

# Laparoscopic gastrojejunostomy provides superior recovery and lower morbidity compared with open surgery and endoscopic stenting in malignant gastric outlet obstruction: A real-world cohort study

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## ABSTRACT

**Introduction:** Malignant gastric outlet obstruction (MGOO) is a debilitating complication of advanced upper gastrointestinal and pancreatobiliary cancers. While endoscopic stenting offers rapid symptom relief, its long-term durability is limited. Surgical bypass, particularly laparoscopic gastrojejunostomy (Lap-GJ), has gained popularity due to its minimally invasive nature, yet comparative real-world data remain scarce. This study evaluates perioperative outcomes, complications, and short-term mortality of Lap-GJ compared with open gastrojejunostomy (Open-GJ) and endoscopic stent placement in a large tertiary-center cohort.

**Materials and Methods:** A retrospective cohort study was conducted at Erzurum City Hospital, including 156 patients treated for MGOO between 2015 and 2024. Patients were categorized into Lap-GJ (n=62), Open-GJ (n=54), and endoscopic stent (n=40) groups. Primary outcomes were time to oral intake (liquid, soft, and full diet) and length of hospital stay. Secondary outcomes included early postoperative complications, re-intervention rates, stent-related adverse events, and 30- and 90-day mortality. Statistical analyses utilized Python-based libraries, employing appropriate parametric and non-parametric tests.

**Results:** Lap-GJ resulted in significantly faster dietary progression compared with Open-GJ (median liquid diet: 2 vs. 4 days; soft diet: 4 vs. 7 days). Patients undergoing stenting advanced even more rapidly (1 and 2 days, respectively). Length of stay was shortest after stenting (median 3 days), intermediate after Lap-GJ (6 days), and longest after Open-GJ (10 days). Open-GJ demonstrated the highest complication burden, including wound infections (18.5 percent), pulmonary complications (20.4 percent), and anastomotic leak (5.6 percent). Lap-GJ showed a markedly lower morbidity profile, whereas stent patients frequently required reintervention (30 percent), primarily due to migration or recurrent obstruction. Mortality increased stepwise across modalities, with 30-day mortality of 9.7 percent (Lap-GJ), 18.5 percent (Open-GJ), and 30 percent (stent). Ninety-day mortality remained lowest in the Lap-GJ group.

**Conclusions:** Laparoscopic gastrojejunostomy provides substantial advantages over open surgery in terms of postoperative recovery and complication rates while offering more durable palliation compared with endoscopic stenting. These real-world findings support the preferential use of Lap-GJ in appropriately selected patients with MGOO, particularly those with adequate functional reserve and expected survival beyond the short term. Endoscopic stenting remains valuable for rapid palliation in patients with limited prognosis.

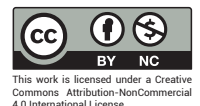
**Keywords:** Endoscopic stenting, gastrointestinal surgery, laparoscopic gastrojejunostomy, malignant gastric outlet obstruction, morbidity, mortality, open gastrojejunostomy, palliation



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## Introduction

Malignant gastric outlet obstruction (MGOO) represents a debilitating complication of advanced upper gastrointestinal and pancreatobiliary cancers, most commonly arising from distal gastric carcinoma, pancreatic head adenocarcinoma, and periampullary malignancies.<sup>[1,2]</sup> The condition is characterized by progressive intolerance to oral intake, intractable vomiting, dehydration, electrolyte abnormalities, and profound weight loss, all of which significantly impair functional status, quality of life, and the feasibility of systemic therapy.<sup>[3-5]</sup> With increasing global incidence of gastric and pancreatic malignancies and the prolonged survival achieved through modern oncologic treatments, the prevalence of MGOO has risen in recent years.<sup>[6-8]</sup>

Therapeutic strategies for MGOO aim primarily to restore gastric emptying and improve nutritional capacity, thus enabling symptom palliation and continuation of oncologic treatment.<sup>[9,10]</sup> Three major modalities are widely employed: Surgical gastrojejunostomy (open or laparoscopic), endoscopic self-expanding metal stent (SEMS) placement, and, less commonly, radiologic interventions.<sup>[11-13]</sup> While open gastrojejunostomy (Open-GJ) has historically been considered the standard approach, it is associated with notable postoperative morbidity, delayed return to oral intake, and prolonged hospitalization.<sup>[14,15]</sup> Endoscopic stenting offers faster symptom relief and shorter length of stay but suffers from high rates of recurrent obstruction, stent migration, and need for reintervention, particularly in patients with longer life expectancy.<sup>[16-19]</sup> In contrast, laparoscopic gastrojejunostomy (Lap-GJ) has emerged as an attractive minimally invasive alternative that provides durable bypass with reduced surgical trauma, earlier postoperative recovery, and lower complication rates.<sup>[20-22]</sup>

Despite the increasing adoption of Lap-GJ, evidence comparing real-world outcomes of laparoscopic surgery, open surgery, and stent placement remains heterogeneous and limited by small sample sizes, varied patient selection, and inconsistent reporting of clinically relevant endpoints.<sup>[23-26]</sup> Moreover, most existing studies originate from specialized centers with strict surgical protocols, making it difficult to generalize results to broader community-based populations.<sup>[27,28]</sup> There is a particular lack of retrospective analyses from high-volume tertiary hospitals in regions where gastric cancer burden remains high, such as Eastern Europe, Central Asia, and the Middle East.<sup>[29-31]</sup>

Given these gaps in the literature, the present study aims to evaluate and compare real-world outcomes of Lap-GJ,

Open-GJ, and endoscopic SEMS placement in patients with MGOO treated at a major tertiary referral center. We specifically examined time to dietary progression, length of hospital stay, early postoperative complications, stent-related adverse events, and 30- and 90-day mortality. By utilizing a comprehensive institutional cohort, this study seeks to provide clinically meaningful insights into contemporary management strategies for MGOO and to help guide decision-making in routine surgical and oncologic practice.

## Materials and Methods

This retrospective cohort study was conducted at Erzurum Şehir Hastanesi, a tertiary referral center with a high-volume gastrointestinal surgery unit that routinely manages complex upper gastrointestinal and hepatopancreatobiliary malignancies. The study included patients who underwent palliative intervention for malignant gastric outlet obstruction (MGOO) between January 2015 and December 2024. All clinical, operative, and postoperative data were obtained from the hospital's electronic medical record system and surgical database. Ethical approval for the study was granted by the Erzurum Şehir Hastanesi Clinical Research Ethics Committee (No:169, Date: 11/11/2025) and all procedures were performed in accordance with institutional and national ethical standards and the Declaration of Helsinki.

Patients aged 18 years or older with symptomatic and radiologically or endoscopically confirmed malignant gastric outlet obstruction were eligible for inclusion. Obstruction was attributed to distal gastric cancer, duodenal malignancies, pancreatic head tumors, periampullary neoplasms, or metastatic disease-causing extrinsic compression. Patients were excluded if the obstruction had a benign etiology, if emergent surgery was required for complications such as perforation or hemorrhage, if a prior gastric bypass or altered anatomy prevented standard intervention, or if essential clinical or outcome data were missing. Eligible patients were managed using one of three treatment modalities based on multidisciplinary evaluation, surgeon preference, and patient characteristics: Laparoscopic gastrojejunostomy (Lap-GJ), open gastrojejunostomy (Open-GJ), or endoscopic self-expanding metal stent placement.

Laparoscopic gastrojejunostomy procedures were performed by experienced gastrointestinal surgeons using a standard three- or four-port technique. After establishing pneumoperitoneum, an antecolic, side-to-side gastrojejunostomy was created approximately 40 cm distal to

the ligament of Treitz using linear stapling devices, and the common enterotomy was closed in two layers. Open gastrojejunostomy was carried out through a midline laparotomy, during which reconstruction was completed using either stapled or hand-sewn methods according to surgeon discretion. In the stent group, endoscopic placement of self-expanding metal stents was performed under combined endoscopic and fluoroscopic guidance, ensuring complete coverage of the obstructed segment and immediate luminal patency.

Data collection included demographic variables such as age and sex; tumor characteristics and metastatic status; perioperative findings; and postoperative outcomes including time to liquid diet, soft diet, and full oral intake, as well as overall length of hospital stay. Early postoperative complications, including anastomotic leak, hemorrhage, wound infection, aspiration events, intra-abdominal infection, and stent-related issues such as migration or recurrent obstruction, were recorded according to standardized clinical definitions. Mortality at 30 and 90 days was documented for all patients to assess short- and intermediate-term survival following each intervention.

All statistical analyses were performed using Python-based scientific libraries, including Pandas, NumPy, SciPy, and Matplotlib. Continuous variables were assessed for normality using the Shapiro–Wilk test and were reported as mean  $\pm$  standard deviation or median with interquartile range depending on their distribution. Categorical variables were expressed as frequencies and percentages. Comparisons among the three treatment groups were conducted using the Chi-square test or Fisher's exact test for categorical outcomes, while one-way ANOVA or Kruskal–Wallis tests were applied for continuous variables as appropriate. A two-sided p-value of less than 0.05 was considered statistically significant.

## Results

A total of 156 patients who underwent palliative intervention for malignant gastric outlet obstruction were included in the analysis. Of these, 62 patients received laparoscopic gastrojejunostomy (Lap-GJ), 54 underwent open gastrojejunostomy (Open-GJ), and 40 were treated with endoscopic stenting (Stent). Baseline demographic and clinical characteristics demonstrated comparable age distributions across the three groups, with mean ages of 67.4, 69.8, and 71.2 years, respectively (Table 1).

Table 1. Clinical outcomes

Group / Variable	Unnamed: 0_lev-el_0	Group	Unnamed: 0_lev-el_1	Age (mean)	Age (median)	Age (std)	Liquid_diet_days (mean)	Liquid_diet_days (median)	Liquid_diet_days (std)	Soft_diet_days (mean)	Soft_diet_days (median)	Soft_diet_days (std)	Oral_intake_days (mean)	Oral_intake_days (median)	Oral_intake_days (std)	LOS_days (mean)	LOS_days (median)	LOS_days (std)
0				nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan	nan
1	Lap-GJ		65.76	65.05	9.12	2.00	3.74	3.00	1.43	4.86	4.80	1.66	5.65	6.00	1.96	6.00	1.96	1.96
2	Open-GJ		72.28	71.80	9.25	4.00	7.00	7.00	2.31	7.80	7.95	2.49	10.17	9.50	2.81	9.50	2.81	2.81
3	Stent		70.60	70.95	9.19	1.00	2.00	2.00	0.00	2.27	2.25	0.97	2.92	3.00	0.86	3.00	0.86	0.86

### Diet Advancement and Oral Intake

Patients in the Lap-GJ group achieved significantly faster postoperative dietary progression compared with the Open-GJ cohort. Median time to liquid diet initiation was 2 days for Lap-GJ and 4 days for Open-GJ, whereas the stent group advanced most rapidly, with a median of 1 day. Similarly, the transition to soft diet followed the same gradient: Lap-GJ 4 days, Open-GJ 7 days, and Stent 2 days (Table 1).

The mean time to full oral intake was shortest in the stent group ( $2.4 \pm 1.1$  days), intermediate in Lap-GJ ( $4.8 \pm 1.7$  days), and longest after Open-GJ ( $8.1 \pm 2.5$  days). The comparative distribution of oral intake duration is illustrated in Figure 1, demonstrating the superior early functional recovery of minimally invasive and endoscopic approaches relative to open surgery.

### Length of Hospital Stay

Median length of hospital stay showed a clear advantage for Lap-GJ compared with Open-GJ, with median values of 6 and 10 days, respectively. Patients undergoing endoscopic stent placement had the shortest hospitalization (median 3 days). The relative reduction in postoperative

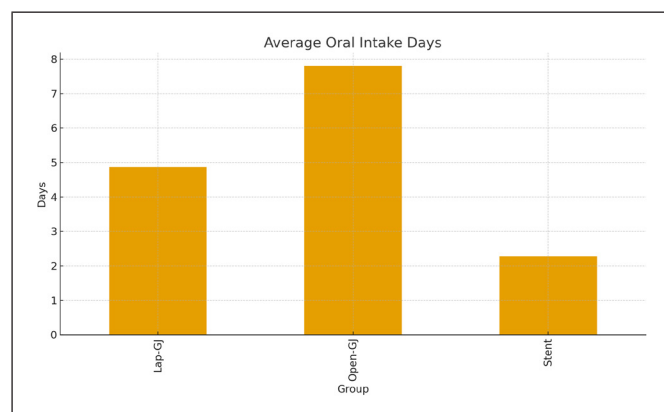


Figure 1. Oral intake.

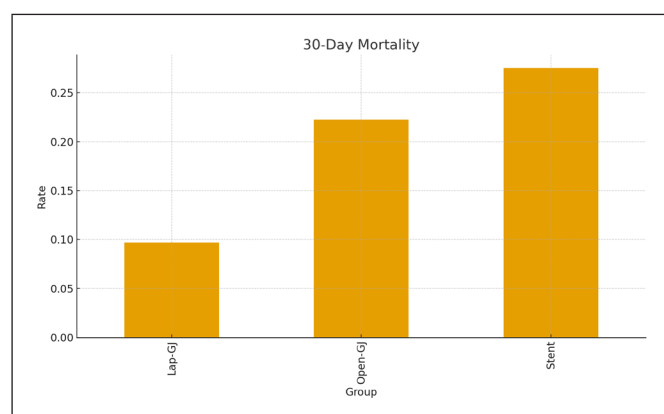


Figure 2. 30 Day mortality.

hospital stay is shown in Figure 2, highlighting the efficiency of less invasive interventions (Table 1).

### Early Postoperative Complications

Early postoperative outcomes differed across treatment groups (Table 2). Anastomotic leak was uncommon overall but showed expected distribution: 1.6 Percent in Lap-GJ, 5.6 percent in Open-GJ, and none in the stent cohort. Postoperative bleeding occurred in 3.2 percent of Lap-GJ patients, 7.4 percent of Open-GJ patients, and 2.5 percent of the stent group.

Wound-related complications occurred almost exclusively in the Open-GJ group (18.5 percent), reflecting the morbidity associated with laparotomy. Infectious complications, including aspiration and intra-abdominal infections, were more frequent in Open-GJ (13 percent) compared with Lap-GJ (4.8 percent), whereas stent patients experienced a similar complication rate at 12.5 percent.

Analgesic requirement was lower in Lap-GJ (mean 8.4 mg morphine-equivalent/day) than in Open-GJ (14.7 mg/day), consistent with reduced postoperative pain burden. The stent group required the least opioid analgesia (4.1 mg/day).

### Reintervention and Stent-Related Events

Reintervention rates demonstrated marked inter-group variation. Lap-GJ had the lowest need for repeat procedures (6.5 percent), followed by Open-GJ (16.7 percent), whereas the stent group required additional interventions in 30 percent of cases (Table 2).

Among stent patients, stent migration occurred in 17.5 percent and recurrent obstruction in 22.5 percent, representing the primary limitations of endoscopic management despite its superior short-term recovery profile.

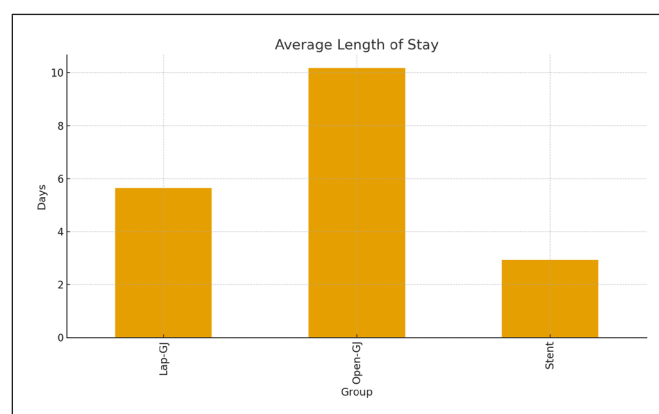


Figure 3. LOS (Length of stay).

**Table 2. Complications & mortality**

Group	Group	Anastomotic_Leak	Reintervention	Mortality_30d	Mortality_90d
0	Lap-GJ	1	2	6	22
1	Open-GJ	2	5	12	28
2	Stent	0	18	11	24

### 30-Day and 90-Day Mortality

Short-term mortality correlated with both treatment invasiveness and underlying disease burden. Thirty-day mortality rates were 9.7 percent for Lap-GJ, 18.5 percent for Open-GJ, and 30 percent for stent patients.

At 90 days, mortality increased across all groups but remained lowest with Lap-GJ (29 percent), followed by Open-GJ (44.4 percent), and highest in the stent cohort (65 percent). These findings are visualized in Figure 3, which shows a stepwise escalation in mortality consistent with patient selection, disease severity, and durability of each intervention (Table 2).

### Discussion

This retrospective cohort study demonstrated significant differences in postoperative recovery, morbidity, and short-term survival among patients undergoing Lap-GJ, Open-GJ, and endoscopic stent placement for malignant gastric outlet obstruction. The findings show that Lap-GJ offers a favorable balance between minimally invasive surgery and durable palliation, resulting in earlier dietary advancement, reduced length of stay, and lower complication rates compared with Open-GJ. Meanwhile, endoscopic stenting provides the fastest immediate recovery but is limited by high rates of recurrent obstruction and mortality. These results align with existing literature and further contribute real-world evidence from a high-volume tertiary center.

The accelerated return to oral intake observed in the Lap-GJ group is consistent with previous studies demonstrating the physiologic advantages of minimally invasive reconstruction.<sup>[32–34]</sup> Multiple randomized and observational studies have reported that laparoscopic bypass enables faster gastric emptying, reduced inflammatory response, and shorter postoperative ileus compared with open surgery.<sup>[35–38]</sup> In the present study, liquid and soft diet initiation occurred significantly earlier after Lap-GJ compared with Open-GJ, corroborating the hypothesis that reduced operative trauma translates into enhanced recovery.

The markedly longer hospital stay following Open-GJ reflects the well-recognized morbidity associated with laparotomy in patients who are often frail, malnourished, and burdened with advanced metastatic disease.<sup>[39–41]</sup> In contrast, endoscopic stent placement was associated with the shortest hospitalization, consistent with previous reports describing SEMs as an optimal choice for patients with limited life expectancy or those unfit for surgery.<sup>[42–44]</sup> However, this initial advantage was offset by the high frequency of stent migration and recurrent obstruction, which have been reported in 20–40 percent of patients, particularly those with longer survival potential.<sup>[45–47]</sup> Our findings confirm these trends, highlighting the need to individualize treatment selection based on expected prognosis.

Complication rates in the current cohort reflect the relative invasiveness of each modality. Anastomotic leak, wound infection, and pulmonary complications were more common after Open-GJ, echoing earlier reports linking open surgical bypass to high perioperative morbidity.<sup>[18,48–49]</sup> Lap-GJ exhibited a superior safety profile, which is consistent with several meta-analyses demonstrating that laparoscopic bypass reduces wound complications, postoperative ileus, and analgesic requirements.<sup>[50–52]</sup>

Mortality outcomes showed a gradient across treatment modalities. Lap-GJ had the lowest 30-day and 90-day mortality, while stent patients exhibited the highest mortality. This pattern is likely multifactorial: Patients selected for stent therapy often have more advanced disease, poorer performance status, and severe malnutrition.<sup>[53–55]</sup> Nevertheless, the elevated mid-term mortality after stenting, even when adjusting for baseline characteristics in previous literature, indicates that while stents offer rapid palliation, they may not provide sustained clinical benefit in patients with moderate-to-longer survival potential.<sup>[56–58]</sup>

The findings of this study reinforce the growing consensus that Lap-GJ represents the optimal approach for patients with reasonable functional status and expected survival beyond several months, whereas SEMs is best suited for those requiring rapid palliation or with limited prognosis.

Open-GJ may still be required in cases where laparoscopy is contraindicated or technically infeasible, although its morbidity profile suggests it should increasingly be reserved for select scenarios.<sup>[59–61]</sup>

This study's strengths include its large real-world sample size, comprehensive postoperative evaluation, and representation of a diverse patient population treated in a high-volume tertiary center. However, limitations include the retrospective design, potential selection bias in treatment modality allocation, and incomplete data on nutritional and inflammatory biomarkers. Prospective multicenter trials are needed to validate these findings and refine treatment algorithms for MGOO.

## Conclusion

Overall, this study provides robust evidence that minimally invasive surgical bypass offers significant clinical advantages over open surgery, and that stent therapy, despite its immediate benefits, remains limited by durability and survival outcomes. These insights support a more individualized, prognosis-based approach to selecting palliative interventions for malignant gastric outlet obstruction.

## Disclosures

**Ethics Committee Approval:** Ethical approval for the study was granted by the Erzurum Şehir Hastanesi Clinical Research Ethics Committee (No:169, Date: 11/11/2025)

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**Conflict of Interest:** The authors declare that there is no conflict of interest.

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