

Impact of Falciform Ligament Reinforcement in Esophagojejunostomy Leakage After Total Gastrectomy: A Pilot Study

Qayom Khan Dawlatzay

Marmara University School of Medicine

Ahmet Akmercan

dr.akmercan@gmail.com

Marmara University Pendik Research and Training Hospital

Şakir Karpuz

Marmara University School of Medicine

Tevfik Kivılcım Uprak

Marmara University School of Medicine

Research Article

Keywords: Gastric cancer, Total gastrectomy, Esophagojejunostomy, Anastomotic leakage, Falciform ligament, Anastomotic reinforcement

Posted Date: October 12th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-11111891/v1>

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

[Read Full License](#)

Additional Declarations: No competing interests reported.

Impact of Falciform Ligament Reinforcement in Esophagojejunostomy Leakage After Total Gastrectomy: A Pilot Study

Qayom Khan Dawlatzay¹, Ahmet Akmercan^{2*}, Şakir Karpuz¹, Tevfik Kıvılcım Uprak¹

1 MD, Department of General Surgery, Marmara University School of Medicine, Istanbul, Turkey

2 MD, Department of General Surgery, Marmara University Pendik Training and Research Hospital, Istanbul, Turkey

*** Corresponding Author:** Ahmet Akmercan, MD

Address: Marmara University Pendik Training and Research Hospital, Fevzi Çakmak Mahallesi, Muhsin Yazıcıoğlu Caddesi, No:10, 34899 Pendik/Istanbul, Türkiye

Tel: +905342000446 , ORCID iD: 0000-0002-9470-4249

e-mail: dr.akmercan@gmail.com

Abstract

Introduction:

The falciform ligament is used in various reconstructive procedures; however, its use in esophagojejunostomy reinforcement has not been reported previously. This study aimed to evaluate the impact of falciform ligament reinforcement (FLR) on the incidence of esophagojejunostomy leakage after total gastrectomy.

Materials and Methods

This retrospective cohort study included consecutive patients with gastric adenocarcinoma who underwent total gastrectomy with hand-sewn esophagojejunostomy. Patients were divided into two groups based on FLR use. Demographic, clinicopathological, operative, and postoperative data were analyzed. The primary outcome was esophagojejunostomy leakage. Secondary outcomes included anastomotic stricture, length of hospital stay, and factors associated with leakage.

Results:

A total of 106 patients were included, comprising 51 patients in the FLR group and 55 in the control group. Baseline demographic and clinicopathological characteristics were comparable between groups. The overall incidence of esophagojejunostomy leakage was 8.5% and was significantly lower in the FLR group than in the control group (2.0% vs. 14.5%, $p = 0.020$). Median hospital stay was significantly shorter in the FLR group (5 vs. 6 days, $p=0.017$). No benign anastomotic strictures were observed during follow-up. Multivariable analysis identified lower preoperative albumin level (OR 1.48, $p=0.043$) and increased intraoperative blood loss (OR 1.03, $p=0.028$) as independent risk factors for leakage. FLR was not a protective factor in the multivariable model.

Conclusion:

Falciform ligament reinforcement was associated with a lower incidence of esophagojejunostomy leakage and shorter postoperative hospital stay after total gastrectomy. Favorable clinical outcomes and technical simplicity suggest that FLR may be a promising adjunctive technique for esophagojejunostomy reinforcement.

Keywords: Gastric cancer; Total gastrectomy; Esophagojejunostomy; Anastomotic leakage; Falciform ligament; Anastomotic reinforcement.

Introduction

Esophagojejunostomy following total gastrectomy for gastric cancer represents a critical step in the surgical procedure. Anastomotic leakage is one of the most severe postoperative complications and is associated with substantially increased morbidity and mortality. The reported incidence of esophagojejunostomy leakage varies across studies, ranging from 3% to 15%. [1, 2] Both patient- and surgery-related factors contribute to the development of anastomotic leakage. Patient-related factors include advanced age, comorbidities, malnutrition, and pre-existing pulmonary and cardiac disease. Surgery-related factors include anastomotic tension, inadequate tissue perfusion, prolonged operative time, and excessive intraoperative blood loss. Intraoperatively, ensuring adequate vascularization of the anastomotic site and constructing a tension-free anastomosis are fundamental principles for reducing the risk of leakage. [3, 4]

The falciform ligament is a versatile, well-vascularized autologous tissue that can be easily harvested during abdominal surgery. It has been used as a valuable reconstructive tool in a wide range of surgical procedures. Reported applications include reinforcement of hiatal and diaphragmatic hernia repairs, treatment of peptic ulcer perforations, biliary and vascular reconstruction, prevention and management of postoperative pancreatic fistula, protection of major vessels following pancreatic surgery, and liver transplantation. [5-7] Given its proximity to the upper gastrointestinal tract and rich vascular supply, the falciform ligament may provide additional mechanical support and vascular reinforcement at the anastomotic site. As an autologous tissue, it can be harvested without additional morbidity and eliminates the need for prosthetic materials. Despite the growing body of evidence supporting falciform ligament use across various abdominal surgical procedures, its application as a reinforcement material for esophagojejunostomy following total gastrectomy has not been previously described in the

literature. We hypothesized that falciform ligament reinforcement may offer a feasible and effective strategy to reduce the incidence and clinical severity of anastomotic leakage.

This study aimed to evaluate the impact of falciform ligament reinforcement (FLR) on the incidence of early esophagojejunostomy leakage following total gastrectomy for gastric cancer.

Material and Methods

Study design and participants

This retrospective cohort study was conducted using data from a prospectively maintained institutional database. Consecutive patients diagnosed with stage I–III gastric adenocarcinoma who underwent total gastrectomy between January 2023 and December 2025 were included. Patients were excluded if they had stage IV disease, underwent emergency surgery, had esophagojejunostomy performed using a stapler, had a non-adenocarcinoma diagnosis, underwent R2 resection, or required multiorgan resection. After applying the exclusion criteria, patients were stratified into two groups based on the use of falciform ligament reinforcement of the esophagojejunostomy: the FLR group and the control group. This study was approved by the Marmara University School of Medicine Clinical Research Ethics Committee (Approval No: 09.2025.25-0721). Written informed consent was obtained from all participants.

Data collection and clinicopathological variables

Demographic and clinical data were collected, including age, sex, body mass index (BMI), American Society of Anesthesiologists Physical Status (ASA-PS), comorbidities, smoking status, and neoadjuvant treatment history. Comorbidities included diabetes mellitus, hypertension, cardiac comorbidities (coronary artery disease, heart failure, arrhythmias, and

valvular disease), and pulmonary comorbidities (chronic obstructive pulmonary disease, bronchiectasis, and a history of pulmonary embolism). Preoperative laboratory values, including hemoglobin and albumin levels, were recorded. Tumor location, operative time, and estimated blood loss were recorded as intraoperative data. Pathological T and N stages were determined based on histopathological examination of the surgical specimen and classified according to the 8th edition of the American Joint Committee on Cancer (AJCC) staging system. [8] Postoperative outcomes, including esophagojejunostomy leakage, stricture, and length of hospital stay, were recorded.

Surgical procedures

All patients underwent total gastrectomy via open approach during the study period. Lymphadenectomy was performed according to the Japanese Gastric Cancer Treatment Guidelines. [9] Digestive tract reconstruction was performed using Roux-en-Y esophagojejunostomy. A hand-sewn, single-layer, full-thickness anastomosis was constructed using braided absorbable sutures. [10]

The decision to perform FLR was left to the discretion of the operating surgeon. In patients who underwent FLR, the falciform ligament was dissected from the anterior abdominal wall from the umbilical level to the diaphragmatic surface and mobilized toward the liver. Small vascular branches were coagulated and divided, creating a well-vascularized pedicled flap approximately 20–30 cm in length without tension. The patch vascularity was routinely assessed under white light following gastric resection, and the falciform ligament was not used if perfusion was deemed inadequate. After completion of the esophagojejunostomy, the mobilized falciform ligament was wrapped circumferentially around the anastomosis without causing luminal narrowing or tension. It was then secured with a single or, if necessary, two

absorbable sutures. Care was taken to avoid torsion or compression of the anastomosis (**Figure 1**).

Definition of anastomotic leakage and anastomotic stricture

Anastomotic leakage was defined based on clinical and/or radiological findings, including one or more of the following: (1) Presence of ingested material or saliva in surgical drains or at the wound site; (2) Radiological evidence of contrast extravasation from the anastomosis or adjacent fluid collections consistent with dehiscence in patients with clinical suspicion (e.g., fever, abdominal pain); (3) Endoscopic confirmation of a defect or fistula at the anastomosis. [3]

Anastomotic stricture was assessed during routine postoperative follow-up visits at 3 and 6 months. Patients were evaluated for symptoms suggestive of benign esophagojejunostomy stricture, including dysphagia, nausea/vomiting, and unintended weight loss. Endoscopic examination was performed in patients with clinical suspicion of anastomotic stricture.

Study outcomes

The primary outcome of the study was to evaluate whether the FLR had a protective effect against esophagojejunostomy leakage. Secondary outcomes included the incidence of anastomotic stricture, length of hospital stay, and identification of factors associated with anastomotic leakage.

Statistical analysis

Descriptive statistics were used to specify the patients' demographics, clinicopathological characteristics, and surgical outcomes. Categorical variables were reported as frequency with percentage n(%), and continuous variables were reported as median

(interquartile range, IQR). The Shapiro-Wilk test assessed the normality of continuous variables. Categorical variables were compared with the chi-square or Fisher's exact test, while continuous variables were compared with the Mann-Whitney U test. Multivariable regression analysis was used to evaluate the association between variables and esophagojejunostomy leakage. Variables with a p -value < 0.05 in the univariable analysis were included in the multivariable model. The odds ratio (OR) with a 95% confidence interval (CI) was calculated for each variable. All statistical analyses were conducted using Jamovi software (version 2.7.8), and a two-sided p -value < 0.05 was regarded as statistically significant.

Results

A total of 106 patients met the inclusion criteria and were included in the final analysis. Following the application of exclusion criteria, patients were divided into two groups: those who underwent falciform ligament reinforcement ($n = 51$) and those who did not ($n = 55$) (**Figure 2**).

The median age of the entire cohort was 66 years (IQR: 59–71), and 74.5% of patients were male. There were no statistically significant differences between the FLR group and the control group regarding age ($p = 0.571$), sex ($p = 0.179$), BMI ($p = 0.147$), ASA-PS score ($p = 0.886$), smoking status ($p = 0.392$), or neoadjuvant chemotherapy ($p = 0.252$). Comorbidities—including diabetes mellitus, hypertension, cardiac diseases, and pulmonary diseases—were comparable between the groups (all $p > 0.05$). Preoperative laboratory parameters (hemoglobin and albumin levels), operative time, estimated blood loss, tumor location, and pathological T and N stages were also well balanced between groups (all $p > 0.05$). The overall incidence of esophagojejunostomy leakage was 8.5%. The FLR group had a significantly lower rate of esophagojejunostomy leakage compared to the control group (2.0% vs. 14.5%, $p = 0.020$). The median length of hospital stay was significantly shorter in the FLR group (5 days, IQR: 4–6) compared to the control group (6 days, IQR: 5–7) ($p = 0.017$). No benign esophagojejunostomy

strictures were observed during the scheduled follow-up period in either group. Baseline demographic and clinicopathological characteristics of the study population are summarized in **Table 1**.

In the FLR group, one patient developed esophagojejunostomy leakage, which was successfully managed conservatively without additional intervention. In the control group, eight patients developed anastomotic leakage. Of these, three were treated with percutaneous drainage combined with endoscopic stent placement, two underwent stent placement alone, one underwent percutaneous drainage alone, and two were managed conservatively. Despite these treatments, two patients with anastomotic leakage died in the control group.

Comparisons between patients with and without esophagojejunostomy leakage are presented in **Table 2**. Patients who developed leakage were significantly older (median 71 vs. 65 years, $p = 0.006$), had lower preoperative hemoglobin levels (median 9.5 vs. 11.4 g/dL, $p = 0.004$); and had lower albumin levels (median 31 vs. 39 g/L, $p < 0.001$). Estimated intraoperative blood loss was significantly higher in patients with leakage (260 vs. 180 mL, $p < 0.001$). Sex, BMI, ASA-PS score, comorbidities, smoking status, neoadjuvant therapy, tumor location, operation duration, and pathological stage were not significantly associated with anastomotic leakage (all $p > 0.05$).

Univariable analysis found that older age (OR: 1.10, 95% CI: 1.02–1.19; $p = 0.017$), lower hemoglobin level (OR: 1.97, 95% CI: 1.16–3.34; $p = 0.011$), lower albumin level (OR: 1.50, 95% CI: 1.19–1.89; $p < 0.001$), and increased intraoperative bleeding (OR: 1.02, 95% CI: 1.01–1.03; $p = 0.001$) were significant factors associated with esophagojejunostomy leakage. The FLR was identified as a protective factor against the development of esophagojejunostomy leakage in univariable analysis (OR: 0.11, 95% CI: 0.01–0.97; $p = 0.047$). In multivariable analysis, lower albumin level (OR: 1.48, 95% CI: 1.01–2.19; $p = 0.043$) and increased intraoperative bleeding (OR: 1.03, 95% CI: 1.01–1.06; $p = 0.028$) remained independent risk

factors for esophagojejunostomy leakage. The FLR did not remain statistically significant in the multivariable model (OR: 0.36, 95% CI: 0.02–5.23; $p = 0.454$) (**Table 3**)

Discussion

In this retrospective cohort, reinforcement of esophagojejunostomy with a falciform ligament was associated with a significantly lower incidence of esophagojejunostomy leakage and a shorter postoperative hospital stay following total gastrectomy for gastric cancer. Although FLR did not remain an independent protective factor in the multivariable model, the observed reduction in leakage rates suggests a potential beneficial effect on anastomotic healing. Preoperative lower albumin level and increased intraoperative bleeding emerged as independent risk factors of esophagojejunostomy leakage. Our findings provide novel clinical data supporting the feasibility and potential value of this simple, easily available, and low-cost autologous tissue for reinforcement of esophagojejunostomy.

Esophagojejunostomy is one of the most critical steps of total gastrectomy, and the development of anastomotic leakage is associated with negative patient outcomes. Esophagojejunostomy leakage may result in intra-abdominal infection, sepsis, re-intervention, prolonged hospitalization, delayed recovery, and even mortality. The negative clinical burden of this complication stimulates interest in adjunctive techniques aimed at improving the anastomosis healing. Previous studies have demonstrated that reinforcement of the anastomotic site with autologous vascularized tissues or biologic acellular scaffolds has beneficial effects on healing. These beneficial effects are thought to result from mechanical support, enhanced granulation tissue formation, improved collateral blood flow, and stimulation of angiogenesis provided by the vascularized tissue. [11] A study from the Memorial Sloan Kettering Cancer Center reported a clinical anastomotic leakage rate of only 2.7% after reinforcement of the

esophagojejunostomy with a biologically degradable extracellular matrix following total gastrectomy, highlighting the potential protective role of anastomotic reinforcement. [12] The omentum is the most widely utilized autologous tissue for reinforcement of gastrointestinal anastomoses, and its protective effect against anastomotic leakage has been well documented. Zhou et al. reported that omentoplasty significantly reduced anastomotic leakage rates in cervical anastomoses after esophagectomy. [13] A recent meta-analysis showed that omentoplasty decreased leakage rates and promoted anastomotic healing in gastrointestinal surgery. [11]

Unfortunately, the omentum is often unavailable for reinforcement of the esophagojejunostomy following total gastrectomy. The falciform ligament represents an easily available, well-vascularized autologous option that may serve as a practical alternative. The falciform ligament is a feasible and safe pedicled flap in foregut surgery, and it remains underused in abdominal surgery despite its potential. [5, 7] Its successful use has been reported in various surgical fields, including perforated peptic ulcer repair, coverage of liver resection surfaces, vascular reconstructions, and hiatal hernia repair.[6, 14-16] To the best of our knowledge, no previous studies have specifically evaluated the use of falciform ligament reinforcement for esophagojejunostomy following total gastrectomy. Our findings suggest that the theoretical advantages of FLR may translate into meaningful clinical benefits, as the FLR group experienced a significantly lower rate of anastomotic leakage compared with the control group. Beyond the reduction in leakage incidence, one leakage event in the FLR group was managed conservatively, whereas several patients in the control group required invasive interventions, and two died. While the small number of events precludes definitive conclusions, these findings support the possibility of FLR mitigating the clinical severity of leakage. Additionally, no patient in the FLR group developed anastomotic stricture or any FLR-related morbidity during the follow-up period.

Although FLR was significantly associated with the risk of anastomotic leakage in the univariable analysis, this significance did not persist in the multivariable analysis when adjusting for other variables. This finding should be interpreted cautiously due to the small sample size and low number of leakage events in our cohort. The limited patient and event numbers likely reduced the statistical power of the multivariable analysis, increasing the probability of a type II error. Therefore, the loss of statistical significance in the multivariable analysis does not necessarily preclude the clinically relevant potential benefits of FLR.

Several risk factors for esophagojejunostomy leakage following total gastrectomy for gastric cancer have been identified. Across multiple studies, the strongest predictors of leakage include older age, male sex, high BMI, multiple comorbidities (particularly diabetes mellitus and respiratory diseases), smoking, hypoalbuminemia, proximal tumor location, increased intraoperative blood loss, and prolonged operative time. [2-4] In our study, preoperative hypoalbuminemia and increased intraoperative blood loss emerged as independent risk factors for esophagojejunostomy leakage. Hypoalbuminemia is a well-known marker of malnutrition and has been associated with impaired collagen synthesis, tissue regeneration, and anastomotic healing.[3] Increased intraoperative blood loss may reflect greater operative complexity and can lead to tissue hypoperfusion, thereby adversely affecting anastomotic integrity and healing. [17] Patients who developed esophagojejunostomy leakage were significantly older than those without leakage. However, age did not remain an independent predictor in the multivariable analysis. Additionally, we did not observe a significant association between other previously reported risk factors and anastomotic leakage. This discrepancy may be related to the limited sample size, the low number of leakage events, and the relatively homogeneous distribution of clinicopathological characteristics among patients.

This study has several limitations. First, its retrospective, non-randomized design introduces the potential for selection bias and residual confounding. Particularly, the decision

to perform FLR was left to the surgeon's discretion, which may have introduced selection bias. Second, although the cohort was relatively homogeneous, the number of anastomotic leakage events was limited, which may have reduced the statistical power of the multivariable analysis and affected the stability of risk estimates. Third, this was a single-center study including only patients who underwent open total gastrectomy with hand-sewn esophagojejunostomy, which may limit the generalizability of the findings to other surgical techniques and practice settings. In addition, objective assessment of anastomotic perfusion was not routinely performed, precluding evaluation of the biological mechanisms underlying the potential protective effect of falciform ligament reinforcement. Finally, long-term functional results and quality of life were not assessed.

Conclusion

This study provides the first clinical evidence regarding the potential efficacy of FLR in reducing esophagojejunostomy leakage after total gastrectomy. The technique was safe, easily available, and was not associated with anastomotic stricture or procedure-related morbidity during follow-up. Although FLR was not identified as an independent protective factor in multivariable analysis, the observed clinical benefits warrant further investigation in larger prospective multicenter studies.

References

1. Gong W, Li J. Combat with esophagojejunal anastomotic leakage after total gastrectomy for gastric cancer: A critical review of the literature. *Int J Surg.* 2017;47:18-24. doi: 10.1016/j.ijsu.2017.09.019.
2. Liu J, Hu J, Fang J, Chen Y, Chen Y, He J, et al. Risk factors of esophagojejunal anastomotic leakage after total gastrectomy for gastric and Siewert type II/III esophagogastric cancer: a

retrospective analysis from a tertiary hospital. *Front Oncol.* 2024;14:1481278. doi: 10.3389/fonc.2024.1481278.

3. Bracale U, Peltrini R, De Luca M, Ilardi M, Di Nuzzo MM, Sartori A, et al. Predictive Factors for Anastomotic Leakage after Laparoscopic and Open Total Gastrectomy: A Systematic Review. *J Clin Med.* 2022;11(17). doi: 10.3390/jcm11175022.

4. Senti IFS, Herrero Vicente C, Viciano Martin M, Clavell Font A, Garsot Savall E. Unraveling the risks: A systematic review of factors leading to esophagojejunal dehiscence after gastric cancer surgery. *Surg Open Sci.* 2026;31:24-32. doi: 10.1016/j.sopen.2026.03.004.

5. Baskaran V, Banerjee JK, Ghosh SR, Kumar SS, Anand S, Menon G, et al. Applications of hepatic round ligament/falciform ligament flap and graft in abdominal surgery-a review of their utility and efficacy. *Langenbecks Arch Surg.* 2021;406(5):1249-81. doi: 10.1007/s00423-020-02031-6.

6. Kashyap SS, Abbas KA, Herron R, Abbas FA, Chudnovets A, Abbas G. Use of a mobilized, perfused, falciform ligament patch for repair of paraconduit herniation after robotic-assisted Ivor Lewis esophagectomy. *JTCVS Tech.* 2024;25:204-7. doi: 10.1016/j.xjtc.2024.02.023.

7. Liu T, Saber A. Utility of Falciform Ligament in Abdominal Surgery: A Systematic Review. *Am Surg.* 2023;89(6):2705-12. doi: 10.1177/00031348221142577.

8. Amin MB, Greene FL, Edge SB, Compton CC, Gershengwald JE, Brookland RK, et al. The Eighth Edition AJCC Cancer Staging Manual: Continuing to build a bridge from a population-based to a more "personalized" approach to cancer staging. *CA Cancer J Clin.* 2017;67(2):93-9. doi: 10.3322/caac.21388.

9. Japanese Gastric Cancer A. Japanese Gastric Cancer Treatment Guidelines 2021 (6th edition). *Gastric Cancer.* 2023;26(1):1-25. doi: 10.1007/s10120-022-01331-8.

10. Seufert RM, Schmidt-Matthiesen A, Beyer A. Total gastrectomy and oesophagojejunostomy--a prospective randomized trial of hand-sutured versus mechanically stapled anastomoses. *Br J Surg.* 1990;77(1):50-2. doi: 10.1002/bjs.1800770118.
11. Wiggins T, Markar SR, Arya S, Hanna GB. Anastomotic reinforcement with omentoplasty following gastrointestinal anastomosis: A systematic review and meta-analysis. *Surg Oncol.* 2015;24(3):181-6. doi: 10.1016/j.suronc.2015.06.011.
12. Afaneh C, Abelson J, Schattner M, Janjigian YY, Ilson D, Yoon SS, et al. Esophageal reinforcement with an extracellular scaffold during total gastrectomy for gastric cancer. *Ann Surg Oncol.* 2015;22(4):1252-7. doi: 10.1245/s10434-014-4125-4.
13. Zhou D, Liu QX, Deng XF, Zheng H, Lu X, Dai JG, et al. Anastomotic reinforcement with omentoplasty reduces anastomotic leakage for minimally invasive esophagectomy with cervical anastomosis. *Cancer Manag Res.* 2018;10:257-63. doi: 10.2147/CMAR.S145917.
14. Rahimli M, Perrakis A, Schellerer V, Andric M, Stockheim J, Lorenz E, et al. A falciform ligament flap surface sealing technique for laparoscopic and robotic-assisted liver surgery. *Sci Rep.* 2020;10(1):12143. doi: 10.1038/s41598-020-69211-8.
15. Elgazar A, Awad AK, Elseidy SA. Falciform ligament use in perforated duodenal ulcer repair: a case report and literature review. *J Surg Case Rep.* 2020;2020(11):rjaa243. doi: 10.1093/jscr/rjaa243.
16. Costalat G, Dravet F, Noel P, Alquier Y, Vernhet J. Coelioscopic treatment of perforated gastroduodenal ulcer using the ligamentum teres hepatis. *Surg Endosc.* 1991;5(3):154-5. doi: 10.1007/BF02653225.
17. Deguchi Y, Fukagawa T, Morita S, Ohashi M, Saka M, Katai H. Identification of risk factors for esophagojejunal anastomotic leakage after gastric surgery. *World J Surg.* 2012;36(7):1617-22. doi: 10.1007/s00268-012-1559-3.

Legends

Table 1. Baseline clinicopathologic characteristics of patients stratified by falciform ligament reinforcement

Table 2. Clinicopathologic characteristics of patients with and without esophagojejunostomy leakage

Table 3. Univariable and multivariable logistic regression analyses of risk factors for esophagojejunostomy leakage

Figure 1. Stepwise preparation and tension-free application of a falciform ligament for anastomotic reinforcement.

Figure 2. Study flowchart

Declarations: N/A

Ethics approval and consent to participate: This study was performed in line with the principles of the Declaration of Helsinki. This study was approved by the Marmara University School of Medicine Clinical Research Ethics Committee (Approval No: 09.2025.25-0721). Written informed consent was obtained from all participants. The Ethics Committee granted a full waiver of informed consent for reviewing the patient's chart and data analysis.

Acknowledgments: N/A

Declaration of Generative AI and AI-Assisted Technologies in the Writing Process: The initial draft of this article was written in Turkish and later translated into English. To enhance grammar, language quality, readability, and proofreading, the author used ChatGPT 5 (<https://chatgpt.com>). These tools were employed exclusively for AI-assisted copy editing purposes, such as improving grammar, style, and clarity, without autonomous content generation. After using these tools, the author thoroughly reviewed, edited, and approved the final version and takes full responsibility for the published work.

Funding: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Competing interests: The authors have no relevant financial or nonfinancial interests to disclose.

Availability of data and material: The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Code availability: Not applicable

Authors' contributions: All listed authors meet the ICMJE criteria. We attest that all authors contributed significantly to the creation of this manuscript, each having fulfilled criteria as established by the ICMJE. We confirm that the manuscript has been read and approved by all named authors.

All listed authors meet these conditions:

- a. Substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; and
- b. Drafting the article or revising it critically for important intellectual content; and
- c. Final approval of the version to be published; and
- d. Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Credit authorship contribution statement:

Conceptualization: QKD, AA, ŞK, TKU

Methodology: QKD, AA, ŞK, TKU

Formal analysis and investigation: QKD, AA, ŞK, TKU

Writing - original draft preparation: QKD, AA, ŞK, TKU

Writing - review and editing: QKD, AA, ŞK, TKU

Funding acquisition: QKD, AA, ŞK, TKU

Resources: QKD, AA

Supervision: ŞK, TKU

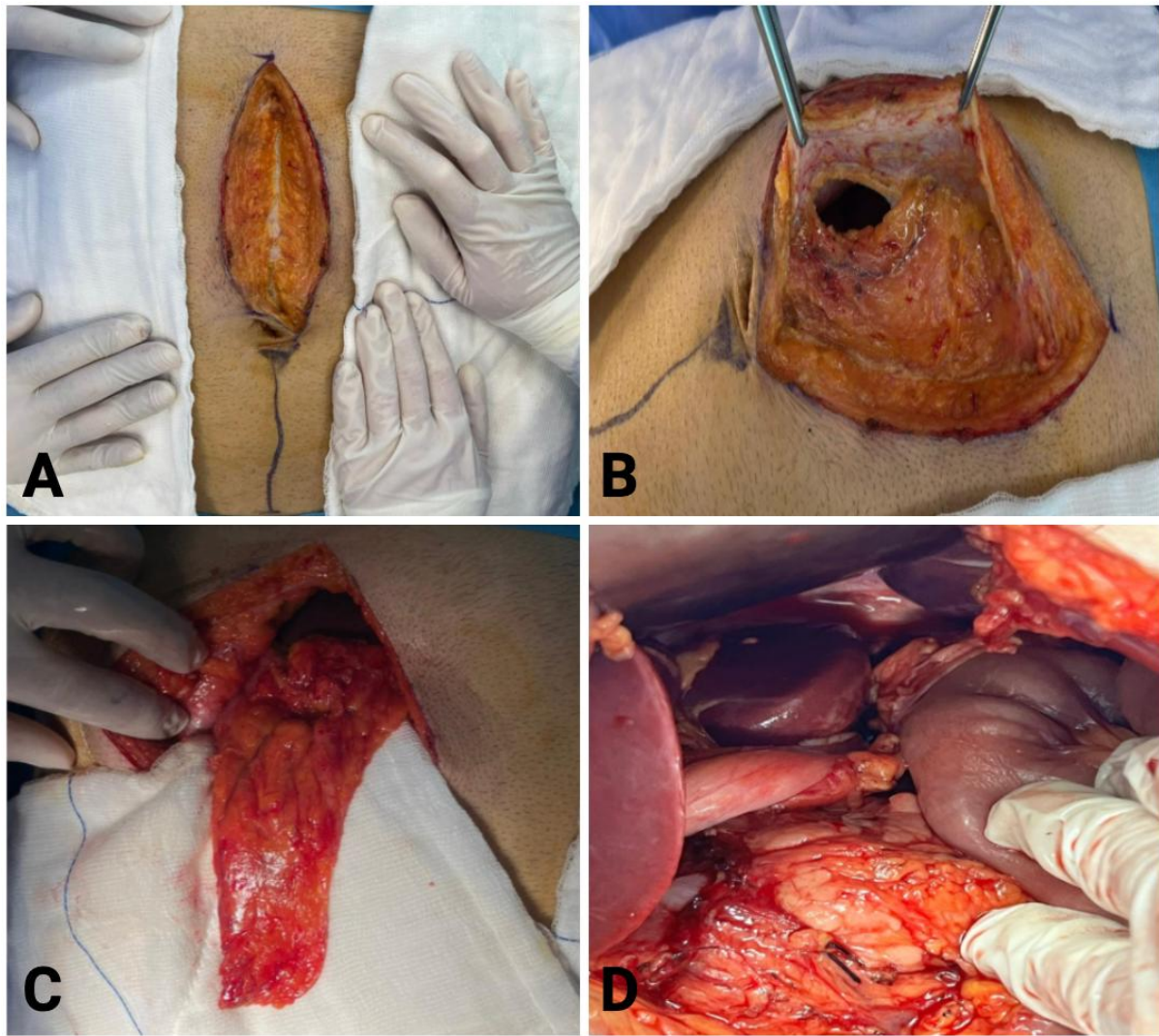


Figure 1: Stepwise preparation and tension-free application of a falciform ligament for anastomotic reinforcement. **(A)** Exposure of the linea alba through a supraumbilical midline incision. **(B)** Mobilization of the falciform ligament by careful dissection from the anterior parietal peritoneum, extending from the umbilicus to the liver. **(C)** Creation of a pedicled falciform ligament flap of sufficient length. **(D)** Tension-free application of the falciform ligament patch around the anastomotic line.

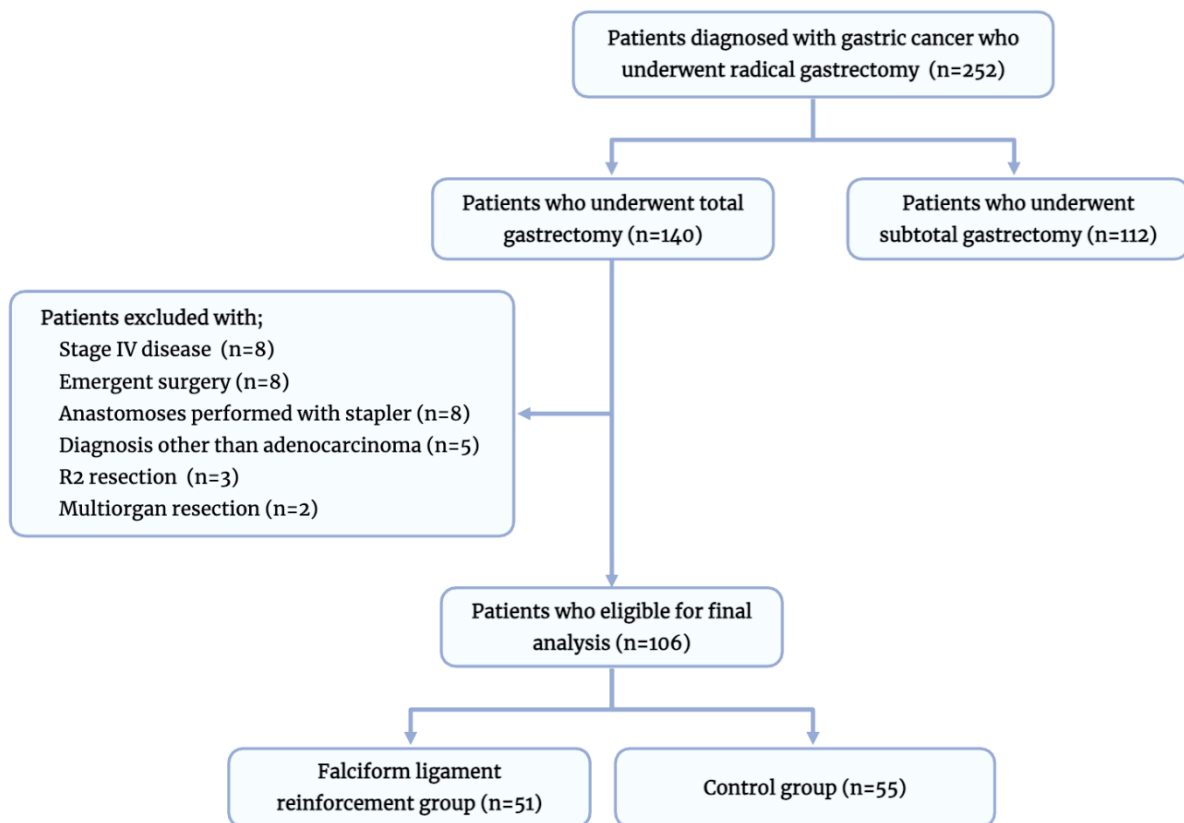


Figure 2: Study flowchart

Table 1: Baseline clinicopathologic characteristics of patients stratified by falciform ligament reinforcement

Parameter	All patients (n=106)	FLR group (n=51)	Control group (n=55)	p-value
Age (years)	66 (59-71)	66 (59-71)	67 (58-72)	0.571
Sex				0.179
Male	79 (74.5%)	35 (68.6%)	44 (80%)	
Female	27 (25.5%)	16 (31.4%)	11 (20%)	
BMI (kg/m ²)	24.5 (22.0-28.2)	24.2 (21.8-27.2)	26.0 (22.5-28.9)	0.147
ASA-PS score				0.886
I	10 (9.4%)	5 (9.8%)	5 (9.1%)	
II	71 (67%)	33 (64.7%)	38 (69.1%)	
III	25 (23.6%)	13 (25.5%)	12 (21.8%)	
Comorbidities				
Diabetes mellitus	29 (27.4%)	11 (21.6%)	18 (32.7%)	0.198
Hypertension	35 (33.0%)	17 (33.3%)	18 (32.7%)	0.947
Cardiac comorbidities	32 (30.2%)	16 (31.4%)	16 (29.1%)	0.798
Pulmonary comorbidities	10 (9.4%)	6 (11.8%)	4 (7.3%)	0.429
Smoking	44 (41.5%)	19 (37.3%)	25 (45.5%)	0.392
Neoadjuvant chemotherapy	50 (47.2%)	27 (52.9%)	23 (41.8%)	0.252
Hemoglobin (g/dL)	11.1 (9.6-12.9)	11.5 (9.9-12.8)	10.8 (9.6-13.0)	0.742
Albumin (g/L)	39 (35-41)	40 (36-41)	38 (35-41)	0.343
Operation duration (min)	125 (110-154)	122 (111-158)	126 (113-152)	0.965
Intraoperative blood loss (ml)	190 (150-250)	180 (150-215)	200 (150-250)	0.081
Tumor location				0.752
Proximal	69 (65.1%)	35 (68.6%)	34 (61.8%)	
Distal	26 (24.5%)	11 (21.6%)	15 (27.3%)	
Linitis plastica	11 (10.4%)	5 (9.8%)	6 (10.9%)	
Pathologic T stage				0.802
pT0/1	11 (10.4%)	4 (7.8%)	7 (12.7%)	
pT2	7 (6.6%)	3 (5.9%)	4 (7.3%)	
pT3	48 (45.3%)	25 (49.0%)	23 (41.8%)	
pT4	40 (37.7%)	19 (37.3%)	21 (38.2%)	
Pathologic N stage				0.837
pN0	28 (26.4%)	14 (27.5%)	14 (25.5%)	
pN1	16 (15.1%)	6 (11.8%)	10 (18.2%)	
pN2	22 (20.8%)	11 (21.6%)	11 (20%)	
pN3	40 (37.7%)	20 (39.2%)	20 (36.4%)	
Anastomosis leakage	9 (8.5%)	1 (2.0%)	8 (14.5%)	0.020
Length of hospital stay	5 (4-7)	5 (4-6)	6 (5-7)	0.017

Categorical data were summarized as frequency count with associated percentages (%), continuous data were summarized as median with interquartile range (IQR)

FLR: Falciform ligament reinforcement, BMI: Body mass index, ASA-PS: American Society of Anesthesiologist Physical Status

Table 2: Clinicopathologic characteristics of patients with and without esophagojejunostomy leakage

Parameter	Patients with no leakage (n=97)	Patients with leakage (n=9)	p-value
Age (years)	65 (58-71)	71 (70-77)	0.006
Sex			0.301
Male	71 (73.2%)	8 (88.9%)	
Female	26 (26.8%)	1 (11.1%)	
BMI (kg/m²)	24.3 (22.1-28.3)	25.7 (20.8-26.8)	0.799
ASA-PS score			0.575
I	10 (10.3%)	-	
II	64 (66.0%)	7 (77.8%)	
III	23 (23.7%)	2 (22.2%)	
Comorbidities			
Diabetes mellitus	26 (26.8%)	3 (33.3%)	0.674
Hypertension	31 (32.0%)	4 (44.4%)	0.446
Cardiac comorbidities	29 (29.9%)	3 (33.3%)	0.830
Pulmonary comorbidities	10 (10.3%)	0	0.311
Smoking	41 (42.3%)	3 (33.3%)	0.603
Neoadjuvant chemotherapy	48 (49.5%)	2 (22.2%)	0.117
Hemoglobin (g/dL)	11.4 (10.0-13.0)	9.5 (8.7-10.3)	0.004
Albumin (g/L)	39 (36-41)	31 (29-34)	<0.001
Operation duration (min)	122 (110-154)	140 (135-150)	0.090
Intraoperative blood loss (ml)	180 (150-230)	260 (250-360)	<0.001
Tumor location			0.616
Proximal	62 (63.9%)	7 (77.8%)	
Distal	25 (25.8%)	1 (11.1%)	
Linitis plastica	10 (10.3%)	1 (11.1%)	
Pathologic T stage			0.574
pT0/1	9 (9.3%)	2 (22.2%)	
pT2	6 (6.2%)	1 (11.1%)	
pT3	45 (46.4%)	3 (33.3%)	
pT4	37 (38.1%)	3 (33.3%)	
Pathologic N stage			0.129
pN0	24 (24.7%)	4 (44.4%)	
pN1	13 (13.4%)	3 (33.3%)	
pN2	21 (21.6%)	1 (11.1%)	
pN3	39 (40.2%)	1 (11.1%)	

Categorical data were summarized as frequency count with associated percentages (%), continuous data were summarized as median with interquartile ratio (IQR)

FLR: Falciforme ligament reinforcement, BMI: Body mass index, ASA-PS: American Society of Anesthesiologist Physical Status

Table 3: Univariable and multivariable logistic regression analyses of risk factors for esophagojejunostomy leakage

Factors	Univariable analysis		Multivariable analysis	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age (years)	1.10 (1.02-1.19)	0.017	1.10 (0.02-5.23)	0.134
Hemoglobin (g/dL)	1.97 (1.16-3.34)	0.011	2.78 (0.79-9.80)	0.109
Albumin (g/L)	1.50 (1.19-1.89)	<0.001	1.48 (1.01-2.19)	0.043
Intraoperative blood loss (ml)	1.02 (1.01-1.03)	0.001	1.03 (1.01-1.06)	0.028
FLR No preformed Performed	ref 0.11 (0.01-0.97)	0.047	ref 0.36 (0.02-5.23)	0.454

OR: Odds ratio, CI: confidence interval, FLR: Falciform ligament reinforcement