Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Surgical versus Endoscopic Gastrojejunostomy for Malignant Gastric Outlet Obstruction: A Real-World Nationwide Analysis

Anil Mathew Philip

anil.philip@cookcountyhealth.org

John H. Stroger Jr. Hospital of Cook County

Bhanu Siva Mohan Pinnam

University of Kansas Medical Center

Ibrahimkhalil-Mohamud Sheikh

John H. Stroger Jr. Hospital of Cook County

Saksham Kohli

John H. Stroger Jr. Hospital of Cook County

Revati Varma

John H. Stroger Jr. Hospital of Cook County

Gedion Yilma Amdetsion

John H. Stroger Jr. Hospital of Cook County

Daniel Guifarro

University of Texas Health San Antonio

Hemant Mutneja

John H. Stroger Jr. Hospital of Cook County

Research Article

Keywords: Endoscopic ultrasound-guided gastroenterostomy, gastrojejunostomy, malignant gastric outlet obstruction, lumen-apposing metal stent, propensity score matching, palliative care

Posted Date: November 23rd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11720980/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background.

Malignant gastric outlet obstruction (MGOO) is a debilitating complication of advanced upper gastrointestinal and periampullary malignancy. Endoscopic ultrasound-guided gastrojejunostomy (EUS-GJ) has emerged as a minimally invasive alternative to surgical gastrojejunostomy (SGJ), but comparative data on broader postprocedural complications and reintervention remain limited.

Methods.

We performed a retrospective cohort study using the TriNetX US Collaborative Network. Adults with gastric, pancreatic, or duodenal malignancy who underwent EUS-GJ or SGJ were identified by procedure codes. 1:1 propensity score matching balanced demographics, comorbidities, and baseline laboratory values, yielding 760 patients per group. Outcomes were assessed at 30- and 90-days using risk ratios, odds ratios, and Kaplan-Meier and Cox hazard ratios (HR) with 95% confidence intervals (CI).

Results.

At 30 days, EUS-GJ was associated with lower risks of blood transfusion (HR 0.41; 95% CI 0.28–0.61), ileus or bowel obstruction (HR 0.26; 0.14–0.48), acute kidney injury (HR 0.70; 0.49–1.00), venous thromboembolism (HR 0.53; 0.31–0.90), and hospital readmission (HR 0.64; 0.53–0.76). These reductions persisted at 90 days, with an additional reduction in sepsis (HR 0.64; 0.46–0.89). Gastrointestinal bleeding, respiratory failure, and heart failure did not differ. EUS-GJ carried a higher 90-day reintervention rate (4.3% vs 1.7%; HR 2.78; 1.46–5.28). A borderline 30-day mortality signal (HR 1.44; 1.02–2.02) was not sustained at 90 days and was attenuated by residual confounding (E-value 2.23).

Conclusions.

In real-world practice, EUS-GJ was associated with lower postprocedural morbidity and healthcare utilization than SGJ, at the cost of higher reintervention. These findings support EUS-GJ as a palliative option for MGOO at centers with advanced endoscopic expertise.

Introduction

Malignant gastric outlet obstruction (MGOO) is a late-stage complication of upper gastrointestinal and periampullary malignancies that results from mechanical obstruction of the distal stomach, pylorus, or proximal small bowel, most commonly arises in patients with pancreatic, gastric, or duodenal cancers. These patients develop progressive malnutrition, and impaired quality of life. [1, 2] Despite advances in oncologic therapy, MGOO remains a clinically significant complication. Restoration of enteral nutrition

and symptom relief are central palliative goals that improve quality of life and facilitate ongoing cancer treatment. [3–5]

Surgical gastrojejunostomy (SGJ) provides durable relief of MGOO but is associated with longer recovery and procedure-related morbidity. Endoscopic ultrasound-guided gastrojejunostomy (EUS-GJ), enabled by lumen-apposing metal stents (LAMS), has emerged as a minimally invasive alternative. [3, 5, 6]

Early observational studies suggested that EUS-GJ achieves clinical outcomes comparable to surgery while reducing recovery time and length of stay.[7, 8] More recently, the randomized ENDURO and Bang et al. trials demonstrated comparable efficacy between EUS-GJ and SGJ, with advantages for EUS-GJ in time to oral intake and patient-centered outcomes.[3, 9] These findings are supported by multiple systematic reviews and meta-analyses that increasingly favor EUS-GJ in appropriately selected patients treated at centers with advanced endoscopic expertise.[11–15] In the DRA-GOO trial, EUS-GJ was also associated with lower reintervention rates and improved eating-related quality of life compared with enteral metal stenting.[25]

Despite these encouraging data, the comparative safety profile of EUS-GJ and SGJ beyond traditional efficacy endpoints remains incompletely characterized. Most studies have focused on technical success, clinical success, length of stay, and procedure-related adverse events, whereas broader postprocedural outcomes such as acute kidney injury, venous thromboembolism, sepsis, and hospital readmission have received less attention. In addition, many comparative studies and randomized trials have been limited by modest sample sizes, restricting assessment of less frequent but clinically important outcomes.[3, 7–9] A recent National Inpatient Sample analysis by Pinnam et al. found lower odds of respiratory failure, transfusion, and peritonitis with endoscopic gastrojejunostomy, but was limited to index-hospitalization outcomes.[10] Whether these benefits persist after discharge, and how they balance against potential late complications requiring reintervention, remains uncertain.

To address these knowledge gaps, we performed a propensity score-matched retrospective cohort study using the TriNetX US Collaborative Network. We compared 30- and 90-day outcomes following EUS-GJ and SGJ, including mortality, major medical complications, readmission, and reintervention. We hypothesized that EUS-GJ would be associated with lower postprocedural morbidity and healthcare utilization, albeit with a higher risk of reintervention.

Materials and Methods

Data Source

This study was conducted using the TriNetX US Collaborative Network, a federated health research network aggregating de-identified electronic health record data including diagnoses, procedures, medications, laboratory values, and demographics from 66 participating healthcare organizations across the United States.

Study Design and Population

We identified two cohorts of adult patients (age ≥ 18 years) with gastrointestinal or periampullary malignancy, specifically malignant neoplasms of the stomach (ICD-10-CM C16), pancreas (C25), or duodenum (C17.0), who underwent gastric bypass for the management of gastric outlet obstruction. Cohort 1 comprised patients who underwent endoscopic ultrasound-guided gastrojejunostomy (EUS-GJ), identified by CPT codes 43240 or 43242. Cohort 2 comprised patients who underwent surgical gastrojejunostomy (SGJ), identified by CPT codes 43820 (without vagotomy) or 43825 (with vagotomy, any type). The index date was defined as the date of the gastrojejunostomy procedure, and a temporal constraint was enforced requiring the gastrojejunostomy to precede or coincide with the malignancy encounter in the medical record.

To ensure procedural homogeneity and avoid misclassification, patients were excluded from both cohorts if they had previously undergone gastrectomy (total or partial; CPT 43620–43622, 43631–43632, 43634–43635), pancreaticoduodenectomy (CPT 48150), or endoscopic tumor ablation (CPT 43270). Patients whose index event occurred 20 or more years prior to the analysis date were also excluded; no patients met this criterion in either cohort. Prior to matching, the EUS-GJ cohort comprised 2,202 patients (across 48 contributing providers) and the SGJ cohort comprised 1,074 patients (across 43 contributing providers) (Fig. 1).

Adults aged ≥ 18 years with malignant neoplasms of the stomach, pancreas, or duodenum who underwent gastrojejunostomy for malignant gastric outlet obstruction were identified in the TriNetX US Collaborative Network. Before matching, 2,202 patients underwent endoscopic ultrasound-guided gastrojejunostomy (EUS-GJ) and 1,074 underwent surgical gastrojejunostomy (SGJ). After 1:1 propensity score matching using demographics, malignancy type, comorbidities, and baseline laboratory values, 760 patients remained in each cohort for outcome analysis. Exclusion criteria included prior gastrectomy, pancreaticoduodenectomy, endoscopic tumor ablation, or an index event ≥ 20 years before the analysis date.

Propensity Score Matching

To mitigate confounding by indication and baseline differences between groups, 1:1 propensity score matching (PSM) was performed using the TriNetX comparative outcomes platform. Pre-specified matching covariates included demographic variables (age at index, sex, and race/ethnicity) and clinically relevant comorbidities: type 2 diabetes mellitus (E11), chronic kidney disease stages 3–5 (N18.3–N18.5), end-stage renal disease (N18.6), heart failure (I50), chronic obstructive pulmonary disease (J44), cirrhosis/liver fibrosis (K74), coagulopathy (D68), overweight/obesity (E66), malnutrition (E40–E46), and malignancy type (C16, C17, C25, C77, C78, C79). Baseline laboratory values including serum creatinine, INR, total bilirubin, albumin, and hemoglobin were also included as matching variables. After PSM, both cohorts were balanced at 760 patients each. All post-matching standardized mean differences were below 0.10 for demographic and most clinical variables, confirming adequate covariate balance (Online

Resource 1). A residual imbalance in total bilirubin (standardized difference 0.329 after matching) persisted, likely reflecting the higher prevalence of biliary obstruction in patients with pancreatic head malignancies managed endoscopically.

Outcomes and Time Windows

Clinical outcomes were assessed across two pre-specified follow-up periods: 30 days and 90 days following the index procedure. Outcomes tracked at both time windows included all-cause gastrointestinal bleeding (ICD-10-CM K92.0, K92.1, K92.2), all-cause mortality (deceased status), acute respiratory failure (J96.0, J96.9), sepsis (A40, A41, R65.20, R65.21), blood transfusion (CPT 36430; ICD-10-PCS 30233N1), ileus or bowel obstruction (K56.0, K56.60), acute kidney injury (N17), venous thromboembolism (VTE; I26, I82.4), heart failure (I50), and hospital readmission (any inpatient encounter, emergency visit, short stay, observation encounter, or inpatient non-acute visit). Procedure-related reintervention, defined as a repeat EUS-GJ (CPT 43242) or SGJ (CPT 43820), was additionally assessed at 90 days.

Statistical Analysis

All outcomes analyses were performed on the propensity-matched cohorts. For each outcome, measures of association were calculated including risk difference (RD), risk ratio (RR), and odds ratio (OR) with 95% confidence intervals. Time-to-event analyses were conducted using the Kaplan-Meier method; between-group differences were assessed with the log-rank test using daily time intervals. The proportional hazards assumption was evaluated, and hazard ratios (HR) with 95% confidence intervals were reported. Patients were censored at the date of their last recorded encounter within the TriNetX network. Each calendar date on which an outcome was recorded was counted as one instance. A two-sided p-value of less than 0.05 was considered statistically significant. Because this was a retrospective analysis of all eligible patients within the network, no prior sample size or statistical power calculation was performed. All analyses were conducted by the study investigators using the TriNetX comparative outcomes analytics platform (TriNetX, LLC, Cambridge, MA).

Ethical Considerations

Because the TriNetX network provides access only to aggregated, de-identified patient data that do not constitute human subjects research, this study was exempt from institutional review board review and the requirement for informed consent was waived.

Results

Baseline Characteristics

After 1:1 propensity score matching, both cohorts comprised 760 patients. The matched groups were well-balanced across all pre-specified covariates. Mean age at index was 66.2 ± 12.7 years in the EUS-GJ

group and 66.3 ± 11.8 years in the SGJ group (p = 0.905). Female sex was similarly distributed (43.0% vs. 42.2%, p = 0.756). Pancreatic cancer was the most prevalent malignancy in both cohorts, accounting for 53.2% and 55.1% of EUS-GJ and SGJ patients, respectively (p = 0.440), followed by gastric cancer (15.8% vs. 15.4%) and small intestinal malignancy (7.0% vs. 7.5%). Malnutrition was prevalent in both groups (28.3% vs. 29.3%, p = 0.651). Comorbidity profiles including diabetes mellitus, heart failure, CKD, and COPD were comparable between cohorts. Serum albumin (3.3 ± 0.8 vs. 3.3 ± 0.7 g/dL) and INR (1.2 ± 0.3 vs. 1.2 ± 0.2) were similar across groups. Total bilirubin remained nominally higher in the EUS-GJ cohort after matching (3.5 ± 6.1 vs. 1.8 ± 3.6 mg/dL; standardized difference 0.329), consistent with the higher prevalence of biliary obstruction associated with pancreatic head malignancy in patients managed endoscopically. Baseline characteristics are presented in Table 1.

Table 1
Baseline characteristics of propensity-matched EUS-GJ and SGJ cohorts (N = 760 per group).

Characteristic	EUS-GJ (N = 760)	SGJ (N = 760)	P-value	Std. diff.
Demographics				
Age at index, mean ± SD	66.2 ± 12.7	66.3 ± 11.8	0.905	0.006
Female sex, n (%)	327 (43.0%)	321 (42.2%)	0.756	0.016
Male sex, n (%)	433 (57.0%)	439 (57.8%)	0.756	0.016
White, n (%)	529 (69.6%)	541 (71.2%)	0.500	0.035
Black or African American, n (%)	125 (16.4%)	106 (13.9%)	0.175	0.070
Hispanic or Latino, n (%)	52 (6.8%)	54 (7.1%)	0.840	0.010
Asian, n (%)	37 (4.9%)	38 (5.0%)	0.906	0.006
Malignancy and comorbidities				
Pancreatic malignancy (C25), n (%)	404 (53.2%)	419 (55.1%)	0.440	0.040
Gastric malignancy (C16), n (%)	120 (15.8%)	117 (15.4%)	0.832	0.011
Small intestinal malignancy (C17), n (%)	53 (7.0%)	57 (7.5%)	0.692	0.020
Secondary malignancy — resp./dig. organs (C78), n (%)	147 (19.3%)	152 (20.0%)	0.747	0.017
Secondary malignancy — lymph nodes (C77), n (%)	47 (6.2%)	48 (6.3%)	0.916	0.005
Secondary malignancy — other sites (C79), n (%)	53 (7.0%)	55 (7.2%)	0.842	0.010
Malnutrition (E40–E46), n (%)	215 (28.3%)	223 (29.3%)	0.651	0.023
Type 2 diabetes mellitus (E11), n (%)	213 (28.0%)	210 (27.6%)	0.864	0.009
Overweight/obesity (E66), n (%)	70 (9.2%)	68 (8.9%)	0.858	0.009
Heart failure (I50), n (%)	57 (7.5%)	60 (7.9%)	0.773	0.015
COPD (J44), n (%)	51 (6.7%)	55 (7.2%)	0.687	0.021
CKD stage 3 (N18.3), n (%)	31 (4.1%)	33 (4.3%)	0.798	0.013
CKD stage 4 (N18.4), n (%)	10 (1.3%)	10 (1.3%)	1.000	< 0.001
End-stage renal disease (N18.6), n (%)	10 (1.3%)	10 (1.3%)	1.000	< 0.001
Cirrhosis/liver fibrosis (K74), n (%)	16 (2.1%)	16 (2.1%)	1.000	< 0.001
Coagulopathy (D68), n (%)	34 (4.5%)	33 (4.3%)	0.901	0.006

Characteristic	EUS-GJ (N = 760)	SGJ (N = 760)	P-value	Std. diff.
Demographics				
Laboratory values (mean ± SD)				
Creatinine (mg/dL)	1.0 ± 0.7	0.9 ± 0.6	0.003	0.167
INR	1.2 ± 0.3	1.2 ± 0.2	0.012	0.162
Total bilirubin (mg/dL)	3.5 ± 6.1	1.8 ± 3.6	< 0.001	0.329
Albumin (g/dL)	3.3 ± 0.8	3.3 ± 0.7	0.140	0.085
Hemoglobin (g/dL)	11.4 ± 2.2	11.1 ± 2.1	0.004	0.162

EUS-GJ endoscopic ultrasound-guided gastrojejunostomy, SGJ surgical gastrojejunostomy, SD standard deviation, CKD chronic kidney disease, COPD chronic obstructive pulmonary disease, INR international normalized ratio, Std. diff. standardized mean difference. All standardized mean differences were below 0.10 for demographic variables after matching.

30-Day Outcomes

At 30 days, the EUS-GJ cohort demonstrated significantly lower rates of blood transfusion compared to the SGJ cohort (4.6% vs. 11.6%; RR 0.398, 95% CI 0.272–0.581; HR 0.410, 95% CI 0.277–0.606; p < 0.001). EUS-GJ was also associated with markedly lower rates of ileus or bowel obstruction (1.7% vs. 6.8%; RR 0.250, 95% CI 0.137–0.455; HR 0.259, 95% CI 0.141–0.476; p < 0.001), acute kidney injury (6.4% vs. 9.7%; RR 0.662, 95% CI 0.468–0.937; HR 0.696, 95% CI 0.485–0.998; p = 0.019), VTE (3.1% vs. 6.0%; RR 0.512, 95% CI 0.306–0.857; HR 0.530, 95% CI 0.313–0.897; p = 0.009), and hospital readmission (30.2% vs. 45.5%; RR 0.665, 95% CI 0.578–0.764; HR 0.635, 95% CI 0.533–0.757; p < 0.001). There were no statistically significant differences in rates of GI bleeding (4.6% vs. 5.1%; p = 0.634), acute respiratory failure (4.3% vs. 5.1%; p = 0.469), sepsis (5.4% vs. 7.1%; p = 0.168), or heart failure (3.1% vs. 4.1%; p = 0.309). All-cause 30-day mortality was numerically higher in the EUS-GJ group (10.0% vs. 7.6%; HR 1.438, 95% CI 1.022–2.024; log-rank p = 0.036), although the overall risk difference did not reach conventional statistical significance (RD 0.024, 95% CI − 0.005 to 0.052; p = 0.103). Thirty-day outcomes are presented in Table 2 and illustrated in Fig. 2.

Table 2
Thirty-day clinical outcomes in propensity-matched EUS-GJ versus SGJ cohorts (N = 760 per group).

Outcome	EUS-GJ, n (%)	SGJ, n (%)	RR (95% CI)	HR (95% CI)	p-value
GI bleeding	35 (4.6%)	39 (5.1%)	0.897 (0.575–1.401)	0.956 (0.605–1.509)	0.634
All-cause mortality[a]	76 (10.0%)	58 (7.6%)	1.310 (0.945–1.816)	1.438 (1.022–2.024)	0.103
Acute respiratory failure	33 (4.3%)	39 (5.1%)	0.846 (0.538–1.330)	0.898 (0.565–1.427)	0.469
Sepsis	41 (5.4%)	54 (7.1%)	0.759 (0.512–1.125)	0.814 (0.543–1.222)	0.168
Transfusion	35 (4.6%)	88 (11.6%)	0.398 (0.272–0.581)	0.410 (0.277–0.606)	< 0.001
Ileus/bowel obstruction	13 (1.7%)	52 (6.8%)	0.250 (0.137–0.455)	0.259 (0.141–0.476)	< 0.001
Acute kidney injury	49 (6.4%)	74 (9.7%)	0.662 (0.468–0.937)	0.696 (0.485–0.998)	0.019
VTE	21 (3.1%)	41 (6.0%)	0.512 (0.306–0.857)	0.530 (0.313–0.897)	0.009
Heart failure	21 (3.1%)	28 (4.1%)	0.750 (0.430–1.308)	0.780 (0.443–1.373)	0.309
Readmissions	208 (30.2%)	313 (45.5%)	0.665 (0.578–0.764)	0.635 (0.533–0.757)	< 0.001

EUS-GJ endoscopic ultrasound-guided gastrojejunostomy, SGJ surgical gastrojejunostomy, GI gastrointestinal, RR risk ratio, OR odds ratio, HR hazard ratio, CI confidence interval, VTE venous thromboembolism.

[a] *Log-rank p = 0.036 for 30-day all-cause mortality by Kaplan-Meier analysis.*

Forest plot showing hazard ratios with 95% confidence intervals for 30-day outcomes in the propensity-matched EUS-GJ and SGJ cohorts. Hazard ratios less than 1 favor EUS-GJ, while hazard ratios greater than 1 favor SGJ. At 30 days, EUS-GJ was associated with lower hazards of transfusion, ileus or bowel obstruction, acute kidney injury, venous thromboembolism, and readmission. Gastrointestinal bleeding, acute respiratory failure, sepsis, and heart failure did not differ significantly between groups. A higher 30-day mortality hazard was observed by time-to-event analysis, although the risk difference was not statistically significant.

90-Day Outcomes

The favorable short-term profile of EUS-GJ was sustained or amplified at 90 days. EUS-GJ was associated with significantly lower rates of transfusion (6.4% vs. 15.9%; RR 0.405, 95% CI 0.295–0.556; HR 0.416, 95% CI 0.298–0.579; p < 0.001), ileus or bowel obstruction (2.4% vs. 9.1%; RR 0.261, 95% CI 0.157–0.434; HR 0.270, 95% CI 0.161–0.454; p < 0.001), sepsis (7.6% vs. 12.8%; RR 0.598, 95% CI 0.439–0.815; HR 0.640, 95% CI 0.463–0.887; p = 0.001), AKI (9.3% vs. 14.2%; RR 0.657, 95% CI 0.496–0.872; HR 0.692, 95% CI 0.513–0.934; p = 0.003), VTE (4.5% vs. 9.3%; RR 0.479, 95% CI 0.322–0.712; HR 0.502, 95% CI 0.333–0.755; p < 0.001), and hospital readmission (40.5% vs. 53.7%; RR 0.755, 95% CI 0.677–0.841; HR 0.722, 95% CI 0.623–0.837; p < 0.001). Rates of GI bleeding, all-cause mortality, acute respiratory failure, and heart failure did not differ significantly between groups at 90 days. Notably, EUS-GJ was associated with a significantly higher rate of procedure-related reintervention compared to SGJ (4.3% vs. 1.7%; RR 2.538, 95% CI 1.347–4.785; HR 2.781, 95% CI 1.464–5.284; p = 0.003). Ninety-day outcomes are presented in Table 3 and illustrated in Fig. 3.

Table 3
Ninety-day clinical outcomes in propensity-matched EUS-GJ versus SGJ cohorts (N = 760 per group).

Outcome	EUS-GJ, n (%)	SGJ, n (%)	RR (95% CI)	HR (95% CI)	p-value
GI bleeding	48 (6.3%)	58 (7.6%)	0.828 (0.572–1.197)	0.889 (0.606–1.303)	0.314
All-cause mortality	137 (18.0%)	158 (20.8%)	0.867 (0.706–1.065)	0.958 (0.762–1.205)	0.173
Acute respiratory failure	47 (6.2%)	53 (7.0%)	0.887 (0.607–1.296)	0.955 (0.645–1.415)	0.535
Sepsis	58 (7.6%)	97 (12.8%)	0.598 (0.439–0.815)	0.640 (0.463–0.887)	0.001
Transfusion	49 (6.4%)	121 (15.9%)	0.405 (0.295–0.556)	0.416 (0.298–0.579)	< 0.001
Ileus/bowel obstruction	18 (2.4%)	69 (9.1%)	0.261 (0.157–0.434)	0.270 (0.161–0.454)	< 0.001
Acute kidney injury	71 (9.3%)	108 (14.2%)	0.657 (0.496–0.872)	0.692 (0.513–0.934)	0.003
VTE	34 (4.5%)	71 (9.3%)	0.479 (0.322–0.712)	0.502 (0.333–0.755)	< 0.001
Heart failure	45 (5.9%)	43 (5.7%)	1.047 (0.698–1.570)	1.118 (0.736–1.699)	0.826
Reintervention	33 (4.3%)	13 (1.7%)	2.538 (1.347–4.785)	2.781 (1.464–5.284)	0.003
Readmissions	308 (40.5%)	408 (53.7%)	0.755 (0.677–0.841)	0.722 (0.623–0.837)	< 0.001

EUS-GJ endoscopic ultrasound-guided gastrojejunostomy, SGJ surgical gastrojejunostomy, GI gastrointestinal, RR risk ratio, OR odds ratio, HR hazard ratio, CI confidence interval, VTE venous thromboembolism.

Forest plot showing hazard ratios with 95% confidence intervals for 90-day outcomes in the propensity-matched EUS-GJ and SGJ cohorts. Hazard ratios less than 1 favor EUS-GJ, while hazard ratios greater than 1 favor SGJ. At 90 days, EUS-GJ was associated with lower hazards of sepsis, transfusion, ileus or bowel obstruction, acute kidney injury, venous thromboembolism, and readmission. Gastrointestinal bleeding, all-cause mortality, acute respiratory failure, and heart failure did not differ significantly between groups. EUS-GJ was associated with a higher hazard of procedure-related reintervention at 90 days.

Discussion

In this large propensity score-matched cohort study of patients undergoing palliative bypass for malignant gastric outlet obstruction, EUS-GJ was associated with significantly lower rates of several clinically important postprocedural complications compared with SGJ. At 30 days, EUS-GJ was associated with lower risks of blood transfusion (HR 0.410; 95% CI 0.277–0.606), ileus or bowel obstruction (HR 0.259; 95% CI 0.141–0.476), acute kidney injury (HR 0.696; 95% CI 0.485–0.998), venous thromboembolism (HR 0.530; 95% CI 0.313–0.897), and hospital readmission (HR 0.635; 95% CI 0.533–0.757) (Table 2). These differences persisted through 90 days and were accompanied by a significantly lower incidence of sepsis (HR 0.640; 95% CI 0.463–0.887) (Table 3). Rates of gastrointestinal bleeding, acute respiratory failure, and heart failure were similar between groups at both time points. EUS-GJ carried a higher rate of procedure-related reintervention at 90 days (HR 2.781; 95% CI 1.464–5.284), although the absolute event rate remained low (4.3% vs. 1.7%). A numerical excess in 30-day mortality was observed among patients undergoing EUS-GJ (10.0% vs. 7.6%; HR 1.438; 95% CI 1.022–2.024; log-rank p = 0.036) that was not sustained at 90 days and is most plausibly attributable to residual confounding.

These findings are broadly consistent with the evolving literature supporting EUS-GJ as a less invasive alternative to surgical bypass, while extending it in two respects. Canakis et al. reported overall adverse event rates of 13.4% versus 33.3% favoring EUS-GJ across 310 patients, and the National Inpatient Sample analysis by Pinnam et al. found lower adjusted odds of respiratory failure (aOR 0.68), blood transfusion (aOR 0.63), and peritonitis (aOR 0.55) during the index hospitalization. [7, 10] The present analysis evaluates a broader spectrum of complications across both 30- and 90-day windows, capturing associations that extend beyond the index admission. Most notably, reductions in acute kidney injury, venous thromboembolism, and sepsis have received comparatively little attention in prior comparative work despite their substantial impact on morbidity, resource utilization, and eligibility for ongoing cancer-directed therapy, and represent the principal novel contribution of this study.

The borderline 30-day mortality signal diverges from the preponderance of prior comparative data. A meta-analysis by Dermanis et al. pooling 14 studies and 22,337 patients found no difference in 30-day mortality (OR 1.03; p = 0.91), and a second by Abosheisha et al. demonstrated a trend toward lower mortality with EUS-GJ (OR 0.59; p = 0.05).[11, 12] The ENDURO and Bang et al. randomized trials, neither powered for mortality, reported no statistically significant mortality difference, although Bang et al. observed numerically higher 6-month mortality in the EUS-GJ arm (57.9% vs. 41.7%; p = 0.172).[3, 9] The DRA-GOO trial likewise found no significant 30-day difference despite numerically more deaths in the EUS-GJ arm (21% vs. 12%; p = 0.286).[25] This inconsistency with the broader literature supports residual confounding rather than a true procedural hazard. The signal was sensitive to analytic method, as the risk difference did not reach significance (RD 0.024; 95% CI − 0.005 to 0.052; p = 0.103) despite a significant log-rank test, and it was not sustained at 90 days, which would be unexpected for a durable safety concern. Total bilirubin remained substantially imbalanced after matching (3.5 ± 6.1 vs. 1.8 ± 3.6 mg/dL; standardized difference 0.329), plausibly reflecting more advanced periampullary disease, greater tumor burden, or concomitant biliary obstruction that independently worsens short-term prognosis and influences treatment selection. The mortality finding should therefore be regarded as hypothesis-generating rather than evidence of excess procedural mortality attributable to EUS-GJ.

The observed morbidity reductions are mechanistically plausible. By avoiding operative dissection and anastomotic construction, EUS-GJ reduces transfusion requirements clinically relevant in patients with advanced malignancy who frequently have baseline anemia or nutritional deficiency and lowers the burden of postoperative ileus, whose nearly fourfold reduction directly supports restoration of enteral intake, the primary therapeutic goal of MGOO management.[10] Major abdominal surgery triggers an inflammatory and neuroendocrine cascade of cytokine release, endothelial activation, coagulation upregulation, and hemodynamic instability that is linked to organ dysfunction and thrombosis; by avoiding laparotomy or prolonged laparoscopic intervention, EUS-GJ plausibly attenuates this cascade and the associated risks of acute kidney injury and venous thromboembolism, although these pathways were not directly measured.[20–24] The reduction in sepsis emerged at 90 but not 30 days, suggesting cumulative downstream effects rather than an immediate procedural mechanism. The higher reintervention rate reflects a genuine tradeoff: unlike a surgical anastomosis that epithelializes and achieves structural maturity, EUS-GJ depends on sustained luminal patency through a LAMS, and peri-stent tissue reaction, occlusion, or migration may necessitate repeat intervention.[16, 17] The LONG-RANGE prospective cohort reported clinically overt EUS-GJ dysfunction in 8.4% of patients over a median follow-up of 128 days, typically amenable to endoscopic salvage.[16] The absolute reintervention difference here was modest relative to the reductions in transfusion, ileus, and readmission, and the observed rate (4.3%) was lower than the 15.5% reported by Canakis et al., a discrepancy attributable to differences in case selection, coding definitions, follow-up duration, or technique that cannot be resolved from these data.[7]

The reduction in hospital readmission may be among the most meaningful findings. In patients with advanced malignancy and limited life expectancy, avoiding recurrent hospitalization is an important patient-centered outcome that bears directly on treatment continuity, caregiver burden, and resource

utilization in value-based care. The approximately 15-percentage-point absolute reduction in 30-day readmission represents a favorable benefit-to-risk balance across these endpoints.

Collectively, these real-world data complement existing randomized and observational evidence rather than redefining treatment algorithms: EUS-GJ can achieve outcomes comparable to surgical bypass while reducing several complications of operative intervention, with late stent dysfunction and reintervention remaining the relevant tradeoff. Because the procedure is technically complex and typically concentrated in advanced therapeutic endoscopy settings, these findings support EUS-GJ as an important palliative option at centers with appropriate expertise while preserving a role for SGJ when anatomy, durability, or local expertise favors surgery. [3, 9, 10, 11, 12, 15, 17, 18]

This study has several strengths. It used a large multicenter EHR network spanning diverse healthcare settings across the United States, strengthening external validity, and propensity score matching achieved adequate balance across most measured covariates. The matched cohort of 1,520 patients is among the largest longitudinal EHR-based comparisons of EUS-GJ and SGJ to date, with sufficient power to detect differences in uncommon but clinically important outcomes venous thromboembolism, acute kidney injury, and sepsis that prior comparative studies were underpowered to assess. Longitudinal follow-up enabled evaluation of readmissions and delayed complications across two time windows, providing a more comprehensive safety assessment than analyses limited to technical success or index-hospitalization adverse events.

Several limitations warrant consideration. As with all retrospective observational research, residual confounding cannot be eliminated despite propensity score matching; determinants of treatment selection such as performance status, frailty, metastatic burden, symptom severity, nutritional reserve, and degree of obstruction are not reliably captured within TriNetX. Several laboratory covariates remained imbalanced after matching most notably total bilirubin (standardized difference 0.329), along with creatinine, INR, and hemoglobin likely introducing bias, most consequentially in the 30-day mortality analysis. Cohort identification and outcome ascertainment relied on diagnostic and procedural coding, allowing misclassification, and clinically relevant variables such as GOOSS scores, ECOG performance status, chemotherapy exposure, and patient-reported quality of life were unavailable, precluding assessment of comparative efficacy for symptom relief and functional recovery. The TriNetX network predominantly reflects academic medical centers and large integrated health systems, which may limit generalizability to community practice while potentially accounting for the lower reintervention rate observed here. Because deaths occurring outside contributing organizations may be incompletely captured, and because patients who die are no longer at risk for events such as readmission or reintervention, standard Kaplan-Meier and Cox analyses may overestimate the cumulative incidence of non-mortality endpoints; a competing-risk Fine-Gray framework would be methodologically preferable but is not currently supported within TriNetX.[18, 19] Finally, the reintervention definition was restricted to repeat EUS-GJ or SGJ and may exclude endoscopic salvage maneuvers such as balloon dilation or stent-in-stent placement, and the observational design precludes causal inference.

Among patients undergoing palliative treatment for malignant gastric outlet obstruction, EUS-GJ was associated with lower rates of transfusion, ileus or bowel obstruction, acute kidney injury, venous thromboembolism, sepsis, and hospital readmission than SGJ, at the cost of a higher reintervention rate, with comparable rates of gastrointestinal bleeding, respiratory failure, and heart failure. These findings suggest that the minimally invasive nature of EUS-GJ translates into meaningful reductions in postprocedural morbidity and healthcare utilization in real-world practice. Prospective studies incorporating disease stage, performance status, and patient-reported outcomes are needed to refine patient selection for each approach and to determine whether the complication-sparing advantages of EUS-GJ yield improvements in quality-adjusted survival and time spent outside the hospital during the final months of life.

Declarations

Disclosures:

Drs. Anil Mathew Philip, Bhanu Siva Mohan Pinnam, Ibrahimkhalil-Mohamud Sheikh, Saksham Kohli, Revati Varma, Gedion Yilma Amdetsion, Daniel Guifarro, Hemant Mutneja have no conflicts of interest or financial ties to disclose.

Funding:

None

Author Contribution

A.M.P. and H.M. conceived and designed the study, R.V. performed the TriNetX data extraction and statistical analysis, S.K.prepared Figures 1–3, Tables 1–3, and Online Resource 1. A.M.P, I.M.S.and wrote the main manuscript text. B.S.M.P. contributed to study design and interpretation of the data. I.M.S., S.K., R.V., and G.Y.A., D.G. performed the literature review and contributed to drafting the Introduction and Discussion. D.G. contributed to interpretation of the data and critical revision of the manuscript for important intellectual content. H.M. supervised the study and critically revised the manuscript. All authors reviewed and approved the final manuscript.

Data Availability

The data that support the findings of this study were obtained from the TriNetX US Collaborative Network (TriNetX, LLC, Cambridge, MA, USA), a federated electronic health record network. Restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. Aggregated, de-identified data are available to researchers at institutions participating

in the TriNetX network, subject to TriNetX's data use agreements. Additional aggregated results are available from the corresponding author upon reasonable request.

References

1. Jeong SH, Park M, Seo KW, Min JS (2025) Advances in surgical management of malignant gastric outlet obstruction. Cancers 17(15):2567. https://doi.org/10.3390/cancers17152567
2. Upchurch E, Ragusa M, Cirocchi R (2018) Stent placement versus surgical palliation for adults with malignant gastric outlet obstruction. Cochrane Database Syst Rev 5:CD012506. https://doi.org/10.1002/14651858.CD012506.pub2
3. van de Pavert YL, Kastelijn JB, Besselink MG, et al (2025) Endoscopic versus surgical gastroenterostomy for palliation of malignant gastric outlet obstruction (ENDURO): a randomised controlled trial. Lancet Gastroenterol Hepatol 10(12):1065–1074. https://doi.org/10.1016/S2468-1253(25)00209-2
4. Jue TL, Storm AC, Naveed M, et al (2021) ASGE guideline on the role of endoscopy in the management of benign and malignant gastroduodenal obstruction. Gastrointest Endosc 93(2):309–322. https://doi.org/10.1016/j.gie.2020.07.063
5. Ahmed O, Lee JH, Thompson CC, Faulx A (2021) AGA clinical practice update on the optimal management of the malignant alimentary tract obstruction: expert review. Clin Gastroenterol Hepatol 19(9):1780–1788. https://doi.org/10.1016/j.cgh.2021.03.046
6. Troncone E, Fugazza A, Cappello A, et al (2020) Malignant gastric outlet obstruction: which is the best therapeutic option? World J Gastroenterol 26(16):1847–1860. https://doi.org/10.3748/wjg.v26.i16.1847
7. Canakis A, Bomman S, Lee DU, et al (2023) Benefits of EUS-guided gastroenterostomy over surgical gastrojejunostomy in the palliation of malignant gastric outlet obstruction: a large multicenter experience. Gastrointest Endosc 98(3):348–359. https://doi.org/10.1016/j.gie.2023.03.022
8. Kouanda A, Binmoeller K, Hamerski C, et al (2021) EUS-guided gastroenterostomy versus open surgical gastrojejunostomy: clinical outcomes and cost effectiveness analysis. Surg Endosc 35(12):7058–7067. https://doi.org/10.1007/s00464-020-08221-z
9. Bang JY, Puri R, Lakhtakia S, et al (2025) Endoscopic or surgical gastroenterostomy for malignant gastric outlet obstruction: a randomised trial. Gut 75(1):24–32. https://doi.org/10.1136/gutjnl-2025-336339
10. Pinnam BSM, Ojemolon PE, Mohammed A, et al (2025) Comparison of endoscopic and surgical gastrojejunostomy in patients with malignant gastric outlet obstruction: a national cohort analysis (2016–2020). Gastrointest Endosc 102(2):205–213. https://doi.org/10.1016/j.gie.2025.01.025
11. Dermanis AA, Thompson D, Rao PKD, Hajibandeh S, Hajibandeh S (2026) Meta-analysis of endoscopic ultrasound guided gastrojejunostomy versus surgical gastroenterostomy for the management of gastric outlet obstruction. Eur J Surg Oncol 52(6):111818. https://doi.org/10.1016/j.ejso.2026.111818

12. Abosheisha M, Alqasem M, Nasr E, et al (2026) Endoscopic ultrasound-guided gastroenterostomy versus surgical gastrojejunostomy for malignant gastric outlet obstruction: a systematic review and meta-analysis. J Gastrointest Surg 102465. https://doi.org/10.1016/j.gassur.2026.102465
13. Maida M, Facciorusso A, Rizzo GEM, et al (2026) EUS-guided versus surgical gastroenterostomy for the management of malignant gastric outlet obstruction: a systematic review and meta-analysis. Dig Liver Dis 58(3):323–330. https://doi.org/10.1016/j.dld.2025.12.017
14. Menegat ALRS, de Moura DTH, Ribeiro IB, et al (2026) Endoscopic versus surgical gastrojejunostomy for malignant gastric outlet obstruction: a systematic review and meta-analysis. Surg Endosc 40(6):4573–4597. https://doi.org/10.1007/s00464-026-11697-4
15. Brigida M, Crinò SF, Dell'Anna G, et al (2026) Comparative efficacy and safety of treatments for malignant gastric outlet obstruction: a systematic review and network meta-analysis. Gastrointest Endosc. https://doi.org/10.1016/j.gie.2026.02.031
16. Vanella G, Frigo F, Perelli F, et al (2026) Long-term outcomes of EUS-guided gastroenterostomy (LONG-RANGE study): a prospective cohort study. Gastrointest Endosc. https://doi.org/10.1016/j.gie.2026.01.007
17. Forbes N, Coelho-Prabhu N, Al-Haddad MA, et al (2022) Adverse events associated with EUS and EUS-guided procedures. Gastrointest Endosc 95(1):16–26. https://doi.org/10.1016/j.gie.2021.09.009
18. Stein E, Hüser M, Amirian ES, Palchuk MB, Brown JS (2025) TriNetX Dataworks-USA: overview of a multi-purpose, de-identified, federated electronic health record real-world data and analytics network and comparison to the US Census. Pharmacoepidemiol Drug Saf 34(9):e70198. https://doi.org/10.1002/pds.70198
19. Lin TL, Chen YJ, Wu CY (2026) Choosing real-world data for clinical and epidemiological research: methodological lessons from NHIRD and TriNetX—a narrative review. Ann Med 58(1):2616549. https://doi.org/10.1080/07853890.2026.2616549
20. Ostermann M, Lumlertgul N, Jeong R, et al (2025) Acute kidney injury. Lancet 405(10474):241–256. https://doi.org/10.1016/S0140-6736(24)02385-7
21. Albayati MA, Grover SP, Saha P, et al (2015) Postsurgical inflammation as a causative mechanism of venous thromboembolism. Semin Thromb Hemost 41(6):615–620. https://doi.org/10.1055/s-0035-1556726
22. Ronco C, Bellomo R, Kellum JA (2019) Acute kidney injury. Lancet 394(10212):1949–1964. https://doi.org/10.1016/S0140-6736(19)32563-2
23. Gameiro J, Fonseca JA, Neves M, Jorge S, Lopes JA (2018) Acute kidney injury in major abdominal surgery: incidence, risk factors, pathogenesis and outcomes. Ann Intensive Care 8(1):22. https://doi.org/10.1186/s13613-018-0369-7
24. Khan F, Tritschler T, Kahn SR, Rodger MA (2021) Venous thromboembolism. Lancet 398(10294):64–77. https://doi.org/10.1016/S0140-6736(20)32658-1

25. Teoh AYB, Lakhtakia S, Tarantino I, et al (2025) Endoscopic ultrasound-guided gastroenterostomy versus enteral metal stenting for malignant gastric outlet obstruction (DRA-GOO): a multicentre randomised controlled trial. Lancet Gastroenterol Hepatol 10(6):e8–e16. https://doi.org/10.1016/S2468-1253(25)00136-0
26. VanderWeele TJ, Ding P (2017) Sensitivity analysis in observational research: introducing the E-value. Ann Intern Med 167(4):268–274. https://doi.org/10.7326/M16-2607

Figures

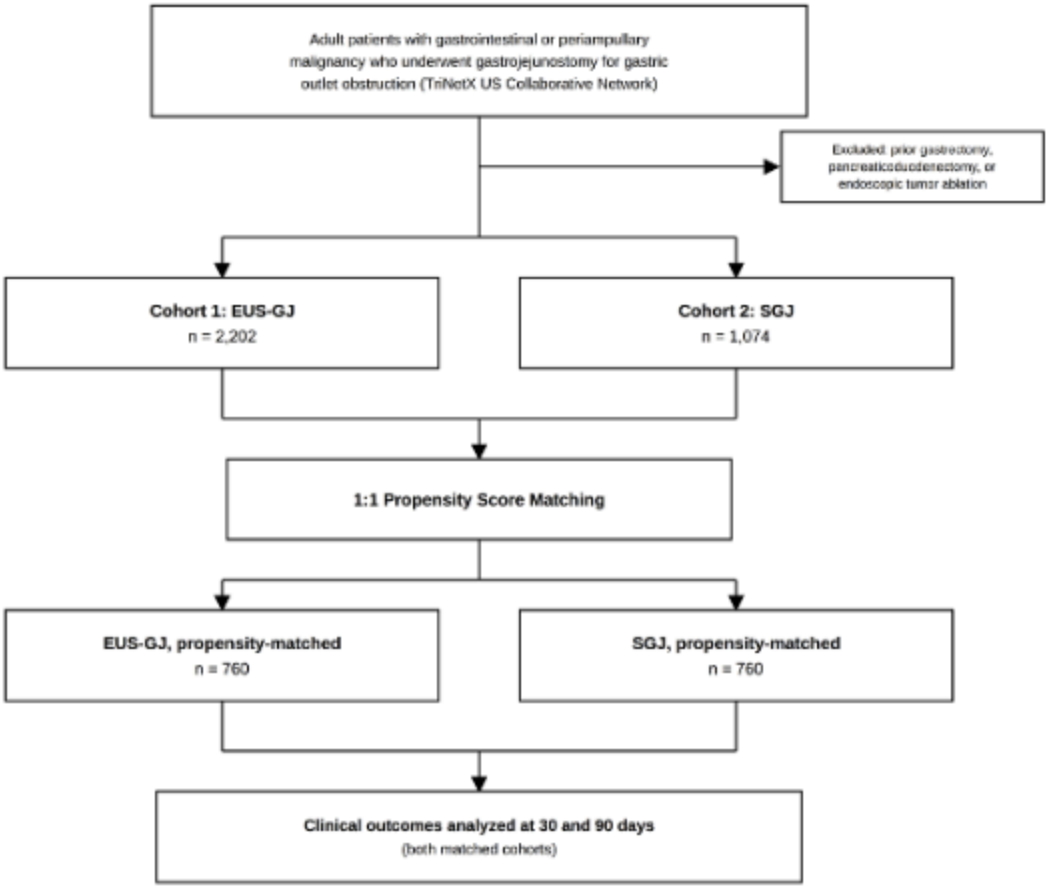

Figure 1

Study flow diagram for the EUS-GJ and SGJ cohorts.
Adults aged ≥18 years with malignant neoplasms of the stomach, pancreas, or duodenum who underwent gastrojejunostomy for malignant gastric outlet obstruction were identified in the TriNetX US Collaborative Network. Before matching, 2,202 patients underwent endoscopic ultrasound-guided gastrojejunostomy (EUS-GJ) and 1,074 underwent surgical gastrojejunostomy (SGJ). After 1:1 propensity score matching using demographics, malignancy type, comorbidities, and baseline laboratory

values, 760 patients remained in each cohort for outcome analysis. Exclusion criteria included prior gastrectomy, pancreaticoduodenectomy, endoscopic tumor ablation, or an index event ≥20 years before the analysis date.

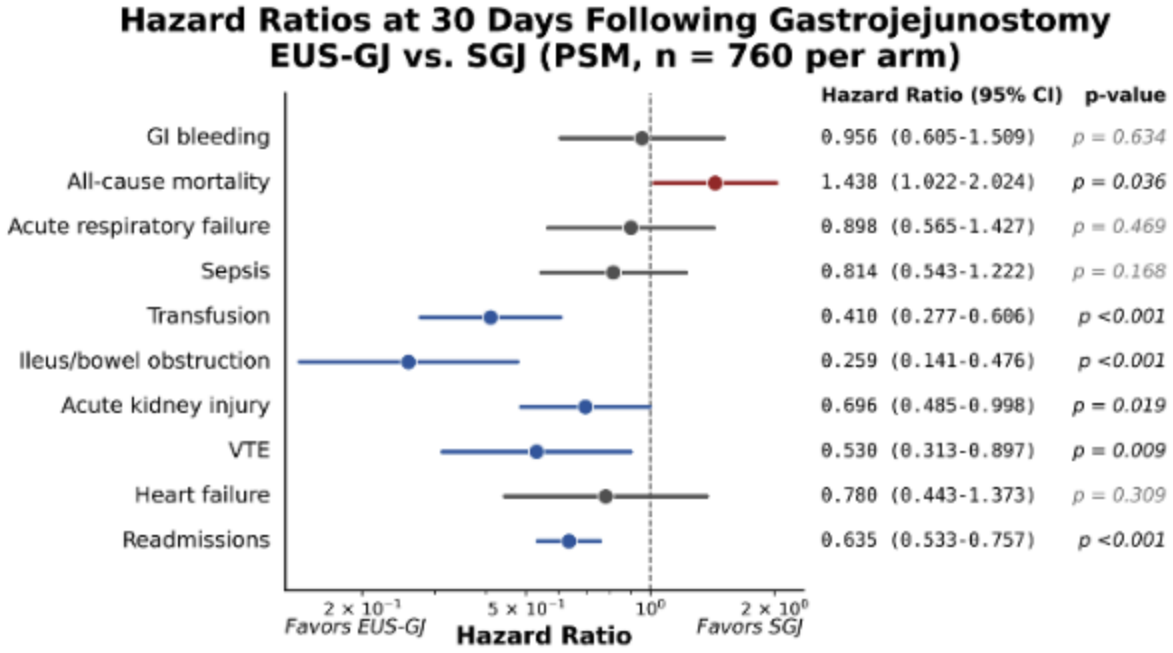

Figure 2

Thirty-day clinical outcomes after EUS-GJ versus SGJ.
Forest plot showing hazard ratios with 95% confidence intervals for 30-day outcomes in the propensity-matched EUS-GJ and SGJ cohorts. Hazard ratios less than 1 favor EUS-GJ, while hazard ratios greater than 1 favor SGJ. At 30 days, EUS-GJ was associated with lower hazards of transfusion, ileus or bowel obstruction, acute kidney injury, venous thromboembolism, and readmission. Gastrointestinal bleeding, acute respiratory failure, sepsis, and heart failure did not differ significantly between groups. A higher 30-day mortality hazard was observed by time-to-event analysis, although the risk difference was not statistically significant.

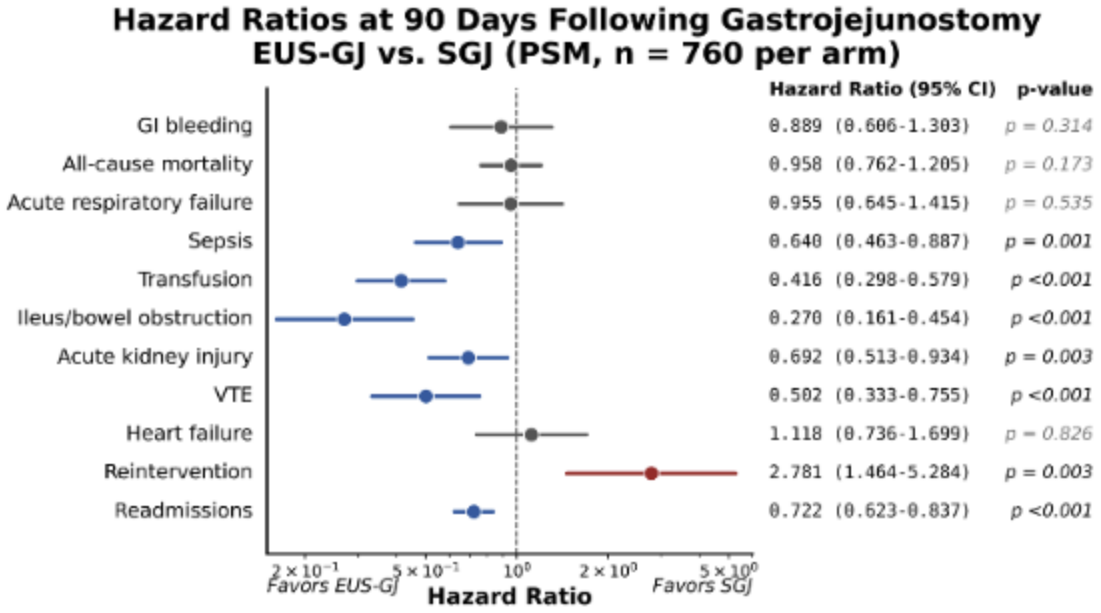

Figure 3

Ninety-day clinical outcomes after EUS-GJ versus SGJ.
Forest plot showing hazard ratios with 95% confidence intervals for 90-day outcomes in the propensity-matched EUS-GJ and SGJ cohorts. Hazard ratios less than 1 favor EUS-GJ, while hazard ratios greater than 1 favor SGJ. At 90 days, EUS-GJ was associated with lower hazards of sepsis, transfusion, ileus or bowel obstruction, acute kidney injury, venous thromboembolism, and readmission. Gastrointestinal bleeding, all-cause mortality, acute respiratory failure, and heart failure did not differ significantly between groups. EUS-GJ was associated with a higher hazard of procedure-related reintervention at 90 days.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- EUSGJvsSGJSupplementalMaterialDDS.docx