Percutaneous endoscopic gastrostomy for critically ill patients in a general intensive care unit

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Abstract

Background and Aim : **percutaneous endoscopic gastrostomy (PEG) is an effective way of providing enteral feeding to patients with functionally normal gastrointestinal tract who cannot meet their nutritional needs because of inadequate oral intake. This retrospective study evaluated the clinical outcome of critically ill patients with high assistance level undergoing PEG in a general ICU over a 12 year period.**

Patients and Methods : **we studied a cohort of 82 patients who underwent PEG over a 12-year period between 1 January 1999 and 31 December 2010. Patients were followed-up for 1 year after PEG placement.**

Results : **There were no complications related either to the procedure or to the management of PEG, even in house nursing. In one patient, PEG with a collapsible bumper was successfully removed because the patient fully recovered from his neurological problem. Catheter substitution was necessary in three patients during the first year, because of stoma inflammation due to enteric reflux between the stoma and the catheter. One year after PEG, 66 patients were still alive while 16 patients died from the underlying disease during hospitalization. None of the patients with PEG had aspiration pneumonia.**

Conclusions : **PEG, in expert hands, is a safe and effective procedure for enteral nutrition. Moreover, catheters should be chosen in relation to the duration of enteral feeding and as to whether the patient is likely to recover from his underlying disease.** (Acta gastroenterol. belg., **2013**, 76, **306-310**).

Key words : percutaneous endoscopic gastrostomy, enteral nutrition, tracheostomy.

Acronyms :

intensive care unit (ICU)
enteral nutrition (EN)
percutaneous endoscopic gastrostomy (PEG)
APACHE (Acute Physiology, Age, Chronic Health Evaluation)
mechanical ventilation (VAM)

Introduction

Nutrition is particularly relevant in the general intensive care unit (ICU) (1). Traditionally, nutrition in the critically ill population is regarded to as an adjunctive care designed to provide exogenous fuel to support the patient during response to stress. Nutritional support has 3 main objectives : to preserve lean body mass, to maintain immune function, and to avoid metabolic complications (2).

Nutritional modulation of the stress response to critical illness includes early enteral nutrition, appropriate macro- and micronutrient delivery, and accurate glycemic control. Enteral nutrition (EN) via tube feeding is, today, the preferred way of feeding the critically ill patient and represents an important means to counteract the catabolic state, to decrease disease severity, to prevent complications, to decrease length of stay in the ICU, and to favourably impact patient outcome (1,2).

Percutaneous endoscopic gastrostomy (PEG), introduced into clinical practice in 1980 (3), is now a well established and effective way of providing enteral feeding to patients who have functionally normal gastrointestinal tract but who cannot meet their nutritional needs because of inadequate oral intake (4). PEG the preferred method of feeding when nutritional intake is likely to be inadequate for more than four to six weeks, and when enteral feeding is likely to prevent further weight loss, to correct nutritional deficiencies, and to improve quality of life in patients with insufficient nutritional intake (1,2). Several authors have reported their experience with this technique (5-7). While PEG is a safe technique and the indication for PEG is increasing, an appropriate selection of patients is crucial. The aim of this study was to analyze retrospectively more than ten years of clinical experience of critically ill patients with high assistance level undergoing PEG in a general ICU. We discuss the indications and the complications of PEG and provide practical advice on its management.

Patients and methods

Eligibility criteria included all patients who underwent gastrostomy tube insertion for nutritional purposes (either sole or supplemental) during a 12-year period between 1 January 1999 and 31 December 2010 at the Department of anesthetic, surgical and emergency science of Second University of Naples.

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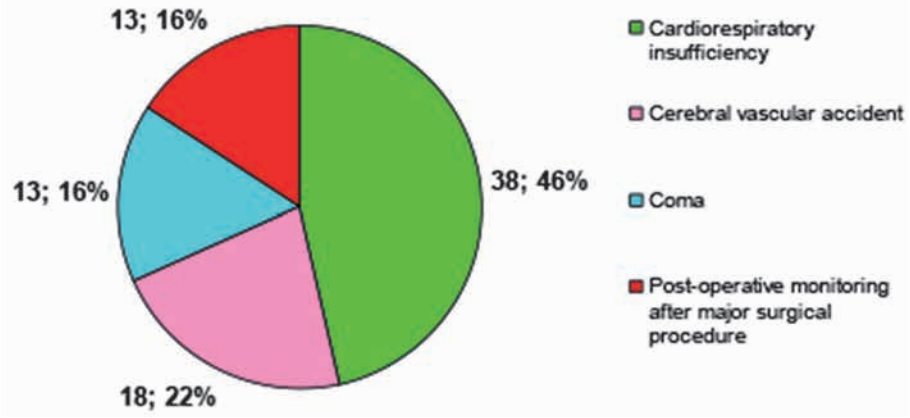

Fig. 1. — Indications to PEG (number of patients ; percentage)

We analyze a cohort of 82 patients (41 males and 41 females ; median age 68 years, range 22-92) submitted to PEG with various diagnosis of admission (Fig. 1). Information related to patient demographics and clinical characteristics, the tube insertion procedure practices, minor complications (defined as non-life-threatening within the first 30 days of gastrostomy tube insertion and before hospital discharge), major complications (defined as life-threatening within the first 30 days of gastrostomy insertion and before hospital discharge), as well as patient outcomes, were collected. Early complications were defined as complications occurring within 7 days of the PEG.

The severity of the illness was assessed in each patient using the APACHE (Acute Physiology, Age, Chronic Health Evaluation) III prognostic system (median and range 73.2 ; 20-119) (8).

Patients had already received EN through and PEG was performed 16.4 days (range 1-37) after admission to the ICU. PEG was performed using the pull-through technique in all patients (9,10). The catheters used for PEG administration were described in Table I.

PEG was always associated with tracheostomy in 67 (81.7%) patients. The technique was always performed at the bedside in the ICU, using total intravenous general anesthesia for patients with spontaneous ventilation and using local anesthesia for patients on mechanical ventilation under sedation. Enteral feeding through PEG usually started 24 h after the end of the procedure.

Results

Patients had concomitant diseases, as reported in Figure 2.

The average procedure time was 7 ± 4 minutes. In patients unable to swallow, we evaluated the aspiration risk. A swallowing functional test with methylene blue was performed in patients with tracheostomy. The test was considered positive if, after oral administration of methylene blue to the patient, the dye was recovered from his tracheotomy tube. A positive test was an indication for PEG placement (11,12). In patients without tracheostomy, we searched for radiological signs of aspiration pneumonia. No clinical events of pneumonia occurred in any patient. During mechanical ventilation (VAM), in order to reduce the incidence of aspiration, we routinely used a further protective device consisting of continuous aspiration for cleaning the subglottic area (Hi-Lo® Evac Mallinckrodt/Covidien).

Our population was followed-up for 1 year. In this period we observed no complications related either to the procedure (such as stoma infections, cellulitis, abscess, peritonitis, air embolism and stroke, massive pneumoperitoneum, accidental perforations, and haemorrhage) or to the management of gastrostomy, even in house nursing. We performed PEG using a Dura-PEG™ (Abbott) in those patients who were likely to have a long survival with no recovery of physiological nutrition, because this device can stay positioned for up to 2 years without the need of being replaced and has low incidence of infections.

In one patient, PEG with a collapsible bumper was successfully removed because the patient fully recovered from his neurological problem. Stoma closed spontaneously in 36 hours without endoscopic assistance. Catheter substitution, performed without endoscopic assistance, was necessary in three patients (3.6%) during the first year, because of stoma inflammation due to enteric reflux between the stoma and the catheter. Reflux occurred only in patients with an Entristar™ PEG (Covidien Healthcare/Kendall) 20Fr catheter with a collapsible fenestrated bumper. Inflammation was managed by placing a silicon catheter with a collapsible non-fenestrated balloon bumper (Corflo® – Dual or Triple Gt Gastrostomy Tubes – Viasys Healthcare – Medsistems). In three patients (3.6%) with Corflo max, the polyurethane catheters were replaced with the silicon catheters because of skin irritation by external fixation device between the 9th and 14th day.

One year after PEG, 66 patients were still alive while 16 patients died from the underlying disease during hospitalization. None of the patients with PEG suffered

Table 1. — **Various feeding tubes used for PEG placement (pull technique)**

Patients' number (percent)	Catheter's model	Bumper at the distal end of the tube for gastric retention	Manufacturer
26 (32)	biocompatible 16Fr Polyurethane (carbotan) tube	non collapsible disk	Flexiflo DURA-PEG™ (Abbott Laboratories, Sligo, Ireland)
11 (13)	Biocompatible 20Fr silicone feeding tube	collapsible Roll-Tip Bumper	Flexiflo Inverta-PEG™ (Abbott Laboratories, Sligo, Ireland)
35 (43)	polyurethane catheter	Flower disk bumper patented collapsible internal retention cage CORFLO®-MAX PEG Ring bumper material is polyurethane. It is maintained in its natural expanded shape by a collapsible/expandable polyurethane foam.	3 Flocare® PEG Set 18Fr (Nutricia™ Healthcare S.A., The Netherlands) 10 Entristar™ PEG 20Fr (Covidien Healthcare/Kendall) 22 Corflo® max PEG 20Fr Corpak®Medsystems
10 (12) As replacement PEG tube	silicone catheter 20Fr 16/20/24 Fr silicone catheter 18/20 Fr	Radiopaque Collapsible bell-shaped Bumper collapsible balloon bumper	4 Kimberly-Clark* MIC* PEG Ballard™ 6 Flow® Cook Medical Corflo®–Dual & Triple Gt Gastrostomy Tubes – Viasys Healthcare – Medsistems

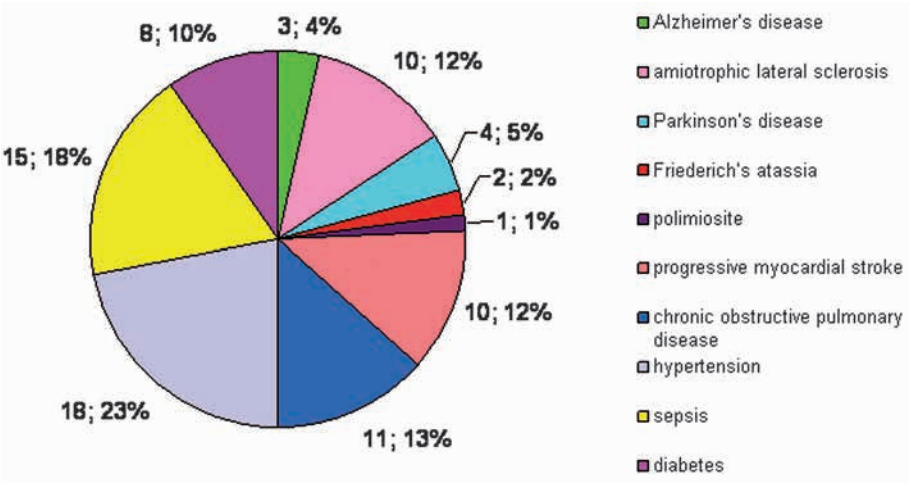

Fig. 2. — Concomitant diseases which are affected the enrolled patients (number of patients ; percentage)

from aspiration pneumonia in ICU or in the follow-up period.

Discussion

PEG represents the preferred enteral access to patients who need long-term enteral nutrition. Due to its simplicity, safety and low cost, PEG offers several advantages over other feeding techniques, particularly nasogastric tube feeding and parenteral feeding. However, PEG needs to be performed by expert hands and requires high level of care in order to maintain a low incidence of complications (13). When compared with other methods of enteral nutrition, such as via nasogastric catheter, gastrostomy feeding caused less discomfort and had lower rates of complications such as bleeding, blockage, and dislodgment of the tube (14). Although gastrostomy feeding does not prevent reflux or aspiration, this occurs

at lower rates than in patients fed through a nasogastric tube (15,16).

Absolute PEG contraindications are : massive ascitis, gastric varices, hepatomegaly, coagulopathies and total esophageal stenosis. Previous abdominal surgery may not represent a problem if there is good adherence between the abdominal and the gastric wall. In our series, in one patient with diaphragmatic relaxation, we delayed PEG placement until stomach returned into its intra-abdominal following mechanical ventilation in ICU.

In the literature, there are no statistically significant differences in success and complication rates between the push or pull techniques in PEG placement (17). We preferred the pull technique because it is easier to perform and it is not associated with the risk of spacing out the plans crossed by the stoma during percutaneous dilation, thus reducing complications such as infections and/or hemorrhage.

Based on our study, carbotan tubes should be preferred in patients who are likely to be on enteral nutrition for a long period of time. In fact, we did not have any complication nor there was the need for replacement of the catheter at 1 year follow-up. Polyurethane or silicon tubes with collapsible bumpers (which can be removed without endoscopic assistance) represent a better option for patients who are likely to recover from their underlying problem and may need catether removal after a short period of time. Our results, which show no significant complications related to the procedure, confirm data from previous reports (18-21).

Biocompatibility of used materials (carbotan or polyurethane) allows to delay tube replacement. In our series, this was necessary only in three patients (3.6%), a few weeks after PEG placement using a polyurethane tube with a fenestrated collapsible bumper because of stoma inflammation likely due to leakage of gastric juice. Three more patients needed replacement of the catheter because skin irritation by external fixation device. We always used a silicon catheter with a collapsible balloon bumper in PEG replacement. This kind of catheter provides greater comfort to the patient, its external retention bolster prevents migration and eliminates need for tape or sutures. Finally, its design facilitates air circulation thus reducing peristomal inflammation and facilitating stoma healing.

We did not perform an analysis of costs. However, the high cost of carbotan catheters was compensated by a decreased need for nursing without the need for catheter replacement during follow-up. No patient who received PEG suffered from reflux and/or diarrhea, probably because gastrostomy improves esophageal sphincter function more compared with nasogastric tube. Furthermore, careful nursing care (with slow enteral administration of meals at the appropriate temperature) avoids common enteral feeding complications.

The use of nasojejunal tubes or trans-PEG jejunostomy was limited to patients with severe gastroesophageal reflux or gastric motor disorders.

PEG should be considered in several clinical situations : a) for temporal use in those patients with potentially reversible diseases ; b) in non-reversible diseases in which a long survival (i.e. > 6 months) is likely, and c) in patients with terminal and debilitating illnesses in whom a relatively long survival is likely. The appropriate training of care professionals and familiar supporters in charge of the patients carrying a PEG ensures its continuous functioning and reduces the risk of complications. Awareness of these complications and the use of preventive strategies can allow the endoscopist to maximize outcomes and to identify early complications.

Aspiration pneumonia is frequently seen in patients with tracheostomy receiving prolonged positive pressure mechanical ventilation. Episodes of aspiration are not always associated with clinical symptoms of distress to alert the bedside observer (11,22). Prompt diagnosis of swallowing dysfunction may facilitate the implementation of corrective actions to prevent respiratory complications (11,12). In our practice we use the methylene blue test to check swallowing dysfunction in tracheotomized patients. A positive methylene blue test is an indication to PEG placement which may avoid aspiration pneumonia thus reducing ICU stay and costs (23).

One additional and relevant advantage of PEG in this setting is the faster recovery of swallow function and better response to swallow training. In partial support of this concept, a recent study by Kumagai *et al*. demonstrated that, compared with nasogastrig tube feeding, PEG tube feeding did not induce aspiration pneumonia due to impairment of intact swallowing function and that this was associated with a higher survival rate of approximately two years (24).

One major limitation of this study is the retrospective nature of our observation. This, together with the fact that only medical files were checked, may partially explain the striking absence of episodes of aspiration pneumonia or diarrhea in our patient population. However, prompt PEG placement might have contributed to the absence of episodes of aspiration pneumonia in our patient. Also, considered the APACHE score, the number of patient still alive after 1 year (i.e. 66/82) is unexpectedly high. Whether this is due a an excellent level fo assistance or to the fact that patients were less sick than it might be expected given the baseline APACHE score is difficult to say.

In conclusion, this study reporting our experience in a large series of patients with over 1 year follow up, confirms that PEG, in expert hands, is a safe and efficient procedure for enteral nutrition with a very low rate of early or late complications. Also, much attention must be paid in patients with tracheostomy or mechanically ventilated patients in order to avoid aspiration pneumonia. Finally, this study strengthens the concept that catheters should be chosen in relation to the duration of enteral feeding and as to whether the patient is likely to recover from his underlying disease.

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