Percutaneous endoscopic gastrostomy outcomes: can patient profiles predict mortality and weaning?

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ABSTRACT

Introduction: The benefits of percutaneous endoscopic gastrostomy (PEG) remain controversial. Patient selection is important to identify those who will benefit from PEG. This study aims to identify patient factors that may help in patient selection for PEG.

Methods: Patients who underwent PEG at the Gastroenterology Unit of Tan Tock Seng Hospital, Singapore, from January 1998 to December 1999, were identified. Multiple logistic regression was used to predict patient's outcomes.

Results: There were 106 (61 male) patients with a mean follow-up period of 465 days (range 3-1,410 days). The mean patient age was 64.5 years (range 17-94 years). The 30-day, six-month, one-year and two-year mortality rates were 7.5 percent, 26.4 percent, 35.8 percent and 46.2 percent, respectively. Older age (p-value is 0.023), presence of bedsores (p-value is 0.042) and abnormal nutritional status based on body mass index less than 20 kg/square metres (p-value is 0.001) were predictive of mortality. 26 percent of patients were able to wean off PEG in an average period of 185 days (range 3-870 days). Patients were generally younger (p-value is 0.003) and had better renal function (p-value is 0.047).

Conclusion: Older age, poor nutritional status and presence of bedsores were predictors of poor outcome. Younger age and preserved renal function were significant predictors of weaning off PEG feeding.

Keywords: endoscopy, enteral feeding, gastrostomy, percutaneous endoscopic gastrostomy

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INTRODUCTION

Percutaneous endoscopic gastrostomy (PEG) has gained wide acceptance as the mode of choice for provision of long-term enteral feeding, since its introduction in 1980[1]. Compared to the traditional nasogastric tube, studies have shown that PEG-fed patients get more of their prescribed feed and PEG to be beneficial[2,3]. However, the long-term benefits of nutrition and morbidity have not been shown consistently in other studies, and this is particularly true in patients with advanced dementia[3-5]. The mortality rate of PEG-fed patients remains high, with 30-day mortality rates that range from 8.2% to 32.8%, and one-year mortality rates of 38-90%[4-7]. This high rate has been partly attributed to the underlying comorbid conditions. It remains a challenge for physicians involved in making these decisions due to current controversies regarding impact of PEG on quality of life, functional status and patients' survival. Our study aims to identify patient factors that may help to select those who may benefit from PEG feeding.

METHODS

Patients who underwent PEG at the Gastroenterology Unit of Tan Tock Seng Hospital, Singapore, from January 1998 to December 1999 were identified and retrospectively analysed. All PEGs were performed using the "pull" technique and the position checked endoscopically. All indications for PEG were deemed appropriate by the gastroenterology team. Patients were considered for PEG if they did not have a terminal illness and were expected: (1) to be dependent on enteral feeding (nasogastric tube feeding) for more than one month, (2) to survive well beyond six months, and (3) require supplemental feeding due to inadequate oral intake, such as head and neck cancers patients who were due to undergo therapy.

Written consent was obtained from all patients or relatives/carers by a member of the gastroenterology team. Feeds were withheld overnight and patients were routinely started on intravenous fluid before

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the scheduled procedures. Conscious sedation (midazolam and fentanyl) was routinely used, unless contraindicated. Intravenous antibiotic prophylaxis with cefazolin (1 g) was routinely given one hour before procedure, if the patients were not already on antibiotics. Post-PEG placement, patients were kept nil by PEG for at least 24 hours and monitored for any complication. Patients were routinely assessed by the gastroenterology team the following morning and thereafter, periodically until discharge for complications related to the procedure (such as wound infection, bleeding, feeding intolerance and peritonitis).

Feeding were started as per dietitians' instructions and increased to the desired volume over the next few days. Family and carers were taught on the techniques of feeding and the care of the PEG tube. Complications were treated immediately and accordingly, when encountered. Patients were discharged to their homes or nursing care facilities when the patients' carers were familiar with PEG feeding and care. Following discharge, patients were routinely followed up in outpatient clinic for review and change of the PEG (usually at six-monthly intervals). Patients were assessed for possible recovery of swallowing functions by the attending clinic gastroenterologist, and referred to speech therapists for formal assessment, if there was the possibility of weaning of PEG.

Each patient's demographical, clinical (comorbid conditions, presence of bedsores and body mass index (BMI) [<20 kg/m^2 and ≥20 kg/m^2]) and biochemical variables before PEG placements (serum albumin, urea, creatinine, haemoglobin and total white cells) were analysed. Biochemical and haematological variables were converted to normal (within normal reference) and abnormal variables (above normal reference for serum urea and creatinine, below reference for serum albumin and haemoglobin level, and either below or above reference in presence of sepsis before PEG placement for white cell count), based on the hospital laboratory reference values. Multiple logistic regression was used to predict patients' outcomes with 5% level of significance. Data were presented as p-value, odds-ratio (OR) and 95% confidence interval (CI). The model was shown to be adequate by the Hosmer-Lemeshow test.

RESULTS

There were 106 patients (male:female ratio, 61:45) with a mean age of 64.5 years (range, 17-94 years) who underwent PEG placement during this period. The mean follow-up period was 465 days (range, 3-1,410 days). 17% of the patients had underlying

Table I. Demographics of patients (n = 106) at PEG placements.

Age (in years)	64.5 (range 17-94)
Gender (male: female)	61:45
Ethnic background	
Chinese	92 (86.7%)
Indian	8 (7.6%)
Malay	6 (5.7%)
Indications for PEG placements	
Cerebrovascular events	66 (63%)
Degenerative disorders	16 (15%)
Head injury	12 (11%)
Others *	12 (11%)
Body mass index at PEG placement	
<20 kg/m^2	43%
≥20 kg/m^2 **	57%
Comorbid conditions	
One	30%
Two	34%
Three or more	36%
Presence of bedsores	21%

* Include patients with head and neck tumours (n=6) and HIV cachexia patients with inadequate intake (n=2)

** Only 5% of patients have BMI of ≥25 kg/m^2

Table II. Characteristics of patients who died (n=7) within the same admission for PEG insertion.

Variables	
Age (in years)	77 (range 60-88) ‡
No. of significant comorbid conditions *	3 (range 2-3) ‡
Neurological disorders	7 (100%)
Stroke	5 (71%)
Neurodegenerative disorders †	3 (43%)
Respiratory disorders	3 (43%)
Others **	7 (100%)
Premorbid (dependent on ADL)	5 (71%)
Presence of bedsores	1 (14%)

‡ expressed as median and range (in parentheses). All other values expressed as absolute number and percentage (in parentheses)

† one patient also had a history of stroke

* Significant comorbid conditions that have significant impact on patients' health as listed.

** Other comorbid conditions include cardiac and endocrine disorders

ADL: activities of daily living

dementia, 71% were dependent for their activities of daily living, and 63% had a background history of cerebrovascular events at the time of PEG insertion. Patients' demographical data are shown in Table I.

Overall, 51 patients had died by the mean time of follow-up. The mean time of PEG usage was 263 days (range, 2-1,230 days). The 30-day, six-month, one-year and two-year mortality rates were 7.5% (8), 26.4% (28), 35.8% (38) and 46.2% (49), respectively. The main causes of death were pneumonia (45%), progressive disease (24%) and sepsis (16%). Causes of death were unknown in 14%, due to deaths occurring either at home, rehabilitative/nursing institutions, or in another hospital.

Seven patients died before discharge at a median of seven days (range, 2-20 days). Causes of death were pneumonia(5) and sepsis(2). All patients had significant underlying comorbidities. Characteristics of these seven patients are shown in Table II. Older age, presence of bedsores and abnormal nutritional status based on BMI of <20 kg/m^2 were predictive of higher chance of mortality (Table III). 28 (26%) of patients were able to wean off PEG at a mean of 185 days (range, 3-870 days). Patients who were able to wean off PEG were younger and had preserved renal function. Presence of bedsores that was contributory to mortality was marginally non-significant (p=0.082) (Table IV). 9 (32%) of patients who were weaned off PEG were older than 70 years.

27 (25.5%) patients were treated for wound infection (culture-positive 15.1% [16] and culture-negative 10.4% [11]). Multiple organisms were isolated in three patients (single organism [13], two organisms [2] and three organisms [1]). The commonest organisms were *Pseudomonas aeruginosa* (8) and *Staphylococcus aureus* (7), four of which were methicilllin-resistant *Staphylococcus aureus* (MRSA). All were successfully treated with antibiotics. There was a case of a buried bumper syndrome that occurred at one month. This was removed and replaced without further complication. Inadvertent removal occurred in 24 (23%) patients at some point during follow-up.

Table III. Comparisons between patient mortality and survival after PEG placements.

	Mortality				
Parameters	Yes (n = 51)	No (n = 55)	OR	95% CI	p-value
Age (in years)	71.2 (27-94)	58.3 (17-92)	1.056	1.007-1.107	0.023
Gender (male vs female)	31 / 20	30 / 25	0.324	0.081-1.299	NS
Presence of bedsores	33%	10%	0.149	0.024-0.932	0.042
BMI (<20 kg/m^2)	64%	23%	0.074	0.016-0.348	0.0001
Comorbid (≥2)	86%	56%	1.095	0.440-2.724	NS
Urea (mmol/L)	6.8 (2.4-24)	6.6 (2-47.5)	0.362	0.067-1.952	NS
Creatinine (mmol/L)	69 (18-120)	60 (22-362)	0.275	0.062-1.221	NS
Haemoglobin (g/dL)	11.5 (7.3-16)	11.9 (8.2-16.7)	0.508	0.125-2.069	NS
White cell count (10^9)	11.0 (3.6-32.4)	8.9 (2.1-17.9)	3.837	0.902-16.326	NS
Albumin (g/L)	33.2 (25-44)	33.6 (22-46)	1.397	0.376-5.197	NS

Continuous variables expressed in mean and range (in parentheses)

NS: not significant

Table IV. Comparisons between abilities to wean off PEG feeding.

	Weaning off PEG				
Parameters	Yes (n = 28)	No (n = 78)	OR	95% CI	p-value
Age (in years)	50.9 (17-87)	69.1 (27-94)	0.917	0.866-0.971	0.003
Gender (male vs female)	16 / 12	45 / 33	3.428	0.517-22.718	NS
Presence of bedsores	11%	25%	6.468	0.789-52.965	NS
BMI (<20 kg/m^2)	28%	45%	1.801	0.332-9.785	NS
Comorbid (≥2)	43%	81%	1.690	0.557-5.125	NS
Urea (mmol/L)	5.4 (2.4-10.4)	7.1 (2-47.2)	0.877	0.106-7.281	NS
Creatinine (mmol/L)	60 (23-120)	67.2 (18-362)	0.159	0.026-0.972	0.047
Haemoglobin (g/dL)	11.4 (8.2-16.4)	11.8 (7.3-16.7)	6.932	0.907-52.988	NS
White cell counts (10^9)	9.4 (2.1-32.4)	9.9 (3.6-23)	0.835	0.149-4.654	NS
Albumin (g/L)	32.6 (22-42)	33.6 (24-48)	2.616	0.472-14.489	NS

Continuous variables expressed in mean and range (in parentheses)

NS: not significant

DISCUSSION

Our study shows that certain patients' factors can predict survival and weaning off PEG feeding. This is important as it may help physicians to select patients who are likely to benefit and exclude those who will not. Guidelines are available to help physicians to assess patients for PEG[8-10]. There is strong evidence that there is benefit for stroke patients in the short-term[2,3]. However, controversies remain regarding the benefit of PEG feeding, particularly in the long-term[11]. Most studies have shown that the age, comorbidities, dementia and indications for the procedure affect the outcomes. This is particularly true for patients with dementia. Patients with underlying head and neck tumours undergoing therapies have also been consistently shown to benefit from PEG[12,13]. This is expected as these patients have potential for recovery after treatment.

Nursing home studies involving patients with eating disorder and dementia have failed to show any long-term benefits (nutrition status and survival) between patients receiving PEG versus hand feeding[14-16]. Different conclusions seen in different studies are probably due to heterogeneity of the patient populations included in these studies. Although heterogeneous, the majority of our patient population had neurogenic dysphagia as the result of stroke, neurodegenerative disorders or head trauma, as indications for PEG.

Patients with underlying malignant conditions, dementia, degenerative disorders, previous history of recurrent infections and older patients (>75 years old) have been shown to do poorly with high 30-day mortality[3-6,17]. Our results concur with these findings and are comparable to another study done locally[18]. In our study, older age, presence of bedsores and poor nutritional status predict poorer survival outcome. Comparable to published data, most of the deaths that occurred within 30 days were in patients who had significant comorbidities, with most deaths occurring within the same admission. These observations are not unexpected, as patients with significant underlying comorbidities generally tend to do poorly anyway[11]. Mortality rates as high as 54% and 90% within one month and one year, respectively, have been reported[4]. In that study, there as a large number of patients who were elderly and had dementia. The fewer number of patients with dementia (17%) in our study probably explains the lower mortality rate.

Complications related to the procedure are important, as they can affect the outcome. It is possible that mortality in our patients that had occurred within the same admission was procedure related. However, none of these patients had any complications during the procedure or within the immediate 24 hours after the procedure. Hence, these deaths were probably not directly related to the procedure but rather to the underlying comorbidities. Most minor complications in our study were mainly due to wound infections that were fortunately easily treatable. The other complications, such as buried bumper syndrome and inadvertent removal, are expected occurrences but need to be managed appropriately.

Weaning off PEG has been reported to range from 10% to 31%, depending on the underlying condition[19-22]. Our study showed that 26% of patients were able to wean off PEG feeding, and the significant factors were younger age and preserved renal function. Despite this, older patients have also been shown to do well. Nine of our patients who were weaned off were older than 70 years old, suggesting that all patients should be periodically checked for possibility of weaning. Better renal function, that was a significant factor for weaning, was however not significant for survival. This may be due to the small number of patients in our study, leading to failure to detect a significant difference.

Underlying conditions that lead to patients' disabilities can predict which patient may wean off PEG at a later time. Other factors such as tolerance to early difference in diet textures in patients after stroke can also predict recovery from dysphagia[23]. Rehabilitation by a dedicated dysphagia team (speech therapist, dietitian and nurse practitioner) has been shown in a small study to result in a higher weaning- off rate of 63%[24]. Hence, the introduction of a more intensive programme that includes a multidisciplinary approach, will improve patients' outcomes. However, these findings need to be validated by larger studies.

Difficulties remain in the decision making regarding PEG. Despite these, there are factors that can help to decide in choosing between the use of PEG and the traditional methods of providing feeding (nasogastric tube or regular-assisted feeding), as shown in this and other studies. However, it remains paramount that patients and family members be involved in the decision making. Due to the differences in the study populations, more studies specifically looking at particular patient groups, are needed to better define the use of PEG as a means of long-term enteral access. Results from studies based on different groups of patients cannot be generalised to others, as clearly the natural histories are different. However, they can be used to guide decision making.

There are few limitations with our study. Firstly, there are inherent limitations with retrospective studies. Secondly, the small sample size in our study may affect the results. Thirdly, use of BMI to assess nutritional status is not ideal; however, it is a reasonable indicator of nutritional status and can be applied easily without the need for sophisticated assessments. Despite these limitations, our results are comparable to published data showing that certain patients' factors can predict the outcomes. With expanding indications and the increasing number of PEG done, more studies are needed to address the controversial issues.

In conclusion, our study showed that older age, poor nutritional status based on BMI and presence of bedsores were predictors of poor outcome. Younger age and preserved renal function were significant predictors of weaning off PEG feeding. These factors may guide physicians in deciding to which patients to offer PEG.

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