

Palliative percutaneous endoscopic gastrostomy placement for gastrointestinal cancer: Roles, goals, and complications

Matthew Mobily, Jitesh A Patel

Matthew Mobily, Departments of Surgery, University of Arizona, Tucson, AZ 85724, United States

Jitesh A Patel, Division of General Surgery, University of Kentucky, Lexington, KY 40536, United States

Author contributions: Mobily M and Patel JA equally contributed to this paper.

Conflict-of-interest: There are no conflicts of interest to disclose.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>

Correspondence to: Jitesh A Patel, MD, Division of General Surgery, University of Kentucky, 800 Rose Street, UKMC C221, Lexington, KY 40536, United States. jitesh.patel@uky.edu

Telephone: +1-859-3236346

Fax: +1-859-3236840

Received: September 1, 2014

Peer-review started: September 2, 2014

First decision: October 28, 2014

Revised: December 11, 2014

Accepted: January 9, 2015

Article in press: January 12, 2015

Published online: April 16, 2015

of malignant obstructions. The rates of successful placement for cancer patients with either of these indications are high, similar to those in mixed populations. There is no conclusive evidence that the procedure will help patients reach nutritional goals for those needing alimantal supplementation. However, it is effective at relieving symptoms caused by malignant obstruction. A high American Society of Anesthesiologist physical status score and an advanced tumor stage have been shown to be independent predictors of poor outcomes following placement in cancer patients. This suggests the potential for similar outcomes in the palliative care of patients with advanced stage gastrointestinal cancer who may be in relatively poor physiologic condition. However, this potential should not preclude its use in patients with terminal gastrointestinal cancer considering the high rate of successful tube placement, the possible benefits and the ultimate goal of comfort in palliative care.

Key words: Percutaneous endoscopic gastrostomy tube; Palliative care; gastrointestinal cancer; Nutritional supplementation; Gastrointestinal decompression

© The Author(s) 2015. Published by Baishideng Publishing Group Inc. All rights reserved.

Abstract

Percutaneous endoscopic gastrostomy tube placement is an invaluable tool in clinical practice that has an important role in the palliative care of patients with gastrointestinal cancer. While there is no extensive data regarding the use of this procedure in patients with gastrointestinal malignancy, inferences can be made from the available information derived from studies of similar or mixed populations. Percutaneous endoscopic gastrostomy tubes can be used to provide enteral nutrition for terminal malignancies of the upper gastrointestinal tract as well as for decompression

Core tip: Percutaneous endoscopic gastrostomy tube placement may be used in the palliative care of patients with gastrointestinal cancer for supplemental nutrition or to decompress distal obstructions. There is a high rate of successful placement in cancer patients. It has been shown to relieve symptoms of malignant obstruction and has the potential to help patients reach nutritional goals. While poor physiologic condition and advanced tumor stage have been associated with a higher risk of worse outcomes, this should not preclude its use in these patients considering the high rate of successful placement, potential benefits and the goal of comfort in palliative care.

Mobily M, Patel JA. Palliative percutaneous endoscopic gastrostomy placement for gastrointestinal cancer: Roles, goals, and complications. *World J Gastrointest Endosc* 2015; 7(4): 364-369 Available from: URL: <http://www.wjgnet.com/1948-5190/full/v7/i4/364.htm> DOI: <http://dx.doi.org/10.4253/wjge.v7.i4.364>

INTRODUCTION

The use of gastrostomy tubes to gain enteral access has been implemented since the late 19th century. The Witzel or Stamm techniques, either open or laparoscopic, have been the standard of care for surgical gastrostomy through the 1970s^[1]. In 1980, Gauderer *et al*^[2] first described the percutaneous endoscopic gastrostomy (PEG) method for enteral access in children with swallowing disorders^[2]. Since that time, the use of PEG has been extended broadly to patients with dysphagia, either physiologic or obstructive, for the provision of enteral nutrition. PEG tube placement can be performed quickly at the bedside and requires only local anesthesia and minimal sedation resulting in substantial time and cost savings compared to surgical gastrostomy^[3]. Additionally, it has been successfully used to decompress the stomach and/or proximal gastrointestinal tract in the setting of malignant obstructions distal to the pylorus^[4]. PEG placement has become an important and frequent procedure performed by surgeons and gastroenterologists. In a review 20 years following its initial description there were estimated to be greater than 216000 PEG procedures performed annually in the United States^[5].

This endoscopic procedure has also been utilized with a palliative intent as a means to provide enteral nutrition or relieve intestinal obstructions. The World Health Organization characterizes "palliative care" as "an approach that improves the quality of life of patients and their families facing the problem associated with life-threatening illness^[6]". More concisely, "palliative care" provides "care alleviating symptoms without curing the underlying disease"^[7]. It was a surgeon, Balfour Mount, who originally coined the term "palliative care" in 1975^[8]. Since that time, as the elderly population and the prominence of chronic disease have increased, the need for palliative care has increased in kind^[9]. Palliative medicine is an essential component to the care of patients with gastrointestinal cancer, encompassing any malignancy from the mouth to the anus, and PEG tube placement is an invaluable tool in the field. In the palliative care of patients with terminal gastrointestinal cancer, PEG may be used either as a method to provide enteral nutrition in patients with an obstructing upper gastrointestinal cancer or as a means to decompress the upper gastrointestinal tract in patients with malignant bowel obstructions.

The purpose of this review is to better understand

roles (uses) and goals (outcomes) of palliative PEG tube placement in patients with gastrointestinal cancer. Unfortunately, the use of this type of palliative PEG for patients with terminal gastrointestinal cancer has not been extensively studied. There are no clear guidelines regarding the role of PEG placement in the palliative care of these patients. However, an understanding of the use, broad outcomes and complication incidence of PEGs placed in all cancer patients for nutritional support or bowel decompression may provide insight into its roles and goals in the palliative care of patients with gastrointestinal cancer. While the need to decompress a gastrointestinal obstruction is a clear indication for intervention, PEG tube placement for nutritional purposes in the setting of palliative care raises multiple ethical issues. This review will focus on better understanding the risks and benefits of the procedure in these situations in order to properly guide the patient towards an informed decision.

ROLES

Enteral nutrition

The most common indication for PEG tube placement is provision of enteral nutrition for patients with neurologic disorders, head/neck cancer and trauma^[10,11]. With respect to gastrointestinal cancer, PEG tube placement in patients with obstructing oropharyngeal, esophageal or stomach cancer is designed to provide enteral nutrition. In a recent retrospective review of all patients within a cancer institution who underwent PEG, roughly half of the patients had head/neck cancer; 22% of the patients had a different gastrointestinal cancer. The most common indication for PEG was nutritional supplementation^[12]. Similarly, another retrospective study of all cancer patients found that 73% of the patients received a PEG tube for enteral access and nutritional supplementation while the remaining 27% had it placed for bowel decompression^[13].

Decompressive PEG

Malignant bowel obstruction is an important consideration in patients with gastrointestinal cancer. It is particularly relevant to palliative care as its occurrence often serves as a harbinger of worsening disease or recurrence^[14]. Though the rates of obstruction vary in the literature, the incidence of malignant obstruction for colorectal cancer has been reported to be between 10% and 28.4%^[15]. In the setting of metastatic disease its identification is particularly ominous and often signals the need for end-stage palliation^[16].

Obstruction of the gastrointestinal tract by a malignancy leads to a complex pathophysiologic process that involves aggregation of bowel gas and secretions, impaired motility, decreased absorption and inflammation^[17]. The result is malnutrition and debilitating nausea, vomiting and abdominal pain. PEG tube placement is a method to decompress the stomach and proximal bowel to alleviate these symptoms^[18].

For patients ineligible for definitive surgical treatment, other management strategies for malignant bowel obstruction include medical therapy, nasogastric tube decompression, stent placement in colorectal cancer and surgical resection. Medical treatment is targeted both at resolution of obstruction and symptom management. In addition to their antiemetic effect, a Cochrane review showed that corticosteroids have the potential to aide in the resolution of intestinal obstruction^[19]. The medical armamentarium also includes other antiemetics, anticholinergics, somatostatin analogues and opiates, all of which may be of limited benefit^[16,20,21]. The initial management of malignant obstruction usually involves nasogastric tube decompression. However, long-term use of nasogastric tubes is not feasible considering patient discomfort and the potential erosion of the nasal pathways^[14,17]. For patients with colorectal cancer, stents have been used to relieve obstruction. A systematic review of self-expanding metal stents found a median clinical success rate of 92% however complication rates of stent migration and re-obstruction were both > 10%^[22]. Given the mixed success and complication rates of these strategies, the role of decompressive PEG tube placement should be considered.

In a retrospective review of all PEG tubes placed at a medical center, 6% were performed for decompressing a malignant obstruction^[16]. When limited to cancer patients excluding those with head/neck and thoracic malignancies, Keung *et al.*^[13] found that 27% of PEGs were performed for gastric decompression/management of obstructive symptoms. This procedure has the ability to both alleviate obstructive symptoms and permit patients to participate in the culturally important act of eating, albeit non-nutritive, that can dramatically improve the quality of life of patients undergoing palliative care. The success and complication rates of both decompressive PEG and those placed for nutritional supplementation in patients with gastrointestinal malignancy is considered below.

GOALS

Outcomes

In patients with head and neck cancer, PEGs placed for enteral alimentation is well studied and has clearly been shown to improve both nutritional status and quality of life^[12,23-25]. Similarly, the use of decompressive PEG in patients with malignant bowel obstruction secondary to advanced gynecologic cancer has been shown to effectively ameliorate obstructive symptoms^[18,26,27]. While the use of PEG in these scenarios has been well studied, there has been relatively little data regarding the outcomes of PEG in patients with primary gastrointestinal malignancy outside of the oropharynx. As mentioned above, several recent studies have looked at PEG placement in all cancer patients who may benefit from PEG as a palliative measure either for nutritional support or decompressing malignant

obstructions^[12].

There is a high rate of success for PEG placement in patients with cancer. Three retrospective studies analyzing PEG in cancer patients reported success rates > 95%^[13,28,29]. One of these studies found a 98.9% success rate despite 51.9% of their patients having had prior abdominal surgery^[13]. The success rate for PEG placement in cancer patients is similar to that of the overall population. This suggests that cancer is not necessarily a physiologic or technical limitation. For cancer patients who had successful PEG placement, studies have found varied median survival times. A 2013 retrospective study of 218 cancer patients who underwent PEG found a median survival time of 10.2 mo (8 d-5.7 years); the 30-d mortality rate was 13%^[12]. This is comparable to a 14% 30-d mortality rate reported by Zera *et al.*^[28] in a similar patient population^[28]. Interestingly, a study that excluded patients with head/neck and thoracic cancer found a slightly higher 30-d mortality rate of 18.5%^[13]. It is important to note that Keung *et al.*^[13] additionally assessed the achievement of nutritional goals following PEG. Among all cancer patients (those who received PEG for nutritional support and those who received decompressive PEG) 73.5% were able to tolerate some degree of tube feeding following the procedure. However, among those who had the procedure for nutritional support and received total parental nutrition (TPN) prior, only about half became independent of TPN following the PEG^[13].

Several smaller retrospective studies have looked at the outcomes of decompressive PEG placement for malignant obstruction alone and have reported similar outcomes^[16,26,27,30-35]. The largest and most recent of which, performed by Kawata *et al.*^[30] in 2013 with 76 patients, reported a success rate of 93%, obstructive symptom relief in 95% and a median survival of 63 d (range of 8-444 d). Notably, 96% of patients in the study who required nasogastric decompression prior to the procedure no longer required it following PEG placement^[30]. These data suggest that patients with malignant obstruction secondary to a GI malignancy would benefit from a PEG with a high probability of success and obstructive symptom relief.

Complications

PEG complications are differentiated as major and minor. While minor complications include pain, formation of granulation tissue, cellulitis, *etc.*, major complications are more immediately life-threatening such as pneumonia, peritonitis, perforation, and deep venous thrombosis/pulmonary embolism (DVT/PE)^[12,36-40]. In mixed patient populations, the incidence of major PEG complications has been reported at 1%-3% to as high as 9%; the incidence of minor complications is more widely varied ranging from 16% to 50%^[41,42]. A large systematic review of patients with head/neck cancer found a 7.4% incidence of major complications and a 28.9% incidence of minor complications^[37].

Table 1 American Society of Anesthesiologists Physical Status Classification

Class	Description
1	Patient is a completely health fit patient
2	Patient has mild systemic disease
3	Patient has severe systemic disease that is not incapacitating
4	Patient has incapacitating disease that is a constant threat to life
5	A moribund patient who is not expected to live 24 h with or without surgery

E. Emergency surgery, E is placed after the Roman numeral.

In all cancer patients, many who receive PEG for palliative reasons, several studies have assessed the incidence of complications and their predictors^[12,13,28]. Richards *et al.* studied the incidence of PEG complications in all cancer patients, 22% had gastrointestinal cancer, and found a major and minor complication incidence of 8.7% and 37%, respectively; 30-d mortality was 13% while overall mortality was 72%^[12]. Only the overall mortality was inconsistent with mixed populations as would be expected in cancer patients^[42]. The only significant predictor of major complications on multivariate analysis was an American Society of Anesthesiologist (ASA) score of 4/4E/5E (HR = 4.9, $p = 0.0394$); packed red blood cell transfusion was nearly significant (HR = 4.6, $P = 0.0543$). Table 1 describes the ASA physical status classification^[43]. With respect to 30-d mortality, an ASA score 4/4E/5E (HR = 4.66, $P = 0.0292$), advanced tumor stage (HR = 8.22, $P = 0.0362$) and elevated WBC count (HR = 1.17, $P = 0.0060$) were found to be independent predictors. Interestingly, the indication of decompressing a malignant obstruction was an independent predictor of overall mortality (HR = 1.74, $P = 0.031$)^[12]. As may be expected, this data suggests that patients in worse physiologic condition (*e.g.*, higher ASA scores) or with more terminal stages of cancer (*e.g.*, advanced tumor stage), such as patients receiving a PEG for palliative reasons, would potentially have a higher incidence of major complications and 30-d mortality.

Several studies have also evaluated complication rates for only decompressive PEGs in cancer patients. In the recent study performed by Kawata *et al.*^[30] assessing palliative PEG in patients with malignant bowel obstruction deemed ineligible for surgical intervention, 15 of 71 patients (21%) experienced complications, only one of which would be considered a major complication^[30]. This incidence of complications is consistent with previous studies that evaluated decompressive PEGs^[16,26,27,31-35]. In these studies only 1 case of PEG-related death was reported, secondary to peritonitis^[27]. These complication incidences for decompressive PEG with malignant obstruction are comparable with mixed populations. Therefore, while this indication may be a predictor of worse outcomes, likely a reflection of the terminal status of the illness, the procedure itself does not seem to put the patient

with malignant bowel obstruction at undue risk.

CONCLUSION

PEG tube placement may be used in the palliative care of patients with terminal gastrointestinal cancer either as a means to provide enteral nutrition in cases of proximal obstruction or to decompress the upper gastrointestinal tract in cases of distal bowel obstruction. The evidence suggests that PEG can be performed in these patients with a high level of success^[12]. With respect to goal achievement, it is not clear that terminal cancer patients receiving PEG for enteral alimentation will meet their nutritional goals and become independent of TPN. Additionally, considering the goal of palliative care is to provide comfort, it is unclear if PEG placement for nutritional supplementation is consistent with this objective. While nutritional supplementation may help ameliorate suffering involved with starvation and comfort family members faced with this difficult situation, PEG placement for this purpose does not ensure achievement of nutritional goals, may lead to further patient discomfort and could unduly prolong suffering. The decision to place a PEG tube for nutritional supplementation in patients with terminal gastrointestinal cancer involves careful discussion of the potential risks and benefits in addition to understanding the patient's wishes. Patients receiving PEG for decompression of a malignant obstruction, however, clearly have improvement of their obstructive symptoms. Given both the association of major complications with high ASA scores and the association of 30-d mortality with both high ASA scores and advanced tumor stage, it would not be surprising if palliative patients with advanced stage gastrointestinal cancer, who may be in relatively poor physiologic condition, would have a higher incidence of these bad outcomes. However, these poor outcome rates would need to be viewed through the lens of the palliative care ethos whereby the ultimate goal is patient comfort. Undoubtedly, more objective data is needed to determine evidence-based guidelines for palliative PEG placement in patients with gastrointestinal cancer.

REFERENCES

- 1 Spelsberg FW, Hoffmann RT, Lang RA, Winter H, Weidenhagen R, Reiser M, Jauch KW, Trumm C. CT fluoroscopy guided percutaneous gastrostomy or jejunostomy without (CT-PG/PJ) or with simultaneous endoscopy (CT-PEG/PEJ) in otherwise untreatable patients. *Surg Endosc* 2013; **27**: 1186-1195 [PMID: 23232989 DOI: 10.1007/s00464-012-2574-z]
- 2 Gauderer MW, Ponsky JL, Izant RJ. Gastrostomy without laparotomy: a percutaneous endoscopic technique. *J Pediatr Surg* 1980; **15**: 872-875 [PMID: 6780678]
- 3 Dwyer KM, Watts DD, Thurber JS, Benoit RS, Fakhry SM. Percutaneous endoscopic gastrostomy: the preferred method of elective feeding tube placement in trauma patients. *J Trauma* 2002; **52**: 26-32 [PMID: 11791048]
- 4 McClave SA, Ritchie CS. The role of endoscopically placed feeding or decompression tubes. *Gastroenterol Clin North Am* 2006;

- 35: 83-100 [PMID: 16530112 DOI: 10.1016/j.gtc.2005.12.003]
- 5 **Gauderer MW.** Percutaneous endoscopic gastrostomy-20 years later: a historical perspective. *J Pediatr Surg* 2001; **36**: 217-219 [PMID: 11150469]
 - 6 **WHO.** WHO Definition of Palliative Care 2014. The World Health Organization Definition of Palliative Care. Available from: URL: <http://www.who.int/cancer/palliative/definition/en/>
 - 7 **Stedman' Medical Dictionary.** 25th ed. Baltimore: Williams & Wilkins, 1990
 - 8 **Fahy BN.** Palliative care for the surgical oncologist: embracing the palliativist within. *Surgery* 2013; **153**: 1-3 [PMID: 22910488 DOI: 10.1016/j.surg.2012.06.002]
 - 9 **Teitelbaum HS, Travis LD, Heilig DL, Neslund SE, Menze AK, Baker CD, Gragossian A, Mays C, Risner EK.** The epidemiology of hospice and palliative care. *Dis Mon* 2013; **59**: 309-324 [PMID: 23973414 DOI: 10.1016/j.disamonth.2013.05.002]
 - 10 **Rosenberger LH, Newhook T, Schirmer B, Sawyer RG.** Late accidental dislodgement of a percutaneous endoscopic gastrostomy tube: an underestimated burden on patients and the health care system. *Surg Endosc* 2011; **25**: 3307-3311 [PMID: 21533968 DOI: 10.1007/s00464-011-1709-y]
 - 11 **Schrag SP, Sharma R, Jaik NP, Seamon MJ, Lukaszczuk JJ, Martin ND, Hoey BA, Stawicki SP.** Complications related to percutaneous endoscopic gastrostomy (PEG) tubes. A comprehensive clinical review. *J Gastrointestin Liver Dis* 2007; **16**: 407-418 [PMID: 18193123]
 - 12 **Richards DM, Tanikella R, Arora G, Guha S, Dekovich AA.** Percutaneous endoscopic gastrostomy in cancer patients: predictors of 30-day complications, 30-day mortality, and overall mortality. *Dig Dis Sci* 2013; **58**: 768-776 [PMID: 23007733 DOI: 10.1007/s10620-012-2397-8]
 - 13 **Keung EZ, Liu X, Nuzhad A, Rabinowits G, Patel V.** In-hospital and long-term outcomes after percutaneous endoscopic gastrostomy in patients with malignancy. *J Am Coll Surg* 2012; **215**: 777-786 [PMID: 22999329 DOI: 10.1016/j.jamcollsurg.2012.08.013]
 - 14 **Dolan EA.** Malignant bowel obstruction: a review of current treatment strategies. *Am J Hosp Palliat Care* 2011; **28**: 576-582 [PMID: 21504999 DOI: 10.1177/1049909111406706]
 - 15 **Ripamonti C, De Conno F, Ventafridda V, Rossi B, Baines MJ.** Management of bowel obstruction in advanced and terminal cancer patients. *Ann Oncol* 1993; **4**: 15-21 [PMID: 8435356]
 - 16 **Teriaky A, Gregor J, Chande N.** Percutaneous endoscopic gastrostomy tube placement for end-stage palliation of malignant gastrointestinal obstructions. *Saudi J Gastroenterol* 2012; **18**: 95-98 [PMID: 22421713 DOI: 10.4103/1319-3767.93808]
 - 17 **Roeland E, von Gunten CF.** Current concepts in malignant bowel obstruction management. *Curr Oncol Rep* 2009; **11**: 298-303 [PMID: 19508835]
 - 18 **Brooksbank MA, Game PA, Ashby MA.** Palliative venting gastrostomy in malignant intestinal obstruction. *Palliat Med* 2002; **16**: 520-526 [PMID: 12465700]
 - 19 **Feuer DJ, Broadley KE.** Corticosteroids for the resolution of malignant bowel obstruction in advanced gynaecological and gastrointestinal cancer. *Cochrane Database Syst Rev* 2000; **(2)**: CD001219 [PMID: 10796761 DOI: 10.1002/14651858.cd001219]
 - 20 **Mercadante S, Casuccio A, Mangione S.** Medical treatment for inoperable malignant bowel obstruction: a qualitative systematic review. *J Pain Symptom Manage* 2007; **33**: 217-223 [PMID: 17280927 DOI: 10.1016/j.jpainsymman.2006.06.014]
 - 21 **Ang SK, Shoemaker LK, Davis MP.** Nausea and vomiting in advanced cancer. *Am J Hosp Palliat Care* 2010; **27**: 219-225 [PMID: 20197557 DOI: 10.1177/1049909110361228]
 - 22 **Watt AM, Faragher IG, Griffin TT, Rieger NA, Maddern GJ.** Self-expanding metallic stents for relieving malignant colorectal obstruction: a systematic review. *Ann Surg* 2007; **246**: 24-30 [PMID: 17592286 DOI: 10.1097/01.sla.0000261124.72687.72]
 - 23 **Nguyen NP, North D, Smith HJ, Dutta S, Alfieri A, Karlsson U, Lee H, Martinez T, Lemanski C, Nguyen LM, Ludin A, Sallah S.** Safety and effectiveness of prophylactic gastrostomy tubes for head and neck cancer patients undergoing chemoradiation. *Surg Oncol* 2006; **15**: 199-203 [PMID: 17280829 DOI: 10.1016/j.suronc.2006.12.002]
 - 24 **Corry J, Poon W, McPhee N, Milner AD, Cruickshank D, Porceddu SV, Rischin D, Peters LJ.** Prospective study of percutaneous endoscopic gastrostomy tubes versus nasogastric tubes for enteral feeding in patients with head and neck cancer undergoing (chemo)radiation. *Head Neck* 2009; **31**: 867-876 [PMID: 19296528 DOI: 10.1002/hed.21044]
 - 25 **Morton RP, Crowder VL, Mawdsley R, Ong E, Izzard M.** Elective gastrostomy, nutritional status and quality of life in advanced head and neck cancer patients receiving chemoradiotherapy. *ANZ J Surg* 2009; **79**: 713-718 [PMID: 19878166 DOI: 10.1111/j.1445-2197.2009.05056.x]
 - 26 **Campagnutta E, Cannizzaro R, Gallo A, Zarrelli A, Valentini M, De Cicco M, Scarabelli C.** Palliative treatment of upper intestinal obstruction by gynecological malignancy: the usefulness of percutaneous endoscopic gastrostomy. *Gynecol Oncol* 1996; **62**: 103-105 [PMID: 8690280 DOI: 10.1006/gyno.1996.0197]
 - 27 **Herman LL, Hoskins WJ, Shike M.** Percutaneous endoscopic gastrostomy for decompression of the stomach and small bowel. *Gastrointest Endosc* 1992; **38**: 314-318 [PMID: 1607082]
 - 28 **Zera RT, Nava HR, Fischer JI.** Percutaneous endoscopic gastrostomy (PEG) in cancer patients. *Surg Endosc* 1993; **7**: 304-307 [PMID: 8351601]
 - 29 **Shastri YM, Shirodkar M, Mallath MK.** Endoscopic feeding tube placement in patients with cancer: a prospective clinical audit of 2055 procedures in 1866 patients. *Aliment Pharmacol Ther* 2008; **27**: 649-658 [PMID: 18221411 DOI: 10.1111/j.1365-2036.2008.03621.x]
 - 30 **Kawata N, Kakushima N, Tanaka M, Sawai H, Imai K, Hagiwara T, Takao T, Hotta K, Yamaguchi Y, Takizawa K, Matsubayashi H, Ono H.** Percutaneous endoscopic gastrostomy for decompression of malignant bowel obstruction. *Dig Endosc* 2014; **26**: 208-213 [PMID: 23772988 DOI: 10.1111/den.12139]
 - 31 **Stellato TA, Gauderer MW.** Percutaneous endoscopic gastrostomy for gastrointestinal decompression. *Ann Surg* 1987; **205**: 119-122 [PMID: 3813684]
 - 32 **Cannizzaro R, Bortoluzzi F, Valentini M, Scarabelli C, Campagnutta E, Sozzi M, Fornasari M, Poletti M.** Percutaneous endoscopic gastrostomy as a decompressive technique in bowel obstruction due to abdominal carcinomatosis. *Endoscopy* 1995; **27**: 317-320 [PMID: 7555938 DOI: 10.1055/s-2007-1005700]
 - 33 **Scheidbach H, Horbach T, Groitl H, Hohenberger W.** Percutaneous endoscopic gastrostomy/jejunostomy (PEG/PEJ) for decompression in the upper gastrointestinal tract. Initial experience with palliative treatment of gastrointestinal obstruction in terminally ill patients with advanced carcinomas. *Surg Endosc* 1999; **13**: 1103-1105 [PMID: 10556447]
 - 34 **Felsher J, Chand B, Ponsky J.** Decompressive percutaneous endoscopic gastrostomy in nonmalignant disease. *Am J Surg* 2004; **187**: 254-256 [PMID: 14769314 DOI: 10.1016/j.amjsurg.2003.11.002]
 - 35 **Vashi PG, Dahlk S, Vashi RP, Gupta D.** Percutaneous endoscopic gastrostomy tube occlusion in malignant peritoneal carcinomatosis-induced bowel obstruction. *Eur J Gastroenterol Hepatol* 2011; **23**: 1069-1073 [PMID: 21975697]
 - 36 **Larson DE, Burton DD, Schroeder KW, DiMagno EP.** Percutaneous endoscopic gastrostomy. Indications, success, complications, and mortality in 314 consecutive patients. *Gastroenterology* 1987; **93**: 48-52 [PMID: 3108063]
 - 37 **Grant DG, Bradley PT, Pothier DD, Bailey D, Caldera S, Baldwin DL, Birchall MA.** Complications following gastrostomy tube insertion in patients with head and neck cancer: a prospective multi-institution study, systematic review and meta-analysis. *Clin Otolaryngol* 2009; **34**: 103-112 [PMID: 19413607 DOI: 10.1111/j.1749-4486.2009.01889.x]
 - 38 **Ehrsson YT, Langius-Eklöf A, Bark T, Laurell G.** Percutaneous endoscopic gastrostomy (PEG) - a long-term follow-up study in head and neck cancer patients. *Clin Otolaryngol Allied Sci* 2004; **29**: 740-746 [PMID: 15533171 DOI: 10.1111/j.1365-2273.2004.00897.x]
 - 39 **Pruthi D, Duerksen DR, Singh H.** The practice of gastrostomy tube placement across a Canadian regional health authority. *Am*

- J Gastroenterol* 2010; **105**: 1541-1550 [PMID: 20104220 DOI: 10.1038/ajg.2009.756]
- 40 **Rustom IK**, Jebreel A, Tayyab M, England RJ, Stafford ND. Percutaneous endoscopic, radiological and surgical gastrostomy tubes: a comparison study in head and neck cancer patients. *J Laryngol Otol* 2006; **120**: 463-466 [PMID: 16772054 DOI: 10.1017/s0022215106000661]
- 41 **Kwon RS**, Banerjee S, Desilets D, Diehl DL, Farraye FA, Kaul V, Mamula P, Pedrosa MC, Rodriguez SA, Varadarajulu S, Song LM, Tierney WM. Enteral nutrition access devices. *Gastrointest Endosc* 2010; **72**: 236-248 [PMID: 20541746 DOI: 10.1016/j.gie.2010.02.008]
- 42 **Sheehan JJ**, Hill AD, Fanning NP, Healy C, McDermott EW, O'Donoghue DP, O'Higgins NJ. Percutaneous endoscopic gastrostomy: 5 years of clinical experience on 238 patients. *Ir Med J* 2003; **96**: 265-267 [PMID: 14753579]
- 43 **Dripps R**. New classification of physical status. *Anesthesiology* 1963; **24**

P- Reviewer: Classen CF, Nishiwaki S, Venskutonis D

S- Editor: Ji FF **L- Editor:** A **E- Editor:** Wu HL





Published by **Baishideng Publishing Group Inc**

8226 Regency Drive, Pleasanton, CA 94588, USA

Telephone: +1-925-223-8242

Fax: +1-925-223-8243

E-mail: bpgoffice@wjgnet.com

Help Desk: <http://www.wjgnet.com/esps/helpdesk.aspx>

<http://www.wjgnet.com>

