

Assessment of Nutrition-Related Complications in Hospitalized Patients with Tube Enterostomy

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Cite this article as: Ünsal P, Akçay K, Ölmez, YN et al. Assessment of nutrition-related complications in hospitalized patients with tube enterostomy. *Clin Sci Nutr.* 2022;4(1):8-13.

ABSTRACT

Objective: Malnutrition is an important problem that increases mortality and morbidity in hospitalized patients. If enteral nutrition is expected to be long-term, gastrostomy and jejunostomy should be preferred. In our study, we aimed to examine the nutritional-related complications of patients with nutritional osteomy.

Methods: Patients followed by Hacettepe University Faculty of Medicine Adult Hospital, Clinical Nutrition Unit and fed from gastrostomy or jejunostomy were included in the retrospective study. The clinical demographic information of the patients, indications for feeding ostomy and ostomy methods were evaluated. Nutrition-related complications were divided into three as gastrointestinal, mechanical and metabolic.

Results: A total of 404 patients were included in the study. The median age of the patients was 70 (18-94) and 187 (46.3%) were women. Three hundred forty seven (85.9%) patients were fed from gastrostomy and 57 (14.1%) patients from jejunostomy. Diarrhea was observed in 36 (8.9%) patients, aspiration pneumonia in 19 (4.7%) patients, vomiting in 13 (3.2%) patients, and regurgitation in 13 (3.2%) patients. The rate of ostomy infection is 5.9%, and the rate of refeeding syndrome is 12.5%. In multivariate regression analysis, weight [OR=0.967, 95% CI:0.938-0.996; $P = .027$] and COPD [OR=4.889, 95% CI:1.754-13.63; $P = .002$] was associated with ostomy infections, independent of all other parametric values. Age [OR=1.040, 95% CI: 1.007- 1.073; $P = .016$], weight [OR=0.959, 95% CI: 0.928-0.992; $P = .014$] and dementia [OR=3.535 95% CI: 1.302-9.597; $P = .013$] are also associated with refeeding syndrome, independent of all other causes.

Conclusion: As a result, close follow-up and early treatment of nutrition-related complications is a priority in patients fed through ostomy.

Keywords: Enteral, Feeding jejunostomy, Malnutrition, Percutaneous endoscopic gastrostomy; Refeeding syndrome.

INTRODUCTION

Malnutrition in hospitalized patients is an important problem characterized by prolonged hospital stay, increased cost, morbidity and mortality. The prevalence of malnutrition in hospitalized patients varies between 20-50%.¹ In a study conducted with the participation of 12 centers in Turkey, the prevalence of malnutrition with MUST was found to be 44.2% in hospitalized patients. According to Balci C et al., the prevalence of malnutrition in hospitalized patients due to acute illness is 35.9% according to GLIM criteria, 38% according to NRS-2002 and 37.2% using SGA.²

A third of the patients without malnutrition before hospitalization and more than half of the patients with malnutri-

tion may have worsening in their nutritional status during their hospitalization.³ The nutritional status of hospitalized patients should be evaluated at regular intervals and nutritional therapy should be started in the early period in patients with malnutrition.⁴ Enteral nutrition therapy should be started in patients who cannot take enough calories and protein orally. If treatment is expected to be longer than 4-6 weeks, gastrostomy or jejunostomy should be preferred as the access route. Tube enterostomies can be placed in the gastrointestinal tract by surgical, endoscopic, or radiological methods.⁵

Mechanical, infectious, gastrointestinal and metabolic complications can be seen in patients fed by tube enterostomy. Mechanical complications include tube oc-

clusion, malposition of the feeding tube, tube breakage, tube leakage, and accidental tube extrusion.⁶

Periostomal infections are also among the important complications and their incidence varies between 4-30%. Prophylactic antibiotics are recommended prior to tube placement to reduce infectious complications. Diabetes mellitus, long-term hospitalization, low serum albumin levels, malignancy and severe malnutrition have been found to be associated with infectious complications.^{7,8}

Gastrointestinal complications are nausea and vomiting, diarrhea, constipation, cramps, bloating and aspiration. Diarrhea may be seen in approximately 30% of patients admitted to internal and surgical services and approximately 80% of patients in the intensive care unit. Infectious causes, drugs and nutritional solutions are among the causes of diarrhea.⁹

Electrolytic disorders, hypernatremia, hypokalemia, hypomagnesemia, hypo and hyperglycemia and refeeding syndrome are metabolic complications. In the literature, the definition of refeeding syndrome shows heterogeneity. There are different definitions, including only low phosphorus or abnormalities in fluid balance, severe electrolyte imbalance and organ dysfunctions.¹⁰ In the consensus report prepared by the American Society for Parenteral and Enteral Nutrition (ASPEN) in 2020 for refeeding syndrome; body mass index (BMI) of 18.5 kg/m², 5% weight loss in last 1 month, no oral intake for 5–6 days, or less than 75% of estimated energy need for more than 7 days during an acute illness or injury, or taking less than 75% of the estimated energy need for more than 1 month, low potassium, magnesium and phosphorus levels, decrease in subcutaneous fat and muscle mass, and high-risk co-morbidities are determined as risky conditions for refeeding syndrome.¹¹

In our study, we aimed to examine the complications related to nutrition therapy in patients who were followed by the Hacettepe University Faculty of Medicine Adult Hospital, Clinical Nutrition Unit and fed from the ostomy.

Main Points

- Malignancies, neurological diseases, and dementia are the most common indications for feeding with gastrostomy and jejunostomy.
- Feeding ostomy complications which are categorized gastrointestinal, mechanical, and metabolic are still important problems for nutrition.
- Low weight and chronic obstructive pulmonary disease are risk factors for ostomy infection in addition to that age, low weight and dementia are an independent predictors for refeeding syndrome.

METHODS

Patients and Study Design

The patients followed by the Hacettepe University Faculty of Medicine Adult Hospital, Clinical Nutrition Unit were evaluated retrospectively. Patients fed from gastrostomy or jejunostomy were included in the study. Age, gender, height, weight, BMI, NRS-2002, and accompanying co-morbidities of the patients were evaluated. Feeding ostomy opening indications and ostomy opening ways were evaluated. Nutrition-related complications were divided into three as gastrointestinal, mechanical and metabolic. Gastrointestinal complications were determined as diarrhea, regurgitation, vomiting and aspiration pneumonia, and mechanical complications as ostomy infection, tube occlusion and medicine leakage and metabolic complications as refeeding syndrome (serum phosphorus level below 2.5 mg/dL), hypokalemia and hypernatremia.

Ethics committee approval of the study was received by the Hacettepe University Ethics Committee (Date: March 19, 2019, Decision No: 2019/08-02).

Statistical analysis

Descriptive statistics were expressed as mean \pm standard deviation if numerical variables fit the normal distribution, if not, as median and minimum-maximum values and as numbers and percentages for categorical variables. Comparisons between groups were made with t-test or Mann Whitney U test according to normal distribution for numerical variables and chi-square test for categorical variables. In multivariate analysis, factors that were determined in univariate analyzes were put into the model, and the factors that would predict ostomy infection and refeeding syndrome were determined, and model fit was evaluated using the Hosmer-Lemeshow test. For $P < .05$, the results were considered statistically significant. Statistics of the study were carried out by using the Statistical Package for the Social Sciences version 23.0 (IBM SPSS Corp.; Armonk, NY, USA).

RESULTS

A total of 404 patients were included in the study. The median age of the patients was 70 (18-94) and 187 (46.3%) were women. Three hundred forty seven (85.9%) patients were fed from gastrostomy and 57 (14.1%) patients from jejunostomy. Percutaneous endoscopic gastrostomy (PEG) (n=292, 84.1%) was used most frequently among the gastrostomy opening methods. Percutaneous radiological gastrostomy was performed in 48 (13.9%) patients, and gastrostomy was performed in 7 (2%) patients by open surgery. Open surgery was performed in 38 (66.7%) patients with jejunostomy, and

Table 1: Demographic and Clinical Characteristics of the Patients

	n= 404
Age, years	70 (18-94)
Sex (female)	187 (46.3%)
Weight (kg)	63.1 ± 15.2
Height (meter)	1.64 ± 1.01
BMI (kg/m ²)	23.19 ± 5.3
NRS-2002	5 (3-7)
Follow up time, days	17 (1-364)
Gastrostomy (n,%)	347 (85.9)
Percutaneous Endoscopic Gastrostomy	292 (84.1)
Percutaneous Radiologic Gastrostomy	48 (13.9)
Open Gastrostomy	7 (2)
Jejunostomy (n,%)	57 (14.1)
Open Gastrojejunostomy	38 (66.7)
Percutaneous Endoscopic Jejunostomy	19 (33.3)
Ostomy Indications (n,%)	
Malignancy	175 (43.3)
Stroke and other neurological diseases	103 (25.5)
Dementia	64 (15.8)
Prolonged Enteral Tube Feeding	35 (8.7)
Others	27 (6.7)
Co-morbidities	
Hypertension	85 (36.6)
Diabetes Mellitus	110 (27.2)
Malignancy	86 (21.3)
Coronary Artery Disease	72 (17.8)
Chronic Obstructive Pulmonary Disease	33 (8.2)

Table 2: Complications of Enterostomy Tube Feeding

Gastrointestinal complications	Mechanical complication	Metabolic complications
Diarrhea 36 (8.9%)	Ostomy infection 24 (5.9%)	Refeeding syndrome 50 (12.5%)
Regurgitation 13 (3.2%)	Tube Clogging 14 (3.5%)	Hypokalemia 11 (2.8%)
Vomiting 13 (3.2%)	Tube Leakage 4 (2.7%)	Hypernatremia 6 (1.5%)
Aspiration pneumonia 19 (4.7%)		

Table 3: Clinical Characteristics of the Patients with Ostomy Infection

	Ostomy infection (n=24)	Control (n=380)	P
Age	72.5 (20-93)	70 (18-94)	.848
Sex (female)	11 (45.8%)	176 (46.3%)	.963
Weight (kg)	56.89 ± 15.69	63.53 ± 15.18	.039
Height (meter)	1.61 ± 1.06	1.65 ± 1.06	.105
BMI (kg/m ²)	21.59 ± 4.98	23.29 ± 5.31	.128
NRS-2002	4.5 (3-7)	5 (3-7)	.901
Follow up time, days	26 (6-202)	16 (1-364)	.029
Diabetes Mellitus	9 (37.5%)	101 (26.6%)	.244
Hypertension	6 (33.3%)	79 (36.9%)	.762
Chronic Obstructive Pulmonary Disease	6 (25%)	27 (7.1%)	.009
Malignancy	2 (8.3%)	84 (22.1%)	.110

percutaneous endoscopic jejunostomy was performed in 19 (33.3%) patients. Malignancies, stroke and other neurological diseases, dementia, prolonged enteral tube feeding and other causes (burn, cystic fibrosis, etc.) are listed among the indications for ostomy opening. Demographic and clinical characteristics of the patients are shown in Table 1.

The incidence of gastrointestinal complications was diarrhea in 36 (8.9%) patients, aspiration pneumonia in 19 (4.7%) patients, vomiting in 13 (3.2%) patients, and regurgitation in 13 (3.2%) patients. The ostomy infection rate is 5.9%. During the follow-ups, tube obstruction was observed in 14 (3.5%) patients and tube leakage was observed in 4 (2.7%) patients. Refeeding syndrome was observed in 50 (12.5%) patients, hypokalemia was observed in 11 (2.8%) patients, and hypernatremia was observed in 6 (1.5%) patients. Complication rates of the patients are shown in Table 2.

Compared with the control group without ostomy infection, 24 patients with ostomy infection were low weight (56.89 ± 15.69 vs. 63.53 ± 15.18, $P = .039$) and had longer follow-up times [26 (6-202) vs 16 (1-364), $P = .029$]. Demographic and clinical information of patients with and without ostomy infection are shown in Table 3.

The median age of 50 patients with refeeding syndrome was 77 (32-93), and that of the control group was 68 (18-94) ($P = .001$). Four patients were excluded from this anal-

Table 4: Clinical Characteristics of the Patients with Refeeding Syndrome

	Refeeding syndrome (n= 50)	Control (n= 350)	P
Age	77 (32-93)	68 (18-94)	.001
Weight (kg)	59.44 ± 13.77	63.73 ± 15.49	.064
Height (meter)	1.61 ± 0.09	1.65 ± 0.01	.011
BMI (kg/m ²)	22.63 ± 4.69	23.25 ± 5.44	.447
NRS-2002	5 (3-7)	5 (3-7)	.717
Follow up time, days	18 (1-364)	17 (1-206)	.639
Diabetes Mellitus	23 (46%)	87 (24.9%)	.002
Hypertension	15 (57.7%)	70 (34%)	.018
Chronic Obstructive Pulmonary Disease	6 (12%)	26 (7.4%)	.266
Dementia	16 (32%)	48 (13.7%)	.001
Malignancy	11 (22%)	72 (20.6%)	.816

*4 patients have been excluded from the analysis because of missing data.

Table 5: Multivariate Regression Analysis for Ostomy Infection and Refeeding Syndrome

Ostomy infection#	OR	95 % CI	P
Weight (kg)	0.967	0.938- 0.996	.027
Chronic Obstructive Pulmonary Disease	4.889	1.754- 13.63	.002

#Independent variables: Age, Weight, Diabetes Mellitus, Chronic Obstructive Pulmonary Disease

Refeeding#	OR	95 % CI	P
Age	1.040	1.007- 1.073	.016
Weight (kg)	0.959	0.928- 0.992	.014
Dementia	3.535	1.302- 9.597	.013

Independent variables: Age, Weight, Follow up time, Diabetes Mellitus, Hypertension, Dementia

ysis due to missing data. Considering the co-morbidities of the patients, hypertension [15 (57.7%) vs 70 (34%), $P = .018$], diabetes mellitus [23 (46%) vs 87 (24.9%), $P = .002$] and dementia [16 (32)] % vs 48 (13.7 %), $P = .001$] is more common in patients with refeeding syndrome (Table 4).

In the multivariate regression analysis, after putting age, weight, diabetes mellitus, and coronary obstructive pulmonary dis-

ease (COPD) in the model, weight [OR=0.967, 95% CI:0.938-0.996; $P = .027$] and COPD [OR=4.889, 95% CI:1.754-13.63; $P = .002$] were associated with ostomy infections, independent of all other parametric values. Age [OR=1.040, 95% CI: 1.007-1.073; $P = .016$], weight [OR=0.959, 95% CI: 0.928-0.992; $P = .014$] and dementia [OR=3.535 95% CI: 1.302-9.597; $P = .013$] are associated with refeeding syndrome, independent of all other causes (Table 5).

DISCUSSION

In our study, we retrospectively evaluated the ostomy indications and nutrition-related complications of patients fed by tube enterostomy. Age, low weight and presence of dementia for refeeding syndrome; and age and presence of COPD for ostomy infections were associated with complications independent of all other causes.

In our study, the indications for ostomy opening were listed as malignancies with a frequency of 40%, stroke and other neurological diseases with 25%, and dementia with 15%. In a study by Aksoy E et al., the most common indications for PEG were dementia (28.6%) after stroke with a frequency of 34%, malignancies (10.8%) and other causes (15.8%).¹² In another study in which 119 patients were evaluated, PEG opening indications were listed as head and neck tumors (47.9%), neurological diseases (29.4%) and esophageal diseases (9.3%).¹³ In our study, ostomy opening indications were similar to the literature.

Ostomy infections occur at a rate of 4-30% and are among the important complications. In a study in which 73 patients with nutritional jejunostomy were evaluated, the rate of infection was 1.3% in the early period, while this rate increased to 4.1% in the late period¹⁴. In our study, the rate of ostomy infection was 5.9%. In local infections, the technique of opening the osteoma, whether antibiotic prophylaxis is given beforehand, and nursing care are important. In addition, patient-related factors such as DM, malignancy, malnutrition, obesity, and chronic corticosteroid use play an important role.^{6,15} The European Society of Gastrointestinal Endoscopy (ESGE) Guidelines recommend the administration of prophylactic single-dose beta-lactam antibiotics to reduce the risk of wound infection after endoscopic enteral tube placement.^{16,17} In our study, age and presence of COPD were found to be associated with ostomy infections. While COPD is particularly associated with infections in the respiratory system, an increase in extra-pulmonary infections (including skin infections) was not observed in a study.¹⁸ The reason for the increased risk of ostomy infection in patients with COPD may be related to hospitalization with acute exacerbations and long-term steroid therapy.

Refeeding syndrome is a metabolic shift process characterized by a decrease in insulin secretion and an increase in glucagon secretion, in which protein and fat are used as energy sources after muscle mass loss instead of glucose. It is presented with low levels of intracellular vitamins and minerals, especially phosphate, potassium, and magnesium. Edema can result in death as well as respiratory and heart failure. In a systematic review and meta-analysis, the frequency of refeeding syndrome varies between 0-62%. The reason for this change in incidence rates may be related to differences in definition. While the incidence is reported to be lower when both clinical and electrolyte disturbances are used in the diagnosis, this rate is higher in older patients with malnutrition, inpatients in the intensive care unit, or in studies using higher electrolyte threshold values for the diagnosis of refeeding syndrome.¹⁹ In our study, the refeeding syndrome was accepted as hypophosphatemia, serum phosphorus level being below 2.5 mg/dL²⁰ and the frequency of refeeding syndrome was found as 12.5%.

In a study evaluating 967 hospitalized patients with malnutrition, the frequency of refeeding syndrome was found to be 14.6% and appetite loss, cancer and hypertension were observed more frequently in patients with refeeding syndrome. Refeeding syndrome increased mortality 1.53 times.²¹ In patients with low phosphorus before endoscopic gastrostomy, mortality was higher both in the 1st week and in the 1st month.²² In our study, age, low weight and dementia were found to be associated with the refeeding syndrome. Dementia patients and advanced age are among the important risk factors for both malnutrition and refeeding syndrome. However, there is no clear data that nutritional support reduces mortality in patients with advanced dementia, and it is even thought that it may increase fatal outcomes due to refeeding syndrome.²³

Tube leakage was observed in 12.5% and tube occlusion in 2.5% of mechanical complications. In a study evaluating patients with jejunostomy, the rate of tube occlusion in late complications was 8.2%, and tube leakage was 1.3%.¹⁴ In a study by Saka B et al., the rate of tube occlusion among PEG-related complications was 4.9%.²⁴ In the literature, tube occlusion is a common problem with a rate of 25-35% and improper administration of drugs from the tube is one of the most important causes.²⁵ The reason for our lower tube occlusion rates may be that we had an experienced clinical pharmacist in our team who evaluated drug administration methods and drug interactions.

Although enteral nutrition is blamed as an important cause of diarrhea in hospitalized patients, drugs, infectious causes and underlying diseases should be primarily

evaluated.²⁶ In our study, the frequency of diarrhea was found to be 8.9% in patients who received enteral nutrition from an ostomy.

The strength of our study is the evaluation of enteral nutrition-related complications in patients who underwent gastrostomy and jejunostomy with different modalities (endoscopic, radiological and surgical). Our complication rates are similar to the literature. The retrospective design of our study and the fact that tube enterostomies were not performed in a single center can be listed among our limitations.

CONCLUSION

Malnutrition is still an important problem in hospitalized patients and if enteral nutrition therapy is expected to be long-term, tube enterostomy should be chosen. Close follow-up and treatment of nutrition-related complications by experienced clinical nutrition teams should be a priority.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Hacettepe University. (Date: March 19, 2019, Decision No: 2019/08-02)

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - P.Ü., M.H.; Design: P.Ü., K.A., M.H.; Supervision - M.H.; Resources - P.Ü., K.A., Y.N.Ö., F.T., Ş.A., B.K.Ç.; Materials - P.Ü., K.A., Y.N.Ö., F.T., Ş.A., B.K.Ç.; Data Collection and/or Processing - P.Ü., K.A., Y.N.Ö., F.T., Ş.A., B.K.Ç.; Analysis and/or Interpretation - P.Ü., B.K.Ç., M.H.; Literature Search - P.Ü., M.H.; Writing Manuscript - P.Ü., M.H.; Critical Review - M.H.

Declaration of Interests: The authors have no conflicts of interest to declare.

Funding: The authors declared that this study has received no financial support.

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