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# Comparing outcomes between “pull” versus “push” percutaneous endoscopic gastrostomy in acute care surgery: under-reported pull percutaneous endoscopic gastrostomy incidence of tube dislodgement

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## ABSTRACT

**Background:** Percutaneous endoscopic gastrostomy (PEG) complications are often under-reported in the literature, especially regarding the incidence of tube dislodgement (TD). TD can cause significant morbidity depending on its timing. We compared outcomes between “push” and “pull” PEGs. We hypothesized that push PEGs, because of its T-fasteners and balloon tip, would have a lower incidence of TD and complications compared with pull PEGs. **Methods:** We performed a chart review of our prospectively maintained acute care surgery database for patients who underwent PEG tube placement from July 1, 2009 through June 30, 2013. Data regarding age, gender, body mass index, indications (trauma versus non-trauma), and complications (including TD) were extracted. Procedure-related complications were classified as either major if patients required an operative intervention or minor if they did not. We compared outcomes between pull PEG and push PEG. Multiple regression analysis was performed to identify risk factors associated with major complications. **Results:** During the 4-y study period, 264 patients underwent pull PEGs and 59 underwent push PEGs. Age, gender, body mass index, and indications were similar between the two groups. The overall complications (major and minor) were similar (20% pull versus 22% push,  $P = 0.61$ ). The incidence of TD was also similar (12% pull versus 9% push,  $P = 0.49$ ). However, TD associated with major complications was higher in pull PEGs but was not statistically significant (6% pull versus 2% push,  $P = 0.21$ ). Multiple regression analysis showed that dislodged pull PEG was associated with major complications (odds ratio 29.5; 95% confidence interval, 11.3–76.9;  $P < 0.001$ ).

**Conclusions:** The incidence of pull PEG TD associated with major complications is under-recognized. Specific measures should be undertaken to help prevent pull PEG TD.

**Level of evidence:** IV, therapeutic.

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## Introduction

Percutaneous endoscopic gastrostomy (PEG) tube placement is a commonly performed procedure in trauma patients.<sup>1,2</sup> Since the establishment of the acute care surgery (ACS) model,<sup>3,4</sup> the role of ACS in PEG tube placement in many institutions has expanded. The incidence of PEG tube complications has been under-reported in the literature and varies widely among the patient populations studied and the definition of complications utilized.<sup>1,2,5-11</sup> Major and minor complications may range from 3% to 26%. Our institution, under an ACS model, has previously reported an overall 25% complication rate with 10% major and 14% minor complications associated with pull PEG.<sup>12</sup>

There are two different types of PEG: “pull” and “push”. The pull PEG technique is most common and has been in use since the original publication by Gauderer *et al.* in 1980.<sup>13</sup> Since its original description, the pull PEG technique has undergone modification for ease of placement and removal.<sup>14</sup> The most commonly available pull PEG now is the flexible, button-typed PEG (EnTake; ConMed, Utica, New York). Because of its flexible button and ease of removal, it can also easily dislodge with significant tension and traction, particularly in patients with agitation and/or traumatic brain injury.

On the contrary, the push PEG was introduced by Russell *et al.* just 4 y later in 1984.<sup>15</sup> Since then, it too has undergone significant modifications in design and placement techniques.<sup>16-22</sup> Today, the three main features which distinguish a push PEG from pull PEG are (1) direct tube placement through the abdominal wall using a Seldinger guidewire method. This mechanism was proposed to decrease oral contamination and incidence of peristomal infection as well as seeding of malignancy at the stomal site<sup>20-22</sup>; (2) the gastrostomy using the T-fastener method; and (3) the balloon-inflated tip.

The incidence of PEG tube dislodgement (TD) is unknown in the literature as it has only been sporadically mentioned in prior reports.<sup>5-11</sup> There have been few case reports of TD associated with serious consequences.<sup>23,24</sup> In the only contemporary series published, Rosengart *et al.* reported the incidence of early TD (defined as <7 d from the time of tube placement) as 4% with a lifetime TD risk of 13%.<sup>25</sup> Two of their TDs were associated with major life-threatening complications. At our own institution, we have experienced several early TDs resulting in significant and potentially life-threatening complications that we believe are under-reported in the literature.

The aim of our study was to compare the outcomes between push PEG and pull PEG, particularly, the incidence of TD. We hypothesized the push PEG’s design, utilizing both the T-fasteners and the balloon tip, would result in a lower incidence of TD than push PEG, and this would lead to lower TD-associated PEG complications.

## Methods

This study was approved by the Institutional Review Board of the University of Arizona. We queried the prospectively

maintained ACS database at our tertiary level I trauma center, part of a major academic hospital, for PEG tube placement performed by the ACS service. We reviewed patient charts and confirmed pertinent data with our billing records. Our 48-month study period was from July 1, 2009 through June 30, 2013. We excluded patients from our analysis who underwent PEG tube placement by different specialties (interventional radiology, gastroenterology) because of potentially different technical aspects and follow-up. Our ACS service comprised nine acute care surgeons who provide in-house, 24/7 coverage for all trauma activations, all intensive care unit (ICU) patients, and all in-house general surgery consultations.

From the patient charts, we obtained demographic data, body mass index (BMI), hospital admission dates, length of hospital stay, comorbidities, diagnoses, and procedures. From the operative reports, we obtained data on the indication (trauma versus nontrauma), technique used, findings, bumper height in centimeters (cm) for pull PEG, and operative details. We reviewed all subsequent clinic visit notes, consult notes, hospital discharge notes, operative notes, and any emergency physician notes regarding patients’ hospital visits after the original PEG tube placement for any evidence of PEG tube-related complications or mortality. Because of our prospectively maintained ACS database, all readmissions with PEG-related complications were entered into our database.

## Procedural techniques

### Pull PEG

All PEG tubes were performed either at the bedside in the surgical ICU or in the operating room. One dose of perioperative first-generation cephalosporin or an equivalent antibiotic was given before the PEG procedure. The pull PEG

**Table 1 – Baseline characteristics and complication rates between the two PEG groups.**

Characteristic	“Pull” PEG, n = 264	“Push” PEG, n = 59	P
Age, y, mean ± SD	56 ± 21	58 ± 21	0.45
Gender, male, %	67%	73%	0.36
BMI, kg/m <sup>2</sup> , mean ± SD	26 ± 9	29 ± 10	0.10
Indications, trauma (versus nontrauma), %	48%	39%	0.19
Complications, overall, n (%)	50 (19)	16 (27)	0.16
Major, n (%)	23 (9)	4 (7)	0.63
Minor, n (%)	27 (10)	12 (20)	0.03
Tube dislodgement, overall, n (%)	31 (12)	6 (10)	0.73
TD associated with major compl., n (%)	16 (6)	1 (2)	0.21
Mortality, n (%)	19 (7)	3 (5)	0.56

BMI = body mass index; compl. = complications; kg = kilogram; m<sup>2</sup> = meter square; PEG = percutaneous endoscopic gastrostomy; SD = standard deviation.

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