DOI: https://doi.org/10.53350/pjmhs02024181551

ORIGINAL ARTICLE

Impact of Innovative Anastomotic Techniques on Anastomotic Leak Rates and Clinical Outcomes Following Gastrectomy

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ABSTRACT

Objective: To evaluate the impact of innovative anastomotic techniques on anastomotic leak rates and clinical outcomes following gastrectomy.
Place and Duration of Study: Department of General Surgery, Northwest Teaching Hospital, Peshawar, from Oct 2022 to September 2023.
Methodology: This randomized controlled trial included 100 patients undergoing gastrectomy for gastric cancer or benign conditions. Patients were randomly allocated into two groups: Group A (conventional anastomotic technique) and Group B (innovative anastomotic technique). The primary outcome was the rate of anastomotic leaks. Secondary outcomes included postoperative complications, surgery duration, and hospital stay. Data were analyzed using chi-square and t-tests, with a p-value of <0.05 considered significant.
Results: Anastomotic leak rates were 10% in the conventional group and 4% in the innovative group (p=0.24). Postoperative complications occurred in 24% of patients in the conventional group and 16% in the innovative group (p=0.32). Surgery duration was significantly shorter in the innovative group (160 ± 20 minutes) compared to the conventional group (175 ± 25 minutes, p=0.03). Hospital stay was shorter in the innovative group (12 ± 2 days) compared to the conventional group (14 ± 3 days, p=0.05).
Conclusion: Innovative anastomotic techniques demonstrated a trend toward reduced leak rates, shorter surgery duration, and hospital stay, although the difference in leak rates was not statistically significant. Further studies with larger sample sizes are recommended.
Keywords: Gastrectomy, anastomotic leak, innovative techniques, postoperative complications, randomized controlled trial.

INTRODUCTION

Gastrectomy is a critical surgical procedure commonly performed to treat conditions such as gastric cancer, benign tumors, and severe ulcers. One of the most serious complications following gastrectomy is anastomotic leakage, with rates ranging from 1% to 7% depending on surgical techniques, patient factors, and the extent of the surgery[1,2]. These leaks can lead to severe morbidity, prolonged hospitalization, and increased mortality. Thus, reducing anastomotic leak rates is an essential focus in the development of surgical innovations.

Recent studies have reported that conventional techniques have a leak rate of approximately 10%, while innovative approaches such as indocyanine green (ICG) fluorescence imaging during surgery have reduced leak rates to as low as 5%[6,7]. In light of these developments, it is crucial to investigate whether further refinements in anastomotic techniques can lower leak rates even further.

The current study aims to evaluate the impact of innovative anastomotic techniques on reducing leak rates following gastrectomy. With the serious clinical consequences of anastomotic leaks, ongoing research into improved techniques is essential to optimize surgical outcomes and enhance patient safety.

METHODOLOGY

This randomized controlled trial (RCT) was conducted at the Department of General Surgery, Northwest Teaching Hospital Peshawar form October 2022 to September 2023.Patients requiring gastrectomy for gastric cancer or benign gastric conditions were recruited. Participants were randomly allocated into two groups: Group A received the conventional anastomotic technique, and Group B underwent the innovative anastomotic technique. The primary outcome of the study was the rate of anastomotic leaks, while secondary outcomes included postoperative complications, duration of surgery, and length of hospital stay.

Inclusion Criteria: Patients eligible for inclusion in the study were those aged 18 years or older, diagnosed with either gastric cancer or benign gastric conditions requiring gastrectomy. Only patients who were deemed fit for surgery based on a comprehensive preoperative evaluation were considered. Additionally, all participants provided written informed consent before enrollment in the study.

Exclusion Criteria: Patients were excluded from the study if they had metastatic or unresectable gastric cancer, which would render the gastrectomy non-viable as a treatment option. Those with a history of previous gastric surgery were also excluded to avoid confounding factors from past surgical interventions. Patients with severe comorbidities, such as uncontrolled diabetes or advanced cardiac or pulmonary disease, that contraindicated surgery were not eligible to participate. Finally, pregnant or breastfeeding women were excluded to ensure patient safety and to avoid complications related to these conditions.

Data were collected preoperatively, intraoperatively, and postoperatively. Preoperative data included patient demographics, comorbidities, and relevant clinical information. Intraoperative data, including the duration of surgery and the type of anastomotic technique used, were recorded. Postoperative data, such as anastomotic leak occurrence, complications, and length of hospital stay, were collected through clinical monitoring during the hospital stay and follow-up visits.

The data were analyzed using statistical software. Descriptive statistics were used to summarize baseline characteristics, while the primary outcome (anastomotic leak rate) was compared between the two groups using a chi-square test. Secondary outcomes, such as postoperative complications, surgery duration, and hospital stay length, were analyzed using appropriate statistical tests. A p-value of <0.05 was considered statistically significant.

RESULTS

The mean age was 60 years (±10) in the conventional group and 58 years (±9) in the innovative group (p=0.35). BMI was similar, with 25 kg/m² (±3) in the conventional group and 24 kg/m² (±3) in the innovative group (p=0.22). Gender distribution was also comparable, with no significant differences between the groups (p=0.42 for both male and female percentages) (Table I).

The conventional group had a leak rate of 10% (5 patients), while the innovative group had a lower rate of 4% (2 patients), although this difference was not statistically significant (p=0.24). Most patients in both groups did not experience leaks, with 90% in the conventional group and 96% in the innovative group remaining leak-free (Table II).

Received on 06-10-2023
Accepted on 25-12-2023

Table 1: Baseline Characteristics (n=100)

Characteristic	Conventional Group (n=50)	Innovative Group (n=50)	p-value
Age (years)	Mean ± SD: 60 ± 10	Mean ± SD: 58 ± 9	0.35
BMI (kg/m²)	Mean ± SD: 25 ± 3	Mean ± SD: 24 ± 3	0.22
Gender (Male)	28 (56%)	26 (52%)	0.42
Gender (Female)	22 (44%)	24 (48%)	0.42

Table 2: Anastomotic Leak Rate (n=100)

Group	Anastomotic Leak (n)	No Leak (n)	p-value
Conventional (n=50)	5 (10%)	45 (90%)	0.24
Innovative (n=50)	2 (4%)	48 (96%)	0.24

Postoperative complications were reported in 24% of the conventional group and 16% of the innovative group (p=0.32). Surgery duration was significantly shorter in the innovative group (160 ± 20 minutes) compared to the conventional group (175 ± 25 minutes, p=0.03). Hospital stay was also shorter in the innovative group (12 ± 2 days) compared to the conventional group (14 ± 3 days), nearing significance (p=0.05) (Table III).

Table 3: Secondary Outcomes (n=100)

Outcome	Conventional Group (n=50)	Innovative Group (n=50)	p-value
Postop Complications	12 (24%)	8 (16%)	0.32
Surgery Duration (min)	Mean ± SD: 175 ± 25	Mean ± SD: 160 ± 20	0.03
Hospital Stay (days)	Mean ± SD: 14 ± 3	Mean ± SD: 12 ± 2	0.05

DISCUSSION

The current study demonstrated a lower anastomotic leak (AL) rate in the innovative technique group (4%) compared to the conventional group (10%), although the difference was not statistically significant. These findings are consistent with previous studies, which report AL rates between 1% and 6% after gastrectomy, with factors such as low albumin levels and diabetes contributing to the risk. A large cohort study involving 3,926 patients identified low albumin concentration and diabetes as key predictors of AL, findings that support this study's results[8]. Laparoscopic techniques, while reducing overall morbidity, have been associated with a higher risk of AL in some cases due to the technical complexity of the procedure[9].

Innovative techniques, such as intraoperative indocyanine green (ICG) fluorescence imaging, have been shown to reduce AL rates by improving tissue perfusion assessment. One study demonstrated a significant reduction in AL rates when ICG was used to guide anastomosis during gastrectomy, underscoring the importance of real-time tissue viability assessment[10]. In the current study, the innovative approach demonstrated a trend toward lower AL rates, supporting the efficacy of advanced surgical techniques[11].

In terms of secondary outcomes, this study found that the surgery duration and hospital stay were significantly shorter in the innovative group. These findings are consistent with studies that report shorter operative times and quicker recovery periods with laparoscopic and robotic-assisted surgeries. For example, a study published in 2020 found that robotic surgery reduced postoperative complications and shortened hospital stays, which aligns with the current study's findings[12].

However, the lack of statistical significance in AL rate reduction in this study may be attributed to the relatively small sample size. Larger studies, such as those involving more than 900 patients, have demonstrated significant reductions in AL rates when innovative techniques are combined with adjunct technologies like ICG or advanced stapling devices[13][14]. This highlights the need for larger-scale studies to validate the findings observed in smaller studies like this one.

The main limitation of this study is the relatively small sample size, which may have reduced the statistical power to detect significant differences in AL rates. Additionally, the study was conducted in a single center, limiting the generalizability of the findings. Another limitation is the short follow-up period, which may not fully capture long-term complications or outcomes associated with anastomotic techniques. Finally, variations in surgeon experience and patient comorbidities could have introduced confounding variables, impacting the outcomes of both groups.

In conclusion, while the study shows potential benefits of innovative anastomotic techniques in reducing AL rates, shortening surgery duration, and decreasing hospital stay, further research with larger sample sizes and longer follow-up periods is necessary to confirm these findings. These results contribute to the growing body of evidence that suggests technological advancements in surgery are likely to improve outcomes for gastrectomy patients[15][16][17].

CONCLUSION

The study demonstrated that innovative anastomotic techniques tend to reduce anastomotic leak rates, shorten surgery duration, and decrease hospital stay compared to conventional methods, though the differences were not statistically significant. The findings highlight the potential benefits of advanced techniques in improving surgical outcomes. However, larger studies with longer follow-up periods are needed to validate these results and determine the full impact of these innovations on postoperative complications and recovery.

REFERENCES

1. Schniewind B, Eichelmann A, El Sourani D, et al. Management of intra-thoracic anastomotic leakages after esophagectomy: updated systematic review and meta-analysis of endoscopic vacuum therapy versus stenting. BMC Surg. 2021;21(1):62.
2. Park DJ, Kim SH, Lee JW, et al. Treatment and prevention of postoperative leakage after gastrectomy for gastric cancer. J Clin Med. 2021;10(14):3023.
3. Mann C, Berlth F, Hadzijusufovic E, et al. Minimally invasive esophagectomy: clinical evidence and surgical techniques. J Clin Med. 2020;9(6):1061–7.
4. Chen Y, Tan S, Li W, et al. Efficacy and safety of totally laparoscopic gastrectomy with uncut Roux-en-Y for gastric cancer: a dual-center retrospective study. World J Surg Oncol. 2023;21(1):42.
5. Slooter GD, Van Daele E, Kumagai Y, et al. Impact of indocyanine green fluorescence imaging on anastomotic leakage rates in gastrectomy: a meta-analysis. J Surg Oncol. 2022;125(8):1081-8.
6. Van Daele E, Ceelen WP, De Vleeschauwer P, et al. Minimally invasive techniques in gastrectomy: current evidence and future prospects. BMC Surg. 2021;21(1):113.
7. Kumagai Y, Kawaguchi Y, Fukuhara S, et al. The "90-second rule" for anastomosis evaluation in gastric surgery using indocyanine green fluorescence. BMC Surg. 2022;22(1):11.
8. Frontiers | Risk factors and conservative therapy outcomes of anastomotic leakage after gastrectomy: Experience of 3,926 patients from a single gastric surgical unit. [Internet]. Available from: https://www.frontiersin.org/articles/10.3389/fonc.2021.687090/full.
9. Sierzega M, Kolodziejczyk P, Kulig P, Kulig J. Impact of anastomotic leakage on long-term survival after total gastrectomy for carcinoma of the stomach. Br J Surg. 2010;97(7):1035–42.
10. Kumagai K, Hiki N, Nunobe S, et al. Validation of the Clavien-Dindo grading system for complications after gastric surgery. Asian J Surg. 2019;42(2):165–72.
11. Bonenkamp JJ, Songun I, Hermans J, Sasako M, Welvaart K, Plukker JT, et al. Randomised comparison of morbidity after D1 and D2 dissection for gastric cancer in 996 Dutch patients. Lancet. 1995;345(8952):745–8.
12. Fujita J, Sugioka A, Tanigawa N, et al. Laparoscopy-assisted gastrectomy: Results of a Japanese multicenter study. Gastric Cancer. 2011;14(2):103–9.
13. Sano T, Sasako M, Yamamoto S, et al. Gastric cancer surgery: morbidity and mortality results from a prospective randomized controlled trial comparing D2 and extended para-aortic lymphadenectomy–Japan Clinical Oncology Group Study 9501. J Clin Oncol. 2004;22(14):2767–73.

14. Takeuchi M, Ishii K, Seki H, et al. Excessive visceral fat area as a risk factor for early postoperative complications of total gastrectomy for gastric cancer: a retrospective cohort study. BMC Surg. 2016;16(1):54.
15. Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. CA Cancer J Clin. 2015;65(2):87–108.
16. Cuschieri A, Fayers P, Fielding J, Craven J, Bancewicz J, Joypaul V, et al. Postoperative morbidity and mortality after D1 and D2 resections for gastric cancer: preliminary results of the MRC randomised controlled surgical trial. Lancet. 1996;347(9007):995–9.
17. Academic.oup.com. The assessment of perioperative risk factors of anastomotic leakage after intestinal surgeries; a prospective study. BJS Open [Internet]. 2020 [cited 2024 Sept 11];107(12):1648–1653. Available from: https://academic.oup.com/bjs/article/107/12/1648/6120830

This article may be cited as: Amin M, Ahmad I, Bazai AK, Jan A, Aslam U, Khan J: Impact of Innovative Anastomotic Techniques on Anastomotic Leak Rates and Clinical Outcomes Following Gastrectomy. Pak J Med Health Sci, 2023;18(1):551-553