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Original Research

PULMONARY PROCEDURES

Safety and Feasibility of Interventional Pulmonologists Performing Bedside Percutaneous Endoscopic Gastrostomy Tube Placement

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Background: **Prior to the 1980s, permanent feeding tube placement was limited to an open surgical procedure until Gauderer and colleagues described the safe placement of percutaneous endoscopic gastrostomy (PEG) tubes. This procedure has since expanded beyond the realm of surgeons to include gastroenterologists, thoracic surgeons, and interventional radiologists. In some academic centers, interventional pulmonologists (IPs) also perform this procedure. We describe the safety and feasibility of PEG tube placement by IPs in a critically ill population.**

Methods: **Prospectively collected data of patients in a medical ICU undergoing PEG tube placement from 2003 to 2007 at a tertiary-care center were reviewed. Inclusion criteria included all PEG tube insertions performed or attempted by the IP team. Data were collected on mortality, PEG tube removal rate, total number of days with PEG tube, and complication rates. Follow-up included hospital length of stay and phone contact after discharge. Procedural and long-term PEG-related complications were recorded.**

Results: **Seventy-two patients were studied. PEG tube insertion was completed successfully in 70 (97.2%), with follow-up data in 69 of these 70. Thirty-day mortality was 11.7%. No deaths or immediate complications were attributed to PEG tube placement. PEG tube removal occurred in 27 patients, with a median time to removal of 76 days.**

Conclusions: **Bedside PEG tube placement can be performed safely and effectively by trained IPs. Because percutaneous tracheostomy is currently performed by IPs, the ability to place both PEG and tracheostomy tubes at the same time has the potential for decreased costs, anesthesia exposure, procedural times, ventilator times, and ICU days.** ***CHEST 2013; 144(2):436–440***

Abbreviations: ASGE = American Society for Gastrointestinal Endoscopy; IP = interventional pulmonologist; PDT = percutaneous dilatational tracheostomy; PEG = percutaneous endoscopic gastrostomy

Gastrostomy tube placement is one of the oldest modern abdominal surgeries, having been performed for more than a century.[1] Early reports of this surgical technique indicated that it was universally fatal, and it was not until 1875 that Jones reported the first successful gastrostomy procedure.[2] Prior to 1980, the placement of feeding tubes was limited to surgeons inserting them through an open laparotomy procedure. In 1980, Gauderer et al[3] published a small series in which they described the successful and safe placement of percutaneous feeding tubes in children through endoscopic guidance. Since this initial description, placement of the percutaneous endoscopic gastrostomy (PEG) tube has become the preferred procedure and route for long-term delivery of enteral nutrition in critically ill patients.

Gastroenterologists and surgeons have traditionally placed PEG tubes; however, other specialists who have received appropriate training and satisfied credentialing requirements now perform this procedure. In some tertiary-care centers, interventional pulmonologists (IPs) have been performing these procedures. IPs are well suited to perform this procedure because of their extensive study of thoracic anatomy and the advanced endoscopic and procedural

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training they receive during their formal fellowship training.[4,5]

Although IPs are placing PEG tubes, there are no published data, to our knowledge, describing their experience with this procedure. In this article, we describe the safety and feasibility of PEG tube placement by IPs in patients in a medical ICU.

Materials and Methods

We performed a review of prospectively collected data from February 2003 to April 2007 at a single tertiary-care center. All patients were hospitalized in the medical ICU for various medical conditions. The inclusion criteria were all performed or attempted PEG tube insertions by the IP team. There were no exclusion criteria.

Consultation for PEG tube placement came from the primary team caring for each patient, and timing depended on clinical need per the attending intensivist. All requests were reviewed by the IP team for the appropriate indication as well as the appropriateness of performing the procedure at the bedside. In most cases, a simultaneous request for bedside percutaneous tracheostomy was included; however, either one of these requests did not influence the other (ie, ability to perform bedside tracheostomy did not influence the ability to perform bedside PEG tube placement and vice versa). Informed consent was obtained from all patients for tracheostomy and PEG tube placement.

Administration of anesthesia (including IV anesthesia and muscle relaxation) was performed by an attending anesthesiologist in every case. If the procedure was scheduled as a combined tracheostomy and PEG, the PEG portion of the procedure was performed after the tracheostomy, and patients were continued on the same anesthetic plan. All patients were monitored throughout the procedure. All procedures were performed in the patient's room within the medical ICU.

All patients received preoperative prophylactic antibiotic therapy per current guidelines.[6,7] In those patients already receiving antibiotic therapy with an acceptable spectrum of coverage, no additional therapy was used. All PEG procedures were performed with the pull-through technique described by Gauderer et al.[3] During the study period, two different types of commercial PEG kits (Ponsky Pull PEG Kit; Bard Access Systems, Inc and the Kendall Entristar Safety P.E.G. Kit; Covidien) were used per availability and physician request. Enteral feeding and medication administration was allowed 4 h after the procedure to ensure that there were no residual effects from anesthesia and paralysis, unless there was another clinical indication for restricted enteral status.[8,9]

Follow-up of each patient included data from their hospital stay as well as phone calls to the patient or last known caregiver after discharge. Prospective data were collected on mortality, PEG tube removal rate, total number of days with PEG tube (PEG tube days), and complication rate (procedural and long term). Procedural complications were defined as bleeding (requiring the need for suturing, packing, transfusion, or surgical intervention), inability to complete the procedure once an abdominal incision was made, unintentional abdominal organ puncture, or death (within 24 h of the procedure). Long-term PEG-related complications, such as cellulitis, peritonitis, and PEG tube malfunction, were recorded.

The Institutional Review Board at the Beth Israel Deaconess Medical Center approved this study (BIDMC IRB # 2007P-000207) for data collection. For proper credentialing and to independently perform the PEG tube procedure, the institution required supervision of the first 20 procedures by surgeons and gastroenterologists who were credentialed in performing PEG tube insertion. Given that the IPs in this study practiced in a high-volume center with many years of complex endoscopic experience, there was multidisciplinary agreement that IPs could safely learn and perform esophagoscopies. After adequate volume and competency was achieved, the IP team performed all PEG tube insertions independently.

Statistical analysis was performed with STATA version 12.1 (StataCorp) and Microsoft Excel version 14.2 (Microsoft Corp) software. Simple descriptive statistics, including mean, median, range, and percentage, were used to describe the data, including complication rates and patient characteristics. Mortality rates were calculated by the Kaplan-Meier method.

Results

Seventy-two patients (40 women) were included in this study (Table 1). The median age was 70 years (range, 21-96 years). Bedside PEG tube insertion was successfully completed in 70 of the 72 patients (97.2%). All patients were hospitalized in the medical ICU for respiratory failure and an expected prolonged recovery by the primary intensivist team. Underlying medical conditions at the time of evaluation were ARDS (7%), COPD (14%), neurologic dysfunction (17%), congestive heart failure (19%), HIV (7%), malignancy (10%), and infection (24%).

Follow-up data were available in 69 of 70 patients, including phone calls after discharge (Table 2). The

Table 1—*Patient Demographics*

Variable	Result
Age, y	70 (21-96)
Male sex	32 (44.4)
Female sex	40 (55.6)
Combined tracheostomy and PEG tube placement	41
PEG tube placement only	31

Data are median (range), No. (%), or No. PEG = percutaneous endoscopic gastrostomy.

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Table 2—*Long-term PEG Tube Data*

Variable	Result
PEG tube complications, %	1.4
Major complications (bleeding, organ puncture, death, peritonitis)	0
Minor complications (cellulitis, tube malfunction)	1
PEG tube days	90 (4-1,573)
Follow-up time, d	91 (4-1,594)
Procedure duration, min	15.8 ± 4.3
Mortality	
30 d, %	11.4
365 d, %	47.1
Mean survival, d	110

Data are presented as median (range) or mean ± SD, unless otherwise indicated. See Table 1 legend for expansion of abbreviation.

median follow-up time was 91 days (range, 4-1,594 days). The median PEG tube days was 90 (range, 4-1,573 days). Thirty-four patients died during follow-up. Thirty-day mortality for the entire cohort was 11.94% (eight patients). There were no immediate complications or deaths attributed to PEG tube placement. The 1-year mortality rate was 75.7% (33 deaths). The median survival time from PEG tube insertion was 164 days (Fig 1).

PEG tube removal occurred in 27 patients, with a median time to removal of 76 days (range, 24-611 days). In the small subset of patients (n = 7) remaining alive with a PEG tube in place, the median days of follow-up without complication was 255 (range, 44-1,573 days).

Procedural time for PEG tube insertion was not recorded during the initial credentialing process but was recorded after the initial 20 cases were performed. The average procedural time for PEG tube insertion was 15.8 min (range, 8-25 min).

No procedural complications were associated with PEG tube placement. Mild cellulitis around the PEG tube insertion site developed in one patient (1.4%) for whom there was no change in medical management aside from more frequent dressing changes. No other complications were identified from hospital records or from follow-up. No PEG tubes were removed as a result of infection or malfunction.

PEG tube insertion was not completed in two patients (2.8%). Neither case occurred during the initial IP credentialing period. In the first patient, adequate gastric-cutaneous transillumination could not be visualized; therefore, the procedure was aborted. The thoracic surgery team later performed PEG tube placement at the bedside. PEG tube insertion was not completed in a second patient because of technical difficulty with advancing the gastroscope through the esophagus. This case was later successfully performed by the gastroenterology team at the bedside. No specific underlying pathology was identified to explain the inability of the IPs to perform the procedure in these two cases.

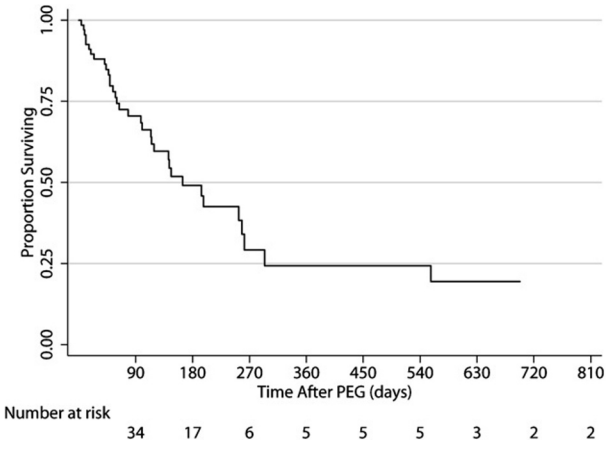

FIGURE 1. Kaplan-Meier curve for median survival time from PEG tube insertion. PEG = percutaneous endoscopic gastrostomy.

DISCUSSION

We have demonstrated that bedside PEG tube placement in critically ill patients can be performed both safely and effectively by trained IP; no procedural complications occurred during PEG tube placement in this cohort. IPs have demonstrated an excellent safety and efficiency profile in the performance of percutaneous dilatational tracheostomy (PDT) in critically ill patients.[10] The ability of IP teams to perform bedside PDT and PEG tube placement concurrently can potentially decrease costs, anesthesia exposure, procedural times, ventilator times, and ICU days.

There were no major complications recorded in the present cohort. One minor complication occurred in a patient in whom superficial cellulitis developed around the PEG tube insertion site. The cellulitis did not require active intervention aside from more frequent dressing changes because the patient was already receiving antibiotics for an unrelated clinical infection. The overall procedure complication rates were favorable compared with previous studies.[11,12]

A high mortality rate in patients in a medical ICU receiving PEG tubes is not unexpected given the underlying critical illnesses of this cohort. The 30-day mortality rate of 11.94% was excellent compared with 30-day mortality rates of 25% reported in the GI literature[13]; the present rate relates to selecting patients who were not clinically worsening and who were anticipated to recover. The 1-year mortality rate of 76% illustrates the underlying substrate of critically ill patients who receive PEG tubes, with prior studies also showing poor long-term survival.[13,14]

Forty-one of the 70 PEG tubes (58%) placed in this study were performed immediately after PDT placement. The average procedural time for PEG tube insertion was < 16 min (range, 8-25 min). When performed at the same time as PDT, the additional anesthesia requirements to place a PEG tube were minimal.

The goal of PEG tube placement is to provide enteral nutrition with the hope of not only prolonging the quantity of life but also the quality of life; therefore, it is important to select patients who are most likely to benefit from the procedure.[15] Ideally, critically ill patients will recover their ability to swallow and have their PEG tubes removed. In the present study, the PEG tube removal rate was 38% (27 of 70) in all patients and 73% (27 of 37) in the patients who did not die during the study follow-up, suggesting appropriate patient selection with the goal of removal.

For two patients within the cohort, the IP did not complete initial PEG tube placement because of technical issues. There were no complications related to these unsuccessful procedures or to the follow-up procedures performed by the surgery and gastroenterology teams. The data demonstrate a similar failure rate for PEG tube placement as documented by senior surgical residents under direct faculty supervision (3.5%).[12] We believe that the ability to work in a multidisciplinary fashion allows for the safe and effective performance of these procedures in a critically ill population. We also demonstrated this type of safe and effective multidisciplinary care of critically ill patients in the performance of bedside PDT.[10]

One limitation of the study is that we did not collect data on the number of patients who refused bedside PEG tube placement by the IP team. We did not prospectively record all consultations for PEG placement; therefore, the potential for referral to other specialties exists. Anecdotally, this would represent a minority of patients because we were unaware of any PEG tube placements being performed within the medical ICU by services other than the IP team. We believe it is important that all patients considered for bedside PEG tube placement undergo a standardized evaluation to determine whether they are appropriate candidates for the procedure. Our general practice has excluded the placement of PEG tubes by our team in the following situations: morbid obesity (BMI > 50 kg/m^2), significant ascites, concern for active peritonitis, prior gastric surgery (prior PEG tube placement excluded), uncorrectable coagulopathy, and known GI pathology (ie, esophageal varices, gastric outlet obstruction). Patients with these conditions are referred to our surgical or GI colleagues for feeding tube placement. Likewise, the procedure would be aborted and referred to our surgical and GI colleagues if adequate transillumination could not be visualized.[16]

Appropriate training and supervision in both the evaluation of patients for PEG tube placement and the performance of the actual procedure are paramount in maintaining the safety and efficacy associated with the benefits of the procedure. According to the current American Society for Gastrointestinal Endoscopy (ASGE) guidelines, competence is suggested by the performance of 15 PEG procedures and 130 esophagogastroduodenoscopy procedures. The ASGE guidelines also recognize that trainees' skill levels will vary, and the acquisition of cognitive and technical skills needed to perform a specific procedure will vary among trainees. These competency numbers are based on a novice learner, taking into account the acquisition of new skills needed, such as hand-eye coordination, manually handling the gastroscope dials, and intubating key structures.[17]

Currently, no data exist to provide evidence-based recommendations with regard to the number of PEG tube insertions needed for IPs to be considered competent. Although the ASGE guidelines recommend 15 PEG tube placements, our institution (Beth Israel Deaconess Medical Center) requested the performance of 20 proctored PEG tube insertion procedures. The Accreditation Council for Graduate Medical Education has documented that the mean number of PEG tube insertion procedures completed by general surgical residents at the end of their training is 11.[18] Although no definitive numbers are available for IP performance of PEG tube insertion, many advanced endoscopy skills have been mastered during IP fellowship because of the multitude of procedures and the advanced training IP professionals receive.[4,5] In fact, numerous studies have demonstrated successful IP use of endobronchial and endoscopic ultrasound-guided procedures in the investigation of hilar and mediastinal adenopathy.[19-22] The present study, however, was not intended to be a reference for establishing the number of PEG tubes procedures required to define competence.

In conclusion, bedside PEG tube placement in critically ill patients can be performed both safely and effectively by trained IPs within an appropriate multidisciplinary team. This team must be equipped to handle the multiple complexities that are inherent in caring for critically ill patients.

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Dr Yarmus: contributed to the data review and analysis and writing of the manuscript.

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