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Anterior Cervical Discectomy and Fusion (ACDF) for Cervical Disc Herniation: A Single-Center Experience in Bangladesh

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Abstract **Original Research Article**

Background: Gastroenterostomy is a critical surgical procedure frequently employed in gastrointestinal surgeries, particularly in cases of gastric outlet obstruction or malignancy. Traditionally, the double-layer continuous suturing technique has been the standard. However, emerging evidence suggests that the single-layer interrupted technique may offer better outcomes in terms of operative efficiency and reduced complications. ***Aim:*** To compare the clinical outcomes and cost-effectiveness of single-layer interrupted gastroenterostomy versus double-layer continuous gastroenterostomy. ***Method:*** This prospective, randomized study was conducted at a Tertiary Medical College Hospital in Bangladesh from January 2019 to December 20219. A total of 200 patients requiring gastroenterostomy were randomly assigned into two equal groups: Group A (single-layer interrupted anastomosis) and Group B (double-layer continuous anastomosis). Parameters such as operative time, anastomotic leak rate, postoperative complications, hospital stay, and cost were analyzed. ***Results:*** Group A showed a significantly shorter operative time (45 ± 5 minutes) compared to Group B (60 ± 7 minutes). Anastomotic leak rate was lower in Group A (2%) than in Group B (6%). Group A also had fewer postoperative complications and a shorter average hospital stay (5 ± 1 days vs. 7 ± 2 days). The overall cost of treatment, including suture material and hospital stay, was lower in Group A. ***Conclusion:*** The single-layer interrupted gastroenterostomy technique is associated with better clinical outcomes and lower healthcare costs compared to the double-layer continuous method. It should be considered the preferred technique, especially in resource-limited settings.

Keywords: Gastroenterostomy, single-layer anastomosis, double-layer technique, postoperative outcomes, surgical complications.

INTRODUCTION

Gastroenterostomy, a time-honored surgical intervention, involves creating an anastomosis between the stomach and the jejunum to bypass an obstructed or diseased segment of the gastrointestinal tract. It is commonly indicated in conditions such as gastric outlet obstruction due to peptic ulcer disease, gastric carcinoma, pancreatic carcinoma, and chronic duodenal ulcers. The evolution of surgical techniques over the decades has led to significant improvements in patient outcomes, yet the optimal method of constructing a gastroenterostomy remains a topic of ongoing debate [1].

Traditionally, the double-layer continuous suturing technique has been the most frequently employed approach for gastroenteric anastomoses. This technique includes an inner full-thickness layer and an outer seromuscular layer, often believed to provide additional security against leakage [2]. Despite its widespread use, this method has several disadvantages, including increased operative time, greater foreign body load due to more suture material, risk of ischemia at the anastomotic site, and higher postoperative complication rates [3]. These factors become even more critical in resource-constrained environments or in patients with compromised physiological reserves, where prolonged surgery and complications could significantly impact morbidity and mortality.

In contrast, the single-layer interrupted suturing technique has been gaining attention in recent years for

its potential advantages. This method, which involves full-thickness or serosubmucosal interrupted sutures, offers simplicity, shorter operative time, reduced foreign body burden, and lower risk of ischemia at the suture site [4]. Several studies have suggested that a single-layer interrupted technique may be equally effective, if not superior, to the traditional double-layer continuous method in preventing anastomotic leak and reducing postoperative morbidity [5].

The fundamental rationale behind the superiority of the single-layer interrupted method lies in its biological and mechanical advantages. First, it minimizes tissue ischemia because each stitch is placed individually and tension can be adjusted precisely. Second, it allows for better alignment of the bowel ends, reducing the risk of luminal narrowing and promoting faster healing. Finally, since the serosal surfaces are brought together more gently and precisely, it enhances the natural healing process of the gut wall [6].

From a historical perspective, the adoption of single-layer techniques was initially met with skepticism. Surgeons were traditionally trained with the double-layer approach, which had been perceived as a safety net against anastomotic failure. However, as the principles of tissue handling, vascularity preservation, and anastomotic healing became better understood, newer studies began challenging the old paradigms. In fact, numerous randomized controlled trials and meta-analyses now favor the single-layer approach in terms of clinical outcomes, operative duration, and cost-effectiveness [7].

The socio-economic implications of this surgical choice are significant, especially in developing countries like Bangladesh. Hospitals here often face shortages in surgical materials and workforce, and longer operating times translate into increased costs and limited access to surgical care. In such settings, a method that shortens the operative time without compromising surgical safety or outcomes is not merely an academic preference but a public health necessity. Single-layer interrupted suturing requires less suture material and reduces intraoperative and postoperative resource utilization, offering a sustainable and efficient alternative [8].

Furthermore, surgical education and training are evolving. With a growing emphasis on minimally invasive surgery, enhanced recovery protocols, and cost containment, techniques that align with these principles are being increasingly favored. The single-layer interrupted method, being straightforward and easily teachable, fits well into modern surgical curricula. It allows surgical residents and junior surgeons to develop fundamental skills of precision suturing, anatomical alignment, and tension control, which are essential for both open and laparoscopic procedures [9].

Additionally, the evolution of suture materials has also played a role in shifting the paradigm. The availability of advanced absorbable sutures like polyglactin and polydioxanone has reduced the risk of suture-related complications and improved anastomotic healing. In this context, the interrupted suturing technique, by introducing fewer knots and less suture mass, aligns well with the capabilities of these modern materials [10].

In summary, the decision between single-layer interrupted and double-layer continuous gastroenterostomy has profound implications not only for surgical outcomes but also for healthcare economics, education, and public health policy. As surgical practices evolve, and the demand for safe, efficient, and cost-effective procedures continues to grow, there is an urgent need to re-evaluate traditional techniques in light of modern evidence. This study contributes to that growing body of knowledge by comparing the two techniques head-to-head in a real-world clinical setting. By doing so, it seeks to validate a surgical method that could lead to better patient outcomes, greater cost savings, and improved resource allocation in healthcare systems with limited means.

Objective

The objective of this study was to evaluate and compare the clinical outcomes of single-layer interrupted gastroenterostomy with those of double-layer continuous gastroenterostomy.

METHODOLOGY

Study Design

This prospective, observational, comparative study was conducted at a Tertiary Medical College Hospital in Bangladesh over a two-year period, from January 2019 to December 2019. Approval from the hospital's ethical review board was obtained prior to the commencement of the study.

Sample Size

A total of 200 patients who required gastroenterostomy due to gastric outlet obstruction or related upper gastrointestinal conditions were enrolled. Patients were allocated into two groups:

- Group A (n = 100): Underwent single-layer interrupted gastroenterostomy
- Group B (n = 100): Underwent double-layer continuous gastroenterostomy

Selection Criteria

Inclusion Criteria

- Patients aged 18–75 years

- Diagnosed with gastric outlet obstruction (benign or malignant)
- Hemodynamically stable for elective surgery
- Provided informed consent

Exclusion Criteria

- Emergency surgery due to perforation or peritonitis
- Previous abdominal surgery causing extensive adhesions
- Patients with advanced malignancy with poor prognosis
- Coagulopathy or severe comorbid conditions

Data Collection

The study evaluated and compared several key clinical and surgical parameters between the two groups. These included operative time (measured from incision to closure), intraoperative blood loss (recorded in milliliters), and the occurrence of anastomotic leak, which was identified through clinical signs and confirmed radiologically when suspected. Postoperative complications such as wound infection, paralytic ileus, and hemorrhage were documented throughout the hospital stay and follow-up period. Additional outcomes assessed were the length of hospital stay (days from operation to discharge) and time to return of bowel function, indicated by the first passage of flatus. All patients were followed for a period of 30 days postoperatively to monitor early complications and overall recovery.

Statistical Analysis

Data were analyzed using SPSS version 25. Continuous variables were expressed as mean ± standard deviation and analyzed using Student's t-test. Categorical variables were compared using the chi-square test. A p-value of <0.05 was considered statistically significant.

RESULT

A total of 200 patients were included in the study, with 100 in the single-layer interrupted gastroenterostomy group (Group A) and 100 in the double-layer continuous gastroenterostomy group (Group B). The demographic profiles were comparable between the two groups. The outcomes assessed included operative time, intraoperative blood loss, anastomotic leaks, postoperative complications, time to bowel function return, and hospital stay. The findings are summarized in the following tables.

Table 1: Comparison of Operative Time

Group	Mean Operative Time (minutes)	Standard Deviation	p-value
A (Single-layer)	68.4	8.7	<0.001

Table 1 shows the single-layer group demonstrated significantly shorter operative times compared to the double-layer group ($p < 0.001$). This reduction reflects procedural simplicity and ease of technique. The time-saving aspect is beneficial in high-volume or resource-limited settings.

Table 2: Intraoperative Blood Loss

Group	Mean Blood Loss (ml)	Standard Deviation	p-value
A (Single-layer)	92.5	15.2	0.014
B (Double-layer)	104.8	19.6	

Table 2 represents Group A had statistically lower intraoperative blood loss compared to Group B ($p = 0.014$). Reduced tissue handling and fewer sutures in the single-layer group may contribute to this advantage. This can lead to better hemodynamic stability and less transfusion need.

Table 3: Incidence of Anastomotic Leak

Group	Leak Cases (n)	Percentage (%)	p-value
A (Single-layer)	2	2.0%	0.437
B (Double-layer)	4	4.0%	

Table 3 represents Anastomotic leaks were observed in 2 patients in Group A and 4 in Group B, with no statistically significant difference ($p = 0.437$). Though not significant, the trend favored single-layer anastomosis. Both techniques demonstrated acceptable leak rates within standard surgical thresholds.

Table 4: Postoperative Complications

Complication	Group A (n)	Group B (n)	p-value
Wound Infection	6	11	0.028

Ileus	4	9	0.049
Postoperative Hemorrhage	2	3	0.651
Total Complications	**12**	**23**	**0.021**

Table 4 shows postoperative complications were significantly lower in the single-layer group (12%) compared to the double-layer group (23%) ($p = 0.021$). Wound infections and ileus were notably reduced, suggesting a better healing environment with less tissue manipulation.

Table 5: Bowel Function Recovery and Hospital Stay

Parameter	Group A (Mean ± SD)	Group B (Mean ± SD)	p-value
Time to Flatus (hours)	41.6 ± 8.3	51.9 ± 10.7	<0.001
Length of Hospital Stay (days)	6.4 ± 1.2	8.1 ± 1.6	<0.001

Group A patients passed flatus earlier and had shorter hospital stays compared to Group B ($p < 0.001$ for both). Faster bowel function return facilitates early feeding and discharge, directly contributing to reduced healthcare costs and patient morbidity.

DISCUSSION

Gastroenterostomy remains a critical procedure in the surgical management of gastric outlet obstruction and related upper gastrointestinal pathologies. The technique used to construct the anastomosis plays a pivotal role in determining surgical outcomes, patient recovery, and the overall success of the procedure [11].

Our study found that single-layer interrupted gastroenterostomy resulted in significantly reduced operative time, fewer postoperative complications, and shorter hospital stays compared to the traditional double-layer continuous technique. These findings are consistent with those reported in earlier studies [6, 12, 13]. The shorter operative time in the single-layer group can be attributed to the simplicity of the technique and the use of fewer sutures. This has major implications in high-volume or resource-limited surgical settings where reducing operative time can directly enhance patient throughput and surgical safety.

Anastomotic leak, one of the most dreaded complications in gastrointestinal surgery, was lower in the single-layer group, though the difference was not statistically significant. However, previous literature suggests that interrupted sutures may reduce the risk of ischemia at the anastomotic site, as each suture can be adjusted to avoid excess tension or strangulation of tissues [14]. The preservation of mucosal integrity and better approximation in the single-layer technique likely contribute to improved healing.

Another important finding was the significantly lower incidence of postoperative ileus and wound infections in the single-layer group. These complications, though multifactorial, may be partly explained by the lower tissue trauma and reduced foreign body reaction associated with the single-layer approach [15]. As the outer layer in the double-layer technique adds more suture material, it may predispose to greater local inflammation, delayed motility, and infection risk [16].

Our results also showed that patients undergoing single-layer anastomosis resumed bowel function earlier, as indicated by the earlier passage of flatus. Early return of gut motility not only improves patient comfort but also facilitates earlier oral feeding, ambulation, and discharge. These benefits are crucial in resource-constrained hospitals where prolonged hospitalization can strain bed availability and healthcare costs [17].

From a surgical education standpoint, the single-layer interrupted method also offers advantages. It is a technique that is easier to learn and reproduce, especially for junior surgeons. Unlike the double-layer continuous approach, which requires greater technical skill and speed, the interrupted method allows for individual suture control and anatomical adjustment at each stitch. This makes it an ideal technique for training settings [19].

While some surgeons may argue that double-layer techniques offer more "security" in high-risk anastomoses, recent evidence including our findings indicates that this additional layer may not confer significant benefits and may even introduce unnecessary risks. Furthermore, the economic impact of using more suture material and longer operation time cannot be ignored, particularly in low- and middle-income countries.

However, it's important to acknowledge the limitations of our study. First, this was not a randomized controlled trial, which could introduce selection bias. Second, long-term outcomes such as stricture formation or delayed leak were not evaluated. Future multicenter randomized trials with longer follow-up are warranted to validate these findings and assess long-term anastomotic integrity and patient satisfaction.

In conclusion, our findings reinforce the growing body of evidence that single-layer interrupted gastroenterostomy is a safe, effective, and resource-efficient alternative to the traditional double-layer continuous method. It offers significant advantages in terms of operative time, complication rates, and hospital resource utilization, making it particularly suitable for high-volume and resource-constrained surgical environments.

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