

Original Article

Percutaneous endoscopic gastrostomy feeding is beneficial in patients with advanced dementia

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Background and Objectives: We aimed to show the long-term results of patients who received percutaneous endoscopic gastrostomy (PEG) tubes and to evaluate the usefulness of this method in advanced dementia patients, which is considered to be of controversial benefit in the literature. Therefore, we compared three groups of patients: advanced dementia patients fed via PEG, stroke patients fed via PEG and advanced dementia patients not fed via PEG. **Methods and Study Design:** In total, 305 files of patients who underwent PEG implantation were screened retrospectively, and 283 were analyzed. A total of 93 advanced dementia patients who were not fed via PEG were included as the control group, and the PEG-fed group was compared in terms of mortality and CRP levels with the advanced dementia control group not fed via PEG. **Results:** The median length of PEG stay was 9 months. In total, 49 (17.5%) patients developed complications. Mortality ($p=0.0002$) and CRP levels ($p=0.01$) were statistically significant in the advanced dementia group not fed via PEG. The group with stroke and the dementia patients were analyzed regarding length of PEG stay, complications and mortality. The length of PEG stay, rate of complications and mortality in the stroke group were not found to be statistically significant in comparison to the dementia group. **Conclusions:** Mortality and CRP levels were statistically significantly higher in the advanced dementia group not fed via PEG. The mortality and rate of complications in the dementia group were similar to those in the stroke group. Feeding with PEG-tubes is a proper and preferable method for advanced dementia patients.

Key Words: percutaneous endoscopic gastrostomy, feeding, advanced dementia, stroke, mortality

INTRODUCTION

Feeding with a PEG tube is a preferable method in patients with impaired oral intake and an intact gastrointestinal system (GIS). Because of the feasibility of this minimally invasive method and the possibility of long-term enteral feeding, it is widely used worldwide. Mostly, it is used in neurological and oncological patients with impaired oral intake. Furthermore, it is used for gastric decompression. Absolute contraindications for PEG-tube implantation are hemodynamic instability, severe coagulopathy and distal gastrointestinal obstruction. PEG tubes for enteral feeding can be placed endoscopically, radiologically or surgically. Endoscopic placement is the most preferred technique for PEG placement. This intervention can be associated with so-called minor or major complications. Major complications include buried-bumper-syndrome (BBS), bleeding, organ injuries, aspiration pneumonia and necrotizing fasciitis. Wound infection, tube leakage to the abdominal cavity (peritonitis), tube leakage, inadvertent PEG removal, and tube blockage are minor complications.¹⁻⁴ Compared to nasogastric tube feeding, the rates of aspiration pneumonia, irritation, ulceration, bleeding, and reflux esophagitis are lower. Further, the feeding effectiveness and quality of life were found to be superior.^{5,6} PEG-placement methods include the pull-through, push or Russell techniques. The pull-through technique is widely used. Some publications recommend that feeding can be started 1-24 hours post inter-

vention, whereas a meta-analysis reports that feeding could be started 4 hours after placement.⁷ Stroke, advanced age, infection, comorbidity, and low albumin are reported as risk factors for higher mortality.^{1-4,8-11}

METHODS

A total of 305 patient files noting PEG-tube placement between 2010 and 2017 in a tertiary referral hospital (Recep Tayyip Erdogan University) were screened retrospectively. A total of 283 patients were evaluated. Since the data of 22 patients were insufficient and 5 of the patients had both dementia and stroke, these patients were not included in the study. PEG-tube placement was performed by the pull-through technique. In advanced dementia patients with oral intake disorder, the decision to feed via PEG was made with the consent of gastroenterologists and anesthesiologists at the request of the neurologist. Consent is obtained from the first degree relatives of the patient. It was used in patients with a life expectancy longer than 2 months.

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The patients' reasons for inadequate oral intake, length of PEG stay, whether the patient died, cause of death, complications, use or not of antibiotics, C-reactive protein (CRP), neutrophilic granulocyte levels, history, and whether a patient suffered a stroke were documented. A total of 93 advanced dementia patients who were not fed via PEG were included as the control group. The PEG-fed group was compared in terms of mortality and CRP levels with the advanced dementia control group not fed via PEG. In addition, both groups with stroke and dementia were compared regarding length of PEG stay and complications. The group that was not fed via PEG was formed from the patients who were hospitalized in the internal medicine and palliative care units between the same dates. These patients were periodically fed via enteral, parenteral or nasogastric tube method.

The approval of the ethics committee of the medical faculty of RTE University was obtained.

The statistical analysis was performed with SPSS 12 version. Data sets were tested for a normal distribution with the Kolmogorov-Smirnov test. PEG stay was analyzed using Student's t-test, and age-dependent with non-parametric distribution was performed using the Wilcoxon test. Sex, complications and mortality were analyzed with the Chi-square test.

RESULTS

A total of 283 patients were evaluated. A total of 165 patients were female and 118 were male (58% vs. 42%). The median age was 59.5 (16-103) years. In total, 121 (43%) of these patients had suffered stroke, 101 (35.7%) had dementia, 11 (3.8%) had hypoxic brain injury, 10 (3.5%) had motor neuron disease, 8 (2.8%) had suffered trauma, 8 (2.8%) had cerebral palsy, 7 (2.4%) had Parkin-

son's disease, 6 (2.1%) had epilepsy, 5 (1.8%) had malignancy and 6 (2.1%) had chronic obstructive pulmonary disease (COPD), chronic heart disease and chronic kidney disease. The mean age was 82.5 years in the control group that was not fed via PEG. Sixty-one patients were female, and 32 patients were male. There was no difference in terms of age, sex or comorbidities compared with the PEG-fed group. The median length of PEG stay was 9 months. In total, 49 (17.5%) patients developed complications. The groups with stroke and dementia patients were analyzed for length of PEG stay, complications and mortality. Mortality ($p=0.0002$) and CRP elevation ($p=0.01$) were statistically significant in the advanced dementia group not fed via PEG. The rates of complications and mortality in the stroke group compared to the dementia group were not found to be statistically significant. Although the duration of PEG-tube stay was longer in the stroke group, no statistically significant value was found. No statistical significance was found between the 2 groups. The results are shown in Tables 1 and 2.

Female sex and elderly individuals predominated in the dementia group. There were documented minor complications in 26 patients, and 14 patients had major complications (buried bumper syndrome and pneumonia).

Analyzing the factors leading to death using the multivariate regression analysis, it was shown that age, duration of PEG-stay, complications, C-reactive protein increase, pneumonia and history of stroke each had a significant value. In the stroke group, the increased mortality rate was not statistically significant compared to the dementia group. We aimed to emphasize that stroke was a risk factor for mortality. Analyzing the causal factors for complications using the multivariate regression analysis showed that only C-reactive protein increase ($p=0.01$) had

Table 1. Baseline and clinical characteristics

Characteristics	Values
Age, median (minimum, maximum)	59.5 (16-103)
Sex (female/male, %)	165/118 (58.3/41.7)
Duration of PEG-stay, median	9 months
C-reactiv protein-increase (%)	56
Neutrophile granulocytes-increase (%)	31.4
Prophylactic antibiotics application (%)	94
Indication for PEG-tube placement (n, %)	121, 43
Stroke (n, %)	101, 35.7
Dementia (n, %)	11, 3.9
Hypoxic brain injury (n, %)	10, 3.5
Motor neuron disease (n, %)	8, 2.8
Trauma (n, %)	8, 2.8
Cerebral palsy (n, %)	7, 2.4
Parkinson's disease (n, %)	6, 2.1
Epilepsy (n, %)	5, 1.8
Malignancy (n, %)	6, 2.1
Others [†] (n, %)	49, 17.3
Complications (n, %)	
Major complications	
Aspiration pneumonia	14, 5
Buried bumper syndrome	4, 1.4
Minor complications	
Peristomal leakage	21, 7.5
Wound infection	4, 1.4
Tube occlusion	3, 1
Accidental tube removal	3, 1

[†]Others: Congestive cardiac failure, chronic renal failure, chronic obstructive pulmonary disease (COPD).

Table 2. Statistical analysis among the 3 groups

	Dementia Fed via PEG (n=101)	Stroke Fed via PEG (n=121)	Dementia 2 Not Fed via PEG (n=93)	<i>p</i> value
Female sex, n (%)	74 (73.3)	70 (57.8)	61 (65.6)	0.055
Age (years)	84.5 (79-90)	79 (72-86)	82.5 (73-92)	0.211
PEG-stay (months)	10.7±9.9	12.8±10.1	–	0.119
Death (n, %), (Total mortality)	53 (52.5)	68 (56.2)	73 (78.5)	0.0002
Complications, n (%)	17 (16.8)	23 (19)	–	0.807
C-reactive protein increase, n (%)	54 (53.4)	74 (61)	69 (74.2)	0.010
Comorbidities, n (%)	44 (43.5)	53 (43.8)	45 (48.4)	0.746

a significant value.

DISCUSSION

Feeding via PEG-tubes has become an effective, safe and inexpensive method in patients with impaired oral intake and an intact gastrointestinal system in recent years. Most these diseases (90%) comprise neurological disorders. Stroke and dementia are the most frequent neurological diseases requiring feeding via PEG tubes. Temporarily, they are also used during the treatment of head-neck and bronchial cancer.¹² The duration of feeding via PEG tubes in these patients is dependent on the therapy time and the prognosis of the primary disease. The presence of a stroke history increases mortality. The data on the benefit of PEG tubes in patients with advanced dementia are controversial.¹³⁻²¹ There are no randomized controlled trials in the literature on this topic. Our knowledge is based on retrospective and observational studies. The definition of advanced dementia was made according to the Functional Assessment Staging (FAST) and the Clinical Dementia Rating (CDR) scale.²²⁻²⁸ Stroke is defined as a cerebrovascular accident. Impaired oral intake in dementia is a factor for poor prognosis as well as for advanced disease stage. Our study was comprised of patients with advanced dementia over 80 years of age who were confined to bed, had impaired oral intake and for whom it was decided to feed via PEG tube. The control group comprised advanced dementia patients not fed via PEG. It was shown that the mortality among dementia patients over 80 years was high.²² We determined that the overall mortality among dementia patients fed via PEG was 52.5% overall, with 56.2% in the stroke group fed via PEG and 78.5% in the advanced dementia patients not fed via PEG. Although mortality among advanced dementia patients not fed via PEG was statistically significant, there was no difference between advanced dementia and stroke patients who were both fed via PEG. However, mortality and CRP levels, which can be considered signs of infection, were found to be significantly higher in the control group with similar features to advanced dementia patients not fed via PEG. Although PEG itself constitutes an infection focus, we think that it reduces mortality, especially because it protects patients from fatal pulmonary infections. It is also expected that recurrent infections may lead to more hospitalizations. The significant increase in mortality and infections in the control group clearly showed that PEG feeding was very beneficial in these patients. Therefore, we conclude that feeding via PEG in advanced dementia patients was as beneficial as feeding

via PEG in stroke patients. The length of PEG-tube stay in the dementia patient group was 10.7 months and 12.8 months in the stroke group. The difference between the groups was not statistically significant. The rate of complications in the dementia group was 17% and in the stroke group, the rate was 23%. As reported, placement of PEG tubes in dementia patients did not offer any benefits,¹⁸⁻²¹ another publication with dementia patients showed that there was no improvement of decubitus wounds after placement of PEG tubes and that they even led to the emergence of new wounds.^{24,25} According to the National U.S. Data and Statistics Bureau, the rate of age-related deaths among stroke patients was 42/100000, and the rate was 23/100000 among dementia patients.²⁹ Five patients with advanced dementia had a 36-month and more stable life period after PEG tube placement in our study. We think that this situation most likely emerged because of improved nutritional status and fewer aspiration pneumonias resulting from feeding with PEG tubes.

The most frequent complications seen in our study were a leaking PEG tube (7.5%), aspiration pneumonia (5%), buried-bumper syndrome (1.4%) and wound infection (1.4%). Leaking PEG tubes are observed mostly among dementia patients after gastric surgery and medical conditions potentially leading to late wound healing¹ and are mostly seen in the early period within the first days after PEG tube placement, but a leaking PEG tube can also occur after the formation of the fistula tract. In any patients with leaking PEG tubes, an emerging infection, wound ulceration, change of tube localization, widening of the fistula tract, buried-bumper syndrome or delayed gastric emptying and/or residual gastric contents should be evaluated. Further, a differential diagnosis must be made. This minor complication was observed in 21 (21/283) of our patients (7.5%). It was necessary to change the PEG tube in 3 patients, whereas in the other patients, the problem was solved by correction of the underlying cause. The number of aspiration pneumonias was 14 (5%). Factors such as inappropriate active or passive body positioning after feeding via PEG tube or exceeding food amounts against the feeding rules are blamed for rising rates of aspiration pneumonia. The mortality rate of aspiration pneumonia is high. In our study, three of five patients with aspiration pneumonia (60%) among the dementia group fed via PEG, two of four patients with aspiration pneumonia (50%) among the stroke group fed via PEG and twenty-one of twenty-five patients

with aspiration pneumonia (84%) among the advanced dementia group not fed via PEG died.

Buried-bumper syndrome (BBS) is a rare late complication that can be lethal. In many cases, it develops after months or years. In our study, the earliest case of BBS occurred after three months. Once buried-bumper syndrome has occurred, associated wound infections, peritonitis or necrotizing fasciitis can develop.³⁰

One patient in our study underwent surgery because of gastric perforation and resulting peritonitis. In patients with buried-bumper syndrome, the button that is buried under the inner gastric wall can be removed in three ways:

First, by manual forced pulling; second, by making four-quadrant incisions with a needle-knife papillotome beginning from the center and moving outwards to shift the button from its current position; and third, with surgical intervention performed under local anesthesia.

All our patients underwent surgical therapy. No patient died because of BBS in our series. The recommendation to fix the outer PEG-bolster in a loose position to prevent buried bumper syndrome, on the one hand, includes the risk of leakage and peritonitis, on the other hand.³⁰⁻³³ We rotated the tube around its axis to demonstrate its mobility and fix the outer bolster according to the ease of tube rotation. Four patients (4/283) had wound infections (1.4%). This rate could be low because of patients already experiencing the complication of a leaking PEG. PEG tube placement frequency increased in elderly patients, those with insufficient oral intake, immunosuppressed patients or in cases with underlying malignancy or diabetes.³⁴ Bacterial colonization of the nasopharyngeal and upper gastrointestinal tract has been shown to be a source of wound infections or bacterial transmission in patients with PEG placement using the pull-through technique.³⁵ Its prevalence has been reported to be 5-25% in various studies, as well as 65%.^{36,37}

If the patients did not take antibiotics for other reasons, we prophylactically administered to our PEG patients a third generation cephalosporin one hour before the intervention. For this reason, we consider our wound infections to be low with respect to the infection rates in the literature.³⁸⁻⁴⁰

A dislocation of the PEG tube was observed in three patients (3/283), or 1%. All three patients developed this complication in the early period after PEG tube placement. In some publications, the tube dislocation rate is reported to be 12.8%, whereas our rate is low.^{41,42} High C-reactive protein levels, increased neutrophilic granulocytes and low albumin levels are hypothesized to be independent predictors for increased mortality in many publications.^{10,11,32,33} In contrast, high cholesterol levels are assumed to be good prognostic factors.

We found an increased rate of C-reactive protein in 56% and an increased rate of neutrophilic granulocytes in 31.4% of our patients. The documentation was not sufficient for the analysis of the cholesterol levels. In our study, high C-reactive protein levels were considered to be predictors of mortality and complications. The limitation of our study was its retrospective model.

Since the mortality rate of the PEG -fed group was low and less exposed to fatal infection, it was stable in our

study, and we can conclude that PEG feeding would improve the quality of life and lead to less hospitalization.

This fact was clear despite the infectious sources of PEG tube placement itself. PEG tube placement was performed under sterile conditions, but the process itself of pulling the tube through the mouth, pharynx and esophagus was a possible source of contamination. Since the cooperation of the patient cannot be attained in oral feeding by the caregiver, the food either escapes down the throat or the nutrition was insufficient. In a questionnaire conducted with caregivers of advanced dementia patients fed via PEG, 60 (92.3%) of 65 caregivers stated that feeding via PEG was more comfortable for both them and their patient.

We showed that the duration of PEG stay in the dementia group was similar to that of the stroke group, which was related to a high mortality rate. However, the patients in the dementia group were significantly older, and the female sex rate was higher than in the stroke group. One publication reported that feeding via the PEG tube led to higher care costs and a higher rate of hospital admissions.⁴³ In contrast, our study showed that CRP elevation was more pronounced in the non-PEG-fed group and that there were no patients who died due to local complications of the PEG except for pulmonary infections. Furthermore, although the benefit of feeding via PEG tube in advanced dementia patients is controversial, the use in this patient population is growing. As recommended in the literature,⁴⁴ we concluded that educating family doctors in how to change the percutaneous PEG tube and having this technique spread could increase the availability of the technique in a steadily aging population and reduce medical nursing costs. Oral feeding by the caregiver cannot provide adequate nutrition due to the inconvenience of the process; it also causes frequent pulmonary infections. Nasogastric tube feeding and parenteral feeding have the disadvantages of not being able to be applied continuously. All of these causes lead to higher mortality and infection in advanced dementia patients fed by non-PEG methods. This leads to a decrease in the quality of life.

Conclusion

In summary, in our study, PEG feeding decreased mortality and tended to cause infection in patients with advanced dementia. In addition, advanced dementia patients demonstrated a similar profile to stroke patients in the duration of feeding with PEG tubes, although advanced dementia patients were older and frailer. Mortality and the rate of complications were similar to those in the stroke group. Feeding with a PEG tube was a proper and preferable method for patients with advanced dementia.

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AUTHOR DISCLOSURES

The authors declare that there are no conflicts of interest or financial support.

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