Evaluating The Factors Affecting Mortality and Survival of the Patients Who Underwent Percutaneous Endoscopic Gastrostomy;
The Short-term and Long-term Results

Betül Keskinkılıç Yağız[1], Metin Yalaza[2]

1 Samsun Gazi State Hospital, Department of General Surgery, Samsun, Türkiye
2 University of Health Sciences Dr. Abdurrahman Yurtaslan Ankara Oncology T&R Hospital, General Surgery Clinic, Ankara, Türkiye

Abstract

Aim: Percutaneous endoscopic gastrostomy (PEG) is a common minimally invasive technique performed in patients with oral feeding problems. The aim of the current study is to evaluate the associated factors that have an impact on the short- and long-term survival and mortality in these patients who received PEG tube placement.

Methods: The patients who underwent PEG placement between June 2020 and June 2023 are enrolled in the study. Mortality data was extracted from the National Death Registry database. Data regarding the demographics, indications of PEG, co-morbidities, length of hospital stay prior to PEG procedure, the need for mechanical ventilator support, body-mass index, serum levels of hemoglobin, leukocyte, albumin, and c-reactive protein are extracted retrospectively. Kaplan Meier and Cox regression analyses were used to evaluate the factors affecting survival.

Results: A total of 137 patients are enrolled in the study (71 female and 66 male). One-month mortality was 16.7% and overall mortality during a follow-up of 38 months was 51%. Survival was significantly higher in patients with motor neuron diseases than the patients with Alzheimer's (p=0.036). Length of hospital stay before PEG placement and haemoglobin levels were found to have a significant impact on survival in Cox regression analysis (p=0.000, p=0,009).

Conclusions: Length of hospital stay before PEG placement, need for mechanical ventilator support and hemoglobin levels were found significantly associated with survival. Higher mortality in Alzheimer's patients may indicate that indications of PEG should be re-evaluated in these patients.

Keywords: Percutaneous endoscopic gastrostomy, survival, mortality

1. Introduction

Advancements in healthcare have led to increased living standards and life expectancy, and together with reduced birth and death rates, resulted in an increased proportion of elderly individuals within the total population. Potential candidates for PEG placement appear to have doubled in recent years due to increased people with chronic diseases which is a direct consequence of the aging population.[1] Clinical utilization of PEG was initially reported in 1980.[2] PEG is a relatively simpler technique than traditional open surgical gastrostomy tube placement which has lower morbidity rates.[3]

PEG is commonly indicated in patients in whom oral feeding is not expected to be restored for at least 4-6 weeks. Commonly, patients with cerebrovascular diseases, chronic neurological disease, cancer and chronic gastrointestinal disease are expected to benefit from PEG procedure.[4] Although the benefits of PEG were demonstrated in a certain subset of patients, increasing the incidence of PEG application raised some degree of concerns by some, and evidence about the long-term results is lacking.[5] The decision to place a PEG catheter is quite challenging for both the family members of the patients and the healthcare providers. A prominent theoretical benefit of feeding the patient with a catheter as perceived by the physicians and the patients' proxies is the improved survival.[6,7] However, current observational studies suggest that feeding catheters does not improve survival.[8,9] The poor results were attributed to the suggestion that these patients are referred too late to benefit from feeding by feeding tubes.[10]

In the present study, data from the patients who had undergone a

PEG procedure between June 2020 and June 2023 are retrospectively extracted to evaluate the prognosis of the patients. The primary aim of the study is to determine the factors that have an impact on mortality and survival in the short-term and long-term follow-up.

2. Materials and methods

A total of 137 patients are enrolled in the study. Local Ethical Board approval was obtained (Approval No: Samsun University KAEK-2023 17/19). Patients data were reviewed on the electronic charts of the Hospital Information System. Indications of PEG were cerebrovascular disease (CVD), Alzheimer's, motor neuron disease and trauma. In addition to standard demographic data such as age and gender of the patients, the following were recorded: PEG indications, length of hospital stays prior to the PEG procedure, presence of mortality, survival time, mechanical ventilator support, comorbidities, body mass index (BMI), hemoglobin, leukocyte, creatinine, albumin, and C-reactive protein (CRP) levels. Mortality data were obtained from the hospital records and the National Death Registry database. PEG was performed in the endoscopy unit or as a bedside procedure in the ICU if the transport of the patient was inappropriate. Enteral feeding was ceased 12 hours before the procedure. If the patient is not on antibiotics, 1 gram of intravenous cephazolin sodium was administered 4 hours before the procedure. The patient was monitored and nasal oxygen was delivered. Sedation was performed by a combination of midazolam and propofol. Pull technique was preferred for PEG placement in all patients.

All procedures were performed with a Pentax® fiber endoscope. A 20F PEG kit was used in all patients. Low-volume enteral feeding was initiated 24 hours after the procedure and increased gradually.

2.1. Statistical analysis

Data were analyzed with IBM SPSS® Statistics 26 software. Descriptive statistics were used for numerical variables (mean, standard derivation, minimum, maximum) and frequency distribution was used for categorical variables (number, percentage). Kaplan Meier and Cox regression analysis were used for the evaluation of the factors affecting survival. A p-value of <0.05 is regarded as statistically significant.

3. Results

The study group consisted of 137 patients with 71 females (51.8%) and 66 males (48.2%). Mean age of the patients was 78.75±12.08 years (range; 27-98 years). At the time of the PEG procedure, 82% of the patients were in the ICU and 18% were in the Palliative Care Unit. PEG indications were cerebrovascular disease in 60 (43.8%), Alzheimer's in 47 (34.3 %), motor neuron disease in 11 (8 %), and trauma in 19 (13.9%) (Table 1). Comorbidities were hypertension (HT) in 76.6%, atrial fibrillation (AF) in 45.3%, coronary artery disease (CAD) in 35.8%, diabetes mellitus (DM) in 35.8%, and chronic obstructive pulmonary disease (COPD) in 38,7%. Sixty-four patients (46.7%) were under mechanical ventilation support while the rest 73 (53.3%) were breathing spontaneously. Mean BMI was 25.45±3.63 (range; 18-32). In our study, the 1-month mortality rate was 16.7%, and the overall mortality rate at 38 months of follow-up was 51%. The higher mortality rate was found in patients with Alzheimer's and the lowest was in patients with motor neuron diseases (Table 2).

Kaplan-Meier analyses demonstrated no significant survival

Table 1

Demographics of the study group

		n	%
Age	mean±sd	78,75±12,08	
	(min-max)	(27-98)	
	≤80	62	45,3
	>80	75	54,7
Gender	• Female	71	51,8
	• Male	66	48,2
Length of hospital stay before PEG	mean±sd	29,52±18,35	
	(min-max)	(3-120)	
	• ≤30 day	81	59,1
	• >30 days	56	40,9
Respiration	• Spontaneous	73	53,3
	• Mechanical ventilation	64	46,7
Indications of PEG	• CVD	60	43,8
	• Alzheimer's	47	34,3
	• Motor neuron diseases	11	8,0
	• Trauma	19	13,9
BMI (kg/m2)	meant±sd (min-max)	25,45±3,63 (18-32)	
	• Normal	71	51,8
	• Overweight	47	34,3
	• Obese	19	13,9
HT		105	76,6
AF		62	45,3
CAD		49	35,8
DM		49	35,8
COPD		53	38,7
Hemoglobin (109/L)	meant±sd	10,61±1,46,	
	(min-max)	(7,4-13,4)	
Leukocyte (109/L)	meant±sd	8,91±3,28	
	(min-max)	(4-16,7)	
Creatinin (mg/dL)	meant±sd	1,15±0,98	
	(min-max)	(0,3-7)	
Albumin (g/L)	meant±sd	27,46±3,51	
	(min-max)	(20,7-34,7)	
CRP (mg/dL)	meant±sd	48,69±42,18	
	(min-max)	(3-181)	
Mortality	• 1-month mortality	23	16,7
	• Overall mortality	70	51

AF: Atrial fibrillation, BMI: Body mass index, CAD: Coronary artery disease, COPD: Chronic obstructive pulmonary disease, CRP: C-reactive protein, CVD: Cerebrovascular disease, DM: Diyabetes mellitus, HT: Hypertension

Table 2

Mortality according to PEG indication

PEG indications (n=137)	1-month mortality n (%)	Overall mortality n (%)
CVD (n=60)	8 (13,3)	33 (55)
Alzheimer's (n=47)	13 (27,6)	27 (57,4)
Trauma (n=19)	2 (10,5)	9 (47,3)
Motor neuron diseases (n=11)	-	1 (9)

CVD: Cerebrovascular disease

difference with respect to age, gender, BMI and comorbidities (p>0.05). Survival was significantly higher in patients hospitalized shorter than 30 days before PEG placement than in patients hospitalized longer than 30 days (p=0,000). Survival was higher in patients with spontaneous breathing than the patients who were on mechanical ventilation support (p=0.032). Survival was significantly higher in patients with motor neuron diseases than the patients with Alzheimer's (p=0.036). Kaplan-Meier survival curves are given in Figure1-3.

Cox regression analyses revealed that the length of hospital stay before PEG placement and hemoglobin levels have a significant impact on survival. In patients with a length of hospital stay of more than 30 days before PEG placement, the risk of mortality was 2.502 times higher (1.557-4.022) compared to those with a length of hospital stay of 30 days or less, while a 1-unit decrease in hemoglobin levels was found to increase the risk of mortality by 1/0.808 = 1.238 times (1.055-1.453) (Table 3).

Figure 2

Kaplan-Meier Survival curve according to respiratory status (p=0,032)
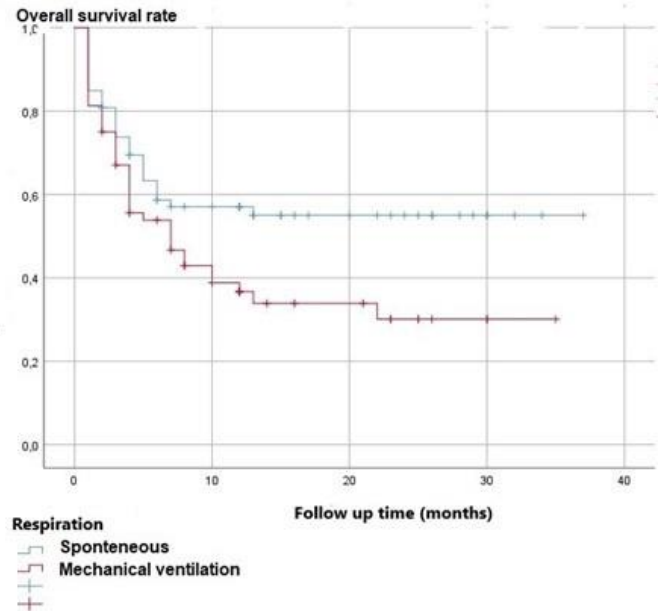

Figure 1

Kaplan-Meier Survival curve according to length of hospital stay before PEG placement (p=0,000)
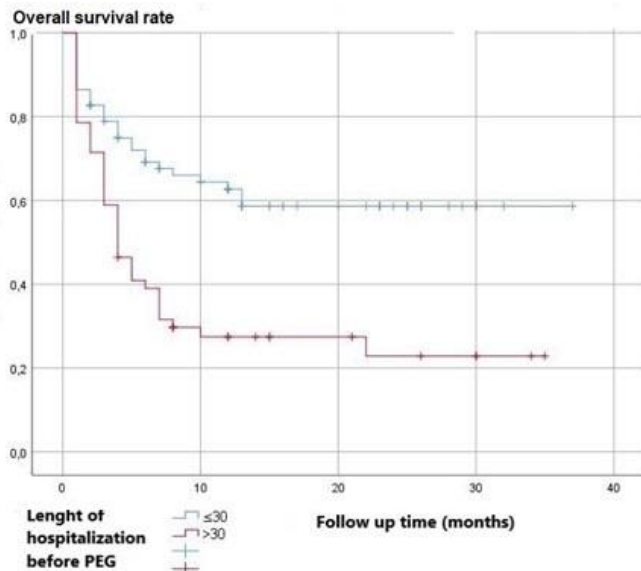

Figure 3

Kaplan-Meier Survival curve according to the indication for PEG tube. Survival was significantly higher in patients with motor neuron diseases than the patients with Alzheimer's (p=0,036)
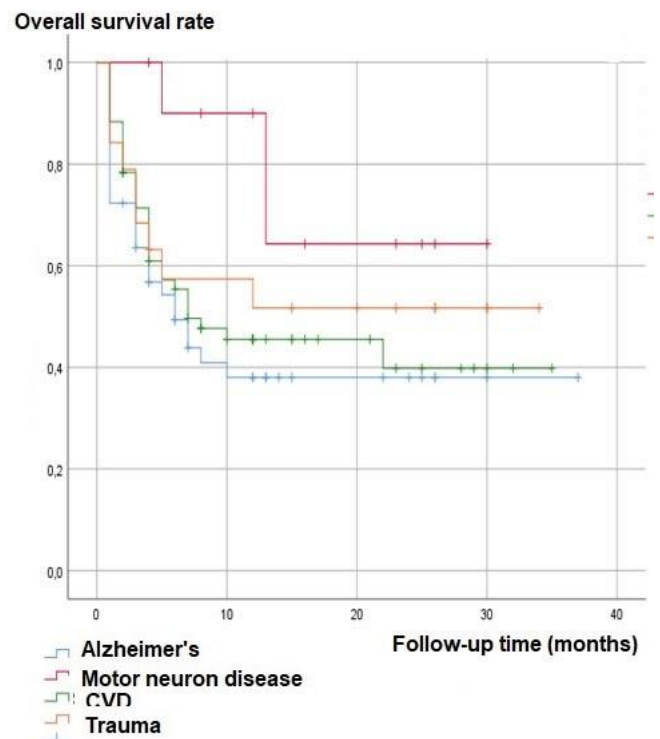
Table 3

Multivariate Cox regression analysis to determine independent prognostic factors affecting overall survival

	B	SE	Wald	p	HR	95,0% CI	
						Lower limit	Upper limit
Hospital stay before PEG (≤30 day vs >30 day)	0,917	0,242	14,347	0,000*	2,502	1,557	4,022
Hemoglobin (for 1 unit decrease)	-0,214	0,082	6,835	0,009*	0,808	0,688	0,948

CI: Confidence interval, HR:Hazard ratio

4. Discussion

Nasogastric tube, nasojejunal tube, percutaneous fluoroscopic gastrostomy, surgical gastrostomy and PEG are enteral feeding options for patients who can not be fed by oral route despite patent gastrointestinal system[11]. Over time, PEG became a common endoscopic practice for enteral feeding purposes. PEG is considered to be superior to the other enteral feeding modalities due to lower aspiration risk[12,13]. Shorter procedure duration, lower cost and minimally invasive nature made rapid acceptance and widespread performance of the technique. However, it is not recommended to be performed in patients with a life expectancy of <30 days[14,15].

A study from England demonstrated a 60% reduction in 30-day mortality after the PEG procedure over 13 years. This result was attributed to improved patient selection and timing of the procedure[16]. In our study, the 1-month mortality rate was found to be 16.7%, and the overall mortality rate at 38 months of follow-up was 51%. Higher mortality rates in our study may be attributed to a high rate of patients with neurological disease as 43.8% had CVD and 34.3% had Alzheimer's in the study population. A study from Japan, which is also an aging country, reported reduced mortality rates by improving patient selection criteria, and that dementia is not an indication of PEG anymore[17].

The most common indications of PEG are dysphagia secondary to neurological conditions, head and neck malignancies and trauma[18,19]. A study from Türkiye indicated neurological diseases as the leading underlying cause leading to PEG placement with rates between 67-89.4%[20,21]. Consistent with the literature, neurological diseases were the most common indication of PEG in our patients, too (86.1%). The strong correlation between PEG placement and increased mortality in patients with malignancy has been demonstrated in many studies[22-24]. BMI was also reported as a risk factor for increased mortality[24]. The patients were divided into subgroups as normal, overweight and obese according to their BMI and no significant difference was observed among the groups for survival (p>0.05) in our study.

Procedure-related mortality is very low for PEG placement. Reported mortality is mostly related to primary or co-existing conditions rather than the procedure itself[25,26]. No mortality related with the PEG procedure itself is encountered in our study. Most patients who require nutritional support will need it for less than a month, and nasogastric tube feeding is the most commonly used method of tube feeding[27]. PEG tubes are widely used in long-term nutritional support. In our study, the hospital stay before PEG was 30 days or less in 81 (59.1%) patients. The risk of mortality in patients with a hospital stay of >30 days before PEG was found to be 2.5 times higher than in those with a hospital stay of ≤30 days (p=0.000).

The survival rate was found higher in patients who do not need ventilation support than the patients who need mechanical ventilation support (p=0.032). In patients requiring mechanical ventilator support, decreased survival rates may be attributed to the inherent disordered swallowing functions, complications associated with mechanical ventilation, and comorbidities leading to the need for ventilatory support. Subgroup analysis of PEG indications revealed that lowest mortality was in patients with motor neuron diseases and higher mortality was in patients with Alzheimer's which demonstrated a significant difference between the subgroups (p=0.036). Patients with Alzheimer's appear to have the worst prognosis. The indication for PEG is still under debate in patients with dementia (which includes Alzheimer's) to higher mortality rates after the procedure[28]. In our region, PEG is commonly performed in these patients due to the social pressure exerted by their families and relatives, possibly to soothe their conscience by ensuring they have provided the best medical care they can.

We did not find any significant impact of age, gender, BMI and comorbidities on the survival of the patients (p>0.05). Since the mean age of our patients is 78.75±12.08 years, we could not be able to compare young and elderly patients, and could only compare the elderly with the even older. A study involving younger patients with an average age of 65 demonstrated a significant relationship between advanced age and mortality[29]. Many previous studies demonstrated the relationship between co-existing diabetes and heart failure with mortality[24,30]. In our study, no significant difference was found between comorbidities and survival (p>0.05). Hemoglobin levels appear to have a significant impact on survival. One unit decrease in hemoglobin level is related with a 1.2-fold increase in mortality (p=0.009). Accordingly, our finding that lower hemoglobin levels are associated with worse outcomes is not surprising. This finding is also demonstrated by previous studies and low hemoglobin levels should be regarded as an indicator of serious underlying conditions[24].

The retrospective nature of the study increases the likelihood of bias in the interpretation of the results. Other limitations of our study is the small sample size and being conducted as a single-center study. Finally, the absence of patients with malignant diseases (which is a common indication of PEG) is another limitation of our study.

5. Conclusion

Hemoglobin levels, need for mechanical ventilation support and prolonged length of hospital stay before PEG procedure appear to have a significant impact on the survival. PEG tube placement should not be delayed when the need for long-term nutritional support is anticipated. Higher mortality in patients with Alzheimer's dictates that indication of PEG should be reevaluated in this subgroup. More extensive clinical studies are necessary to evaluate the role of PEG placement in individual subgroups of patients with different underlying conditions.

Statement of ethics

The study protocol was approved by the Samsun University KAEK-

2023 17/19.

Conflict of interest statement

The authors declare that they have no financial conflict of interest with regard to the content of this report.

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Author Contributions

BKY: Conceptualization and design of the study, data acquisition, data analysis, literature review, writing and editing of the manuscript, and critical review

MY: Conceptualization and design of the study, data analysis, literature review, writing and editing of the manuscript, and critical review

Availability of data and materials

The data supporting this study's findings are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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