Pneumonia and mortality after percutaneous endoscopic gastrostomy insertion

Neville AZZOPARDI¹, Pierre ELLUL

Department of Gastroenterology, Mater dei Hospital, Tal Qroqq, Malta

Background/aims: Percutaneous endoscopic gastrostomy feeding provides enteral nutrition to patients with neurological dysphagia. Thirty-day mortality rates of 4-26% have been reported, with pneumonia being the common cause post-percutaneous endoscopic gastrostomy insertion. Materials and Methods: This retrospective analysis of percutaneous endoscopic gastrostomy tube insertions in Malta (January 2008 - June 2010) compares the incidence of pneumonia in patients fed through a nasogastric tube versus in those fed via a percutaneous endoscopic gastrostomy tube. We analyzed the indications, poor prognostic factors and mortality for percutaneous endoscopic gastrostomy insertion. Results: Ninety-seven patients underwent percutaneous endoscopic gastrostomy insertion. Fifty-four patients received nasogastric feeds before percutaneous endoscopic gastrostomy feeds. Patients on nasogastric feeds developed 32 episodes of pneumonia over a total of 7884 days of feeds (1 every 246 days). Patients with percutaneous endoscopic gastrostomy feeds after a period of nasogastric feeds developed 48 pneumonia episodes over 36,238 days (1 every 755 days). Patients with percutaneous endoscopic gastrostomy feeds without previous nasogastric feeds developed 28 pneumonia episodes over 23,983 days (1 every 856 days), and this was statistically significant (χ² test p value <0.005). Forty-seven patients had died at the time of data collection, with 29 patients dying from pneumonia. One-week mortality was 3%, 30-day mortality was 8% and 1-year mortality was 39%. All patients dying within the first week and 50% of those dying within 30 days of the procedure died following pneumonia. Conclusions: There was a statistically significant decrease in the number of pneumonia episodes among patients receiving percutaneous endoscopic gastrostomy feeds versus nasogastric feeds. However, pneumonia is still the major cause of death among percutaneous endoscopic gastrostomy patients.

Key words: Gastrostomy, percutaneous endoscopic gastrostomy, pneumonia, nasogastric
INTRODUCTION
The introduction of percutaneous endoscopic gastrostomy (PEG) feeding in 1980 has resulted in an ever-increasing demand for endoscopic procedures to provide enteral feeding to patients who have lost enteral access but who retain the absorptive capacity of their gastrointestinal tract (1). There is considerable evidence of the benefits for maintaining nutrition in such patients. While nasogastric tubes (NGTs) are the established means of enteral access in acute cases, these tubes are often poorly tolerated in conscious patients and can lead to increased risk of nasal ulceration and aspiration pneumonias in the unconscious patient. PEG tube feeding is frequently regarded as a safe and effective method of providing long-term enteral nutrition to patients with neurological dysphagia and offers important advantages over NGT feeding, mainly because of greater weight gain and less treatment failure due to tube dislodgement (2). Studies have also shown that early gastrostomy tube feeding (at 14 days after the event) is greatly superior to NGT feeding and should be the nutritional treatment of choice for patients with acute dysphagic stroke (3). However, there is insufficient evidence to suggest that enteral tube feeding is beneficial in patients with advanced dementia, and most authors suggest a greater mortality and advise avoiding PEG insertion in these patients (4-7).

The recent guidelines on the provision of a PEG service were published in view of the National Confidential Enquiry into Patient Outcome and Death (NCEPOD) report, which expressed concern over the morbidity and mortality associated with PEG placement. These guidelines highlighted the importance of adequate selection of patients for long-term enteral nutrition (8,9). The NCEPOD report revealed a 1-week mortality of 43% after PEG insertion, and in 19% of cases, the procedure was deemed futile by the same panel (10).

Ethical considerations should always be taken into account when selecting patients for PEG insertion, particularly with respect to their quality of life (11). Families and caregivers are frequently 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 (8). Patients receiving a PEG are usually seriously ill, often with major neurologic disabilities. The extent of anticipated recovery may be limited or uncertain, and in some cases, a prolonged clinical course with deterioration to death occurs. Patients provided with long-term nutritional support via PEG may accordingly experience an extended life of poor quality and the burden of care frequently falls on the family (12). Studies have shown that in a substantial proportion of cases, the clinical course subsequent to PEG is poor. Patients interviewed after the procedure were uncertain that proceeding to nutritional support via a PEG had been the right decision (13).

Patients undergoing PEG are often at high risk for complications caused by associated comorbidity. Minor complications associated with PEG placement occur in 13-43% of patients (14-16), and include tube occlusion, maceration from leakage of gastric contents around the tube and peristomal pain. Major complications, reported in 0.4-8.4% of procedures (14, 16-19), include wound infections, necrotizing fasciitis, aspiration, bleeding, perforation, ileus, injury of internal organs, tumor seeding, and death. Procedure-related mortality has been reported to range from 0-2% with a 30-day mortality in the range of 6.7-26% (14, 16, 20, 21). This may be due, in part, to the patients’ underlying comorbidities. Pneumoperitoneum occurs commonly after PEG and is of no clinical significance unless accompanied by signs and symptoms of peritonitis (22). The most common complication is wound infection. Antimicrobial prophylaxis is recommended because it may reduce the frequency of peristomal wound infection (23-27) and is cost-effective (28). A mature fistulous tract is required to safely replace a percutaneous gastros- tomy tube/button. Non-endoscopic replacement of a dislodged tube/button is contraindicated in the absence of a mature tract. Non-operative management of early dislodgement of PEG tubes has been described (29).

MATERIALS AND METHODS
This is a retrospective study in which we analyzed all PEG insertions in our hospital performed between January 2008 and June 2010. Our hospital has a captive population of 400,000. Our aims were to analyze:
1. The indications for PEG insertion;
2. Mortality at 7 days, 30 days and 1 year post-PEG insertion and the poor prognostic factors (PPFs) for PEG insertion;
3. The incidence of pneumonia episodes among patients fed through a NGT versus among patients after insertion of a PEG tube.
Patients were referred for PEG insertion following consultation with a Speech and Language Pathologist (SLP) by their treating physician, and all patients were reviewed by the gastroenterology team prior to the PEG insertion. Post-PEG instructions and follow-up are usually carried out by a nutrition specialist nurse together with the treating gastroenterologist.

Patients were identified through the endoscopy unit database. The approval of the Data Protection Officer at our hospital was obtained. Data were collected through the patients’ case notes and included the following:

- Patient characteristics (age, gender)
- Indication for PEG referral
- Duration of NG feeds prior to PEG insertion
- Number of pneumonia episodes while on NGT
- Duration of PEG feeds
- Number of pneumonia episodes while on PEG tube
- Mortality figures at 7 days, 30 days and 1 year
- Cause of death
- Poor prognostic factors (PPFs) for PEG insertion – the PPFs that were analyzed included:
  a. Male gender
  b. Age >65 years
  c. Dementia
  d. Albumin level <30 g/L
  e. Recurrent aspiration pneumonia
  f. Heart failure
  g. History of subtotal gastrectomy
  h. Presence of bedsores
  i. Presence of advanced malignancy
- Patient nil by mouth (or nil by NGT) for ≥11 days
- Need and indication for PEG re-insertion
- Albumin level within 28 days prior to PEG insertion
- Use of prophylactic antibiotics
- Use of sedation or general anesthesia

**Statistical Analysis**

A Pearson chi-square test was performed to analyze the ratio of the number of days with pneumonia against the duration of feeds through NGTs and PEG tubes. A Pearson chi-squared test was also used to analyze the association between different PPFs and 30-day mortality.

**RESULTS**

**Patient Characteristics**

Ninety-seven patients (44 male, 53 female) underwent PEG insertion in the 30-month period under study. As shown in Figure 1, PEGs were inserted at different ages, though they were more common with increasing age. All patients received prophylactic antibiotics as per guidelines (30). Intravenous midazolam was the drug used for sedation in 85.3% of patients. In 12.4% of cases, the procedure was performed using propofol, while in 2 procedures (2.1%) only local anesthesia was used.

**Indication for Referral**

The indications for PEG insertion are demonstrated in Figure 2. The main indication was neurologically unsafe swallowing. This broad category can be divided into (a) neurologically unsafe swallowing following a cerebrovascular accident and (b) neurologically unsafe swallowing secondary to progressive neuromuscular degeneration (56% - including Huntington’s disease, Parkinson’s disease, progressive dementia, motor neurone disease, cerebral palsy, and other progressive disorders including hydrocephalus, Down’s syndrome, progressive supranuclear palsy, familial neurodegenerative disorder, and spinocerebellar degeneration). Other reasons for referral were malignancy (nasopharyngeal, oropharyngeal, gastrointestinal and cerebellar) and persistent vegetative states.

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**Figure 1.** Numbers of PEGs inserted according to age.
Pneumonias in NGT- and PEG Tube-Fed Patients

Only 54 of the patients in the study had a NGT inserted before the PEG insertion. 29.6% of patients with a NGT developed at least one pneumonia episode while receiving NG feeds. The mean in-hospital stay for admissions with pneumonia was 8.5 days. The mean duration of NG feeds in the patients with a cerebrovascular accident was 85.3 days (range, 7–348 days). Patients were divided into three subgroups as follows:

- Patients developing pneumonia while on NG feeds;
- Patients developing pneumonia while on PEG feeds following NG feeds;
- Patients developing pneumonia while on PEG feeds without having previous NG feeds.

Table 1 demonstrates the results in these patients. 34.0% of patients with a PEG tube developed at least one pneumonia episode. The total in-patient hospital stay for pneumonia during PEG feeds was 646 days, or 8.5 days for each pneumonia episode. Statistical analysis using chi-squared test comparing the ratio of the in-hospital man-days with pneumonia with the total number of days on NG/PEG feeds was significant for the three subgroups ($\chi^2$ value = 279.686, p<0.005). Thus, during the same time period, patients with a NGT developed pneumonia three times more frequently than those fed by PEG tube.

Figure 3 describes the frequency of pneumonia in patients requiring enteral feeding for different pathologies. Eight patients experienced recurrent pneumonia while receiving nutrition first through a NGT and subsequently through a PEG tube. Eight patients developed pneumonia only while receiving NG feeds with no further pneumonia upon PEG insertion. Twenty-five patients had pneumonia only when fed through a PEG tube, either because no NGT was inserted before the PEG tube or because the patient had no pneumonia episode while receiving NG feeds.

Mortality

The cause of death in these patients is displayed in Figure 4, while Table 2 describes the 7-day, 30-

| Table 1. Pneumonias in patients with NG/PEG feeds |
|---------------------------------|-----------------|-----------------|
| **NG feeds** | **PEG feeds following NG feeds** | **PEG feeds in patients without previous NG feeds** |
| Number of patients developing pneumonia | 16 | 22 | 12 |
| Number of pneumonia episodes | 32 | 48 | 28 |
| Total number of patients | 54 | 54 | 43 |
| Days on NG / PEG feeds | 7884 | 36,238 | 23,983 |
| In-hospital man-days with pneumonia | 262 days | 455 days | 191 days |
| Frequency of pneumonia | 1 every 246 days | 1 every 755 days | 1 every 856 days |

NG: Nasogastric. PEG: Percutaneous endoscopic gastrostomy.
day and 1-year mortality figures. Three patients died within one week of the procedure. One patient died secondary to a colonic perforation complicated by pneumonia. The other two patients died secondary to pneumonia. A PEG was deemed necessary in these patients because of swallowing impairment secondary to Huntington’s disease, laryngeal malignancy and Down’s syndrome.

The indications for referral for PEG insertion in patients who died within 30 days after the procedure are described in Table 3. Pneumonia was the cause of death in 50% of patients dying within 30 days of the procedure.

**Poor Predictive Factors Before PEG Insertion**

The incidence of PPF in those patients who died within the 30-day mortality figure was analyzed. All patients who were within this category had at least 1 PPF. Two patients had 1 PPF, 1 patient had 2 PPFs and 5 patients had 3 PPFs. The commonest PPFs were male gender (62.5%), history of recurrent aspiration pneumonia (50%), age >65 years (37.5%), dementia (37.5%), and advanced malignancy (25%). Each PPF was statistically analyzed for an association with 30-day mortality using the Pearson chi-squared test. However, there was no dependence or association found in these variables (male sex p=0.0788, aspiration pneumonia p=0.8308, age >65 years p=0.5574, dementia p=0.5574, hypoalbuminemia p=0.7430, and advanced malignancy p=0.2034).

Thirty-one patients (31.95%) had their albumin level checked within 28 days before the PEG insertion, and their mean albumin level was 34.47 g/dl (range, 22.0–47.9 g/dl). Seventeen patients (54.8% of those having their albumin checked) had a serum albumin level <34.0 g/dl, while 8 patients (25.8% of those having the test) had an albumin level <30 g/dl. Three of the patients with severe hypoalbuminemia had suffered a major cerebrovascular event. The relationship of the number of PPFs and PEG insertion is demonstrated in Figure 5, while the incidence of the different PPFs is demonstrated in Figure 6.

**Need for PEG Reinsertion**

Twenty-three patients (23.7%) required reinsertion of the gastrostomy tube. The reasons for reinsertion of the PEG tube included 32 cases of a dislodged PEG tube, 5 cases of a fractured PEG tube and 1 case of a leaking tube.
The results from this study indicate that up to 83% of all PEG tubes inserted are performed due to neurologically unsafe swallowing (27% following a cerebrovascular accident and 56% for a progressive neuromuscular condition that impairs swallowing). Only 6% of referrals were due to dementia, reflecting appropriate patient selection before the procedure. Our study clearly demonstrates that patients with NGT are three times more likely to develop pneumonia than patients with a PEG (p value < 0.005). This reduced risk is equally statistically significant between patients with a PEG who did or did not have a NGT prior to PEG insertion. This further demonstrates the conferred advantage of PEG insertion. Furthermore, due to this advantage, the amount of hospital admissions for patients with PEGs was lower than for patients with NGT.

Advanced age and cerebrovascular accident are associated with a higher risk of pneumonia (31).

In our study, cerebral palsy was associated with a higher risk of pneumonia (p value = 0.033). A prospective study (31) on 24 patients undergoing a PEG insertion revealed an increased incidence of pneumonia in patients with esophagitis during the insertion and in those with a prior history of pneumonia. None of our pneumonia patients had documented esophagitis during the PEG insertion, while 24.2% of our patients had a prior history of pneumonia while on NG feeds. Those patients who developed pneumonia while on PEG feeds had an average age at insertion of 60.4 years (range, 16–82 years). Patients who developed pneumonia while on NG feeds had an average age at insertion of 57.2 years (range, 16–89 years).

There was a significant delay in PEG insertion in our stroke patients, with a mean duration between NG and PEG insertion of 85.3 days. This contrasts with the recommendations in the guidelines to insert a gastrostomy tube 14 days after the cerebrovascular event (8). These data might explain in part the higher incidence of pneumonia among NGT-fed patients.

Does this mean, therefore, that PEG tubes will be uniformly effective in preventing pneumonia? As the mortality figures show, pneumonia is still the major cause of death among patients with a PEG tube, with a significant 62% all-cause mortality, 50% 30-day mortality and 100% 1-week mortality. Interestingly, 50% of the patients who developed pneumonia while receiving NG feeds also developed pneumonia while receiving PEG feeds. The indications for PEG insertion in these patients were swallowing impairment secondary to Parkinson’s disease (37.5%), cerebrovascular accident (37.5%), cerebral palsy (12.5%), and Down’s syndrome (12.5%). These data might indicate that patients suffering from certain conditions might be more prone to aspirate, whichever method is used. This was not statistically significant in view of the small numbers in the study (only 8 patients developed pneumonia while receiving NG feeds and also while receiving PEG feeds). Figure 3 above demonstrated how pneumonia in conditions like Huntington’s disease and cerebral palsy remains very common notwithstanding PEG insertion.

Another possibility is that the feeds are being given to patients in the prone position, which may predispose to reflux and aspiration of gastric contents.

These data highlight the importance of adequate education of caregivers and post-PEG insertion

**DISCUSSION**

The results from this study indicate that up to 83% of all PEG tubes inserted are performed due to neurologically unsafe swallowing (27% following a cerebrovascular accident and 56% for a progressive neuromuscular condition that impairs swallowing). Only 6% of referrals were due to dementia, reflecting appropriate patient selection before the procedure. Our study clearly demonstrates that patients with NGT are three times more likely to develop pneumonia than patients with a PEG (p value < 0.005). This reduced risk is equally statistically significant between patients with a PEG who did or did not have a NGT prior to PEG insertion. This further demonstrates the conferred advantage of PEG insertion. Furthermore, due to this advantage, the amount of hospital admissions for patients with PEGs was lower than for patients with NGT.

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follow-up. This service should be provided by a multidisciplinary Nutrition Care Team including nutrition nurses, speech pathologists, gastroenterologists, patients, and caregivers. This team should also be involved in the decision-making process as to whether a percutaneous feeding tube is in the patient’s best interest (32). Evidence suggests that complications related to tube feeding are less common in hospitals with a functioning multidisciplinary team (33). A well-functioning nutrition team can also reduce the number of inappropriate PEG tube insertions (34-36).

Thirty-day mortality rates varying between 4.1% and 26% have been described in different studies (37). In a cohort of 7369 veterans who underwent PEG, 23.5% died during the hospital admission during which the PEG was placed, and the median survival was only 7.5 months (38). In another study of 81,105 older Medicare beneficiaries who underwent gastrostomy placement (59,969 PEG and 21,136 operatively placed), in-hospital mortality occurred in 15.3%. The 1- and 3-year mortality rates were 63.0% and 81.3%, respectively (39). The 8% 30-day mortality and 39% 1-year mortality figures in our study are significant in that they stress the importance of careful patient selection before the procedure. While these figures might improve to a certain extent with more stringent selection criteria, ethical issues frequently arise that may complicate these decisions. The prognostic factors mentioned above might help in the final decision as to which patients should undergo PEG insertion. Though no statistically significant association could be found in this study, PPFs might still have a role in deciding which patients should undergo PEG insertion. As demonstrated in the results, all patients who died within 30 days had at least one PPF, with 62.5% having three PPFs. The lack of a statistically significant association between the PPF and 30-day mortality might be explained by the limited numbers analyzed in this study.

Patients with poor nutrition are likely to do worse after PEG insertion, with an increased early mortality (40). Hypoalbuminemia is frequently a marker of poor nutrition. A limitation of our study with regards to PPF was that only 32% had a serum albumin available prior to PEG insertion. Studies have recommended that there may be some benefit in performing PEG before the onset of severe hypoalbuminemia (40). While low albumin is a PPF for PEG insertion, further studies are required to investigate whether correction of hypoalbuminemia before the procedure decreases post-PEG mortality. A low serum albumin before the procedure may help predict mortality following PEG insertion and thus may be important in appropriate patient selection before the procedure.

In conclusion, PEG insertion in patients with neurological dysphagia decreases the frequency of pneumonia when compared to NG feeding. However, pneumonia is still the major cause of death among these patients. This should be adequately explained to patients and their caregivers before they consent to the procedure. Careful patient selection for PEG insertion, taking into consideration any PPF, may help further improve the mortality associated with this procedure.

REFERENCES


