Nurse		Date: _____ Time: _____
Expiration vs Beyond Use Date: _____		Time: _____

# Standard Enteral Nutrition Label Template (Neonatal or Pediatric Patient)

<b>ENTERAL USE ONLY</b>	
<i>Institution and Department Name – Contact information</i>	
Patient Name _____	Patient ID _____
Room Number _____	
<b>Generic (Brand) Formula Name</b>	
Base Formula: _____	_____ kcal /100 mL
	_____ mL / container
Fortifier: _____	
Final Concentration: _____	_____ kcal /100 mL _____ mL / container
Prepared by: _____	Date: _____ Time: _____
<b>Delivery Site</b>	
Route of Delivery: _____	
Enteral Access Site: _____	
	
<b>Administration</b>	
Method of Administration: Bolus Continuous	
Rate of Administration: _____ mL/h	
Formula Hung By: _____, Nurse Date: _____ Time: _____	
Expiration Date: _____ Time: _____	

# Indications for Use of Water

- Flushes
- Diluting Medications
- Formula Reconstitution
- Maintain patient hydration



# Types of Water

- Sterile Water: solute-free, nonpyrogenic
- Distilled Water: is not necessarily free of dissolved or suspended matter & should not be used for the preparation or administration of medications.
- Tap Water



# Maintaining Hydration/Flushes

Tap water or bottled water may be adequate for hydration of:

- Immunocompetent





# Diluting Medications & flushing

- Sterile water
- Saline

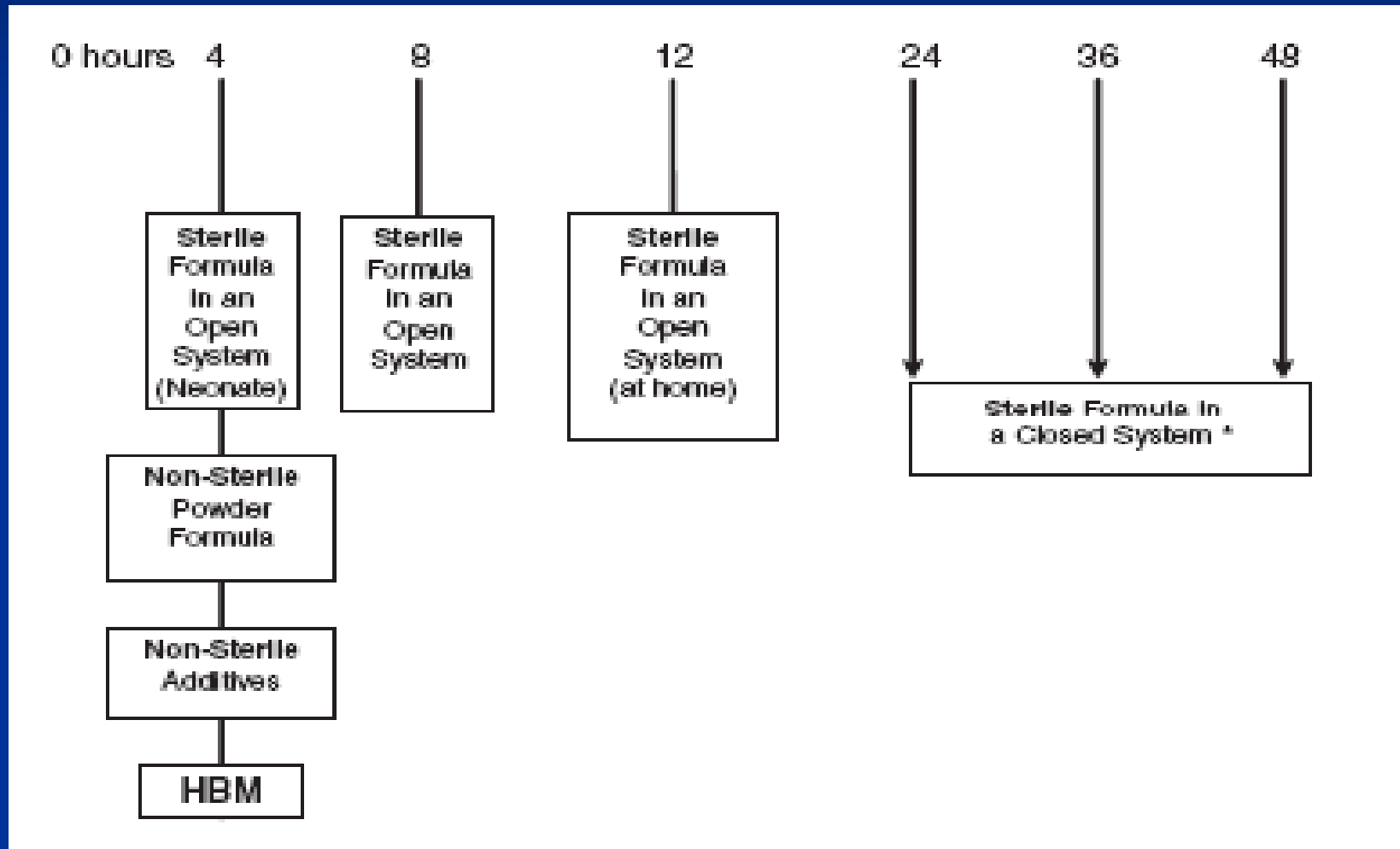


# Formula Reconstitution

- All water supplied for feeding preparation must meet federal standards for drinking water.
- Only sterile water is recommended for preparing infant formula preparation



# Hang Time for Enteral Formula



# Preference:

- Sterile, liquid EN formulas

- Store unopened commercially-available liquid EN formulas under controlled (dark, dry, cool) conditions.
- Product's expiration date

- Formulas reconstituted in advance should be immediately refrigerated, and discarded within 24 hs of preparation
- formulas should be exposed to room temperature for no longer than 4 hs, after which they should be discarded.

- Disposable gloves
- A feeding pump with a drip chamber prevents retrograde contamination of the EN formula from the feeding tube

# Changing Administration sets

- Open system formulas: every 24 hs
- Closed-system formulas: per manufacturer guidelines
- HBM: every 4 hours





# Changing Administration sets

- Administration sets and feed container are for single use and must be discarded after each feeding session.



# Flushes

- Flush feeding tubes with 30 mL of water every 4 hours during continuous feeding or before and after intermittent feedings in an adult patient.
- Flush the feeding tube with 30 mL of water after residual volume measurements in an adult patient

# Flushes

- Sterile water is recommended before and after medication administration.
- Use sterile water for tube flushes in immunocompromised or critically ill patients

# MEDICATION

- Prior to administering medication, stop the feeding and flush the tube with at least 15 mL water.
- Dilute the solid or liquid medication as appropriate and administer using a clean oral syringe ( $\geq 30$  mL in size).
- Flush the tube again with at least 15 mL water taking into account patient's volume status.

# MEDICATION

- Do not add medication directly to an EN formula
- Avoid mixing together medications
- Each medication should be administered separately
- Liquid dosage is preferable
- Grind and mix with sterile water.

- Enteric- and film-coatings do not crush well and tend to aggregate in clumps when diluted in water, thereby increasing the risk of clogging.

- 5%-43% of practitioners flush tubes before or between medications
- 32%-51% administer drugs separately from one another
- 44%-64% dilute liquid medication
- 75%-85% avoid crushing modified-release dosage forms

# MONITORING ENTERAL NUTRITION ADMINISTRATION

- Evaluate all enterally fed patients for risk of aspiration.
- Assure that the feeding tube is in the proper position before initiating feedings.



# MONITORING ENTERAL NUTRITION ADMINISTRATION

- Keep the head of the bed elevated at 30°-45° at all times during the administration of EN & 60 min after feeding
- Evaluate gastric residuals using at least a 60 mL syringe.

# MONITORING ENTERAL NUTRITION ADMINISTRATION

- Check gastric residuals every 4 hours during the first 48 hours for gastrically fed patients.
- If the GRV is  $> 250$  mL after a second gastric residual check, a promotility agent should be considered in adult patients.

# MONITORING ENTERAL NUTRITION ADMINISTRATION

- A GRV  $> 500$  mL should result in holding EN and reassessing patient tolerance by use of an established algorithm including physical assessment, GI assessment, evaluation of glycemic control, minimization of sedation, and consideration of promotility agent use, if not already prescribed.
- Consideration of a feeding tube placed below the ligament of Treitz when GRVs are consistently measured at  $> 500$  mL.

# Monitoring

- Wt : daily
- Edema/ daily
- Dehydration/ daily
- I & O/ daily
- Adequacy of intake: 2 times/wk
- Nitrogen balance/ weekly : if appropriate
- Gastric residuals/ q 4 hr: if appropriate
- Serum electrolytes, BUN, creatinine: 2-3/wk
- Glu, Ca, Mg, P ( weekly or as ordered)
- Stool output & consistency (daily)

# Transitional Feeding

- Moving from one type of feeding to another

Oral diet be initially:

low fat, lactose free, low in simple CHO:

- make digestion easier
- minimize the possibility of osmotic diarrhea.
- Maximize intake.

# Transitional Feeding

- PN → EN:
- Begin with: 30 to 40 mL/hr
- In severe GI compromise: use predigested formula
- PN can discontinued when 75% of nutrient needs is given by EN



# Transitional Feeding

- PN → ORAL:
- Clear liquids → diet that is low in fiber and fat and is lactose free.
- It takes several days
- PN can discontinued when 75% of nutrient needs is given by EN

# Transitional Feeding

- EN → ORAL:

Move from continuous feeding to a 12 and then 8-hour EN at night.

