

Endoscopic gastrostomy, nasojejunal and oral feeding comparison in aspiration pneumonia patients

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Background: Aspiration pneumonia is a potentially preventable illness requiring attention to small details of patient care. The type, management, and care of feeding should be carried out properly. **Materials and Methods:** This is a prospective clinical study of enteral feeding on patients admitted to hospital with aspiration pneumonia. The known enteral nutritional methods, advantages, and disadvantages were told to the patient or proxy. If they didn't accept Percutaneous endoscopic gastrostomy (PEG), nasojejunal tube (NJT) was advised. If they denied all of the procedures, oral feeding education was given. A total of 94 patients were enrolled to the study, 29 of them accepted PEG, 42 preferred NJT, and 23 preferred oral route. **Results:** A total of 94 patients with a mean age of 77.84, standard deviation 10.784; 95% confidence interval (CI) 75.63-80.03 were enrolled to the study of which 27 (28.7%) patients had a history of aspiration pneumonia. Oral feeding was prominently preferred for patients nursed by a relative (15; 65.2% of Oral feeding group and 16% of total) or a caregiver (7; 30.4% of Oral feeding group and 7.4% of total) while only 1 (4.3% of Oral feeding group and 1.1% of total) with a health-care worker ($P = 0.001$). Overall re-aspiration rates at the 6th month were 58%, 78%, 91% in EG, NJT, oral groups, respectively. Sixth months' survival rates of the different feeding groups were not significantly divergent from each other. History of aspiration was also found to be a significant contributor of mortality. **Conclusion:** In aspiration pneumonia patients' long-term survival rates of the different feeding groups were not significantly divergent from each other.

Key words: Aspiration pneumonia, emergency department, enteral feeding, mid arm circumference, nasojejunal tube, nutrition, oral feeding, percutaneous endoscopic gastrostomy

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INTRODUCTION

Aspiration pneumonia is a type of pneumonia in which oropharyngeal or gastric secretions or other exogenous material are aspirated and associated with recognizable pulmonary sequelae. Aspiration pneumonia most often occurs in the presence of impairment of protective upper and lower airway reflexes in patients who have a decreased level of consciousness or central nervous system disease.

As there is an increasing elderly population with many comorbid conditions pre-disposing to aspiration, the incidence of aspiration pneumonia among the patients admitted to emergency departments is likely to rise. Aspiration pneumonia is a potentially preventable illness requiring attention to the small details of patient care. The type, management, and care of feeding should be carried out properly. There are many types of enteral feeding: nasogastric (NGT), nasoduodenal/nasojejunal tube (NJT), percutaneous endoscopic gastrostomy tubes (PEG) or jejunostomy.

The process of patient selection for types of enteral feeding remains ill-defined. There are studies which has shown no difference in the rate of aspiration pneumonia in patients with NGT compared to PEG.^[1,2] However, there is no study about NJT feeding versus PEG, yet.

We performed a prospective clinical study of enteral feeding in patients, specifically those with at least once admitted to hospital with aspiration pneumonia. We compared the use of NJT to PEG and oral feeding despite tube indication, examining the rate of aspiration complications, the nutritional outcome, survival outcome, and satisfaction score of caregiver from the feeding type.

MATERIALS AND METHODS

The study was a single center, prospective, clinical study involving adult patients (>18 years) admitted to Marmara University Hospital Emergency Department (Istanbul, Turkey), due to at least once aspiration pneumonia history,

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requiring the long-term enteral feeding (>2-3 weeks) between June 2010 and January 2011. Our study was approved by the Local Research Ethics Committee. Informed written consent was obtained from all the patients or their proxy.

Patients were eligible for the study if they met the criteria: Need of long-standing artificial enteral feeding, stable medical condition (pneumonia clinically resolved), and the presence of normal gastrointestinal tract.

Patients excluded from the study were those refused to participate in the study, those requiring enteral feeding for esophagus pathology, serious coagulation disorders (INR (international normalized ratio) >1.5, PTT (partial thromboplastin time) >50 s, platelets <50,000/mm³), peritoneal carcinomatosis, severe ascites, peritonitis, clearly limited life expectancy due to malignancy, respiratory, liver or renal failure. Furthermore, if the data set for the patient was incomplete or if they withdrew voluntarily before the completion of the study, they were excluded.

PROCEDURE

A total of 94 patients with a mean age of 77.84 (standard deviation [SD] 10.784; 95% confidence interval [CI] 75.63-80.03) were enrolled to the study. We diagnosed "aspiration pneumonia" in whom there was a history of oropharyngeal or gastric secretions or other exogenous material were aspirated and associated with recognizable pulmonary squeals.

The indication for enteral feeding and the gag reflex tests was determined by a senior emergency department doctor with a consultant neurologist or a gastroenterology specialist. First of all, the known enteral nutritional methods, their advantages and disadvantages were told to the patient or proxy by the same study physician; all medical and ethical issues described and informed consent was requested for feeding via PEG.^[3] The patients those accepted PEG, taken in PEG Group. If the patient or proxy did not accept PEG, then NJT feeding was advised. If they accept NJT, then they were grouped as NJT Group. If he denied all of the procedures those were told, oral feeding education was given by our dietician although they were not able to swallow sufficiently well to be fed orally [Figure 1]. These patients grouped as Oral Group.

The patient number of PEG group, NJT group and oral feeding group was 29, 42, and 23 respectively. Presenting symptoms to the emergency room were cough, fever, and dyspnea; change in general well-being, confusion, agitation, not swallowing anything, hard feeding. History of aspiration before, history of concomitant diseases asked.

10 French NJTs (Flexi-flo, Abbott, Turkey) were placed in a standard fashion and their position checked by fluoroscopy.

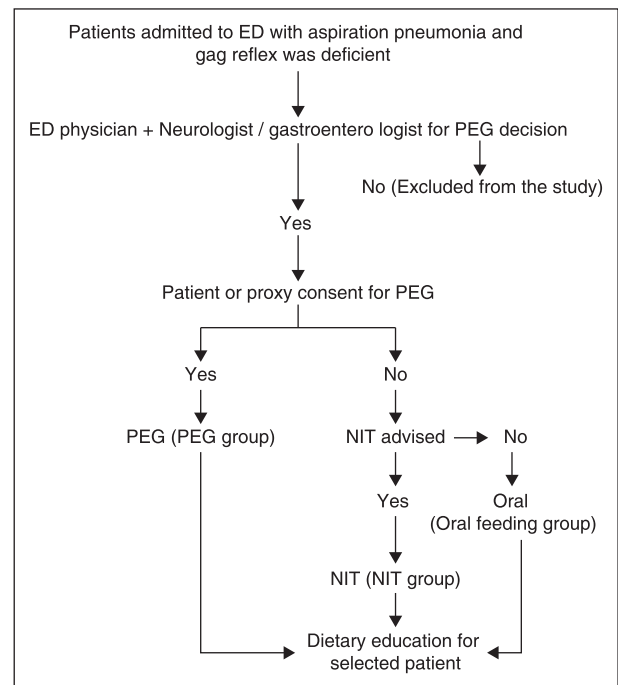


Figure 1: Study protocol (ED: Emergency department, PEG: Percutaneous endoscopic gastrostomy tubes, NJT: Nasoduodenal/nasojejunal, Oral: Oral feeding)

Before PEG placement esophagogastroduodenoscopy was carried out, a standard 24 French PEG tube (Flocare, Nutricia, Turkey) was placed using "PUSH technique" by percutaneous approach. Sedation was induced by using 3-5 mg midazolam, and a prophylactic antibiotic was not administered at the same time because all of our patients were already on broad-spectrum antibiotics due to aspiration pneumonia.

Patients in all groups were assessed by a dietitian. Nutritional requirements were calculated by her. As a part of care of the patient, preparation of individual nutrition plan was made, and the patient/his relatives/caregiver personnel were trained in care of the tubes, administration of the feed. Type of diets those were enterally fed was selected according to patient's nutritional requirements.

Home methods of NJT position control like pH, verifying that the external length of the tube has not been changed; checking the appearance of aspirate for typical gastric, intestinal, or respiratory secretions, documenting tolerance of feedings, and insufflation of 10 cc of air and air aspiration control method are told. Since no method of verification is foolproof, they were told that if any clinical indications of tube displacement existed, continuous or intermittent feedings should be stopped until appropriate tip position has been confirmed.

In our cases due to debility, it is not possible to obtain height and weight, so we used mid-arm circumference (MAC), measured with a tape around the upper arm midway

between the acromion and the olecranon for nutritional status screening.

Patients were contacted at the 1st week, 1st month, 3rd month and 6th months by phone.

Patients were given the opportunity to switch to the other feeding method on the withdrawal from the trial.

The principal outcome measures were repeated aspiration history, MAC value changes, repeated admission to hospital, mortality. Complications were recorded.

Patients' caregivers recorded a score (scoring system 0-10) for satisfaction from the type of feeding route at 1st week, 1st month, 3rd month and 6th month. This was called as "satisfaction score."

Statistical analysis

Normally distributed variables were reported as means and SD with 95% CI and were compared using the Student's *t*-test. Categorical variables were presented as percentages and were assessed using the Fisher's exact test. Estimated mean survival times were presented as means and standard errors (SE) with 95% CI. Kaplan-Meier analysis was performed for each significant contributor variable and subgroups were compared to Log-rank (Mantel-Cox) test. After the assessment of variables and confirming that pre-analysis assumptions were met, repeated measures ANOVA was used for the comparison of the changes in MAC values and satisfaction scores in time. In this study, the maximum type I error was 0.05, and the level of significance was accepted as $P < 0.05$. All analyses were performed using the SPSS version 20 (IBM, New York, USA).

RESULTS

Among patients, 60 (63.8%) were women and 34 (36.2%) were men. The mean age of the patients according to their accepted feeding route was 88.31 (SD 4.622; 95% CI; 86.55-90.07) in PEG group, 73.5 (SD: 10.061; 95% CI; 70.36-76.64) in NJT group and 72.57 (SD: 8.134; 95% CI; 69.05-72.79) in oral feeding (Oral) group. Mean age of the patients were not significantly different between NJT and Oral groups, whereas the patients in the PEG group (accepted) were significantly older than the other two ($P < 0.001$).

General characteristics of the patient population are shown in Table 1. Fever (31 patients; 33%) and change in general well-being (30 patients; 31.9%) were the most common reasons for admitting to an ED (emergency department). Other complaints were cough (19 patients; 20.2%), dyspnea (8 patients; 8.5%) and other symptoms (6 patients; 6.4%). Gag reflex was absent in 63 (67%) patients. Twenty-seven

Table 1: Patient population characteristics

General Characteristics	Accepted feeding type n (%)			P
	PEG (n=29)	NJT (n=42)	Oral (n=23)	
Gender				
Women	17 (58.6)	20 (47.6)	23 (100.0)	<0.001
Men	12 (41.4)	22 (52.4)	0 (0.0)	
Presentation symptom				
Cough	8 (27.6)	9 (21.4)	2 (8.7)	<0.001
Fever	11 (37.9)	20 (47.6)	0 (0.0)	
Dyspnea	1 (3.4)	5 (11.9)	2 (8.7)	
Change in general well-being	9 (31.0)	8 (19.0)	13 (56.5)	
Other	0 (0.0)	0 (0.0)	6 (26.1)	
Gag reflex				
Present	0 (0.0)	0 (0.0)	0 (0.0)	<0.001
Absent	29 (100.0)	13 (31.0)	21 (91.3)	
Decreased	0 (0.0)	29 (69.0)	2 (8.7)	
History of aspiration				
Present	8 (27.6)	17 (40.5)	2 (8.7)	0.025
Absent	21 (72.4)	25 (59.5)	21 (91.3)	
Concurrent illness				
CVA	9 (31.0)	13 (31.0)	23 (100.0)	<0.001
Alzheimer	8 (27.6)	12 (28.6)	0 (0.0)	
Dementia	12 (41.4)	17 (40.5)	0 (0.0)	
Caregiver				
Health-care worker	11 (37.9)	20 (47.6)	1 (4.3)	0.009
Relative	10 (34.5)	13 (31.0)	15 (65.2)	
Paid caretaker	8 (27.6)	9 (21.4)	7 (30.4)	

PEG = Percutaneous endoscopic gastrostomy; NJT = Nasojejunal tube; CVA = Cerebrovascular accident. *7 cells (46.7%) have expected count less than 5. Reported value is Pearson Chi-square with Yates correction

(28.7%) patients had a history of aspiration pneumonia. Concurrent illnesses with a high-risk of aspiration were cerebrovascular accident (CVA) in 45 (47.9%), dementia in 26 (30.9%), and Alzheimer Disease in 20 (21.3%) patients.

We have offered enteral feeding via PEG for all of the patients. Twenty-nine (30.9%) patients accepted enteral feeding via PEG; however, 42 (44.7%) preferred NJT, and 23 (24.5%) preferred oral route. Caregivers were educated for the methods and key points of oral feeding in such patients. No immediate procedure-associated complications or mortalities were experienced.

Caregiver was a relative in 38 (40.4%), a health-care worker in 32 (34%) and a caretaker in 24 (25.5%) patients. Oral feeding was prominently preferred for patients nursed by a relative (15; 65.2% of oral feeding group and 16% of total) or a caregiver (7; 30.4% of oral feeding group and 7.4% of total) while only 1 (4.3% of oral feeding group and 1.1% of total) with a health-care worker ($P = 0.001$). If the caregiver was a health-care worker PEG was preferred, and if not NJT was favored.

Mean satisfaction scores of new feeding routes and its change in time is shown in Table 2. There was a statistically significant difference between the mean satisfaction scores according to the accepted route of feeding ($F [3, 176] = 55.63, P < 0.0005$; Wilk's $\lambda = 0.080$, partial $\epsilon^2 = 0.72$). Accepted route of feeding has a statistically significant effect on mean satisfaction scores of 1st week ($F [2, 91] = 68.67; P < 0.0005$; partial $\epsilon^2 = 0.60$), 3rd month ($F [2, 91] = 25.67; P < 0.0005$; partial $\epsilon^2 = 0.36$) and 6th month ($F [2, 91] = 16.63; P < 0.0005$; partial $\epsilon^2 = 0.27$); however, not on mean satisfaction scores of 1st month ($F [2, 91] = 0.64; P > 0.05$; partial $\epsilon^2 = 0.01$). There was a statistically significant difference between the mean satisfaction scores of different accepted feeding routes on 1st week (PEG: 6.55, SE: 0.12; %95 CI: 6.32, 6.79; NJT, 6.02, SE: 0.10, %95 CI: 5.83, 6.22; Oral, 7.96, SE: 0.13, %95 CI: 7.69, 8.22; *Post-hoc* 6 cross-comparison of 3 groups (Tukey) $P < 0.0005$). No statistically significant difference was observed among the routes on 1st month (PEG, 7.31, SE: 0.26; %95 CI: 6.80, 7.82; NJT, 6.95, SE: 0.21, %95 CI: 6.53, 7.38; Oral, 7.22, SE: 0.29, %95 CI: 6.65, 7.79; *Post-hoc* 6 cross-comparison of 3 groups (Tukey) $P > 0.05$). On 3rd month, NJT and Oral feeding had same satisfaction scores (3.64; SE: 0.37; %95 CI: 2.91, 4.38 and 3.83; SE: 0.50; %95 CI: 2.83, 4.82; respectively; *post-hoc* comparison (Tukey) $P > 0.05$); however, satisfaction scores of PEG feeding was almost twice much of these routes and this difference was statistically significant (7.55; SE: 0.45; %95 CI: 6.67, 8.44; *post-hoc* 2 cross-comparison with 2 other groups (Tukey) $P < 0.0005$). On 6th month, again NJT and Oral feeding

were similar (2.57; SE: 0.45; %95 CI: 1.67, 3.47 and 1.57; SE: 0.61; %95 CI: 0.35, 2.78; respectively; *post-hoc* comparison (Tukey) $P > 0.05$) and PEG feeding had significantly higher satisfaction scores (5.90; SE: 0.55; %95 CI: 4.81, 6.98; *post-hoc* comparison with other 2 groups (Tukey) $P < 0.0005$). To investigate the changes of satisfaction scores according to groups also a repeated measures ANOVA test was performed. repeated measures ANOVA with a Greenhouse-Geisser correction determined that mean satisfaction scores differed statistically significantly between time points ($F [1.593, 148.175] = 94.211, P < 0.0005$). *Post-hoc* tests using the Bonferroni correction revealed that by time satisfaction scores decreased significantly in for all feeding routes ($P < 0.001$). We can, therefore, conclude that with lengthened use of each feeding route (6 months) a statistically significant reduction in satisfaction scores was elicited for each time point investigated. There was a significant difference between the trends of the groups' satisfaction scores (MANOVA). Satisfaction scores in the PEG group were higher than the other two at 6th month ($P < 0.001$) [Figure 2].

MAC values are recorded at the initiation, 1st month and 6th month of the new feeding regime [Figure 3]. There was no statistical difference between the amount of change in MAC values among feeding groups, according to sex, concurrent illness, history of aspiration, type of caregiver, and re-admission ($P > 0.05$) [Figure 3]. The development of the nutritional status and the intake in the 3 groups were similar.

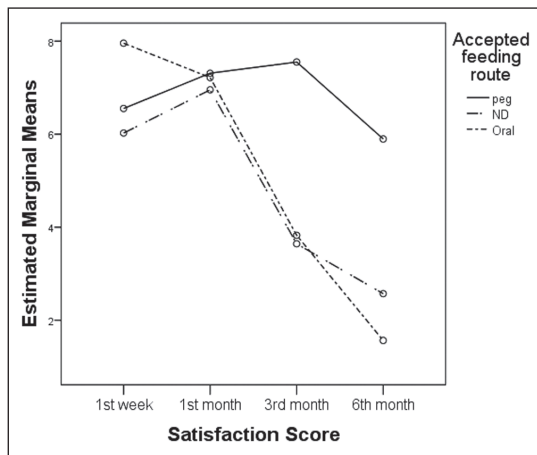


Figure 2: Satisfaction scores according to accepted feeding route (PEG: Percutaneous endoscopic gastrostomy tubes; NJT: Nasoduodenal/nasojejunal; Oral: Oral feeding)

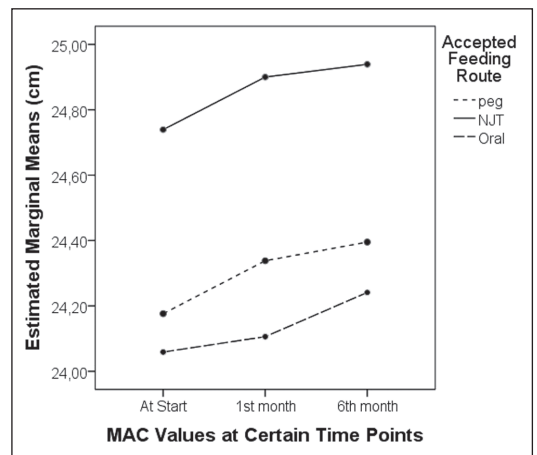


Figure 3: Mid-arm circumference values according to accepted feeding route (MAC: Mid-arm circumference; PEG: Percutaneous endoscopic gastrostomy tubes; NJT: Nasoduodenal/nasojejunal; Oral: Oral feeding)

Table 2: Satisfaction scores among time for different accepted feeding types

Type of feeding	Satisfaction scores among time for different accepted feeding types							
	1 st week		1 st month		3 rd month		6 th month	
	Mean (SD)	95% CI	Mean (SD)	95% CI	Mean (SD)	95% CI	Mean (SD)	95% CI
PEG	6.55 (0.736)	6.27, 6.83	7.31 (1.65)	6.68, 7.94	7.55 (2.114)	6.75, 8.36	5.90 (3.802)	4.45, 7.34
NJT	6.02 (0.643)	5.82, 6.22	6.95 (1.306)	6.55, 7.36	3.64 (2.574)	2.84, 4.44	2.57 (2.624)	1.75, 3.39
Oral	7.96 (0.475)	7.75, 8.16	7.22 (2.114)	6.75, 8.36	3.83 (2.424)	2.78, 4.87	1.57 (2.107)	0.65, 2.48
Total	6.66 (1.001)	6.45, 6.86	7.13 (1.378)	6.85, 7.41	4.89 (2.975)	4.28, 5.50	3.35 (3.394)	2.66, 4.05

PEG = Percutaneous endoscopic gastrostomy; NJT = Nasojejunal tube; CI = Confidence interval; SD = Standard deviation

Overall re-aspiration rates at 6th month were 58%, 78%, 91% in PEG, NJT, Oral groups, respectively. There was a significant difference between the groups ($P < 0.05$).

A total of 33 patients were lost in 6 months (37%). However, during the follow-up period of 6 months, only 1 of 34 (2.9%) men, and 32 of the 60 (53.3%) women were died. Since sex seems to be a prominent contributor, to cancel the effect of sex on survival analysis, following comparisons were made among 60 women with 32 mortalities. Kaplan-Meier curves were used and survival of subgroups was compared to Log-rank test. Estimated mean survival was significantly shorter for women with reduced gag reflex (2.182 months [SE: 0.325]; 95% CI: 1.544, 2.820) compared to women with no gag reflex (4.789 months [SE: 0.303]; 95% CI: 4.196, 5.383) (Log-rank, Mantel-Cox: $P < 0.001$). History of aspiration was also found to be a significant contributor of mortality. 16 of the 18 women (none of 9 men) with a history of aspiration were died. However, estimate of mean survival was still statistically lower for patients with a history of aspiration when both sexes were considered together (4.148 [SE: 0.304] vs. 4.761 [SE: 0.261] months; Log-rank, Mantel-Cox: $P = 0.017$). 19 of 20 women (95%) (none of the 11 men) who were admitted with the complaint of fever and 8 of 10 women (80%) (none of the 9 men) with cough were died during the 6 months period. No mortalities were present in dyspnea and decline in general well-being subgroups. Type of the caregiver was also found to be a significant contributor for survival. Women nursed by healthcare workers had significantly lower survival [Figure 4]. Estimated mean survival of the women nursed by health-care workers was significantly lower than other options (Health-care worker: 2.238 months (SE: 0.336; 95% CI: 1.579, 2.897), Relative: 4.917 months (SE: 0.322; 95% CI: 4.285, 5.548); Caretaker: 4.333 months (SE: 0.609; 95% CI: 3.141, 5.526) months; Log-rank, Mantel-Cox: $P < 0.001$). In addition, re-admission to a hospital bed was also found to be associated with significantly lower survival rates among

women (85.7% vs. 25%; 2.214 months [SE: 0.333; 95% CI: 1.562, 2.866] vs. 5.25 months [SE: 0.23; 95% CI: 4.8, 5.7]; Log-rank, Mantel-Cox: $P < 0.001$). Estimated mean survival of the women in NJT feeding group (PEG: 4.765 months [SE: 0.358] 95% CI: 4.063, 5.467; NJT: 2.050 months [SE: 0.296] 95% CI: 1.471, 2.529; Oral: 4.696 months [SE: 0.458] 95% CI: 3.288, 4.378) was significantly lower than PEG and Oral groups (Log-rank, Mantel-Cox: $P < 0.001$). The sole mortality in men was a patient who presented with cough, had no gag reflex, with no history of aspiration, had CVA as a concurrent illness, taken care of a relative, and accepted to be fed by PEG.

DISCUSSION

Enteral feeding with NGT or PEG is used for patients with dysphagia caused by multiple etiologies frequently associated with neurological abnormalities or head and neck cancers. Such methods of feeding help decrease morbidity and mortality due to malnutrition. However, there are complications that can occur with tube feeding. The most serious complication of enteral tube feeding is aspiration pneumonia. The mortality from aspiration pneumonia associated with tube feeding in the intensive care unit has been reported to be 17-62%.^[4]

The major risk factors for aspiration are a previous history of aspiration, altered level of consciousness, anatomic abnormality, gastrointestinal disease, neuromuscular disease, severe vomiting or GER, prolonged supine position, and retained gastric material.^[4,5] In addition, intermittent feeding of large amounts, poor oral hygiene, and advanced age may also increase the risk.

In contrast to the widespread use of PEG treatment, there is still no published randomized controlled trial comparing PEG feeding with NJT and oral feeding in patients with a history of aspiration pneumonia. For the major long-term enteral nutrition treatment indication, stroke, a recent multicenter trial concluded that early tube feeding might reduce case fatality, but at the expense of increasing the proportion surviving with poor outcome.^[6]

In our study, we have compared the use of PEG, NJT with oral feeding in patients admitted to the emergency department with aspiration pneumonia, prospectively.

We found that re-aspiration within 6 months of enteral feeding in these patients were higher in oral feeding than NJT and PEG. PEG may have a beneficial effect over NJT with regard to aspiration. However, unfortunately, this complication is not completely prevented by any feeding type.

Although we could not know the diet compliance of the patients' and their caregivers, nutritional outcome and mortality was similar in all groups in the end of 6 months.

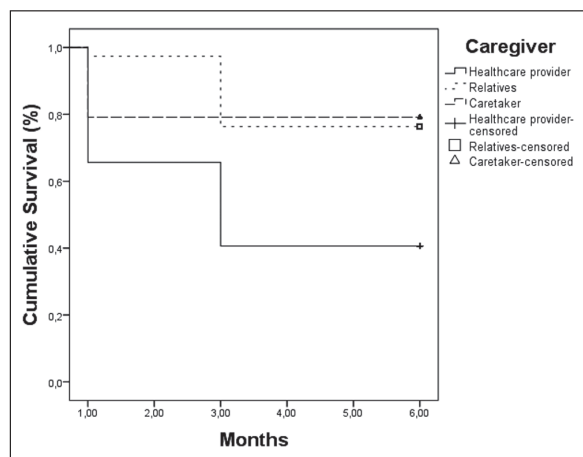


Figure 4: Survival functions according to caregiver. Estimates were obtained by using the Kaplan-Meier method

These results were same as a retrospective study comparing the use of PEG and nasogastric tubes,^[7] but were different from another prospective study, which was comparing nasogastric tube with PEG and revealed the use of PEG was associated with improved survival.^[8] The difference may be due to post pyloric feeding in our study.

Our study also shows that the major indication for long-term enteral nutrition treatment was a neurological disorder, with the majority of patients suffering from CVAs same as other PEG studies.^[9,10]

PEG was found more convenient by health-care workers. This result was same as a prospective study of 90 patients requiring enteral feeding that compared nasogastric tube to PEG, but its follow-up period was short^[11] and there was no serial satisfaction observation with time. We have seen that Satisfaction Scores in the PEG group were higher than the other two at 6th month. We think this was due to PEG feeding is better tolerated by patients than NJT and oral feeding. It is more comfortable and much easier to manage also for caregiver. There was no statistical difference between the amounts of change in MAC values among feeding groups. Although the patients in PEG group were nearly 15 years older, their mortalities and reaspiration rates were lower.

The interesting point in the results was patients, those were nursed by health-care workers, had significantly lower survival rates when compared to patients nursed by relatives or caretakers. This could be due to more debility of those patients. Furthermore, most of the health-care workers were aiding their patients in nursing homes. Quality of nursing homes was questionable.

Our study showed that co-morbid medical conditions are not important in the survey of these patients. Re-admission to a hospital bed was found to be associated with significantly lower survival rates.

This study is a prospective study, but randomization could not be made due to ethical climate of Turkish hospitals. Furthermore, there was no way to make this study as blind. Regular hospital control was hard for both patients and doctors, so phone call follow-up preferred. This was exceedingly difficult to perform in an emergency department that is already suffering from overcrowding. So some outcome variables such as physical function/capacity, health-related quality of life, body composition, laboratory test follow-ups, measurement of energy metabolism, and feeding formula types could not be compared. Furthermore, we cannot be sure that all the tubes that were placed in the jejunum by fluoroscopy did not return to the stomach throughout the study period.

Despite the lack of randomization, this prospective study suggests that in elderly patients admitted to hospital with known aspiration pneumonia, after medical stabilization, patients with PEG show fewer aspirations, satisfaction from feeding method is higher. However, long-term survival does not change in these groups of patients as mentioned in reviews.^[11] History of aspiration and complaint on admission did not reveal any impact on survival rates. Major risk for mortality is a need for re-admission to a hospital bed, which was found to be associated with significantly lower survival rates. Survival rates of the different feeding groups were not significantly divergent from each other.

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