Approach to Oral and Enteral Nutrition in Adults

Module 8.3

Techniques of Enteral Nutrition

Matthias Pirlich (MD)
Dept. of Internal Medicine and Gastroenterology
Elisabeth Protestant Hospital
Lützowstr. 24-26, 10785 Berlin, Germany

Learning Objectives

- To appreciate the different routes of delivery of EN;
- To appreciate the different types of tubes and access routes;
- To be able to select an appropriate type of tube and access route;
- To recognize key characteristics of PEG and PEJ;
- To select an appropriate feed delivery protocol.

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Key Messages

- If oral nutrition cannot be maintained, artificial enteral nutrition using a feeding tube may be indicated;
- The material and construction of a feeding tube should maximise safety, comfort and functionality;
- Bacterial contamination of the enteral feeding system has to be avoided;
- Correct placement of the feeding tube in the stomach or upper jejunum has to be monitored to avoid dislocation and aspiration;
• Placement of a feeding tube into the upper jejunum is a special challenge in daily practice;
• Enteral feeding via tube can be delivered by boluses or continuously, depending on the clinical situation;
• After the start of feeding clinical observation of tolerance is necessary but routine checking of gastric residual volumes in all patients is not mandatory;
• A treatment algorithm for high gastric reflux should be employed;
• The precise indications for propulsive drugs have yet to be defined.

1. Introduction

Enteral feeding is an important component of nutritional support. In patients who have a functioning gut but cannot achieve an adequate oral nutritional intake by regular food, by food fortification or by sip feeding, artificial nutritional support should be considered. This method of artificial support has developed significantly over the past few decades. EN is more physiological, as efficacious as, and less costly than parenteral feeding. When EN is indicated decisions about the access route and medical devices to be used should be made. The patient’s primary disease process, the expected duration of enteral feeding and tube preference will influence the type of enteral feeding access. Nasogastric and nasoenteric feeding methods are usually employed for relatively short-term alimentation (less than 30 days duration). Gastrostomy and jejunostomy are preferable methods in patients who require long-term enteral feeding (more than 30 days duration).

Over time, the spectrum of technical solutions for EN has been developed with respect to different tubes, feeding pumps, and feed containers.

The general rule is to obtain a high level of safety and quality control, with low cost if possible. Therefore, both process management and a high level of structural quality are necessary to provide an optimized nutritional service.

2. Legal Regulation

According to EU regulations, systems for delivery of enteral nutrition are medical devices. The core legal framework for medical devices consists of 3 directives: Directive 90/385/EEC, Directive 93/42/EEC; and Directive 98/79/EC. These fundamental directives have been supplemented over time by several modifying and implementing directives, including the last technical revision brought about by Directive 2007/47 EC. Similar Directives in the various non-EU countries regulate the legal framework and requirements for medical devices.

3. Safety and Quality Standards

3.1 Feeding Tubes and Delivery Systems

Feeding tubes for EN are made of polyvinyl, silicone, or polyurethane (Fig. 1).
They are in direct contact with the skin or mucosal surface. Therefore they should be anti-allergic and free of potentially toxic material which potentially could be absorbed. Polyvinyl tubes are the cheapest but they are more rigid and can cause ulcers in the oesophagus or stomach. The more flexible and less traumatic silicone or polyurethane tubes are therefore preferred. Tubes should be non-leaching, pliable, and non-stiffening. The connecting systems of enteral and parenteral systems should be different by shape and colour to prevent mistakes, especially, the accidental parenteral infusion of enteral solutions and vice versa. (Fig. 2).
3.2 Hygienic Aspects of Enteral Feeding Systems

Although normal food is not sterile, enteral feeding solutions should be sterile and contamination must be avoided. Commercial enteral feeding solutions have been prepared accordingly. Open or closed feeding systems are available. Contamination of feeds can be minimised by meticulous handling and the use of closed rather than open systems. With increasing length of use, feeding tubes are frequently colonized with bacteria. Although retrograde contamination of the giving set can be observed, minimising manipulation of the enteral nutrition bags at the bedside remains critical for bacterial safety.

4. Indications and Contraindications for Enteral Access (See Also Module 8.1)

EN is indicated in patients with malnutrition or inadequate oral food intake:

- Unconscious patient: head injury, ventilated patient
- Swallowing disorder: multiple sclerosis (MS), motor neurone disease (MND), bulbar and pseudobulbar palsies, after stroke
- Chronic organ failure with inflammation and anorexia: eg liver disease, COPD, renal disease
- Increased nutritional requirements: e.g. cystic fibrosis, Huntington’s disease
- Psychological problems (rarely): e.g. severe depression, anorexia nervosa

In the following situations EN is contraindicated or ill-advised:
- failure of intestinal function,
- complete intestinal obstruction,
- anastomotic leak or absence of intestinal integrity
- “high-output” intestinal fistula
- shock of any origin
- ethical considerations (e.g. terminal care, advanced dementia).

More about indications and contraindications are to be found in Module 8.1.

5. Routes of Enteral Access

Regarding routes of enteral nutrition there is a useful distinction between short-term and long-term feeding. Several methods of enteral access for nutritional support are available (Fig. 3).

In everyday practice nasogastric (NGT), nasoenteric (NET), PEG, PEJ, and fine needle catheter jejunostomy are most commonly used, so our attention will be directed more towards these techniques. The choice of the feeding route depends on the underlying pathology, anticipated duration of EN, preference of the patient and ethical considerations. Nasogastric feeding is the least expensive and easiest way to gain enteral feeding access and is the preferred route for short-term enteral feeding. PEG is usually indicated when the patient is expected to need tube feeding for longer than 4 weeks.

![Fig. 3 Routes of enteral feeding (from Sobotka L. Basics in Clinical Nutrition, 2011)](fig3.jpg)

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5.1 Short-Term Enteral Feeding

Short-term enteral access feeding tubes are mostly placed when EN is expected to be of less than 30 days in duration. Pre-pyloric tubes or nasogastric tubes are the most frequent type of tubes used for short-term enteral feeding.

- **Nasogastric tube (NG)**
  - NG tube placement
  - Pre-pyloric endoscopic tube placement
    - peroral endoscopic NG tube placement
    - transnasal endoscopic NG tube placement

- **Nasoenteral tube (NET)**
  - Non-endoscopic post-pyloric tube placement
  - Post-pyloric endoscopic tube placement
  - Peroral endoscopic post-pyloric tube placement
  - Transnasal endoscopic post-pyloric tube placement
  - Double-lumen nasoenteral tube

5.1.1 Nasogastric Tube (NG)

NG tube placement is typically performed at the patient’s bedside (Fig.4). This method requires little training and it is the first choice for the majority of patients requiring short-term nutrition. The NG tube is inserted from the naris to be distally placed in the stomach. The NG tube delivers EN to the stomach and thus constitutes the most physiological method of enteral feeding. The stomach can tolerate higher feeding rates and increased food density compared to post-pyloric feeding. Typically, 8 to 12 French gauge diameter NG tubes are utilized, and feeding can be done by both, bolus or continuously using mechanical pump.

![Fig. 4 Placement of nasogastric/ nasoenteric feeding tube (with thanks to Johann Ockenga)](image)

Disadvantages of this approach include tube dislocation and clogging. Nasogastric tube holders are easily placed at the bedside and can fix the tube in position at the naris, and
can prevent dislodgment of the tube. The use of a magnetically guided bridle is particularly helpful in the transiently confused patient who is prone to remove tubes repeatedly. NG tubes can also provoke patient discomfort, irritation, mucosa ulceration and GI bleeding.

Blind insertion has the potential for malposition with tracheal, pulmonary, or pleural positions in 0.5% to 15%, depending on the clinical state of the patient. Patients with absence of cough reflexes (e.g. neurological impairment, coma, old age) especially have a higher risk of tracheal malposition of the tube.

The correct position of the NG tube is confirmed by ensuring that the aspirate suctioned has a pH< 5. An abdominal X-ray can be performed to determine definite placement position. In difficult cases placement can be performed with endoscopic or fluoroscopic assistance.

**Peroral** endoscopic NG tube placement may be valuable if there is any obstruction in the oesophagus (such as oesophageal stricture) that prevents bedside NG tube placement. In these circumstances the endoscope is passed to the stricture and the NG tube is then passed through the stricture using direct vision.

Another option for placing pre-pyloric NGT is the use of an ultrathin gastroscope and a guidewire that remains in situ. A NGT tube can then be placed over the guidewire into the stomach.

Both methods will require a difficult mouth-to-nose transfer step.

**Transnasal** endoscopic NG tube placement is not routine but it has been described (for example in oesophageal cancer patients). An ultrathin gastroscope is used to intubate the oesophagus via the nasal cavity and the positioning of the guidewire into the stomach through any oesophageal stricture. Very often oesophageal stricture dilatation is required to allow passage of the ultrathin gastroscope, before placement of the NG tube.

### 5.1.2 Nasoenteral Tube (NET)

A special challenge is the postpyloric or jejunal positioning of the feeding tube, which is another option to allow EN in patients where gastric feeding has failed (large residual gastric volumes, vomiting or regurgitation). Also, post-pyloric feeding should be considered in patients with high risk of aspiration, severe gastro-oesophageal reflux, gastrocutaneous fistula or gastroparesis. Gastric residual volumes of up to 500 mL can usually be tolerated, as it is only levels greater than this which significantly increase the risk of pulmonary aspiration.

Post-pyloric NETs have smaller diameters and they are more prone to clogging and blockage. Management of post-pyloric NETs therefore includes: a) flushing the tube immediately after each intermittent feeding bolus infusion, b) flushing the tube every 6-8 hours during continuous feeding, c) flushing the tube immediately after installation of any medications, d) only using liquid or completely dissolved medications.

In most patients standard enteral diets can be applied using continuous feeding, but in some patients a switch to low molecular diets is necessary to obtain better tolerance.

**Non-endoscopic post-pyloric tube placement**

Spontaneous transpyloric tube migration placed at the bedside occurs only in 15% - 30% of patients. A typical protocol consists of the use of a 11 Fr tube, right lateral positioning, gastric insufflation, tube tip angulations and clockwise torque during insertion. It is a time-consuming procedure (20 to 40 minutes). The use of promotility drugs like metoclopramide or erythromycin may facilitate transpyloric passage of the tube.
A modification of the standard tube is the self-propelling feeding tube and it too can be inserted at the bedside. By using this type of NET, with air insufflation and intravenous erythromycin it is possible to achieve post-pyloric placement in a high percentage of ICU patients.

However, the success rate of both post-pyloric placement techniques strongly depends on the level of experience of the practitioner.

Transpyloric tube positioning can be done more effectively with fluoroscopic or endoscopic assistance.

Combining the use of a long guidewire with fluoroscopic assistance yields successful postpyloric placement in up to 86% of patients; a jejunal position can be achieved in approximately 50% (Fig. 5). With this method the patient is exposed to radiation for ~20 minutes, and the radiation burden has to be considered.

![Two-lumen feeding tube after application of contrast medium.](image)

The distal lumen is placed in the small bowel and the proximal lumen drains the stomach

(With thanks to Johann Ockenga)

**Post-pyloric endoscopic tube placement**

Peroral endoscopic post-pyloric tube placement can be done in four different ways with high success rates of about 95%:

1) **Drag and pull technique:** A suture is placed at the distal tip of the tube. The tube is then passed via the naris to the stomach. The gastroscope is then navigated perorally into the stomach. A grasping forcep is used to grab the suture and drag the tube as far down the small bowel as possible. The tube is then released and the gastroscope is withdrawn slowly. The grasping forceps can then be used to keep the tube in position by stepwise re-grasping and pushing the tube further down the small bowel while the gastroscope is retracted. Unfortunately the combined effect of friction and surface tension of the endoscope against the tube often produces retraction of the tube into the stomach. In this situation lubrication of the gastroscope with MCT oil may facilitate the procedure. Alternatively, the tube’s position can be secured by ligating the suture loop to the small intestinal mucosa by using an endoscopic clip.

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2) **Over-the guidewire technique**: The gastroscope is advanced perorally into the small bowel. A guidewire is then advanced down the biopsy channel into the small bowel and the gastroscope is removed leaving the guidewire in situ. The guidewire exits orally and needs to be changed to achieve nasal exit. This is achieved by a nasopharyngeal catheter. Then, the tube can be guided over the guidewire to the small bowel.

3) **Push technique**: The NET is stiffened using 2 guidewires. This “stiffened” tube is then navigated through the nose and into the stomach. This preliminary placement of the tube through the nose into small bowel avoids the difficult oral-nasal transfer. The NET is then grabbed by biopsy forceps and pushed into the small bowel with advancement of the gastroscope. The stiffened NET is thought less likely to migrate proximally on removal of the endoscope.

4) **Therapeutic gastroscope method**: A small diameter NET, 240 cm long, can be introduced through the biopsy channel of a large diameter therapeutic scope. This allows direct placement of the large diameter gastroscope into the small bowel. The scope is removed once the distal end of the NET is in a suitable position. An advantage of this form of endoscopic placement is the additional information on condition of the gastrointestinal mucosa; the key disadvantage is the increased utilisation of medical and personnel resources.

**The transnasal endoscopic post-pyloric tube placement** method is an alternative approach which is not widely used. Potential benefits of this approach are avoidance of intravenous sedation and no necessity for difficult mouth to nose wire transfer. Excessive gastric looping of the ultra-thin gastrocope is however common, which compromises the method.

**Double or three-lumen nasoenteral tubes**

To obtain jejunal access and gastric drainage at the same time, feeding tubes with two or three lumens have been developed. While the small distal feeding tube (9 F) is positioned in the duodenum or jejunum, a second larger lumen of the same tube is positioned in the stomach for drainage. The main disadvantage of these tubes is their stiffness, and therefore they are predominantly used in the intensive care setting with sedated patients *(Fig. 6)*.

![Fig. 6 Three-lumen nasoenteral tube (with thanks to Zeljko Krznaric)](image)
5.2 Long- Term Enteral Nutrition

Long-term enteral feeding requires the establishment of permanent access to the stomach or small bowel. The best way of doing this is normally by introducing a percutaneous endoscopic gastrostomy (PEG) tube.

Long- term enteral feeding approach:
- percutaneous endoscopic gastrostomy (PEG)
- radiological or sonographical guided gastrostomy (PSG or RIG)
- surgical gastrostomy (Stamm or Witzel fistula)
- jejunal extended PEG (PEG-J)
- direct percutaneous endoscopic jejunostomy (D-PEJ)
- surgical jejunostomy (direct or fine needle catheter jejunostomy)

5.2.1 Percutaneous Endoscopic Gastrostomy (PEG)

The basic precondition for PEG placement is that endoscopic oesophago-gastric passage is possible. Relative and absolute contraindications for PEG insertion and use are described in Module 8.1.

Before the start of a PEG procedure coagulation parameters should be checked. The platelets should be greater than 50,000 and the INR less than 1.4 prior to PEG insertion. Some departments have more cautious rules. Aspirin use can be continued during PEG insertion. Warfarin should be stopped and the use of LMWH considered depending on the risk of thromboembolism. The use of new oral anticoagulants (NOACs) has also to be interrupted a certain time period before the intervention according to the manufacturers’ recommendations (typically less than a week). Clopidrogel should normally be stopped but there is a need to liaise with the relevant cardiologist. Some operators are additionally nervous about patients on moderate to high doses of steroids because of fears of poorer healing after the procedure.

Three techniques for PEG placement are established: the “pull” method, the “push” method, and the “introducer” method. The most used method is the pull method introduced 1980 by Gauderer et al. Commonly, conscious sedation is used. In the “pull through” method a routine gastroscopy with duodenal intubation is performed to ensure there is no gastric outlet obstruction. Two operators are usually involved, but one operator PEG insertion is also possible and safe. In the “two operator” method the first operator controls the gastroscope. The gastroscope light can normally be made visible through the anterior abdominal wall – transillumination or diaphanoscopy. The second operator applies finger pressure on the anterior abdominal wall at this site to get confirmation that the site of transillumination corresponds to the intended site as seen endoscopically with indentation from the finger pressure. Recent data have however shown that diaphanoscopy (transillumination of the anterior abdominal wall) is not essential. The needle aspiration test can be used as an alternative to diaphanoscopy to show if there is an overlying bowel loop in the intended PEG placement route. With either technique the abdominal wall is aseptically cleaned. Local anaesthetic is then injected along the tract into the stomach lumen. Next a short incision is made at the puncture site and a trocar needle is inserted into the stomach lumen. A guidewire (Seldinger wire) or thread (depending on the device used) is placed via the trocar into the stomach, grabbed by forceps or a snare loop and then retracted through the mouth while removing the
gastroscope. The PEG tube is then attached to the guidewire and is pulled via the mouth to the abdominal wall exit site. The external bolster should be positioned 1-2 cm from the external abdominal wall. No dressings are needed at the exit site. The external bolster should not be sutured.

There is normally no need for repeated gastroscopy to confirm PEG tube position. With the “push” method a feeding tube is placed over a Seldinger wire. This procedure can also be performed under sonographical or radiological guidance. When a direct puncture of the stomach succeeds, a placement of a feeding tube by the Seldinger technique allows the facilitation of a feeding tube in patients with an obstructed oesophago-gastric passage (e.g. tumour obstruction).

The “introducer” method uses a balloon catheter which is placed transabdominally into the stomach after puncture and dilatation according to the Seldinger technique. This
technique has an increased risk of misplacement due to deflection by the stomach wall. A new safer introducer method has become available, which uses the combination of a double gastropexy with a peel-away sheath introducer to place an intragastric balloon catheter, which is externally secured to the skin with a plate. This method may be suitable for patients, where the standard “pull” technique cannot be used because of increased risk during the passage of the internal bumper through the oesophagus.

With the classical pull PEG, studies report rates of 13% - 40 % for minor complications, 0.4% - 4% for major complications, and 0% - 1% procedure-related mortality.

Complications of PEG are most often:
- Bleeding 0.6% – 1.2%
- Tube site infection 3% - 30%
- Intraperitoneal leakage
- Perforation of small/large bowel
- Metastatic head and neck cancer to the PEG exit site (< 1%)
- “Buried bumper“ migration of the internal disc or bumper into the gastric wall

PEG tube-related complications are more likely to occur in elderly patients with co-morbidity.

Various guidelines suggest intravenous antibiotics for all patients prior to PEG tube insertion. A single dose of a broad spectrum antibiotic (eg 3rd generation cephalosporines or co-amoxiclav), 30 to 60 minutes before PEG insertion has been shown to reduce the incidence of peristomal wound infection. Patients already receiving broad-spectrum antibiotics do not require additional prophylaxis for PEG.

To prevent the “buried bumper syndrome” (migration of the internal bumper into the stomach wall) excessive traction applied to the PEG tube should be avoided (Fig. 8). In addition, it is advisable to mobilize the PEG from outside at least every second day. Feeding via a PEG can be started as early as 2-4 hours after placement after an uncomplicated PEG procedure, but early feeding is rarely practiced and most endoscopists start to feed their patients only 12 hours after the procedure following an earlier preliminary trial with water.

Fig. 8 “Buried bumper”
5.2.2 Skin Level Gastrostomy (Button)

Button PEG-tubes are low profile devices and are less socially stigmatising and it has been shown that they improve the patients’ quality of life. They are usually used in young persons who find normal PEG-tube protrusion socially unacceptable, and patients with peristomal complications. There are three types of so-called “buttons” available with two different retaining elements (balloon and retention dome) (Fig. 9). The external connecting system can be easily removed and only a small skin level head of the button remains between feeds.

![Button](image)

*Fig. 9 Button (with thanks to Zeljko Krznaric)*

These are usually placed once the PEG tract has formed (not before 4 weeks after PEG insertion) but can also be inserted in a single step endoscopically. Initial button placement should be done under endoscopic control, to avoid misplacement and to remove the initially placed PEG. However, a defective button can be usually replaced without endoscopic input.

5.2.3. Percutaneous Endoscopic Jejunostomy (PEG-J or D-PEJ)

In patients who have not tolerated pre-pyloric enteral tube feeding it is appropriate to use percutaneous post-pyloric feeding if long-term feeding is required. This can be achieved with a jejunal extension of an already established PEG (PEG-J) or by direct percutaneous endoscopic jejunalostomy (D-PEJ).

Potential indications for PEG-J or D-PEG are:

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<tr>
<th>Indication</th>
<th>PEG-J</th>
<th>D-PEG</th>
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<tbody>
<tr>
<td>Vomiting</td>
<td>Gastric resection</td>
<td></td>
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<tr>
<td>Aspiration</td>
<td>PEG not possible</td>
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<tr>
<td>Gastro-oesophageal feed reflux</td>
<td>Recurrent dislocation of PEG-J</td>
<td></td>
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<tr>
<td>Gastroparesis</td>
<td>Gastric outlet stenosis</td>
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</table>
Contraindications are the same as in PEG placement. In case of a PEG-J a 9-12 Fr jejunal feeding tube is passed through the previously placed PEG into the stomach. Then this tube is placed radiologically via a guide wire or endoscopically by the pull method and moved beyond the ligament of Treitz. This is essential to reduce the retrograde migration rate. Nonetheless retrograde tube migration remains a frequent reason for tube dysfunction, often caused by kinking and obstruction of the feeding tube. This problem may be overcome by endoscopically placed Hemoclips® to secure the tip of the jejunal tube and prevent migration. The risk of obstruction due to the small bore lumen still remains however.

Alternatively a D-PEJ can be placed. When the enteroscope reaches the jejunum, diaphanoscopy and finger indentation is performed as for a PEG. Next, the negative needle aspiration test is performed. Access to the small bowel is achieved using a trocar needle. The guidewire is positioned through the needle, and the D-PEJ is then inserted using a “pull” technique as with PEG insertion. D-PEJ tubes (18-20 French gauge) are larger in diameter than PEG-J tubes.

In retrospective series technical success for PEG-J and D-PEJ has been reported in 72% to 88% of patients. Failure was mostly due to gastric outlet/small bowel obstruction or inability to perform diaphanoscopy. The potential serious complications are intestinal perforation, jejunal volvulus, major bleeding and aspiration. It is known that obesity has a negative effect on the success rate of D-PEJ insertion. D-PEJ tubes have lower rates of reintervention (due to less kinking/clogging/retrograde jejunal tube migration) and increased tube longevity when compared to PEGJ.

5.2.4. Surgical Access

Surgical techniques for enteral feeding are necessary when percutaneous endoscopic placement is not possible. This is most often the case when endoscopy is impossible due to tumour obstruction. Open surgical access for EN to the stomach or jejunum is usually performed by the Stamm or Witzel technique. Laparoscopic techniques for direct or percutaneous gastrostomy and jejunostomy have been developed. The fine needle catheter jejunostomy (FNCJ) is a frequently used alternative, especially when jejunal access is achieved during (upper) abdominal surgery (e.g. gastrectomy). A large-bore needle is tunnelled subserosally before entering the jejunal lumen, and then a feeding catheter is inserted before the needle is removed (Fig. 10). The feeding catheter is fixed with a purse-string suture. Then the catheter is exteriorized through the abdominal wall using a second large-bore needle. The optimal site of introduction is the mid-third of the line connecting the umbilicus with the left costal arch. Finally the jejunal loop with the 8 to 9 Fr feeding catheter is fixed to the abdominal wall.
The characteristic complications of FNCJ are:
- Tube obstruction due to the small lumen (only 8 to 9 Fr).
- Wound infection.
- Peritoneal leakage
- Very rarely volvulus
- Rarely necrosis of the small bowel
- Rarely peritonitis
- Rarely ileus
- Unintentional removal

6. Management and Delivery of Nutrients
6.1. Bolus Versus Continuous Feeding

There are two principal methods to deliver the enteral feeding formula through the tube: continuous feeding and intermittent feeding (bolus). In bolus feeding a measured amount is slowly given by syringe over an identified time. The rate of administration should not exceed 30 ml/min. In “continuous” feeding, formula is delivered slowly but without interruption for up to 20 hours. In critically ill patients continuous administration over 24 hours via a feeding pump is well established (Fig. 11).
In conscious mobilized patients the majority can be fed via gravitation based feeding systems. Either continuous or bolus application of feeding mixtures is possible. The choice of method should take into account the patient’s individual tolerance and personal wishes.

The advantage of a bolus based feeding protocol is that the time for the feeding procedure is reduced and the patient can organise his or her daily activities more individually. In the case that diarrhoea or vomiting occurs during bolus application, the patient should switch to continuous feeding, starting with a low feeding rate.

### 6.2. Approach to a Feeding Protocol

Intolerance to EN in ICU patients is a frequent problem. This may result in an increased risk of gastro-oesophageal reflux, aspiration associated pneumonia, and inadequate delivery of EN. The basic procedure to decrease risk of reflux and aspiration is positioning of the body with the head elevated to 30 degrees. This has been shown to reduce the incidence of aspiration pneumonia.

EN should be commenced slowly and then increased to 40-50 ml/h. According to new study data routine checking of gastric residual volumes is not necessary in asymptomatic patients. However, in symptomatic patients with high gastric residual volume (> 500 mL) adjustment of delivery rate and other measures are necessary:

- Drugs with promotility activity like metoclopramide, domperidone (both at 10mg every 6 hours) or erythromycin (200-250 mg every 8 hours) are used to overcome high gastric
residuals in clinical practice. The use of motility agents is associated with increased gastric emptying, decreased gastric residual volumes, and improved tolerance to EN. Another means to combat high gastric residuals and gastro-oesophageal reflux is to employ jejunal feeding via an appropriately positioned feeding tube (see 5.1.2., 5.2.3. and 5.2.4.). Although small bowel feeding may be associated with a reduced rate of pneumonia and an increased rate of appropriate nutrient delivery, nasogastric feeding is still the preferred option for most patients. Small bowel feeding is not currently recommended for all patients because the benefits do not appear to outweigh the logistic and cost considerations.

A feeding protocol has the potential to optimize the process quality in EN. The successful implementation of such a protocol requires active dissemination strategies, which include: (a) use of experts and opinion leaders, (b) education at different levels, (c) audit and feedback, (d) involvement of all medical professionals and associated disciplines.

7. References

8. Weblinks

ESPEN guidelines
http://www.espen.org/education/espen-guidelines

German guidelines on enteral nutrition
http://www.dgem.de/enteral.htm

Critical care nutrition
http://www.criticalcarenutrition.com/

AGA position paper enteral nutrition

The Austrian Society for Clinical Nutrition
http://www.ake-nutrition.at/RECOMMENDATIONS.