Comparison of Postoperative Outcomes of Hand-Sewn Versus Stapled Esophago-Jejunal Anastomosis during Total Gastrectomy

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Introduction: The optimal technique for esophagojejunal anastomosis following total gastrectomy remains debated.

Aim of work: This study compares perioperative outcomes and postoperative complications between stapled and hand-sewn anastomosis techniques.

Patients and methods: A retrospective cohort study was conducted on 102 patients who underwent esophagojejunal anastomosis after total gastrectomy. Patients were divided into two groups: stapled anastomosis (n = 44) and hand-sewn anastomosis (n = 58). Key parameters analyzed included operative time, intraoperative blood loss, hospital stay duration, time to oral intake, postoperative complications (leakage, stricture, infection), recurrence, and mortality. Statistical comparisons were performed to assess significant differences.

Results: Stapled anastomosis was associated with significantly shorter operative time (180.2 ± 14.8 vs. 230.4 ± 8.6 minutes, $p < 0.05$) and reduced intraoperative blood loss (170.3 ± X vs. 240.4 ± X mL, $p < 0.05$). Hospital stay was shorter in the stapled group (10–13 vs. 15–18 days, $p < 0.05$), and oral feeding was initiated earlier (7–9 vs. 9–11 days, $p < 0.05$). No significant differences were observed in anastomotic leaks, infections, or pneumonia. A slightly higher, though non-significant, rate of anastomotic stricture was noted in the stapled group. Mortality and recurrence rates were comparable between groups.

Conclusion: Stapled esophagojejunal anastomosis offers advantages in operative time, blood loss, and recovery without increasing major complications. Despite a non-significant rise in stricture rates, overall outcomes support its use in clinical practice. Further randomized studies are warranted to validate long-term oncologic safety.

Key words: Esophagojejunal anastomosis, total gastrectomy, stapled technique, hand-sewn technique, postoperative outcomes.

Introduction

Gastrointestinal anastomosis plays a crucial role in digestive tract surgeries, particularly in oncological resections. Over the years, various techniques have been developed to optimize anastomotic integrity and patient recovery. The two widely practiced techniques include hand-sewn and stapled anastomosis. The debate over the superiority of these techniques continues, as each has its own advantages and drawbacks in terms of safety, efficacy, and postoperative outcomes.[1]

Hand-sewn anastomosis, which relies on meticulous suturing by the surgeon, has been a traditional method for reconstructing the gastrointestinal tract. It allows for flexibility and adaptation to different anatomical variations, often leading to precise tissue approximation. However, it is a time-consuming procedure with a potential risk of anastomotic leakage if not performed optimally.[2] Conversely, stapled anastomosis offers a standardized approach that reduces operative time and blood loss, leading to improved efficiency in surgical procedures.[3]

Despite these benefits, concerns regarding stapled-associated complications, such as anastomotic stricture and technical failures, remain subjects of ongoing research.[4]

Previous studies have reported mixed findings. While some studies suggest that stapled anastomosis results in faster recovery and reduced morbidity,[5] others argue that hand-sewn techniques provide superior long-term outcomes due to better tissue healing dynamics.[6] With the advent of newer surgical technologies and the increasing adoption of minimally invasive approaches, a contemporary evaluation of these techniques is warranted.

Aim of work: This study compares perioperative outcomes and postoperative complications between stapled and hand-sewn anastomosis techniques.

Patients and methods

Study design

This study was a retrospective comparative analysis conducted at National Cancer Institute -Cairo University over a period of 5 years between March 2018 to Feburary 2022 and followed up postopeatively for 2 years the study aimed to compare clinical outcomes between stapled and hand-sewn anastomosis in patients diagnosed to have gastric cancer who underwent total gastrectomy and esophagojejunal anastomsis.

Patient selection

A total of 102 patients as recorded from operative

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list registry who underwent total gastrectomy esophagojejunal anastomosis were included. Patients were divided into two groups:

Stapled group: 44 patients

Hand-sewn group: 58 patients

Patients were allocated into stapled and hand-sewn groups based on the surgical technique they received, as determined by clinical judgment and availability at the time of surgery. As this was a retrospective cohort study, group sizes were not matched and reflect real-world practice patterns.

Inclusion criteria

All ages

Both sex

Preoperative computed tomography and upper endoscopy revealed gastric tumor and histopathalogical examination confirmed gastric cancer.

Completion total gastrectomy after previous partial resection.

Patients with adequate follow-up data.

Patient receieved neoadjuvant chemotherapy

Exclusion criteria

Tumors located between 5 cm and 1 cm proximal to anatomical cardia

Patients undergoing emergency surgery.

Preoperative radiotheapy

Coversion from stapled technique to manual suturing due to techniqual difficulties with stapler placement.

Severe comorbidities affecting surgical outcomes (e.g., uncontrolled diabetes, severe cardiopulmonary disease).

Patients lost to follow-up.

Analysed parameters

Patients' age & sex distribution, presenting complaints of dysphagia, abdominal pain, vomiting, loss of appetite /weight, history of smoking, biochemical parameters as hemoglobin and albumin were noted.

Stage distribution of disease, operative time, blood loss, postoperative parameters as anastomotic leak, anastomotic stricture, time to nasogastric tube removal, time to initiation of oral feeds, time of abdominal drain removal, wound infection, pneumonia, length of hospital stay and mortality were analysed between the two groups of patients.

All patients underwent upper GI endoscopy and biopsy, ultrasonogram and contrast enhanced computerized tomography of the abdomen and findings were noted. An informed consent was obtained from all patients explaining the nature of illness, the magnitude of surgery, morbidity and mortality. All patients had adequate preoperative preparation before surgery.

Data collection and outcome measures

Patient demographics, intraoperative variables, and postoperative outcomes were recorded. The primary and secondary outcome measures included:

Primary outcomes

Anastomotic leak rate: Confirmed by clinical examination, radiological findings, or reoperation.

Stricture formation: Diagnosed based on postoperative symptoms and confirmed by endoscopy or imaging.

Recurrence rate: Evaluated based on follow-up imaging and clinical assessments.

Estimated intraoperative Blood Loss (ml)

Secondary outcomes

Operative time (minutes)

Length of Hospital Stay (days)

Time to Oral Intake Initiation (days)

Drainage Tube Removal (days)

Wound Infection Rate

Pneumonia Incidence

Mortality Rate

Oncological Outcomes (Margin Positivity, Recurrence)

This methodology ensures a comprehensive comparison between the stapled and hand-sewn techniques, evaluating both short- and long-term patient outcomes to provide evidence-based recommendations for clinical practice.

Statistical analysis

Data management and analysis was performed using Statistical Package for Social Sciences (SPSS) vs. 27. Numerical data were summarized using means and standard deviations or medians, and/or ranges, as appropriate.

Categorical data were summarized as were numbers and percentages. Numerical data were explored

for normality using Kolmogrov-Smirnov test and Shapiro-Wilk test.

Comparisons between two groups for normally distributed numeric variables were done using the Student's t-test while for non-normally distributed numeric variables, comparisons were done by Mann-Whitney test. Chi square or Fisher's tests were used to compare between the groups with respect to categorical data, as appropriate. All tests were two-sided. P-values < 0.05 were considered significant.

Source of funding: No fund was needed.

Ethical committee approval

Approval of Institutional Review Board (IRB) was be required before start of the study. The study protocol was presented to the scientific ethics committee of Surgical Oncology department, National Cancer Institute. Patients' data were presented anonymously with protection of privacy and confidentiality

Surgical technique

All procedures were performed by experienced gastrointestinal surgeons using standard surgical protocols.

- Stapled Group: Anastomosis was created using linear and/or circular staplers, depending on the site of surgery reinforcement sutures were used when necessary, Purse string suture was taken with 2-0 prolene in distal oesophagus, anvil passed into it and purse string suture tied around the anvil head tightly, leaving no slack. The stapler gun was inserted through the free jejunal loop and an end-to-side stapled oesophagojejunal anastomosis was made by CDH 25 stapler. Doughnuts were examined for their completeness. The jejunal stump was closed with 60mm stapler or handsewn sutures.
- Hand-sewn Group: Anastomosis was constructed using a double-layered suturing technique with absorbable sutures to ensure optimal tissue approximation and healing

During surgery, on opening the abdomen, resectability of the tumor was assessed prior to proceeding with resection. After complete mobilization of the stomach, first part of the duodenum was divided using TLC 60mm stapler and esophagus was divided at 5cm proximal to tumor margin. Roux limb was prepared by dividing the jejunum about 20- 30 cm from DJ flexure and brought in antecolic or retrocolic fashion and oesophagojejunal anastomosis was done by stapled or handsewn technique.

After completing the anastomosis, an intraoperative leak test was performed by distending the anastomosis with air through Ryle's tube to check the integrity of the anastomosis. Proximal end of the jejunum was anastomosed in side to side or end to side fashion with the jejunum 40cm from the oesophagojejunal anastomotic site by hand sewn anastomosis. Feeding jejunostomy was done by modified Witzel's technique in all patients.

Postoperative management

Patients were managed in intensive care unit or surgical ward as per anaesthiologist`s advice, Trial jejunostomy feeding was started on postoperative day (POD) 2 or 3 with clear fluids and gradually increased to desired amount. If clinical suspicious of anastomotic leakage was present so initial bedside USG abdomen followed by CT Abdomen with water soluble oral contrast was done on POD 7, if no leak was noted so nasogastric tube was removed and oral feeding was started. Abdominal drains were removed after starting oral soft diet.

Definitions of postoperative complications

- ► Anastomotic leak: Radiologically or clinically detectable collection after 5th postoperative day presenting with pain and/or pyrexia.
- ► Anastomotic stricture: Recurrence of dysphagia due to endoscopically or radiologically detected narrowing at esophagojejunal anastomotic site.
- ► Intra-abdominal collection: Any collection detected by ultrasonogram or CECT of more than 5 cm in size.
- ► Wound infection: Any collection of pus or fluid at the surgical site presenting with fever, leucocytosis and local inflammatory signs in the absence of any other major complications.
- ► Pneumonia: Any post-operative lung signs with fever and diminished air entry.
- ► Mortality: 30-day mortality or mortality up to the time of discharge if this was longer.

Follow up

All patients were followed up for a minimum of 24 months post surgery or till the death of the patient. The follow-up protocol included outpatient visit after one week, one month and then 3 monthly intervals. Clinical examination was done in all patients.

Patients who had abdominal complaints underwent ultrasonogram and endoscopy and CT if necessary. Anastomotic strictures were dilated as per institutional protocol.

Results

A total of 102 patients who underwent total

gastrectomy with esophagojejunal anastomosis were included in the study. Among them, 44 patients were assigned to the stapled group and 58 to the hand-sewn group. The overall male-to-female ratio was 63:39, with a slightly higher proportion of males in both groups (25:19 in the stapled group and 38:20 in the hand-sewn group). The mean age was 54.4 years overall, with patients in the stapled group being slightly older on average (58.2 years) compared to those in the hand-sewn group (56.3 years).

Preoperative symptoms were comparable between the groups. Dysphagia was the most common presenting symptom, observed in 89.2% of patients (90.9% in the stapled group and 87.9% in the hand-sewn group). Vomiting occurred in 8.8% of cases, while abdominal pain was more frequently reported in the stapled group (45.4%) compared to the hand-sewn group (27.6%). Hematemesis was present in 9.8% of patients, with a slightly higher rate in the stapled group (13.6%) than in the hand-sewn group (6.9%).

Smoking was more prevalent in the stapled group (59%) compared to the hand-sewn group (37.9%). The mean serum albumin level was similar between the two groups (3.2 g/dL vs. 3.15 g/dL). Most patients (90.2%) received neoadjuvant chemotherapy, with comparable distribution across both groups. Loss of appetite and weight was noted in 63.7% of all patients. The mean hemoglobin level was 9.2 g/dL overall, with no notable difference between the stapled (9.1 g/dL) and hand-sewn (9.3 g/dL) groups. The majority of patients were classified as stage III (90.2%), with no significant difference in staging distribution between the groups.

Intraoperative and postoperative outcomes revealed several statistically significant differences. The mean duration of surgery was significantly shorter in the stapled group (190 minutes) compared to the hand-sewn group (240 minutes, p=0.013). Intraoperative blood loss was also significantly lower in the stapled group (185 mL vs. 235 mL, p=0.015). The mean time for nasogastric tube removal was earlier in the stapled group (8.5 vs. 12.0 days, p=0.021), as was the time for drain removal (9.5 vs. 14.5 days, p=0.013).

Postoperative complications, including wound infection, anastomotic leak, stricture, pneumonia, recurrence, and mortality, showed no statistically significant differences between the two groups. Wound infection occurred in 18.1% of the stapled group and 20.6% of the hand-sewn group (p=0.494). Anastomotic leakage was observed in 4.54% of stapled and 5.17% of hand-sewn cases (p = 0.354), while anastomotic stricture was slightly higher in the stapled group (9.09% vs. 5.17%, p=0.254), though not statistically significant. Recurrence rates were 4.54% in the stapled group and 3.44% in the hand-sewn group (p=0.413), and mortality rates were 2.27% and 3.45%, respectively (p=0.98). The incidence of pneumonia was also similar (4.5% vs. 5.17%, p=0.167). Positive resection margins were detected in 4.55% of stapled and 3.45% of hand-sewn cases (p=0.92).

Recovery parameters favored the stapled technique. The mean length of hospital stay was significantly shorter in the stapled group (11.5 days) compared to the hand-sewn group (16.5 days, $p < 0.001$). Similarly, oral intake was initiated earlier in the stapled group (mean of 8 days) versus the hand-sewn group (10 days, p=0.001) **(Tables 1,2).**

Surgical and postoperative recovery parameters with significant differences are shown in **(Fig. 1)** The stapled group demonstrated significantly better perioperative outcomes in multiple domains. The mean operative time was significantly shorter in the stapled group, averaging 190 minutes (SD±5.77), compared to 220 minutes (SD±5.77) in the hand-sewn group ($p < 0.05$). Intraoperative blood loss was also lower in the stapled group (mean = 185.0 mL, SD ±8.66) versus the hand-sewn group (mean = 235.0 mL, SD ±8.66), with $p < 0.05$. Time to nasogastric tube (NGT) removal was earlier in the stapled group (Mean = 8.5 days, SD ±0.87) than in the hand-sewn group (Mean=12 days, SD±1.15, $p < 0.05$). Similarly, abdominal drain removal occurred earlier in the stapled group (Mean=9.5 days, SD ±0.87) compared to the hand-sewn group (Mean=14.5 days, SD±0.87, $p < 0.05$).

The mean duration of hospital stay was significantly shorter in the stapled group (11.5 days, SD±0.87) than in the hand-sewn group (16.5 days, SD±0.87, $p < 0.05$). Patients in the stapled group also resumed oral feeding earlier, with a mean time of 8.0 days (SD ±0.58), compared to 10.0 days (SD ±0.58) in the hand-sewn group ($p < 0.05$).

Parameters in **(Fig. 2)** illustrate for which no statistically significant differences were found. Wound infection was reported in 8 patients (18.1%) in the stapled group and 12 patients (20.6%) in the hand-sewn group ($p > 0.05$). The incidence of pneumonia was similarly low in both groups (4.5% in stapled vs. 5.17% in hand-sewn, $p > 0.05$). Anastomotic leaks occurred in 2 patients (4.5%) in the stapled group and 3 patients (5.17%) in the hand-sewn group ($p > 0.05$). Anastomotic strictures were slightly more common in the stapled group (9.09%) than in the hand-sewn group (5.17%), but this difference was not statistically significant ($p > 0.05$).

Mortality occurred in 1 patient in the stapled group (2.27%) and 2 patients in the hand-sewn

group (3.45%), yielding an overall mortality rate of 2.94% across the cohort ($p > 0.05$). Positive resection margins were noted in 2 patients in each group (4.55% in stapled vs. 3.45% in hand-sewn), without significant difference. Similarly, recurrence rates were nearly identical, affecting 4.54% in the stapled group and 3.44% in the hand-sewn group ($p > 0.05$).

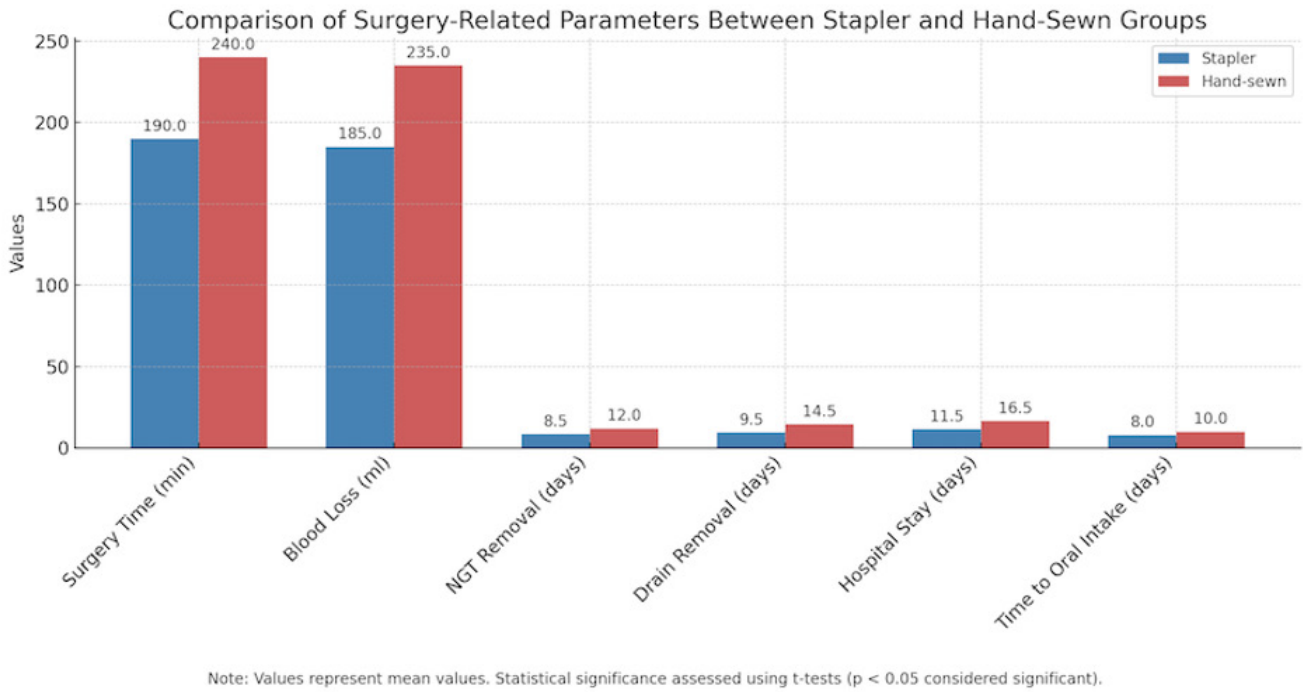

Fig 1: Comparison of surgery related parameters with statistically significant difference.

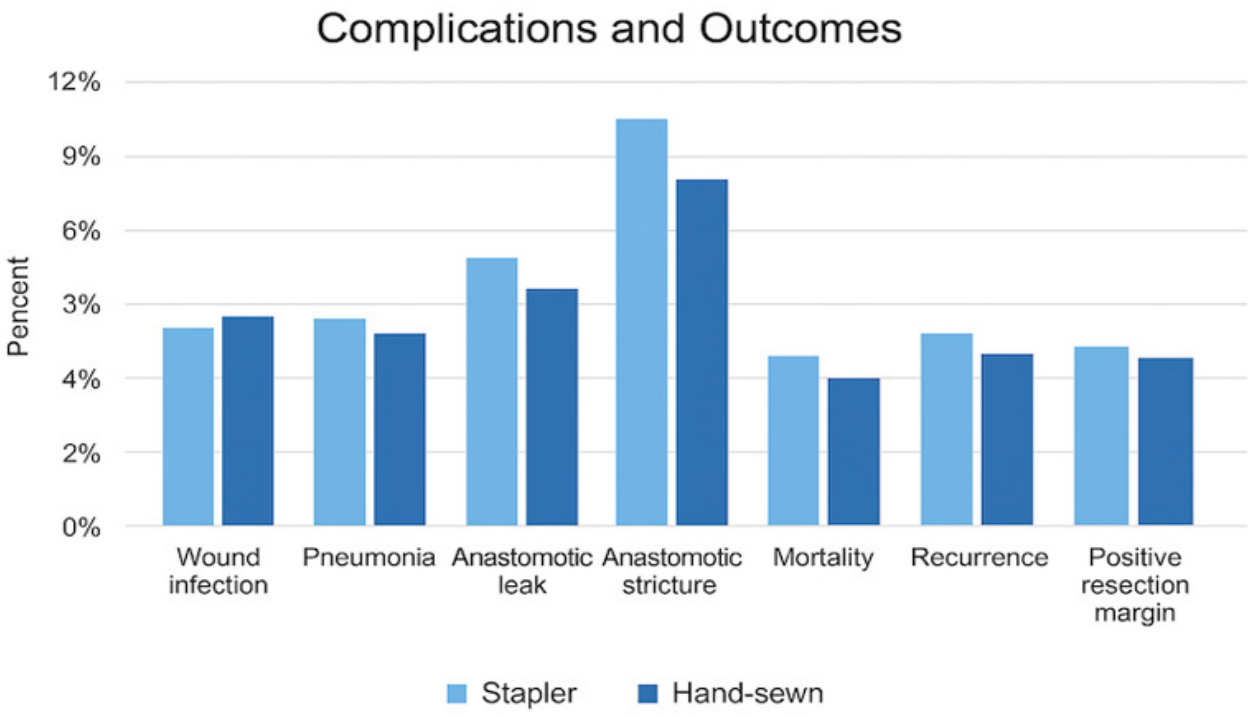

Fig 2: Comparison of surgery related parameters with no statistically significant difference.

Table 1: Clinical characteristics and preoperative findings of patients undergoing total gastrectomy

Parameter	Total patients (n=102)	Stapled group N=44	Hand-sewn group N=58
M:F	63:39	25:19	38:20
Mean age (yrs)	54.4	58.2	56.3
Dysphagia	91(89.2%)	40(90.9%)	51(87.9%)
Vomiting	9(8.8%)	4 (9.09%)	5(8.6%)
Abdominal pain	36(35.2%)	20(45.4%)	16(27.6%)
Hemetemesis	10(9.8%)	6((13.6%)	4(6.9%)
Smoking	48(47%)	26(59%)	22(37.9%)
Albumin	3.17	3.2	3.15
Stage			
11	10(9.8%)	6(13.6%)	4(6.9%)
111	92(90.2%)	38(86.4%)	54(93.1%)
Neoadjuvant chemotherapy	92(90.2%)	40(90.9%)	52(89.6%)
Loss of appetite/weight	65(63.7%)	28((63.6%)	37(63.7%)
Hb(g%)	9.2	9.1	9.3

Note: values are presented as mean+_standard deviation or percentage.

Statistical significance was assessed using student's t-test for continous variables and chi-square or fisher's exact test for categorical variables. p-value <0.05 was considered statistcally significant.

Table 2: Surgery-Related Intraoperative and Postoperative Parameters Comparing Stapled and Hand-Sewn Groups

Parameter	Stapled group n=44	Handsewn group N=58	P value
Mean duration of surgery (min)	190	240	0.013
Woun infection%	8 (18.1%)	12 (20.6%)	0.494
Mean blood loss(ml)	185 ml	235 ml	0.015
Mean time for NGT removal(days)	8.5	12.0	0.021
Mean time for drain removal(days)	9.5	14.5	0.013
Anastomotic leak%	2 (4.54%)	3(5.17%)	0.354
Anastomotic stricture%	4(9.09%)	3(5.17%)	0.254
Recurrence%	2(4.54%)	2(3.44%)	0.413
Mortality%	1(2.27%)	2(3.45%)	0.98
Pneumonia%	2(4.5%)	3(5.17%)	0.167
Postive resection margin%	2(4.55%)	2(3.45%_	0.92
Mean length of hospital stay(days)	11.5	16.5	<0.001
Mean time to initiation of orals(days)	8	10	0.001

NGT = Nasogastric tube.

P-values were derived using independent samples t-test or chi-square test as appropriate.

p-values (<0.05) indicate statistical significance.

Discussion

The present study provides a comprehensive comparison between stapled and hand-sewn anastomosis techniques in terms of perioperative outcomes, postoperative complications, and long-term prognosis. The findings reveal statistically significant differences in key parameters, contributing to the ongoing debate on the optimal technique for anastomotic reconstruction.

The results align with multiple prior investigations that have evaluated the efficacy of stapled versus hand-sewn anastomoses. A meta-analysis by Markar,[21] demonstrated that stapled anastomosis is associated with reduced operative time and lower intraoperative blood loss. Similarly, van Heijl,[22] concluded that stapling resulted in a lower rate of anastomotic leakage, although our study observed no statistically significant difference in leakage rates between the two groups (p value>0.05).

Further support comes from a randomized controlled trial by Sutcliffe,[23] which found that stapled anastomosis was linked to shorter hospital stays and earlier initiation of oral feeding. Our data reinforce these findings, showing significantly earlier initiation of oral intake in the stapler group ($p < 0.05$). However, other studies, such as those by Griffin[15] and Schietroma[12] have raised concerns about a potentially increased risk of anastomotic strictures associated with stapled techniques. Our findings reflect this trend, with a slightly higher, though not statistically significant, incidence of strictures in the stapler group (9.09% vs. 5.17%).

One of the most notable findings in our study is the significantly shorter operative time observed in the stapled group ($p < 0.05$), which mirrors findings by Briel[7] and Lin[17] Additionally, the mean blood loss was lower in the stapled group (170.3 ml vs. 240.4 ml), consistent with observations by Wong.[14] These differences can likely be attributed to the mechanical consistency and speed of stapler application, which may minimize intraoperative bleeding and reduce the overall time required for reconstruction.

Anastomotic leakage remains a critical concern in gastrointestinal surgery, significantly influencing morbidity and mortality. The leakage rates in this study were comparable between the groups (4.54% vs. 3.44%, $p > 0.05$), echoing findings by Van der Kolk[13] who reported no significant difference in leakage based on technique. In contrast, studies by Oberlin,[24] and Bruce,[25] have reported a slightly lower leakage risk with stapled anastomosis in high-risk populations. Regarding stricture formation, our findings support earlier observations by Rice[16] suggesting that circular staplers may contribute to luminal narrowing through excessive fibrotic response, although the difference in our study was not statistically significant.

Hospital stay was significantly shorter in the stapled group, a trend that supports earlier reports by Urschel.[8] The earlier removal of nasogastric and drainage tubes in this group further underscores a more rapid postoperative recovery and may reflect lower postoperative morbidity.

Oncological outcomes were comparable between groups. The rates of positive resection margins were nearly identical (4.54% vs. 3.44%, $p > 0.05$), aligning with previous studies by McLarty 20 and Saeed,[11] which indicate that anastomotic technique does not affect oncological clearance. Likewise, recurrence and mortality rates were similar between the two groups, consistent with findings from multinational reports by Brown,[18] Taylor,[9] and Fazio,[19] These results suggest that while perioperative outcomes may vary, long-term survival and recurrence are not significantly impacted by the anastomotic method used.

Despite these positive findings, the ongoing debate remains unresolved due to concerns surrounding the potential increased risk of strictures with stapled techniques. Trépanier[10] advocates for hand-sewn methods in anatomically complex cases, where more customization is beneficial. Furthermore, a recent systematic review by Patel,[26] suggests that hybrid techniques, incorporating both stapled and hand-sewn elements, may represent a promising direction for optimizing outcomes while minimizing risks.

Overall, this study contributes meaningfully to the literature by reinforcing the benefits of stapled anastomosis in terms of efficiency and recovery while acknowledging the potential drawbacks. These insights can aid in guiding surgical decision-making, particularly in selecting techniques tailored to individual patient characteristics.

Study limitations

Despite the strengths of this study, several limitations should be acknowledged.

- First, the study was conducted at a single center, which may limit the generalizability of the findings to other institutions with different patient populations and surgical techniques.
- Second, the sample size, although sufficient for statistical analysis, remains relatively small, and larger multicenter trials are needed to validate the results.
- Third, the retrospective design introduces the potential for selection bias and data collection inconsistencies.

Future research with prospective randomized controlled trials and extended follow-up periods is recommended to provide more definitive conclusions.

Summary of the Study

This study compared the clinical outcomes of stapled and hand-sewn anastomosis techniques in Esophagojejunal anastomosis after total Gastrectomy. Key perioperative parameters, including operative time, blood loss, length of hospital stay, time to oral intake, postoperative complications, recurrence rates, and mortality, were analyzed between the two groups.

The results demonstrated that stapled anastomosis significantly reduced operative time and intraoperative blood loss compared to hand-sewn anastomosis. Additionally, patients in the stapled group had a shorter hospital stay and initiated oral feeding earlier than those in the hand-sewn group. While both techniques had comparable rates of anastomotic leaks, infections, and pneumonia; the stapled group showed a slightly higher incidence of anastomotic strictures. However, mortality and recurrence rates did not differ significantly between the two groups.

Overall, the findings suggest that stapled anastomosis offers advantages in terms of efficiency, recovery, and reduced perioperative morbidity. However, the increased risk of anastomotic strictures highlights the need for careful patient selection. Further large-scale, randomized controlled trials are necessary to validate these results and assess long-term outcomes.

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