

# The provision of a percutaneously placed enteral tube feeding service

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## ABSTRACT

There is overwhelming evidence that the maintenance of enteral feeding is beneficial in patients in whom oral access has been diminished or lost. Short-term enteral access is usually achieved via naso-enteral tube placement. For longer term tube feeding there are recognised advantages for enteral feeding tubes placed percutaneously. The provision of a percutaneous enteral tube feeding service should be within the remit of the hospital nutrition support team (NST). This designated team should provide a framework for patient selection, pre-assessment and post-procedural care. Close working relations with community-based services should be established. An accredited therapeutic endoscopist should be a member of the NST and direct the technical aspects of the service. Every endoscopy unit in an acute hospital setting should provide a basic percutaneous endoscopic gastrostomy (PEG) service. This should include provision for fitting a PEG jejunal extension (PEGJ) if required. Specialist units should be identified where a more comprehensive service is provided, including direct jejunal placement (DPEJ), as well as radiological and laparoscopically placed tubes. Good understanding of the indications for percutaneous enteral tube feeding will prevent inappropriate procedures and ensure that the correct feeding route is selected at the appropriate time. Each unit should adopt and become familiar with a limited range of PEG tube equipment. Careful adherence to the important technical details of tube insertion will reduce peri-procedural complications. Post-procedural complications remain relatively common, however, and an awareness of the correct approach to managing them is essential for all clinicians involved in providing a percutaneous enteral tube feeding service. Finally, ethical considerations should always be taken into account when considering long-term enteral feeding, especially for patients with a poor quality of life.

## DEVELOPMENT OF THE GUIDELINE

This guideline, relating to the provision of a percutaneously placed enteral tube feeding service, is focused upon a specific area of nutrition provision that has not been previously targeted. It should be read in the context of other recent guidelines, which have covered the wider field of nutrition provision.<sup>1,2</sup> The present guideline includes a summary of the ethical issues associated with enteral tube feeding, but these issues are dealt with in detail by the Royal College of Physicians working party report on oral feeding.<sup>3</sup> Furthermore there is no reference to the provision and make-up of the enteral feeds themselves (an area well covered in the reports referred to).

The aim of the guideline is to identify the role of percutaneously placed enteral feeding tubes within

the wider context of nutrition provision. Guidance is provided for patient selection, the technical aspects of tube placement as well as the prevention and management of associated complications, with an emphasis on endoscopic tube placement (rather than radiological or surgical techniques). The target audience is wide, and includes consultants and specialist registrars in gastroenterology, surgery and radiology, nurse endoscopists and endoscopy nurses, dietitians and nutrition nurse specialists (both hospital and community based). This guideline also provides a basis upon which a primary care trust can purchase enteral nutrition services.

The working party is comprised of four gastroenterologists and a nurse consultant who have a specific interest in the provision of enteral tube feeding. The chair (DW) is a current member of the BSG Endoscopy committee and DS is the chair of the Small Bowel and Nutrition committee.

Throughout this guideline the strength of statements on evidence and of recommendations is categorised according to the North of England Evidence-based Guidelines Development Project (see box 1).<sup>4</sup>

## INTRODUCTION

There is now considerable evidence of the benefits of maintaining enteral nutrition in a wide spectrum of illness. Loss of enteral access is a common occurrence in many severe acute illnesses. The resulting gut disuse is recognised as a cause of reduced immune integrity with an associated risk of complications. Re-establishment of enteral nutrition can be considered an essential therapeutic tool in such cases.

In many chronic conditions diminished or inadequate oral intake represents a serious threat to nutritional status and establishment of enteral access is an integral part of management.

There have been a number of reviews documenting the benefits of maintaining enteral nutrition<sup>1</sup> and identifying routes of access. The per-nasal route is the established means of enteral access in the majority of acute cases. In the long-term, however, per-nasal feeding tubes are often poorly tolerated in the conscious patient; they are frequently displaced and are associated with an increased risk of pulmonary complications. As a consequence, the alternative approach of a percutaneously placed enteral feeding tube has been widely adopted particularly following the introduction of an endoscopically placed tube in 1980.<sup>5</sup> Since then, further developments in percutaneous enteral tube access have been made in response to specific clinical problems such as gastroparesis, pulmonary aspiration and concerns about the risk

**Box 1 Categories of strength used in statements****Strength of evidence**

1. Ia—Evidence from meta-analysis of randomised controlled trials
2. Ib—Evidence from at least one randomised controlled trial
3. IIa—Evidence from at least one controlled study without randomisation
4. IIb—Evidence from at least one other type of quasi-experimental study
5. III—Evidence from descriptive studies, such as comparative studies, correlation studies, and case-control studies
6. IV—Evidence from expert committee reports or opinions or clinical experience of respected authorities, or both

**Strength of recommendations**

1. A—Directly based on category I evidence
2. B—Directly based on category II evidence or extrapolated recommendation from category I evidence
3. C—Directly based on category III evidence or extrapolated recommendation from category I or II evidence
4. D—Directly based on category IV evidence or extrapolated recommendation from category I, II or III evidence shows these categories in descending order of importance.

of tumour implantation in the presence of oro-pharyngeal malignancy. These new techniques offer the option of direct gastric access as well as post-pyloric tube placement. There are both radiological and laparoscopic alternatives.

The recent NCEPOD<sup>6</sup> report expressed concern about the morbidity and mortality associated with percutaneous endoscopic gastrostomy placement and has focused attention on the selection of patients for long-term enteral nutrition and their subsequent management.

The aim of this document is to provide guidance for the provision of a percutaneously placed enteral tube feeding service. The terminology has been selected with care. The emphasis will be on endoscopic techniques of placement but there is increasing recognition that in a significant minority of patients their best interest is served by alternative methods of placement including radiological and surgical techniques. Furthermore, while the 'pull-through' percutaneous endoscopic gastrostomy (PEG) tube represents the optimal approach in most cases there are a number of instances in which alternative endoscopic techniques should be considered. The provision of a percutaneous enteral tube feeding service cannot be considered in isolation. This should be one part of a much wider nutritional support structure. The guidance in this document aims specifically at this type of tube feeding but inevitably those supporting this service will be involved in all aspects of enteral tube feeding.

**SERVICE ORGANISATION****Multidisciplinary team**

Judging whether placement of a percutaneous feeding tube is in a patient's best interest is complex. As well as the risk of complications, patients on long-term artificial nutrition must face discomfort, alteration of body image, emotional and social adjustment and considerable inconvenience. It medicalises a normal activity of everyday living and has significant implications for the patient's future care. The decision requires contributions from several different clinical disciplines as well as

consideration of psychological, social and ethical factors. For these reasons, the decision-making process should involve a multidisciplinary team.<sup>1-7</sup> Evidence suggests that complications related to tube feeding are less common in hospitals where a multidisciplinary nutrition team functions.<sup>8</sup> Other potential advantages provided by a nutrition support team (NST) are outlined in box 2.<sup>1</sup>

The composition and operational arrangements of a NST will depend on the size and type of hospital. It should, however, be formally recognised and comprise at least a nutrition nurse, a dietitian and a clinician from a relevant speciality (usually gastroenterology) who has had specific training in nutritional support. Close liaison with the speech and language therapy (SALT) team is vital and there should be good biochemistry and microbiology laboratory support. In addition, most NSTs will include a pharmacist as a core member.

Co-ordination and organisation of the NST is the responsibility of the Nutrition Steering Committee, which should work within the governance framework and report directly to the Chief Executive or Trust Board.<sup>1,2</sup>

Many hospital NSTs will have parenteral feeding as their main focus of interest. Enteral tube feeding (incorporating the techniques associated with percutaneous enteral tube placement) requires specialist expertise and this should be recognised within the NST with identified personnel responsible for the service; in effect, a specialist enteral tube feeding team operating within the NST (see box 3).

**Referral pathway**

All cases considered for percutaneous enteral tube feeding should follow a defined referral pathway. Details of this should be available within the trust both in hard copy and electronically. The precise structure of the referral pathway will vary depending on local arrangements but the pathway should always include the following elements:

- ▶ A specific referral form (online appendix 1)
- ▶ Pre-procedure assessment (ward visits)—by a member of the enteral feeding team. This will usually be a nurse specialist
- ▶ An assessment form to highlight important parameters including co-morbidity, current medication and relevant prior surgical operations (online appendix 1)
- ▶ A checklist for ward staff detailing the pre-procedure protocol (clotting parameters, antibiotic prophylaxis, period of fasting etc) (online appendix 2)
- ▶ A mechanism for considering consent issues and their management
- ▶ Documentation regarding the type of tube selected and the feeding regimen recommended
- ▶ Clear arrangements for feeding provision following discharge

**Box 2 Potential advantages of a nutrition support team****Reduction of unnecessary treatments**

- ▶ Pharmaceutical advice on stability and compatibility of drugs and EN regimens
- ▶ Production or support of existing guidelines
- ▶ Education and training of other staff, patients and carers
- ▶ Audit/research
- ▶ Acting as advocates for patients
- ▶ Point of contact for patients and carers, especially for those on home enteral tube feeding.

**Box 3 Specialist enteral tube feeding team****Suggested minimum personnel**

- ▶ Designated lead—therapeutic endoscopist
- ▶ Nurse specialist—specifically designated and appropriately trained
- ▶ Dietitian—specifically designated and with experience in enteral tube feeding
- ▶ Support available from speech and language therapy (SALT), pharmacy, biochemistry and microbiology.

- ▶ Liaison with the referring team
- ▶ Advice and support for patients and carers when the request for enteral tube feeding is not considered in the patient's best interest.

**Who should do it?**

- ▶ An accredited therapeutic endoscopist (usually a gastroenterology consultant)
  - ▶ A second operator responsible for the procedure at skin level
- The role of the second operator is well suited to the nurse specialist. There are no specified training requirements for this role but competencies in relevant surgical anatomy, aseptic technique, administration of local anaesthetic as well as the technical aspects of the percutaneous tube placement are a prerequisite and criteria for accreditation within each unit should be defined.

**Extent of service provision**

There are important considerations regarding the spectrum of techniques available within a unit. The type of enteral tube used and the technique of placement should be optimised for each patient and not restricted by available resources and expertise. Decision-making should always involve the option of referral to a more specialised centre for this to be achieved (see under special considerations). All hospitals providing acute medical services and incorporating an endoscopy unit should offer enteral tube feeding support as described above. Basic level service should include:

- ▶ PEG tube placement
- ▶ Conversion for post-pyloric feeding using a jejunal extension (PEGJ)
- ▶ Conversion of the PEG tube to a low profile device.

**Special considerations**

The majority of patients requiring percutaneous enteral tube feeding can be managed satisfactorily by PEG tube placement. However, there are a number of clinical settings in which such an approach may not be optimal:

- ▶ *Oro-pharyngeal or oesophageal malignancy*: standard pull-through PEG placement may expose to the risk of tumour seeding within the tract
- ▶ *Advanced neuromuscular disorders*: the sedation required for the endoscopic procedure may represent a significant risk of ventilatory failure
- ▶ *Patients unable to tolerate intra-gastric feeding*: may be better managed by direct percutaneous jejunostomy tube placement
- ▶ *Children*: the placement of a percutaneous enteral feeding tube in a child should only be considered in the context of a paediatric nutrition support team

To provide these specialised services there is a need to identify centres with the multidisciplinary expertise incorporating

advanced endoscopic, radiological and surgical techniques for tube placement.

**Post-procedure management**

To minimise the risk of post-procedure complications and the failure to optimise feed provision it is important to establish a post-procedural protocol. This should be readily available both in hard copy and electronically within the trust (online appendix 3). The enteral tube feeding support team should also provide or facilitate the following:

- ▶ Training requirements for receiving wards: what they need and who will do it?
- ▶ Specific considerations for jejunostomies, jejunal extensions and balloon-retained devices
- ▶ Dietitian review
- ▶ Pump training
- ▶ Pharmacy review
- ▶ Liaison with community teams and discharge planning
- ▶ Trouble-shooting guidelines (online appendix 4)
- ▶ Arrangements for blood monitoring in line with NICE recommendations
- ▶ Defined responsibilities and guidance on when to refer back
- ▶ A point of contact for advice after discharge.

**Long-term follow-up**

Achieving the aims of percutaneous enteral tube feeding requires long-term support by the enteral tube feeding team. The following need to be assessed and managed:

- ▶ Nutritional status in response to feeding
- ▶ The need to replace an indwelling tube
- ▶ Discontinuation of tube feeding when oral intake has been re-established or when it is no longer considered to be in the patient's best interest

This requires the development of close relationships between the hospital based enteral feeding support team and community based dietitians, community SALT teams and nursing homes.

**INDICATIONS FOR THE PLACEMENT OF A PERCUTANEOUS ENTERAL FEEDING TUBE**

Placement of a percutaneous enteral feeding tube is usually carried out to facilitate direct enteral feeding in patients in whom normal oral intake is either insufficient to meet nutritional requirements or in whom anatomical or neurological abnormalities preclude safe swallowing, increasing the risk of aspiration or nutritional failure.

**Neurologically unsafe swallowing****Acute ischaemic or haemorrhagic stroke**

Stroke remains the commonest indication for PEG placement. There is a paucity of literature in this field. However, the recent large, multicentre FOOD trials<sup>9 10</sup> demonstrated that early enteral feeding (within 7 days) resulted in an absolute reduction in mortality of 5.8% (95% CI -0.8 to 12.5, p=0.09) when compared to delayed enteral feeding. The same investigators observed no excess rate of pneumonia in the patients who were fed early. This benefit is offset by the observation that there was a greater level of disability in the survivors.

Appropriate timing of PEG placement relative to the onset of the neurological deficit is not clearly defined. A proportion of patients will regain swallowing function within the first 2 weeks, avoiding the need for tube feeding. At 4 weeks 20% of patients will no longer require tube feeding<sup>11</sup> but long-term follow-up suggests that two-thirds require ongoing PEG feeding.<sup>12 13</sup> Insertion of the PEG tube at 14 days reduces mortality and

improves nutritional outcome at 6 weeks compared with continued nasogastric feeding,<sup>11 14 15</sup> but the risk of medical complications or death is increased during long-term rehabilitation compared with patients not requiring enteral feeding.<sup>16</sup> Interpretation of these conflicting studies remains difficult.

#### **Recommendations for clinical practice**

In patients with acute stroke, gastrostomy feeding should be considered at 14 days post-stroke. (*Evidence level Ib, strength of recommendation A.*)

#### **Chronic progressive neuromuscular disease**

Dysphagia, or loss of safe swallow, characterises chronic progressive neurological and neuromuscular degeneration; for example, bulbar and pseudobulbar palsies, motor neuron disease, multiple sclerosis, Huntington's disease, Parkinson's disease and spastic diplegia. PEG feeding provides an acceptable approach to nutritional support in such patients and is associated with cessation of weight loss, improved functional and nutritional indices and prolonged survival.<sup>17 18</sup> Timing of tube placement is important: delaying until severe bulbar dysfunction is present negates benefit.<sup>19</sup> There is some limited evidence to suggest that radiologically inserted gastrostomy tubes may confer a survival benefit in patients with motor neuron disease – this may be explained by the fact that radiological tube placement avoids the risk of sedation in patients with a lower forced vital capacity.<sup>20</sup>

#### **Recommendations for clinical practice**

PEG placement can prevent weight loss and improve long-term outcomes in patients with progressive neuromuscular disease. (*Evidence level III, strength of recommendation C.*)

In patients with ventilatory impairment, endoscopic tube placement should only be carried out following respiratory/anaesthetic review. A radiologically placed tube is an alternative in such cases. (*Evidence level III, strength of recommendation C.*)

#### **Failure of feeding**

##### **Dementia**

Failure of oral intake is a common event in progressive, end-stage dementia and results in frequent referral for PEG insertion. Life expectancy in this group, without other significant morbidity, is reduced compared to other groups referred for PEG. Survival in those over the age of 80 with dementia ranges from 60 to 171 days following PEG insertion.<sup>21 22</sup> Insertion of a PEG in patients with nutrition failure due to dementia does not improve survival<sup>21 23</sup> and post-PEG survival is significantly reduced in patients with dementia compared with other groups (30 day mortality 54% vs 30%).<sup>24</sup> Occasionally, clinicians will justify PEG placement in advanced dementia on the grounds that it may facilitate discharge and allow the patient to be cared for in their own home. Pressure to insert a PEG tube on the basis that it permits nursing home placement should, in general, be resisted since it may be driven by higher remuneration rates for patients with PEGs in situ.<sup>25</sup>

#### **Recommendations for clinical practice**

PEG insertion does not improve survival in end-stage dementia and should be avoided except in circumstances where it can be justified as a palliative intervention, genuinely in the patient's best interest. (*Evidence level III, strength of recommendation D.*)

##### **Anorexia nervosa**

No evidence on the role of PEG feeding exists in anorexia nervosa. Case reports suggest that this may be more acceptable than nasogastric feeding. Such intervention requires a multi-disciplinary approach including psychological assessment and support.

#### **Systemic sclerosis**

Specific outcome data are not available in patients with systemic sclerosis. Anecdotal data suggest that PEG or jejunal feeding may reduce chronic aspiration and therefore improve outcome.

#### **Cystic fibrosis**

Nutritional failure is common in late stage cystic fibrosis. PEG insertion in these patients is safe and improves nutritional status with stabilisation of pulmonary function.<sup>25 26</sup> PEG feeding in children with cystic fibrosis is also well accepted by patients.<sup>27</sup> The evidence in favour of enteral tube feeding in this cohort of patients originates from specialist cystic fibrosis centres and is facilitated by close cooperation between chest physicians and gastroenterologists.

#### **Recommendation for clinical practice**

PEG feeding is safe, efficacious and acceptable in children and adults with nutritional failure due to cystic fibrosis but should be carried out only in the context of close cooperation between cystic fibrosis chest physicians and an enteral feeding team. (*Evidence level IV, strength of recommendation D.*)

#### **Peritoneal dialysis**

Nutritional failure in peritoneal dialysis is associated with decreased survival and reduced likelihood of renal transplant. PEG insertion can improve nutritional status but increased the risk of fungal peritonitis and failure of dialysis.<sup>28</sup>

#### **Recommendations for clinical practice**

PEG insertion can be undertaken in patients on peritoneal dialysis. Dialysis should be stopped for 3 days and prophylactic antifungal therapy given. (*Evidence level IV, strength of recommendation D.*)

#### **Oro-pharyngeal and oesophageal malignancy**

In patients undergoing treatment for head and neck cancer, endoscopic gastrostomy tube placement is associated with lower procedure-related morbidity and a more durable feeding route than radiologically or surgically placed enteral tubes<sup>29</sup> and provides improved nutritional outcomes compared to nasogastric tube feeding or sip drinks in those undergoing chemoradiotherapy.<sup>30</sup> Concern remains about the risk of PEG stoma metastasis when using pull through techniques.<sup>31–34</sup> While early metastasis is probably due to direct tumour seeding, late metastasis to the PEG site is usually associated with other sites of distal metastasis.<sup>32</sup> The alternative, direct puncture technique is safe, has not been demonstrated to result in metastasis<sup>35</sup> and has a lower complication rate.<sup>36</sup>

In patients with oesophageal malignancy, insertion of a PEG may render the stomach unusable for formation of a gastric tube at oesophagectomy,<sup>37</sup> a risk that may be reduced by placement of the PEG as close to the lesser curve as possible.

In patients in whom the proximal oesophagus is not accessible from the mouth, transnasal approaches using slim endoscopes provide an adequate alternative.<sup>38</sup>

#### **Recommendations for clinical practice**

Enteral tube placement into the stomach may hinder surgical techniques in oesophageal cancer and should be avoided if curative resection is planned. (*Evidence level IV, strength of recommendation D.*)

#### **Clinical situations requiring caution**

##### **Infection**

Active systemic infection increases the risk of early mortality and morbidity post-PEG placement. Elevation of serum

C-reactive protein (CRP) is the most accurate prognostic indicator of poor outcome.<sup>39</sup>

#### Other co-morbidity

Poorer outcome, with increased PEG site and systemic infection have been reported in patients with diabetes mellitus,<sup>40 41</sup> chronic obstructive pulmonary disease<sup>41</sup> and low albumin,<sup>41</sup>

#### Ventriculo-peritoneal shunts

Placement of PEG tubes in patients with ventriculo-peritoneal (VP) shunts increases the risk of shunt infection<sup>42</sup> but this risk decreases with increased time between shunt insertion and PEG insertion.<sup>43</sup> Prophylactic antibiotics may further reduce the infection risk.<sup>44</sup>

#### Anatomical considerations

In patients with severe kyphoscoliosis, the stomach is often intrathoracic. This applies in particular to patients with cerebral palsy. Radiological and endoscopic approaches may be impossible. A combined laparoscopic/endoscopic approach can be tried but this requires a general anaesthetic, which also represents a considerable risk in such patients.

### TECHNICAL ASPECTS OF PERCUTANEOUS ENTERAL FEEDING TUBE PLACEMENT

In the majority of patients in whom there is an indication for percutaneous enteral tube feeding, an endoscopic gastrostomy is the procedure of choice. There are a number of important technical aspects of safe percutaneous endoscopic gastrostomy placement. In only a minority of these are there RCT study data on which to base recommendations.

#### PEG tube equipment

Several commercially kits are available. The large majority involve a pull-through technique (the so-called push technique is not widely adopted although very similar in principle). It is important for each unit to identify and become fully conversant with one set of equipment. The calibre of available tubes ranges from 9Fr to 20Fr. Comparison of 12Fr and 20Fr PEG tubes has shown no difference with respect to complications or long-term patency.<sup>45</sup> Smaller calibre tubes (typically 12–15Fr) have a cosmetic advantage and in most circumstances should be adopted.

#### Recommendations for clinical practice

Each unit should adopt and familiarise with a limited range of PEG tube equipment. In most circumstances smaller calibre PEG tubes are recommended. (*Evidence level Ib, strength of recommendation B.*)

#### Oropharyngeal and oesophageal malignancy

For patients with oropharyngeal or oesophageal carcinoma, placement of a PEG tube using the standard pull technique is associated with a small but well documented risk of tumour implantation (<1%) at the skin site.<sup>46</sup> To avoid this risk, particularly in patients for whom cancer therapy is of curative intent, PEG placement can be achieved by a direct gastric puncture technique under endoscopic guidance using either the Russell or Gastropexy procedure.<sup>47</sup> An alternative approach is to place the gastrostomy by a radiological or laparoscopic technique.<sup>29</sup>

#### Recommendations for clinical practice

Patients with oro-pharyngeal or oesophageal malignancy should be considered for a direct gastric puncture technique for percutaneous feeding tube placement. This should be considered

mandatory for patients receiving radical therapy with curative intent. (*Evidence level III, strength of recommendation C.*)

#### Prophylaxis of PEG site infection

PEG tube placement should be carried out under full aseptic conditions using 2% chlorhexidine in alcohol for skin preparation. Antibiotic prophylaxis has been extensively assessed as a means of reducing skin site infection. There is RCT evidence to support its use.<sup>48</sup> However, the increasing recognition of methicillin-resistant *Staphylococcus aureus* (MRSA) as a cause of peristomal infection in some centres has led to a reappraisal of infection prophylaxis at local level.<sup>49</sup> The majority of such MRSA skin site infections are as a consequence of oro-pharyngeal colonisation with these bacteria. This risk may be reduced by oral decontamination<sup>49</sup> or use of an overtube or sheath to protect the PEG tube from contact with the oro-pharynx during pull-through.<sup>50</sup>

#### Recommendations for clinical practice

PEG tube placement should be carried out under full aseptic technique. Antibiotic prophylaxis is indicated to prevent skin site infection. In areas of high MRSA prevalence oro-pharyngeal colonisation should be identified and managed prior to PEG tube placement. (*Evidence level Ia, strength of recommendation A.*)

#### PEG site selection and placement

The site of PEG placement should provide the most direct percutaneous route. Anatomically this relates to the anterior gastric wall at the level of the antrum. Using this landmark minimises the length of the tract required, reducing the risk of inadvertent puncture of other intra-abdominal structures. The short tract aids subsequent tube replacement. The antral site also facilitates the placement of a jejunostomy extension if this is required.

The surface marking for placement of a PEG tube requires confirmation of both endoscopic visualisation of finger compression and transillumination. In the large majority of cases, both of these will be achieved, allowing safe tube placement. If there is uncertainty, further guidance may be obtained by a plain abdominal radiograph following the instillation of 500 ml of air via a naso-gastric tube and using surface markers for the costal margin and the umbilicus. If finger compression and transillumination are still suboptimal, the decision to proceed with an attempt at tube placement should only be made by an operator with extensive experience of difficult tube placement.

The safe-tract technique is a prerequisite for placement of a PEG tube and represents an important safeguard against inadvertent puncture of another viscus along the path to the gastric lumen. This involves the passage of a 21- or 23-gauge needle (with syringe attached) across the abdominal wall in the direction of the proposed placement while aspirating continuously. Gas bubbles should not be seen in the syringe until the needle appears within the gastric lumen. A stab incision is then made to the skin with an 11 scalpel blade to allow the enteral tube to pass smoothly. In very malnourished patients care should be taken to avoid the scalpel blade puncturing the underlying gastric wall. Care should also be taken during gastric wall puncture with the trochar to avoid trauma to the posterior wall of the stomach. The trochar should be lassoed by a snare passed via the endoscope and held in position until the guide wire is advanced into the gastric lumen. This manoeuvre prevents the trochar being displaced out of the stomach in the case of sudden patient movement.

The final position of the internal and external bumper of the PEG tube is important to prevent local site complications such

as infection and buried bumper. These complications are more likely if the fit is too tight. Animal studies suggest play of 10 mm is optimum.<sup>51</sup> Inspecting the PEG bumper endoscopically after insertion provides useful reassurance that placement is correct, but is no longer considered mandatory.

#### **Recommendations for clinical practice**

The safe and accurate placement of PEG tubes requires strict adherence to surface marking recognition, the use of a safe-tract technique and optimal positioning of the retaining bumpers. (Evidence level IV, strength of recommendation D.)

#### **Feed administration**

The type of feed used is beyond the scope of this document. The timing of feed commencement after tube placement has been the subject of a number of randomised studies and, with the proviso that there are no overt complications of placement, feeding can safely be introduced 4 h post procedure.<sup>52</sup> The total calculated nutrient supply can be provided from the outset unless the patient is considered at risk of the refeeding syndrome.

The mode of feed delivery may be bolus or continuous (usually utilising a purpose-designed feeding pump). There is no conclusive evidence of specific advantage of either approach and the choice is usually governed by practical issues relating to the clinical setting and patient/carer preference.<sup>1</sup>

A minority of patients tolerate intra-gastric feeding poorly with nausea, vomiting or gastro-oesophageal reflux. Poor gastric emptying may be manifest by high gastric residual volumes. In such cases there is study evidence of benefit from the introduction of a prokinetic.<sup>1</sup> When these symptoms do not respond to prokinetics, it is recommended that the feed is delivered into the jejunum either by an extension tube from the PEG (percutaneous endoscopic gastrojejunostomy—PEGJ) or by direct percutaneous jejunal puncture (DPEJ).

#### **Recommendations for clinical practice**

In the absence of complications, feeding can be started 4 h after tube insertion. The adoption of bolus or continuous feeding can be individualised in relation to patient/carer issues. (Evidence level Ib, strength of recommendation A.)

A trial of a prokinetic should be carried out in patients who develop upper gastro-intestinal symptoms with the feed before considering PEGJ or DPEJ. (Evidence level III, strength of recommendation C.)

#### **PEG tube removal and replacement**

PEG tube removal cannot be considered until the tract is mature. This is usually the case by 14 days post-insertion but may be as long as 28 days in patients with risk factors for poor healing. If return to oral nutrition has been anticipated, a 'traction-removable' PEG tube may have been employed. It is essential to confirm that the tube is designed for percutaneous withdrawal before any attempt at traction removal is made. If there are any doubts, the manufacturer should be contacted to obtain this information or an alternative technique of removal used. For non-traction removable devices, the choice is between endoscopic retrieval of the internal bumper or cutting the tube and allowing the internal bumper to pass via the gastrointestinal tract. The latter approach has been widely used and is considered a safe alternative by many.<sup>53</sup> However, there is an associated small but recognised risk of bowel obstruction.<sup>54</sup> If this approach is considered—usually to avoid a further endoscopic procedure—a risk assessment for possible bowel obstruction should be carried out and the patient consented for the process.

Well cared for PEG tubes can remain clean and functional for a number of years; however, each manufacturer will give guidance about longevity and it is advisable to plan for an elective replacement rather than risk interruption of feeding as a consequence of tube malfunction. The indwelling tube is removed and replaced by a new PEG tube or a balloon-retained device. Balloon-retained devices have the advantage of avoiding the need for further endoscopy; however, this must be balanced against the reduced durability of these tubes.

PEG tubes are, by design, bulky and have an adverse cosmetic effect, particularly in the mobile patient. In such patients, the PEG tube may be replaced by a low profile ('button') replacement when the tract is fully developed. Such low profile devices have also been employed in patients who are at high risk of inadvertent tube displacement. There are commercially available PEG tube kits that allow the placement of a low profile tube from the outset.

#### **Recommendations for clinical practice**

PEG tubes can only be safely removed when a tract is fully established. This can only be assumed after a minimum of 14 days and up to 4 weeks in patients with impaired healing. (Evidence level IV, strength of recommendation D.)

#### **Post-pyloric feeding**

Percutaneous endoscopic gastrojejunostomy (PEGJ) and direct percutaneous endoscopic jejunostomy (DPEJ) are techniques that facilitate direct instillation of feed into the small bowel. They allow maintenance of enteral nutrition in patients with gastroparesis or gastric outlet obstruction. They are also of value in patients who tolerate intragastric feeding poorly, particularly when this is manifest by gastro-oesophageal reflux and free regurgitation with the associated risk of pulmonary aspiration. Most experience has been obtained with the PEGJ technique in which a jejunal extension tube is passed via a PEG tube. This can be achieved at the time of PEG placement or as a separate procedure utilising a previously placed PEG tube. Initial placement of the PEG tube in the gastric antrum allows a more direct route for the extension tube to cross the pylorus and reduces the risk of gastric looping, which is a common cause of subsequent displacement. The risk of displacement of the jejunal extension back into the stomach is also minimised by its placement beyond the ligament of Treitz. This may be achieved by an over the guide-wire technique, or by carrying the jejunal tube down and holding it in position by long (240 cm) forceps while the enteroscope (or paediatric colonoscope) is withdrawn. Despite adherence to these recommendations, 30–40% of PEGJ tubes will migrate back into the stomach within 2 months of placement. Without the appropriate attention to the detail of placement, such early displacement is almost universal. This remains a major limitation of this technique.

DPEJ represents an alternative method of establishing jejunal feeding and involves the direct placement of the percutaneous feeding tube into the jejunum. DPEJ is technically demanding; it requires an endoscopist experienced in enteroscopy and an assistant who is fully cognisant and comfortable at skin puncture to gain enteral access. Except in those patients who have had a prior gastrectomy, the procedure requires a paediatric colonoscope or enteroscope. A wide area of the abdomen should undergo sterile preparation (from costal margins to iliac crest) to accommodate the spectrum of possible final puncture sites. Antibiotic prophylaxis should follow the same local protocol as for PEG tube placement. Hyoscine butylbromide (Buscopan<sup>®</sup>) or glucagon are helpful to reduce peristalsis. Repeated intubation of

the jejunum may be required to identify a possible puncture site. The same principles of transillumination and finger compression are required as for PEG tube placement. This may be assisted by fluoroscopy in difficult cases. The safe-tract technique (see above) safeguards against transfixing other loops of small bowel or colon. Standard PEG tube kits can be used for DPEJ but the selection of a small sized internal bumper will minimise the risk of this occluding the small bowel lumen. The post-procedural care and timing of introducing feed is the same as for PEG tube placement.

The enhanced technical demands of DPEJ placement are reflected in a significant failure to achieve placement (in 15–20%) but, when established, it provides a more secure means of jejunal feeding. Laparoscopic placement of a jejunostomy tube offers an alternative to the endoscopic technique.

#### **Recommendations for clinical practice**

Percutaneous feeding to the jejunum (PEGJ or DPEJ) should be offered as a primary procedure for patients with documented gastroparesis and to those who do not tolerate intra-gastric feeding. DPEJ should be considered in patients in whom there is recurrent failure of PEGJ. A DPEJ should only be placed in centres with the appropriate experience and expertise available. (*Evidence level IV, strength of recommendation D.*)

### **COMPLICATION OF PERCUTANEOUS ENTERAL TUBE ACCESS AND THEIR MANAGEMENT**

This section considers complications arising from endoscopic placement of percutaneous enteral feeding tubes and their subsequent management. It will not discuss metabolic or feed-related problems.

#### **Incidence of complications**

It is difficult to quantify the true incidence of complications related to percutaneous enteral tube feeding. Rates vary depending upon the populations concerned and the definitions used. 'Minor' complications are undoubtedly quite common but often go unreported, despite causing considerable discomfort and distress to the patient.<sup>55</sup> Major complications are much less common, occurring in about 3% of PEG insertions in one large study.<sup>56</sup> Risk factors for complications include underlying malignant disease, severe malnutrition, extreme old age, diabetes and low albumin.<sup>57</sup> Early experience with direct percutaneous jejunostomy suggested major complication rates no higher than for PEG<sup>58</sup> but a recent large series has reported moderate or severe complications in about 10% although only reflected in a mortality of 0.3%.<sup>59</sup>

The high 30-day mortality rate for PEG insertion noted in several studies<sup>6,24</sup> reflects the severity of underlying co-morbidity, with dementia, severe cardiac failure and a history of pneumonia being particularly associated with poor survival.<sup>60</sup> Direct procedure-related mortality rates are low; typically less than 1% in most recent series. A suggested classification for complications is given in box 4.

#### **Respiratory complications**

##### **Immediate**

Patients with large oropharyngeal tumours are at risk of airways obstruction during endoscopic intubation. If there is concern about the airway, it is better to delay PEG insertion until after a tracheotomy has been performed.

##### **Early**

The majority of the early deaths following PEG insertion are as a result of pneumonia.<sup>6</sup> It is unclear whether this is due

### **Box 4 Classification of complications**

#### **Classification according to degree of severity:**

- ▶ Major – Complications that result in:
  - Further endoscopic or surgical intervention or
  - A threat to the patient's life or
  - Hospitalisation or a prolonged hospital stay
- ▶ Minor – Complications that do not result in any of the above

#### **Classification according to when they arise:**

- ▶ Immediate (ie, at the time or immediately after tube placement),
- ▶ Early (within 2–4 weeks of placement)
- ▶ Late (after 4 weeks, when the fistulous tract has formed).

to respiratory suppression and/or aspiration of secretions during tube placement or due to aspiration of feed in the early post-procedure period.

#### **Prevention**

Careful pre-assessment of patients to identify those with significant ventilatory impairment is key to reducing complications. In such cases, an endoscopy may represent too high a risk and a radiologically placed tube should be considered. Avoidance of excessive sedation and attention to oropharyngeal suction will reduce the risk of respiratory suppression and aspiration during the procedure. Patients undergoing percutaneous tube placement have often been unable to eat for some time and their mouths may be in a poor state of hygiene. Good mouth care before referral is essential. Avoid laryngeal local anaesthetic in patients with a compromised swallow reflex (ie, those with neurological dysphagia).

#### **Recommendations for clinical practice**

Patients with evidence of significant ventilatory compromise should be considered for a radiologically placed tube. Careful attention to sedation levels and to airway management reduces the risk of peri-procedural pulmonary complications. (*Evidence level III, strength of recommendation C.*)

#### **Late**

Beyond the early post-procedure period, aspiration pneumonia remains a common cause of mortality. It is important to realise that neither gastrostomy nor jejunostomy abolishes the risk of aspiration. A tube placed beyond the ligament of Treitz should prevent reflux of feed to the oro-pharynx<sup>61</sup> but patients with neurological dysphagia and impaired airway protection remain at risk from aspiration of oral and gastric secretions.

#### **Prevention**

Gastrostomy-fed patients should be fed sitting upright or in a semi-recumbent position (propped up at 30° or more) and should maintain this position for 60 min after feeding.

If reflux is suspected, testing the refluxate with Glucostix® can help to confirm that it contains feed. (Adding colouring to feed is not recommended because it risks introducing infection.) Using continuous or intermittent pump feeding may reduce the risk of reflux compared to bolus feeding. Prokinetics are often used if reflux persists.<sup>1</sup> Consider the possibility of drug therapy or severe constipation contributing to delayed gastric emptying.

Recurrent aspiration pneumonia due to reflux of feed in a PEG-fed patient is an indication for post-pyloric feeding.<sup>58</sup>

If a patient with a jejunal extension develops aspiration pneumonia or has reflux of feed to the mouth, an abdominal radiograph is required to confirm that the jejunal extension has not recoiled into the stomach.

#### **Recommendations for clinical practice**

Patients with recurrent pulmonary aspiration of feed should receive post-pyloric feeding with placement of a PEGJ or DPEJ. (*Evidence level III, strength of recommendation C.*)

### **Bleeding**

#### **Immediate**

Significant bleeding from the abdominal wall or gastric puncture site is rare. It will usually stop as a result of tamponade provided by the internal and external fixation devices once these are in place.

Bleeding may also result from trauma to the oesophageal mucosa caused by passage of the internal bumper during pull-through tube placement. Rectus sheath haematomas have been reported but are usually self-limiting. More serious bleeding can result if another intra-abdominal organ or mesenteric vessel is punctured inadvertently during needle passage. This is more likely during DPEJ placement.<sup>59</sup> Significant intra-abdominal bleeding following tube placement may require laparotomy.

Bleeding complications are more likely in patients with coagulopathy, severe systemic illness (especially sepsis) and jaundice. The presence of portal hypertension is a relative contraindication to percutaneous tube placement because there may be unrecognised intra-abdominal varices.

#### **Recommendations for clinical practice**

Coagulopathy should always be corrected prior to PEG/DPEJ placement. A platelet count of 80 000 or more and an INR < 1.5 are recommended.<sup>62</sup>

Ensure the stomach or jejunum is clearly localised before needle passage. (*Evidence level IV, strength of recommendation D.*)

### **Peritonitis**

#### **Immediate**

Peritonitis immediately after the procedure usually indicates damage to another viscus. Inadvertent puncture of small bowel or transverse colon by a narrow-gauge needle does not usually have serious consequences but if unrecognised there is a risk of more significant injury caused by passage of a larger trochar needle along the same path. Small bowel perforation by the endoscope should also be considered as a possibility if peritonitis develops immediately after DPEJ placement.

Pneumoperitoneum without signs of peritonitis is not an indication for surgical intervention. Air under the diaphragm can be seen in up to 40% of percutaneous feeding tube placements and may persist for several days.

#### **Recommendation for clinical practice**

Severe peritonitis occurring in the first few hours after tube placement (before feeding has commenced) usually requires an exploratory laparotomy. (*Evidence level IV, strength of recommendation D.*)

Air under the diaphragm without evidence of peritonitis is a normal post-procedural observation and does not require intervention. (*Evidence level III, strength of recommendation C.*)

### **Early**

Early peritonitis may result from displacement of the internal bumper or failure of the gastric or jejunal puncture wound to seal properly around the tube (leakage without displacement).

The latter is associated with factors that delay wound healing such as severe malnutrition or long-term corticosteroid use.

Localised abdominal pain and tenderness in the early post-procedure period is not uncommon and usually settles with temporary suspension of feeding and broad-spectrum antibiotics for 48 h.

A 'tubogram' (soluble radiological contrast passed through the tube) is helpful to ensure that the internal bumper has not become displaced from the stomach/jejunum into the peritoneal cavity. If the tube is correctly placed and the signs are mild, they will usually settle with conservative therapy as outlined above.

If the 'tubogram' demonstrates displacement of the bumper, or there is obvious leakage of contrast into the peritoneal cavity around the tube, surgery is usually required.

A 'tubogram' will not reliably exclude leakage without displacement, so if there is severe or generalised pain and tenderness, an abdominal CT scan is required. If this shows gross peritoneal contamination with feed, surgery is inevitable. If there is no gross contamination and the internal bumper remains in the correct position, conservative therapy may be attempted until symptoms settle.

#### **Recommendation for clinical practice**

Peritonitis following commencement of feeding usually reflects a displaced internal bumper. This should be confirmed as early as possible by a contrast tubogram. In most such cases laparotomy will be required. (*Evidence level IV, strength of recommendation D.*)

### **Displacement**

#### **Early displacement**

Accidental removal of the PEG/PEJ within 2–4 weeks of placement may result in peritonitis because the fistula is not fully mature and gastric contents can leak into the peritoneum. The external bumper should be kept secure during this period so that the stomach or jejunal loop does not fall away from the abdominal wall. If close apposition with the abdominal wall is not maintained, the fistula may not form properly and intraperitoneal leakage result.

Excessive traction on the tube during this early period may pull the internal bumper through the gastric/jejunal wall so that it comes to lie in the peritoneal cavity. This is very dangerous since, if unrecognised, feed will be delivered directly into the peritoneum. The risk of this is greater with traction-removable devices.

In the event of a tube becoming completely displaced within the first 2 weeks, 'blind' replacement at the bedside is best avoided because the fistula is unlikely to be mature and will be easily disrupted. Urgent replacement should be attempted either endoscopically or radiologically. A radiological technique is probably preferable because it minimises air insufflation. If endoscopic replacement is tried, air insufflation is kept to a minimum to avoid further disruption of the tract.<sup>63</sup> It is helpful to pass a floppy-tipped guide-wire through the fistula to re-establish the tract prior to passage of a plastic cannula (as in the Seldinger technique). If it proves impossible to re-establish the tract by passing a guide-wire into the fistula from the outside, an attempt to pass it into the fistula internally via the endoscope may be more successful, probing the tract gently with a cannula and guidewire in ERCP style until the guide-wire emerges through the abdominal wall.

If replacement is not possible and the patient remains well, conservative therapy (nil by mouth and broad-spectrum antibiotics) will usually prevent serious sequelae while the fistula is allowed to close spontaneously. If peritonitis ensues, surgery will usually be required.<sup>64</sup>

If the tube comes out between 2 and 4 weeks after placement, 'blind' bedside replacement using a balloon-retained tube may be possible but should only be undertaken by an experienced member of the specialist enteral tube feeding team. Correct positioning of the internal balloon must be confirmed before inflation. For those not receiving acid suppressive medication this can be achieved by testing the tube aspirate with Universal Indicator paper. A pH < 5 confirms correct gastric placement. For jejunostomy tubes, or if there is any doubt about the position of a replacement gastrostomy, a 'tubogram' or endoscopy should be performed.

If the tube is accidentally pulled and partial displacement of the internal bumper is suspected, a 'tubogram' should be performed. If displacement is confirmed, the device will need to be removed completely. A non-traction removable device will require surgical removal. For traction removable tubes, a second PEG should be placed prior to traction removal of the displaced tube to prevent the stomach falling away from the abdominal wall.

#### **Recommendations for clinical practice**

Avoid traction-removal tubes in confused patients who are likely to pull at them. Recognition of a displaced internal bumper before the tract is fully established should be managed by an urgent attempt at either endoscopic or radiological replacement. If this fails and free leakage is confirmed a laparotomy is indicated. (Evidence level IV, strength of recommendation D.)

#### **Late displacement**

If displacement occurs after the fistula has matured (4 weeks), peritoneal leakage cannot occur. The tract will close very quickly (within 12–24 h), so the priority is to preserve it. Late displacement is most commonly seen with balloon-retained devices when the balloon has burst or leaked. A regular, weekly check on the volume of water in the balloon will alert the patient or carer to such problems.

If possible, preserve the fistula by replacing the tube or button as soon as possible and securing it with tape.

If the tube is not available or the fistula has begun to close and the original tube cannot be passed, efforts should be made to keep the fistula open until a new balloon-retained device can be placed. Foley urinary catheters are sometimes used for this purpose but this practice cannot be recommended except as a last resort where no alternative exists.

Passing a replacement tube may require gentle dilatation of the tract (under conscious sedation) using a balloon dilator. Whenever a tube is replaced, especially if the tract has been dilated, correct positioning should be confirmed before the balloon is inflated.

Carers should not attempt to pass anything through the stoma unless it is certain that the tract is properly mature.

#### **Recommendation for clinical practice**

Following tube displacement an established tract will close within 12–24 h. During this window a replacement balloon tube or button tube should be inserted to maintain the tract. (Evidence level IV, strength of recommendation D.)

#### **Late fistula disruption**

Although the fistulous tract is generally established within 4 weeks, it takes much longer to mature fully. Great care must be taken to avoid force when passing a replacement device through a recently formed fistula. If excessive force is used, even a mature gastro-cutaneous fistula will break down.

## **Infection**

### **Early**

Peristomal infection is a frequent early complication of PEG placement. It appears to be more common in patients with diabetes mellitus.

Necrotising fasciitis is a rare complication caused by a rapidly spreading infectious process involving the fascia and subcutaneous tissues.<sup>65</sup> It is recognised by oedema and marked erythema around the PEG site, usually with surgical emphysema (crepitus), accompanied by fever and systemic upset. Fasciitis may be more likely if the feeding tube is pulled through the abdominal wall without an adequate scalpel incision; tearing the tissues with the leading edge of the tube is thought to force organisms into the subcutaneous space. Necrotising fasciitis requires aggressive treatment with urgent surgical debridement and broad-spectrum antibiotics.

Superficial infections will usually respond to regular wound cleaning and local antiseptics. More severe peristomal infections require systemic antibiotics, guided by the results of swabs sent for microbiological culture.

Avoid excessive tightening of the external fixator which may cause local ischaemia and encourage infection.<sup>66</sup>

### **Late**

A similar approach is taken with peristomal infection developing around an established percutaneous feeding tube. Occasionally, severe localised tenderness will indicate the development of an abdominal wall abscess related to the fistula. Ultrasound scanning is useful to confirm this. Most abscesses discharge spontaneously, but surgical incision is required occasionally.

If peristomal infection persists despite conservative management the tube may need to be removed to allow resolution.

#### **Recommendations for clinical practice**

The external fixator should not be kept too tight. (Evidence level IIb, strength of recommendation C.)

Evidence of tube site infection should be treated aggressively with local antiseptics and swab-directed antibiotics. In the presence of resistant infection the tube should be removed. (Evidence level IV, strength of recommendation D.)

## **Further late complications**

### **Leakage**

Leakage of gastric or intestinal contents around the feeding tube is a common late complication. It results in chemical burns to the surrounding skin and is one of the most difficult minor complications to deal with. Repeated lateral movement of the tube is thought to contribute to enlarging the stoma so this should be avoided by ensuring the external fixator is fitted at no more than 1 cm from the skin. Intractable leakage is not uncommon in patients who are severely unwell from other causes or in the terminal stages of illness.

Management includes protecting the skin with a barrier cream (such as Cavilon®) and leaving it open to the air as much as possible. Reducing the acidity of gastric juice with a high-dose proton pump inhibitor will reduce the skin damage produced by a leaking PEG. Prokinetics are advocated by some to enhance gastric emptying.

Temporary tightening of the external fixator may help but in the long term, this is likely to cause pressure necrosis and exacerbate the problem. Replacing the tube with one of greater diameter rarely helps because the stoma eventually becomes even larger. Temporary removal of the tube for a day or two may

allow partial closure of the stoma. A smaller calibre balloon retained tube (or preferably low-profile device) can then be reinserted.

Intractable leakage in a long-established percutaneous feeding tube may require its replacement at a different site.

### Recommendations for clinical practice

Leakage usually reflects repeated lateral tension on the tube and enlargement of the tract. Maintaining the external fixator no more than 1 cm from the skin site prevents such movement. With persisting leakage tube removal and replacement may be necessary. (Evidence level IV, strength of recommendation D.)

### Hypergranulation

Excessive granulation around the stoma is uncomfortable, often bleeds and makes cleaning difficult. Factors leading to its formation are poorly understood and it frequently recurs after treatment. Rotating a gastrostomy or DPEJ tube once a week is widely advocated to encourage development of a healthy fistula, but excessive movement of the tube should be avoided.

A PEG fitted with a jejunal extension should NOT be rotated as this risks displacement of the jejunal tube.

Steroid/antibiotic ointments (designed for ear or eye infections) are commonly used to treat hypergranulation, although this is an unlicensed indication. Silver nitrate cautery may help but can be painful. Cautery with the argon plasma coagulator has also been described.

### Buried bumper

A buried bumper occurs when the internal bumper is pulled up against the gastric mucosa with too much force. Over time, the bumper erodes into the mucosa, which then grows over it, until the bumper becomes either partially or completely buried. Eventually, flow through the tube is obstructed and feed may leak back around it onto the skin. It is more common with gastrostomy tubes that have a silicon internal retention disc. Buried bumper is suspected if the PEG cannot be pushed in easily. It can be prevented by rotating and pushing in the tube gently once a week (unless a jejunal extension is fitted).

The position of the external fixator should be noted to make sure that it is not too tight whenever it is reconnected. The external fixator position should be adjusted as the thickness of the anterior abdominal adipose tissue layer increases with improved nutrition.

A deeply buried bumper may require surgical removal but several other approaches have been described:

- ▶ *Using a needle knife:* A needle knife papillotome can be used to cut away the overgrowing granulation tissue. This can be difficult in practice and often results in considerable local bleeding.<sup>67</sup>
- ▶ *'Balloon push' technique:* Under endoscopic control, pass an oesophageal dilatation balloon through the tube from the outside so that it can be seen emerging into the stomach. Inflate the balloon while it is still partly within the PEG tube. This will dilate a passage through the over-grown mucosa and also stiffen the tube so that it can be pushed back into the stomach.
- ▶ *'Balloon pull' technique:* This is similar to the technique described above except that the balloon is passed into the PEG tube from the gastric side (via the endoscope). It is then inflated partially within the PEG tube and traction applied to drag the bumper back into the stomach.
- ▶ *Snare technique:* Cut the PEG tube short and keep the portion that has been removed. Pass a polypectomy snare through the

tube from the inside so that it emerges externally through the cut end. Pass the snare around the mid point of a 2 cm length of tubing cut from the trimmed-off portion. This acts as a T-piece so that traction applied to the snare will pull on the PEG tube and may deliver the buried bumper back into the stomach.

If the bumper cannot be removed and the patient is unsuitable for surgery, pass a jejunal extension through the PEG (after opening up the overgrown mucosa with a dilatation balloon if necessary) and advance it a short distance into the stomach. This will provide a route for continued feeding.

### Recommendations for clinical practice

A buried bumper can be prevented by avoiding excessive tension on the internal bumper. This can be achieved by maintaining at all times a 1 cm degree of 'play' between the external fixator and the skin site. A number of non-surgical techniques have been used to retrieve a buried bumper. Surgical removal may be required in a minority of cases. (Evidence level IV, strength of recommendation D.)

### Small bowel obstruction

Small bowel obstruction may result if the internal bumper becomes detached, either spontaneously or deliberately (as in the 'cut and drop' method of removal). It is estimated that about 1% of PEG bumpers will fail to pass. Impaction of the detached bumper is more likely in children or in adults with intestinal strictures.

Duodenal obstruction may also result if the external fixator of a PEG is so loose that the internal bumper, still attached, is allowed to pass down into the duodenum. In this scenario, the distance marker on the tube at skin level usually indicates that an extra 6 cm or more of tubing sits in the stomach. The bumper can be surprisingly difficult to pull back through the pylorus.

Intestinal ischaemia, small bowel volvulus and intussusception should be considered in the differential diagnosis of a jejunostomy patient presenting with features of small bowel obstruction.

### Small bowel ischaemia

This complication is seen predominantly following jejunostomy. Two mechanisms can be distinguished: mechanical (or occlusive) and non-occlusive mesenteric ischaemia.

Mechanical interruption of the small bowel blood supply may result from small bowel volvulus or intussusception (where the internal bumper acts as the leading edge). Volvulus is well-recognised following surgical jejunostomy but there are relatively few case reports of it occurring after DPEJ.

Non-occlusive ischaemia is a rare consequence of jejunostomy feeding, particularly in children.<sup>68</sup> It is thought to occur because the presence of feed in the jejunal lumen increases mucosal metabolic activity. In patients with sepsis, hypovolaemia or cardiogenic shock, the increased oxygen demand may not be satisfied by the available delivery, leading to gut ischaemia and necrosis. This typically occurs within 2–3 weeks of starting feeding in a critically ill patient, usually preceded by a period of 'intolerance' to enteral feeding with abdominal distension and failure to absorb feed. Some authorities advise against jejunal feeding in the acutely ill, hypotensive patients for this reason.

### Colo-cutaneous fistula

This is a rare complication but may go unrecognised for some time. It occurs if the trochar needle inadvertently passes through a loop of bowel (usually colon) during tube placement. If

unrecognised, the percutaneous enteral feeding tube will end up traversing the colon on its way to the stomach or jejunum. A gastro-colo-cutaneous fistula (or jejuno-colo-cutaneous fistula in the case of a jejunostomy) is thus created. Some patients present early with symptoms of colonic perforation, obstruction or faeculent discharge around the tube but more often it remains unrecognised until the gastrostomy (or jejunostomy) is changed and the replacement tube ends up lying within the lumen of the interposed colon.<sup>69</sup> This results in profuse diarrhoea that is often identifiable as undigested feed.

Careful adherence to the 'safe-tract' technique<sup>70</sup> should prevent this complication.

### Management

Early presentations with colonic obstruction or peritonitis require surgical repair. Late presentations can usually be managed conservatively; the colo-cutaneous fistula will usually close spontaneously once the tube is removed.

### Tumour implantation

It has become established practice to place a percutaneous enteral feeding tube prior to major head and neck surgery or radiotherapy for oropharyngeal cancer. If the 'pull-through' method is used there is the risk of tumour cells being picked up by the 'bumper' during its passage through the oropharynx and implanted at the stoma site. This presents as a metastatic tumour mass at the PEG/PEJ site between 3 and 16 months after the procedure.<sup>71</sup> Although rare, there have been several case-reports of this in the literature and most authorities recommend using a direct puncture (Seldinger or Russell introducer) method for insertion, so that the tube does not come into direct contact with the tumour.

### Tube dysfunction

#### Blockage

PEG tubes are relatively short and rarely block due to feed alone. Blockage is more commonly due to inappropriate sticky or particulate medication and failure to adequately flush the tube promptly after feed or medication. Jejunal extensions, by contrast, are long and narrow and will block unless flushed regularly. They also have a tendency to kink within the bowel lumen. Direct jejunostomies are much less prone to blockage and so provide a more reliable route for post-pyloric feeding.

### Management

Ensure that the tube moves freely in and out of the abdomen to exclude 'buried bumper' as the cause of blockage. Try to clear a blocked tube by flushing with warm water using a small volume (2 ml) syringe. If this fails, an alkaline solution of pancreatic enzymes can be used. The contents of three Pancrex V<sup>®</sup> tablets can be mixed with half a teaspoon of sodium bicarbonate and diluted in 20 ml of warm water. Instil as much of this as possible into the tube and leave for 30 min before attempting flushing once more. NOTE: This is an unlicensed use of Pancrex V<sup>®</sup>. Care should be taken when handling pancreatic enzymes.

Passing guide-wires down the tube to clear blockages is not recommended unless performed under fluoroscopy. The wire might puncture the tube at a bend or kink and cause perforation.

Exclude kinking as a cause of jejunal extension blockage by obtaining an abdominal radiograph. Pulling back the tube by a few centimetres will occasionally straighten it out.

### Recommendations for clinical practice

PEG tube blockage usually reflects poor care and is avoided by prompt flushing after feed or medication. All medication that is

administered via the tube should be discussed with the pharmacy to minimise particulate content. (*Evidence level IV, strength of recommendation D.*)

### Split tubes

Tubes made from polyurethane tend to last longer than silicone tubes, but will split if repeatedly kinked in the same place. Equally, repeated closure of the C-clamp at the same position on the tube will cause indentation and ultimately splitting. Carers should be encouraged to move the clamp up and down the tube so that it does not indent at the same place every time it is closed. The C-clamp should be left open once the spigot is in place.

### Management

If the tube is split far enough away from the skin, it can be cut below the split and the feeding port reassembled on the end of the shortened tube. If the split is too close to the skin a replacement tube is necessary.<sup>72</sup>

### Yeast colonisation

Silicon feeding tubes are particularly prone to colonisation with a variety of yeasts. The yeast/fungal build-up within the tube may be so great as to block it. Yeasts also damage the structure of the tube and cause it to dilate or stretch. A badly colonised tube will usually need to be replaced.

### ETHICAL CONSIDERATIONS

Ethical issues should always be taken into account before proposing percutaneous enteral tube feeding. A well-functioning nutrition team can reduce the number of inappropriate PEG placements carried out<sup>57 73 74</sup> but too often families and carers are told about the plan to insert a PEG tube before it has been properly discussed. This can create unrealistic expectations, which make subsequent discussions with the family more difficult.

### Terminal illness

If a patient's prognosis is so poor that survival beyond a few weeks is unlikely, percutaneous enteral nutrition is inappropriate. In the terminal stages of a patient's life, the burden of PEG insertion usually outweighs any benefit. Loss of desire for food is a natural part of the dying process and there is no evidence that providing nutrition in this situation improves patients' well-being. Similarly, PEG tubes should not be placed for the purpose of administering fluid or medication to a patient in whom death is inevitable in the short term.

### Advanced dementia

Where patients have lost the ability to eat due to severe dementia, requests for percutaneous enteral tube feeding should usually be rejected on grounds of futility. PEG feeding is regarded as a medical treatment; it is not just part of 'basic care'. Like all other medical interventions, it should not be undertaken unless there is evidence of benefit and a clear objective. Current evidence suggests that patients with severe dementia do not benefit from PEG feeding either in terms of prolongation of life<sup>21 75 76</sup> or increased comfort. PEG insertion cannot therefore be justified with these objectives in mind (but see 'Safeguard procedures' described below).

Where the dementia itself is not the primary cause of eating difficulty (eg, the patient with mild/moderate dementia who has a stroke), enteral feeding may be warranted to assist recovery, but in all cases it should be remembered that dementia

is a 'terminal disease' and the burden of PEG placement may outweigh its benefits.

### Chronic systemic disease

The futility argument can also be invoked in chronic disease states where there is no malabsorption or dysphagia but the patient loses weight due to loss of appetite and/or increased catabolism. In this 'anorexia–cachexia syndrome' the nutritional deficit is believed to be due to alterations in intermediate metabolism. These are largely refractory to nutritional therapy. Consequently, many experts consider PEG feeding to be futile.<sup>77</sup> However, enteral nutrition has been shown to be beneficial in some conditions within this category, most notably renal failure patients on dialysis. In these specific circumstances PEG feeding may be justified.

### Refusal of consent

If a patient has mental capacity to consent and refuses treatment this must always be respected. The doctor has a duty to explore reasons for the refusal to ensure the patient is fully informed but, however apparently ill-advised, a patient's decision is binding. Capacity should always be assumed unless the contrary is proven.

### Advance decisions

Where a patient has lost mental capacity to consent but has made a valid, clear and unambiguous advance directive that artificial nutrition be withheld, this has the same legal authority as a contemporaneous refusal. The doctor must, however, be satisfied that the advance decision is valid (see box 5).

### Best interest judgements

The most difficult ethical decisions arise where patients lack capacity and appear to have a very poor quality of life. Many patients with a chronic or progressive neurological disorder fall within this category. In the absence of a valid advanced decision, the medical team must act in the patient's 'best interests'. This means coming to a judgement about what the person would have chosen for him/herself. In reaching this judgement, the Mental Capacity Act (2005)<sup>78</sup> makes it a requirement that the medical team obtains the views of family and carers. Furthermore, the patient may have conferred a Lasting Power of Attorney (LPA) giving someone else the authority to make

#### Box 5 Criteria for a valid advanced directive

- ▶ It is in writing, signed and witnessed at a time when the patient had mental capacity to make the decision.
- ▶ It is clear that the patient had envisaged the specific circumstances which have subsequently arisen and for which the advance decision is being invoked. This should include a statement that the decision applies even if it puts the patient's life at risk.
- ▶ There are no reasonable grounds for believing that circumstances exist which the patient did not anticipate at a time of the directive which would have altered his/her decision.
- ▶ He/she has not withdrawn the decision (while having capacity to do so), conferred authority for this specific decision onto someone else under LPA (see above) or done anything else clearly inconsistent with the advance decision being his/her fixed decision.

decisions about health and personal welfare. The Personal Welfare LPA does not grant decision-making powers in relation to life-sustaining treatment unless this is expressly stated in the agreement. In the absence of family or an appointed representative, an Independent Medical Capacity Advocate should be arranged to represent the patient's interests. Remember however, that under English law, family members and Independent Medical Capacity Advocates do not have the right to refuse or consent to treatment on a patient's behalf. Case conferences can be a useful way of bringing together everyone involved in the patient's care to ensure good communication. Ethics committees are also valuable in difficult cases, but are not widely available.

### Severe global neurological damage, where there is no prospect of recovery

In situations where severe neurological disease has resulted in total or near total loss of awareness and there is no realistic prospect of improvement, the concept of 'quality of life' loses its meaning. Recognition that the patient is in this state requires skilled multidisciplinary assessment. In many such cases the patient's condition is so poor that death is inevitable whatever treatment is provided. In these circumstances PEG is contra-indicated for reasons outlined above.

If the patient's condition has stabilised, the only purpose of PEG feeding is to maintain life and organ function. This is not necessarily in the patient's best interests, as recognised by law, and in some circumstances the doctor may be justified in withholding PEG feeding (but see 'Safeguard procedures' below).<sup>2</sup>

In view of the uncertainty of medical prognosis, a trial of PEG feeding may be appropriate to allow time for further assessment. This should be undertaken for a predetermined period with prearranged review and the nature and purpose of the trial should be made unambiguously clear at the outset to all those involved in the patient's care and, where appropriate, the relatives.

### Psychiatric disorders

Patients who refuse to eat due to a psychiatric disorder will usually also refuse tube feeding and their autonomy should be respected (unless they are being treated for anorexia nervosa under the provision of the Mental Health Act, 1983). Occasionally, tube feeding is accepted as an alternative to eating but such patients are often manipulative and PEG placement is best avoided, since complaints about the tube and its function will quickly replace issues around food intake as the main focus of attention.

Nasogastric tube feeding may be enforced under the Mental Health Act for anorexia nervosa but this is usually a temporary measure; long-term percutaneous tube feeding can usually be avoided.

### Safeguard procedures

Whenever consideration is given to withholding enteral feeding from a patient in whom death is not imminent, it is helpful to request a formal clinical review by a senior clinician who has experience of the condition from which the patient is suffering and who is not part of the treating team. Where the decision not to treat is supported, details of the case and any discussions that have taken place should be fully documented. The reasons for the decision should be set out clearly in the case notes so that they are available for review if the decision is subsequently challenged.<sup>79</sup>

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## Editor's quiz: GI snapshot

### Management of lower gastrointestinal bleeding: endoscopist or radiologist?

#### CLINICAL PRESENTATION

An 83-year-old male presented to the emergency department with a history of heavy rectal blood loss. He described copious amounts of fresh blood with multiple clots. There was no previous history of colonic bleeding or prior colonic investigation. Past medical history included atrial fibrillation for which he was on warfarin.

On examination he was haemodynamically unstable with a pulse rate of 100 bpm and blood pressure of 104/50 mm Hg.



**Figure 1** CT angiogram.

Haemoglobin was 8.6 g/dl and international normalised ratio (INR) was 3. He was immediately resuscitated with packed red cells and fresh frozen plasma.

Colonoscopy was not possible as the rate of bleeding and the fact that the bowel was unprepared would have rendered it technically difficult to locate the bleeding point. This would have delayed definitive treatment which, in an unstable patient, was unadvisable. He was instead transferred immediately for a CT angiogram (figure 1).

#### QUESTION

What does this image show and what is the most appropriate course of action in this unstable patient with ongoing torrential rectal bleeding?

*See page 1679 for the answer*

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