

Current Management of Benign Gastric Outlet Obstruction: Narrative Review Article

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Abstract: Benign gastric outlet obstruction is a rare condition that is seen and its causes obstruction of the pylorus. Peptic ulcer disease accounts for the most common cause for benign gastric outlet obstruction. The diagnosis is confirmed by imaging modalities like upper gastrointestinal contrast series or computerized tomography. The treatment of benign gastric outlet obstruction is divided into endoscopic or surgical treatment. Endoscopic balloon dilatation is the most common primary treatment for benign gastric outlet obstruction with surgical therapy being reserved for failure of endoscopic treatment. Surgical therapy involves performing a vagotomy and a drainage procedure like a pyloroplasty or gastrojejunostomy. We have conducted this review article to look at the diagnosis and treatment of benign gastric outlet obstruction.

Keywords: Gastric outlet obstruction, Pyloric stenosis, peptic ulcer disease, endoscopic balloon dilatation and gastrojejunostomy.

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INTRODUCTION

Gastric outlet obstruction is a condition that is caused by mechanical obstruction of the distal stomach, pylorus and duodenum. The causes can be divided into benign and malignant conditions with gastric cancer accounting for the most common cause for malignant gastric outlet obstruction. Peptic ulcer disease is the most common benign cause followed by caustic ingestion, acute pancreatitis, non-steroidal anti-inflammatory drug (NSAID) usage, post-surgical strictures and infections like tuberculosis (Koop *et al.*, 2019; Maharshi *et al.*, 2016). The incidence of benign gastric outlet obstruction is less than 5% and the clinical presentation is with nausea, vomiting, epigastric pain, abdominal distension and weight loss. A succussion splash may be demonstrated by auscultation of a splash which reflects retained gastric material after four hours of ingestion (Kochhar, 2011).

The diagnosis of gastric outlet obstruction can be confirmed by performing an upper gastrointestinal contrast series or a computerized tomography. These imaging modalities will locate the site of obstruction, but

it will not identify the cause. Esophagogastroduodenoscopy (OGDS) is used to identify the site, degree of obstruction and the pathology of stenosis. Biopsies may also be taken to establish the diagnosis. Failure to pass a 9-11mm endoscope through the stenosis will confirm the diagnosis of gastric outlet obstruction (Jawa & Mercer, 2013; Milosavljevic *et al.*, 2011). The overall prevalence of helicobacter pylori infection rate in patients with benign gastric outlet obstruction is 69%. Patients with gastric outlet obstruction helicobacter pylori positive should undergo eradication therapy as it is helpful in the management of this condition, but ultimately patients will require some form of definitive endoscopic or surgical treatment (Gisbert & Pajares, 2002).

The management of benign gastric outlet obstruction initial begins with intra-venous fluids and inserting a Ryles tube and decompressing the stomach. Intra-venous proton pump inhibitors are also started, to correct any fluid and electrolyte abnormality. Definitive management of benign gastric outlet obstruction is by endoscopic or surgical management. Endoscopic

management involves endoscopic ballon dilatation of the pyloric stricture, and this is performed with a gradual increase in the endoscopic ballon size. The success rate of this procedure is at 50% and the main complication is perforation. The surgical management involves performing a vagotomy with a drainage procedure. The vagotomy can be performed as a truncal, selective or highly selective vagotomy. The most common drainage procedure performed is a pyloroplasty or a gastrojejunostomy. Partial gastrostomies are seldom performed for benign gastric outlet obstruction (Dada & Fuhrman, 2011; Ellis & Ch, 1987; Barksdale *et al.*, 2002; Jaka *et al.*, 2013; Khullar, 1996.).

The American Society of Gastrointestinal Endoscopy (ASGE) concluded that the etiology of gastric outlet obstruction, the length of the stricture, the response to endoscopic ballon dilatation and the comorbidities of the patient are important factors when deciding on what is the best management of patients who present with benign gastric outlet obstruction (Jue *et al.*, 2021).

As there is no current consensus in the management of benign gastric outlet obstruction with regards to the role of endoscopic treatment of this

condition, the role of endoscopic ballon dilatation and other endoscopic procedures like endoscopic ultrasound gastrojejunostomy (EUS-gastrojejunostomy) are investigated. The surgical management of benign gastric outlet obstruction is investigated, including the role of vagotomy, pyloroplasty and gastrojejunostomy. We have conducted this review article looking for answers for all these factors in the management of benign gastric outlet obstruction. We conducted a literature review using PUBMED, the Cochrane database of systemic reviews, Google scholar and semantic scholar looking for randomized control trials, non-randomized trials, observational and cohort studies, clinical reviews, systemic reviews, and meta-analysis from 1980 to 2024. The following keywords were used, “gastric outlet obstruction”, “pyloric stenosis”, “peptic ulcer disease”, “endoscopic ballon dilatation” and “gastrojejunostomy”. All articles were in English, and all articles were assessed by manual cross referencing of the literature. Commentaries, case reports and editorials were excluded from this review. Adult male and female patients were included in this study and pediatric patients were excluded.

Image I

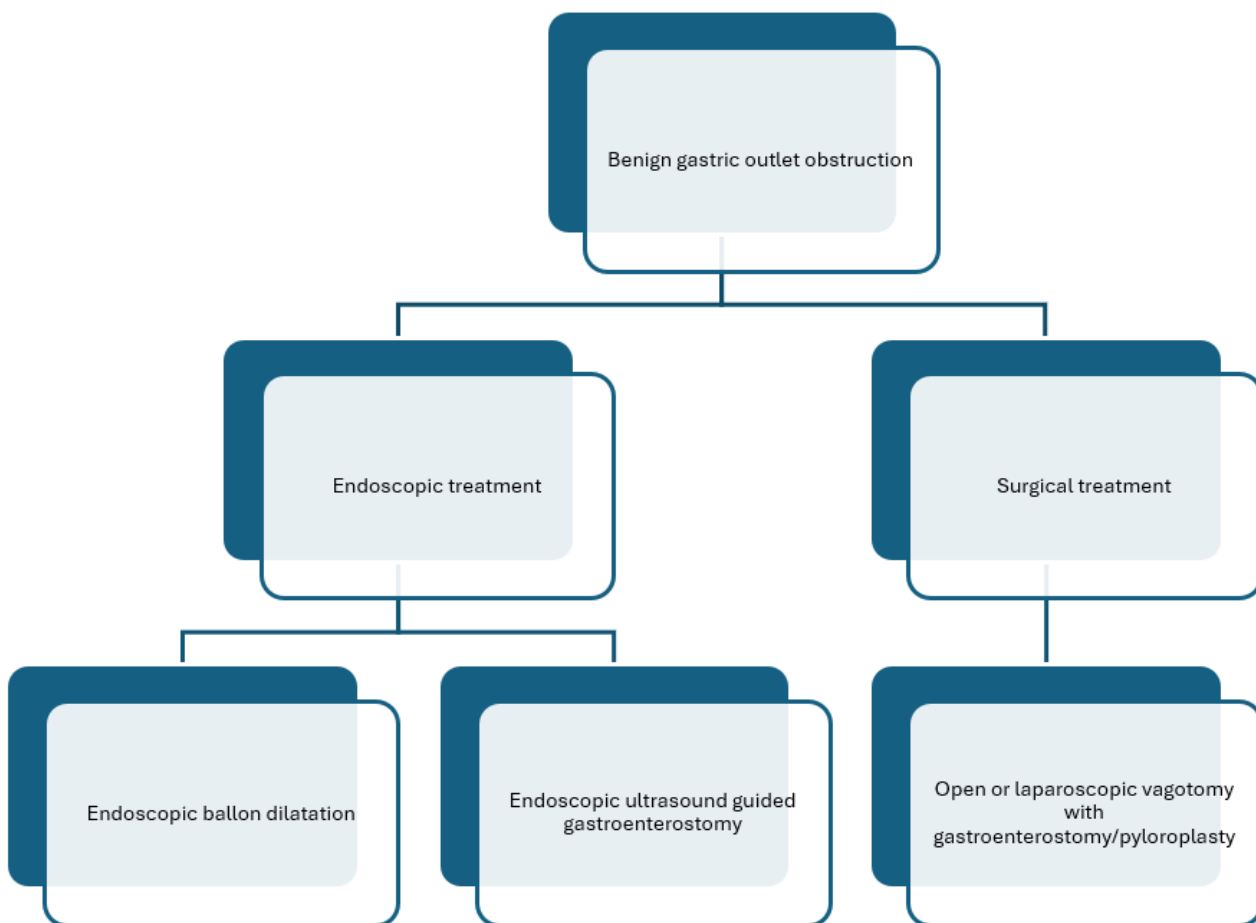


Image showing the algorithm for treatment of benign gastric outlet obstruction

DISCUSSION

Endoscopic Ballon Dilatation for Benign Gastric Outlet Obstruction

Endoscopic ballon dilatation is a minimally invasive endoscopic procedure that is used to treat benign gastric outlet obstruction. For patients with benign gastric outlet obstruction secondary to peptic ulcer disease it is combined with helicobacter pylori eradication therapy. The procedure involves passage of the ballon over the stricture and inflating the ballon for 1 to 2 minutes. A series of ballons of various diameters are then used and the success of the procedure was confirmed by the passage of the endoscope into the duodenum. The immediate success rate of endoscopic ballon dilatation was 80% to 100% and the main complications were perforation and bleeding (Cherian *et al.*, 2007; Hamzaoui *et al.*, 2015; Iliklerden *et al.*, 2021; Yusuf & Brugge, 2006). The recurrence rate of endoscopic ballon dilatation is high with patients who have undergone long term follow up with these patients requiring surgical intervention. The use of larger ballon can decrease the recurrence rate, but they are associated with a higher risk of complications like perforation. Those patients who were positive for helicobacter pylori and underwent eradication therapy were associated with fewer complication(Bo Ylan *et al.*, 1999.; Lam *et al.*, 2004).

Endoscopic ballon dilatation has also been shown to be effective in the management of gastric outlet obstruction secondary to caustic strictures. It is a good alternative form of therapy as it is associated with reduced complications like perforation and bleeding. However, these patients will require more endoscopic dilatation sessions, and the recurrence rate is higher when compared to gastric outlet obstruction secondary to peptic ulcer disease (Tringali *et al.*, 2019). Patients with Non-steroidal anti-inflammatory drug (NSAID) induced gastric outlet obstruction can also be treated with endoscopic ballon dilatation. These drugs induced strictures can affect the pylorus and the duodenal bulb and endoscopic ballon dilatation was found to be effective in its management (Kochhar *et al.*, 2011).

Kochhar *et al.*, retrospectively assessed the efficacy of endoscopic ballon dilatation for the management of gastric outlet obstruction and they concluded that it was effective for the management of benign gastric outlet obstruction secondary to peptic ulcer disease and caustic ingestion but not against gastric outlet obstruction secondary to chronic pancreatitis (Kochhar *et al.*, 2004). Supplementary techniques like intralesional steroid injection and endoscopic incision have been attempted to improve endoscopic ballon dilatation especially in benign gastric outlet obstruction secondary to caustic injury, but clinical data is lacking on its efficacy(Kochhar, 2010).

Some studies have looked at the long term efficacy of endoscopic ballon dilatation for benign

gastric outlet obstruction and they concluded that an average of 1.5 to 3 dilatation sessions are required to reduce the recurrence rate and the size of the ballon should be 15mm.The immediate short term success rate was up to 100% but the relapse rate was high with up to 30% of patients requiring surgical intervention (Solt *et al.*, 2003.; Zare *et al.*, 2019).

Endoscopic Ultrasound Guided Gastroenterostomy

Endoscopic ultrasound guided gastroenterostomy with a lumen apposing metal stent is minimally invasive procedure to manage benign gastric outlet obstruction. This procedure involves placement of a metallic stent to connect the stomach with the distal small bowel, effectively bypassing the obstruction. The location of the site of obstruction is important when deciding on performing this procedure (Storm & Ryou, 2017; Ziogas *et al.*, 2024). Chen *et al.*, retrospectively assessed its efficacy in the management of benign gastric outlet obstruction and they concluded that endoscopic ultrasound guided gastroenterostomy was a useful form of therapy in patients who underwent treatment failure from endoscopic ballon dilatation. The duration of stent placement and the need for removal are an area of concern but the procedure shows minimal morbidity when performed by experienced persons (Chen *et al.*, 2018).

A systemic review and meta-analysis on the clinical outcomes of endoscopic ultrasound guided gastroenterostomy in the management of benign gastric outlet obstruction was conducted by Fan *et al.*, Ten studies with 297 patients were included in the study, and the clinical success rate was 88% and the complication rate was 6.8%. The most common complication was bleeding and abdominal pain. This study concluded that endoscopic ultrasound guided gastroenterostomy was a safe and effective minimally invasive procedure in the management of benign gastric outlet obstruction (Fan *et al.*, 2020). Another systemic review and meta-analysis was conducted by Iqbal *et al.*, on the use of endoscopic ultrasound guided management of gastric outlet obstruction.12 studies with 285 patients were included in this study and the success rate was 90% and the complication rate was 9%. This study concluded that endoscopic ultrasound guided gastroenterostomy was safe and effective in the management of gastric outlet obstruction (Iqbal *et al.*, 2020).

Endoscopic ultrasound guided gastroenterostomy was compared with surgical gastroenterostomy in the management of gastric outlet obstruction in a systemic review and meta-analysis by Kumar *et al.*, Seven studies with 625 patients were included of which 372 underwent endoscopic ultrasound guided gastroenterostomy and 253 underwent surgical gastroenterostomy. This study concluded that endoscopic ultrasound guided gastroenterostomy was associated with a shorter procedure time, minimal complications rate and earlier recovery when compared

with surgical gastroenterostomy. The overall success rate was similar between both the procedures with regards to the outcome of gastric outlet obstruction (Kumar *et al.*, 2022).

Surgical Management of Benign Gastric Outlet Obstruction

Surgical management of benign gastric outlet obstruction should be considered once there is failure of endoscopic therapy. The surgical treatment of peptic ulcer disease induced gastric outlet obstruction includes an acid suppression procedure and a bypass procedure. The common acid suppression procedures include a truncal vagotomy, selective vagotomy and a highly selective vagotomy. The common bypass procedures that are performed include the pyloromyotomy, pyloroplasty and gastrojejunostomy. A subtotal or total gastrectomy is performed only if there are failure of these surgical options. The truncal vagotomy is associated with complications like diarrhea and pyloric dysfunction, and these complications are reduced with the selective and highly selective vagotomy (Millat *et al.*, 2000; Miller & Schwartzberg, 2014; Saydi & Todd, 2018).

One of the common drainage procedures that are performed is a pyloroplasty, which is included with a truncal vagotomy. There are two types of pyloroplasty, the Finney and the Heineke-Mikulicz method. The Heineke-Mikulicz procedure involves making a linear incision on the pylorus and closure of the defect in a transverse manner to establish continuity from the stomach to the duodenum. The Finney procedure involves a horseshoe incision on the antrum to the duodenum, and the closure is done transversely (Søreide *et al.*, 2006). Gastrojejunostomy is another surgical drainage procedure that can be performed for benign gastric outlet obstruction. It can be performed as an open or laparoscopic procedure and it is associated with better long-term outcomes (Papanikolaou & Siersema, 2022).

A retrospective study was conducted by Palanivelu *et al.*, on the laparoscopic management of complicated peptic ulcer disease. A total of 142 patients had undergone a truncal vagotomy with a gastrojejunostomy. The average operative time ranged from 72 hours to 140 hours and the average stay in the hospital was 5 days. There were minimal post operative morbidity and mortality, and this study showed that laparoscopic gastrojejunostomy was a viable option in the management of gastric outlet obstruction (Palanivelu *et al.*, 2006). Another retrospective study by Zhang *et al.*, on the role of laparoscopic gastrojejunostomy for the treatment of gastric outlet obstruction concluded that there was intraoperative blood, earlier oral intake and shorter length of hospital stay. This study showed that laparoscopic gastroenterostomy was safe and comparable to open gastroenterostomy in the management of gastric outlet obstruction (Zhang *et al.*, 2011).

CONCLUSION

The management of benign gastric outlet obstruction has seen a change over the past decade with the introduction of proton pump inhibitors in the management of peptic ulcer disease. As peptic ulcer disease still accounts as the most common cause of benign gastric outlet obstruction, endoscopic management in the form of balloon dilatation is the primary form of treatment with helicobacter pylori eradication therapy. Surgical management is reserved for those that have failed endoscopic management and the most common surgical procedure is a truncal vagotomy followed by a gastroenterostomy. Total and subtotal gastrostomies are rarely performed as they are invasive and associated with a high morbidity and mortality. Endoscopic procedures like endoscopic ultrasound gastroenterostomy are slowly being introduced as they are minimally invasive and associated with reduced morbidity and mortality. With advancement of endoscopic therapy, there is a reducing trend in the role of open surgery in the management of benign gastric outlet obstruction. Surgical therapy will still have a role in the management of advanced gastric outlet obstruction.

Conflict of Interest: There is no conflict of interest.

REFERENCES

- Boylan, J. J., & Gradzka, M. I. (1999). Long-term results of endoscopic balloon dilatation for gastric outlet obstruction. *Digestive diseases and sciences*, *44*(9), 1883–1886. <https://doi.org/10.1023/a:1018807125952>
- Chen, Y.-I., James, T., Agarwal, A., Baron, T., Itoi, T., Kunda, R., Nieto, J., Bukhari, M., Gutierrez, O., Sanaei, O., Moran, R., Fayad, L., & Khashab, M. (2018). EUS-guided gastroenterostomy in management of benign gastric outlet obstruction. *Endoscopy International Open*, *06*(03), E363–E369. <https://doi.org/10.1055/s-0043-123468>
- Cherian, P. T., Cherian, S., & Singh, P. (2007). Long-term follow-up of patients with gastric outlet obstruction related to peptic ulcer disease treated with endoscopic balloon dilatation and drug therapy {A figure is presented}. *Gastrointestinal Endoscopy*, *66*(3), 491–497. <https://doi.org/10.1016/j.gie.2006.11.016>
- Dada, S. A., & Fuhrman, G. M. (2011). Miscellaneous disorders and their management in gastric surgery: Volvulus, carcinoid, lymphoma, gastric varices, and gastric outlet obstruction. In *Surgical Clinics of North America* (Vol. 91, Issue 5, pp. 1123–1130). <https://doi.org/10.1016/j.suc.2011.06.011>
- Ellis H. (1987). Pyloric stenosis complicating duodenal ulceration. *World journal of surgery*, *11*(3), 315–318. <https://doi.org/10.1007/BF01658108>

- Fan, W., Tan, S., Wang, J., Wang, C., Xu, H., Zhang, L., Liu, L., Fan, Z., & Tang, X. (2020). Clinical outcomes of endoscopic ultrasound-guided gastroenterostomy for gastric outlet obstruction: a systematic review and meta-analysis. In *Minimally Invasive Therapy and Allied Technologies* (pp. 1–9). Taylor and Francis Ltd. <https://doi.org/10.1080/13645706.2020.1792500>
- Barksdale, A.R., & Schwartz, R.W. (2002). The evolving management of gastric outlet obstruction from peptic ulcer disease. *Current surgery*, 59 4, 404-9.
- Gisbert, J. P., & Pajares, J. M. (2002). Review article: Helicobacter pylori infection and gastric outlet obstruction - Prevalence of the infection and role of antimicrobial treatment. In *Alimentary Pharmacology and Therapeutics* (Vol. 16, Issue 7, pp. 1203–1208). <https://doi.org/10.1046/j.1365-2036.2002.01275.x>
- Hamzaoui, L., Bouassida, M., Ben Mansour, I., Medhioub, M., Ezzine, H., Touinsi, H., & Azouz, M. M. (2015). Balloon dilatation in patients with gastric outlet obstruction related to peptic ulcer disease. *Arab Journal of Gastroenterology*, 16(3–4), 121–124. <https://doi.org/10.1016/j.ajg.2015.07.004>
- Iliklerden, Ü. H., Kalayci, T., & Kotan, M. Ç. (2021). Benign gastric outlet obstruction surgery: A tertiary center experience. *Eastern Journal of Medicine*, 26(3), 450–456. <https://doi.org/10.5505/ejm.2021.47354>
- Iqbal, U., Khara, H. S., Hu, Y., Kumar, V., Tufail, K., Confer, B., & Diehl, D. L. (2020). EUS-guided gastroenterostomy for the management of gastric outlet obstruction: A systematic review and meta-analysis. In *Endoscopic Ultrasound* (Vol. 9, Issue 1, pp. 16–23). Spring Media. https://doi.org/10.4103/eus.eus_70_19
- Jaka, H., McHembe, M. D., Rambau, P. F., & Chalya, P. L. (2013). Gastric outlet obstruction at Bugando Medical Centre in Northwestern Tanzania: A prospective review of 184 cases. *BMC Surgery*, 13(1). <https://doi.org/10.1186/1471-2482-13-41>
- Jawa, R. S., & Mercer, D. W. (2013). Gastric outlet obstruction. In *Common Problems in Acute Care Surgery* (pp. 227–248). Springer New York. https://doi.org/10.1007/978-1-4614-6123-4_18
- Jue, T. L., Storm, A. C., Naveed, M., Fishman, D. S., Qumseya, B. J., McRee, A. J., Truty, M. J., Khashab, M. A., Agrawal, D., Al-Haddad, M., Amateau, S. K., Buxbaum, J. L., Calderwood, A. H., DeWitt, J., DiMaio, C. J., Fujii-Lau, L. L., Gurudu, S. R., Jamil, L. H., Kwon, R. S., ... Wani, S. B. (2021). ASGE guideline on the role of endoscopy in the management of benign and malignant gastroduodenal obstruction. *Gastrointestinal Endoscopy*, 93(2), 309-322.e4. <https://doi.org/10.1016/j.gie.2020.07.063>
- Khullar, S. K., & DiSario, J. A. (1996). Gastric outlet obstruction. *Gastrointestinal endoscopy clinics of North America*, 6(3), 585–603
- Appasani, S., Kochhar, S., Nagi, B., Gupta, V., & Kochhar, R. (2011). Benign gastric outlet obstruction--spectrum and management. *Tropical gastroenterology: official journal of the Digestive Diseases Foundation*, 32(4), 259–266.
- Kochhar, R. (2010). Endoscopic balloon dilation for benign gastric outlet obstruction in adults. *World Journal of Gastrointestinal Endoscopy*, 2(1), 29. <https://doi.org/10.4253/wjge.v2.i1.29>
- Kochhar, R., Sethy, P. K., Nagi, B., & Wig, J. D. (2004). Endoscopic balloon dilatation of benign gastric outlet obstruction. *Journal of gastroenterology and hepatology*, 19(4), 418–422. <https://doi.org/10.1111/j.1440-1746.2003.03283.x>
- Kochhar, R., Noor, M. T., Dixit, P., Nagi, B., Dutta, U., Singh, K., & Poornachandra, K. S. (2011). NSAIDs-related pyloroduodenal obstruction and its endoscopic management. *Diagnostic and Therapeutic Endoscopy*. <https://doi.org/10.1155/2011/967957>
- Koop, A. H., Palmer, W. C., & Stancampiano, F. F. (2019). Gastric outlet obstruction: A red flag, potentially manageable. In *Cleveland Clinic Journal of Medicine* (Vol. 86, Issue 5, pp. 345–353). Cleveland Clinic Educational Foundation. <https://doi.org/10.3949/ccjm.86a.18035>
- Kumar, A., Chandan, S., Mohan, B. P., Atla, P. R., McCabe, E. J., Robbins, D. H., Trindade, A. J., & Benias, P. C. (2022). EUS-guided gastroenterostomy versus surgical gastroenterostomy for the management of gastric outlet obstruction: a systematic review and meta-analysis. *Endoscopy International Open*, 10(04), E448–E458. <https://doi.org/10.1055/a-1765-4035>
- Lam, Y. H., Yun-wong Lau, J., Ming-kit Fung, T., Kwok-wai Ng, E., Kin-hung Wong, S., Jao-yiu Sung, J., & Sheung-chee Chung, S. (2004). Endoscopic balloon dilation for benign gastric outlet obstruction with or without Helicobacter pylori infection. *Gastrointestinal Endoscopy*, 60(2), 229–233. [https://doi.org/10.1016/S0016-5107\(04\)01569-X](https://doi.org/10.1016/S0016-5107(04)01569-X)
- Solt, J., Bajor, J., Szabó, M., & Horváth, O. P. (2003). Long-term results of balloon catheter dilation for benign gastric outlet stenosis. *Endoscopy*, 35(6), 490–495. <https://doi.org/10.1055/s-2003-39664>
- Maharshi, S., Puri, A. S., Sachdeva, S., Kumar, A., Dalal, A., & Gupta, M. (2016). Aetiological spectrum of benign gastric outlet obstruction in India: new trends. *Tropical Doctor*, 46(4), 186–191. <https://doi.org/10.1177/0049475515626032>
- Millat, B., Fingerhut, A., & Borie, F. (2000). Surgical treatment of complicated duodenal ulcers: Controlled trials. *World Journal of Surgery*, 24(3), 299–306. <https://doi.org/10.1007/s002689910048>
- Miller, A., & Schwaitzberg, S. (2014). Surgical and Endoscopic Options for Benign and Malignant Gastric Outlet Obstruction. *Current Surgery*

- Reports*, 2(4). <https://doi.org/10.1007/s40137-014-0048-z>
- Milosavljevic, T., Kostić-Milosavljević, M., Jovanović, I., & Krstić, M. (2011). Complications of peptic ulcer disease. *Digestive Diseases*, 29(5), 491–493. <https://doi.org/10.1159/000331517>
 - Palanivelu, C., Jani, K., Rajan, P. S., Kumar, K. S., Madhankumar, M. V., & Kavalakat, A. (2006). Laparoscopic management of acid peptic disease. *Surgical laparoscopy, endoscopy & percutaneous techniques*, 16(5), 312–316. <https://doi.org/10.1097/01.sle.0000213742.70030.96>
 - Papanikolaou, I. S., & Siersema, P. D. (2022). Gastric Outlet Obstruction: Current Status and Future Directions. In *Gut and Liver* (Vol. 16, Issue 5, pp. 667–675). Editorial Office of Gut and Liver. <https://doi.org/10.5009/gnl210327>
 - Saydi, J., & Todd, S. R. (2018). Benign and malignant gastric outlet obstruction. In *Emergency General Surgery: A Practical Approach* (pp. 111–120). Springer International Publishing. https://doi.org/10.1007/978-3-319-96286-3_9
 - Søreide, K., Sarr, M. G., & Søreide, J. A. (2006). Pyloroplasty for benign gastric outlet obstruction--indications and techniques. *Scandinavian journal of surgery: SJS: official organ for the Finnish Surgical Society and the Scandinavian Surgical Society*, 95(1), 11–16. <https://doi.org/10.1177/145749690609500103>
 - Storm, A. C., & Ryou, M. (2017). Advances in the endoscopic management of gastric outflow disorders. In *Current Opinion in Gastroenterology* (Vol. 33, Issue 6, pp. 455–460). Lippincott Williams and Wilkins. <https://doi.org/10.1097/MOG.0000000000000403>
 - Tringali, A., Giannetti, A., & Adler, D. G. (2019). Endoscopic management of gastric outlet obstruction disease. In *Annals of Gastroenterology* (Vol. 32, Issue 4, pp. 330–337). Hellenic Society of Gastroenterology. <https://doi.org/10.20524/aog.2019.0390>
 - Yusuf, T. E., & Brugge, W. R. (2006). Endoscopic therapy of benign pyloric stenosis and gastric outlet obstruction. *Current opinion in gastroenterology*, 22(5), 570–573. <https://doi.org/10.1097/01.mog.0000239874.13867.41>
 - Zare, E., Raeisi, H., Honarvar, B., & Lankarani, K. B. (2019). Long-term results of endoscopic balloon dilatation for gastric outlet obstruction caused by peptic ulcer disease. *Middle East Journal of Digestive Diseases*, 11(4), 219–225. <https://doi.org/10.15171/mejdd.2019.152>
 - Zhang, L. P., Tabrizian, P., Nguyen, S., Telem, D., & Divino, C. (2011). Laparoscopic gastrojejunostomy for the treatment of gastric outlet obstruction. *Journal of the Society of Laparoendoscopic Surgeons*, 15(2), 169–173. <https://doi.org/10.4293/108680811X13022985132074>
 - Ziogas, D., Vasilakis, T., Kapizioni, C., Koukoulioti, E., Tziatzios, G., Gkolfakis, P., Facciorusso, A., & Papanikolaou, I. S. (2024). Revealing Insights: A Comprehensive Overview of Gastric Outlet Obstruction Management, with Special Emphasis on EUS-Guided Gastroenterostomy. In *Medical sciences (Basel, Switzerland)* (Vol. 12, Issue 1). <https://doi.org/10.3390/medsci12010009>