

3-2013

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Citation

Simons, Shellie and Remington, Ruth. "The Percutaneous Endoscopic Gastrostomy Tube: A Nurse's Guide to PEG Tubes." *MEDSURG Nursing* 22, no. 2 (2013): 77-83. Accessed at http://digitalcommons.framingham.edu/nurs_facpub/24

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The Percutaneous Endoscopic Gastrostomy Tube: A Nurse's Guide to PEG Tubes

Shellie Simons
Ruth Remington

Nasogastric enteral nutrition is an option for persons requiring short-term nutritional support. However, nasogastric feeding tubes are difficult to maintain in position and pose a significant risk of aspiration and pneumonia (Hsu et al., 2009). For individuals who require enteral feeding longer than 6 weeks, a safer, more permanent access is required (Best, Hitchings, Boulton, & Gordon, 2009).

Percutaneous endoscopic gastrostomy (PEG) tubes are placed endoscopically using local anesthesia and conscious sedation. They were first introduced in 1980 as a safer alternative to laparotomy for surgical placement of a feeding tube (Gauderer, Ponsky, & Izant, 1980). Since their introduction, the number of tubes placed endoscopically has increased dramatically. According to a review of Medicare beneficiaries, 61,000 PEG tubes were placed in 1988; that number increased to 121,000 by 1995 (Iyer & Crawley, 2007). An estimated 250,000 PEG tubes are placed every year in the United States, and as many as 10% of institutionalized older adults are being fed with PEG tubes (Chen, Shih, Bair, Lin, & Wu, 2011; Wu, Leech, Rosenberg, Huggins, & Papa, 2009).

The use of a PEG tube allows the cardiac sphincter to remain intact, which decreases the risk of gastroesophageal reflux and pulmonary aspiration (Jung et al., 2011). A PEG tube is not appropriate in patients who cannot lie flat for 20-30 minutes, have a gastric wall malignancy, or are obese (making external loca-

Nurses are primarily responsible for the care and maintenance of percutaneous endoscopic gastrostomy (PEG) tubes and yet their care is not often included in nursing skills textbooks. Best practice recommendations to care for a person with a PEG tube are described.

tion of the stomach position difficult by digital indentation and trans-illumination (Best et al., 2009).

Types of G-Tubes

Patients who have an intact gastrointestinal tract but lack the ability to take food by mouth due to dysphagia or loss of appetite are candidates for PEG tube placement. The most common reason for PEG tube placement is swallowing difficulty resulting from a stroke. Other indications are neurological conditions, such as multiple sclerosis, Parkinson's disease, and amyotrophic lateral sclerosis, or head, neck, and esophageal cancers (Chen et al., 2011).

A PEG tube can be placed by a surgeon, radiologist, or gastroenterologist at the bedside or in the endoscopy suite. Patients are required to fast for 8 hours prior to the procedure (Cleveland Clinic, 2013). Following intravenous sedation with medications such as fentanyl and midazolam, a polyurethane or silicone catheter is

inserted through the mouth into the stomach. It is then pulled through a tiny abdominal incision and is held in place with internal and external bumper devices without sutures (Haywood, 2012) (see Figure 1). Polyurethane tubes are preferable to silicone tubes because polyurethane is less likely to deteriorate. Tube deterioration results in loss of patency, which increases the possibility of tube clogging and disrupts prescribed feeding and medication schedules (Naik, Joshipura, Patel, & Haribhakti, 2009).

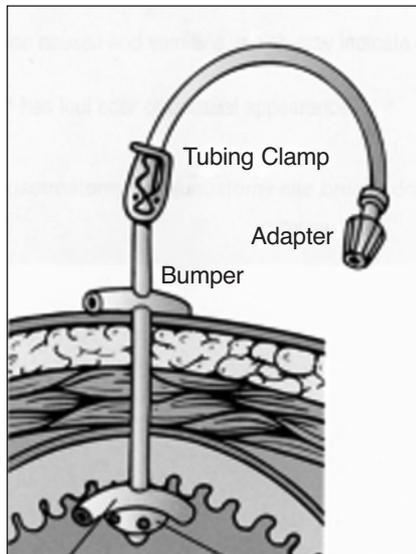
A feeding tube also can be inserted into the stomach by radiologic gastrostomy. This method is used when endoscopic placement is difficult or contraindicated. The stomach is inflated with air through a nasogastric tube, an external incision is made, and a tube is inserted into the stomach (Best et al., 2009).

A balloon gastrostomy, otherwise called a G-tube, is used as a replacement tube into a well-healed, mature tract. It is held in place with a water-filled balloon, similar to the balloon

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FIGURE 1.
Placement of PEG Tube into
the Stomach



Source: Perry & Potter, 2010. Copyright Elsevier (2010). Reprinted with permission.

in an indwelling urinary catheter. This type of tube has a life span of 3-6 months. One advantage is that less invasive placement can be done at the patient's bedside at home or in the hospital (Best et al., 2009).

The button gastrostomy or low-profile gastrostomy tube is used commonly to provide long-term enteral nutrition (Al-Zubeidi & Rahhal, 2012). It lies flush with the skin and is held in place by a water-filled balloon or traction device. The tube is placed after the tract has healed and is mature, usually 2-4 weeks after the PEG tube is placed. A button gastrostomy often is used in younger, more ambulatory patients because it is more appealing cosmetically and does not interfere with fitted clothing. It is also useful with patients who have a tendency to pull at their gastrostomy because self-extubation is more difficult than with standard gastrostomy tubes (Best et al., 2009).

Gastric or Jejunum Feeding

Feeding into the stomach is preferred in most cases because gastric feedings are easier to place. However,

when gastric motility is impaired, gastric feedings can accumulate in the stomach and increase the risk of aspiration. In these cases, a tube may be placed directly into the jejunum (J-PEG). Once the J-PEG tube is in the stomach, a long, small-gauge tube is passed through the lumen of the tube and pulled into the small intestine with the assistance of endoscopic forceps (Best et al., 2009). It has been suggested feeding tubes placed beyond the stomach may reduce the risk of aspiration of gastric contents into the lungs, but evidence remains unclear. Jiyong, Tiancha, Huiqin and Jingfen (2013) found post-pyloric feeding is associated with a significant reduction in gastroesophageal regurgitation and aspiration pneumonia. Hsu and co-authors (2009) found patients receiving duodenal feedings had a higher average daily calorie and protein intake compared to those receiving gastric feedings, and lower rates of vomiting and ventilator-associated pneumonia. However, earlier studies found persons who received gastric feedings had no increase in aspiration rates or other adverse outcomes compared with those receiving small bowel feeding (Esparza, Boivin, Hartshorne, & Levy, 2001; Marik & Zaloga, 2003; Neumann & DeLegge, 2002). Most complications related to the J-PEG are similar to those found with a PEG tube. However, a unique complication of the J-PEG is migration of the tube. Migration of the tube from the jejunum into the stomach may cause vomiting and aspiration while downward migration of the tube can lead to obstruction with vomiting and abdominal distention and pain (Holmes, 2012).

Nursing Care

Hospital policies and current nursing texts are inconsistent in recommendations for care of the patient with a PEG tube. A comprehensive online literature review was completed to compare recommended care of the nasogastric feeding tube to the PEG tube. The search included literature published 1980-2013 in the Cumulative Index to Nursing and Allied Health Literature

(CINAHL), MEDLINE, and the Health Reference Center Academic. The following key words and phrases focused the search: *PEG tube, enteral feeding, enteral nutrition, nasogastric nutrition, nasogastric nutrition, nasogastric feeding tube, percutaneous endoscopic gastrostomy tube, J-PEG, and nursing care*. All English-language, research-based articles pertaining to the care of these tubes in adult patients were reviewed. This investigation was initiated to identify whether current evidence warrants separate policies and procedures to provide appropriate care for the patient with a PEG tube.

Most notably included in the recommended procedure for administering enteral nutrition through a nasogastric, gastrostomy, or jejunostomy tube is the verification of tube placement position by methods that include observing the color and pH of gastric aspirate before each feeding or administration of a medication (Craven & Hirnle, 2009; Perry & Potter, 2010; Wilkinson & Treas, 2011). After a careful review of the evidence, this step is not recommended in any of the literature on PEG tube care. The PEG tube is placed endoscopically and though it can migrate toward the esophagus or the stomach pylorus, checking placement would only verify it is, in fact, in the stomach. When the PEG-J is suspected to have migrated into the stomach, verifying placement using pH is needed. Turgay and Khorshid (2010) found nasogastric tubes in the stomach had pH readings averaging 4.2 (*SD* 1.2) as tested on a colorimetric pH strip.

Following placement of the PEG tube, the patient should receive no fluid for 4 hours. Then the tube should be flushed with 30-50 ml of water to assess patient comfort. If there is no discomfort or resistance to the flush, feedings may commence (Best et al., 2009).

To reduce the risk of aspiration during gastrointestinal reflux, the head of the patient's bed should be elevated at least 30 degrees during feeding. The PEG tube site also should be kept clean and dry; it should be washed with sterile water and covered with gauze for the first

10 days to prevent infection. To promote a straight stoma, the tube should not be taped to the patient's abdomen until the site is healed fully (Best et al., 2009). Thereafter, it should be cleaned daily with soap and water. Use of hydrogen peroxide should be avoided because it is cytotoxic to human cells, even when diluted (Myers, 2008). No dressing is necessary around the PEG tube unless there is continued discharge. If discharge is present, a gauze dressing should be placed over the external fixation plate to avoid excessive tension on the internal abdominal surface and erosion of the abdominal wall (Best et al., 2009; Schrag et al., 2007). After 10 days, routine care does not require aseptic technique. During daily cleansing with soap and water, the centimeter marking on the tube should be noted to determine if it has migrated from its original point. The use of powders or creams could increase the risk for infection or skin breakdown. After bathing, the PEG site simply should be dried thoroughly (Best et al., 2009).

The external fixation device is a small piece of polyurethane or silicone designed to keep the external portion of the PEG tube from being pulled into the stomach. It should be placed 2-3 mm away from the skin surface. If it is too tight, it can cause tissue necrosis; if it is too loose, the tube can migrate into the stomach (Best et al., 2009).

Assessment of Residual Volumes

Checking gastric residual volume (GRV) is a routine nursing task recommended before each intermittent feeding and every 4-6 hours in patients receiving continuous feedings (Fessler, 2010). However, the evidence is unclear regarding how much GRV is too much, how frequently GRV needs to be assessed, and when to withhold feeding (Fessler, 2010). GRV greater than 200-250 generally is considered high in patients who are mechanically ventilated because of their increased risk of aspiration (Metheny, Schallom, Oliver, & Clause, 2008).

Patients with gastroparesis, poorly controlled diabetes, ileus, and those who receive large amounts of opioid medications are at risk for delayed gastric emptying. The aspiration risk should be evaluated carefully in any patient with GRV of 200-500 ml. Otherwise, feedings should be withheld when GRV exceeds 500 ml. GRV less than 200 ml generally is well tolerated (Fessler, 2010). For persistently elevated GRV, the physician may order a prokinetic agent such as metoclopramide and erythromycin, either alone or in combination, to stimulate gastric emptying (Fraser & Bryant, 2010). Assessing GRV can increase the risk of clogging the tube because sediment may form when gastric juices are mixed with enteral formulas. Flushing the tube with water after assessing GRV therefore is essential (Kenny & Goodman, 2010). Checking residuals can be discontinued 48 hours after tube feedings reached the target volume if the patient is conscious, alert, and can communicate and respond to an interview of symptoms, such as nausea, vomiting, abdominal distention, and passage of stool and flatus (Parrish & McClave, 2008).

Intestinal residual volume is typically small and a sharp increase in residual volume may indicate the tube has migrated from the small bowel into the stomach (Metheny, 2009). In this case, the feeding should be stopped for 1 hour, and then the aspirate should be examined and pH tested. Gastric aspirate is colorless or white with a curdled appearance, while intestinal aspirate is often bile stained. A pH value of 0-4 is a good indication the tube is in the stomach, while a pH greater than 6 suggests the tube is positioned in the small bowel and a pH greater than 7.5 indicates pulmonary positioning (Bourgault & Halm, 2009; Metheny, 2009). If gastric aspirate suggests a J-PEG has migrated into the stomach, the feeding should be held and the physician notified.

Major Complications

Aspiration

Aspiration pneumonia occurs when

oropharyngeal or gastric contents are inhaled into the lungs. Gastroesophageal reflux (GER) increases the risk for aspiration in patients with enteral feeding tubes. The incidence of GER and aspiration pneumonia in patients with PEG tubes is inconsistent in the literature, ranging from 8% to 56% (Echevarria & Schwoebel, 2012). Because the tube may migrate upward toward the esophagus, increasing the risk of aspiration, the tube should be marked with a permanent marker at the time of placement to aid in assessing gastric placement (Hosseini et al., 2008). To prevent aspiration, the head of the bed should be elevated at least 30 degrees during feedings and residual volume should be assessed to avoid gastric distension (Best et al., 2009). Fraser and Bryant (2010) recommended using pharmacological therapy to reduce reflux. In patients at high risk, changing the level of infusion of feeding from the stomach to the jejunum can reduce the risk of aspiration and regurgitation substantially (Freeman & Delegge, 2009).

Buried Bumper Syndrome

Buried bumper syndrome (BBS) is a potentially serious complication in the patient with a PEG tube. In this condition, the internal bumper becomes lodged between the gastric wall and the skin anywhere along the PEG tract. It results from excessive tension between the internal and external bumpers, and leads to gastric ulceration at the bumper site (Schrag et al., 2007). Abdominal pain and inability to infuse the feed are the most common clinical manifestations of BBS. If BBS occurs, the PEG tube must be removed and replaced (Naik et al., 2009; Schrag et al., 2007).

To prevent BBS, the external bumper should be left 1-2 cm from the abdominal wall at the time of insertion, and the setting should be noted and left at the patient's bedside to guide nurses in resetting the external bolster when cleaning the site (Naik et al., 2009). Routine care of the PEG includes rotating the external tube gently. Initially, this should be done every day; once the stoma has healed fully, it should be

done every week. To rotate the PEG, the external fixation device should be released; the tube should be cleaned thoroughly with soap and water, and pushed gently into the abdomen 1-2 cm to move the internal bumper away from the stomach wall; and the tube rotated 360 degrees. Rotation of the tube without pushing the tube 1-2 cm into the stomach is insufficient because the tube will rotate and the internal bumper still can be imbedded in gastric mucosa. There should be no resistance. Once this is accomplished, the nurse should pull the tube back gently to its original position until resistance is felt, and replace the external fixation device. If the tube is immobile, BBS should be suspected and the physician notified (Naik et al., 2009).

PEG Tube Dislodgement

Schrag and colleagues (2007) estimated PEG tubes become removed inadvertently in 1.6%-4.4% of patients. This risk is more common in patients who are confused or combative (Naik et al., 2009). If the PEG becomes dislodged within the first 7-10 days after placement, the tract is not yet mature and will close within hours. The tube will need to be replaced in the endoscopy suite (Staynor, Bhatnagar, McGinn, & Fang, 2012). When a PEG becomes dislodged from a mature stoma tract, a replacement tube can be reintroduced through the same tract without endoscopy. To prevent a repeat dislodgement, the use of a low-profile button may be beneficial (Staynor et al., 2012).

Tube Misconnections

Numerous reports have documented accidental connections of feeding lines being hooked to intravenous or tracheotomy cuffs and other life-threatening misconnections of compatible tubing to the wrong line (Guenter et al., 2008; The Joint Commission, 2006). An early report of a misconnection occurred in 1972, when a patient received an inadvertent intravenous infusion of 100 ml milk, resulting in catastrophic complications (Wallace, Payne, & Mack, 1972). Since that time, more

than 60 voluntary reports were made of tube misconnections. This may be an underrepresentation of the occurrence due to the voluntary nature of the reporting (Guenter et al., 2008). In 2010, a child received cholestyramine (Questran®) through a central venous catheter intended for administration of antibiotic therapy instead of through the enteral feeding tube (Institute for Safe Medication Practices, 2010). This type of mistake happens because the brain allows humans to perform common tasks automatically but also sometimes without thinking. Human factors, such as fatigue and inadequate training, as well as physical and design factors in the equipment contribute to the risk of misconnection (Guenter et al., 2008). To prevent a tragic error, Guenter and colleagues (2008) and The Joint Commission (2006) recommended the following:

- Turn on the light in a darkened room before connecting or reconnecting tubes.
- Do not modify or adapt a device; it may compromise safety features.
- Always trace a tube or catheter from the patient to the point of origin before connecting any device or infusion.
- Inform non-clinical staff, patients, and their families they must get help from nurses whenever there is a need to connect or disconnect devices or infusions.
- Never use Luer-lock syringes to administer oral medications or enteral feedings to prevent the inadvertent insertion of the Luer-lock into intravenous tubing.
- Label or color-code feeding tubes and connectors.
- Emphasize the risk of tubing misconnections in staff education.
- Minimize conditions that contribute to staff fatigue.

Minor Complications

Superficial Infection

Infection around the PEG tube site is the most common complication, occurring in approximately 18% of

patients, but the infections are rarely serious (Schrag et al., 2007). Factors that increase patient risk for infection are diabetes, obesity, malnutrition, and long-term corticosteroid use. Administering a single dose of a broad-spectrum antibiotic at the time of PEG tube insertion can reduce the risk of infection sufficiently (Naik et al., 2009). An infected PEG site is erythematous, warm, edematous, and painful. Drainage is often foul smelling, thick, and purulent (Wound, Ostomy and Continence Nurses Society, 2008). Most PEG wound infections respond to a first-generation cephalosporin, but methicillin-resistant *Staphylococcus aureus* has emerged as an important cause of PEG site infections (Naik et al., 2009).

Leakage

Some leakage often occurs within the first few days after a PEG tube is placed (Naik et al., 2009). Excessive leakage around the tube is a complication that can be caused by a variety of factors, including bacterial or fungal infection around the tube, over-granulation, and mechanical issues such as BBS (Schrag et al., 2007). Discontinuing acid-suppressive medications can lead to increased gastric acid production and leakage around the tube. Treatment is directed at the underlying cause. Barrier creams and skin protectants containing zinc oxide should be applied to protect the skin from acidic leakage (Naik et al., 2009; Schrag et al., 2007). When excessive leakage is caused by intolerance to the feeding, the PEG can be changed to a J-PEG to deliver food directly into the jejunum. Simply increasing the size of the tube should be avoided as it seldom alleviates the problem (Staynor et al., 2012).

Tube Blockage

A clogged PEG tube is a common complication caused by blockage from medication or the enteral formula (Naik et al., 2009). This is understandable given the viscosity of the feedings and the relative narrowness of the feeding tube. A blocked PEG tube is costly and uncomfortable to the patient as it often necessitates a tube change. It is

far easier to prevent a clog than to clear an obstruction. Most tube blockages are caused by a failure to flush the tube regularly, administration of partially crushed medication, or a food/drug interaction. To prevent obstructions, the nurse should flush the PEG with 30 ml tepid water every 4-6 hours during continuous feedings and whenever feedings are held, before and after administration of feedings and medications, and after checking residuals. Medications should not be added directly to the feeding bag, and each medication should be given separately with a water flush of about 10 ml between each medication. The nurse should use a 60-ml syringe for flushing to avoid putting too much pressure on the PEG (Naik et al., 2009).

Before attempting to dislodge the blockage, the nurse could try rolling the tube between the forefinger and thumb to disrupt the blockage and then attempt to aspirate as much of the tube contents as possible (Best et al., 2009). Liquids, such as cranberry juice and carbonated beverages, and meat tenderizer have been used with varying success, but Naik and co-authors (2009) found warm water is the best irrigating solution. Pancreatic enzymes require a physician's order and should be used judiciously (Kenny & Goodman, 2010). The nurse should avoid using excessive force or a sharp instrument to dislodge the blockage, as this could cause serious harm to the posterior stomach wall (Best et al., 2009).

Granulation Tissue

Granulation tissue is a proliferation of capillaries that form in and around the stoma opening, and continues to form after the wound defect has been filled (Myers, 2008). This highly vascular connective tissue (also called hypergranulation or overgranulation) formed during the healing process appears as a mound of fragile tissue that extends above the surface of the surrounding epithelium. This tissue remains moist and often cannot withstand even minor trauma. Granulation tissue is unsightly, often painful when touched, and easily infected; it bleeds easily. This complication can

be prevented through correct positioning of the external fixation device. Current treatment options include topical steroids in the absence of infection and less occlusive high-absorbency dressings. Topical antimicrobials can reduce bacteria in the wound without affecting systemic flora. Caustic preparations such as silver nitrate used in the past are now recommended only as a last resort due to pain and damage caused to surrounding tissue (McGrath, 2011). No published controlled studies comparing the efficacy of various treatments have been found.

Diarrhea

Diarrhea is a common complication of enteral feeding that may occur in 15%-40% of patients, depending on the criteria used to define diarrhea (Ferrie & Daley, 2011). Several studies supported the theory that diarrhea may be caused by improper handling of formula and equipment (Bankhead et al., 2009; Schrag et al., 2007). *Clostridium difficile* is significantly more likely in patients receiving enteral feeding (20% vs. 8%, $p=0.03$) than those receiving oral feeding and should be ruled out before changing the formula (Bankhead et al., 2009).

Because most enteral feeding formulas are hyperosmolar, it once was believed they would pull water into intestines to cause diarrhea. Formula dilution to half or three-quarter strength was common practice in an attempt to reduce diarrhea. However, current evidence suggests the osmolarity of the formula does not cause diarrhea (Trabal, Leyes, Hervás, Herrera, & de Talló Forga, 2011).

Diarrhea also can be caused by bacterial contamination if formula is allowed to stand in the feeding bag for more than 12 hours. Open cans of formula should be refrigerated and warmed to room temperature before feeding, and unused formula discarded 24 hours after opening. Administration sets should be changed every 24 hours (Enteral Nutrition Practice Recommendations Task Force, 2009).

Another factor linked to diarrhea in enterally fed patients is related to the elixir form of medications com-

monly ordered once a feeding tube is in place. Many liquid medications contain sorbitol as a sweetener to make the liquid more palatable. Sorbitol increases the osmotic pressure in the bowel by drawing in free water and becomes an effective osmotic laxative (Whelan & Schneider, 2011). Because sorbitol is an inactive additive, it is not required to list this ingredient on the medication label (Skipper, 2012). Thorson, Bliss, and Savik (2008) found receiving medications that contain sorbitol is not sufficient to cause diarrhea, but the combination of sorbitol and enteral feeding is associated significantly with an increase in the incidence of diarrhea. When an enterally fed patient develops diarrhea, all possible causes should be investigated before assuming a change in formula is needed (Thorson et al., 2008).

Tube Removal

A PEG tube is removed because a patient recovers and is able to take food orally. If the tube is removed accidentally, the stoma can close spontaneously within 4 hours. Patients at home are advised to place a catheter into the opening as a space saver until a health care provider can replace the PEG properly (Parsh, 2010). Several different types of replacement tubes currently are available and can be placed without endoscopy. The two major types are a double-lumen balloon design held in place with an internal balloon and an outer retention disk, and a non-balloon tube held in place with a soft internal dome. Both have an external device to hold the PEG in place (Wound, Ostomy & Continence Nurses Society, 2008).

Nishiwaki and co-authors (2011) recommended all tubes be removed and routinely replaced at 6-month intervals. Although it is not necessary for the patient to be restricted from oral intake for tube removal, it is desirable; any food in the stomach will leak from the PEG site after the tube is removed. Removal of the tube depends on the brand. If the brand of tube has a soft internal mushroom bolster, it can be re-

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Objectives

This continuing nursing educational (CNE) activity is designed for nurses and other health care professionals who are interested in percutaneous endoscopic gastrostomy (PEG) tubes. After studying the information presented in this article, the nurse will be able to:

1. Describe types of gastrointestinal tubes.
2. Summarize nursing care recommendations for patients with PEG tubes.
3. Discuss major and minor complications associated with PEG tubes.
4. Explain indications for PEG tube removal.

Note: The authors, editor, and education director reported no actual or potential conflict of interest in relation to this continuing nursing education article.

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moved by pulling. The patient should be told there is some discomfort as the PEG is pulled through the abdominal wall. The tube is pulled quickly and strongly as it requires significant force to pull the bumper through the PEG tract. If it has a balloon internal bolster, the balloon bumper is deflated and the tube is removed. A dressing should be placed over the site as there will be some drainage for about 24 hours. A balloon or button gastrostomy is removed by deflating the balloon and pulling the tube from the abdomen (Best et al., 2009).

Conclusion

The literature is inconsistent in recommendations for care of the patient receiving PEG feedings. To give the best possible care for patients with a PEG, nurses and future nurses need current nursing textbooks and procedure manuals that reflect the best-known evidence. Informed nursing care will enable safe enteral feedings for the patient receiving long-term nutritional support. **MSN**

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