WRHA Adult Enteral Nutrition Manual

This manual was undertaken as a project of the WRHA Nutrition Advisory Subcommittee. It is the work of a multi-disciplinary group of Nutrition Support specialists in Dietetics, Nursing, Pharmacy and Medicine.

The manual was adapted from the Enteral Section of the Health Sciences Centre Parenteral and Enteral Nutrition Manual, 2001. It attempts to integrate the most current research in medical nutrition therapy in order to achieve evidence-based practice. The literature was reviewed and updated using scientific and clinical practice journals, manuals and books. Recommendations were therefore made using an evidence-based decision making process. When there was a lack of literature, expert opinion was used, based on consensus from the working group members.

Working Group Members include:

Evelyn Boyko, RD (Co-Chair)
Jennifer Dunits, RD (Co-Chair)
Donna Butterworth, RD
Don Duerksen, MD
Perry Gray, MD
Jean Helps, RD
Diane Korbaylo, RD
Shelley Oleschuk, BPharm
Andrea Rodrigue, RD
Connie Soja, RN, BN
Elizabeth Tyndall, RN, BN
Jackie Zander, RD

Reviewed by:

Gabriella Benedictson, RD, MS
Brenda Hotson, RD, MS

Approved by:

WRHA Nutrition Advisory Subcommittee
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1. INTRODUCTION

Enteral Nutrition (EN) is the provision of nutrients via the gastrointestinal tract, either orally or through a feeding tube. For the purpose of this manual, enteral nutrition will refer to tube feeding.

When oral intake is inadequate to meet nutritional needs or is contraindicated, and the gastrointestinal tract is at least partially functioning, tube feeding is the preferred method of nutritional support. Every effort should be made to feed via the gastrointestinal tract. However, when the gut is non-functioning/inaccessible or when complete bowel rest is required, parenteral nutrition is indicated.

Enteral nutrition offers advantages over parenteral nutrition in terms of:
- ease in establishing feeding route
- lower cost of product (TF formula versus TPN solution).

Indications for Enteral Feeding

Unable to orally maintain/improve nutritional status:
- protein-calorie malnutrition (PCM) or risk of PCM with inadequate oral intake (>2 - 5 days)
- normal nutritional status with prolonged inadequate oral intake (> 7-10 days).

Contraindications to Enteral Feeding

- perforation of gastrointestinal tract
- gastrointestinal ischemia (hemodynamically unstable on vasopressors)
- complete mechanical bowel obstruction
- complete non-mechanical bowel obstruction
- high output enterocutaneous fistula
- inability to access GI tract
- patient refusal of enteral feeding.
2. FORMULA SELECTION

Selection of the appropriate tube feeding formula is based on the individual patient’s medical condition, nutritional status and digestive/absorptive capabilities. A wide variety of commercially prepared formulas are currently available. Due to periodic contract changes, formulas available may change. In addition, since the composition of commercial products periodically changes, readers are advised to review the actual product label whenever exact nutrient content is required. Non-formulary enteral products may occasionally be required and may be requested using the WRHA Non-Formulary Request form (see Appendix A).

Enteral formulas are often categorized as polymeric, chemically defined, disease specific formulas and modular nutrient sources.

2.1 Polymeric Formulas (Standard)

Polymeric formulas contain intact protein from soy or casein, carbohydrate in the form of disaccharides, oligosaccharides and polysaccharides and variable amounts of fat, fiber and water. They require effective digestive and absorptive processes for utilization and therefore are suitable only for patients with a functional gastrointestinal tract. When sufficient volume is provided, these formulas are nutritionally complete and supply all necessary vitamins, minerals and trace elements.

General Characteristics:
- flow easily through large or small bore feeding tubes
- available in a variety of caloric densities such as 1.0, 1.2, 1.5 and 2.0 kcal/mL
- may be isotonic (i.e. 300 mOsm/L) or hypertonic (i.e. 720 mOsm/L)
- may be low residue or supplemented with fiber
- available as ready-to-use liquid formulas
- may be suitable for oral supplementation
- contain significant amounts (larger than usual oral intake) of Vitamin K which may affect dosage of Coumadin required in stable patients
- majority are lactose free and gluten free.

2.2 Chemically Defined Formulas (Elemental/Semi-Elemental)

Chemically defined formulas have nutrients supplied in partially predigested forms with minimum residue and fiber. They require minimal digestive and absorptive abilities. Protein sources may be crystalline amino acids and/or short-chain peptides. Carbohydrates consist primarily of oligosaccharides although some products may contain sucrose. The fat content is variable, comprised principally of vegetable oils combined with medium-chain triglycerides (MCT). They are suitable for patients with compromised gastrointestinal function such as in malabsorption syndromes, acute pancreatitis, chronic pancreatic insufficiency or gastrointestinal fistulas.
General Characteristics:

- flow easily through large or small bore feeding tubes
- available in caloric densities of 1 kcal/mL and 1.5 kcal/mL; powdered formulas requiring reconstitution can be concentrated to a high caloric density
- most semi-elemental formulas are isotonic, although some may be hypertonic
- contain minimal residue
- available in powder (needs reconstitution) or ready-to-use liquid formulas
- may be suitable for oral supplementation; flavorings may be added to enhance acceptance but adding flavorings increases tonicity
- contain significant amounts (larger than usual oral intake) of Vitamin K which may affect dosage of Coumadin required in stable patients.

2.3 Disease Specific (Specialty) Formulas

Specialty formulas include products designed for patients with specific diseases/medical conditions that may respond to nutrient manipulation. Examples include products specifically formulated for patients with renal failure, hepatic failure, trauma, diabetes, pulmonary insufficiency or compromised immune function. These products are usually expensive and may or may not be nutritionally complete.

Within its mandate, the WRHA Nutrition Advisory Subcommittee established working groups to examine the literature for evidence supporting the use of the following specialty products. Each working group undertook a comprehensive literature review, evaluating articles for quality and strength of evidence. The following is a brief summary of the conclusions from the work completed in October 2002:

A. Disease-Specific Enteral Formulas: Diabetes/Abnormal Glucose Tolerance and Respiratory Compromise

- there is insufficient evidence to support the routine use of low carbohydrate, modified fat formulas for diabetes or low carbohydrate, high fat formulas for respiratory compromised patients.

B. Immune-Enhancing Enteral Formulas

- there is insufficient evidence to recommend the use of immune-enhancing formulas in most patients.

2.4 Modular Nutrient Sources

Protein, carbohydrate and fat are available in modular form. They are not nutritionally complete in themselves. However, they can be added to commercial formulas to alter the nutrient content/caloric density, which creates a unique formula that more closely meets a specific patient’s nutritional requirements.
3. ROUTES OF ADMINISTRATION

The route for enteral feeding must be individualized. Factors determining the route include the condition of the GI tract and the anticipated duration of feeding. Enteral feeding may be administered by a nasoenteric tube or by an enterostomy tube.

3.1 Nasoenteric Route

- most common route used although in certain patients the orogastric route may be used
- simplest, least expensive and most commonly used approach
- provides short-term enteral nutrition support (< 4-6 weeks)
- indicated in patients unable to take adequate amounts of oral nutrition
- contraindicated for patients with GI tract obstruction (above or below the stomach), severe gastroesophageal reflux, facial or cranial trauma and esophageal varices.

A. Nasogastric (pre-pyloric)

- preferred route for patients with normal gastric function
- easiest to insert
- requires an intact gag reflex
- delivers nutrients in a more physiologic manner into the stomach
- associated with an increased risk of aspiration, therefore gastric residuals must be checked regularly
- large bore or small bore tubes (with or without a wire stylet) are available
- continuous or intermittent formula delivery may be used.

B. Nasoduodenal/Nasojejunal (post-pyloric)

- indicated for patients not tolerating gastric feedings or at high risk for gastroesophageal reflux and aspiration
- contraindicated in patients with obstruction of the GI tract (above or below the duodenum), intolerance to small bowel feedings or those hemodynamically unstable
- the more distal to the stomach the feeding is delivered, the less likely tube feeding related aspiration is to occur. Optimal post-pyloric tube placement is in the fourth portion of the duodenum or past the ligament of Treitz
- may decrease the risk of aspiration; however reflux of the feed into the stomach or tube migration into the stomach can occur
- associated with increased sensitivity to osmolality and volume, therefore continuous infusion is recommended
- tube placement can be difficult, time consuming and costly and requires specialized equipment and expertise.
3.2 Enterostomy Tube Route

- indicated when long-term (> 4-6 weeks) enteral nutrition support is necessary or when nasal intubation is not possible (e.g. esophageal obstruction)
- the most common anatomic sites of enterostomy tubes are the stomach and jejunum
- enterostomy tubes eliminate patient discomfort, nasal irritation, frequent tube changes due to clogging or inadvertent removal of nasoenteric tubes.

A. Gastrostomy Tubes

- indicated for patients with normal gastric emptying and where there is little risk of esophageal reflux and aspiration
- most common long-term enteral access
- insertion techniques include: laparotomy, endoscopy, radiography and laparoscopy
- percutaneous endoscopic gastrostomy (PEG) is a non-surgical procedure and is the preferred option for most patients.

B. Jejunostomy Tubes

- indicated in patients with upper gastrointestinal tract disease who have normal small bowel function or in patients who are at high risk of esophageal reflux and aspiration
- contraindicated in distal intestinal obstruction
- insertion techniques include: laparotomy, endoscopy, radiography and laparoscopy
- operative jejunostomy may be performed as a primary procedure for patients requiring long-term enteral nutrition support where gastric feeding is contraindicated or as a secondary procedure at the time of laparotomy
- percutaneous endoscopic gastrojejunostomy (PEG-J) is a non-surgical procedure. The PEG-J is a tube that is inserted through a PEG and is guided through the pylorus and into the distal duodenum or jejunum.
4. FEEDING TUBES

Feeding tubes are generally described in terms of their intended use, composition, estimated length of time required, cost effectiveness and tube features (e.g. external diameter* and length of tube, weighted tip or stylet).

Tube length is dependent on desired placement in the gastrointestinal tract. Nasogastric tubes are usually 36 to 45 inches (90-115 cm) long; small bowel feeding tubes are 43 to 60 inches (110-150 cm) in length.

* external diameter is expressed in French (FR) units; 1 FR unit equals .33mm.

4.1 Nasogastric

- available in sizes 8 - 16 FR
- composed of polyvinyl chloride
- non-weighted tip
- most appropriate for gastric decompression
- may be used for short-term (<4-6 weeks) nasogastric feeding
- associated with patient discomfort due to the size and stiffness of the tube
- long-term use may be associated with esophageal irritation/stricture/sinusitis
- may inhibit patient’s ability to swallow
- may increase risk of aspiration due to compromise of the lower esophageal sphincter
- inserted on ward by nurse or physician
- to confirm the tube position in the stomach, aspiration of gastric contents, auscultation, pH testing of the gastric aspirate or an abdominal x-ray can be done (see facility nursing P & P)
- normal adult insertion length is 50-60 cm.

4.2 Nasogastric (Small Bore Tube with Wire Stylet)

- available in sizes 8 - 12 FR
- composed of polyvinyl chloride or silicone
- weighted or nonweighted tip
- radiopaque stylet to facilitate tube passage
- associated with greater patient comfort and ease of swallowing
- may reduce risk of aspiration due to less compromise of lower esophageal sphincter
- inserted on ward by nurse or physician
- usually unable to aspirate gastric contents therefore an abdominal x-ray is needed to confirm placement in the stomach (see facility nursing P & P)
- normal adult insertion length is 50-60 cm.
4.3 Nasoduodenal/Nasojejunal (Small Bowel Feeding Tube)

- available in sizes 8 - 12 FR
- composed of polyvinyl chloride or polyurethane
- weighted or nonweighted tip
- radiopaque stylet to facilitate tube passage
- length of 43-60 inches (110-150 cm) allows placement in duodenum or jejunum
- recommended when nasogastric feeding is unsuccessful or the patient is at high risk of pulmonary aspiration
- inserted in Radiology Department by radiologist, in endoscopy suite by experienced physician, or at bedside by nurse or physician trained in proper technique (for confirmation of tube placement see facility nursing P & P)
- normal adult insertion length is > 80 cm to pass beyond pylorus
- monitoring of residuals not performed as aspiration can collapse small tubes and collection of large volumes of formula is unlikely in the small bowel.

4.4 Gastrostomy/Jejunostomy Tubes

A. Percutaneous Endoscopic Gastrostomy (PEG)

- tubes are available in sizes 14 - 28 FR
- inserted by an endoscopist in the operating room or the endoscopy suite under the visual guidance of the endoscope
- PEG tubes extend 12-15 inches from the skin with a cap or plug on the end of the tube.
- kept in place with a short cross-piece, tubing or bolster near skin level at the stoma
- feedings are started in 24 – 48 hours once gastric function returns (confirmation with the physician who inserted the tube is recommended regarding initiation of feeds).

B. Percutaneous Endoscopic Gastrostomy/Jejunostomy (PEG-J)

- tubes are available in sizes 9-12 FR and are passed over a guide wire into the small bowel through a previously placed PEG.

C. Percutaneous Radiologically-Placed Gastrostomy/Gastrojejunostomy

- inserted by a radiologist in the Radiology Department under the visual guidance of fluoroscopy or computerized tomography
- gastrostomy tube size ranges from 10-28 FR
- gastrojejunostomy tube size is 10-14 FR.
D. Replacement Balloon Gastrostomy Tubes

- gastrostomy tubes should be replaced when leaking, damaged, malpositioned or irreversibly occluded
- a replacement balloon gastrostomy tube is usually inserted when the gastrostomy tube tract is well formed and further endoscopy is not needed
- an inadvertently dislodged gastrostomy tube should be replaced as soon as possible because the tube tract can close within a few hours
- during the maturation process (4–6 weeks), only a physician should insert the replacement tube which is usually performed under fluoroscopy or contrast study
- once the gastrostomy tract is well matured, nurses may insert the replacement tube upon a physician’s order, depending on their knowledge, experience and facility policies
- a spare replacement balloon gastrostomy tube should always be available in the facility; replacement tubes should be the same diameter as the original tube
- these tubes are made of silicone and are available in sizes 12-28 FR.

E. Low Profile Devices

- cosmetically appealing to patients but may also be beneficial to children or confused adults who tend to pull at the tube
- may decrease the likelihood of pyloric obstruction from inward migration of the tube
- composed of an internal and external stabilizer, shaft, connecting tube and an anti-reflux valve to keep gastric contents from leaking onto the skin
- may be used as a replacement device after the stoma tract has healed
- initial replacement should be performed by a physician
- choosing the appropriate shaft length is important; if the shaft is too short the patient may develop pressure necrosis of the skin. If the patient has a change in weight (10 lb weight gain or loss) the shaft length will need to be reassessed.

4.5 Surgical Feeding Gastrostomy/Jejunostomy Tubes

- surgical gastrostomy tubes are usually large bore tubes and feedings are started in 24-48 hours once gastric function returns (confirmation with the surgical team is recommended regarding initiation of tube feeds)
- surgical jejunostomy tubes are a smaller bore tube (8-10 FR polyurethane catheters)
- for replacement of the surgical feeding gastrostomy tubes refer to Replacement Balloon Gastrostomy Tubes
- for replacement of the surgical feeding jejunostomy tubes, the physician will need to replace the tube in the endoscopic, radiographic or surgical suite.
5. METHODS OF ADMINISTRATION

Administration of tube feeding may be by continuous or intermittent infusion. The choice of method depends on gastrointestinal function, the feeding site and patient tolerance.

5.1 Continuous Infusion

Administration of formula (25-125 ml/h) over a 12-24 hour period usually by an enteral feeding pump

- preferred and most commonly used delivery method for hospitalized patients
- may be associated with decreased risk of gastric distention and aspiration and fewer gastrointestinal side effects
- highly recommended for feeding into the small bowel, as the small intestine poorly tolerates intermittent feedings and rapid infusion rate changes
- preferred method for patients who are critically ill, debilitated and/or have impaired gastrointestinal function
- use of an enteral feeding pump ensures a constant infusion rate.

5.2 Intermittent Infusion

Administration of a large volume of formula (250 - 500 mL) over a 30 to 90 minute period several times a day usually by gravity-flow

- indicated for stable patients requiring long-term feeding or when greater patient freedom and mobility are desired, such as in the home setting
- may be associated with an increased risk of distention, aspiration and other gastrointestinal complications
- tolerance dependent on functional ability of the gut
- generally recommended for gastric feeding only
- not recommended for critically ill patients.

5.3 Bolus Infusion

Administration of a large volume of formula (200 - 500 mL) over a short period of time (usually less than 15 minutes) several times a day by syringe

- seldom used in the hospital setting; use with caution
- may be appropriate for non-critical patients, home tube-feeding patients or patients in rehabilitation, when greater freedom and mobility are desired
- appropriate for feeding into the stomach only
- may be associated with GI intolerance and an increased risk for aspiration.
6. GUIDELINES FOR ORDERING TUBE FEEDING

Consult the ward clinical dietitian for initial nutritional assessment, recommendations regarding appropriate enteral formula, administration and goal rate as well as ongoing monitoring of nutritional status.

The physician’s order/dietitian’s recommendations, either written or electronically ordered, i.e. HISp, should specify:

- formula requested
- initial flow rate, progression of feeding and goal rate
- route of administration (gastric vs. intestinal)
- volume and frequency of free water flushes for 24 hours.
7. INITIATION AND PROGRESSION

7.1 Continuous Administration

- initiate full-strength formula at 25-50 mL/h
- conservative initiation and advancement rates may be required for critically ill patients, those who have been NPO for a prolonged time and/or patients at risk for refeeding syndrome
- increase infusion rate by 10-25 mL every 4-12 hours as tolerated until goal rate reached
- flush a minimum of 20 ml free water every 4-6 hours to maintain tube patency
- use of an enteral feeding pump is desirable to ensure a constant infusion rate
- most patients with a normal GI tract tolerate advancement to goal rate within 48 hours.

7.2 Intermittent Administration

If a patient has been tolerating continuous tube feeding for several days and is felt to be stable, intermittent feedings may be initiated. This is generally recommended for gastric feeding only.

- to determine the volume per feeding, divide the total quantity of formula needed for a 24 hour period by the desired number of feedings (usually 3 to 6 feedings during the day, each over a 30-90 minute period)
- start with 125 ml of full strength formula for first two feedings; increase by 125 ml each subsequent feed as tolerated until goal rate is reached
- administer the feeding over the stated period of time by gravity (adjust roller clamp to achieve desired infusion rate) or enteral feeding pump
- determine patient’s tolerance to feeding. Assess for abdominal distention, nausea, emesis, cramps; check gastric residual volumes
- flush the feeding tube with minimum 20 ml of water before and after administering the intermittent feed to maintain tube patency.
8. ADMINISTRATION OF TUBE FEEDINGS

8.1 Verification of Feeding Tube Placement (Initial Insertion)

Confirmation for the correct placement of all feeding tubes is required before the tubes are used for aspiration, decompression, feeding, irrigation or medication administration.

A. Nasogastric (pre-pyloric)

Verification that the tube is placed in the stomach may be done by:

- abdominal x-ray
- aspiration of abdominal contents
  - pH measurement of contents aspirated from pre-pyloric feeding tube (only valid on an empty stomach 4-6 hrs; invalid if antacids have been used)
  - range of pH values: gastric fluid (0 – 4), lung fluid (> 6), intestinal fluid (7.5 – 8)
- as per facility policy & procedure (P & P).

Documentation of the insertion time, type, size and position of the tube is done by the nurse or physician who inserted the tube.

Once the tube position has been confirmed:

- securely anchor the tube to the nose
- indicate the tube length at the nares (e.g. numerical calibration, indelible ink or as per facility P & P).

B. Nasoduodenal/Nasojejunal (post-pyloric)

Verification that the tube is placed into the small bowel:

- abdominal x-ray or other radiologic procedure (e.g. CT scan) must be done in all cases
- pH measurement of contents aspirated from the post pyloric feeding tube may be useful during insertion but should not preclude an x-ray
  - range of pH values: gastric fluid (0 - 4), lung fluid (>6), intestinal fluid (7.5 – 8)
- as per facility P & P.

Documentation of the insertion time, type, size and position of the tube is done by the physician or nurse who inserted the tube.

Once the tube position is confirmed:

- securely anchor the tube to the nose
- indicate the tube length at the nares (e.g. numerical calibration, indelible ink or as per facility P & P).
C. Gastrostomy/Jejunostomy Tubes

Verification of the tube position in the stomach or small bowel is done at the time of the procedure and is documented by the physician.

Post insertion:
• indicate the tube length at the abdominal skin and measure the external length (e.g. numerical calibration, indelible ink or as per facility P & P)
• verification of correct tube placement should be checked routinely every 8 hours during continuous feeding and before each intermittent feeding, medication administration or irrigation.

Verification methods would include (as per facility P & P):
• marking the tube where it exits and measuring external length
• observing the color, consistency and/or measuring the pH of the aspirate
• insufflation of air/auscultation
• document placement checks after each assessment, along with amount, color and consistency of drainage.

If displacement of the tube is suspected an abdominal x-ray should be done.

8.2 Care of the Patient with Nasal/Oral Feeding Tubes

• daily inspection of the mouth, nares and pharynx for ulceration, skin irritation, pressure necrosis and lesions
• clean nares daily with warm water
• check the tape on the nose or mouth or the fixator device and change every 3-5 days or as needed; pressure necrosis may occur from incorrect taping
• maintain good oral hygiene.

8.3 Care of the Patient with a Gastrostomy/Jejunostomy

• for the first 48 –72 hours the stoma tract is considered an open wound; dressings are to be placed over the feeding tube/stoma and the skin should be cleansed with sterile normal saline and dried thoroughly
• after 48 – 72 hours the healed stoma should be left open to air without a dressing and the skin should be cleansed with soap and warm water and dried thoroughly
• carefully clean under the discs/bumpers/bolsters to keep them dry
• observe the skin for signs of infection: foul- smelling drainage, unusual tenderness, swelling or redness
• if a peristomal wound infection should occur, topical antibiotics (physician order) may be used or consult skin care specialist
• hypergranulation tissue may develop if the site remains moist and can be eliminated by cauterizing with silver nitrate sticks (physician order)
• check for excessive pressure from the external bumpers and discs; they should be just above the skin level and not taut against the skin
• dressings should not be placed under the external bolster as the dressing may cause the internal bolster to apply pressure to the stomach wall which may force the tube out of the stomach and into the peritoneum
• do not pinch or clamp tubing
• maintain good oral hygiene.

8.4 Tube Stabilization (Gastrostomy/Jejunostomy)

• gastrostomy tubes may have anchor sutures which may be removed once the tract is healed (physician order needed to remove the sutures)
• jejunostomy tubes usually are secured with sutures at all times
• if a balloon replacement tube is used, the water in the balloon is to be checked 1 x/week.

8.5 Maintenance of Feeding Tube Patency

To ensure tube patency:
• schedule routine water flushes of the tube (20-30 mL for adults) every 4-6 hours for continuous feedings as well as before and after each intermittent feeding, medication administration and after checking for gastric residuals
• sterile water should be used for flushing of the feeding tube in patients who are immunocompromised
• check with the pharmacist regarding compatibility of medications given into the tube or use of medication elixirs
• refer to the Mechanical Complications Section for further recommendations.

8.6 Obstructed Feeding Tubes

Causes of tube occlusion include:
• formula residue or coagulation of intact protein formulas
• lack of routine tube irrigation/flushing
• medication/formula interaction
• inadequate crushing of medications given through the tube
• frequent withdrawal of gastric contents
• to restore tube patency, refer to the Mechanical Complications Section.

8.7 Replacement of Feeding Tubes

• nasal/oral tubes should be replaced only when it is necessary (e.g. problems at the site of insertion or occlusion of the tube)
• gastrostomy tubes should be replaced when there is malfunction, breakage of the balloon, occlusion or degradation of the tube
• refer to Replacement Balloon Gastrostomy Tubes
• Whenever a tube is replaced, placement of the new tube should be verified.
8.8 Tube Feeding (General Guidelines)

- all tube feedings should be shaken well prior to use
- check expiration date on formula container
- formula should be administered at room temperature. Heating could alter the nutritional composition and cold formula may cause gastric discomfort because the liquid is not warmed by the mouth and esophagus. If an intermittent feed needs to be warmed, place a measured amount of the formula in a lukewarm water bath to remove the chill
- fill the container and flush the tubing with the formula to remove the air in the tubing. This prevents excess air from entering the gastrointestinal tract once tube feed is initiated
- water may be used for reconstitution/dilution of formula (as required)
- document the type and volume of formula and the amount of free water given
- monitor the patient’s tolerance to the tube feeds: bowel sounds, abdominal distention, nausea/emesis, gastric residual volumes, diarrhea, constipation, intake/output, respiratory pattern, daily weight and serum chemistry
- notify the physician and dietitian of the patient’s intolerance to the tube feeding
- for continuous or intermittent feeding guidelines, refer to Initiation and Progression.

8.9 Minimize Bacterial Contamination of Tube Feeds

- use good hand washing technique when decanting formula and handling delivery sets
- when formulas require preparation, the mixing or reconstituting should be done in a central location (e.g. main kitchen tube feeding area) following food safety procedures
- mark the formula container with date and time of opening
- once formula is opened, refrigerate and discard if not used within 24 hours
- formula (open enteral system) can be hung safely at room temperature up to 8 hours
- prefilled, ready-to-use enteral feeding (closed enteral system) may be hung safely for at least 24 – 48 hours depending on the manufacturer’s guidelines
- tube feeding bags are dated and changed every 24 – 72 hours (as per facility P & P).

8.10 Reduce the Risk of Pulmonary Aspiration

- elevate the head of the bed 30 – 45 degrees during tube feeding administration unless contraindicated
- maintain 30 - 45 degree position for 1 hour post intermittent feedings
- monitor for intolerance of tube feeding: nausea/emesis, abdominal distention, increased gastric residuals, abdominal discomfort and decreased bowel sounds
- administer tube feeding post pylorus for patients who are at risk for gastric aspiration
- the addition of blue dye to enteral feeds in order to detect pulmonary aspiration is poorly standardized, has low sensitivity for detecting aspiration and has been associated with deaths in critically ill patients due to absorption of the coloring
- the use of dye and other colorants for the purpose of detecting or monitoring potential pulmonary aspiration is prohibited. See Appendix B - WRHA Directive.
8.11 Water Requirements

- water requirements are based on the patient’s fluid status
- the volume of water from all sources (i.e. enteral feeding, flushes, intravenous and oral) should be calculated and measured against requirements
- water requirements in a normal, healthy adult are 1 mL/kcal
- the amount of additional water needed depends on the free water content and concentration of formula used
  - In most commercial tube feeding formulas with caloric densities of 1 kcal or 1.5 kcal/mL approximately 80% of the product volume is free water
  - For products with caloric densities greater than 1.5 kcal/mL approximately 70% of the product volume is free water.

8.12 Gastric Residual Volumes

The use of gastric residual volumes (GRV) as a predictor of tube feed intolerance is controversial and may not be based on physiologically sound information. The premise is that elevated GRV represents retained tube feed formula as a result of impaired gastric emptying, which may then lead to regurgitation and aspiration. In actual fact, the relationship between formula infusion, gastric emptying and GRV is much more complex. Endogenous secretions alone have been estimated to generate a volume of 188 mL/h in the normally fed adult. The physiologic capacity of the stomach is 1000-6000 mL and normally intragastric pressure increases significantly only above 1600 mL. A single high GRV may not indicate intolerance and may not necessitate holding of feeds. Likewise, a low GRV does not guarantee tolerance and should not give a false sense of security. Withholding feeds unnecessarily based on GRV also delays attempts to adequately meet nutritional needs.

There is no consensus in the literature on the level of GRV that is considered safe with thresholds ranging from 100-500 mL. As a rule:

- **stop feeding immediately for overt regurgitation and aspiration**
- check GRV q4h for continuous feeds or prior to each intermittent feed. Frequency may be reduced once goal regime is achieved and tolerance is well established
- **if GRV ≤ 200 mL (ward patient) or ≤ 300 mL (ICU patient),** refeed aspirate, continue TF, recheck GRV in 4 hours
- **if GRV > 200 mL (ward patient) or > 300 mL (ICU patient),** discard aspirate, hold TF, notify physician
- the risk of aspiration may be increased in patients with trauma or head injury, altered mental status or those heavily sedated and/or on catecholamines
- trends in GRV may be more useful than isolated values. Increases in GRV may precede clinical deterioration or sepsis
- use GRV in combination with other assessment parameters.
9. ALGORITHM FOR ENTERAL FEEDING ADMINISTRATION

Nutritional Assessment

Maintenance Therapy

Repletion Therapy

Gastrointestinal Tract can be safely used

YES

NO

Adequate Intestinal Absorption

YES

NO

Polymeric Formula

Chemically Defined Formula

Alimentation > 6 weeks

YES

NO

Nasoenteric Tube Feeding initially followed by Enterostomy Tube

Nasoenteric Tube Feeding

At risk for aspiration

Yes

No

Nasoduodenal or Nasojejunal Tube

Nasogastric Tube

Adequate nutrient delivery

Yes

No

Continue same feeding

Supplemental Parenteral Nutrition

Parenteral Nutrition
10. MEDICATIONS AND ENTERAL FEEDING

Every available drug form has the potential to cause undesirable effects or interactions with enteral feeding formulas when administered to the tube-fed patient. Undesirable effects include: gastrointestinal intolerance due to the high osmolality of the medication, or occlusion of the feeding tube by drug particles or viscous syrups. Interaction can occur with feeding formulas, thereby altering the rate and/or absorption characteristics of the drug. Small bowel feeding tubes are narrow, curve throughout the bowel and are therefore very prone to “plugging”, especially with solid or crushed medications.

When medications are to be administered through the feeding tube the following guidelines apply:

1. Use the liquid dosage form whenever possible. **If the medication is available as a solid only, check with the pharmacist prior to crushing as this may alter the absorption characteristics of the medication or plug the tube.**

2. Dilute liquid medications in 30 mL of water; crush tablets to a fine powder and mix with water. When drawing up medication, do not use syringes designed for intravenous use. If the medication contains a significant amount of sorbitol, is enteric-coated, or is a sustained-release preparation, then an alternative dosage form should be considered.

3. Each drug must be administered separately. Flush the tube with 30 mL of warm water before administering the drug, and with 10 - 15 mL of warm water between each drug. Flush tube with 30 mL water after last medication given, before resuming feeding. Use a syringe no smaller than 30 mL to avoid excessive pressure and potential tube rupture. Flushing clears the tube, helps to propel the drug into the gastrointestinal tract and warns you if the tube is plugged. In some cases, flushing volumes may need to be revised to meet patient fluid restrictions.

4. Reconnect feeding bag unless otherwise indicated. For example, with some medications (phenytoin, warfarin, or any other therapy where the absorption of the medication is significantly impaired with continuous feeding), one alternative is to have enteral feeds held at least one to two hours prior to and after the dose. Adjustment of the tube feeding regimen may be needed to account for any downtime of the formula infusion.

5. In some situations, enteral feeding may be continued unaltered, and the drug dosage of the interacting medication titrated upward to override the interaction (e.g. Phenytoin, Ciprofloxacin). The pharmacist should assist with the dosing of these patients.

6. Do not mix drugs directly with the enteral formula as this may lessen the therapeutic effects of the drug and/or disrupt the feeding emulsion.
11. HANDLING AND STORAGE OF TUBE FEEDS

1. Unopened tins/tetra-briks of tube feeding should be stored at room temperature. Stock should be rotated to prevent use of out-of-date products. Discard products that have exceeded manufacturer’s expiration date.

2. Once a tin/tetra-brik is opened, cover unused portion with plastic wrap, label with date and time and store in refrigerator. Discard all opened containers if not used within 24 hours.

3. Products reconstituted and/or specially prepared on site are sent to the wards in dated containers. Upon arrival to the nursing unit, refrigerate immediately and until use. If not used within 24 hours, discard.

4. If a patient does not tolerate cold formula, place a measured amount of formula in a lukewarm water bath to remove the chill.
12. TRANSITIONAL FEEDING

Transitional feeding refers to the gradual progression from one mode of nutritional therapy to another while attempting to maintain adequate nutritional intake. In this case, patients are “weaned” from enteral nutrition to oral feeding.

General Guidelines:
- assess the patient’s ability/desire to commence oral intake
- advance diet as tolerated; provide oral supplements, if indicated
- allow family/friends to bring in consistency appropriate favorite foods from home
- perform accurate daily calorie counts to assess oral intake
- monitor and document tolerance to feeding, e.g. dysphagia, nausea, emesis, abdominal distention, diarrhea
- gradually reduce enteral feeds depending on calorie counts/tolerance
- to stimulate appetite during the day consider cyclic tube feeding to provide 8-12 hours of feeding during the night or intermittent delivery
- discontinue enteral feeds once tolerance to oral diet is demonstrated and a consistently adequate intake is consumed (>50% of estimated nutrient requirements)
- keep enteral feeding tube patent with free water flushes until decision to remove tube is made.

Transitional Feeding Algorithm

```
<table>
<thead>
<tr>
<th>Ability to take Food Orally</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>Continue Enteral Nutrition Only</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
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</tr>
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<td></td>
</tr>
</tbody>
</table>
```
13. **MONITORING**

Monitoring enteral feeding consists of regular attention to nutritional status, fluid and electrolyte balance and gastrointestinal tolerance. Critically/acutely ill patients require more frequent monitoring, usually on a daily basis. For stable or long-term patients, monitoring may occur less frequently, i.e. weekly or as deemed appropriate.

13.1 **Delivery System**

Check regularly (minimum q4h) to ensure:
- patency of the feeding tube
- correct rate of infusion
- secure attachment of the feeding tube to the patient
- proper positioning of the feeding tube.

13.2 **Tolerance**

1. **Residual Volume**
   - it is not indicated to check for residuals in the small bowel
   - when initiating continuous feeds into the stomach, check gastric residual volumes q4h
   - see Gastric Residual Volumes.

2. **Gastrointestinal side effects**
   - document occurrence of nausea, emesis, abdominal distention and pain.

3. **Bowel function**
   - chart stool frequency, consistency and volume
   - the absence of bowel sounds is not a contraindication to tube feeding, however, in the event that bowel sounds were present and then disappear, tube feeding intolerance may occur (i.e. distention, increased residual volume).
## 13.3 Nutritional/Metabolic Parameters

The following parameters are useful in assessing nutritional and metabolic status prior to and during enteral nutrition support.

### Suggested Monitoring of Enteral Feeding**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Critical Illness/Initiation of Feeding</th>
<th>Stable Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight</td>
<td>Daily&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Weekly</td>
</tr>
<tr>
<td>Intake/Output</td>
<td>Daily</td>
<td>Daily</td>
</tr>
<tr>
<td>S-albumin</td>
<td>Weekly&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Weekly&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>S-prealbumin</td>
<td>Weekly&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Weekly&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>S-sodium, S-potassium</td>
<td>Daily, then 3x/week</td>
<td>1 - 2 x/week</td>
</tr>
<tr>
<td>S-urea, S-creatinine</td>
<td>Daily, then 3x/week</td>
<td>1 - 2 x/week</td>
</tr>
<tr>
<td>S-glucose</td>
<td>Daily</td>
<td>Weekly&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>S-calcium, S-magnesium, S-phosphate</td>
<td>Daily, then 2-3x/week</td>
<td>Weekly</td>
</tr>
<tr>
<td>Liver function tests</td>
<td>Weekly</td>
<td>PRN</td>
</tr>
<tr>
<td>Bowel function</td>
<td>Daily</td>
<td>Daily</td>
</tr>
</tbody>
</table>

* Frequency of monitoring should be increased if problems are suspected. Frequency of monitoring may be decreased in long term/chronic care.
<sup>a</sup> Daily weight changes indicative of fluid shifts and may not be relevant to nutritional status.
<sup>b</sup> Not useful when patient in catabolic phase of illness.
<sup>c</sup> If patient has diabetes or is undergoing steroid therapy, increase frequency.


### Additional Parameters
- depending on the patient’s condition, the following may be important parameters to follow: Vitamin B<sub>12</sub>, folate, iron, ferritin, TIBC, zinc.
## 14. COMPLICATIONS ASSOCIATED WITH ENTERAL NUTRITION

### 14.1 Mechanical Complications Associated with Enteral Nutrition

<table>
<thead>
<tr>
<th>Complication</th>
<th>Usual Cause</th>
<th>Management Considerations</th>
</tr>
</thead>
</table>
| Nasopharyngeal irritation, nasal/mucosal erosions, esophageal/laryngeal ulceration and stenosis, acute sinusitis | • Prolonged use of large bore feeding tube                                                                                                   | • Use soft, small bore (<10 F) feeding tube.  
• Position and tape tube to reduce pressure on nares; use other nostril for tube placement.  
• Remove tube for severe sinusitis  
• Consider gastrostomy/jejunostomy feeding tube.  
• Appropriate medical intervention if infection is present, i.e. antibiotic therapy. |
| Obstruction of the feeding tube                                                                   | • Administration of medications via the feeding tube                                                                                         | • Use liquid form of the drug (i.e., elixirs or suspensions rather than syrups) whenever possible. If unavailable, check with the pharmacist prior to crushing/diluting medications due to potential altered pharmacologic effect.  
• Do not add medications directly to the enteral formula.  
• Do not mix medications together; administer separately and flush tube with 10-15 ml of warm water between medications.  
• Avoid instilling bulk-forming agents down the feeding tube (e.g. metamucil).  
• Attempt to restore tube patency by irrigating tube with warm water first.  
• If tube remains clogged, the following solution may be tried:  
  • A mixture of activated pancreatic enzyme [1 tablet Viokase and 1 tablet sodium bicarbonate (325 mg) crushed and dissolved in 5 mL warm water]. Instill solution into the clogged feeding tube, allow to sit for 5-20 min; irrigate tube with warm water. |
<table>
<thead>
<tr>
<th>Complication</th>
<th>Usual Cause</th>
<th>Management Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Precipitation of casein protein due to formula contact with acidic fluid</td>
<td>• Flush feeding tube with 20-30 ml water pre and post checking gastric residual volume to minimize mixing of formula with acidic gastric juice.</td>
</tr>
<tr>
<td></td>
<td>• Inadequate flushing of feeding tube</td>
<td>• Flush feeding tube with 20-30 ml water q4-6h if on continuous feeds/ pre and post each intermittent/bolus feeding.</td>
</tr>
<tr>
<td>Tube Displacement</td>
<td>• Coughing, vomiting</td>
<td>• Replace tube and verify position by abdominal x-ray, air auscultation, or aspirating gastric contents and testing pH if NPO for at least 4 hours. All small bore feeding tubes must have gastric or small bowel placement confirmed by x-ray before initial use.</td>
</tr>
</tbody>
</table>
### 14.2 Gastrointestinal Complications Associated with Enteral Nutrition

<table>
<thead>
<tr>
<th>Complication</th>
<th>Potential Cause</th>
<th>Management Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea, vomiting, abdominal cramps,</td>
<td>- Ileus, partial or complete bowel obstruction</td>
<td>- Hold tube feeding and investigate possible gastrointestinal pathology.</td>
</tr>
<tr>
<td>distention</td>
<td>- Medications</td>
<td>- Review of medications (e.g. narcotics, chemotherapy, inotropes, antibiotics).</td>
</tr>
<tr>
<td></td>
<td>- Inappropriate formula administration (rapid increase</td>
<td>- Assess need for antiemetics.</td>
</tr>
<tr>
<td></td>
<td>in rate/volume)</td>
<td>- Initiate and advance formula rate gradually (see Initiation and Progression); temporarily reduce rate then advance in 10-25 ml increments as tolerated.</td>
</tr>
<tr>
<td></td>
<td>- Lactose intolerance</td>
<td>- Try low fat, low fiber formula.</td>
</tr>
<tr>
<td></td>
<td>- Nutrient malabsorption</td>
<td>- Use lactose-free formula.</td>
</tr>
<tr>
<td></td>
<td>- Infusion of cold formula</td>
<td>- Use formula with hydrolyzed nutrients.</td>
</tr>
<tr>
<td></td>
<td>- High gastric residuals</td>
<td>- Feed formula at room temperature.</td>
</tr>
<tr>
<td></td>
<td>- Delayed gastric emptying</td>
<td>- Remove formula from refrigerator in time to allow it to warm to room temperature, or use warm water bath but <strong>DO NOT</strong> heat formula.</td>
</tr>
<tr>
<td></td>
<td>- Gastric outlet obstruction</td>
<td>- Check gastric residuals before each intermittent feed, or every 4 hours for patients on continuous feeds. Hold feeds if not within accepted guidelines (see Gastric Residual Volumes).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Elevate head of bed 30° or more.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Consider prokinetic medications.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Consider feeding into small bowel past the ligament of Treitz.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Try calorie dense product.</td>
</tr>
<tr>
<td></td>
<td>- Aspiration</td>
<td>- Hold tube feed and investigate possible gastrointestinal pathology.</td>
</tr>
<tr>
<td></td>
<td>Re reflux secondary to:</td>
<td>- Administer feeds by continuous infusion using an enteral feeding pump.</td>
</tr>
<tr>
<td></td>
<td>- Delayed gastric emptying</td>
<td>- Check gastric residuals as above.</td>
</tr>
<tr>
<td></td>
<td>- Medications that relax the lower esophageal sphincter</td>
<td></td>
</tr>
</tbody>
</table>

Complications Associated with Enteral Nutrition – Approved 26/07/07
<table>
<thead>
<tr>
<th>Complication</th>
<th>Potential Cause</th>
<th>Management Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation</td>
<td>• Dehydration</td>
<td>• Assess fluid status; supplement fluid as required.</td>
</tr>
</tbody>
</table>
|              | • Inadequate fiber intake | • Use fiber-containing formula.  
  • Amble patient when possible.  
  • Investigate possible gastrointestinal pathology before using laxatives, prokinetic agents and enemas. |
|              | • Fecal impaction | • Rectal exam and digital disimpaction.  
  • Stool softener and laxative.  
  • Assess fluid status and supplement fluid as required. |
| Diarrhea     | • Infection/Enteric Pathogens | • Check stool for C. difficile toxin or other pathogens.  
  • Appropriate antibiotic treatment (Metronidazole or Vancomycin) if toxin positive, endoscopic confirmation or empirically in severe cases pending investigations.  
  • Concomitant medications, e.g. antibiotic therapy, sorbitol-containing elixirs, hypertonic medications, antacids containing magnesium, electrolyte supplements | • Review current medications.  
  • Discontinue or substitute antibiotics whenever possible.  
  • Discontinue sorbitol-containing elixirs and substitute with alternative form of the medication i.e. tablet form.  
  • Administration of probiotic: Lactobacillus acidophilus preparation to help restore normal gastrointestinal flora.  
  • Dilute medications with a minimum 30 ml water to reduce osmolality, if not fluid restricted. |
|              | • Altered gag reflex  
  • Decreased level of consciousness  
  • Dysphagia  
  • Displaced feeding tube in pharynx, esophagus or lung  
  • Head of bed not elevated adequately | • Feed into the small bowel past the ligament of Treitz.  
  • Monitor tube position by aspirating gastric contents or X-ray. Reposition/replace if necessary.  
  • Elevate head of bed 30° or more during feeding and one hour post intermittent/bolus feeding. |
<table>
<thead>
<tr>
<th>Complication</th>
<th>Potential Cause</th>
<th>Management Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maldigestion/malabsorption</td>
<td>Secondary to:</td>
<td>• Administer anti-diarrheal agents as clinically indicated when other causes ruled out.</td>
</tr>
<tr>
<td></td>
<td>• Mucosal atrophy</td>
<td>• Use a low fat formula.</td>
</tr>
<tr>
<td></td>
<td>• Decreased pancreatic enzyme activity</td>
<td>• Use an elemental formula.</td>
</tr>
<tr>
<td></td>
<td>• Hypoalbuminemia (&lt;25g/l)</td>
<td>• Administer pancreatic enzymes as indicated.</td>
</tr>
<tr>
<td></td>
<td>• Severe malnutrition</td>
<td>• Investigate micronutrient/macronutrient deficiencies.</td>
</tr>
<tr>
<td></td>
<td>• Medical/surgical history or interventions associated with diarrhea e.g. short</td>
<td>• Appropriate treatment of underlying disease/condition.</td>
</tr>
<tr>
<td></td>
<td>bowel syndrome, bile salt malabsorption, IBD, celiac disease, radiation enteritis</td>
<td></td>
</tr>
<tr>
<td>Lactose Intolerance</td>
<td></td>
<td>• Use a lactose-free formula (most commercial formulas are lactose-free).</td>
</tr>
<tr>
<td>Inappropriate increments in tube</td>
<td></td>
<td>• Initiate and advance formula rate gradually (see Initiation and Progression).</td>
</tr>
<tr>
<td>feed volume</td>
<td></td>
<td>• Temporarily reduce rate to previously tolerated level, then advance by 10-25 ml increments as tolerated.</td>
</tr>
<tr>
<td>Bacterial contamination of</td>
<td></td>
<td>• If on intermittent/bolus feeding, change to continuous feeding.</td>
</tr>
<tr>
<td>formula/equipment</td>
<td></td>
<td>• Use clean handling technique for preparation, transfer and administration of formula.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Change feeding bags, delivery sets and syringes every 24 hours (label with date and time) or as per facility policy and procedure.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fill tube feeding bag with a maximum eight hour supply of formula.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Refrigerate opened, unused formula and discard after 24 hours (label with date and time).</td>
</tr>
</tbody>
</table>

Complications Associated with Enteral Nutrition – Approved 26/07/07
14.3 Metabolic Complications Associated with Enteral Nutrition

<table>
<thead>
<tr>
<th>Complication</th>
<th>Potential Cause</th>
<th>Management Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypernatremia</td>
<td>• Dehydration</td>
<td>• Appropriate rehydration.</td>
</tr>
<tr>
<td></td>
<td>• Excessive sodium intake</td>
<td>• Monitor fluid balance (accurate intake/output record, weight and serum electrolytes).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Assess sodium intake (intravenous and enteral).</td>
</tr>
<tr>
<td>Hyponatremia</td>
<td>• Overhydration</td>
<td>• Restrict free water.</td>
</tr>
<tr>
<td></td>
<td>• Excessive sodium loss</td>
<td>• Diuretic therapy if indicated.</td>
</tr>
<tr>
<td></td>
<td>• Low sodium intake</td>
<td>• Under physician’s direction, increase sodium intake intravenously or by the addition of table salt to the formula.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Monitor fluid balance (accurate intake/output record, weight and serum electrolytes).</td>
</tr>
<tr>
<td>Hyperkalemia</td>
<td>• Metabolic acidosis</td>
<td>• Correct metabolic acidosis.</td>
</tr>
<tr>
<td></td>
<td>• Renal failure</td>
<td>• Assess renal function.</td>
</tr>
<tr>
<td></td>
<td>• High potassium intake</td>
<td>• Assess potassium sources, (content of tube feed, therapeutic supplementation).</td>
</tr>
<tr>
<td></td>
<td>• Excessive potassium supplementation</td>
<td>• Change tube feed product if necessary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Restrict or discontinue potassium supplementation.</td>
</tr>
<tr>
<td>Hypokalemia</td>
<td>• Low potassium intake</td>
<td>• Potassium supplementation.</td>
</tr>
<tr>
<td></td>
<td>• Diuretic therapy</td>
<td>• Reassess diuretic agent.</td>
</tr>
<tr>
<td></td>
<td>• Excessive losses (diarrhea, emesis,</td>
<td>• Replace gastrointestinal losses.</td>
</tr>
<tr>
<td></td>
<td>malabsorption)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Severe malnutrition</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Refeeding syndrome</td>
<td></td>
</tr>
<tr>
<td>Hyperphosphatemia</td>
<td>• Renal failure</td>
<td>• See Refeeding syndrome (below).</td>
</tr>
<tr>
<td></td>
<td>• High phosphorous intake</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Excessive phosphorous supplementation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(laxative/enema with phosphate salts)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complication</td>
<td>Potential Cause</td>
<td>Management Considerations</td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Hypophosphatemia   | - Excessive losses (diarrhea, emesis, malabsorption)  
                   - Severe malnutrition  
                   - Refeeding syndrome  
                   - Drug-induced (phosphate binding antacids, steroids, insulin).                         | - Phosphate supplementation.  
                   - See Refeeding syndrome (below).  
                   - Review medications.                                                           |
| Hypermagnesemia    | - Renal failure  
                   - Dehydration  
                   - High magnesium intake  
                   - Excessive magnesium supplementation (Mg containing medications, antacids, laxatives) | - Assess renal function.  
                   - Assess magnesium sources (content of tube feed, therapeutic supplementation).  
                   - Change tube feed product if necessary.  
                   - Review medications.                                                   |
| Hypomagnesemia     | - Excessive losses (diarrhea, emesis, malabsorption, large wounds/burns)  
                   - Severe malnutrition  
                   - Refeeding syndrome  
                   - Drug-induced (diuretics, antibiotics, anti-neoplastic medications)            | - Magnesium supplementation.  
                   - See Refeeding syndrome (below).  
                   - Review medications.                                                          |
| Refeeding Syndrome | - Aggressive re-institution of feeding to malnourished patients, characterized by acute intracellular shifts/depletion of electrolytes (S-K, Mg and PO4), sodium retention, fluid overload and hyperglycemia | - Begin nutritional support conservatively. Start with 100-150 g of glucose/day and increase gradually until metabolically stable.  
                   - Daily monitoring of electrolytes: serum potassium, magnesium and phosphorus until stable. Replace as necessary.  
                   - Daily monitoring of serum glucose.  
                   - Monitor fluid status: accurate intake/output record and weight  
                   - Correct vitamin and trace element deficiencies; specifically consider intravenous thiamine supplementation. |
<table>
<thead>
<tr>
<th>Complication</th>
<th>Potential Cause</th>
<th>Management Considerations</th>
</tr>
</thead>
</table>
| Hyperglycemia              | • History of diabetes mellitus  
• Temporary insulin resistance  
• Corticosteroid therapy, certain antibiotics, sympathomimetic amines, hydrochlorothiazide diuretics | • Routine monitoring of serum glucose.  
• Administer insulin.  
• Treat underlying cause of hyperglycemia, i.e. infection.  
• Adjust medications. |
| Hypercapnia                | • Overfeeding                                                                   | • Do not overfeed total calories.  
• Indirect calorimetry if possible. |
| Fluid Overload             | • Administration of large volumes of fluid (intravenous or enteral)  
• Use of large volumes of water to flush the feeding tube | • Monitor fluid balance (accurate intake/output record, weight and serum electrolytes, urea and creatinine).  
• Restrict fluid intake.  
• Diuretic therapy if indicated.  
• Select a more concentrated formula. |
| Dehydration                | • Fever  
• Inadequate fluid intake  
• Excessive fluid losses (emesis, diarrhea or enterocutaneous fistula)  
• Osmotic diuresis | • Monitor fluid balance (accurate intake/output record, weight and serum electrolytes, urea and creatinine).  
• Supplement with additional water, either enterally or intravenously.  
• Review water requirements. |
| Low serum zinc             | • Increased losses (prolonged diarrhea, gastrointestinal fistula, burns, wounds) | • Zinc supplementation. |
| Essential fatty acid (EFA) deficiency | • Severe malnutrition  
• Prolonged use of low fat enteral formula  
• Malabsorption of fat | • Adequate provision of essential fatty acids, specifically linoleic acid (3-5% of total caloric intake as EFA). |
15. THE ENTERAL FEEDING PUMP

15.1 The Kangaroo 324 Enteral Pump

Kangaroo 324 Enteral Pump

EQUIPMENT:
1. Kangaroo 324 Feeding Pump.
2. Enteral Pump Feeding Set.
3. Enteral Feeding Solution as ordered.

The Kangaroo 324 enteral feeding pump is currently used for enteral feeding in most facilities in the WRHA. This pump is recommended when delivering tube feeding on a continuous basis. The “Kangaroo Pump Set: Easy-cap Closure” is the bag used to hold the formula. The pump will not operate with any other brand of bag sets.

Directions are located on the sides of the pump. These include:
- Directions for use
- Changing the rate
- Setting the dose
- Alarm codes.

Directions for using the Kangaroo 324 Pump

1. Fill bag with the prescribed formula: maximum of 8 hours may be hung at one time.
2. Turn pump ON and allow it to finish the system check.
3. Clear previous volume if necessary by pressing VOL CLR.
4. When display reads 0, set the desired rate in ml/hr by pressing ▲ (increase) or ▼ (decrease) button.

   **OPTIONAL STEP:** you may set a dose to be delivered by pressing DOSE and then ▲ or ▼ to set the amount. The DOSE is the total volume to be infused. The pump will alarm when the DOSE volume is delivered. If DOSE is not used (ie kept at), the pump will infuse until the bag is empty.

5. Insert the pump set into the drip chamber on pump. Do not squeeze the drip chamber; it will fill automatically.

6. Remove cap from distal end of tubing and slowly open the roller clamp and fill the entire tubing with formula. The drip chamber should be about 1/3 full. Close clamp.

7. Gently stretch the silicone part of the tubing and stretch it around the roller on the pump. Insert retainer lock “B”. Thread tubing over tubing guide “C”. Secure latch over tubing “D”.

8. Attach tubing to the patient’s feeding tube.

9. Check screen on pump to ensure correct rate is in place, then press START/HOLD to begin flow. Open the clamp on the tubing.

10. Ensure head of bed is elevated 30°-45° unless contraindicated.

11. Monitor patient for tolerance to the enteral feeding as outlined in the “Monitoring” section of this manual.

12. **Pump Functions:** refer to your facility Nursing P&P manual or the manufacturers handbook for more complete details on operating the pump.

### 15.2 The Kangaroo Feeding Pump Troubleshooting Guide

See following “Trouble Shooting Guide” for the most probable causes of alarm conditions and the how to correct the problem.
## The Kangaroo Feeding Pump Troubleshooting Guide

<table>
<thead>
<tr>
<th>Alarm</th>
<th>Probable Cause</th>
<th>Corrections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow Error (FLO Err)a</td>
<td>Feeding container is empty. Feeding tube or feeding set tubing is occluded.</td>
<td>Refill feeding container. If bag used for 24 hours, replace.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Locate point of occlusion and correct.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NOTE: occlusion may occur upstream or downstream from pump.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Feeding Container</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Feeding Pump Set (control clamp closed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Feeding Tube - patency should be checked.</td>
</tr>
<tr>
<td></td>
<td>Drip chamber is improperly placed in pump.</td>
<td>Check to make sure drip chamber is properly “locked” in position in drip chamber guide.</td>
</tr>
<tr>
<td></td>
<td>Drip chamber walls are coated with feeding formula.</td>
<td>Check to make sure formula is not preventing detectors from proper operation. If formula cannot be removed from inside chamber walls via chamber manipulation, replace set.</td>
</tr>
<tr>
<td></td>
<td>Sensors in upper drip chamber guide are blocked.</td>
<td>Check to make sure detectors are free of dried formula. Remove any deposits by using a cotton swab dampened with warm soapy water.</td>
</tr>
<tr>
<td>Low Battery (Lo bAt)</td>
<td>Battery has been run down below point of maintaining accuracy of pump.</td>
<td>Plug pump power cord into wall outlet.</td>
</tr>
<tr>
<td>Hold Error (HLd Err)</td>
<td>Pump has been left in the hold mode for over 2 ½ minutes.</td>
<td>Press START/HOLD to silence alarm, then press START/HOLD again to restart pump.</td>
</tr>
<tr>
<td>No Set (no SEt)</td>
<td>Pump set has been improperly placed onto pump.</td>
<td>Check to make sure only Kangaroo Pump Set has been placed onto the pump. Check to make sure that retainer clip on pump has been properly positioned into retainer lock on pump.</td>
</tr>
<tr>
<td>System Error (Sys Err)</td>
<td>Rotor is not turning while pump is running. Rotor is turning but is not detected by rotor sensors.</td>
<td>Return pump for technical service.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Return pump for technical service.</td>
</tr>
<tr>
<td>Dose Delivery (doSE dEL)</td>
<td>Present dose has been delivered to patient.</td>
<td>Repeat the dose amount by clearing the volume delivered. Cancel the dose feature by pressing DOSE and ▼ until zero is displayed. To feed additional volume, increase the dose amount by pressing DOSE, then ▲ until new dose is displayed. Turn pump off.</td>
</tr>
</tbody>
</table>
APPENDIX A

Nutrition Advisory Sub-committee
WRHA Pharmacotherapy Committee

Non-Formulary Request
Enteral & Parenteral Nutrition Product

A. PRODUCT INFORMATION

☐ Enteral Nutrition Product
☐ Parenteral Nutrition Product

Product Name: ____________________________________________________________

Manufacturer: ____________________________________________________________

Product Description (include volume(s), concentration, container type): ________________

☐ Ready to Use (RTU)
☐ Requires Preparation or Dilution

Expected Duration of Use: ________ (max. 3 mo./request) # Containers Required: __________

B. JUSTIFICATION FOR REQUEST

☐ Product by family choice
☐ Family will supply SEALED container of product
☐ Facility will need to purchase product

☐ Patient stabilized on product prior to admission
☐ Family will supply SEALED container of product
☐ Facility will need to purchase product
☐ Product supplied by MHNP

☐ Patient has failed trial of formulary product(s) OR Approved disease specific indication
(specify)

________________________________________________________________________

________________________________________________________________________

Additional Information to Support Request: _______________________________________

________________________________________________________________________

Requested by: ___________________________ Date: ________________________

D. APPROVAL

☐ Enteral Nutrition Product – Forward Request to Site Manager, Nutrition and Food Services

☐ Parenteral Nutrition Product – Forward Request to Site Manager, Pharmacy

Approved by: ___________________________ Date: ________________________
APPENDIX B

PHARMACOTHERAPY COORDINATING COMMITTEE DIRECTIVE

<table>
<thead>
<tr>
<th>Directive Name:</th>
<th>Directive #:</th>
<th>Page:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition of Dye or Colorants to Enteral Tube Feeds</td>
<td>110.170.010.510</td>
<td>1 of 1</td>
</tr>
</tbody>
</table>

Key Index Terms: 

Supersedes: 
Date: January 12, 2007

PURPOSE: To prohibit the addition of dye or colourants to enteral tube feeds for the purpose of detecting or monitoring potential pulmonary aspiration.

DEFINITIONS:

2.1 The use of blue food coloring is poorly standardized and has been shown to have low sensitivity for detecting aspiration.\(^5\,^3\)

2.2 Cases of absorption of blue dye from enteral tube feeding in critically ill patients have been temporarily associated with death.\(^5\,^1\)

2.3 Addition of non-sterile food products, such as pureed carrots, may contaminate enteral feeding solutions, resulting in illness or clogged feeding tubes.

DIRECTIVE:

3.1 The addition of blue dye or any other food or colourants (including pureed foods such as carrots) to enteral tube feeds in order to monitor or detect potential pulmonary aspiration is prohibited.

3.2 This policy does not preclude the appropriate use of dye or colourant for other approved diagnostic purposes where medical evidence supports such use. (Note: medical grade blue dye is no longer commercially produced\(^5\,^2\) and not available from site Pharmacy Departments.)

PROCEDURE: None

REFERENCES: (includes cross-reference)

5.1 Health Canada Therapeutic Products Directorate Notice to Hospitals: Safety Warning Concerning the Use of Blue Food Dye in Enteral Feedings. December 16, 2003


Directive Contact: Nutrition Advisory Subcommittee
REFERENCES

The WRHA Enteral Manual was adapted from the Health Sciences Centre Parenteral and Enteral Manual, January 2001.

INTRODUCTION

A.S.P.E.N. Board of Directors: Guidelines for the use of parenteral and enteral nutrition in adult and pediatric patients. JPEN 26 (1- suppl): 1SA-32SA, 2002

FORMULA SELECTION


ROUTES OF ADMINISTRATION/FEEDING TUBES


METHODS OF ADMINISTRATION


GUIDELINES FOR ORDERING TUBE FEEDING

Based on expert opinion

INITIATION AND PROGRESSION


ADMINISTRATION OF TUBE FEEDINGS

McClave S, Snider HL: Clinical use of gastric residual volumes as a monitor for patients on enteral tube feeding. JPEN 26:S43-S47, 2002

ALGORITHM FOR ENTERAL FEEDING ADMINISTRATION

Health Sciences Center. Parenteral and Enteral Nutrition Manual 2001: C-11
MEDICATIONS AND ENTERAL FEEDING


Dickerson, R: Medication administration considerations for patients receiving enteral tube feedings. Hospital Pharmacy 39 (1): 84-89, 96, 2004

HANDLING AND STORAGE OF ENTERAL FEEDING


TRANSITIONAL FEEDING


MONITORING


MECHANICAL COMPLICATIONS ASSOCIATED WITH ENTERAL NUTRITION


GASTROINTESTINAL COMPLICATIONS ASSOCIATED WITH ENTERAL NUTRITION


Practice guideline: Management of diarrhea in the enterally fed patient. Vancouver Hospital and Health Sciences Centre Department of Food and Nutrition Services, November 2000


METABOLIC COMPLICATIONS ASSOCIATED WITH ENTERAL NUTRITION


Practice Guideline: Management of patients at risk for refeeding syndrome. Vancouver Hospital and Health Sciences Centre Department of Food and Nutrition Services, 2001


THE ENTERAL FEEDING PUMP

Sherwood Medical, Kangaroo 324 Feeding Pump Operating Manual. 1995

THE KANGAROO FEEDING PUMP TROUBLESHOOTING GUIDE

Sherwood Medical, Kangaroo 324 Feeding Pump Operating Manual. 1995