



Comparison of open gastrostomy tube to percutaneous endoscopic gastrostomy tube in lung transplant patients



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HIGHLIGHTS

- In lung transplant patients, open gastrostomy tube may result in less mortality than a percutaneous gastrostomy tube.
- In-hospital complications are less when lung transplant recipients receive open gastrostomy as compared to PEG.
- PEG in lung transplant recipients does not result in decreased length of stay when compared to open gastrostomy.

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ABSTRACT

Introduction: Lung transplant patients require a high degree of immunosuppression, which can impair wound healing when surgical procedures are required. We hypothesized that because of impaired healing, lung transplant patients requiring gastrostomy tubes would have better outcomes with open gastrostomy tube (OGT) as compared to percutaneous endoscopic gastrostomy tube (PEG).

Methods: The National Inpatient Sample (NIS) Database (2005–2010) was queried for all lung transplant recipients requiring OGT or PEG.

Results: There were 215 patients requiring gastrostomy tube, with 44 OGT and 171 PEG. The two groups were not different with respect to age (52.0 vs. 56.9 years, $p = 0.40$) and Charlson Comorbidity Index (3.3 vs. 3.5, $p = 0.75$). Incidence of acute renal failure was higher in the PEG group (35.2 vs. 11.8%, $p = 0.003$). Post-operative pneumonia, myocardial infarction, surgical site infection, DVT/PE, and urinary tract infection were not different. Post-operative mortality was higher in the PEG group (11.2 vs. 0.0%, $p = 0.02$). Using multiple variable analysis, PEG tube was independently associated with mortality (HR: 1.94, 95%CI: 1.45–2.58). Variables associated with survival included age, female gender, white race, and larger hospital bed capacity.

Discussion: OGT may be the preferred method of gastric access for lung transplant recipients.

Conclusions: In lung transplant recipients, OGT results in decreased morbidity and mortality when compared to PEG.

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1. Introduction

Lung transplantation remains an effective treatment option for

select patients with end-stage lung disease [1–5]. Some lung transplant patients may go on to require enteral access due to being physically incapable of eating or otherwise not able to meet their nutritional requirements [6]. Percutaneous gastrostomy tube (PEG) has become the method of choice for long term enteral access, given its cost effectiveness and lower complication rate compared to open surgical gastrostomy (OGT) [7,8]. However, lung transplant patients present a unique challenge, as they require high doses of

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immunosuppression to prevent rejection. These same medications have been proven to impair wound healing via various mechanisms [9]. Open gastrostomy tube allows for suturing of the stomach to the anterior abdominal wall, which may decrease the risk of intraperitoneal leak as compared to PEG tube. To our knowledge, there have been no studies comparing outcomes between PEG and OGT in lung transplant patients. The goal of this study is to compare postoperative morbidity and mortality between open surgical gastrostomy and percutaneous endoscopic gastrostomy in lung transplant recipients. We hypothesize that because of impaired wound healing, lung transplant patients undergoing OGT would have better outcomes as compared to PEG.

2. Materials and methods

2.1. Database

After approval from local institutional review board (IRB), the National Inpatient Sample (NIS) Database, developed by the Healthcare Cost and Utilization Project (HCUP), was utilized for this study. This database contains data from approximately 7 million hospital stays each year and is obtained from a stratified sample of 20% of non-federal United States hospitals. The NIS is the largest publicly available, all payer, inpatient health care database in the United States [10]. A self-weighting design reduces the margin of error for estimates and delivers population based estimates. All of our statistical analysis was based on this weighting design as established in previous studies [11]. The NIS is a publically available deidentified database and was therefore granted exempt status from our IRB committee.

2.2. Study population

Adult lung transplant patients who underwent OGT or PEG tube placement between 2005 and 2010 were initially identified by the International Classification of Disease, Ninth Revision (ICD-9) diagnosis and Current Procedural Terminology (CPT) procedure code. Patients were initially selected based on diagnosis code for lung transplant (V42.6) and then separated into groups based on the procedure code for open gastrostomy tube (43.19) and percutaneous gastrostomy tube (43.11).

2.3. Data and statistical analysis

The primary outcome was inpatient mortality after gastrostomy tube placement. Secondary outcomes included in-hospital complications, length of stay, and cost. Individual postoperative complications were identified by ICD-9 codes as established in previous studies [11]. Continuous and categorical variables were compared with student's t-test and chi square analysis. All continuous variables are presented as mean \pm standard deviation. Weighted frequencies and weighted multiple variable logistic regression analysis using clinically relevant variables were used to examine post-operative complications and mortality. Covariates included in the model were age, female sex, race, hospital bed size, Charlson comorbidity index, and PEG tube placement. Odds ratio (OR) with 95% confidence intervals were presented for each covariate. A p-value less than 0.05 was considered statistically significant. Data was analyzed using SAS 9.2 software (SAS Institute, Cary, NC).

3. Theory

We hypothesize that because of impaired wound healing from chronic immunosuppression, lung transplant patients undergoing OGT would have better outcomes as compared to PEG. Because of

impaired wound healing, there is delayed formation of a fibrotic tract after placement of a PEG tube, which increases the risk of intraabdominal tube dislodgement and intraabdominal leak. Placement of an OGT allows for direct pexying of the anterior gastric wall, which minimizes the risk of intraperitoneal leak and results in better outcomes.

4. Results

4.1. Baseline characteristics

A total of 215 lung transplant patients underwent gastric enteral access during the study period. Of these, 171 (79.5%) received a PEG tube and 44 (20.5%) had an OGT. As seen in Table 1, the patients in these two groups were not significantly different with respect to age (52.0 vs. 56.9 years, $p = 0.40$), Charlson Comorbidity Index (3.3 vs. 3.5, $p = 0.75$), and private payer status (37.5 vs. 32.9%, $p = 0.05$). Patients undergoing OGT were more likely to have a history of peripheral vascular disease (4.7 vs. 11.9%, $p = 0.01$). There was no significant difference in history of myocardial infarction (0.0 vs. 0.0%, $p = 0.99$), congestive heart failure (14.6 vs. 11.9%, $p = 0.63$), cerebrovascular disease (0.0 vs. 11.9%, $p = 0.23$), diabetes (33.3 vs. 22.7%, $p = 0.16$), and chronic renal disease (36.8 vs. 22.7%, $p = 0.08$) when comparing the two groups. The PEG cohort was more likely to be male (66.3 vs. 45.3%, $p = 0.01$) or Caucasian (94.3 vs. 88.1%, $p < 0.001$) and less likely to be Hispanic (0.0 vs. 5.3%, $p < 0.001$).

4.2. Post-operative outcomes

As seen in Table 2, the PEG cohort had higher incidence of acute renal failure when compared to the OGT group (35.2% vs. 11.8%, $p = 0.003$). Post-operative pneumonia, myocardial infarction, surgical site infection, deep vein thrombosis (DVT), and pulmonary embolus (PE) were not different when comparing the two groups. As seen in Fig. 1, length of stay (33.0 vs. 27.1 days, $p = 0.63$) and total hospital charges (\$203,023 vs. 294,679, $p = 0.45$) were also similar.

4.3. Survival

Inpatient mortality was significantly higher in the PEG group compared to the OGT cohort (11.2% vs. 0%, $p = 0.02$). As shown in Table 3, using multiple variable analysis, placement of PEG tube (OR: 1.94, 95%CI: 1.45–2.58, $p < 0.001$) and increasing Charlson Comorbidity Index (OR: 1.42, 95%CI: 1.34–1.51, $p < 0.001$) were significantly associated with mortality. Variables associated with survival included female sex (OR: 0.76, 95%CI: 0.65–0.88, $p < 0.001$), white race (OR: 0.75, 95%CI: 0.64–0.87, $p < 0.001$), and

Table 1
Baseline characteristics of patients undergoing gastrostomy tube placement.

	PEG (n = 171)	OGT (n = 44)	p value
Age	56.9 \pm 29.8	52.0 \pm 46.5	0.40
Charlson Comorbidity Index	3.50 \pm 4.19	3.27 \pm 4.24	0.75
History of myocardial infarction	0 (0.0)	0 (0.0)	0.99
History of congestive heart failure	25 (14.6)	5 (11.9)	0.63
History of peripheral vascular disease	4 (4.7)	5 (11.9)	0.01
History of cerebrovascular disease	0 (0.0)	5 (11.9)	0.23
History of diabetes	57 (33.3)	10 (22.7)	0.16
History of chronic renal disease	63 (36.8)	10 (22.7)	0.08
Male (%)	114 (66.3)	20 (45.3)	<0.01
Caucasian (%)	162 (94.3)	39 (88.1)	<0.001
Hispanic (%)	0 (0.0)	5 (11.9)	<0.001
Other Race (%)	10 (5.7)	0 (0)	<0.001
Private insurance (%)	64 (37.5)	14 (32.9)	0.055
Medicare (%)	78 (45.3)	15 (33.7)	0.055
Medicaid (%)	30 (17.2)	15 (33.4)	0.055

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