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Guldan Kahveci, MSc, RN
Semiha Akin, PhD, MSc, RN

Knowledge Levels and Practices About the Enteral Nutritional Practices of Informal Caregivers Caring for Patients Fed Through a Percutaneous Endoscopic Gastrostomy Tube

A Descriptive Observational Study

ABSTRACT

This research aimed to evaluate informal caregivers' knowledge of and practices with enteral nutrition in caring for patients fed through a percutaneous endoscopic gastrostomy tube. Knowledge levels of caregivers about nutritional practices and percutaneous endoscopic gastrostomy tube care practices for patients fed enterally are important to prevent possible complications associated with the percutaneous endoscopic gastrostomy tube in the early period. The research sample for this descriptive observational study consisted of 126 individuals caring for patients fed through a gastrostomy tube. Knowledge and practices of caregivers were evaluated using a knowledge survey and a practice survey. The knowledge (18.90 ± 3.13; range = 0–24) and practice scores (13.41 ± 1.45; range = 0–15) of the caregivers about tube feeding were above the mean. Caregiver confusion was noted around practical aspects of care such as tube care verification of tube position, and care of the insertion site. Elderly caregivers and those with a low education level need more support about enteral nutrition when caring for patients fed through a percutaneous endoscopic gastrostomy tube. It is recommended that the nutrition nurse and other health team members provide more regular training to informal caregivers of patients fed with percutaneous endoscopic gastrostomy tubes.

The most preferred type of enteral nutrition for the medium and long term nutritional assistance is through percutaneous endoscopic gastrostomy (PEG) tubes due to ease of insertion and low complication risks (Akıncı, 2011; Ekin, Uçmak, Oruç, Tuncer, & Yalçın, 2015). Therefore, determining caregivers' awareness about PEG tube feeding and care practices can help nurses with developing educational programs and effective strategies for safe enteral feeding by informal caregivers.

Background

Knowledge of feeding standards and PEG treatment protocols for patients fed enterally by caregivers is of great importance for proper nutrition and prevention of potential early-stage complications (Heuschkel

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About the authors: *Guldan Kahveci, MSc, RN, Ümraniye Training and Research Hospital, University of Health Sciences, Istanbul, Turkey.*

Semiha Akin, PhD, Msc, RN, is Professor, Hamidiye Faculty of Nursing, University of Health Sciences - Turkey, Istanbul, Turkey.

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Correspondence to: *Semiha Akin, PhD, MSc, RN, Faculty of Nursing, University of Health Sciences Turkey, Mekteb-i Tıbbiye-i Şahane (Haydarpaşa) Külliyesi Selimiye Mah. Tıbbiye Cad. No. 38, 34668 Üsküdar, Istanbul, Turkey (semihaakin@yahoo.com).*

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et al., 2015; Rahnemai-Azar, Rahnemaiazar, Naghshizadian, Kurtz & Farkas, 2014; Sobotka, 2017). If the risks associated with PEG application are not found early, there can be life-threatening issues. Therefore, precautions against potential complications associated with PEG application need to be taken and patients and their family should be educated. Preventive steps include monitoring PEG-fed patients for complications, administering anticoagulants and antithrombotic agents, and giving prophylactic antibiotics. Early diagnosis of complications allows for quick intervention and efficient treatment (Hucl & Spicak, 2016).

Studies evaluating the level of knowledge of enteral nutrition worldwide are mainly conducted on healthcare team members. These studies reported that the knowledge of enteral nutrition was not at the desired level even among healthcare team members (Koçhan & Akın, 2018; Madigan, Fleming, McCann, Wright, & MacAuley, 2007; Özbas¸ & Baykara, 2018; Theilla, Cohen, Singer, Liebman, & Kagan, 2016; Uysal, Es¸er, & Khorsıd, 2011). Wanden-Berghe, Patino-Alonso, Galindo-Villardón, and Sanz-Valero (2019) reported that problems with obstruction of the feeding tube were encountered during enteral feeding. Uysal et al. (2011) reported that 100% of the nurses gave water through the tube after giving nutritional products through the PEG tube. Özden, Karagözog˘lu, Güler, and Bülbülog˘lu (2016) determined that 32.7% of caregivers have problems with gastrostomy care, and the burden of care in caregivers has increased because of these problems.

In research by Green, Townsend, Jarrett, Westoby, and Fader (2019), approximately half of the caregivers for patients (children and adults) who are fed with an enteral tube have encountered the problem of tube obstruction, and patients and caregivers have been trained to eliminate tube obstruction. Esenay, Sezer, Kurşun, and Gedik (2016) determined that all caregivers received dressing training, experienced most problems with the insertion site dressing, and wanted to receive applied dressing training (55%). The same research reported that caregivers received training before discharge, and 60% found the training they received to be insufficient (Esenay et al., 2016).

More research is needed to assess the knowledge and practices of informal caregivers. Determining caregivers' knowledge needs and their approaches to solutions will shed light on avoiding PEG-related complications and improving patients' and caregivers' quality of life. In meeting patients' nutritional needs and avoiding the complications associated with the PEG tube in the early period, increasing the level of knowledge and practices of caregivers who feed patients via the enteral tube is of great importance. In addition, the research findings may shed light on identifying nutrition-related issues in patients provided with PEG tubes and the detection of inaccurate knowledge and caregiver practices.

Objectives of the study are as follows:

1. To assess the knowledge of enteral nutrition of informal caregivers caring for patients fed through a PEG tube.
2. To evaluate these caregivers' practices regarding the implementation of enteral nutrition through a PEG tube.
3. To determine the personal characteristics associated with the knowledge of enteral nutrition of informal caregivers caring for patients fed through a PEG tube.
4. To determine the informal caregivers' characteristics associated with the implementation of enteral nutrition practices through a PEG tube.

Methods

This research aimed to evaluate the informal caregivers' knowledge of and practices with enteral nutrition when caring for patients fed through a PEG tube. This research is a descriptive observational design.

Setting

The research was carried out between October 2019 and February 2020 in an internal medicine ward, a neurology clinic, and palliative care units in a training and research hospital in Istanbul. Initially, the researchers assessed data about the clinics or units that implement enteral nutrition frequently at the hospital. The data provided by hospital administration showed that enteral feeding through a PEG tube is conducted frequently. Following the evaluation of these data, the researchers decided to do the research at the selected units (internal medicine service, neurology clinic, and palliative care unit).

Participants

The research population consists of 134 individuals who will be responsible for the care of patients fed through a PEG tube. The study took place while patients were being cared for through the internal medicine service, the neurology clinic, or palliative care units of a training and research hospital. Accordingly, the desired sample size was calculated to ensure the number of research participants would provide reliable statistical estimates at the end of the data collection process. Based on an incidence of 0.5 in the research population consisting of 134 subjects, it was concluded that a minimum of 99 people should be surveyed with a 95% confidence level and ± 0.05 margin of error.

Sampling criteria were set as follows:

1. Being an informal caregiver during the hospital stay for administration of enteral feedings and

care of the PEG tube on the internal medicine service, neurology clinic, or palliative care units;
2. Providing the patient's PEG tube care for at least 1 week;
3. Volunteering to participate in the research; and
4. Being 18 years of age or older.

All caregivers meeting the study criteria were approached. All caregivers who consented to participate were included in the study. The research sample consisted of 130 caregivers. Data were obtained from 126 subjects because three patients died of medical reasons during data collection, and the caregiver of one patient declined to participate in the research. The desired sample size was accomplished with 126 subjects in the survey.

Ethical Considerations

Ethical approval was obtained from the TR Ministry of Health University of Health Sciences Umraniye Training and Research Hospital Clinical Research Ethics Committee (No. B.10.1.TKH.4.34.H.G .P.0.01/152). Institutional permission was obtained from hospital administration. The researchers prepared data collection tools and obtained verbal and written informed consent from subjects.

Data Collection

Data were collected between October 2019 and February 2020. Data were obtained by both survey and observation method. Completion of the surveys and observation were completed in approximately 15–20 minutes. Data are reported in the article using the STROBE checklist.

- *Survey application:* The informal caregiver's knowledge of PEG tube nutrition practices was assessed using the Knowledge Assessment Survey.
- *Observation:* Caregivers were observed using the Nutrition Practices Assessment Survey while providing PEG tube care to patients and feeding them through the PEG tube. Observation of the caregivers during the care practices for enteral nutrition through the PEG tube was completed in about 10 minutes.
- The observer obtained a certification approved by the Ministry of Health of the Turkish Republic. This certification is renewed in certain intervals based on regulations determined by the Ministry of Health of the Turkish Republic. The observer had a master's degree in internal medicine nursing. The observer currently serves as a clinical nurse nutrition specialist at the hospital. The observer (G.K.) participates actively in conferences and educational programs.
- *To avoid observation bias*, the informal caregivers were not aware that they were being observed when giving enteral nutrition through a PEG tube. However, hospital administration was informed that researchers would observe the caregivers. Therefore, the caregivers did not notice that they were being observed while administering enteral nutrition through the PEG tube or when caring for the tube.
- *Testing interrater reliability*: Before conducting the observation, both researchers conducted a pilot study for testing interrater reliability. Both researchers observed the caregivers at the unit separately, and both observations were compared. Differences of observations were discussed. The observations were ended when the researchers did not find any difference between both observers' scores. A total of 11 caregivers were observed until the observers did not find any difference in terms of observations of enteral feedings and tube care.

Instruments

Caregivers' and patients' characteristics were collected using the Caregiver Information Survey and the Patient Information Survey. In addition, the Knowledge Assessment Survey and the Nutrition Practices Assessment Survey were used as data collection tools in the research. All surveys were developed by the researchers based on available literature on enteral nutrition.

The researchers rated each item of the Knowledge Assessment and Nutrition Practices Assessment surveys to test the content validity index (Pierce, 1995). Eight faculty members in the field of nursing were asked to assess the surveys for clarity and appropriateness. In line with the recommendations, each item was evaluated and the forms were finalized. These experts were asked to rate the suitability of each survey item with a score between 1 and 4 (1 point: not suitable; 2 points: somewhat appropriate/need a revision of the statement; 3 points: quite appropriate/appropriate but slight change required; 4 points: very appropriate). These scores were computed, and as a result, the surveys were revised by the researchers according to the content validity results. The content validity index of the knowledge survey was 97.39% and that of the practices survey was 100%. The final form of the survey was tested with pilot research ($n = 5$). The pilot study showed that the survey was easy to apply, and the participants and researchers did not have any difficulty filling out the surveys.

The researchers asked the participants to fill out the Knowledge Assessment Survey questions. Respondents read and responded to the questions on their own. The caregivers were then observed in their patient room while they were implementing PEG tube care. The researchers filled out the Nutrition Practices Assessment observation checklist unobtrusively, so that the participants did not notice that they were being observed as the researchers rated the caregivers' implementation practices.

Caregiver Information Survey

The survey includes 14 questions related to the sociodemographic characteristics (age, gender, and level of education) of caregivers, occupation, state of employment, perceptions of economic status, type of family, chronic disease status, and education on feeding tube practices including patients fed with a feeding tube.

Patient Information Survey

The Patient Information Survey contains nine questions to determine the patient's age, gender, disease history, if living with the patient, the duration of the patient's need for care, and the level of independence in continuing daily living activities.

Knowledge Assessment Survey

Researchers prepared this data collection tool to evaluate the knowledge level of individuals caring for patients who were fed with a PEG tube. There are 24 statements that are answered as "correct," "incorrect," or "I don't know/I have no idea." Statements were answered by placing an "X" next to the appropriate response. The statement correctly answered was given 1 point; a response of "I don't know/I have no idea" or an incorrect answer was given 0 points. The responses of statements in the survey were configured as "correct" for statements 1, 4, 7, 9–11, 13, 15, 16, 18, 20, 22–24 and "incorrect" for statements 2, 3, 5, 6, 8, 12, 14, 17, 19, and 21. The possible survey scores range from 0 to 24. High scores indicate a high level of knowledge.

Nutrition Practices Assessment Survey

Researchers prepared this survey to assess the nutritional practices of people who care for patients fed with a PEG tube. It contains statements relating to the handling of the enteral nutrition product, the dressing of the feeding tube, and the rotation of the plate 360° during the dressing process, as well as monitoring and administering the enteral nutrition products. The observation checklist survey is made up of 15 statements. The researcher observed the caregiver to assess if each statement was fulfilled. Each statement in the survey was given 1 point if applied and 0 if it was not applied. Thus, the possible survey scores range from 0 to 15.

Statistical Analysis

For the data analysis, descriptive statistics (number, percentage, mean, standard deviation), and regular distribution tests (histogram, Shapiro–Wilk test, coefficient of variation, calculations of skewness, and kurtosis) were used. The researchers aimed to determine whether the knowledge and practice assessment scores (observation scores) differed in terms of personal characteristics; hence, the researchers compared the knowledge and practice assessment scores (observation scores) with caregivers' characteristics.

Parametric tests were used for the data that met the assumptions (size of each group or normal distribution) for parametric tests. First, the knowledge and practice assessment scores were compared with variables that met the requirements for using parametric tests (independent-samples *t* test) (such as caregivers' gender and the presence of chronic illness). Second, the knowledge and practice assessment scores were compared with variables that did not meet the requirements for using parametric tests (Kruskal–Wallis *H* test and Mann–Whitney *U* test) (such as receiving PEG tube training, education, and caregivers' family type). The Mann–Whitney *U* test was used to compare quantitative variables that did not show a normal distribution between two groups. More than two quantitative variables that did not show a normal distribution were compared using the Kruskal–Wallis test. Relationships were tested by Pearson's correlation analysis between quantitative variables. The statistical significance level was reflected as $p < .05$.

Results

Characteristics of Caregivers and Patients

The caregivers' mean age was 45.11 years ± 10.20, and most (75.4%) were women. Nearly half of the caregivers were primary school graduates (49.2%), and most of them (70.6%) did not report a history of chronic disease. All participants were trained in nutritional practices with the PEG tube. Most of the training (69.8%) was given by nutrition nurses (Table 1).

The mean age of the patients was 72.67 years ± 15.73. The patients were fed through the PEG tube for a mean of 10.64 months ± 22.42. Nearly 15% of patients, (14.3%) informal caregivers received professional caregiver support at some time during the PEG nutrition experience (Table 2).

Caregivers' Knowledge of Nutritional Practices With a Percutaneous Endoscopic Gastrostomy Tube

The sample's mean score was 18.90 ± 3.13 (range = 0–24) on the Knowledge Assessment Survey for feeding with a PEG tube. The mean score and the percentage of correct answers indicate that caregivers' knowledge of feeding practices with a PEG tube was good (i.e., adequate) (Table 3). The highest correct answer for the sample (99.2%) addressed storing enteral nutrition products. The least correctly answered question was about care of the PEG tube insertion site using an antiseptic solution (correct response rate only 41.3%).

TABLE 1. Personal Characteristics of Caregivers ($N = 126$)

Variables	*n*	%
Age, mean ± *SD*, years	45.11 ± 10.20 (min–max: 18–67)	
Gender		
Female	95	75.4
Male	31	24.6
Status of education		
Primary education	62	49.2
Secondary education	40	31.7
Associate degree	8	6.4
Bachelor's degree and master's degree	16	12.7
Family type		
Nuclear family	103	81.7
Extended family	20	15.9
Fragmented family	3	2.4
Profession		
Housewife	50	39.7
Retired	17	13.5
Worker	11	8.7
Government official	7	5.6
Professional (nurse, engineer, physician, teacher)	4	3.2
Other (self-employed, trade, secretary, marketing, etc.)	37	29.4
Working status		
Currently working	43	34.1
Not working	65	51.6
Retired	17	13.5
Thinking to quit	1	0.8
Perception of income level	12	9.5
Less income than expenses	78	24.6
Income equal to expense		
More income than expenses	36	28.6
Chronic illness		
Yes	37	29.4
No	89	70.6
Type of chronic illness ($n = 37$)		
Hypertension	9	24.3
Diabetes	18	48.6
Other (allergic asthma, arrhythmia, fibromyalgia)	10	27.1
Training status on nutritional practices with PEG		
Yes, he or she was trained	126	100
Training health team member[a]		
Nurse	44	34.9
Nutrition nurse	88	69.8
Nutritionist	18	14.3
Physician	2	1.6

Note. PEG = percutaneous endoscopic gastrostomy.
[a]More than one option has been marked.

Nutritional Practices of Caregivers With a Percutaneous Endoscopic Gastrostomy Tube

The subjects scored 13.41 ± 1.45 points (out of 15 points) on the Nutrition Practices Assessment Survey. The observation results indicate that the caregivers could perform PEG tube feeding steps correctly while feeding with a PEG tube (Table 4). The most frequently and correctly (99.2%) applied interventions during the observation was giving water after administering medication and enteral nutrition products through the PEG tube, and using gloves during PEG tube dressing. It was observed that the least frequently and correctly (99.2%) applied interventions during the observation was the daily rotation of the PEG tube (46.8%) and checking the number written on the PEG tube before giving the enteral nutrition product (77.8%).

Comparison of Knowledge and Practices Survey Scores According to the Personal Characteristics of Caregivers

Primary school graduates obtained statistically lower scores on the Nutrition Practices Assessment Survey than secondary and higher education caregivers ($p < .05$). However, there were no statistically significant differences between Knowledge Assessment Survey scores in terms of education level ($p > .05$) (Table 5).

Scores of the Knowledge Assessment Survey obtained by informal caregivers of children were statistically significantly lower than the scores of caregivers for adults. In addition, the scores on the Knowledge Assessment Survey of caregivers not living in a nuclear family were found to be statistically significantly lower than the scores of subjects living in a nuclear family ($p < .05$) (Table 5).

No statistically significant difference was detected between the Knowledge Assessment Survey and Nutrition Practices Assessment Survey scores in terms of the gender of caregivers ($p > .05$). In addition, comparisons did not find a statistically significant difference between the Knowledge Assessment Survey and Nutrition Practices Assessment Survey scores in terms of the type of healthcare professionals who provided training for caregivers ($p > .05$) (Table 5).

Comparison of Knowledge Assessment Survey and Nutrition Practices Assessment Survey Scores

A statistically significant positive and moderate correlation was determined between the Knowledge Assessment Survey and Nutrition Practices Assessment Survey scores ($r = .42$, $p < .001$). Analyses revealed a statistically significant, negative, and low correlation between caregivers' age and Knowledge Assessment Survey scores about PEG tube nutrition practices ($r = -.20$, $p < .05$).

TABLE 2. Characteristics of Patients That the Caregivers Are Responsible for ($N = 126$)

Variables	*n*	%
Age of the patient, mean ± *SD*, years	72.67 ± 15.73 (min–max: 19–96)	
PEG insertion time, mean ± *SD*, months	10.64 ± 22.42 (min–max: 1–122)	
Gender of the patient		
Female	72	57.1
Male	54	42.9
Patient illness[a]		
Stroke	41	32.5
Alzheimer's disease	43	34.1
Cancer	20	15.9
Other (diabetes, Parkinson's disease, CRF, COPD)	38	30.2
Professional caregiver support		
Yes, paid carer support is available	18	14.3
No, professional caregiver support is not received	108	85.7
Caregivers' relationship to patient		
Parent	24	27.6
Sibling	30	34.5
Spouse	16	18.4
Other	17	19.5

Note. COPD = chronic obstructive pulmonary disease; CRF = chronic renal failure; PEG = percutaneous endoscopic gastrostomy.
[a]More than one option has been marked.

Discussion

Training of informal caregivers who perform PEG tube care is vital to safely maintaining enteral nutrition in the home environment after discharge. Knowledge needs and evidence-based recommendations should be considered when deciding on the educational method to train caregivers. Structuring training programs on nutrition practices with a PEG tube based on evidence is important for training and achieving educational outcomes. The current study identified the caregivers' knowledge and nutrition practices for a PEG tube.

Discussion of Caregivers' Knowledge and Nutrition Practices With a PEG Tube

For informal caregivers to provide safe and cost-effective enteral nutrition with a PEG tube, it is necessary to investigate their knowledge while practicing care in the hospital environment. This study examined knowledge of and care given by caregivers. The mean score obtained from the knowledge survey (18.90 ± 3.13) indicated that the caregivers' knowledge of PEG tube feeding practices was good. The hospitals in Turkey provide nutrition counseling since 2010 for all patients who need nutritional intervention, and the hospitals provide a nutrition support team/unit ("*Guide to Safe Practice for Total Parenteral Nutrition*," 2010). In this study, the caregivers' adequate knowledge of PEG tube feeding practices could be linked to the nutrition support team's educational activities in hospitals.

Unopened enteral nutrition products should be stored in a dry, cool (15–25 °C) place without sunlight until the expiration date (Best, 2008; MEGEP, 2020; Tamer, 2018). The current study found that the most frequent correct answer of the sample was about storing enteral nutrition products. Similarly, another study reported that 90.5% of caregivers gave correct answers to the statement regarding the nutritional product's storage condition (Sezer, Köken, & Çelik, 2020). However, unlike this research, another study (Özden et al., 2016), determined that only 10.2% of caregivers of patients fed with a PEG tube gave correct answers to the question about nutritional storage conditions (Özden et al., 2016). The result obtained in our research suggests that caregivers had sufficient knowledge of nutritional products' storage conditions.

In a study conducted by Lim et al. (2018), nearly half of the caregivers (49.5%) reported that they experienced PEG tube obstruction and these obstructions developed after drug administration. Our study found that the Knowledge Assessment Survey's most frequent correct answer was about giving water (96.8%). Sezer et al. (2020) found that individuals caring for adult patients gave water to a large extent (95.2%) immediately after providing nutritional products (Sezer et al., 2020). The research findings' similarity indicates that caregivers have sufficient knowledge of giving water after providing enteral nutrition products. Another study (Alsaeed, Mobilya, Blandford, Smith, & Orlu, 2018) reported that

TABLE 3. Caregivers' Responses to the Knowledge Assessment Survey for PEG Tubes ($N = 126$)

Statements	Rate of Correct Answers	
	n	%
1. Opened enteral nutrition products can be stored in the refrigerator for a maximum of 24 hr. (C)	111	88.1
2. Opened enteral nutrition products can be stored at room temperature for 24 hr. (I)	94	74.6
3. There is no need to protect the enteral nutrition product from sunlight. (I)	107	84.9
4. Unopened enteral nutrition products can be stored in a dry and cool place until the expiration date. (C)	125	99.2
5. Enteral nutrition product is given through the PEG tube at a cooler temperature than room temperature. (I)	113	89.7
6. The number written on the PEG tube does not need to be checked before each feeding. (I)	79	62.7
7. Hands should be washed before giving the nutritional product. (C)	121	96.0
8. Nutrition product is given while the patient is lying on his or her back. (I)	105	83.3
9. Enteral nutrition is given to the patient through the PEG tube for at least 10–15 min. (C)	107	84.9
10. Patients fed through the PEG tube can consume food orally if they have no problem with swallowing. (C)	61	48.4
11. Water is given after giving enteral nutrition products through a PEG tube. (C)	122	96.8
12. After giving medicine through the PEG tube, no water is given through the tube. (I)	108	85.7
13. Immediately after giving the enteral nutrition product through the PEG tube, the patient is not placed on his or her back. (C)	112	88.9
14. The syringe or formula set used when giving enteral nutrition products through the PEG tube is not changed every day. (I)	102	81.0
15. Oral care is given to the patient who is fed with a PEG tube daily. (C)	118	93.7
16. Gloves should be worn during PEG tube dressing. (C)	119	94.4
17. The PEG tube insertion site is wiped from the outside to inside with an antiseptic solution. (I)	52	41.3
18. The PEG tube insertion site is left open 1 week after the tube is inserted. (C)	94	74.6
19. While PEG tube dressing is done, the tube's plate at the entrance is rotated 90° clockwise. (I)	74	58.7
20. Symptoms such as discharge, redness, and odor may occur at the PEG tube insertion site. (C)	104	82.5
21. As long as the PEG tube is attached, the patient is not allowed to take a bath. (I)	90	71.4
22. PEG tubes can be used for a maximum of 18 months. (C)	79	62.7
23. When the PEG tube is blocked, the feeding tube is massaged with the index and thumb. (C)	85	67.5
24. When the PEG tube is clogged, giving warm water from the feeding tube can be used to try to open the tube. (C)	99	78.6

Note. Knowledge Assessment Survey total score of 18.90 ± 3.13 (min–max: 5–24). C = correct statement; I = incorrect statement; PEG = percutaneous endoscopic gastrostomy.

64% of caregivers received training to prevent enteral feeding tube blockages.

Cleansing the PEG tube site using an antiseptic solution when a PEG tube dressing is applied is recommended to prevent infection (Roveron et al., 2018). The most in correctly answered question on the Knowledge Assessment Survey was about care of the PEG tube insertion site using an antiseptic solution (correct response rate only 41.3%). Remarkably, the result revealed that 58.7% of the caregivers did not know the answer to this question correctly. This result indicates that caregivers need training in wiping the PEG tube insertion area with an antiseptic solution. Boland et al. (2017) found that nearly half (48%) of the patients fed with an enteral tube developed an infection. Lim et al. (2018) reported leakage in 16.2%

TABLE 4. Observations of Caregivers' PEG Care based on the Nutrition Practices Assessment Survey ($N = 126$)

Statements	Applied		Not Applied	
	n	%	*n*	%
1. After the enteral nutrition product is opened, it is kept at room temperature for 4 hr.	105	83.3	21	16.7
2. After the enteral nutrition product is opened, it is stored in the refrigerator for a maximum of 24 hr.	117	92.9	9	7.1
3. Enteral nutrition products and water are given at room temperature.	122	96.8	4	3.2
4. The number written on the PEG tube is checked before the enteral nutrition product is given.	98	77.8	28	22.2
5. Medicine, water, and nutritional products are given through the PEG tube while the patient is in a semi-sitting position.	122	96.8	4	3.2
6. Hands are washed before enteral nutrition is given.	118	93.7	8	6.3
7. Enteral nutrition product is given to the patient through the PEG tube for at least 10–15 min.	114	90.5	12	9.5
8. The feeding syringe or enteral feeding set is changed daily.	121	96.0	5	4.0
9. At least 30 ml of water is given after giving medication and enteral nutrition products through the PEG tube.	125	99.2	1	0.8
10. The patient is seated in a half-sitting (30–45°) position for at least 30 min after being fed with the PEG tube.	116	92.1	10	7.9
11. Hands are washed before PEG tube dressing is done.	115	91.3	11	8.7
12. Gloves are worn before PEG tube dressing is done.	125	99.2	1	0.8
13. The skin around the PEG tube is evaluated for integrity and the presence of signs and symptoms of infection.	124	98.4	2	1.6
14. The PEG tube is wiped with an antiseptic solution from the inside out and dried.	101	80.2	25	19.8
15. The PEG tube plate is rotated 360° daily.	67	46.8	59	53.2

Note. Nutrition Practices Assessment Survey total score: 13.41 ± 1.45 (min–max: 9–15). PEG = percutaneous endoscopic gastrostomy.

of cases at the PEG tube entrance site in adult patients fed enterally at home. In a systematic review by Balogh, Kovács, and Saxena (2019) analyzing 18 articles involving 4,631 patients between 1994 and 2017, it was reported that 10.3% of the patients developed hypergranulation tissue and 8.3% developed a local infection. These results indicate that the PEG tube dressing technique needs to be explained practically to caregivers.

Rotating the plate clockwise is recommended when dressing the PEG tube to prevent buried bumper syndrome (Heuschkel et al., 2015; Roveran et al., 2018; Scott & Bowling, 2015). Our study found that the item about rotation of the PEG tube during site skincare in the Knowledge Assessment Survey was the least known. The current study found that 58.7% of the caregivers answered this question correctly. Sezer et al. (2020) observed that 66.7% of the caregivers turned the tube's plate (Sezer et al, 2020). Unlike our research, another study observed that the rotation of the tube's plate during PEG tube dressing was checked by 100% of the parents of children with a PEG tube (Pars, 2016). In the research conducted by Esenay et al. (2016), 80% of the mothers reported that they encountered problems with PEG dressings during home monitoring of 26 children fed through a PEG tube. These results show that caregivers need to improve their knowledge of caring for PEG dressings.

Discussion of Data About Enteral Feeding Practices

Complications associated with a PEG tube often result from inadequate education of caregivers. Caregivers can safely identify and manage possible complications with theoretical and practical training (Schweitzer et al., 2014). In addition to caregivers' PEG tube care knowledge score, the researchers observed caregivers' practices on PEG tube care. As a result of the observation, the caregivers obtained a score of 13.41 (out of 15) on the Nutrition Practices Assessment Survey in

TABLE 5. Comparison of PEG Knowledge Assessment Survey and PEG Nutrition Practices Assessment Survey Scores to Caregivers' Characteristics ($N = 126$)

Variables	*n*	PEG Knowledge Assessment Survey Scores, Mean ± *SD*	Nutrition Practices Assessment Survey Scores, Mean ± *SD*
Gender			
Female	95	18.93 ± 3.21	13.31 ± 1.48
Male	31	18.81 ± 2.91	23.74 ± 1.32
		$t = 0.84$; $p = .85$	$t = 1.463$; $p = .15$
Education			
Primary school graduate[a]	62	18.47 ± 2.23	12.95 ± 1.52
Secondary school graduate[b]	40	19.13 ± 0.94	13.85 ± 1.18
Associate degree, bachelor's degree, and master's degree[c]	24	19.63 ± 0.94	13.88 ± 1.33
		KW = 2.036; $p = .36$	KW = 12.919; $p < .01$** a < b, c
Having a child			
Yes	97	18.58 ± 2.47	13.30 ± 1.49
No	29	19.97 ± 3.25	13.79 ± 1.24
		$z = 2.155$; $p = .031$*	$z = 1.556$; $p = .12$
Family type			
Nuclear family	103	19.10 ± 3.19	13.45 ± 1.45
Other (extended family etc.)	23	18.00 ± 2.71	13.26 ± 1.45
		$z = 2.069$; $p = .039$*	$z = 0.741$; $p = .46$
Presence of chronic illness			
Yes	37	18.73 ± 3.47	13.27 ± 1.39
No	89	18.97 ± 3.00	13.47 ± 1.48
		$t = 0.385$; $p = .70$	$t = 0.710$; $p = .48$
Healthcare team member providing PEG tube training			
Nurse and physician	108	18.94 ± 3.19	13.43 ± 1.44
Clinical nurse nutrition specialist	18	18.67 ± 2.83	13.33 ± 1.57
		$z = 0.614$; $p = .54$	$z = 0.201$; $p = .84$

Note. Alphabets "a," "b," and "c" are used to explain the difference revealed in post hoc analyses between groups. KW = Kruskal–Wallis *H* test; *t* = *t* test for independent groups; *z* = Mann–Whitney *U* test.

*$p < .05$. **$p < .01$.

this research. This score indicates that the caregivers performed the steps of feeding with a PEG tube wholly and correctly.

In patients fed enterally, it is recommended to give at least 30 ml of water before and after administering nutritional products and drugs to prevent blockage of the tube (Blumenstein, Shastri, & Stein, 2014). It was observed that the most frequently and correctly (99.2%) applied intervention during observation was giving water after administering medication and enteral nutrition products through the PEG tube. The finding obtained from this research shows that the sample group (caregivers) took measures to prevent tube occlusion. It was reported by Lim et al. (2018) that individuals who care for adult patients who are fed enterally at home experience tube obstruction (20%) after administration of medication. Alivizatos, Gavala, Alexopoulos, Apostolopoulos, and Bajrucevic (2012) found that 45.1% of individuals caring for patients receiving enteral nutrition at home encountered the problem of tube obstruction. The research reported that 90% of caregivers caring for patients fed with a PEG tube wash the PEG tube with water after drug administration and 95.5% wash the tube with water after the nutritional product is finished (Sezer, 2018). Demirci et al. (2015) determined that PEG tube obstruction developed in 4.9% of the patients. The occlusion rate of the PEG tube was reported to be 1.8% (Coşkun & Derya, 2019).

Health education is the practice carried out to enable individuals and society to adopt and implement the measures to be taken for a healthy lifestyle, protection and development of health, and the effective use of health services provided (World Health Organization, 1983). In this study, comparison revealed an association between caregivers' knowledge of and practices about enteral nutrition caring for patients fed through a PEG tube. The correlation coefficients suggest that caregivers' PEG practices can be improved as the caregivers' level of knowledge increases. Pars and Soyer (2020)

found that training given at regular intervals increased knowledge level. Özden et al. (2016) reported that caregivers were trained in PEG tube nutrition, possible problems, and solutions, and were supported by home visits. In the research by Sezer (2018), caregivers stated that they did not receive sufficient information about the problems and care related to the PEG tube (Sezer, 2018).

Limitations of the Research

The data collected were valid only for people who cared for patients fed via a PEG tube in the internal medicine facility, the neurology clinic, and the palliative care unit in a training and research hospital. In this study, survey and observation methods were used to obtain the data. In future research, investigation with broader sample groups is suggested. In addition, the long-term issues faced in the home care setting after discharge based on the caregivers' level of expertise and applications for enteral feeding in PEG tube-fed patients should be examined.

Relevance to Clinical Practice

It is recommended that the nutrition nurse and other healthcare team members who provide education about PEG treatment for enteral nutrition, storage of nutritional products, medication applications, PEG tube dressing, and prevention of complications that may arise during feeding with a PEG tube provide more regular training to caregivers of patients fed with a PEG tube. Caregivers need more practical training about procedures such as rotating the PEG tube plate 360°, dressing the PEG tube, checking the tube position, and care of the PEG tube insertion site.

The characteristics of caregivers (age, educational level, and skill level) should be considered during training programs. Training should be replicated at regular intervals for older and poorly educated caregivers. Audiovisual tools such as technology-supported teaching materials and videos for PEG tube feeding applications and tube care for patients and their family post-discharge will improve knowledge and skills.

Conclusion

If PEG tube care and feeding applications are not performed correctly, morbidity and mortality rates associated with complications may increase. Theoretical and practical training is needed to rotate the tube plate 360°, verify the tube's position, and cleanse the insertion site using an antiseptic solution. In addition, elderly caregivers and those with a low education level need more support about enteral nutrition caring for patients fed through a PEG tube. ✪

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