

# Feeding Tube Enterostomies in Upper Aerodigestive Tract Cancers

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## Abstract

Establishment and maintenance of safe access is crucial for long-term enteral nutrition in patients with head-neck and esophagogastric cancers. Tube enterostomies such as gastrostomy and jejunostomy are being increasingly used with wider use of chemoradiation and adjuvant therapy following surgery. This article reviews the currently available enteral access techniques by the open and percutaneous route and their indications, safety, effectiveness and role in modern oncological practice.

**Keywords:** Feeding gastrostomy, jejunostomy, percutaneous techniques.

## INTRODUCTION

A nasogastric (NGT) or nasoenteral tube usually suffices if short-term (< 4 weeks) feeding is required but many patients with upper aerodigestive tract cancers will require a longer period of enteral nutrition. Besides luminal obstruction, cancer anorexia, chemotherapy induced nausea and vomiting and radiation toxicities (mucositis, esophagitis, xerostomia, dysgeusia) during multimodal treatment may severely restrict oral intake and result in significant weight loss.<sup>1</sup> This leads to dehydration, delayed discharge, re-hospitalization, compromised treatment efficacy and poor quality of life. Wound breakdown and anastomotic disruptions are increased in those undergoing surgery. Although, we are aware of these factors, the pervasive attitude that some weight loss is inevitable during protracted treatment or following major operations may impede aggressive intervention. Supplemental nutrition is essential in those who have lost more than 10% of their body weight in the preceding 6 months or 5% in the preceding month to diagnosis. Tube enterostomies obviate difficulties of long-term nasoenteral feeding such as increased risk of aspiration, esophagitis, nasal alar ulceration, rhinosinusitis, inadvertent removal, blockage and poor compliance. Traditional open surgical techniques require an operating room and higher wound related morbidities have limited their use except as an adjunct to major surgery. The newer percutaneous

techniques have revolutionized the approach to enteral access and presented opportunities to improve the quality of life.<sup>2,3</sup>

## TYPES OF LONG-TERM ENTERAL ACCESS

Gastrostomy and jejunostomy are the two most widely used feeding tube enterostomies. They can be either temporary or permanent and a variety of techniques are available. A tube enterostomy is necessary if feeding of more than four weeks is anticipated, or if nasoenteral access is compromised in the short-term. Jejunostomy rather than a gastrostomy is required in gastric outlet obstruction, duodenal obstruction, gastroparesis, and recurrent cancer following partial gastrectomy or esophagogastrectomy and those failing to thrive after total gastrectomy and esophageal resection with gastric pull-up. It is also required in patients at high-risk of aspiration from nasogastric or gastrostomy feeding.<sup>4,5</sup> Cervical pharyngostomy and esophagostomy were used in the past after head and neck surgery, but are no longer used for long-term feeding because of the ease and relative safety of other techniques.<sup>6</sup>

## GASTROSTOMY TECHNIQUES

### Percutaneous

1. *Percutaneous endoscopic gastrostomy (PEG)*: Gauderer and Ponsky introduced this technique in 1980.<sup>7</sup> In the

'pull technique', the endoscope is passed into stomach with the patient lying supine, the stomach is inflated with air and the room lights are dimmed to locate the appropriate puncture site in the epigastrium by transillumination. The assistant makes a stab incision of 5-6 mm at the selected site through which a sheathed needle is advanced into the stomach under endoscopic guidance. The assistant then withdraws the needle and advances a thread into the stomach through the cannula. The endoscopist grasps the thread with a forceps and draws it out through the mouth with the scope. It is then tied to the fixation loop attached to the tapered dilator end of the PEG tube, which is positioned by slowly pulling on the distal end of the thread until the tube emerges through the abdominal wall and the bumper stops at the inner gastric wall. An external fixation device enables a close connection between the wall of the stomach and the parietes. In the 'push technique, a guide-wire is brought out of the patient's mouth over which a feeding tube with a tapered end is pushed in an aboral direction until it exits through the abdominal wall.<sup>8</sup> In the 'introducer technique' the Seldinger method of intubation is used. Serious complications of PEG are rare and include peritonitis, bleeding and colonic perforation and can be avoided by meticulous technique and proper selection of patients. Ascites, portal hypertension, coagulopathy and lack of transillumination of puncture site are absolute contraindications to the procedure.<sup>7</sup>

2. *Percutaneous radiologic gastrostomy (PRG)*: A self retaining balloon catheter is inserted employing Seldinger technique after insufflation of the stomach with air through a fine bore tube and achieving an area of gastropexy with single or multiple retention stitches (T-fasteners) inserted under fluoroscopic or ultrasound control.<sup>9</sup> It is indicated for patients with obstructing lesions in the upper GI tract, prohibiting the passage of an endoscope. A study of 508 procedures in an interventional radiology unit reported a 99% technical success rate and a low procedural complication of 1.4%. Long-term minor complications (17.6%) mainly involved tube disturbances and nearly always resolved once the tube was exchanged.<sup>10</sup>

## Surgical

1. *Open*: While open gastrostomy tube placement has diminished primarily due to higher wound related complications and cost, it is still useful when apposition

of the stomach to the abdominal wall is in question rendering percutaneous approaches dangerous. The most common technique is the temporary Stamm gastrostomy where a series of opposing inner and outer purse-string sutures are used to secure a Foley catheter that has been passed through the anterior abdominal wall into the stomach.<sup>11</sup> In the permanent mucosal gastrostomy of Janeway a rectangular flap is taken from the anterior gastric wall so as to fashion a tube around the indwelling gastric catheter. The gastric tube is then brought through the anterior abdominal wall, and sewn to the skin by direct mucocutaneous sutures.<sup>12</sup>

2. *Laparoscopic*: This is an option in head and neck carcinoma, obstructing esophageal carcinoma not amenable to dilatation, and in those with liver or colon overlying the stomach. In 121 patients with mostly oropharyngeal and esophageal cancers, procedure-related mortality was zero and early complication rate was 9.9%. During a cumulative usage time of 1086.2 months, the complication rate in 1000 usage days was 0.8, and the stoma infection rate was 0.65.<sup>13</sup> Several variations of laparoscopic techniques are in use, e.g. Stamm or Janeway types, endoscopy aided and single port versus multiple port access.<sup>14,15</sup> The principal drawbacks are the cost, longer procedure time and requirement for GA.

*Comparison of different techniques*: PEG has gained widespread acceptance in head and neck surgical units due to low complication rates.<sup>16</sup> It may be slightly less expensive than surgical gastrostomy,<sup>17</sup> but when performed on a regular basis, the complication rates of both approaches are similar.<sup>18,19</sup> A meta-analysis of 721 surgical gastrostomies, 4194 PEGs and 837 PRGs, the technical success rate of both PRG (99.2%) and PEG (95.7%) was high. The major complication and mortality rate of PEG (9.4% and 0.5%) and PRG (5.9% and 0.5%) was far less than that of surgical gastrostomy (19.9% and 2.5%). The risk of life threatening aspiration was four times lower in PRG compared with PEG, although differences possibly reflect institutional bias towards the use of a particular method in different patient categories.<sup>20</sup> In another recent meta-analysis of 2379 head and neck cancer patients, major complication rates following PEG and PRG were 7.4% (95% CI 5.9-9.3%) and 8.9% (95% CI 7.0-11.2%) respectively. PRG was associated with increased morbidity and mortality in those who are ineligible for PEG.<sup>21</sup>

## Head and Neck Cancer—Clinical Considerations

*Predictors for tube enterostomy:* The most significant predictive parameters for reactive enteral feeding were stage 3-4 disease, performance status 2-3 and smoking > 20/day. Patients with primary nasopharyngeal, hypopharyngeal and base of tongue tumors and in need of hyperfractionated RT do well from PEG feeding.<sup>22</sup> A review of 142 postoperative patients found heavy alcohol use, tongue base involvement, pharyngectomy, composite resection and reconstruction with a myocutaneous flap to be significantly associated with the need for long-term nutritional support. A gastrostomy at the time of initial surgical therapy was recommended in this subset of patients.<sup>23</sup> An argument against PEG has been the anecdotal observations of prolonged PEG dependence and increased need for pharyngoesophageal dilatation for persistent dysphagia.<sup>24</sup> Pretreatment swallowing exercises produces measurable improvements in post-treatment swallowing function in patients who undergo organ-preservation chemoradiation (CT/RT) for head and neck cancer and might reduce dependence on PEG.<sup>25</sup> With rising interest in organ preservation, more and more radical radiotherapy and intensive multimodal treatment would be pursued. Whilst deciding the need for tube enterostomies in patients for radiotherapy alone consideration should be given to absolute dose, volume, time-frame and whether brachytherapy is added or not. Even with newer techniques of intensity modulated radiotherapy for precise targeting with consequent reduction of mucositis and long-term dysphagia, enteral tube feeding up to 8 weeks was required.<sup>26</sup>

*Timing (prophylactic or reactive):* In a review of 151 patients with upper aerodigestive tumors who underwent radical CT/RT, those who required PEG in response to significant mucositis during treatment suffered significantly greater weight loss than those who had PEG tubes prophylactically.<sup>27</sup> Prophylactic PEG also results in less treatment interruption, which reduces the efficacy of radiotherapy or chemotherapy.<sup>28,29</sup> A study of 103 head-neck cancer patients treated with concurrent CT/RT, and prophylactic PEG, noted severe (grade 2-3) mucositis in 86% necessitating tube feedings for a mean of 8 months. At a median follow-up of 19 months none developed any serious complications.<sup>30</sup> Piquet et al compared oropharyngeal cancer patients selected for prophylactic PEG (age greater than 70 years, body mass index less than 20,

or recent weight loss greater than 10%) against comparable historical controls. Based on the criteria, 74% of patients qualified for prophylactic PEG and an additional 13% ultimately received reactive PEG for severe dehydration and weight loss. In the control group, 11% had early PEG tubes placed based on clinical judgment and an additional 27% underwent subsequent placement.<sup>31</sup> Early identification of patients in need of prophylactic PEG (ideally 2 weeks before) or at treatment initiation is now practiced in many specialist centers.<sup>4,32,33</sup>

*Tumor seeding (Inoculation metastasis):* This is a rare but significant complication of percutaneous endoscopic gastrostomy (PEG) in cancer patients. Both direct seeding and hematogenous spread have been suggested as possible mechanisms.<sup>34</sup> The risk may be reduced in patients by radiotherapy, chemotherapy, or excision of the tumor before PEG and by substituting the push/pull technique by the introducer technique.<sup>35</sup>

*Quality of life:* Anecdotaly, patients prefer percutaneous enterostomy over prolonged NGT feeding. A randomized trial of PEG versus NGT feeding in 90 patients showed a greater acceptance of PEG by both patients and carers. The NGT group had a feeding discontinuation rate of 15% and swallowing problems of 17% against none in the PEG group.<sup>36</sup> Hospital stay has been reduced by 61% in those undergoing PEG compared to those with NGT feeding after resection for stage 3 and 4 squamous cell carcinomas of upper aerodigestive tract, again an important consideration for the patient and the relatives.<sup>37</sup> Most patients require a very short hospital stay after feeding is commenced 6-24 hours after the procedure. Ambulatory (outpatient) PEG placement with a close follow-up has been successful in 129 out of 136 patients in selected head and neck cancer patients further emphasizing the acceptability of this procedure.<sup>38</sup> The skin level button gastrostomy, by eliminating the protruding tube offers increased comfort and cosmesis. It substitutes the PEG after several weeks when the gastrocutaneous fistula has matured. The button is stretched over a metal stylet and pushed through the fistula into the air-insufflated stomach.<sup>39</sup>

*Airway complications:* This is a rare but potentially lethal complication of PEG. A tumor assessment protocol with flexible awake nasoendoscopy (dynamic assessment) and panendoscopy under GA (static assessment) identifies at-risk patients. T3/T4 oropharyngeal tumors with tongue base

extension and exophytic hypopharyngeal tumors with fixation of at least one hemilarynx and T4 laryngeal tumors with extralaryngeal extension requires prior airway control by an anesthetist during PEG or a substitution with a radiologically guided insertion.<sup>40</sup>

### Esophageal Cancer—Clinical Considerations

*Gastrostomy as a palliative procedure:* A gastrostomy alone for dysphagia in esophageal cancers prolongs poor quality of life and poses an ethical dilemma. In these patients endoscopic palliative procedures of balloon dilatation, laser recanalization and self-expandable metal stenting are preferred. A gastrostomy or a jejunostomy however, is justified when palliative RT is planned and where endoscopic techniques to restore luminal patency fail.

*Facilitation of uninterrupted radiation, CT/RT and neoadjuvant chemotherapy:* The relative ease of PEG placement and maintenance of continued nutrition has allowed intensive multimodal treatments. PEG prior to multimodal therapy is now incorporated in the protocol of many specialist units. Multivariate analysis in one study showed PEG to be significantly related to attainment of target doses of chemoradiotherapy ( $p = 0.034$ ) and survival at 12 months ( $p = 0.02$ ).<sup>41</sup>

*Subsequent esophageal resection:* Open gastrostomy can cause extensive adhesions and scarring of the site precluding use of stomach as a conduit following esophagectomy. However, studies have shown no hindrance to the use of stomach as an esophageal replacement following PEG. Routine placement of PEG before definitive treatment was successful in 97% of 229 consecutive patients in one study. In one patient the PEG damaged the right epiploic artery, even then the stomach could be used for replacement.<sup>42</sup> The risk for PEG-induced adhesions or vascular injury that might adversely influence subsequent gastric pull-up following esophagectomy is low and generally avoidable with attention to anatomic placement in the anterior mid-body.<sup>43</sup> In another report, PEG placement was possible without procedural mortality in 103 of 119 patients, where nearly half had pretreatment with laser or dilatation for luminal narrowing. PEG takedown and site closure at the time of operation was uncomplicated and use of the stomach as an esophageal substitute was possible in all 61 resected patients. Rates of anastomotic leak, stricture, and gastric emptying delay were similar to those for patients proceeding to resection without prior PEG.<sup>41</sup>

## JEJUNOSTOMY TECHNIQUES

### Percutaneous

1. *Direct percutaneous endoscopic jejunostomy (D-PEJ):* First described in 1987, this is technically more difficult than PEG because of the narrow lumen and motility of the jejunum, but provides stable long-term access. A loop of the proximal jejunum is pushed anteriorly against the abdominal wall with an enteroscope or pediatric colonoscope and the jejunostomy site is selected by identifying a discrete light transilluminating the abdominal wall. At this point, the procedural steps are similar to a pull type gastrostomy tube insertion.<sup>44,45</sup> Success depends on the patient's body habitus, with abdominal wall and omental fat, limiting the ability to transilluminate the bowel. D-PEJ is preferred when the surgeon wishes to have a virgin stomach as a conduit where esophagectomy is a possibility following a sufficiently downstaged tumor with chemotherapy. It has also been employed where complications have ensued following esophagectomy without a prophylactic jejunostomy.<sup>46</sup>
2. *PEG with jejunal extension (PEG-J):* This is a technique of placing a narrow tube (6 F to 9 F) through a wider PEG tube (15-20 F) and advancing it into the jejunum with the help of an endoscope. It has the advantage of delivering the feed beyond the pylorus and thereby reducing the risk of aspiration in those with esophageal reflux. Strictly speaking, this is not a jejunostomy, which implies a direct opening through the jejunal wall. Results are not uniformly good. The most common causes of malfunction are clogging (because of the small diameter of the jejunal extension tube), kinking of the tube in the stomach or jejunum, and migration of the tube back into the stomach, which necessitates endoscopic reintervention.<sup>47</sup> A recent study comparing 205 D-PEJ and 58 PEG-J placements showed successful placement in 65.4 and 89.7%, respectively.<sup>48</sup> Another retrospective study comparing 56 direct PEJ (with 20 F tube) with 49 PEG-J showed less endoscopic reintervention rate for tube dysfunction ( $p < 0.0001$ , 5 versus 19 patients) for direct PEJ at a 6-month follow-up.<sup>48</sup> Major complications of bleeding, intra-abdominal abscess, jejunal volvulus, colonic perforation have been reported in 10% of 209 insertions.<sup>49</sup>
3. *Percutaneous radiologic jejunostomy:* Fluoroscopically guided creation of a primary jejunostomy by



interventional radiologists have a high technical success rate of 95-100%.<sup>50,51</sup> Failure is attributed mainly to the difficulty of puncturing the relatively mobile and easily decompressed jejunum. Not all bowel and vascular structures are shown on conventional fluoroscopy and this adds to the risk. CT-guided puncture eliminates these pitfalls as anteriorly positioned nonopacified fluid- or gas-filled bowel loops can be readily identified.<sup>45</sup> Like in gastrostomy, formation of a jejunopexy by placement of an anchoring device to tack the bowel loop to the parietes reduces jejunal mobility. The potential for loss of the access track during dilatation and peritonism after insertion is thus reduced.

## Surgical

1. *Open*: The common Longitudinal Witzel technique employs a jejunal loop several centimeters below the ligament of Treitz which reaches the anterior abdominal wall easily. A purse-string suture is applied around the selected site on the antimesenteric margin. A small enterostomy is made and the tube is inserted 15-20 cm distally, following which the purse-string suture is tied. A serosal tunnel is created 3-5 cm proximally from the catheter's exit site using a continuous suture. The catheter is then delivered through the abdominal wall via a stab incision and the jejunal loop around the tube exit site is anchored to the parietal peritoneum. In the Transverse Witzel technique a T-tube is substituted for a standard catheter and placed in the transverse plane minimizing the risk of obstruction and dislodgement.<sup>52,53</sup>

*Needle catheter jejunostomy (NCJ)*: This consists of insertion of a small (9 Fr) polyethylene catheter through which only low viscosity formula feeds can be given with the help of a feeding pump. A needle is used to create a submucosal tunnel for a few centimeters on the antimesenteric border of the jejunum. The catheter is inserted through the needle, and then the needle is removed. The catheter is brought out through the anterior abdominal wall and the segment of jejunum is secured to the parietes with stitches. Feeding can be started by day 1 in 98% of patients undergoing major upper GI surgery and more than two-thirds of the patients will attain the target nutritional requirements in 3 days.<sup>54</sup> NCJ has largely eliminated problems of leakage around the large tubes into the peritoneal cavity or onto the skin, bowel obstruction, internal hernia and the persistence of enterocutaneous fistula after tube removal.

2. *Laparoscopic*: This may either require retrieval of jejunum through the abdominal wall (laparoscopic aided) or those performed intracorporeally (totally laparoscopic). Numerous variations using ready to use NCJ kits or self-retaining balloon catheters have been described for laparoscopic enteral access.<sup>55,56</sup>

## Upper GI Cancers—Clinical Considerations

*Jejunostomy during esophagectomy and gastrectomy* - Intraoperative placement of feeding jejunostomy allows early enteral nutrition following esophagectomy. There are conflicting reports on the benefits of such an approach with some favoring a routine use<sup>57-60</sup> while others do not, who find nasoduodenal tubes inserted during operation to be an effective alternative.<sup>61,62</sup> A randomized trial of jejunostomy feeding versus intravenous fluids among patients undergoing upper GI surgery found no differences in the nutritional parameters (serum albumin, serum transferrin, serum prealbumin, weight, body fat and fat free mass) on the tenth postoperative day compared to preoperative levels between treatment groups.<sup>63</sup> However, institutions performing high volume esophagectomies with feeding jejunostomy as a routine adjunct find it invaluable in patients with a complicated postoperative course in whom resumption of oral feeds is delayed.<sup>64,65</sup> Feeding was used in all patients in the immediate postoperative period, for more than 3 weeks in 11%, and for more than 2 months in 6.9% among 523 patients studied by Orringer's group, with a 2.1% complication rate and zero jejunostomy-related mortality.<sup>59</sup> The effect of NCJ on weight loss after esophagectomy has been assessed in a population based Swedish study where 48% of 233 patients with NCJ had a 42% statistically non-significant decreased risk of weight loss compared to those without NCJ after adjustment for covariates (Odds Ratio 0.58; 95% CI 0.25-1.39).<sup>66</sup> In a series of 244 gastrectomy patients who underwent placement of NCJ, uninterrupted nutritional support enabled timely adjuvant chemotherapy. Forty-four severely malnourished patients required night time home enteral nutrition and 60% of these received outpatient chemotherapy and maintained a good quality of life.<sup>67</sup>

*Jejunostomy at the time of staging laparoscopy*: Laparoscopic feeding jejunostomy is an option in patients with esophagogastric cancers who are potential candidates for chemotherapy with palliative intent or neoadjuvant treatment prior to surgery. In a series of 43 patients who

had a laparoscopic feeding jejunostomy at the time of staging laparoscopy, 35 had preoperative chemotherapy. In the period between staging and eventual resection (a mean of 10 weeks), 32% required immediate feeding, and subsequently instituted in 14% of those who were thought not to need feeding. More patients gained weight or had a rise in albumin in the group that had jejunal feeding ( $p < 0.05$ ).<sup>68</sup> However, a systematic review concludes that while this is a viable means of achieving enteral access, conversions to an open procedure may be necessary, complications can be serious and strict patient selection is warranted.<sup>69</sup>

*Prior esophageal or gastric resection:* The gastric remnant after subtotal gastrectomy may be intrathoracic and/or relatively small, making PEG unfeasible. An anastomotic leak in the thorax following total gastrectomy or esophagogastrectomy will need nutrition delivered well beyond the anastomosis into the jejunum. Although it may seem that postoperative adhesions will make DPEJ difficult, it actually has a higher likelihood of success in this group, probably due to the shorter and more direct route to the proximal jejunum.<sup>46</sup>

*Unresectable cardiac and proximal gastric carcinoma:* The addition of radiation to chemotherapy for locally advanced disease has been advocated. Gastrostomy tubes are suboptimal in the setting of gastric irradiation. The use of a feeding jejunostomy and a three-dimensional conformal radiation greatly enhances tolerance.<sup>70</sup>

### Accessing the GI Tract – who does it?

The surgeon decides whether to place a feeding enterostomy as an adjunct to major resectional surgery, with the possibility of an anastomotic disruption or complicated postoperative course being the major decisive factor.<sup>71</sup> It is often the oncologist within a multidisciplinary team who has to decide on the need for a feeding enterostomy and this is greatly aided by nutrition assessment protocols and a basic understanding of the technique and safety of each of the procedures. Percutaneous enteral access procedures are carried out by the gastroenterologist, surgeon or radiologist depending upon the local service provisions. Although therapeutic endoscopy is traditionally the domain of gastroenterologists, surgeon-led PEG placement have high success rates, and can be used as an integral part of a major head and neck resection.<sup>72-74</sup>

### SUMMARY

Both baseline and treatment-induced malnutrition need to be addressed, and aggressive nutritional support can decrease the weight loss during treatment and improve quality of life in upper aerodigestive cancers. Tube enterostomies should be incorporated in protocols of multimodal, curative and palliative treatments taking into consideration patient-, tumor- and treatment-related risk factors. There is ample evidence that prophylactic tube enterostomies allow uninterrupted multimodal treatments and has the potential to affect outcome. Percutaneous techniques are safe in trained hands and do not usually require general anesthesia. The heterogeneity of patient population, plethora of techniques and difficulty in accrual has led to only a few adequately powered randomized trials comparing endoscopic, radiological and surgical access. The choice between PEG and PRG depends on the available local expertise. The greater availability of endoscopy have made PEG well suited in those without luminal obstruction. For those with impassable esophageal strictures or oropharyngeal obstructions, an open surgical access is required unless laparoscopic or percutaneous radiological intervention is available. When enteral access is obtained as an adjunct to esophageal resections, a NCJ is ideal although the traditional wide-bore catheter jejunostomy is still valuable in resource-poor countries where gravity assisted bolus feeding rather than continuous pump infusion of low viscosity commercial feeds are commonly employed.

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