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Original Article

Assessment of risk factors on morbidity and mortality in patients undergoing percutaneous endoscopic gastrostomy

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Abstract

Aim: Percutaneous endoscopic gastrostomy (PEG) is a minimal invasive procedure that is performed in patients who are unable to take oral feeding. Herein, we aimed to assess the risk factors for morbidity and mortality in patients who undergo PEG.

Material and Methods: This study was conducted, in a total of 143 patients who underwent PEG for enteral feeding, who were retrospectively analyzed in terms of clinical features, biochemical, hematological and microbiological parameters, and also morbidity and mortality.

Results: The study enrolled 140 of 143 consecutive patients who underwent PEG, and a total of 206 interventions were performed. The rate of successful insertion was 98.5% (140/142). Complications were peristomal leakage (%29.3), infection due to PEG (9.3%), and tube blockage (6.4%), respectively. In multivariate logistic regression analysis; a ≤ 3.5cm length of the PEG tube between the gastric mucosa and the skin (95% CI: 1.290-33.442 and P= 0.023) and a low platelet lymphocyte ratio (OR = 0.994, 95% CI: 0.989-0.999 and p = 0.022) were risk factors of peristomal leakage. The 30-day mortality rate was 16%.

Discussion: In patient with PEG, the complication rate varies between 5% and 66% according to follow-ups in the literature. The mortality usually depends on the primary disease, and it has been reported between 5% and 20%.

Conclusion: PEG is a safe, effective, and minimal invasive procedure. A ≤3.5 cm length of a PEG tube between the gastric mucosa and skin and a low platelet lymphocyte ratio are risk factors for the development of peristomal leakage.

Keywords: Complication; Mortality; Percutaneous Endoscopic Gastrostomy (PEG); Peristomal Leakage.

INTRODUCTION

PEG is an important enteral feeding technique in a patient who is unable to take oral nutrition (1,2). PEG is commonly used in severe dysphagia, inadequate oral feeding, aspiration pneumonia, cerebrovascular disease, and Alzheimer and Parkinson disease (3,4). These patients have poor prognosis if they don't take oral or enteral nutrition because total parenteral nutrition have several complications. PEG provides the continuation of the normal intestinal tract with integrity and barrier function of the intestinal mucosa (1,3,4).

PEG has been performed since three decades worldwide. It can be inserted safely and effectively by experienced physicians (3-5). But sometimes major or minor complications may occur in patients who have co-morbidites such as serebrovascular disease, chronic obstructive lung disease, diabetes mellitus, hypertension, malignancy, and in immunosuppressive states (5,6). Advantages of PEG over parenteral nutrition are less hospital cost, effective and easy feeding, preventing of mucosal atrophy, protection of the normal intestinal flora with less bacterial translocation (7,8). The most popular method of PEG insertion is the pull-PEG technique (5,6,8). Peristomal infection, liquid discharge and hemorrhage, gastric or intestinal perforation, buried-bumper syndrome, necrotizing fasciitis, tube obstruction, and aspiration pneumonia are frequently seen complications after PEG (7-9). In the present study, we aimed to evaluate PEG related risk factors for morbidity and mortality.

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MATERIAL and METHODS

Patients and Ethics

This study was conducted in the general surgery endoscopic unit between September 2015 and December 2017. A total of 143 patients, who underwent PEG for enteral feeding, were included to the study. Patients were retrospectively evaluated in terms of age, gender, BMI (body mass index), co-morbidity, diagnosis, insertion time PEG, ASA score, biochemical, hematological and microbiological parameters, and also morbidity and mortality. The Ethical Committee of the Sakarya University Education and Research Hospital approved the study protocol (Ethical Committee number: 050.01.04/39/2018)

Methodology

A total of '143' Will be '140' patients with PEG, were enrolled in the study. Blood samples were taken from all patients before PEG. The indication of the PEG placement was considered after neurology and anesthesiology consultation. Patients were retrospectively analyzed in terms of gender and age, BMI, co-morbidity, diagnosis, PEG insertion time, ASA score, biochemical, hematological and microbiological parameters, growth in wound culture, complications and mortality.

The risk factors associated with morbidity and mortality were also identified. The patients were followed up in order at the first week, 1 month and 6 month intervals.

Inclusion criteria

- Patients with inability to oral intake
- Patients with normal hemostatic parameters (PTZ/INR, aPTZ, etc).

Exclusion criteria

- Patients who could not be followed up
-Patients with abnormal coagulation tests, immunosuppression, sepsis

Premedication

After 8 hours fasting, a crystalloid solution at 10 mL/kg/ hour was begun in patients with ASA 3-4 before the PEG procedure. The patients were monitored to assess heart rate (HR), mean arterial pressure (MAP) and peripheral oxygen saturation (SpO2) during the intervention. Nasal oxygen was given with at flow rate of 4-6 L / min to achieve FiO2 ratio of 35 to 40% and an oxygen saturation > 90 to 100%. Midazolam at 1-2 mg and 1 mg / kg of fentanyl was given for sedation. After starting the procedure, a bolus dose of 0.5 mg / kg of propofol was given, and if necessary, dose of propofol was increased 0.25 mg / kg. In the case of hypotension, propofol was changed with ketamine at 1-3 mg / kg. Baseline measurements of the patients included HR, MAP, SpO2 and Ramsey sedation scores (RSD) were recorded. PEG procedure time, the amount of propofol, midazolam and ketamine, duration of anesthesia and wake-up time following anesthesia were recorded and controlled during process.

Percutaneous endoscopic gastrostomy

All laboratory results were evaluated before starting the PEG procedure, and oral feeding or naso-gastric tube feeding was stopped eight hours before the procedure. Antibiotic prophylaxis was not used routinely. Cefazolin 1 gram/10 mL in 0.9/ IV sodium chloride was performed intravenously in patients with positive culture. PEG procedure was started routinely after premedication by anesthetist, and it was performed by experienced general surgeons in the surgical endoscopy units.

The pull-PEG method (2) (Gauderer Ponsky) was performed in all patients, and a 20 French EndoViveTM (Boston scientific, Spencer USA) was used during the procedure. All interventions were performed by Fujinon VP-4450HD (Fujifilm corporation, Minato-ku, Tokyo, Japan) fiber-endoscope. The length of the PEG tract between gastric mucosa and the skin were classified in three groups: the length of the PEG tract ≤3.5 cm, the length of the PEG tract >3.5 cm and normal localization (not available of length of tract). Twelwe to16 hours after PEG insertion, 20-40 cc water was given through the PEG tube. If no leak or hemorrhage occurred, 20 cc / hour enteral solution was started continuously according to patient's tolerance. Patients were followed up daily in the first three days and then at one month and 6th month intervals.

Statistical Analysis

Data analysis was performed by using IBM SPSS Statistics version 17.0 software (IBM Corporation, Armonk, NY, USA). It was computed whether the distributions of continuous variables were normal or not being determined by Kolmogorov-Smirnov test. Continuous variables were shown as median (25th – 75th) percentiles. Number of cases and (%) were used for categorical data. While, the mean differences between groups were compared by Student's t test, otherwise, Mann Whitney U test was used for comparisons of the not normally distributed data. Categorical variables were analyzed by Continuity Corrected Chi-square or Fisher's exact test, where appropriate. Determining the best predictor(s) which effect on both hospital mortality and leakage were evaluated by Multiple Logistic Regression Analyses. Any variable whose univariable test had a P value <0.25 was accepted as a candidate for the multivariable model along with all variables of known clinical importance. Odds ratios, 95% confidence intervals and Wald statistics for each independent variable were also calculated. A p value less than 0.05 was considered statistically significant.

RESULTS

Perioperative outcomes

Of the 143 patients, 140 were enrolled in the study, whereas 3 patients were excluded due to failing of the inclusion criteria. A total of 206 interventions were performed. The rate of successful PEG insertion was 98.5% (140/142) and pull-PEG method was used routinely in all cases. Most of the patients had cerebrovascular disease (30.7%), followed by Alzheimer's disease (17.8%), trauma 19 (13.5%), hypoxic or anoxic brain injury (10.7%), acute myocardial infarcts (7.1%), respectively (Table 1).

Table 1. Diagnosis and co-morbidities of the patients

		n (%)
Cerebrovascular disease		43 (30.7)
Alzheimer disease		25 (17.8)
Trauma		19 (13.5)
Hypoxic or anoxic brain injury		15 (10.7)
AMI		10 (7.1)
Parkinson disease		6 (4.2)
Amyotrophic lateral sclerosis		4 (2.8)
Lip or tongue cancer		3 (2.1)
Lung cancer		3 (2.1)
Pulmonary failure		3 (2.1)
Metastatic colon cancer		2 (1.4)
Glioblastoma multiforme		2 (2.1)
Coronary artery Bypass grafting		1 (0.7)
Congestive heart failure		1 (0.7)
Cerebral Palsy		1 (0.7)
Aspiration pneumonia		1 (0.7)
Metastatic breast cancer		1 (0.7)
	Total	140 (100%)
Co-Morbidities		n (%)
Hypertension		59 (42.1)
Senility		59 (42.1)
CAD or CHF		34 (24.2)
Diabetes Mellitus		31 (22.1)
COLD or LF		14 (10)
Malignity		11 (7.8)
Chronic renal failure		8 (5.7)
Trachea esophageal fistula		3 (2.1)
DVT or peripheral vascular disease		3 (2.1)
Thyroid function failure		3 (2.1)
Tuberculosis		1 (0.7)
Single renal		1 (0.7)
infective endocarditis		1 (0.7)
None		5 (3.5)
	Total	230

AMI= Acute myocardial infarcts, CAD: Coronary artery disease, COLD: Chronic obstructive lung disease,
CHF: Congestive heart failure, DVT: Deep venous thrombosis, LF: Lung failure

Most of the patients (53.6%) had co-morbidities which were hypertension (42.1%), senility (42.1%), coronary artery disease or congestive heart failure (24.2%), diabetes mellitus (22.1%) and chronic obstructive lung disease or lung failure (10%), respectively (Table 2). All patients were unable to oral intake at admission (Table 1,2).

The median age was 71 years (min-max; 56-81). Sixty-four patients (45.7%) were females and 76 patients were (54.3%) males. The mean BMI was 26.1 ±5.5. Eleven patients (7.9%) had malignancy. The median ASA score was 4 (min-max; 2-4). One-hundred-six patients (90%) had ASA IV score. The mean follow-up time was (0.1-30) months. The mean PEG insertion time period was 22.3 ±11.9 minutes and the mean follow-up time period was 6.3 ±6.4 months, (Table 2). The median INR (Internalized normalized ratio) was 1,05 (min-max; 0.3-1.58); platelet to lymphocyte ratio (PLR) was 171 (min-max; 112-256), neutrophil to lymphocyte ratio (NLR) was 4.7 (min-max; 2.7-7.3); and albumin was 2.8 (min-max; 2.6-3.1 mg/dl), respectively.

Table 2. Clinical and intervention features

	n (%)
Patient	140 (100%)
Age (year)	71 (56-81)
Female	64 (45.7%)
Male	76 (54.3%)
BMI (kg/m2)	26.1±5.5
Malignity	11 (7.9%)
Co-morbidities	75 (53.6%)
ASA	
II	1 (0.7%)
III	13 (9.3%)
IV	126 (90.0%)
PEG insertion time (min)	22.3 (±11.9)
Follow-up (months)	6.3 (±6.4)
Length of PEG tract (cm)	2 (0-3)
Length of PEG tract	
≤3.5 cm	47 (33.6%)
>3.5 cm	27 (19.3%)
Normal localization(NA)	66 (47.1%)
INR	1.05 (0.3-1.58)
PLR	171 (112-256)
NLR	4.7 (2.7-7.3)
Albumin	2.8 (2.6-3.1)
Number of Complications	**72 (51.3)**
Minor	**63 (45)**
Peristomal leakage	41 (29.3)
Infection due to PEG	13 (9.3)
Tube blockage	9 (6.4)
Major	**9 (6.3)**
Hemorrhage	5 (3.5)
Buried Bumper Syndrome	2 (1.4)
Enterocutaneous fistula	1 (0.7)
Necrotizing fasciitis	1 (0.7)
Hospital mortality (30-day mortality)	**24 (16)**

Complications

Most of the complications were minor complications including peristomal leakage (41 patients (29.3%)), wound infection (13 patients (9.3%)) and tube blockage (9 patients (6.4%)), respectively. Patients with peristomal

leakage were controlled meticulously. If a cellulitis occurred or signs of infection were observed, PEG feeding was stopped and antibiotics were started according to reproduction in culture sample. In patients with wound infection PEG was removed immediately and wound care was made carefully. After completion of the wound healing, PEG was reinserted in a different location. Most of the microbial agents in culture growth were Escherichia coli (4.2%) and Pseudomonas Aeruginosa (3.5%). When a tube blockage was detected, PEG was removed and a new one was inserted in the same location.

The major complications were hemorrhage (3.5%), buried bumper syndrome (1.4%) (Figure 1), entero-cutaneous fistula (0.7%) and necrotizing fasciitis (0.7%). In patients with hemorrhage, hematocrit follow up was made carefully. During this period, PEG feeding was stopped and the PEG catheter was leaved to free-drainage. In the existence of a subcutaneous hematoma a drainage procedure for the hematoma was carried out. However, none of the patients with hemorrhage underwent surgery. Buried bumper syndrome is the internal bumper of PEG that it has been become embedded in the anterior abdominal wall (9). In these cases, we removed the PEG under local anesthesia and started antibiotic treatment. Parenteral feeding was started until wound healing was completed and PEG is inserted thereafter in a different location. In the presence of a entero-cutaneous fistula, parenteral feeding was begun, and wound care was made carefully. The fistula flow rate was followed daily. Necrotizing fasciitis developed in a patient with lung cancer. This patient underwent surgery after PEG removal, and debridement and fasciotomy were performed. In the present study, 30-day mortality occurred in 24 patients (16%), (Table 2).

Figure 1. Buried bumper syndrome in gastroscopy

Risk factors for development of complications

No significant difference was not found between patients with peristomal leakage and those who had not according to age, gender, history of malignancy, multiple co-morbid disease, BMI, ASA score, albumin and NLR level (P > 0.05). Patients with peristomal leakage had significantly shorter length of PEG tract (P = 0.016). The median PLR level also was significantly less in peristomal leakage developed patients (P = 0.010). Patients with peristomal leakage had significantly higher infection rates (P = 0.020) (Table 3).

Table 3. Clinical features in patients with/without peristomal leakage around PEG

	No (n=99)	Yes (n=41)	p-value
Age (year)	74 (56-82)	69 (55.5-78.5)	0.433†
Gender			0.403‡
Female	48 (48.5%)	16 (39.0%)	
Male	51 (51.5%)	25 (61.0%)	
Malignity	8 (8.1%)	3 (7.3%)	>0.999¶
Co-morbidity	52 (52.5%)	23 (56.1%)	0.842‡
BMI (kg/m2)	26.5±6.0	25.4±4.5	0.348$
ASA			0.069†
II	-	1 (2.4%)	
III	7 (7.1%)	6 (14.6%)	
IV	92 (92.9%)	34 (82.9%)	
Length of PEG tract	2.5 (0-4)	0 (0-3)	**0.016†**
Length of PEG tract			
≤3.5 cm	32 (32.3%)	15 (36.6%)	0.772‡
>3.5 cm	25 (25.3%)	2 (4.9%)	0.011‡
Normal localization (NA)	42 (42.4%)	24 (58.5%)	0.121‡
Albumin	2.8 (2.6-3.2)	2.8 (2.5-3.0)	0.636†
PLR	194 (132-265.5)	142 (104.5-234)	0.010†
NLR	5.3 (2.9-8.0)	4.1 (2.3-6.4)	0.171†
Infection due to PEG	5 (5.1%)	8 (19.5%)	**0.020¶**

ASA: American society of anesthesiologists, BMI: Body mass index, NA: Not available, NLR: neutrophil-lymphocyte ratio,
PEG: Percutaneous endoscopic gastrostomy, PLR: Platelet lymphocyte Ratio
† Mann Whitney U, ‡ Continuity Corrected Chi-square, ¶ Fisher's exact test, $ Student's t testi

In univariate analysis, all variables identified as P <0.25 were included as risk factors for the regression model. The length of the PEG tract and PLR level were found as risk factors for peristomal leakage. The length of PEG tract ≤3.5 cm significantly increased the rate of peristomal leakage (P = 0.023) with a risk of 6.567 times (95% CI: 1.290-33.442).

Further, low PLR significantly increased the risk of peristomal leakage (P=0.022) with a risk of 6841 times (95% CI: 0.989-0.999) (Table 4).

Table 4. Assessment of the risk factors on the peristomal leakage, and multivariate logistic regression analysis

	OR	95% CI	Wald	p-value
ASA	0.457	0.153-1.363	1.974	0.160
Length of PEG tract ≤3.5 cm	6.567	1.290-33.442	5.136	**0.023**
Length of PEG tract >3.5 cm	1.000	-	-	-
Normal localization (NA)	6.841	1.428-32.776	5.787	**0.016**
PLR	0.994	0.989-0.999	5.250	**0.022**
NLR	1.001	0.908-1.104	0.000	0.987
Infection due to PEG	3.351	0.919-12.227	3.354	0.067

ASA: American society of anesthesiologists, NA: Not available, NLR: neutrophil-lymphocyte ratio PEG: Percutaneous endoscopic gastrostomy, PLR: Platelet lymphocyte Ratio OR: Odds ratio, CI: Confidence interval

Mortality

Mortality increased significantly in patients with advanced age (P = 0.028). Patients who developed mortality were compared with those alive according to peristomal leakage, and no significant difference was found in terms of gender, history of malignancy, multiple co-morbid disease, BMI, ASA score, traction size, traction classification, albumin, NLR and PLR levels, PEG related infection (P > 0.05) (Table 5).

The concurrent effects of age, albumin, NLR, and peristomal leakage, which are thought to be effective on hospital mortality, were analyzed by multivariate logistic regression analysis. None of these factors was found to be predictive on hospital mortality (P > 0.05) (Table 6).

Table 5. The results of all risk factors on hospital mortality and univariate statistical analysis results

	Alive (n=116)	Exitus (n=24)	p-value
Age (year)	70 (53.2-79.7)	78.5 (61.7-84.5)	0.028†
Gender			0.832‡
Female	54 (46.6%)	10 (41.7%)	
Male	62 (53.4%)	14 (58.3%)	
Malignity	8 (6.9%)	3 (12.5%)	0.401¶
Co-morbidity	60 (51.7%)	15 (62.5%)	0.460‡
BMI (kg/m2)	26.2±5.4	25.8±6.0	0.822$
ASA			0.815†
II	-	1 (4.2%)	
III	12 (10.3%)	1 (4.2%)	
IV	104 (89.7%)	22 (91.7%)	
Length of PEG tract (cm)	2 (0-3.4)	1 (0-3)	0.647†
Length of PEG tract			
≤3.5 cm	39 (33.6%)	8 (33.3%)	>0.999‡
>3.5 cm	23 (19.8%)	4 (16.7%)	>0.999¶
Normal localization (NA)	54 (46.6%)	12 (50.0%)	0.934‡
Albumin	2.8 (2.6-3.2)	2.6 (2.4-2.9)	0.095†
PLR	166 (112-254.5)	208 (129-267)	0.263†
NLR	4.1 (2.6-7.1)	6.5 (3.4-9.1)	0.062†
Infection due to PEG	12 (10.3%)	1 (4.2%)	0.468¶
Peristomal leakage	37 (31.9%)	4 (16.7%)	0.213‡

ASA: American society of anesthesiologists, BMI: Body mass index, NA: Not available, NLR: neutrophil-lymphocyte ratio, PEG: Percutaneous endoscopic gastrostomy, PLR: Platelet lymphocyte Ratio, † Mann Whitney U, ‡ Continuity Corrected Chi-square, ¶ Fisher's exact test, $ Student's t testi

Table 6. Assessment of the risk factors on the hospital mortality with multivariate logistic regression analysis

	OR	95% CI	Wald	p-value
Age	1.026	0.995-1.059	2.709	0.100
Albumin	0.738	0.280-1.945	0.377	0.539
NLR	1.017	0.961-1.076	0.344	0.558
Peristomal leakage	0.452	0.140-1.454	1.775	0.183

NLR: neutrophil-lymphocyte ratio, OR: Odds ratio, CI: Confidence interval

DISCUSSION

The present study evaluated the risk factors for the development of peristomal leakage and 30-day mortality after PEG. The rate of successful PEG insertion was 98.5%. We detected that patients who undergo PEG insertion have high co-morbidities, such as cerebrovascular disease (30.7%), Alzheimer disease (17.8%), history of trauma (13.5%), and hypoxic or anoxic brain injury (10.7%). Most of the co-morbidities are in order with hypertension (42.1%), senility (42.1%) and coronary artery disease or congestive heart failure (24.2%). Major complications such as bleeding, aspiration pneumonia, internal organ injury, necrotizing fasciitis, buried bumper syndrome, tumor seeding of the stoma, and minor complications like granuloma formation, local wound infection, periostomal leakage, tube dislodgment, gastric outlet obstruction. Therefore,pneumoperitoneum might occur (1, 3, 5, 8-10). In the literature, the complication rate varies between 5% and 66%, and there exist a few prospective studies determining the outcomes of PEG procedures (11,12). Özgüç et al (6) reported early and late complications as 25.4% including peristomal leakage (%9.2), tube blockage (%1.5) and wound infection (%1.5). Varis et al (11) reported in a series of 359 patients' minor complications as 6.13% including wound infection (0.8%), inadvertent PEG removal (2.5%) and tube blockage (1.1%), and the rate of major complications as 3% consisting of tube migration, perforation and bleeding. The prospective, randomised, and double blind trial by Preclik et al (12) showed that infection rates significantly decreased from 66% to 22% in patients who receive antibiotic treatment (P < 0.001). Results of the present study showed similar complications rates which are comparable within the literature.

There are some risk factors associated with the development of complications including the use of obturator-type skin-level gastrostomy, existence of malignancy, cirrhosis, history of radiation therapy, and tube traction (13-15). A case series of 1041 patients reviewed by Richter-Schrag et al (14) pointed out that cancer, cirrhosis, and radiation therapy were predictors of infection. Tube traction is another important factor for the development of complications after PEG. Chung et al (15) claimed that complications such as peritonitis, tube extrusion and gastrointestinal hemorrhage significantly decreased when traction of the gastrostomy tube is avoided (15). In present study, the length of PEG tract and low PLR level are determined as risks factors for the development of complications after PEG insertion. The rate of peristomal leakage decrease when the length of PEG tract is longer than 3.5 cm (95% CI: 1.290-33.442 and P= 0.023).

In patients who undergo PEG insertion, the 30-day mortality rate ranges from 4% to 20% due to the underlying disease and high co-morbidity (16-21). Mortality is usually associated with the primary disease. Light et al (17) reported that urinary tract infection, previous aspiration, and age greater than 75 years were predictive

factors for 30-day mortality after PEG insertion. Varnier et al (18) showed that presence of diabetes mellitus and poor nutritional statuses were associated with increased mortality rates. Figueiredo et al (19) reported the mortality rate as 6.5% at 30 days, and the level of C-reactive protein was the strongest predictive factor of 30-day mortality. A prospective study by Blomberg et al (20) found that mortality occurred in 18% of patients within two months. Further, the risk of early mortality increased in patients with neurological disease. Kobayashi et al (21) reported the 30 day mortality rate as 20%, and the Charlson's comorbidity index ≥ 4 was significantly associated with poor prognosis after PEG insertion..

In the present study, age albumin level,NLR, peristomal leakage were analyzed by multivariate logistic regression analysis as predictors of mortality. However, none of them reach statistically significance.

The present study has some limitations. First, it has a retrospective nature, and secondly, insertions of PEGs were performed by different surgeons.

CONCLUSION

PEG placement is a safe, effective and minimal invasive procedure in patients with inability to oral intake. Based on our outcomes, the length of PEG tract ≤3.5 cm and low PLR are independent risk factors for the development of peristomal leakage.

Competing interests: The authors declare that they have no competing interest.
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