

# Factors affecting palliative care mortality after percutaneous endoscopic gastrostomy placement in non-cancer patients

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## ABSTRACT

**Objectives:** The use of enteral route in nutritional support therapy is more physiological. It preserves the structural and functional intestinal integrity as well as the intestinal microbial diversity. Percutaneous endoscopic gastrostomy (PEG) is one of the enteral feeding routes. It is indicated for patients who cannot take oral food at all or cannot take oral food for more than 4 to 6 weeks.

**Methods:** Non-cancer patients who had PEG tube placement between November 1, 2024 and May 1, 2025 in the palliative care service were followed prospectively. Patients were divided into two groups: those who were discharged from the palliative care service after PEG tube placement and those who died in the palliative care service after PEG tube placement. It was examined whether the patients had an infection after PEG placement and, if so, what type of infection they had. The study was conducted with the 83 patients.

**Results:** According to the logistic regression analysis results, age and pneumonia after PEG tube placement were found to be risk factors affecting palliative care mortality after PEG tube placement in the palliative care service (respectively;  $p=0.017$ , odds ratio [OR]=1.06, confidence interval [CI] of OR=1.012- 1.126;  $p=0.004$ , OR=5.32, CI of OR=1.697- 16.680).

**Conclusion:** Age and pneumonia after PEG tube placement were found to be risk factors affecting palliative care mortality after PEG tube placement in non- cancer palliative care patients.

**Keywords:** age, mortality, non-cancer, percutaneous endoscopic gastrostomy, pneumonia

## Introduction

Maintaining adequate nutrient intake is important for health and quality of life in older people. However, older adults are at risk of malnutrition for many reasons.<sup>1</sup> Decreased cognitive and physical functions, depressive mood, poor oral hygiene, socioeconomic conditions, polypharmacy, dysphagia, some neurological diseases such as parkinson, dementia, cerebrovascular occlusion, and diseases that cause loss of appetite such as cancer can cause malnutrition in older people.<sup>2</sup>

The use of enteral route in nutritional support therapy is more physiological. It preserves the structural and functional intestinal integrity as well as the intestinal microbial diversity. Parenteral nutrition carries a risk of infective conditions, most likely due to hyperalimentation and hyperglycemia.<sup>3</sup> Therefore, if there is no contraindication in malnutrition treatment in older patients, we choose the oral or enteral route.

Percutaneous endoscopic gastrostomy (PEG) is one of the enteral feeding routes. It is indicated for patients

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who cannot take oral food at all or cannot take oral food for more than 4 to 6 weeks.<sup>4</sup> Some types of cancer and some neurological diseases such as dementia, Parkinson's disease, motor neuron disease and stroke cause swallowing problems. Therefore, PEG may be indicated in those with these diseases.<sup>5</sup> This procedure can have many major and minor complications. Minor complications include: Wound infection, tube leakage to abdominal cavity, gastric outlet obstruction, inadvertent PEG removal, tube blockage, pneumoperitoneum, stoma leakage. Major complications include: Aspiration pneumonia, necrotizing fasciitis, buried bumper syndrome, perforation of bowel, hemorrhage, metastatic seeding.<sup>4</sup>

It is necessary to make the right decision in which patients and when the PEG tube will be placed. Complications can be much more serious, especially in older and frail patients. In patients with end-stage dementia, the risks of this procedure may outweigh its benefits. In such cases, the wishes of the patient's relatives also become important.

The aim of this study was to investigate the factors affecting palliative care mortality after PEG tube placement in palliative care patients without cancer.

## Methods

### Study participants

Patients who underwent PEG tube placement in the palliative care service were included in the study. Patients who had PEG tube placement between November 1, 2024 and May 1, 2025 were followed prospectively. Cancer patients, patients who had their PEG tube placement in another service, and patients who died or were not

discharged but transferred to another unit during the study period were excluded from the study. There were 100 patients, 17 of whom were excluded from the study. The study was conducted with the remaining 83 patients.

### Data collection

Patients' age, medical history, and laboratory values were recorded. It was examined whether they had an infection after the PEG placement and, if so, what kind of infection they had. The patients' culture results and chest radiographs were followed to understand what type of infection they had. Urinary tract infection was diagnosed after urine culture was positive and an infectious disease specialist started antibiotics accordingly. Pneumonia was diagnosed after a positive sputum culture or infiltration on chest radiography and an infectious disease specialist started antibiotics accordingly. Bacteremia was diagnosed after the blood culture was positive and the infectious diseases specialist started antibiotics accordingly. Wound infection was diagnosed after culture positivity from the pressure ulcer or discharge around the PEG and appropriate antibiotics were started by an infectious disease specialist. Frailty status of patients was assessed using the clinical frail scale (CFS). Scoring is between 1 and 9. Frail is diagnosed at scores of 5 and above (score 5: mildly frail; score 6: moderately frail; score 7: severely frail; score 8: very severely frail and score 9: terminally ill).<sup>6</sup> The patient's daily living activities was evaluated using Katz activities of daily living (ADL).<sup>7</sup> Instrumental daily living activities was evaluated using Lawton-Brody instrumental ADL (IADL).<sup>8</sup> However, our patients received 0 points from the Katz ADL and Lawton-Brody IADL, meaning they were completely dependent in ADL and IADL.

### Ethical statement

Informed consent was obtained from the patients. Approval from the local ethics committee was obtained (decision no: 2024/125).

### Statistical analyses

IBM SPSS version 23 program was used for data statistics. The numerical variables were assessed by Kolmogorov-Smirnov test and histograms to determine whether their distributions were normal. Numerical variables were presented as mean  $\pm$  standard deviation (SD) or median [interquartile range (IQR)] depending on normal or non-normal distribution. Categorical variables were presented

#### Main Points

- Enteral nutrition is more physiological than parenteral nutrition and carries less risk in terms of infection.
- Percutaneous endoscopic gastrostomy (PEG) is one of the enteral feeding routes and is indicated in some patients.
- Pneumonia developing after PEG tube placement is one of the risk factors affecting palliative care mortality after PEG tube placement in non-cancer palliative care patients.

as numbers (percentages). For comparison of numerical variables Student's t-test or Mann-Whitney U test was used depending on normal or non-normal distribution. Chi-square ( $\chi^2$ ) or Fisher's exact test was used to compare categorical variables. Logistic regression analysis was used to determine risk factors affecting mortality after PEG tube placement in palliative care. If the p value was  $\leq 0.05$ , it was considered statistically significant.

## Results

51.8 % (n=43) of patients were female, while the median age of patients was 84 [12]. 50.0 % (n=14) of patients who died after PEG tube placement had pneumonia after PEG tube placement. This rate was 20.0% (n=11) in patients who did not die, and this difference was statistically

significant (p=0.005). Pressure ulcers were present in 89.3% of the patients who died, compared to 69.1% in the patients who did not die, and were statistically significant (p=0.042). While the mean prealbumin value of the non-survivor patients was  $11.3 \pm 5.38$ , this value was  $13.8 \pm 5.12$  in the survivor patients, and this was statistically significant (p=0.041). The general characteristics of the patients are presented in Table 1.

In Table 1, those with a p- value below 0.20 and sex were included in the regression analysis (age, sex, albumin, prealbumin, procalsitonin, pneumonia, hemoglobin, pressure ulcer). Omnibus test for this model had a p-value of  $<0.001$ . Hosmer and Lemeshow test had a p-value of  $>0.050$ . Nagelkerke R square was 0.265 for this model. According to the logistic regression analysis results, age and pneumonia after PEG tube placement were found

**Table 1.** Characteristics of the patients

	Total, n=83	Non-survivor, n=28 (34%)	Survivor, n=55 (66%)	p-value
Sex				
Women; n (%)	43 (51.8)	14 (50.0)	29 (52.7)	0.814
Age; median [IQR]	84 [12]	85 [10]	84 [16]	0.126
CFS Score; median [IQR]	8 [0]	8 [0]	8 [0]	0.953
Pneumonia; n (%)	25 (30.1)	14 (50.0)	11 (20.0)	<b>0.005</b>
Bacteremia; n (%)	11 (13.3)	3 (10.7)	8 (14.5)	0.743
Urinary Tract Infection; n (%)	6 (7.2)	1 (3.6)	5 (9.1)	0.658
Wound infection; n (%)	15 (18.1)	6 (21.4)	9 (16.4)	0.571
Pressure Ulcer; n (%)	63 (75.9)	25 (89.3)	38 (69.1)	<b>0.042</b>
Bolus Feeding; n (%)	8 (9.6)	3 (10.7)	5 (9.1)	1.000
Continuous Feeding; n (%)	75 (90.4)	25 (89.3)	50 (90.9)	1.000
Albumin, g/dL; mean $\pm$ SD	2.79 $\pm$ 0.43	2.67 $\pm$ 0.36	2.85 $\pm$ 0.46	0.074
CRP, mg/dL; median [IQR]	50.8 [83]	66.5 [78.5]	47 [86]	0.340
Prealbumin, mg/dL; mean $\pm$ SD	12.97 $\pm$ 5.31	11.3 $\pm$ 5.38	13.8 $\pm$ 5.12	<b>0.041</b>
Procalcitonin, $\mu$ g/L; median [IQR]	0.13 [0.17]	0.17 [0.28]	0.12 [0.14]	0.143
Hemoglobin, g/dL; mean $\pm$ SD	10.37 $\pm$ 1.72	9.98 $\pm$ 1.57	10.56 $\pm$ 1.78	0.150
Number of Follow-up Days; median [IQR]	16 [15]	18.5 [16]	16 [15]	0.531
Dementia, n (%)	50 (60.2)	19 (67.9)	31 (56.4)	0.312
CVD, n (%)	57 (68.7)	18 (64.3)	39 (70.9)	0.538
DM, n (%)	20 (24.1)	8 (28.6)	12 (21.8)	0.496
HT, n (%)	46 (55.4)	14 (50.0)	32 (58.2)	0.478

n: Number; IQR: Interquartile Ranges; CFS: Clinical Frail Scale; SD: Standard Deviation; CRP: C-Reactive Protein; CVD: Cerebrovascular Disease; DM: Diabetes Mellitus; HT: Hypertension

to be risk factors affecting palliative care mortality after PEG tube placement in the palliative care service. The results are presented in Table 2.

**Table 2.** Logistic regression analysis results\*

	p-value	OR	CI of OR
Pneumonia	<b>0.004</b>	5.32	1.697- 16.680
Age	<b>0.017</b>	1.06	1.012- 1.126
Pressure Ulcer	0.075	3.69	0.875-15.626
Prealbumin	0.128	0.91	0.824- 1.025
Procalcitonin	0.540	1.36	0.508- 3.640
Albumin	0.581	1.52	0.340- 6.862
Hemoglobin	0.888	1.02	0.714- 1.476
Sex	0.930	0.95	0.314- 2.881

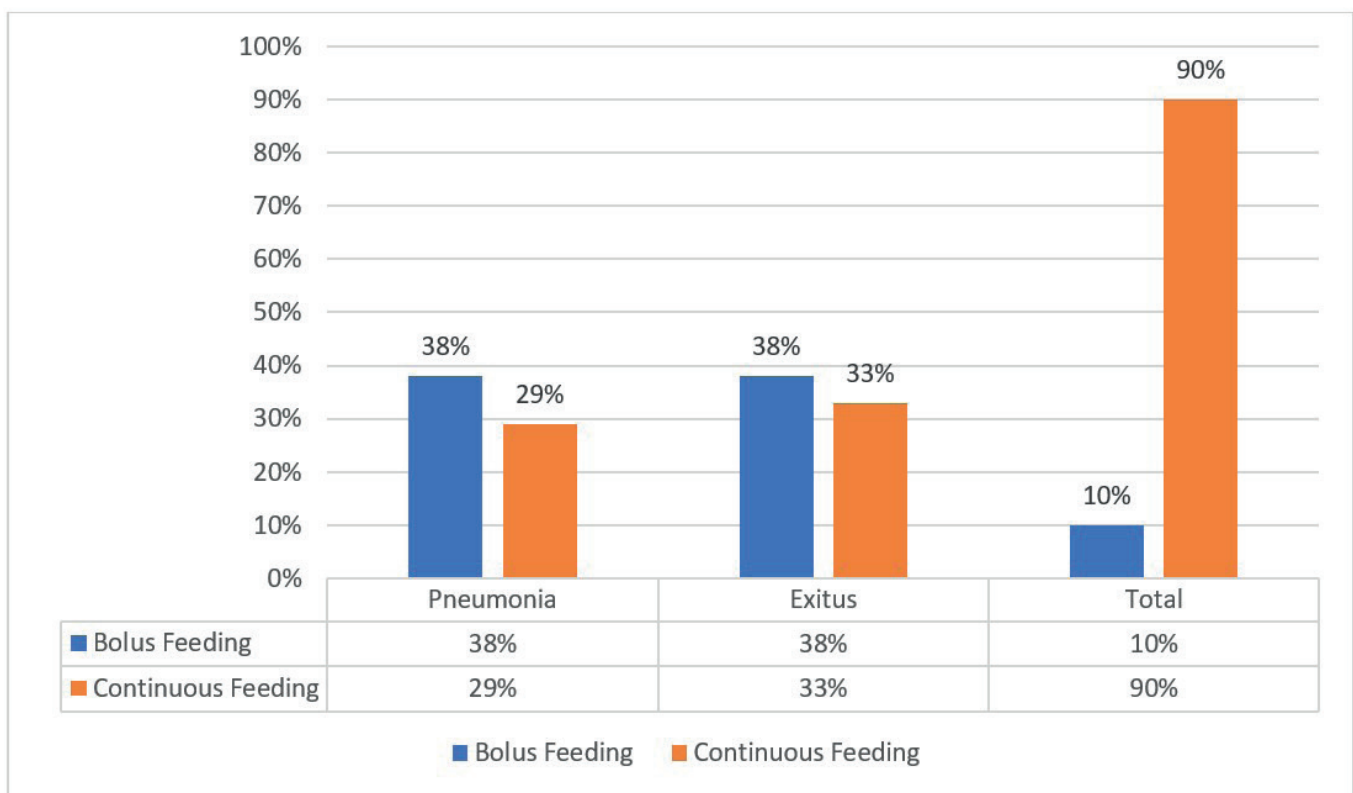
\* Age, sex, albumin, prealbumin, procalcitonin, pneumonia, hemoglobin, pressure ulcer put in the equation. Omnibus test for this model had a p-value of <0.001. Hosmer and Lemeshow test had a p-value of >0.050. Nagelkerke R square was 0.265 for this model.  
CI: Confidence Interval; OR: Odds Ratio

After PEG tube placement, 8 (9.6%) of the patients were bolus fed, while 75 (90.4%) were continuously fed. The rate of pneumonia in patients who were bolus fed after PEG tube placement was 38%, while this rate was 29% in patients who were continuously fed ( $p=0.692$ ). 38% of patients who were bolus fed died, while this rate was 33% in patients who were continuously fed ( $p=1.000$ ). Figure 1 shows pneumonia and mortality rates according to the feeding patterns.

## Discussion

In this study, the most common infection type in both groups was pneumonia. Rates of pneumonia were higher in patients who died than in patients who did not die, but rates of other types of infections were higher in patients who did not die. It was found that pneumonia and age were the most important factors affecting mortality in the palliative care service after PEG tube placement.

Complications may occur after PEG tube placement. In the study conducted by Shehata et al., complications



**Figure 1.** Pneumonia and mortality rates according to the feeding patterns

such as gastrointestinal bleeding were observed in 4.1% of patients, infection at the PEG site in 11.6% of patients, and peritonitis in 0.8% of patients within 30 days after PEG insertion. Complications were significantly higher in immunocompromised patients and in patients followed for non-neurological indications.<sup>9</sup> In the study conducted by Niu et al., higher mortality rates, longer hospital stays, and a higher incidence of septic shock were found in patients with PEG tubes who developed aspiration pneumonia.<sup>10</sup> In the study conducted by Deza et al., the most common complications after PEG tube placement were bronchoaspiration and rupture/dysfunction, respectively. The presence of early complications and age were found to be associated with shorter survival time.<sup>11</sup> The results of these studies also show that pneumonia following PEG tube placement is a serious problem.

In our study, infection developed in 69% of older patients after PEG tube placement. We can attribute this to the age of the patients, immunosuppression due to underlying diseases and long hospital stays. In this study, we found that infections such as urinary tract infection, bacterial infection, and wound infection that developed in patients with a peg tube were less life-threatening. But pneumonia developing after PEG tube placement is a serious, life-threatening risk factor. Half of the patients who died had pneumonia, and logistic regression analysis showed that pneumonia was a risk factor for palliative care mortality in older patients with PEG tubes. Considering that pneumonia is a serious risk factor for patients, we directed patients to continuous feeding rather than bolus feeding. We thought that the nutritional product given with a syringe during bolus feeding could pose a risk for aspiration due to the large and rapid administration of the product. We thought that administering small amounts of nutritional product continuously with a feeding pump would be better tolerated and less risky for aspiration. Eight of our patients received bolus feeding and pneumonia developed in 38% of these patients. 75 of our patients were fed continuously and pneumonia developed in 29% of these patients. This difference may be insignificant because our patient number is small, but this difference can be better understood in larger studies. Our patients were very old and immobile. Therefore, continuous feeding was suitable for them. Continuous feeding may be recommended to reduce the risk of pneumonia in such patients. When we examine the literature, there are generally studies comparing intermittent and continuous feeding in intensive care patients. In these studies, no significant difference was found in terms of negative outcomes in either nutritional group. A study

by Lee et al in intensive care patients demonstrated that continuous enteral feeding significantly improved 80% of target nutritional requirements compared with intermittent enteral feeding. However, no difference was found between intermittent enteral feeding and continuous enteral feeding in terms of mortality or other important secondary outcomes such as length of hospital and intensive care unit stay, gastrointestinal intolerance, and organ support.<sup>12</sup> A meta-analysis by Heffernan et al compared continuous and intermittent enteral feeding in critically ill patients. Outcomes evaluated included bacterial colonization, gastrointestinal disturbance (diarrhea or constipation), increased gastric residual, incidence of pneumonia, and mortality. Patients receiving continuous infusion were found to have an increased risk of constipation. There were no statistically significant differences in other outcomes.<sup>13</sup> In our study, although not statistically significant, negative results were less frequent in continuous feeding. To obtain clearer results, multicenter studies with longer duration and larger patient numbers are needed in palliative care patients.

Age was one of the factors affecting palliative care mortality after PEG tube placement. If very older patients with dementia or cerebrovascular disease (CVD) cannot take oral food, enteral feeding via a nasogastric tube or nasoduodenal tube or parenteral nutrition may be a method of feeding these patients. Enteral feeding with a nasogastric tube or nasoduodenal tube is a short-term solution, not a long-term method. There are various problems with parenteral nutrition, including infection, and it is difficult for relatives of the patient to apply this method at home. Therefore, a PEG tube placement in these patients may be inevitable. However, it is important to explain to the patient's relatives that mortality from this procedure increases with age. In very old patients with end-stage dementia, the expectations of their relatives must be taken into account.

There were limitations in our study. First, the number of patients was small. Longer term studies with larger number of patients may be needed. Additionally, future multicenter studies are needed to generalize the study results. Second, some patients cannot tolerate some nutritional products. This intolerance may also cause aspiration. Therefore, studies can be conducted in which the nutritional product given to patients is also recorded. Third, No microorganisms were recorded growing in the patients' cultures. Mortality may also vary depending on the microorganisms grown in the culture.



## Conclusion

Age and pneumonia after PEG tube placement were found to be risk factors affecting palliative care mortality after PEG tube placement in non- cancer palliative care patients. Continuous feeding may be recommended to reduce the risk of pneumonia in such patients.

## Ethical approval

This study has been approved by the Ordu University Local Ethics Committee (approval date 27.09.2024, number 2024/125). Written informed consent was obtained from the participants.

## Author contribution

The authors declare contribution to the paper as follows: Study conception and design: İİ; data collection: İİ; analysis and interpretation of results: İİ; draft manuscript preparation: İİ. All authors reviewed the results and approved the final version of the article.

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## Conflict of interest

The authors declare that there is no conflict of interest.

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