Percutaneous gastrostomy: troubleshooting complications

Percutaneous endoscopic gastrostomy was first described in 1980 (Gauderer et al, 1980), superseding surgical gastrostomy as a means of providing long-term enteral nutrition. Despite the commonality of this procedure, its associated morbidity and mortality rates are significant, with directly attributable rates of 1:30 and 1:150 respectively.

Poor patient selection and poor management are the principal factors contributing to adverse outcomes. The 2004 National Confidential Enquiry into Patient Outcome and Death recorded that 19% of percutaneous endoscopic gastrostomy procedures performed were 'futile or not indicated at all'. This article provides a practical approach to avoiding and treating complications associated with percutaneous endoscopic gastrostomy feeding.

Avoiding complications

Three factors are important when contemplating insertion of a percutaneous endoscopic gastrostomy: 'patient', 'procedure' and 'preparation'. Each case should be considered on its own merits, taking into account the clinical scenario, underlying diagnosis and prognosis, patient wishes, ethical issues, and expected impact on quality of life.

Appropriate patient?

Table 1 describes the common indications for percutaneous endoscopic gastrostomy feeding, and *Figure 1* outlines contraindications. It is indicated in patients expected to be unable to maintain adequate oral intake for at least 2–3 weeks (Löser et al, 2005), in the absence of limited life expectancy.

The issue of percutaneous endoscopic gastrostomy use in patients with advanced dementia is contentious. Although there have been concerns that procedural risks may be much higher in these individuals, there is variability between case series and much of the observational data have potential confounding factors (Dharmarajan et al, 2001; Higaki et al, 2008). Nonetheless, there is currently no clear evidence that percutaneous endoscopic gastrostomy feeding increases survival, reduces risk of aspiration or improves quality of life in these patients. Consequently, the decision to proceed with an invasive procedure requires careful consideration and sensitive discussion about realistic goals of treatment (Peck et al, 2014).

Ethical considerations often arise in relation to artificial nutritional support. Therefore, it is important to take a multidisciplinary team approach when assessing patient suitability for percutaneous endoscopic gastrostomy insertion. In UK law, tube feeding is regarded as a medical treatment, requiring patient consent. The physician is ultimately responsible for the decision to provide, withhold or withdraw supplemental nutrition to an adult patient lacking mental capacity (in the absence of an advance directive or person with medical power of attorney). Family members and the patient's next of kin should be consulted (or an independent mental capacity advocate if none available), but generally do not have formal decision-making responsibility (Lennard-Jones, 2000). A report from the Royal College of Physicians and British

Table 1. Indications for percutaneous endoscopic gastrostomy

Indication	Example
Selected cognitive impairment	Head injury, stroke, dementia in carefully selected cases
Neurologically unsafe swallow	Stroke, multiple sclerosis, motor neurone disease, Parkinson's disease, cerebral palsy
Mechanical disorders of swallowing	Oropharyngeal and oesophageal malignancy or strictures, facial injury requiring reconstructive surgery with prolonged recovery
Partial failure of intestinal function, where nutritional requirements cannot be met by oral intake alone	Short bowel syndrome, fistulae, cystic fibrosis, Crohn's disease, palliative drainage of gastric secretions in presence of chronic gastrointestinal stenosis or ileus

Adapted from Stroud et al (2003)

Figure 1. Contraindications to percutaneous endoscopic gastrostomy. Adapted from Löser et al (2005).

- Serious coagulation disorders (international normalized ratio >1.4, platelets <50–80 x 10^9/litre)
- Interposed organs (e.g. liver, colon)
- Marked peritoneal carcinomatosis
- Severe ascites
- Peritonitis
- Planned oesophagectomy
- Severe psychosis
- Limited life expectancy
- End-stage dementia (unless multidisciplinary agreement that procedure is in patient's best interests)

Prior abdominal surgery is not a contraindication, but is associated with a higher risk of colonic perforation. Intra-abdominal varices are a relative contraindication

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Society of Gastroenterology (2010) describes ethical considerations regarding adjunctive feeding in anorexia. Adjunctive feeding can be provided for patients being treated for anorexia nervosa against their will. Feeding should never be withheld unless it is deemed futile by the clinical team.

Appropriate procedure?

The enteral feeding method should match the patient's needs. Nasogastric tube feeding should be used when the anticipated duration required is less than 3 weeks (Löser et al, 2005), with nasojejunal tube feeding in those at risk of aspiration. A jejunal extension tube can be fitted to percutaneous endoscopic gastrostomy tubes if aspiration of gastric contents has been demonstrated or suspected, although this may not be preventative.

Appropriate preparation?

Table 2 summarizes a number of practical considerations that are helpful in optimizing outcomes of percutaneous endoscopic gastrostomy placement. In particular:

- Blood tests taken within the previous 5 days are needed to exclude coagulopathy in patients at risk of bleeding (aim for international normalized ratio <1.5), thrombocytopaenia (aim for platelet count >50–80x10^9/litre), and significant anaemia (aim for haemoglobin >100 g/litre) (Löser et al, 2005).
- Stop drugs that interfere with coagulation. Warfarin should be stopped for 5 days before percutaneous endoscopic gastrostomy insertion (with demonstration of international normalized ratio normalization), dabigatran or rivaroxaban for 3 days, and apixaban for 2 days (Scaglione, 2013). High risk patients can be bridged with low molecular weight heparin, which should be stopped 24 hours before the procedure. Prophylactic dose low molecular weight heparin and low dose aspirin can be continued. Clopidogrel should be stopped for 7 days in patients at low risk of thrombosis, but first discuss with a cardiologist in high-risk patients (e.g. those with recent coronary artery stents).
- Meticillin-resistant *Staphylococcus aureus*-colonized patients should have topical suppression therapy before percutaneous endoscopic gastrostomy placement.
- Treat overt sepsis before percutaneous endoscopic gastrostomy insertion.
- Ensure the patient is nil by mouth for at least 8 hours before the procedure, although essential medication should be given (e.g. anti-Parkinson's therapy or anticonvulsants).
- Percutaneous endoscopic gastrostomy should be performed in the morning, so that immediate complications can be recognized within working hours.
- Periprocedural intravenous antibiotics (e.g. ceftriaxone) should be administered.
- Medical and nursing staff should adhere to post-procedure advice.

Table 2. Avoiding complications

Before procedure	Optimize nutritional state
	Treat intercurrent sepsis
	Normalize haemoglobin, platelets and coagulation parameters
	Obtain informed consent
	Fast for at least 8 hours (except for essential tablets)
	Peri-procedural antibiotic prophylaxis
Subsequent to procedure	Maintain low tension traction on external fixation plate for 24 hours
	Loosen external fixation device to 1 cm from the skin surface after 24 hours
	Rotate feeding tube 360° weekly (unless jejunal extension tube in situ)
	Clean tube and renew dressings, initially daily
	Nutrients can be administered 4 hours after uncomplicated tube placement
	Ensure multi-professional support via nutrition team

Adapted from Löser et al (2005)

Complications of percutaneous endoscopic gastrostomy

The percutaneous endoscopic gastrostomy procedure has been quoted as having a 30-day mortality rate of between 10% and 29% (O'Toole, 2006), mostly related to underlying comorbidity such as advanced dementia (Abuksis et al, 2000). Mortality rates associated directly with the procedure are considerably lower (0.7–2%). Major complications occur after about 3% of procedures, whereas minor complications occur in over 20%. Rates are similar regardless of the percutaneous endoscopic gastrostomy technique used (O'Toole, 2006). Complications are more common in the context of malignant disease, severe malnutrition, extreme old age, diabetes and hypoalbuminaemia. Early complications associated with percutaneous endoscopic gastrostomy are shown in *Table 3* and late complications are shown in *Table 4*.

Immediate complications

Haemorrhage

Blood loss can prove fatal following insertion of a percutaneous endoscopic gastrostomy. If the result of vessel damage, it may respond to tightening the intra-gastric flange against the skin. If haemodynamic instability persists, interventional angiography or surgery may be necessary.

Recommendations

Correct coagulopathy before percutaneous endoscopic gastrostomy insertion (Veitch et al, 2016). Endoscopists must have adequate training to minimize the number of passes made with the trochar at the time of percutaneous endoscopic gastrostomy insertion.

Peritonitis

Peritonitis can occur either immediately following the procedure, or soon after feeding commences. It typically presents with fever, abdominal pain and leukocytosis.

Recommendations

Peritonitis occurring before feeding has commenced, or following colonic perforation, requires exploratory laparotomy (Westaby et al, 2010). Peritonitis, without colonic perforation as confirmed by

Table 3. Early complications of percutaneous endoscopic gastrostomy placement

Complication	Prevention	Management
Post-procedural pneumonia	Treat sepsis before percutaneous endoscopic gastrostomy placement. Optimize mouth care. Radiologically inserted gastrostomy if ventilatory impairment. Avoid throat analgesia and excess sedation during insertion; use liberal oral suction	Early identification and antibiotic therapy
Bleeding	Delay percutaneous endoscopic gastrostomy if coagulopathy	Apply traction to internal bumper. Consider surgery
Early peristomal infection	Optimal wound care. Avoid excessive tightening of external fixator	Local antisepsis and/or systemic antibiotic therapy
Peritonitis	Experienced endoscopist to place percutaneous endoscopic gastrostomy	Exploratory laparotomy if occurs before feed, or if radiology demonstrates displaced bumper or leakage into peritoneal cavity. Otherwise conservative management with antibiotics
Displacement (early)	Ensure traction maintained on internal bumper for 4 weeks after percutaneous endoscopic gastrostomy, allowing 10 mm 'play'	Consider replacement under radiological guidance if within 2–4 weeks of initial placement

Table 4. Late complications of percutaneous endoscopic gastrostomy placement

Complication	Prevention	Management
Aspiration pneumonia	Jejunal extension tube unless impaired airway protection. Remain at least semi-recumbent for 60 minutes post feed. Avoid bolus feeding. Prevent or treat delayed gastric emptying. Avoid constipation	Antibiotic therapy
Displacement (late)	Avoid traction-removal percutaneous endoscopic gastrostomy tubes in confused patients. Check traction-removal percutaneous endoscopic gastrostomy internal balloon weekly	Replace balloon-retained or low-profile percutaneous endoscopic gastrostomy within 24 hours
Leakage and peristomal infection	Prevent excessive lateral movement (maintain external fixator at no more than 1 cm)	Air dry skin and use barrier cream. Consider antibiosis. Proton pump inhibitor and prokinetics. Consider tube removal for ≈1 day. Resite percutaneous endoscopic gastrostomy
Stoma granulation	Optimal wound care	Steroid or antibiotic ointment. Silver nitrate or argon plasma cautery
Buried bumper	Rotate feeding tube 360° weekly (unless jejunal extension tube). Avoid over-tightening external fixator	Endoscopic release then percutaneous endoscopic gastrostomy replacement. Jejunal extension tube to maintain nutrition if bumper cannot be removed
Colo-cutaneous fistula	Experienced endoscopist	Resite percutaneous endoscopic gastrostomy if mature fistulous tract
Metastasis from oro-pharyngeal or oesophageal malignancy	Percutaneous endoscopic gastrostomy placement using direct puncture technique, or place radiologically inserted gastrostomy	Oncology advice
Tube blockage	Careful flushing after feed and/or medication	Warm water flush. Alkaline pancreatic enzyme flush. Avoid saline flush. Fluoroscopic guidewire

computed tomography scan, can be managed conservatively with intravenous antibiotics; withhold percutaneous endoscopic gastrostomy feeding until clinically resolved.

Bowel perforation

This usually occurs following catheter protrusion through the anterior transverse colon. It may present acutely with abdominal pain, bowel obstruction or peritonitis. More often, however, it manifests following tube replacement with undigested feed passing per rectum or faecal material refluxing through the percutaneous endoscopic gastrostomy, when the tip of the feeding tube lies in the colon. Ultrasound or computed tomography is diagnostic. It is important to note that sub-diaphragmatic air (pneumo-peritoneum) is present after approximately 20% of percutaneous endoscopic gastrostomy placements; this does not indicate perforation nor does it require intervention (Wiesen et al, 2006).

Recommendations

Peritonitis following bowel perforation requires emergency laparotomy. Otherwise, the percutaneous endoscopic gastrostomy tube should not be used nor removed. Provide broad-spectrum antibiotics for 4 weeks, by

which time the fistula tract will have formed and the tube can be retracted. The aberrant fistulous tract will then gradually close.

Delayed complications

Dislodgment

Patients may attend the emergency department reporting that their percutaneous endoscopic gastrostomy tube has fallen out.

Recommendations

The tract closes within 12–24 hours, so without delay pass a new, balloon-stabilized enteral tube or a low profile 'button' (Rosenberger et al, 2011). If delay is likely, patency of an established tract can be maintained by passing an appropriately sized catheter; a 12 French Foley catheter is often used, although a balloon gastrostomy tube is preferable if available. However, this should not be done if the percutaneous endoscopic gastrostomy was created within the past month; instead a separately sited endoscopic or radiologically-inserted gastrostomy should be placed, followed by radiological exclusion of an ongoing leak before feeding commences. Try to avoid traction-removable tubes if dislodgement is recurrent.

Catheter occlusion

Over time, many percutaneous endoscopic gastrostomy tubes become blocked as a result of the incorrect administration of medication or inappropriate flushing.

Recommendations

Ensure that the tube is flushed with warm water following administration of feed or medication (Scott and Bowling, 2015). Do not use saline as there is a risk of crystallisation, nor wires or needles. Blocked tubes can be vigorously flushed with warm water, and alkalinized enzymes may help (e.g. Creon granules, completely dissolved in alkaline water made using alkaline drops available over-the-counter). Tubes can be used immediately once patent. Discuss with pharmacy whether any medications are incompatible with percutaneous endoscopic gastrostomy administration.

Leakage

This is often the result of excessive lateral tube motion or over-tight fixation of the percutaneous endoscopic gastrostomy to the skin surface, causing pressure necrosis.

Recommendations

Exclude distal intestinal obstruction and treat any cutaneous infection. Wider bore catheters usually still leak; often the percutaneous endoscopic gastrostomy tube needs to be re-sited, having removed the original percutaneous endoscopic gastrostomy a few days earlier.

Cellulitis and granulation tissue

Peristomal cellulitis used to be common in the week following percutaneous endoscopic gastrostomy, occurring in approximately 15% of patients. This has been reduced to about 3% with the use of peri-procedural antibiotics (Ahmad et al, 2003). It presents with localized erythema and tenderness. Systemic upset is rare and antibiotics may not be required. Infections are most commonly caused by *Staphylococcus aureus* or β-haemolytic streptococci. Candida super-infection may also occur. Granulation tissue can occur at the skin surface, and become infected or bleed.

Recommendations

Treatment involves regular antiseptic wound cleaning, sometimes supplemented by antibiotic therapy (refer to local guidelines for treatment of skin and soft tissue infections) (O'Toole, 2006). The percutaneous endoscopic gastrostomy may need to be removed and infection treated before a new tube is sited. Granulation tissue can be treated surgically or by local application of silver nitrate.

Diarrhoea

This is usually caused by intolerance to the feed (Scott and Bowling, 2015). Very rarely, it may be caused by a gastrocolic fistula, which can be asymptomatic for months.

Recommendations

Initially, try reduced osmolarity or low fibre feeds. Small doses of loperamide may also be helpful. A gastrocolic fistula is diagnosed by ultrasound or computed tomography scan and can be managed by re-siting the percutaneous endoscopic gastrostomy, as the residual track closes within days. This may require laparoscopic replacement if colonic interposition is present; this approach also allows excision of any residual fistula (Stroud et al, 2003).

Obstruction

Gastric outlet obstruction can occur if the internal flange lodges in the pylorus or duodenum, most frequently after replacement when percutaneous endoscopic gastrostomy traction is not required. This presents with reflux of stomach contents adjacent to the percutaneous endoscopic gastrostomy.

Recommendations

Diagnosis is usually based on clinical symptoms and signs. Management involves partially withdrawing the tube and reaffixing it, usually with the 4 cm marker at the skin surface. Gastroparesis is an alternative diagnosis.

Buried bumper

This rare, but now well-recognized, complication arises when gastric mucosa over-grows the internal flange, and then occludes the tube lumen (Lee and Lin, 2008). Patients often complain of abdominal pain during feeding. This is believed to occur following excessive tension between the inner and outer bolsters.

Recommendations

Endoscopic examination usually allows the bumper to be released using a needle knife sphincterotome; the percutaneous endoscopic gastrostomy tube should then be replaced. It can be prevented by loosening the external fixation device to allow 10 mm 'free play' the day after percutaneous endoscopic gastrostomy placement, and thereafter rotating the tube every few days.

Reflux and aspiration

This is common following long-term percutaneous endoscopic gastrostomy feeding, particularly in patients with delayed gastric emptying. Pulmonary aspiration should be suspected if acidic feed can be aspirated from the mouth or in the context of chest infections.

Recommendations

Avoid medication that predisposes to constipation or delayed gastric emptying, such as opioids or drugs with anticholinergic effects. Correct any electrolyte disturbances, reduce the rate of feed, avoid feeding the patient when supine, and prescribe prokinetics (e.g. metoclopramide) (O'Toole, 2006). A jejunal extension tube can be

KEY POINTS

- Avoiding inappropriate patient selection is key to reducing the risk of mortality (1:150) and serious morbidity (1:30).
- Careful preparation before percutaneous endoscopic gastrostomy insertion minimizes complications.
- Percutaneous endoscopic gastrostomy should be performed in the morning, by an experienced team.
- Access to hospital and community multi-professional team members should be facilitated.
- Most percutaneous endoscopic gastrostomy complications can be easily resolved in expert hands.

used but often will kink or revert into the stomach, in which case a surgically-placed jejunostomy or a percutaneous endoscopic jejunostomy should be considered.

Cosmetic

Percutaneous endoscopic gastrostomy tubes, particularly in younger patients, can be socially inhibiting.

Recommendations

A button system can be placed once a fistulous tract is formed (>4 weeks), although this must be routinely replaced every 6 months (Löser et al, 2005). There is no need to routinely change standard percutaneous endoscopic gastrostomy tubes, and some have stayed in situ for over 10 years.

Conclusions

This article has highlighted the common adverse events associated with percutaneous endoscopic gastrostomy tubes, as well as techniques to avoid and overcome them. Further information can be obtained from society guidelines (Westaby et al, 2010) or specialist texts (Marks and Harbord, 2013). Patient selection and preparation before the procedure is paramount to mitigate the appreciable risk of complications. The percutaneous endoscopic gastrostomy procedure requires senior endoscopist input, and should be undertaken within the context of input from both hospital and community nutrition teams. Multi-professional support is crucial to prevent, detect and manage early and late complications. **BJHM**

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