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A Better Method for Preventing Infection of Percutaneous Endoscopic Gastrostomy

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Abstract
Background Percutaneous endoscopic gastrostomy (PEG) has been widely used to maintain enteral nutrition in dysphagic patients. Local and occasional life-threatening systemic infections are still the most common complications, and the major infection source may be nosocomial flora. The effect of antibiotic prophylaxis on reducing peristomal infection is popularly accepted. However, it is accompanied with a possible risk of increasing antibiotic resistance.
Aim This study attempted to determine whether 14-day discharge before PEG could reduce the rate of peristomal infection.
Materials and Methods Fifty patients who had received PEG in our hospital were included in this study and followed for at least 6 months (except for those patients who died during this period). Patients were separated into two groups randomly. Twenty-five patients received PEG during in-hospitalization (group A). The other 25 patients received PEG until discharge at least for 14 days (group B). The most frequent indication for PEG insertion was the neurological condition. Risk factors for peristomal infection were analyzed statistically using logistic regression and expressed by odds ratios. Every possible factor was analyzed by chi-square test or Student's *t* test.

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Result Our data showed that group A had a higher peristomal infection rate than group B (32 vs 8%) ($p<0.05$).Group A also showed more need of antibiotics. The risk factors related to peristomal infection were group A and lower albumin. The total rate of 30-day mortality was 4%.
Discussion When compared with previous data, our study showed a similar infection rate in group A, a lower infection rate in group B, and a lower 30-day mortality rate. This meant that one period of discharge could reduce the peristomal infections caused by colonized bacteria. It also decreased the need of using antibiotics and might avoid the possible adverse consequence of promoting bacterial resistance, which is an alarming and growing problem in hospital practice.
Conclusion We suggest that a 14-day grace period after discharge, before PEG insertion, may decrease peristomal infection rate, length of hospital stay after PEG, and the need for antibiotics. This is suitable for moral and ethical considerations.

Keyword Percutaneous endoscopic gastrostomy

Introduction

Since percutaneous endoscopic gastrostomy (PEG) was introduced to clinical practice by Gauderer et al. in the 1980s,[1] it has been widely used to maintain enteral nutrition in dysphagic patients of cerebrovascular disease, oropharyngeal malignancy,[2,3] and motor neuron disease.[4] It is safe due to low procedural mortality. Nevertheless, local and occasional life-threatening systemic infection is still the most common complication. Previous studies have reported overall rates of peristomal infection ranging from 4 to 60%.[5–7] Several investigators have reported low rates of wound infection in patients who were already receiving antibiotics at the time of PEG;[8,9] some centers routinely use antibiotic prophylaxis.[10] However, not all evidence supports routine prophylaxis, particularly in patients with 'benign' disease indications for PEG insertion. Conflicting results, however, have been obtained in prospective clinical trials of antibiotic prophylaxis in PEG.[11,12] Besides this, antibiotic prophylaxis may bring a possible adverse sequence of promoting bacterial resistance.

The nosocomial colonization of bacteria is an important source of procedure-related infection.[13,14] A previous study using univariate and multivariate analysis found that in-hospital insertion of PEG was a predictive factor for mortality.[15] In another previous retrospective study, ambulatory patients were found to survive longer after PEG insertion than hospitalized patients.[16] However, there are few papers discussing the relationship between peristomal infection and hospitalization.

The purpose of this prospective study was to survey the impact of 14-day discharge on the peristomal infection of patients in whom we attempted a PEG (PEG). We also surveyed the indications, success rate, procedure-related complications, and long-term outcome.

Materials and Methods

Fifty patients included in our study had received PEG in Kaohsiung Municipal Hsiao Kang Hospital from Oct. 2003 to Aug. 2005. Follow-up continued until death or Mar. 2006. In the beginning, we separated these patients into two groups randomly. Twenty-five patients received PEG during in-hospitalization when they met the indication of PEG (group A). The other 25 patients were discharged when they were stable and met the indication of PEG, and then they received PEG 14 days after discharge (group B). The most frequent indication for PEG insertion was the neurological condition, the commonest being stroke. A gastroenterologist confirmed suitability for gastrostomy. Exclusion criteria were as follows: a contraindication to PEG, treatment with any antibiotic within the past 4 days, neutropenia (<500 cells/dl), or serum creatinine concentration >300 mmol/l. Written informed consent was required, and the ethics board of Kaohsiung Municipal Hsiao Kang Hospital approved this study.

The use of an antiseptic mouthwash was routinely given before PEG. All patients received parenteral antibiotics against Gram-positive organisms 30–60 min before the procedure. The pull-type PEG procedure with a 20-Fr PEG tube (Wilson-Cook, Medical GI Endoscopy) was performed for all patients. Xylocaine throat spray was used for anaesthesia and intravenous midazolam administered for sedation. The initial dressing (without local antiseptics) was performed by a nurse and daily dressing changes (with beta-iodine only) were standardized and performed by family members throughout the observation period. The enteral feeding started 4 h after PEG tube placement. Complications and post-procedure infections were recorded. All patients were followed for at least 7 days. Blood cell counts were done on days 1, 4, and 7 after gastrostomy. Monitoring included the measurement of body temperature three times daily, recording of peritoneal irritation and abdominal pain, and assessment of potential adverse events and clinical complications.

Peristomal infection endpoints End points were documented on post-intervention days 1, 4, and 7. Local infection was scored using a modified Jain et al. scale:[8] erythematic diameter (0=absent, 1=<0.5 cm, 2=0.5–1.0 cm, 3=>1 cm); exudation (0=absent, 1=slight, 2=dressing damp, 3=dressing soaked); and purulent secretion. An aggregate score of 0.3 or the presence of pus was classified as local infection.

This simplified scale was supported by previous studies showing purulent discharge to be the decisive factor in assessing local infection in almost 100% of cases.[8,9] When purulent secretion was suspected, we collected material for microscopy and culture. Systemic infections included pneumonia (demonstrated by x-ray), signs of sepsis (positive blood culture, hyper- or hypothermia, hyperventilation, tachycardia, leukopenia, or leukocytosis), peritonitis (local peritonitis and signs of systemic infection), and urinary tract infection (UTI; bacteriuria). Post-intervention antibiotic therapy for peristomal or systemic infections was also recorded.

Statistic analysis Risk factors for peristomal infection were analyzed statistically by using logistic regression and expressed by odds ratios (OR). Categorical data were compared by using the chi-square test, and the Student's *t* test was used to compare the means of normally distributed continuous variables. OR are expressed with 95% confidence intervals; a $p<0.05$ was considered significant.

Result

The two groups were similar in patient characteristics, indications for PEG, and possible infection risk factors, e.g., diabetes and obesity (body mass index; Table 1). The rates of using histamine receptor type 2 (H-2) blockers or proton pump inhibitors in group A (hospitalized patients) and group B (outpatients) were 80% (20/25) and 76% (19/25), respectively. There was no significant difference between two groups($p>0.05$). The indications for PEG were neurologic disorders ($n=44$, 88%), malignancy ($n=4$, 8%), and motor neuron disease ($n=2$, 4%). All of these patients were fed with nasogastric feeding tubes before receiving PEG. PEG was successfully placed in all of the 50 patients. There were no obvious hemorrhages, perforations, or fatal complications during the procedure, nor was there any procedure-related mortality. The mean observing period was 8.12 days (8.12±2.1 days) in the in-hospital (group A) patients, 8.03 days (8.03±1.7 days) in the discharged (group B) patients, and 8.07 days (8.07± 2.0 days) overall.

Table 1 Patient Characteristics

	Group A	Group B
Male:female	16:9	15:10
Age	67.84±11.32*	66.36±11.9*
Albumin	2.85±0.25*	2.81±2.09*
BMI	21.04±1.76*	21.15±2.09*
DM (%)	28%	24%

BMI Body weight index, *DM* diabetes mellitus
*All the data were expressed as mean±SD.

Rates of infections The rate of peristomal infection was 20 vs 4% up to day 3 (group A vs group B), 32 vs 8% up to day 7 ($p=0.019$), respectively (Fig. 1). The presence of pus was correlated with a score 3 in 87.5% of patients with local infection. Of the local infections, 60% occurred in the first 72 h (6/10). One patient in group A had oxacillin-resistant *Staphylococcus aureus* infections.

The systemic infections occurred in three patients (12 %) of group A and two patients (8 %) of group B ($p>0.05$; Fig. 1). Two cases of pneumonia, two of urinary tract infection, and one of acute bronchitis were observed, three of which had comorbidity of DM. Two patients developed sepsis that was associated with pneumonia. Peritonitis did not occur in either group.

Risk factors related with infections Patients with the following risk factors identified between admission and PEG also had an increased risk of peristomal infection: group A (OR=79.213), serum albumin concentration less than 2.8 g/dl (OR=156.23).

Post-intervention antibiotic therapy Intravenous antibiotic therapies were administered to eight of group A and two of group B patients (40 vs 8%, respectively; $p<0.05$) after PEG (Fig. 2). The rates of antibiotics for systemic infection, peristomal infection, and combined infections were 20, 60, and 20%, respectively.

Mortality One of group A (4%) and one of group B (4%) died during the following period (total mortality 4%). Both patients died of pneumonia with sepsis within 30 days after PEG. These two patients also showed peristomal infection. Both had lower albumin levels but only one had DM.

Discussion

Our experience suggested that PEG is safe and has a low complication rate, even in patients with multiple medical problems. In our study, the risk factors related with peristomal infection were group A, lower albumin (<2.8 g/dl). It might be associated with colonized flora during long-term admission. The infection rate was higher in group A (32%) in this study. However, it was similar to a previous study's data,[8] so we did not have a higher infection rate compared to other studies. The infection rate reduced significantly in group B (8%). This meant that one period of discharge could reduce the infection rate after PEG.

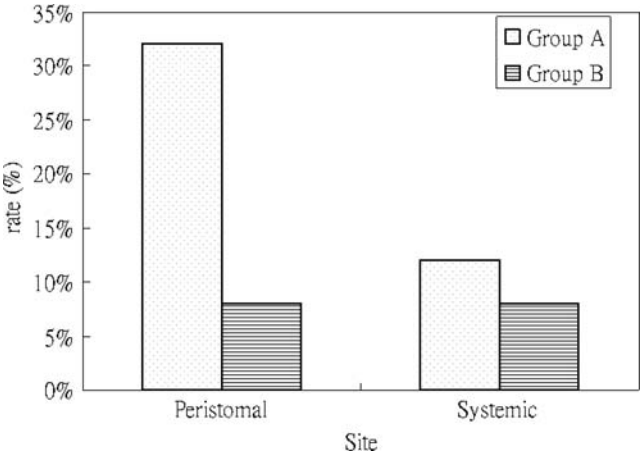

Figure 1 Infection rate of both groups. The peristomal infection rates in groups A and B were 32 and 8%, respectively ($p<0.05$). The systemic infection rates in groups A and B were 12 and 8%, respectively ($p>0.05$).

On the other hand, it might also be related to our standard post-intervention care. We tried to decrease the length of hospital stay by teaching the family how to change the wound dressing since 1 day after PEG. This might have lead to higher possibility of wound contamination. Besides these, earlier feeding timing (4 h after PEG) in our protocol might also be related to peristomal infection.

Patients who had sterile cultures and required no medical or surgical treatment may have had inflammatory reactions associated with foreign material rather than true infection. Such minor or presumed wound infections occurred with a similar frequency among patient group A (5of 25, 20%) and group B (4 of 25, 16%; $p>0.05$).

Our study showed a lower mortality rate of 4% during 30 days after PEG. This compared well with previous studies[5,7] but might be related to the fact that we excluded patients with acute illness that was a risk factor of mortality.[16–18] The previous studies showed that higher 30-day mortality rates were attributed to a trend for less strict patient selection over the last few years.[19,20] Ten years ago, more than 80% of PEGs were placed in patients with cardiovascular disease, motor neurone disease, ear–nose–throat tumors, or multiple sclerosis. This proportion fell to 69% in the current series, due to an increase in PEG placement for acute medical conditions where the long-term benefits of PEG are unproven. In our opinion, PEG tubes should not be placed in the acute care setting, when feedings can be given via nasogastric tubes. Moreover, it should be delayed until the patient's acute illness has resolved; a previous study has also supported this opinion.[16]

In the largest study to date, Grant et al.[21] retrospectively reviewed 81,000 American Medicare beneficiaries who underwent PEG. They showed a 30-day mortality rate of 25%. They found that 30-day mortality was highest among those with non-aspiration pneumonia. Others have found that aspiration pneumonia was a risk factor for 30-day mortality.[22] Other previous studies revealed that factors such as old age (>75 years), previous aspiration pneumonia, urinary tract infection, dementia, long-term hospitalization, malignancy, and lower body mass index increased the risk of mortality.[22–25] Hypoalbuminemia (albumin <2.8 g/dl) was also a risk factor.[26,27] In our study, the major cause of mortality was pneumonia only, where the underlying disease was cerebrovascular disease and both patients had comorbidity with DM. This finding was similar to previous studies.[11,28]

Wound infection at the gastrostomy site may be due to the pull technique because the wound is mainly contaminated by Gram-negative bacteria originating from the oropharynx.[11,29] In the last 2 years, the first five colonized bacteria from wounds in our hospital were *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Enterococcus* spp., and oxacillin-resistant *Staphylococcus aureus*, in order. In our study, we found the major two bacteria identified from group A were *P. aeruginosa* and *E. coli*. It may be regarded as colonized flora due to long-term hospitalization. On the other hand, the bacteria identified from group B were *S. aureus*. It was not related to the colonized bacteria in our hospital.

Antibiotic treatment may have an effect on the incidence of infection but not on the length of hospital stay in patients receiving PEG.[30] However, the potential benefit of increasing in-hospital use of antibiotics should be weighed against the possible adverse consequence of promoting bacterial resistance, which is an alarming and growing problem in hospital practice. Because gastrostomy placement can damage normal innate defense mechanisms in the upper gut resulting in bacterial overgrowth, various bacteria were identified from exudates taken from patients with wound infections with a preponderance of upper respiratory tract organisms.[30] Accordingly, we routinely used an antiseptic mouthwash before PEG. Our data showed that we did not

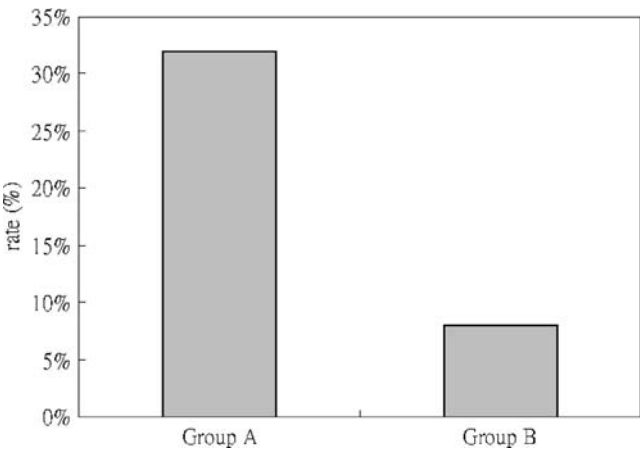

Figure 2 Rate of patients treated with antibiotics. The rate of antibiotics used in groups A and B were 40 and 8%, respectively ($p<0.05$).

meet higher infection rates than the others' data, even in group A. According to this finding, we thought that the routine use of an antiseptic mouthwash before PEG might have some effect on preventing patients from infection and would not have the possible disadvantage of promoting bacterial resistance. However, we should point out that this procedure must be carried out carefully because of swallowing dysfunction and the attendant risk of aspiration in these patients. Regardless, we also support routine antibiotic prophylaxis before PEG for high risk patients, which is in broad agreement with current recommendations.[31]

As we know, the half-life of albumin is about 21 days; therefore, we decided the optimal discharging period was 14 days. In our study, we found that the albumin levels were similar in both groups. It showed that the discharging period did not influence the nutrition status. However , it is needed to survey the optimal period out of hospital before PEG in further study.

For the above reasons and for moral and ethical considerations,[32,33] we suggest that a 14-day grace period after discharge, before PEG insertion, may decrease peristomal infection rate and the need of antibiotics. It also relatively shortens the length of hospital stay after PEG.

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