



Original article

Predictive factors of early mortality after percutaneous endoscopic gastrostomy placement: The importance of C-reactive protein



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SUMMARY

Introduction and aims: Percutaneous endoscopic gastrostomy (PEG) is considered one of the preferred routes for long-term enteral feeding. However, early mortality after PEG placement is high. We aimed at analyzing overall and early mortality in patients who underwent PEG insertion and at identifying risk factors of increased mortality after the procedure.

Methods: Retrospective study which included patients who had a PEG insertion at our department between May 2007 and January 2013. Variables analyzed: demographic, Charlson's co-morbidity index, past aspiration pneumonia, indication for PEG, hemogram, ionogram, urea, creatinine, albumin and C-reactive protein (CRP). Outcome: death. Kaplan–Meier survival analysis was used to calculate mortality after PEG placement. Predictive factors of overall mortality were identified by univariate and multivariate analysis and of 30-day, 90-day and 180-day mortality by logistic regression. The AUROC analysis for CRP levels was performed.

Results: Inclusion of 135 patients: 51.9% female, mean age of 73 ± 17 years, 90.4% with neurological dysphagia and 9.6% with tumors compromising oral intake. The median survival time was 272 days. The 30-day, 90-day and 180-day mortality was 0.14 ± 0.06 (95% CI 0.08–0.20), 0.29 ± 0.08 (95% CI 0.21–0.37) and 0.43 ± 0.08 (95% CI 0.35–0.51), respectively. Patients with higher levels CPR (hazard ratio (HR) 1.009 95% CI 1.002–1.160, $p = 0.012$) and higher levels of urea (HR 1.009 95% CI 1.002–1.160, $p = 0.012$) had worse outcome and those with higher sodium levels (HR 0.945 95% CI 0.908–0.983, $p = 0.005$) had better prognosis. Higher CRP levels was the only independent predictive factor for 30-day mortality (odds ratio (OR) 1.008 95% CI 1.001–1.014, $p = 0.029$), and was also a risk factor for 90-day and 180-day mortality (OR 1.013 95% CI 1.005–1.021, $p = 0.002$ and OR 1.009 95% CI 1.001–1.018, $p = 0.026$, respectively). CRP levels ≥ 35.9 mg/dL could predict death at 30 days with a sensitivity of 0.810 and a specificity of 0.614.

Conclusions: The early mortality after PEG placement is high. CRP, an indicator of acute illness, is a useful parameter at identifying patients with increased probability of dying after PEG insertion. High CRP levels should be considered in the decision making process.

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1. Introduction

Percutaneous endoscopic gastrostomy (PEG) was first reported by Gauderer et al. in 1980 in pediatric patients with dysphagia but has rapidly become an established procedure in adults [1]. Nowadays, it is considered one of the preferred routes for long-term enteral

feeding in patients who are unwilling or unable to maintain oral intake for a period exceeding 4 weeks [2–6]. The most common conditions responsible for impaired swallowing are cerebrovascular disease, oropharyngeal malignancies and esophageal cancer.

Although it is a safe and simple procedure [7], PEG placement is associated with a high early mortality [8,9]. Therefore, it is of utmost importance to find criteria that better select the patients who benefit most from PEG insertion. Some studies have focused on this issue, but published data is still scarce.

The aims of this study are: i) to analyze the 30-day, 90-day, 180-day and overall mortality in patients who underwent PEG

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placement and ii) to identify clinical and analytical risk factors of increased mortality after PEG insertion.

2. Patients and methods

2.1. Study population

A retrospective study was conducted. Patients who underwent PEG placement between May 2007 and January 2013 were included. Data regarding gender, age, Charlson's co-morbidity index to assess baseline illness severity, previous occurrence of aspiration pneumonia and indication for PEG placement was collected from medical records. Analytic variables such as hemogram, ionogram, urea, creatinine, albumin and C-reactive protein (CRP) were also analyzed. Exclusion criteria: absence of follow-up and PEG re-insertions.

2.2. Outcome

Death of the patient was recorded. The overall and 30-, 90- and 180-day mortality after PEG insertion was calculated.

2.3. Procedure

The referral for PEG placement was made by the patient's physician (gastroenterologist, neurologist, otorhinolaryngologist, internal medicine or primary care physician). A critical review of the indication was done in every patient. All procedures were performed by the same endoscopic team, under sedation with propofol administered by an anesthesiologist. The "pull" technique described by Gauderer et al. [1] was used to place PEG tubes (COOK®, U.S. Endoscopy®). All patients received antibiotic prophylaxis with cefotaxime (1 g 30 min before and 8 h and 16 h after the procedure) and were started on a proton pump inhibitor. Feeding through the tube was initiated 24 h after PEG placement if no complications occurred. Patients were evaluated by the nutrition team and detailed recommendations were given. Outpatient follow-up was done by a multidisciplinary team (endoscopic team, nutritional team and trained nurse) at one month after the procedure and then at 3-months intervals or less, as needed.

2.4. Statistical analysis

SPSS 17.0 (SPSS Inc., Chicago, Illinois, USA) was used for data analysis. Continuous variables were expressed as mean \pm standard deviation. Univariate analysis was performed using Student's *t*-test. Survival curves were plotted as Kaplan–Meier estimates and

compared by means of the log-rank test (discrete variables). Univariate cox proportional hazard regression was used to investigate the effect of continuous variables on survival. Then, a multivariate cox proportional hazard regression was performed to adjust for confounding factors. In order to identify independent risk factors for mortality at each time-frame (30-day, 90-day and 180-day period), a logistic regression analysis was applied. The receiver operating characteristic (ROC) curve analysis for the variable CRP was performed for each time-frame and also for overall follow-up time. Two-tailed *p* values of less than 0.05 were considered statistically significant.

3. Results

3.1. Study population

A total of 190 patients were evaluated with 135 being included (the main exclusion criteria was absence of follow-up): 70 (51.9%) female, mean age of 73 \pm 17 years (range 17–97); an average Charlson's index score of 4.7 \pm 2.0; 98 patients (72.6%) with previous aspiration pneumonia. The baseline characteristics of patients who underwent PEG placement are listed in Table 1.

The indications for PEG placement were neurological dysphagia in 122 (90.4%) patients and tumors compromising oral feeding in 13 patients (9.6%). In those with neurological dysphagia, the underlying diseases were: cerebrovascular disease (*n* = 68, 55.7%), dementia (*n* = 24, 19.7%), demyelinating disease (*n* = 8, 6.6%), anoxic brain injury (*n* = 8, 6.6%), traumatic brain injury (*n* = 7, 5.7%) and Parkinson's disease (*n* = 7, 5.7%). In those regarding tumors compromising oral feeding, the majority of patients had esophageal tumors (*n* = 7, 53.8%), followed by head and neck tumors (*n* = 5, 38.5%), with only one patient having a pulmonary tumor (7.7%).

No deaths could be directly related to PEG insertion and 96% of them were due to underlying co-morbidities.

The mean follow-up period was 321 \pm 347 days (range 1–1448). During follow-up, 84 patients (62.2%) died. Two patients (1.5%) had their PEG tube removed due to resumption of oral intake. The baseline characteristics of patients who underwent PEG insertion stratified by survival are listed in Table 1. The patients who died during follow-up had PEG inserted more frequently because of a dysphagia due to a tumor (*p* < 0.001), had aspiration pneumonia more commonly (*p* < 0.001) and had lower levels of hemoglobin (*p* < 0.001), higher values of leucocytes (*p* = 0.005), lower sodium levels (*p* = 0.010) and higher CRP values (*p* = 0.008).

Table 1
Baseline characteristics of patients who underwent PEG placement (all patients and stratified by survival).

| | All patients | Outcome | | <i>p</i> value |
|---|-----------------------------------|-----------------------------------|-----------------------------------|------------------|
| | | Dead (<i>n</i> = 84) | Alive (<i>n</i> = 51) | |
| Gender, female/male (<i>n</i>) | 70/65 | 41/43 | 29/22 | 0.235 |
| Age (mean \pm SD), years | 73.0 \pm 17.0 | 75.0 \pm 16.0 | 70.0 \pm 18.0 | 0.071 |
| Indication, neurological disease vs tumor (<i>n</i>) | 122/13 | 73/11 | 29/2 | <0.001 |
| Past aspiration pneumonia (<i>n</i>) | 98 | 68 | 30 | <0.001 |
| Charlson's index score (mean \pm SD) | 4.7 \pm 2.0 | 4.8 \pm 2.0 | 4.4 \pm 1.9 | 0.531 |
| Hemoglobin (mean \pm SD), g/dL | 11.3 \pm 1.6 | 10.9 \pm 1.6 | 11.9 \pm 1.4 | <0.001 |
| Leucocytes (mean \pm SD) | 9.7 \pm 3.8 | 10.3 \pm 4.3 | 8.6 \pm 2.7 | 0.005 |
| Platelets (mean \pm SD) | 306.000 \pm 126.000 | 305.000 \pm 122.000 | 308.000 \pm 134.000 | 0.885 |
| Urea (mean \pm SD), mg/dL | 35.8 \pm 25.5 | 38.8 \pm 27.4 | 30.9 \pm 21.5 | 0.084 |
| Creatinine (mean \pm SD), mg/dL | 0.7 \pm 0.5 | 0.7 \pm 0.3 | 0.8 \pm 0.6 | 0.513 |
| Sodium (mean \pm SD), mEq/L | 135.1 \pm 6.0 | 134.1 \pm 6.5 | 136.7 \pm 4.8 | 0.010 |
| Potassium (mean \pm SD), mEq/L | 4.4 \pm 0.6 | 4.4 \pm 0.6 | 4.5 \pm 0.6 | 0.636 |
| Albumin (mean \pm SD), g/dL | 2.9 \pm 0.8 | 2.9 \pm 0.8 | 2.8 \pm 0.8 | 0.389 |
| C-reactive protein (mean \pm SD), mg/dL | 52.3 \pm 62.2 | 71.3 \pm 17.1 | 36.4 \pm 38.9 | 0.008 |

SD standard deviation.

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