



A Literature Review of Infracolic Gastrostomy Techniques and Outcomes

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Abstract

Percutaneous radiologic gastrostomies are traditionally done using a supracolic approach due to the perceived increased risk of postprocedural hemorrhage associated with an infracolic approach. Many interventional radiologists will decline attempts at placing a gastrostomy tube in situations of colonic interposition, requiring patients to undergo surgery. The goal of this review was to understand the safety and technique of infracolic gastrostomies to assess the validity of these concerns. There were 12 cases of infracolic gastrostomies identified across two retrospective studies and one case report. All gastrostomy tubes were inserted successfully with no abandoned procedures with the only minor variation in technique being that the colon was displaced superiorly as opposed to inferiorly like in the traditional supracolic approach. Across the two retrospective studies, the percentage of infracolic gastrostomies done during the study period was 1.18% (6 out of 508) and 0.43% (5 out of 1,156). There were no immediate postprocedural complications reported in the study done with six patients who underwent infracolic gastrostomies, but there were two deaths during the follow-up period, both of which were attributed to disease progression. In the study with five patients who had undergone infracolic gastrostomies, there was one minor complication of site soreness along with one case of death due to sepsis secondary to aspiration of the barium contrast used to delineate the colon prior to the procedure. This is a rare complication that can occur when a barium swallow is done, especially in this case where the patient was older and had comorbidities that increased the aspiration risk. Evidently, infracolic gastrostomies have been inserted in the past with minimal complications. However, due to the limited sample size, the safety of this technique cannot be established without future prospective studies.

Keywords

- ▶ gastrostomy
- ▶ infracolic
- ▶ supracolic
- ▶ fluoroscopic
- ▶ interventional radiology

Introduction

Percutaneous radiologic gastrostomy (PRG) is becoming the preferred method for providing enteral nutrition to patients because of its excellent safety profile and low costs.¹ When

compared with endoscopic or surgical gastrostomies, PRG has a higher rate of successful tube placement and lower rate of complications, thus making it a valuable alternative to these methods.^{2,3} PRG is conventionally done using a

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supracolic approach where the location of the colon is first delineated using an ultrasound or barium swallow the day prior to the procedure.⁴ The stomach is then punctured above the colon using fluoroscopic guidance to avoid injury to adjacent structures. Gastropexy has become a standard part of PRG insertion using either T-fasteners or suture anchors since previous studies showed it can help reduce leakage and prevent migration of the gastrostomy tube.^{4,5} A modified Seldinger technique is used to insert the gastrostomy tube, with a guidewire being inserted followed by a dilator to widen the tract.^{4,5} The gastrostomy tube is then inserted over the wire via a peel away sheath, and the intragastric component of the tube is confirmed by injecting a contrast medium into the tube.^{4,5}

In cases of colonic interposition between the anterior abdominal wall and the stomach, an infracolic approach has been described.⁶ The first case of an infracolic puncture was presented by Mirich and Gray⁷ in 1989, where they successfully placed a gastrojejunostomy tube in a situation where the transverse colon was anterior to the stomach. Since then, there have been only a few cases of uncomplicated infracolic gastrostomies worldwide. There are concerns with this approach regarding the potential risk to intervening structures, including the colon, gastrocolic ligament, omental bursa, and transverse mesocolon.⁷ The main concern with an infracolic approach is the risk of hemorrhage. The transverse mesocolon is a highly vascularized structure containing the middle colic and marginal arteries.⁷ The anatomical location of the transverse mesocolon makes it necessary for it to be traversed when performing an infracolic gastrostomy, thus increasing the risk of postprocedural hemorrhage.⁷ Additionally, the gastrocolic ligament contains the left and right gastroepiploic arteries that are at risk of being injured when using an infracolic technique.⁷ There is also the possibility of puncturing the colon itself, which may lead to peritonitis.^{8,9}

The perceived increased morbidity associated with this technique causes many interventional radiologists to decline placing an infracolic PRG, which then requires patients to undergo surgery.^{8–11} However, cases of successful infracolic gastrostomy insertion have been documented in the literature. This review aims to assess the safety of infracolic gastrostomies as well as understand the nuances of this

atypical technique and how it compares to the traditional supracolic technique outlined earlier.

Methods

A literature review of all the available literature for PRGs was conducted on October 13, 2022, of Embase and MEDLINE with no restrictions on publication type or date. Variations of the term “gastrostomy,” “fluoroscopy,” or “image-guided” were used. The reference lists of included articles were then searched for any additional studies discussing infracolic gastrostomies. Additionally, a gray literature search was last conducted on November 7, 2022, using the terms “infracolic” and “gastrostomy” on Google, DuckDuckGo, and OpenGrey. Studies with human populations of all ages that used an infracolic approach and discussed its technique, success, or adverse events were included.

Results

Procedure

Prior to inserting an infracolic gastrostomy, it is important to know the exact location of the colon via some method of opacification, whether it be through air inflation during the gastrostomy insertion or barium swallow the day prior to the procedure.⁶ In both studies identified in the literature, a barium swallow was used to opacify the transverse colon the day prior to the procedure.^{8,12} While this method is not required, it can be beneficial to use a contrast agent to visualize the colon. Additionally, the location of the liver can be identified using ultrasound to avoid any injury.^{8,12}

After the location of the colon and liver was identified, the stomach was insufflated with air. This was done using the typical method of injecting 500 to 800 mL of air into the stomach via a nasogastric tube.^{8,12} However, one study used oral effervescent sodium bicarbonate to distend the stomach due to an upper digestive tract obstruction that prevented the insertion of a nasogastric tube.⁶ The end result was the same and the distention of the stomach caused the colon to be displaced superiorly as opposed to inferiorly, like in the traditional supracolic method.¹² Gastropexy was done caudal to the colon using four T-fasteners, and an 18G needle was used to puncture the center point of the gastropexy.^{6,8}

Table 1 Techniques used for insertion of infracolic gastrostomy tube

Authors (year)	Colonic opacification method	Gastric distention method	Guidewire size	Tube size
Marcy et al (2011) ⁶	Not specified	Oral effervescent sodium bicarbonate powder	0.0038-inch Amplatz guidewire	17F
Cantwell et al (2008) ⁸	Oral dilute barium	Nasogastric tube	0.035-inch Amplatz guidewire	14F
Wong et al (2021) ¹²	Oral barium sulfate	Nasogastric tube	Not specified	12F (3) 14F (1) 16F (1)

The location of the needle within the stomach was either confirmed by connecting a syringe to the needle and aspirating air or administering contrast and confirming the location via fluoroscopy.^{8,12} Once the location was confirmed, an Amplatz guidewire (Cook Medical, Bloomington, Indiana, United States) was coiled into the stomach, and dilators were used to widen the tract to allow for the gastrostomy tube to be inserted via peel away sheath.^{6,8,12} The procedure concluded with administration of contrast to confirm the location of the tip of the catheter.⁸ Among the cases in the literature, there were minor variations in technique that are summarized in ►Table 1.

Outcomes

A total of 12 successful cases of infracolic gastrostomy tube insertions were identified in the literature across two retrospective cohort studies and one case report. In one study, 6 out of 508 gastrostomies done at their institution used an infracolic approach, accounting for 1.18% of the total gastrostomies done over a 3-year period.⁸ All gastrostomy tubes were inserted successfully with no abandoned procedures, and there were no immediate postprocedural complications.⁸ The follow-up time for the patients in this study ranged from 7 to 25 months, and there were two deaths during this time, both of which occurred after the gastrostomy tube had been removed and thus were attributed to disease progression.⁸

Similarly, another study showed successful use of an infracolic approach in 5 out of 1,156 total gastrostomies in an 8-year period, which accounts for only 0.43% of total gastrostomies.¹² The only immediate postprocedural complication was site soreness in one patient, which was easily managed with acetaminophen.¹² The follow-up period in this study ranged from 7 days to 54 months, during which one patient died.¹² This death occurred 19 days after the procedure and was due to sepsis caused by aspiration of the barium used to locate the colon prior to the tube insertion.¹² The outcomes of each study are shown in ►Table 2.

Discussion

Infracolic gastrostomies remain controversial because of their perceived safety issues. This review assessed whether it was possible to insert infracolic gastrostomies in a safe manner, as well as aimed to understand how this technique is performed.

The results show across all three identified studies, infracolic gastrostomies were inserted successfully with no abandoned procedures. In the study done by Cantwell et al,⁸ there were no incidences of postprocedural complications with only two deaths attributed to disease progression. They did not experience any cases of bowel perforation or hemorrhage as is thought to occur with infracolic gastrostomies, allowing them to conclude that this is a feasible technique for inserting gastrostomy tubes. The study done by Wong et al¹² did show one complication of postprocedural site soreness. According to the classification guidelines for adverse events set by the Society of Interventional Radiology (SIR), this

Table 2 Characteristics of retrospective cohort studies detailing adverse events of infracolic gastrostomies

Authors (year)	Study period	No. of patients and mean age	FU period	Indication for infracolic gastrostomy	No. with successful insertion	No. of patients with immediate complications postinsertion	No. of patients with adverse events during FU	Risk of bias
Cantwell et al (2008)	3 y	6 and 57	7–25 mo	Head and neck cancer (4) ALS (1) Stroke (1)	6	0	2—death	Low
Wong et al (2021)	8 y	5 and 79	7 d–54 mo	Head and neck cancer	5	1—site soreness	1—death	Low

Abbreviations: ALS, amyotrophic lateral sclerosis; FU, follow-up.

complication would be deemed minor.¹³ Site soreness is a very common complication of gastrostomies in general and is not unique to the infracolic technique. Previous studies that made use of the standard supracolic technique have reported several incidences of pain at the site of tube insertion, especially when a gastropepy is done.^{14,15} Whether the site soreness was due to the infracolic technique or the gastropepy is unable to be determined. There was also one death during the follow-up period, which was due to the barium swallow used to delineate the colon. According to the SIR criteria, this would be a major complication.¹³ However, this complication is not unique to the infracolic technique and instead is a rare complication that can occur when a barium swallow is done to delineate the colon.¹⁶ Additionally, this patient's older age of 84 years and background of laryngeal cancer likely put them at an increased risk of aspiration which contributed to their death.¹⁷ Overall, within the limited sample size, the results do not support the assumption of increased hemorrhage or colonic perforation risk thought to be associated with infracolic gastrostomies.

The literature showed the technique of infracolic gastrostomies to be nearly identical to the traditional supracolic method. The only major difference being the colon was displaced inferiorly as opposed to superiorly after gastric insufflation.^{6,8,12} The process for both techniques consists of identifying the location of the colon and liver, insufflating the stomach, insertion of the tube using the Seldinger method, and then inserting a contrast medium to confirm the location of the tube. Gastropepy was also done in all the identified studies from the literature.^{6,8,12} There have been some concerns regarding gastropepy in the case of infracolic gastrostomies because there is a greater tract length from the skin to the stomach when inserting the tube below the colon.⁸ This creates the potential for bowel injury and hemorrhage as it must cross the same path as major vessels of the colon and omentum.⁸ However, these concerns were not supported by the studies found in the literature. It is evident, the procedure for an infracolic gastrostomy is very similar to the traditional supracolic procedure. While all three studies made use of fluoroscopy for gastric access, there have been recommendations to use computed tomography (CT) when obtaining gastric access.⁵ CT is useful for identifying the regional and vascular anatomy, thus avoiding inadvertent perforation.¹²

There are a few limitations to this literature review with the most significant being the small number of studies that were found in the literature, as well as the small sample size of each study. Having only three studies outlining a total of 12 cases of infracolic gastrostomies makes it difficult to make conclusions about the safety or efficacy of this technique. Additionally, each of these studies was retrospective in nature and lacked a comparator group, which further reduces the power of the evidence.

Conclusion

In conclusion, the literature shows 12 successful cases of infracolic gastrostomy insertions with a few complications that are also common when using a traditional supracolic

approach. However, due to the limited number of cases, it is difficult to comment on whether this technique is one that can be done safely. Future studies assessing the outcomes of infracolic gastrostomies must be done to definitively determine whether this technique compares to the traditional supracolic method before advocating for interventional radiologists to attempt to place infracolic gastrostomies. Sana Rashid,¹ Harun Jalil,² Alaaeldin Ginawi,² Oleg Mironov,^{1,3} Syed Umair Mahmood

Authors' Contribution

S.R. contributed to literature search and primary write-up. H.J. helped in literature search. A.G. and O.M. helped in editing. S.U.M. is the principal investigator, and helped in idea conception and editing.

Conflict of Interest

None declared.

References

- Given MF, Hanson JJ, Lee MJ. Interventional radiology techniques for provision of enteral feeding. *Cardiovasc Intervent Radiol* 2005; 28(06):692–703
- Martinez Garcia RJ, Lindquister W, Dhangana R, Warhadpande S, Amesur N. An expanding role for interventional radiology: Medicare trends in fluoroscopic, endoscopic, and surgical enteric tube placement and maintenance from 2010 to 2018. *Clin Imaging* 2021;78:201–205
- Wollman B, D'Agostino HB, Walus-Wigle JR, Easter DW, Beale A. Radiologic, endoscopic, and surgical gastrostomy: an institutional evaluation and meta-analysis of the literature. *Radiology* 1995; 197(03):699–704
- Özmen MN, Akhan O. Percutaneous radiologic gastrostomy. *Eur J Radiol* 2002;43(03):186–195
- Shin JH, Park A-W. Updates on percutaneous radiologic gastrostomy/gastrojejunostomy and jejunostomy. *Gut Liver* 2010;4 (Suppl 1):S25–S31
- Marcy P-Y, Lacout A, Figl A, Thariat J. Re: tips and tricks of percutaneous gastrostomy under image guidance in patients with limited access. *Korean J Radiol* 2011;12(05):648–649, author reply 650
- Mirich DR, Gray RR. Infracolic percutaneous gastrojejunostomy: technical note. *Cardiovasc Intervent Radiol* 1989;12(06):340–341
- Cantwell CP, Gervais DA, Hahn PF, Mueller PR. Feasibility and safety of infracolic fluoroscopically guided percutaneous radiologic gastrostomy. *J Vasc Interv Radiol* 2008;19(01):129–132
- Ignotus P, Gray R, Pugash R. Infracolic percutaneous gastrojejunostomy. *Radiology* 1992;183(02):583
- de Baere T, Chapot R, Kuoch V, et al. Percutaneous gastrostomy with fluoroscopic guidance: single-center experience in 500 consecutive cancer patients. *Radiology* 1999;210(03):651–654
- Dewald CL, Hiette PO, Sewall LE, Fredenberg PG, Palestrant AM. Percutaneous gastrostomy and gastrojejunostomy with gastropepy: experience in 701 procedures. *Radiology* 1999;211(03):651–656
- Wong J-J, Ganti S, Mullan D, Edwards D, Laasch H-U. Infra-colic gastrostomy: technique and anatomical considerations. *Int J Gastrointest Interv.* 2021;10(01):12–16
- Khalilzadeh O, Baerlocher MO, Shyn PB, et al. Proposal of a new adverse event classification by the Society of Interventional Radiology Standards of Practice Committee. *J Vasc Interv Radiol* 2017;28(10):1432–1437.e3
- Thornton FJ, Fotheringham T, Haslam PJ, McGrath FP, Keeling F, Lee MJ. Percutaneous radiologic gastrostomy with and without

- T-fastener gastropepy: a randomized comparison study. Cardio-
vasc Intervent Radiol 2002;25(06):467–471
- 15 Shand AG, Wild SR, Grieve DC, Evans J, Pendlebury J, Ghosh S.
Radiological insertion of gastrostomy in patients in whom en-
dосcopy was unsuccessful. Dig Liver Dis 2002;34(04):298–301
- 16 Gonzalez J, Sheer AJ, Lo MC. When barium goes down the wrong
pipe: a severe case of aspiration pneumonitis. J Gen Intern Med
2022;37(05):1295–1295
- 17 Perona F, Castellazzi G, De Iuliis A, Rizzo L. Percutaneous radiologic
gastrostomy: a 12-year series. Gut Liver 2010;4(Suppl 1):S44–S49