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Short and Long term outcomes from Percutaneous Endoscopic Gastrostomy with Jejunal Extension

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Abstract

Background—There is a paucity of data regarding the safety and efficacy of PEG-J. We evaluated adverse events related to percutaneous endoscopic gastrostomy with jejunal extension (PEG-J) and determined the clinical impact of PEG-J in those with chronic pancreatitis (CP).

Methods—This cohort study included all patients who underwent PEG-J placement in a tertiary-care academic medical center between 2010–2012. Main outcome measurements were 1) short- and long-term complications related to PEG-J; 2) changes in weight and hospitalizations during the 12-month period before and after PEG-J in the CP subgroup.

Results—Of 102 patients undergoing PEG-J placement, the overall technical success rate was 97%. During a median follow-up period of 22 months (1–46 months, n=90), at least one tube malfunction occurred in 52/90 (58%; 177 episodes) after a median of 53 days (3–350 days), requiring a median of 2 tube replacements. Short-term (<30 days) tube malfunction occurred in 28/90 (31%) and delayed in 24/90 (27%); these included dislodgement (29%), clogging (26%) and kinking (14%).

In the CP subgroup (n=58), mean body weight (kg) (70 vs. 71, p=0.06) and body mass index (kg/m², 26 vs. 27, p=0.05) increased post-PEG-J. Mean number of hospitalizations (5 vs. 2, p<0.0001) and inpatient days per 12 months (22 vs. 12, p=0.005) decreased.

Conclusions—While we observed no major complications related to PEG-J, half of patients had at least one episode of tube malfunction. In the CP subgroup, jejunal feeding via PEG-J significantly reduced the number of hospitalizations and inpatients days, while improving nutritional parameters.

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Keywords

percutaneous endoscopic gastrostomy with jejunal extension; chronic pancreatitis

Introduction

According to the American Society for Gastrointestinal Endoscopy (ASGE) core curriculum, percutaneous endoscopic gastrostomy with jejunal extension (PEG-J) is an alternative technique for patients who are unable to tolerate gastric feeding or at-risk for aspiration of gastric feeding.(1) Various techniques for PEG-J placement and related adverse events have been reported.(2–9) However, these studies are limited by small sample size, variable deployment techniques, and short-term follow-up. Although direct percutaneous endoscopic jejunostomy (D-PEJ) is believed to provide more stable jejunal access compared with PEG-J, establishing a D-PEJ tract is technically challenging and has a lower success rate (65%–73%) compared to PEG-J (90%–92%).(7, 8) Moreover, patients having D-PEJ may require a separate PEG for gastric decompression whereas a PEG-J tube provides feeding jejunal and gastric decompression ports in a single tract.(7)

For patients with refractory symptoms due to chronic pancreatitis (CP), post-pancreatic feeding is often recommended.(10–16) While this may be performed via nasojejunal (NJ) feeding tube, transnasal access is uncomfortable for patients, and durability is highly variable. Since D-PEJ placement is more technically difficult, jejunal feeding is frequently performed via PEG-J for prolonged jejunal access. In addition to limited data on the durability of PEG-J tubes, there is a paucity of data regarding clinical outcomes of PEG-J for enteral feeding in patients with CP.

Our primary objectives are two-fold: first, to evaluate short- and long-term complications related to PEG-J placement, particularly rates of tube malfunction; second, among individuals with CP, to determine the clinical impact of jejunal feeding via PEG-J on weight and hospitalizations.

Materials and methods

Study Population

Using our endoscopy database (ProVation®MD, Wolters Kluwer Health, Philadelphia, PA), we identified all patients who underwent PEG-J placement at Indiana University Health University Hospital between July, 2010 and June, 2012. Patients who underwent PEG-J placement prior to July, 2010 were excluded. We abstracted medical records for relevant demographic and clinical data, including indications for tube placement, previous gastrointestinal (GI) surgery, short- (< 30 days) and long-term complications related to PEG-J placement, tube removal and the last date of follow-up. In those with at least one tube malfunction, we recorded the number of tube replacements and time to tube malfunction. Time to tube malfunction was defined as the number of days between initial tube placement and the first tube replacement or adjustment. We defined duration of follow-up as the number of months between initial tube placement and the last date of follow-up or date of

death. Duration of tube placement was defined as the number of months between initial tube placement and the date of tube removal. The study protocol was approved by our local Institutional Review Board.

PEG-J technique

All PEG-J placements were performed by one of four experienced endoscopists (G.L., J.W., L.M., or G.C.). The indications for PEG-J placement included intolerance to eating, severe acute or chronic pancreatitis, or recurrent aspiration. The jejunal conversion was performed following placement of a PEG tube (24 Fr EndoVive Safety; Boston Scientific, Natick, Mass) by using the pull method. Initially, a mushroom tip was used for the gastrostomy tube. Using transillumination, we identified a safe location for PEG placement. If feasible, an ideal location was selected in the distal gastric body to minimize coiling of the jejunal extension in the fundus. The final position of the gastrostomy tube was confirmed by relook endoscopy (Figure 1A), and location of the external bumper noted at the skin. The final tension and compression of the abdominal wall by the PEG tube and external bumper were checked so as to avoid buried bumper or leakage of gastric contents around the PEG tract. A 0.038" guidewire (Boston Scientific Corp., Natick, MA) was then placed through the gastric tube and grasped endoscopically using a snare or forceps (Figure 1B). The guidewire was then advanced to the jejunum (15–20 cm distal to the ligament of Treitz) under endoscopic and fluoroscopic guidance (Figure 1C). The guidewire was released from the forceps or snare while the endoscope was slowly withdrawn. A 12Fr, 60 or 90cm jejunal tube (Cook, Bard, or MIC) was then threaded over the guidewire into the jejunum under fluoroscopic guidance (Figure 1D). Appropriate tip position and patency of the tube were confirmed by fluoroscopy with contrast injection (Figure 1E). In an effort to prevent recoiling of the J extension, we tried to minimize jejunal tube redundancy in the stomach (Figure 1F). During the latter portion of the study period, approximately half of patients received a weighted-tip jejunal tube (Bard), based on endoscopist preference, while the remainder had an unweighted variant. If the PEG-J required replacement, a balloon tip gastrostomy tube (Balloon replacement gastrostomy tube, Cook; MIC safety PEG feeding tube) was used. Endoscopy was not routinely required for PEG-J replacement. In these cases, the jejunostomy tube was replaced over a guidewire under fluoroscopic guidance. We did not change the diameter of gastrostomy and jejunostomy tubes when these required replacement.

Patients in CP subgroup

Among patients undergoing PEG-J placement for CP, we collected additional data, including body weight (BW), body mass index (BMI), causes and severity of CP using standard criteria,(17) smoking, diabetes, laboratories (serum albumin, total protein and total calcium levels), chronic opiate utilization and hospitalizations (numbers and total inpatient days). The procedure occurred during a hospital stay specifically to place the tube or for problems related to chronic pancreatitis wherein it was decided to place the PEG-J. We reassessed nutritional parameters (BW, BMI and blood chemistry tests) and hospitalizations at the time of tube removal or last follow-up.

In those patients with at least 12 months follow-up after PEG-J placement, we measured the frequency of hospitalizations before and after, defined as the number of hospitalizations due to pain flares or tube-related issues. We also calculated total inpatient hospital days during the 12-month period before and after PEG-J placement, excluding the first hospital stay required for PEG-J placement and initiation of enteral feeding.

Following successful PEG-J placement, all patients were hospitalized and able to start tube feeding within 12–24 hours. Initially, a 1.5 calories/mL standard polymeric formula was administered continuously for 24 hours. The nutritional regimen was switched to an elemental formula when patients could not tolerate feeding using a standard formula. The volume and rate of tube feeding were adjusted based on each patient's tolerance, then gradually increased to the goal rate, which was calculated by a licensed nutritionist. Patients were allowed to have clear liquid diets and medications by mouth as tolerated. Patients were told to crush and dissolve medications per the jejunal route. All patients were recommended to use the gastrostomy port periodically for gastric decompression. Under the guidance of a nurse practitioner, patients learned to adjust the rate of feeding and to care for the PEG-J before discharge. Caregivers and family members were educated similarly.

Follow-up

Following PEG-J placement, the treating physician periodically followed all patients in the ambulatory setting. Patients contacted a health care provider via phone or email for tube-related issues or other related concerns, such as a CP-associated pain flare. Patients were advised to return to our facility in cases that could not be managed at home. Typically, patients required hospitalization for unmanageable pain or dehydration in the setting of a malfunctioning PEG-J.

The treating physician removed the PEG-J following restoration of nutrition parameters, improvement and stabilization of symptoms related to the underlying disease, tube inefficacy, or per patient request. If these criteria were not met, the patient may have proceeded to specific surgical therapy (subtotal or total pancreatectomy) or continued PEG-J feeding at the time we censored data for analysis.

Statistical Analysis

We used descriptive statistics to define the prevalence of short- and long-term complications related to PEG-J placement, particularly tube malfunction. We defined tube malfunction as any issue that required tube replacement. In the CP subgroup, we compared clinical outcomes (changes in BW, BMI, serum albumin, total protein, total calcium, numbers of hospitalizations and inpatient days) during the 12-month period before and after PEG-J. Continuous variables are presented as mean with standard deviation or median with range as appropriate; comparative statistics included Student's paired t-test to analyze parameters before and after PEG-J placement. Statistical analyses were performed by using Stata v. 11.2 (StataCorp LP, College Station, TX).

Results

Patient characteristics

A total of 102 patients underwent PEG-J placement for enteral feeding (Figure 2 and Table 1) during the study period. The median age was 47 years (range 23–87) and 71 (70%) were female. The most common indication for PEG-J placement was CP (n=53, 52%). In all patients, 16 (16%) had undergone previous GI surgery, mostly pancreaticoduodenectomy (Whipple procedure). Overall, the technical success rate of PEG-J placement was 97%, including 100% of those with normal anatomy but only 81% of those with post-surgical anatomy. Three patients who had previously undergone a Whipple procedure failed PEG-J placement due to intragastric coiling of the jejunal tube. These cases were managed with total parenteral nutrition (TPN, n=2) and surgical J tube (n=1).

Follow-up after PEG-J placement

Following initial successful PEG-J placement (n=99), 9 patients were lost to follow up for unknown reasons. A total of 90 patients (Figure 1) were followed for a median of 22 months (range 1–46) (Table 2). Of those, 51 patients (57%) underwent tube removal during the study period due to clinical improvement (n=27, 53%), tube feeding intolerance (n=10, 20%), surgery due to persistent symptoms (n=11, 22%) or conversion to surgical J tube (n=3, 6%). In all patients with follow-up, the median duration of tube placement was 5 months (range 1–42).

Adverse events related to PEG-J

During the follow-up period, 52/90 (58%) patients had 177 episodes of tube malfunction (Table 2); 27/52 (52%) patients developed more than one episode of long-term issues. Using the Kaplan Meier method, median time to tube malfunction was 65 days (range 3–350) (Figure 3). Among those with at least one tube malfunction, the median number of tube replacements was 2 (range 1–21). Short-term issues occurred in 28/90 (31%; 28 episodes), including jejunal tube clogging (n=7, 4%), kinking (n=10, 6%), and dislodgement (tube migration into the stomach or duodenum) (n=6, 3%), balloon malfunction (n=1, 0.5%), buried bumper (n=2, 1%) and cellulitis (n=2, 1%). Long-term issues occurred in 24/90 (51%; 149 episodes), including jejunal tube clogging (n=40, 22.5%), kinking (n=14, 8%), dislodgement (n=46, 26%), balloon malfunction (n=30, 17%) and cellulitis (n=19, 11%).

Clinical outcomes among CP patients

We evaluated clinical outcomes among 58 patients with CP (n=53) and RAP (n=5) who underwent PEG-J placement for prolonged gut rest and post-pancreatic enteral feeding (Table 3). The most common causes of CP included heavy alcohol use, defined as 8–10 drinks/day for at least 10 years, and idiopathic. Underlying conditions related to RAP included heavy alcohol use (n=1), pancreas divisum (n=1) and SOD (n=3). Based on the Cambridge classification,⁽¹⁷⁾ the majority of patients (n=33, 57%) were found to have mild, moderate or severe CP. The majority (62%) of patients were smokers but the minority (24%) had diabetes mellitus. During a median follow-up period of 26 months (range 2–46), 37/58 (64%) underwent tube removal due to clinical improvement (n=19, 51%), tube feeding

intolerance (n=8, 22%), surgery due to persistent symptoms (n=8, 22%) or conversion to a surgical J tube (n=2, 5%). The median duration of tube placement was 7 months (range 1–42). Three patients undergoing tube removal due to clinical improvement developed recurrent CP pain flares approximately one year following tube removal, requiring Whipple operation (n=1) and another PEG-J tube with placement of an intrathecal pain pump (n=2). No patients were lost to follow-up in this subgroup.

We compared nutritional parameters, opiate utilization and hospitalizations during the 12-month period before and after PEG-J placement (Table 4) in those with 12 months of antecedent and post-tube placement follow-up. Following PEG-J placement, the mean BW and BMI increased with borderline statistical significance. Serum albumin, total calcium and total protein levels significantly increased. After exclusion of patients undergoing surgery (n=8 for persistent symptoms, n=2 for tube conversion), the mean number of hospitalizations (5 vs. 2; $p<0.0001$) and mean total number of inpatient days (22 vs. 12; $p<0.005$). At the time of data censoring for analysis, of 21 CP patients with jejunal tube in place, 16 and 5 received less than 50% and at least 50% narcotic dose reduction, respectively.

Discussion

Although several approaches to PEG-J placement have been reported, a common method involves placing the jejunal tube or guidewire through the gastric tube and grasping either the jejunal extension tube itself or the guidewire endoscopically with a snare or forceps in the stomach.(5, 7, 8) Using this technique, technical success rate for PEG-J placement has been > 90% in previous studies.(5, 7, 8) The most common cause for unsuccessful PEG-J placement appears to be inability to transilluminate or identify a satisfactory location for PEG insertion.(7) Using a conventional approach similar to previous studies,(5, 7, 8) our data confirm a high technical success rates (99/102, 97%) for PEG-J placement. All 3 patients undergoing unsuccessful PEG-J placement had post-Whipple anatomy, causing intragastric coiling of the guidewire. A different approach to PEG-J placement involves passing an ultrathin or neonatal endoscope through the existing PEG tract or PEG tube into the stomach and deep into the jejunum to place the guide wire for jejunal tube placement.(3, 9) In addition, a pilot study (n=7) of a novel ballooned-tip PEG-J feeding tubes (GI Supply, Camp Hill, Pa) has been reported to eliminate the need for repeat endoscopies for tubes that recoil back into the stomach.(2) Although these data of newly emerging techniques demonstrated a high success rate (99%–100%) for jejunal tube placement, these required specific endoscopes and special feeding tubes that may not be available in most centers. We do not anticipate that unique deployment techniques will impact rates of tube malfunction thereafter.

Similar to previous studies,(7)·(8) our findings demonstrated that approximately half of patients (52/90) have at least one tube malfunction after placement during a median follow-up period of 22 months. The main reasons for tube malfunction in the previous studies were clogging (40%) and dislocation (24%–33%) during variable follow-up.(7, 8) In our analysis, the major issues for PEG-J malfunction were jejunal tube kinking (6%) and dislodgement (26%) in short- and long-term follow-up, respectively. Some of tubes might be used for prolonged period and end up with clogging and other complications. If tube patency and

absence of complications by 3 months were chosen as a composite end point, the tube malfunction rate would have been 35% (25/71) in our series. Tube migration was reported in about 7% of patients in a previous study that used endoscopic clips for preventing displacement of the jejunal tube.(6) Risk factors for tube malfunction require larger cohorts, but may include tube stiffness, diameter and length as well as diligence with home care and frequency of writhing. Our data confirm the need for more durable enteral feeding equipment that will reduce rates of malfunction from clogging or tube dislodgement.

Recently, a case series showed 17 patients undergoing 121 jejunal placements via PEG tube over the period 2006 to 2010 (both complete PEG-J placement (n=19, 16%) and jejunal tube replacement alone (n=102, 84%)).(9) At least one tube malfunction occurred in 15/17 (88%), which was higher than our observation (58%). Compared to this series (5; range 1–20),(9) our data demonstrated a lower median number of tube replacements (2; range 1–21) during long-term follow-up. A possible explanation may be the different baseline characteristics of patients having PEG-J placement. While almost all patients in the other study included those with cerebral palsy or cancer who likely required lifelong jejunal feeding,(9) the majority (82%) of patients in our study were those anticipated to have shorter durations of enteral nutrition.

We also evaluated the impact of jejunal feeding on several clinical parameters in the CP subgroup (n=58). We isolated this component of the analysis to patients with RAP/CP in an effort to define a more homogenous patient population, and because this represents the most common indication for PEG-J placement in our practice. Although previous studies have demonstrated the safety and feasibility in jejunal feeding in patients with CP, data are limited by small sample sizes, unspecified severity of CP, heterogeneity of study design (combining feeding via NJ tube, D-PEJ and/or PEG-J), short-term follow-up and limited comparative analysis on clinical outcome after tube placement.(10–13) Compared to 12 months prior to PEG-J, we showed a significant reduction in the mean number of hospitalizations and mean total number of inpatient days after the initiation of enteral feeding. Among CP patients, pain flares frequently require admission. Based on the literature, CP pain may be aggravated by meals due to pancreatic secretion stimulation.(11, 15, 16) Jejunal feeding allows pancreatic rest and for hydration during periods of intolerance to oral intake. This is a probable reason why the need for hospitalization decreases after PEG-J placement in CP patients. Consistent with a previous study of CP patients undergoing tube feeding via PEG-J (n=53) or D-PEJ (n=4) with the 6-month follow-up period, our findings showed an improvement in mean BW (70 vs. 71; p=0.06) and serum albumin (3 vs. 4; p=0.0002) following PEG-J tube feeding. Furthermore, 51% improved clinically during follow-up, allowing for tube removal; this is a substantial proportion in an otherwise challenging patient population.

Study limitations include its retrospective design, lack of a control group, and limited follow-up after PEG-J removal. Additionally, although we compared the number of hospitalizations before and after PEG placement, we did not have comparable data on ambulatory encounters during the same period.

In conclusion, we confirmed a high technical success rate of PEG-J placement using conventional techniques; however, this decreases in patients with postoperative anatomy. No major adverse events related to PEG-J placement were observed. However, nearly half of patients have at least one episode of tube malfunction, suggesting the need for advances in device design. Among patients with refractory CP, jejunal feeding via PEG-J significantly reduces hospitalizations and improves nutritional parameters. Future prospective, comparative effectiveness studies should evaluate the optimal CP population for PEG-J utilization.

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Abbreviations

ASGE	American Society for Gastrointestinal Endoscopy
PEG-J	percutaneous endoscopic gastrostomy with jejunal extension
D-PEJ	direct percutaneous endoscopic jejunostomy
CP	chronic pancreatitis
NJ	nasojejunal
GI	gastrointestinal
BW	body weight
BMI	body mass index
RAP	recurrent acute pancreatitis

References

1. Enestvedt BK, Jorgensen J, Sedlack RE, Coyle WJ, Obstein KL, Al-Haddad MA, Christie JA, Davila RE, Mullady DK, Kubiliun N, Kwon RS, Law R, Qureshi WA. Endoscopic approaches to enteral feeding and nutrition core curriculum. *Gastrointestinal endoscopy*. 2014; 80(1):34–41. [PubMed: 24773773]
2. Kim KJ, Victor D, Stein E, Valeshabad AK, Saxena P, Singh VK, Lennon AM, Clarke JO, Khashab MA. A novel ballooned-tip percutaneous endoscopic gastrojejunostomy tube: a pilot study. *Gastrointest Endosc*. 2013; 78(1):154–157. [PubMed: 23622977]
3. Adler DG, Gostout CJ, Baron TH. Percutaneous transgastric placement of jejunal feeding tubes with an ultrathin endoscope. *Gastrointest Endosc*. 2002; 55(1):106–110. [PubMed: 11756929]
4. Mathus-Vliegen LM, Koning H. Percutaneous endoscopic gastrostomy and gastrojejunostomy: a critical reappraisal of patient selection, tube function and the feasibility of nutritional support during extended follow-up. *Gastrointest Endosc*. 1999; 50(6):746–754. [PubMed: 10570331]
5. Simon T, Fink AS. Recent experience with percutaneous endoscopic gastrostomy/jejunostomy (PEG/J) for enteral nutrition. *Surg Endosc*. 2000; 14(5):436–438. [PubMed: 10858466]
6. Udorah MO, Fleischman MW, Bala V, Cai Q. Endoscopic clips prevent displacement of intestinal feeding tubes: a long-term follow-up study. *Dig Dis Sci*. 2010; 55(2):371–374. [PubMed: 19242799]

7. Fan AC, Baron TH, Rumalla A, Harewood GC. Comparison of direct percutaneous endoscopic jejunostomy and PEG with jejunal extension. *Gastrointest Endosc.* 2002; 56(6):890–894. [PubMed: 12447304]
8. Zopf Y, Rabe C, Bruckmoser T, Maiss J, Hahn EG, Schwab D. Percutaneous endoscopic jejunostomy and jejunal extension tube through percutaneous endoscopic gastrostomy: a retrospective analysis of success, complications and outcome. *Digestion.* 2009; 79(2):92–97. [PubMed: 19279384]
9. Donnelly MC, McKay R, Barber D, McKinlay AW, Leeds JS. Outcomes after through-the-PEG tube placement of jejunal extensions: a case series from a single center. *Gastrointestinal endoscopy.* 2014; 80(2):349–353. [PubMed: 24785126]
10. Lordan JT, Phillips M, Chun JY, Worthington TR, Menezes NN, Lightwood R, Hussain F, Tibbs C, Karanjia ND. A safe, effective, and cheap method of achieving pancreatic rest in patients with chronic pancreatitis with refractory symptoms and malnutrition. *Pancreas.* 2009; 38(6):689–692. [PubMed: 19436233]
11. Fang JC, DiSario JA. Strategies in managing chronic pancreatitis-placement of direct percutaneous endoscopic jejunostomy feeding tubes. *Nutr Clin Pract.* 2004; 19(1):50–55. [PubMed: 16215096]
12. Stanga Z, Giger U, Marx A, DeLegge MH. Effect of jejunal long-term feeding in chronic pancreatitis. *JPEN J Parenter Enteral Nutr.* 2005; 29(1):12–20. [PubMed: 15715269]
13. Hamvas J, Schwab R, Pap A. Jejunal feeding in chronic pancreatitis with severe necrosis. *JOP.* 2001; 2(3):112–116. [PubMed: 11870333]
14. Bodoky G, Harsanyi L, Pap A, Tihanyi T, Flautner L. Effect of enteral nutrition on exocrine pancreatic function. *Am J Surg.* 1991; 161(1):144–148. [PubMed: 1702939]
15. Makola D, Krenitsky J, Parrish CR. Enteral feeding in acute and chronic pancreatitis. *Gastrointest Endosc Clin N Am.* 2007; 17(4):747–764. [PubMed: 17967379]
16. Meier R, Ockenga J, Pertkiewicz M, Pap A, Milinic N, Macfie J, Loser C, Keim V. ESPEN Guidelines on Enteral Nutrition: *Pancreas.* *Clin Nutr.* 2006; 25(2):275–284. [PubMed: 16678943]
17. Axon AT, Classen M, Cotton PB, Cremer M, Freeny PC, Lees WR. Pancreatography in chronic pancreatitis: international definitions. *Gut.* 1984; 25(10):1107–1112. [PubMed: 6479687]

Figure 1.

PEG-J technique: A. PEG tube in place; B. a guide wire grasped by a forceps; C. the guide wire placed in the jejunum under direct endoscopic and fluoroscopic guidance; D. a jejunal extension tube threaded over the guide wire into the jejunum under fluoroscopic guidance; E. jejunal tube in place confirmed by fluoroscopy with contrast injection; F. PEG tube placed close to the pylorus to prevent jejunal tube coiling.

Figure 2.
Patient cohort: PEG-J placement between July 2010 and June 2012

Figure 3.
Durability of PEG-J tube for enteral feeding

Table 1

Baseline characteristics of patients who underwent PEG-J placement (n = 102)

Patient characteristic	
Median age (range) (years)	47.1 (23–87)
% female sex	71 (69.6)
Indication, No. (%)	
• Chronic pancreatitis	53 (52.0)
• Recurrent acute pancreatitis	5 (4.9)
• Necrotizing pancreatitis	5 (4.9)
• Chronic illness/cancer with malnutrition	12 (11.8)
• Impaired swallowing	6 (5.9)
• Chronic abdominal pain/intractable nausea/vomiting	21 (20.6)
• Previous gastrointestinal surgery, No. (%)	16 (15.7)
• Roux-en-Y gastrojejunostomy	1 (1.0)
• Whipple operation (pylorus-preserving resection)	14 (13.7)
• Duodenoduodenostomy	1 (1.0)
Technical success rate of initial tube placement, n (%)	99 (97.1)
• Normal anatomy (n=86)	86 (100.0)
• Altered anatomy (n=16)	13 (81.2)

Table 2

Outcome and adverse events associated with PEG-J (n=90)

Outcome	
Median follow-up period, months (range)	22 (1.1–46.1)
Definite tube removal, No. (%)	51 (56.7)
• Clinical improvement	27 (52.9)
• Tube feeding intolerance	10 (19.6)
• Surgery due to persistent symptoms	11 (21.6)
• Converted to surgical J placement	3 (5.9)
Median duration of tube placement [*] , months (range)	5.2 (1.0–41.9)
At least one tube failure, n (%)	52 ^{**} (57.8)
• Median time to tube failure ^{***} , days (range)	52.5 (3–350)
• Median number of tube replacements ^{***} (range)	2 (1–21)
Short term complications (< 30 days) (28 patients; 28 episodes)	
• Jejunal tube clogging	7 (3.9)
• Jejunal tube kinking	10 (5.6)
• Gastrostomy tube balloon leaking	1 (0.5)
• Jejunal tube displacement	6 (3.4)
• Buried bumper	2 (1.1)
• Cellulitis	2 (1.1)
Long term complications (24 patients; 149 episodes) ^{****}	
• Jejunal tube clogging	40 (22.5)
• Jejunal tube kinking	14 (7.9)
• Gastrostomy tube balloon leaking	30 (16.9)
• Jejunal tube displacement	46 (25.9)
• Cellulitis	19 (10.7)

^{*} Limited to patients undergoing tube removal (n=51)

^{**} 52 patients developed 177 episodes of tube malfunction.

^{***} Limited to patients with at least one tube replacement (n=52)

^{****} More than 1 complication was reported by some individuals (n=27).

Table 3

Baseline characteristics of patients with chronic pancreatitis undergoing PEG-J (n=58)

Patient characteristic	
Median age (range) (years)	42 (23, 72)
% female sex	47 (81.0)
Etiology, No. (%)	
• Heavy alcohol use	14 (24.1)
• Idiopathic	13 (22.4)
• SPINK 1/CFTR mutation	3 (5.2)
• Hypertriglyceridemia	4 (6.9)
• Pancreas divisum	6 (10.3)
Severity of chronic pancreatitis *	
• Normal	10 (17.2) **
• Equivocal	15 (25.9)
• Mild	10 (17.2)
• Moderate	6 (10.4)
• Severe	17 (29.3)
Associating conditions, No. (%)	
• Diabetes	14 (24.1)
• Smoking	36 (62.1)
• Sphincter of Oddi dysfunction	18 (31.0)
Median length of stay after the procedure, days (range)	2 (1, 15)
Median follow-up period (range) (months)	26 (1.7–46.1)
Definite tube removal, No. (%)	37 (63.8)
• Clinical improvement	19 (51.4)
• Tube feeding intolerance	8 (21.6)
• Surgery due to persistent symptoms	8 (21.6)
• Converted to surgical J tube	2 (5.4)
Median duration of tube placement ***, months (range)	6.6 (1.0–41.9)

* Based on the Cambridge classification

** All patients were diagnosed chronic pancreatitis by intraductal secretin stimulation test

*** Limited to patients undergoing tube removal (n=37)

Table 4

Outcome of jejunal feeding via PEG-J in patients with chronic pancreatitis (n=58)

Variables	Before PEG-J	After PEG-J	P value
Mean body weight, kg (SD)	69.9 (18.9)	71.4 (19.4)	0.06
Mean body mass index, kg/m ² (SD)	26.0 (6.8)	26.6 (7.1)	0.05
Mean number of hospitalizations * (SD)	4.6 (3.6)	1.9 (2.5)	<0.0001
Mean total number of inpatient days, days * (SD)	21.6 (14.7)	12.1 (22.1)	0.005
50% narcotic dose reduction, No. (%)	-	13 (22.4)	-
Laboratory findings			
• Albumin (g/dL)	3.1 (0.7)	3.5 (0.6)	0.0002
• Total protein (g/dL)	6.2 (0.8)	6.7 (0.8)	0.001
• Total calcium (mg/dL)	8.6 (0.5)	9.0 (0.5)	<0.0001

* Limited to patients with at least 12 months follow-up (n=45); these represent the number of hospitalization due to pain flares/tube related issues and total inpatients days during the 12-month period before and after PEG-J placement