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Clinical Practice Guidelines for the Nursing Management of Percutaneous Endoscopic Gastrostomy and Jejunostomy (PEG/PEJ) in Adult Patients

An Executive Summary

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ABSTRACT

Enteral nutrition (EN) is the introduction of nutrients into the gastrointestinal tract through a tube placed in a natural or artificial stoma. Tubes may be passed into the stomach (gastrostomy) or the jejunum (jejunostomy) in patients who cannot obtain adequate nourishing via oral feeding. Following placement, nurses are typically responsible for management of gastrostomy or other enteral tube devices in both the acute and home care settings. This article summarizes guidelines developed for nursing management of percutaneous endoscopic gastrostomy or jejunostomy (PEG/PEJ) and gastrojejunostomy (PEGJ) tubes, developed by the Italian Association of Stoma care Nurses (AIOSS—Associazione Italiana Operatori Sanitari di Stomaterapia) in collaboration with the Italian Association of Endoscopic Operators (ANOTE—Associazione Nazionale Operatori Tecniche Endoscopiche) and the Italian Association of Gastroenterology Nurses and Associates (ANIGEA—Associazione Nazionale Infermieri di Gastroenterologia e Associati). The guidelines do not contain recommendations about EN through nasogastric tubes, indications for PEG/PEJ/PEGJ positioning, composition of EN, selection of patients, type of tube, modality of administration of the EN, and gastrointestinal complications

KEY WORDS: Enteral nutrition, Feeding tube, Gastroenterology, Gastrostomy, Jejunostomy, Nursing management, PEG, PEJ, Stoma therapy.

INTRODUCTION

Enteral nutrition (EN) is the introduction of nutrients into the gastrointestinal tract through a tube. It can be administered through a natural cavity (via a nasogastric tube, NGT) or a stoma (gastrostomy or jejunostomy).[1] Various techniques can be used for the creation of gastrostomy or jejunostomy: surgical, endoscopic, and via interventional radiologic methods. Gastric and intestinal nutritional tubes introduced by endoscopic techniques are defined as percutaneous endoscopic gastrostomy (PEG) and percutaneous endoscopic jejunostomy (PEJ).[2] These devices allow long-term EN in patients with nutritional deficiencies or who are at risk of malnutrition for underlying disease such as dysphagia because of cerebrovascular or neurological diseases, head and neck tumors, facial trauma, or for the presence of clinical conditions and pathologies characterized by high catabolism (burns, cystic fibrosis, and traumas). Percutaneous endoscopic gastrojejunostomy (ie, placement of a jejunal tube through a PEG, called PEGJ) and PEJ are indicated in gastroparesis, gastroesophageal reflux,

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This study was carried out on behalf of the Italian Association of Stoma Care Nurses (AIOSS—Associazione Italiana Operatori Sanitari di Stomaterapia), Italian Association of Endoscopic Operators (ANOTE—Associazione Nazionale Operatori Tecniche Endoscopiche), and the Italian Association of Gastroenterology Nurses and Associates (ANIGEA—Associazione Nazionale Infermieri di Gastroenterologia e Associati).

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gastric resection, pancreatitis, and in case of high risk of aspiration or for intolerance to gastric juice.[3] In these cases, PEGJ or PEJ allows adequate nutritional support in patients with gastric disorders or who cannot benefit of EN via the gastric route. Enteral nutrition also may be administered in patients with enterocutaneous or enteroatmospheric fistulas since it can effectively control intestinal fluid secretion and provide sufficient nutritional intake, with no severe side effects.[96]

This article presents guidelines developed for the nursing management of percutaneous endoscopic gastrostomy/jejunostomy (PEG/PEJ) and percutaneous endoscopic gastrojejunostomy (PEGJ) tubes. For convenience in this article, considerations or recommendations about PEG/PEJ are intended to be valid for PEGJ as well. The guidelines are designed to support nurses to ensure appropriate, safe, and efficient assistance for the care of patients with PEG/PEJ. They are intended to be used by all nurses assisting patients with PEG/PEJ in the medical, surgical, and intensive care units (ICUs), nurses who work in the operating rooms, endoscopy service, artificial nutrition outpatients units, gastroenterology units, and home care services.

How to Use These Guidelines

The recommendations contained in these guidelines can be used for the management of PEG/PEJ, and surgically implanted gastrostomies and jejunostomies. Recommendations are a combination of current best evidence and best practice recommendations from clinical experts. A significant proportion of the guidelines are based on lower-level evidence or best practice recommendations. The guidelines are organized into 5 sections: (1) patient preparation for PEG/PEJ placement and monitoring; (2) management of the stoma and EN tube, administration of EN and drugs, prevention of administration mistakes; (3) management of early and late complications; (4) patient and/or caregiver training for the management of the nutritional tube and administration of the EN and drugs; and (5) tube replacement. These guidelines do not provide recommendations about the insertion or use of the NGT, PEG/PEJ positioning, type of EN, selection of patients, type of tube, modality of administration, and gastrointestinal complications.

METHODS

The guidelines for EN through PEG/PEJ were developed from a collaboration between the Italian Association of Stoma care Nurses (AIOSS), the Italian Association of Endoscopic Operators (ANOTE), and the Italian Association of Gastroenterology Nurses and Associates (ANIGEA). The collaborative group comprised professionals with clinical, scientific, and methodological expertise in the area of EN and care the associated stoma. The PICO (population, intervention, control, and outcomes) method was used to formulate research questions and search strings.[4] The main PICO queries and major key words used to inform literature review are listed in Table 1. This review was undertaken by all the components of the research group supervised by members of the EBN Study Center of Bologna.

A systematic review of the literature was performed using 2 electronic databases (MEDLINE and CINAHL) and 4 secondary databases (Cochrane Library, US National Guideline Clearinghouse, Joanna Briggs Institute, and EBN Center of Bologna); we searched for elements published between 2012 and 2015. All clinical studies (including multiple case series and case reports) published in English, French, Spanish, Portuguese, German, and Italian were evaluated. After careful review a level of evidence was assigned to each study based on the SIGN (Scottish Intercollegiate Guidelines Network) taxonomy (Table 2). The group then generated recommendations for clinical practice, and their underlying strength was also ranked using the SIGN taxonomy (Table 3).[5] The final version of these guidelines is the result of the review of the first draft by a group of experts external to the working group, that has helped define and validate evidence-based recommendations. A subsequent consensus conference with representatives of the major scientific societies in this field—medical, nursing, and patients associations (see the Acknowledgment section)—contributed to

TABLE 1.
Main PICO Queries and Major Key Words Used for the Literature Review[a]

Query 1	*Patient preparation for PEG/PEJ procedure* Key words: "gastrostomy," "gastrostomy tube," "feeding tube," "feeding tube placement," "enteral tube feeding," "percutaneous endoscopic gastrostomy," "intubation, gastrointestinal," "gastrostomy tube insertion," "jejunostomy," "percutaneous endoscopic jejunostomy," "preoperative care," "perioperative care," "preanesthetic medication," "perioperative period," "premedication," "oral hygiene," "hair removal," "posture," and "patient positioning"
Query 2	*Nursing management of early and late complications of PEG/PEJ* Key words: "gastrostomy site," "hemorrhage," "intraoperative complications," "postoperative complications," "adverse effects," "surgical wound infection," "infection," "wound infection," "intraabdominal infections," "catheter-related infections," "hyperplasia," "granuloma," "hypertrophy," "hypergranulation tissue," "catheter-related infections," "pyoderma," "skin diseases," "dermatitis," "erythema," "skin ulcer," "occlusion," "blockage," "catheter obstruction," "buried bumper syndrome," "foreign-body migration," "leakage," "aspiration," "regurgitation," "pneumonia, aspiration," and "respiratory aspiration of gastric contents"
Query 3	*Administration of drugs and enteral nutrition, patient and caregiver training, nutritional assessment* Key words: "enteral tube feeding," "enteral tube flushing," "enteral nutrition," "gastric residual volume," "gastric residual volume management," "medication administration," "drug administration," "oral drug administration," "medication errors," "medication error prevention," "home nursing," "domiciliary care," "caregiver," and "caregiver education"
Query 4	*PEG/PEJ management* Key words: "enteral tube flushing," "enteral tube irrigation," "gastrostomy exit site management," "gastrostomy tube aftercare," "gastrostomy tube dressing," "jejunostomy tube dressing," "gastrostomy tube care," "jejunostomy tube care," and "nursing care"
Query 5	*Tube replacement: planned and emergency settings* Key words: "gastrostomy tube substitution," "jejunostomy tube substitution," "gastrostomy tube replacement," "jejunostomy tube replacement," "percutaneous endoscopic gastrostomy replacement," "percutaneous endoscopic jejunostomy replacement," "percutaneous endoscopic gastrostomy tube removal," "percutaneous endoscopic Jejunostomy tube removal," and "feeding device replacement complications"

Abbreviations: PEG, percutaneous endoscopic gastrostomy; PEJ, percutaneous endoscopic jejunostomy.
[a]*Limits*: "2000/01/01"[PDAT] : "2015/12/31"[PDAT]) AND "humans"[MeSH Terms] AND (English[lang] OR French[lang] OR German[lang] OR Italian[lang] OR Portuguese[lang] OR Spanish[lang])).

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TABLE 2.
Levels of Evidence

1++	High-quality meta-analyses, high-quality systematic reviews of randomized clinical trials or randomized clinical trials with very low risk of bias
1+	Well-conducted meta-analyses, systematic review of clinical trials, or well-conducted clinical trials with low risk of bias
1−	Meta-analyses, systematic reviews of clinical trials, or clinical trials with high risk of bias
2++	High-quality systematic reviews of cohort or case control studies; cohort or case control studies with very low risk of bias and high probability of establishing a causal relationship
2+	Well-conducted cohort or case control studies with low risk of bias and moderate probability of establishing a causal relationship
2−	Cohort or case control studies with high risk of bias and significant risk that the relationship is not causal
3	No-analytical studies, such as case reports and case series
4	Expert opinion

validation of guideline recommendations. During the consensus conference, all points not supported by high-level scientific evidence were faced with free response questions and their strength of recommendation was defined as CC. An Italian-language version of these guidelines was previously posted on http://www.aioss.it/assets/linee-guida-peg-2016.pdf in 2016 and printed as a booklet for the members of the collaborating associations. The development of the guidelines was financially supported by the participating professional associations. There were no financial contributions from third parties, either public or private.

Section 1: Patient Preparation for PEG/PEJ Procedures and Perioperative Monitoring

Guidelines suggest that the patient should have fasted for over 6 hours for solid food and 2 to 3 hours for fluids[6-8]; refer to your facility's guidelines or protocols for recommendations regarding fasting prior to PEG/PEJ tube placement (strength of recommendation D-GPP) (Table 2). Guidelines from the United Kingdom recommend fasting for over 6 hours before PEG/PEJ procedures to allow gastric emptying; however, no level of evidence for this recommendation is reported.[6,7] The European Society for Clinical Nutrition and Metabolism guidelines[9] and 2 published guides for PEG/PEJ care recommend fasting for over 8 hours before the procedure.[10,11] Peristomal infection is the most common complication following PEG/PEJ tube placement; and its incidence ranges from 4% to 30%.[97] Several interventions are recommended for prevention of infection at the tube placement site. The first is antibiotic prophylaxis administered 30 minutes before the procedure (strength of recommendation A, level of evidence 1+).[12-15] The second is use of a mouthwash with an oral chlorhexidine solution to reduce bacterial burden (strength of recommendation B); this recommendation is based on evidence from 4 systematic reviews about prevention of pulmonary infections in patients undergoing mechanical ventilation, which is reported to reduce bacterial counts and prevent pneumonia up to 40%.[16-19] Manual or mechanic tooth brushing alone is not recommended; current best evidence indicates it does not reduce pulmonary infection occurrences (level of evidence 1+).[20] Preoperative hair clipping is also recommended if hair in the area of tube insertion, which is likely to interfere with the procedure; use of an electric shaver is recommended (strength of recommendation A).[20]

Application of standard measures for infection prevention is recommended including aseptic preparation of the surgical field and preoperative handwashing. In order to reduce the risk of colonic perforation, the patient should be positioned in a reverse or anti-Trendelenburg position during the procedure (strength of recommendation D-GPP). The prevention of gastrocolocutaneous fistula is based on the correct execution of the PEG procedure via a "safe track technique," defined as use of an aspirating syringe filled with saline in order to identify intervening bowel between the skin and the stomach if air bubbles appear in the syringe prior to endoscopic visualization of the needle in the gastric lumen[98] (level of evidence 3).[21,22]

Checklists that serve as reminders of all steps prior to tube placement including identification of the patient, written informed consent, fasting, peripheral venous access, antibiotic prophylaxis, management of the antithrombotic/anticoagulant therapy, oral hygiene, hair removal, and patient positioning are recommended (strength of recommendation CC). During tube placement, routine monitoring of the patient's heart rate, blood pressure, pulse oximetry, and body temperature

TABLE 3.
Grades of Recommendation

A	At least 1 meta-analysis, systematic review, or clinical trial classified as 1++ and directly applicable to the target population of the guidelines, or a volume of scientific evidence comprising studies classified as 1+ and which are highly consistent with each other.
B	A body of scientific evidence comprising studies classified as 2++, directly applicable to the target population of the guideline and highly consistent with each other, or scientific evidence extrapolated from studies classified as 1++ or 1+.
C	A body of scientific evidence comprising studies classified as 2+, directly applicable to the target population of the guideline and highly consistent with each other, or scientific evidence extrapolated from studies classified as 2++.
D	Level 3 or 4 scientific evidence, or scientific evidence extrapolated from studies classified as 2+. Consensus conference.
D-GPP	Good practice points. Recommended best practice based on the clinical experience of the guidelines development group.
CC	Recommendation resulted from the consensus conference.

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is recommended in order to promptly recognize and reduce negative outcomes arising from hypoxemia and hypercapnia during sedation (strength of recommendation C).[1,21,23]

Procedure-related documentation should include the modality of PEG/PEJ tube insertion, its type and size, the mode of internal and external fixation, the amount of water in the internal balloon (if one is used), the modality of removal (by traction or via endoscopy), the length of the tube at the skin level, the presence of any stitches for fixation, and the position of the tip of the gastric tube (stomach, duodenum, and jejunum). Record any problems or complications that occurred during the procedure (strength of recommendation D, level of evidence 4).[1,24]

We also recommend providing patients with a "clinical passport." The passport should provide demographic information (name and surname, date of birth, address, telephone number, and native language). It should also identify an emergency contact, allergies, blood type, and major comorbid conditions. In addition, the passport should document the type of device used for EN, its caliber, length of the tube beyond skin level, type of internal fixation, grade of deflatable internal fixator filling, and date of insertion. Finally, the passport should list contact information for the individual's primary care physician and other health care professionals or health services.

Monitoring During the Initial 72 Hours After EN Tube Placement

We recommend monitoring heart rate, blood pressure, temperature, respiratory frequency, oxygen saturation, presence of pain, nausea, and grade of sedation every 15 minutes for the first 3 hours following EN tube placement. If the patient is stable, vitals may be monitored every 30 minutes for the next 3 hours. If the patient continues to be stable, monitor the vitals every 6 hours for the next 12 hours. Due to the expected difficulties in performing such intensive monitoring, we acknowledge that the level of monitoring may vary based on care setting and techniques used for EN tube insertion (strength of recommendation D-GPP).[25,26]

We also recommended using the "red flag alerts" identified by the National Patient Safety Agency, a system used to report adverse events to the British National Health System.[25] The red flag alerts are (1) severe pain not responding to routine analgesics or increasing when the tube is used for washing or infuse fluids; (2) active bleeding (small bleeding is normal after the procedure and may require an adequate dressing), discharge of gastric fluid, or mixture nutrient from the stoma; (3) a sudden change in the individual's vital signs or clinical condition; and (4) a sudden change in level of consciousness or behavior (level of evidence 4).[25] We recommend that any type of administration through the tube should be discontinued and the physician notified promptly, should any of these signs occur during the first 72 hours following tube placement (strength of recommendation D-GPP, level of evidence 3).[8,24-26]

The position of a PEG/PEJ tube should be checked daily. We recommend using the length of the external tube at the skin level or indelible mark affixed as a reference point. This point should be compared to the length reported in the clinical documentation after its placement. The exit site should also be assessed for signs of inflammation, infection, hypergranulation tissue, pressure injury, or erosion. Document each mark detected and the treatment undertaken (strength of recommendation D-GPP).[24,27-29]

Section 2: Management of the Stoma and Tube

Since these guidelines provide recommendations for adult patients with longer tubes (and not low-profile tubes or children), the external fixation device should be placed 0.5 cm above the skin to avoid excessive tension between interior and exterior fixers, and to reduce the risk of ischemia, necrosis, infection, and buried bumper syndrome (BBS). The choice of 0.5 cm represents a compromise between some who suggest a 1- to 3-mm distance between the external bumper and the skin[33,34] and others who propose a distance of 10 to 15 mm.[8,26,35,36] Buried bumper syndrome is an uncommon but serious complication characterized by a mucosal overgrowth following the migration into the gastric wall of the internal fixation device, or "bumper." Care should be taken to avoid creating too much distance between the external fixer and the skin to prevent fixation of the gastric wall to the abdominal wall and formation of a gastrocutaneous fistula. Proper placement also prevents/avoids excessive tube movement and unintended enlargement of the stoma (strength of recommendation D).[24,27,30-32]

The clinician should mark the exit point of the tube from the abdominal wall with a permanent marker. This action allows identification of dislocation of the tube; daily checks of tube placement are recommended (strength of recommendation C, level of evidence 2+).[1,36]

Cleanse the stoma and peristomal skin of the gastric or jejunal EN tube with sterile saline and gauze 24 hours after placement to remove any discharge or material around the tube. If necessary, cover the stoma with a sterile gauze in order to absorb exudate or other fluids. Cleanse the stoma and peristomal skin with sterile solution every day for the first week.[1,24,27,28,37] Assess the stoma and peristomal skin daily for signs of inflammation, infection, pressure injury, bruises, and hypergranulation tissue. Document results of assessment and treatment used to manage stomal or peristomal complications (strength of recommendation D, level of evidence 4).[27-29]

After 7 to 10 days, the output point of the tube can be cleansed (after loosening the external fixer, if necessary) with running water and nonperfumed soap using a clean cloth. Affix a dressing under the exterior bumper, and replace it when necessary, such as with persistent leakage of fluid around the stoma, to prevent moisture-associated skin damage to the peristomal skin.[9,24,27,28,37] Avoid use of creams or powders around to the stoma to prevent proliferation of pathogens.[27,38]

Several authors suggest placing the dressing above the external fixer to avoid excessive tension between the fixation device and the skin.[38-40] This arrangement also enables the dressing to absorb any peristomal leakage. If the exterior fixer is placed 5 mm above the skin, the dressing can be placed under the bumper, if not too thick (strength of recommendation D, level of evidence 4). Rotate the position of the gastrostomy tube 360° after the first 24 hours to prevent adhesion,[24,30,38] and repeat this maneuver at least once weekly, but no more than once daily, to prevent BBS (strength of recommendation D, level of evidence 4).[24,26,29,30,37]

We recommend against rotating jejunal tubes in order to avoid perforation. If the external fixation device of a PEGJ is not stitched in place, it is anchored by an internal fixation device. The external fixation device can be released, and the stoma cleaned. We also recommend avoiding rotation of a PEGJ because the jejunal

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extension lacks a retaining disc and rotation could displace the tube (strength of recommendation D, level of evidence 4).[24,28,38,99]

In addition to rotation of the PEG tube described earlier, the risk of BBS may be reduced by gently pushing the EN tube into the stomach 2 to 3 cm after loosening the exterior fixer, and then gently pulling it back until it reaches the area of minimal resistance (the internal gastric wall). The maneuver should be repeated at least once weekly, and no more than once daily. This push/pull maneuver should not be initiated until 7 to 10 days after initial insertion of a PEG tube, when the gastrocutaneous tract has healed (strength of recommendation D, level of evidence 4).[24,27,28,34]

A gastric tube with a retention balloon should be inflated with distilled water to prevent precipitation of salt or encrustations with subsequent failure of balloon deflation. Clinicians should follow manufacturer's recommendations concerning inflation and deflation of retention balloons (strength of recommendation D, level of evidence 4).[35,38,40,41] Check the volume of fluid in the balloon (to prevent accidental dislocations of the tube), and the clarity of the solution (to highlight possible losses) once weekly. If precipitate is noted, the tube should be replaced and the retention balloon filled with distilled water (strength of recommendation D).[24,35]

Administering Nutrition and Drugs

Enteral nutrition can be initiated as soon as 4 hours after PEG/PEJ placement (strength of recommendation A).[1,10,24,26,32,42] Start with 50 mL of pure water and assess the patient for any red flag alerts during the first hour following administration (strength of recommendation D-GPP).[8,10,25,26] Before administering EN, verify the correct placement of the tube by assessing the length of exposed tubing as described previously (strength of recommendation D, level of evidence 4).[24,27,28,37,40] Use disposable gloves when administering nutrition and replace the nutritional set every 24 hours (strength of recommendation A).[1,27] Irrigate the EN tube with 15 to 30 mL of pure water every 4 to 6 hours (when continuous nutrition is administered), or after each bolus injection of EN or administration of drugs to prevent tube obstruction. Jejunal tubes tend to have smaller calibers than gastric tubes, and particular attention should be paid to strategies to avoid obstruction (strength of recommendation B, level of evidence 2++).[1,38] Use sterile water in immunocompromised or critical patients if there are concerns about the safety of the pure water[1] (strength of recommendation D, level of evidence 4).

Implement a protocol to maintain the patency of the PEG/PEJ tube in people with restricted fluid intake (strength of recommendation C). The protocol should include standardized instructions to prevent occlusion of the lumen of the tube, as flushing with 10-mL filtered water every 6 hours with continuous infusions, flushing with 10 ml after administering a drug, complement, or interruption of nutrition, and flushing with 5 mL of filtered water before drug or complement administration or before beginning EN infusion. This recommendation is based on a nonrandomized study in patients in ICUs with NGT; implementation of the protocol resulted in a significant reduction in the NGT obstructions in critically-ill patients with fluid restriction (level of evidence 2+).[43]

Preventing Reflux or Aspiration of Gastric Contents

In the absence of contraindications, elevate the head of the bed 30° to 45° to prevent reflux or aspiration of gastric contents and maintain this position for at least 1 hour after the end of the administration (strength of the recommendation A).[1,10,30,37,40] This recommendation is also strongly supported by a 2011 Spanish Society of Parenteral and Enteral Nutrition consensus document and 2009 American Society of parenteral and Enteral Nutrition guidelines for prevention of the gastric reflux and aspiration pneumonia together with the postpyloric EN, the use of prokinetic drugs and oral hygiene with chlorhexidine gluconate (level of evidence 1+).[38,46] We recommend placing the patient who cannot tolerate a semi-Fowler position in a reverse- or anti-Trendelenburg position (strength of recommendation D).[1,38]

Monitor gastric residual volume and emptying time every 4 hours during the first 48 hours of continuous EN or before every bolus when administering intermittent EN in patients with PEG to prevent nausea, reflux, abdominal distension, and aspiration pneumonia. Do not stop EN if the residual volume is less than 500 mL; rather, monitor these individuals every 6 to 8 hours (strength of recommendation D).[1,10,37,40,44]

Modality of Drug Administration

Administer drugs given via EN separately from nutritional preparations to avoid interactions, obstruction of the tube, or altered absorption and onset of action of drugs. Administer drugs labeled as "for oral use only" whenever possible (strength of recommendation C).[1] Whenever possible, select a liquid formulation of a particular drug or crush and dissolve tablets in pure water (strength of recommendation C, level of evidence 2+).[1,27,48-52] Stop EN before the administration of drugs and irrigate the tube with 15mL of lukewarm water. At the end of the administration, irrigate the tube with the same quantity of water. Wait 30 to 60 minutes before restarting EN (strength of recommendation A, level of evidence 1+).[1,27,50]

Use medical devices specifically designed for enteral and avoid devices designed for parenteral administration (strength of recommendation D-GPP). Refer to national, regional, or facility policies for prevention of errors in enteral administration. In the United States, the Joint Commission on Accreditation of Healthcare Organizations and the National Patient Safety Agency provide guidelines concerning prevention of errors when administering enteral versus parenteral nutrition.[53-56] In Italy, the Minister of Health has recommended use of enteral devices consistent with European standards (strength of recommendation D-GPP).[1,32,50]

Nursing Management of Common Complications

The most frequent complications in PEG/PEJ are bleeding, leakage, peristomal skin damage (inflammation, infection, and hypergranulation), tube occlusion or dislocation, and BBS,[24,30,57-61,63,64,67-70] Because of the risk for bleeding associated with PEG/PEJ procedures, the patient should be screened preoperatively for bleeding disorders and for use of anticoagulant/antiaggregant therapy (level of evidence 3, strength of recommendation D).[57,58]

Leakage from around the EN tube may result from enlargement of the stoma due to traction on the tube, weight loss, underinflation or rupture of the internal bumper, increased abdominal pressure, higher residual gastric volume, and BBS.[11,24,30,45,59-61] Prevention of leakage includes securement of the tube in a manner that avoids excessive traction, regular adjustment of the internal bumper, replacement of the tube before degeneration, prevention of constipation, treatment

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of coughing, and control of residual gastric volume. Do not replace an EN but with a larger tube, as this may cause enlargement of the tract, resulting in exacerbation of the leakage (strength of recommendation D).[11,24,32,45,59-61]

Peristomal moisture-associated skin damage may be caused by poor placement of the tube, excessive traction or laxity of the fixers, and contact of the gastric fluid with the skin.[24,30] Protect the skin with a nonocclusive dressings, keeping it clean and dry, and change the dressing frequently (strength of recommendation D).[24,30] Hyperhydrated and inflamed skin promotes growth of coliform microorganisms. Regular cleansing of the skin and antibiotic prophylaxis are first-line interventions preventing cutaneous infections.[11-14,60,62-66] Secondary prevention is based on early detection of signs and symptoms of infection such as loss of skin integrity, erythema, purulent and/or malodorous exudate, fever, and pain. Routine skin care and antimicrobials are also used to treat peristomal cutaneous infections (strength of recommendation D).[24]

Medical device-related pressure injuries may occur. Regularly assess the position of the external disc of the fixation device and readjust it to 5 mm from the abdomen when indicated. Rotate EN tubes regularly and regularly assess tube placement to reduce the risk for pressure injuries. Consider the effects of changes in body weight on pressure injury risk (strength of recommendation D).[24,30,67]

Peristomal hypergranulation tissue may form in response to excessive humidity and friction.[24,60,63,64,68-70] Prevent its formation by cleansing the peristomal skin at least once daily and minimize friction from the EN tube on the stoma by stabilizing the tube and its extensions. Local treatment includes application of nonocclusive dressings such as polyurethane foam under the external fixer or use of antimicrobial agents like polyhexanide. If these treatments do not lead to satisfactory results, refer to physician to consider alternative treatments such as topical corticosteroids or silver nitrate (strength of recommendation D).[24,30,68,70,71]

Occlusion of the EN tube causes slowing or interruption of delivery of nutritional or other agents through the tube. Obstruction also may be attributable to viscosity of infused solutions, caliber of the tube, formation of biofilm or encrustation within the lumen of the tube, or insufficient irrigation following administration of nutritional preparations or drugs.[49,59,67] Preventive interventions include regular irrigation with water as described previously and following the manufacturer's recommendations when constituting and administering nutritional or pharmacologic agents.[30,45,59,62,63] If occlusion occurs, implement the following recommendations in this order: (1) irrigate the EN tube with lukewarm water using a gentle "push and pull" technique; (2) if this strategy fails to reverse occlusion, use an 8.4% NaHCO3 solution; and (3) if strategies 1 and 2 fail, irrigate with pancreatic enzymes diluted in water plus NaHCO3 solution closing the tube for 5 to 10 minutes.[47,49,62,67,73,74] If all these strategies fail, use a brush to mechanically dislodge obstructing materials. Do not use sodas or cranberry juice, since they can worsen the occlusion (strength of recommendation D). If the occlusion is due to fungal infection, the tube must be replaced (strength of recommendation CC).[30,47,49,59,60,67,73]

Tube dislocation, defined as unintended movement out of the stoma, toward the esophagus or toward the pylorus/duodenum, may occur, resulting in obstruction. Prevent dislocation by regular assessment of the external fixation disc; assess its mechanical seal, length of the exposed tube, and volume of fluid in the retention balloon; all must be consistent with parameters documented after tube placement (strength of recommendation D).[10,11,63,67,75]

Gastrostomy tubes for EN should be regularly replaced every 4 to 6 weeks. If the tube is unintentionally dislodged, attempt reintroduction. If a replacement gastrostomy tube is not available, an indwelling urinary catheter may be gently inserted until a new gastrostomy tube can be placed (strength of recommendation D).[28,59,63] Consult the physician immediately if a jejunal or gastrostomy tube is dislocated within 4 weeks of placement. Under these circumstances, replacement should occur under endoscopic or radiological guidance (strength of recommendation D).[41,59] In the case of pyloric or duodenal migration (indicated by a different length of the tube at skin level to that reported after its placement), gently manipulate the tube back into its original position (strength of recommendation D-GPP).[63,67,76]

Buried bumper syndrome is caused by excessive traction of the tube and/or fixers resulting in ischemia and necrosis of the gastric epithelium and migration of the internal fixer into the gastric wall.[1,32,62,77,78] Prevent BBS by maintaining a minimum distance between the internal and external fixation devices in such a way that the external one should be separated from the skin of at least 0.5 cm,[32,33,59] daily to weekly rotation of the tube, and retraction of the tube (strength of recommendation D)[24,27,28,60,63,79] In the case of BBS, the tube must be removed and may require endoscopic guidance when replaced.[32,69,77,79]

Rare complications associated with EN include necrotizing fasciitis, gastrocolic fistula, and peritonitis. Necrotizing fasciitis is a rare but serious complication of EN tubes characterized by erythema and edema, high fever, cellulitis, septic shock, and death.[72] Preventive strategies include avoidance of excessive traction between the internal and external fixer and maintaining the external fixer at 0.5 cm from the skin plane (strength of recommendation D).[11,67,81] Gastrocolic fistulae may occur with accidental puncture of the colonic wall interposed between the stomach and the abdominal wall during the PEG positioning. Clinical manifestations are diarrhea and dehydration. The transverse colon is at the greatest risk. Additional risk factors are insufficient gastric inflation and previous abdominal operations.[62,82] Peritonitis may occur before consolidation of a fistula occurs. Prevention is based on correct location of the EN tube and prompt recognition of signs and symptoms of fistula or peritonitis.[21,80,83]

Section 4: Education for Patients and Caregivers

Provide written instructions about care of the EN tube. Ensure educational materials are clear and written at an appropriate level for patients and lay care providers. Incorporate photographs and diagrams into educational materials whenever indicated. Provide a replacement EN in case of dislocation and key telephone contacts (strength of recommendation D).[27,48,64,85] Advise patients and caregivers to stop the EN infusion immediately and seek professional advice if the patient experiences pain during nutritional infusion, prolonged pain after the procedure, passage of nutritional fluids or drugs through the stoma, or bleeding (strength of recommendation D-GPP).[60,86,87] Patients and caregivers should be taught all pertinent procedures regarding the administration of EN or drugs along with techniques for connecting and disconnecting all tubes and connectors (strength of recommendation D-GPP).[53-56,89]

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Counsel patients about oral hygiene and care. The teeth and gums should be brushed twice daily with a toothbrush and toothpaste (strength of recommendation D).[30,38,88]

Section 5: Tube Replacement and Methods to Assess Tube Position

All tubes should be replaced according to the manufacturer's directions (strength of recommendation D).[9,11,27,30,32,59,90,91] Prior to routine (anticipated) tube replacement, the patient should refrain from fluid intake for 2 hours and nutritional intake for 4 hours. Administer only essential drugs during this period (strength of recommendation D).[10,91]

We recommend performing the first planned tube change in a clinic or hospital environment (strength of recommendation D).[84] After initial healing of the stoma (at least 1 month from the first tube placement), replacement may be completed in the home care setting by patients themselves or by a nurse if patients are not able to perform it (strength of recommendation D).[11,20,90]

Gently insert the new tube in the fistula, verifying the correct positioning in the gastric cavity. Radiographic or endoscopic imaging is considered the gold standard for confirming placement of EN tubes (strength of recommendation D).[30,90,92,93] Alternative techniques to check for tube placement are (1) aspiration of gastric contents and confirmation that the pH is 5 or less (strength of recommendation D),[30,32,45,58,90-94] (2) irrigation of the tube with 3 to 50 mL of sterile water without resistance or leakage from around the stoma (strength of recommendation D),[30.45,90] (3) assessment of the external length of the tube (strength of recommendation D),[30,90,92,93] and (4) manipulation of the tube via rotation and in-out movement (strength of recommendation D).[30,90] Do not introduce air through the tube while listening to peristalsis; this technique has proved unreliable for confirmation of tube placement; specifically, it was failed to distinguish whether peristalsis originated from the stomach or intestine (strength of recommendation B).[30.90,92] Document scheduled and unplanned tube replacements along with characteristics of the tube and aspirated materials (strength of recommendation D).[91,95]

CONCLUSIONS

The guidelines presented in this article describe care of adults with PEG, PEJ, PEGJ, or surgically implanted gastrostomies and jejunostomies. They are intended to be used by nurses caring for patients with EN in all care settings, including acute and critical care facilities, operating rooms, digestive endoscopy services, artificial nutrition outpatient units, gastroenterology units, and home care.

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