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Single Versus Double Layer Intestinal Anastomosis: A Comparison of Features and Treatment Outcomes

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Abstract **Original Research Article**

Background: Intestinal anastomosis is a critical surgical procedure for restoring gastrointestinal continuity after resection. The choice between single-layer and double-layer anastomosis techniques remains a subject of debate, with implications for operative time, complication rates, and long-term outcomes. This study aimed to compare the features and treatment outcomes of single-layer versus double-layer intestinal anastomosis. ***Methods:*** This comparative study, conducted at Shaheed Ziaur Rahman Medical College Hospital in 2011, included 92 patients undergoing intestinal anastomosis. Group I (45 patients) had single-layer anastomosis, while Group II (47 patients) underwent double-layer procedures. Data were analyzed using SPSS 23.0, with participants selected via consecutive sampling. ***Results:*** Postoperative bowel function returned faster in the single-layer group (76.27 hours) compared to the double-layer group (85.91 hours). First oral intake began earlier in the single-layer group. Wound infection rates were 6.66% in Group I and 12.58% in Group II. Anastomotic leakage occurred in 4.44% of Group I and 10.56% of Group II patients. Mortality was 0% in Group I and 2.12% in Group II. Hospital stays averaged 9.42 days for Group I and 10.8 days for Group II. ***Conclusion:*** The single-layer anastomosis method offers notable advantages over the double-layer conventional technique. Patients undergoing single-layer anastomosis experience a quicker postoperative return of bowel function and an earlier initiation of oral feeding. Additionally, this approach is associated with a lower incidence of anastomotic failure and septic complications. Consequently, single-layer anastomosis is both a safe and cost-effective option for surgical treatment.

Keywords: Anastomosis, Anastomotic leakage, Extra mucosal, Hemicolectomy, Interrupted, Single layer.

INTRODUCTION

Intestinal anastomosis is a crucial surgical procedure that involves the rejoining of two segments of the gastrointestinal tract following resection. The technique used significantly influences postoperative outcomes, including complications such as leakage, stricture formation, and anastomotic healing [1]. Surgeons have long debated the relative merits of single-layer versus double-layer intestinal anastomosis techniques, with each approach having distinct advantages and limitations [2]. Single-layer anastomosis is characterized by a single suture line, often using continuous or interrupted absorbable sutures. It is considered less time-consuming and technically simpler compared to double-layer techniques [3]. This approach minimizes tissue handling and ischemia, which are critical factors in enhancing healing and reducing postoperative complications [4]. On the other hand, double-layer anastomosis, which includes an inner layer of full-thickness sutures and an outer layer of seromuscular sutures, is traditionally believed to provide added strength and security, particularly in high-risk cases [5]. The choice between single- and double-layer anastomosis often depends on clinical factors such as the patient's condition, site of anastomosis, and the surgeon's preference and expertise. Studies have reported comparable outcomes between the two techniques in terms of anastomotic leakage rates and postoperative morbidity, challenging the conventional notion that double-layer anastomosis offers superior results [6,7].

Furthermore, advancements in suture materials and surgical technology have prompted a reevaluation of traditional practices, emphasizing evidence-based approaches tailored to individual patients [8]. The cost-effectiveness of the two techniques has also garnered attention, particularly in resource-limited settings where reducing operative time and material costs is a priority [9]. Single-layer anastomosis, requiring fewer sutures and less time, maybe more suitable in such scenarios. However, concerns remain regarding its applicability in cases involving friable tissues or compromised blood supply [10]. Despite extensive research, whether single-layer or double-layer anastomosis is superior remains unresolved, partly due to variability in study designs and patient populations [11]. This study aimed to compare the features, complications, and treatment outcomes of single- and double-layer intestinal anastomosis techniques in a tertiary care hospital setting. The study sought to provide insights that may guide surgical decision-making and improve patient outcomes by analyzing these factors.

METHODOLOGY

This prospective comparative study was conducted in the Department of General Surgery at Shaheed Ziaur Rahman Medical College Hospital, Bogura, Bangladesh, from January to December 2011. Using consecutive sampling, 92 patients aged 15 to 60 who underwent intestinal anastomosis surgery during the study period were included. The inclusion criteria comprised patients undergoing end-to-end or end-to-side anastomosis of the small or large intestine, while esophageal, gastric, low anterior resection and ileoanal anastomoses were excluded. Eligible patients were required to have a palpable good volume pulse, a systolic blood pressure above 90 mmHg, and a hemoglobin level greater than 8 g/dL. Exclusion criteria included fecal peritoneal soiling (due to increased risks of infection and leakage), a history of previous laparotomy (owing to potential adhesions), multiple anastomoses, and diabetes mellitus (due to a higher likelihood of postoperative complications). The patients were divided into two groups: group I consisted of 45 patients who underwent single-layer extra-mucosal seromuscular anastomosis, while group II included 47 patients who underwent double-layer anastomosis. Ethical approval for the study was obtained from the hospital's ethical committee, and data were analyzed using SPSS version 23.0.

RESULT

In this study, the age distribution between the two groups showed minimal variation. The largest proportion of patients (42.39%) belonged to the 30–45 years age group, accounting for 39 out of 92 patients. The mean age was 37.71 ± 11.65 years, with 27 patients in the over-45 age group and none below 15 years. The most commonly performed surgeries included ileostomy closure (38%), resection and anastomosis of the small and large intestines (25%), and right hemicolectomy closure (8.69%). Resection and anastomosis were primarily performed for cases such as sigmoid volvulus, strangulated hernia, and blunt abdominal trauma. Postoperatively, the timing of bowel movement, marked by the passage of flatus, showed that 3 patients (3.2%) in Group I experienced it within 24 to 48 hours, while none in Group II did. Bowel movements occurring within 48 to 72 hours were observed in 18 patients (40.0%) from Group I and 7 patients (14.89%) from Group II. The majority of bowel movements occurred within 72 to 96 hours, with 22 patients in Group I and 32 patients in Group II. The average time for bowel movement was 70.71 hours in Group I and 84.25 hours in Group II, with the difference being statistically significant ($p<0.01$). Postoperatively, the timing of first oral intake began with sips of water and liquid diets. Within 48 to 72 hours, 6 patients (13.33%) in Group I and 1 patient (2.12%) in Group II initiated oral feeding. Between 72 to 96 hours, 33 patients (73.33%) in Group I and 24 patients (51.06%) in Group II started oral feeding. After 96 hours, oral feeding was initiated in 6 patients (13.33%) from Group I and 22 patients (46.80%) from Group II. Notably, no patients in either group began oral feeding before 48 hours. The observed differences were statistically significant ($p<0.01$). Wound infections were observed in 3 out of 45 patients (6.68%) in Group I, compared to 6 out of 47 patients (12.56%) in Group II. Anastomotic leakage occurred in 2 cases (4.44%) in Group I and 5 cases (10.64%) in Group II. No mortality was reported in Group I (single-layer extra-mucosal anastomosis), whereas 1 patient (2.12%) in Group II (double-layer anastomosis) succumbed to complications from anastomotic leakage, sepsis, and multi-organ failure. These differences were statistically significant ($p<0.01$). In this study, 76 out of 92 patients (82.60%) were discharged from the hospital within 7 to 14 days' post-operation, with 39 patients (86.66%) from Group I and 37 patients (78.72%) from Group II. A prolonged hospital stay of more than 14 days was observed in 4 patients (8.88%) from Group I and 10 patients (21.27%) from Group II. The average postoperative hospital stay was 9.42 days in Group I and 10.8 days in Group II, showing a statistically significant difference ($p<0.01$).

Table 1: Age distribution of patients (N=92)

Age (Years)	Group-I	Group-II	Total	%
15-30 Yrs.	12	14	28	28.26%
30-45 Yrs.	21	18	39	42.39%
45-60 Yrs.	12	15	27	29.34%
Total	45	47	92	100%
Mean± SD	36.47±13.13	37.46±12.81	37.71±11.66	

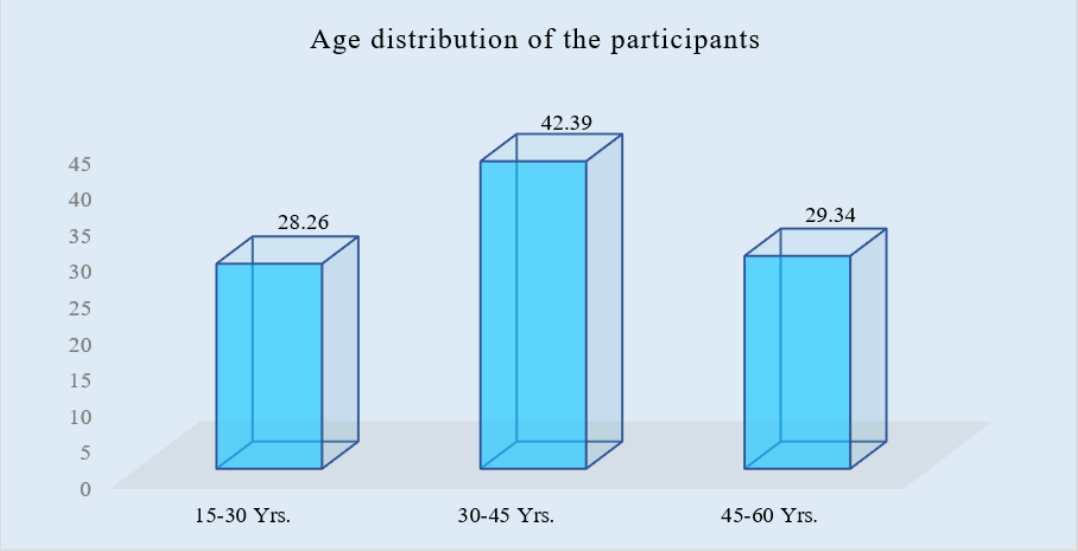

Figure I: Column chart showed age wise patients distribution (N=92)

Table 2: Operative procedures (N=92)

Operation	Single layer	Double layer	Total	%
Ileostomy closure	17	18	35	38.00%
R and A of small and large intestine	9	11	23	25.00%
Right Hemicolectomy	5	3	8	8.69%
Left hemicolectomy	3	3	6	6.52%
Total	45	47	92	99.97

Table 3: Time of bowel movement postoperatively (N=92)

Duration	Single layer	Double layer	n	%
<24 hours	0	0	0	0%
24 to 48 hours	3	0	3	3.20%
48 to 72	18	7	25	27.17%
72 to 96 hours	22	32	54	58.69
>96	2	8	10	7.27%
Average	70.71 hours	84.25 hours		p<0.01

Table 4: Time to first oral intake postoperatively (N=92)

Time to first oral Intake	Single layer	Double layer	Total	%
<48 hours	0	0	0	0%
48 to 72	6	1	7	7.60%
72 to 96 hours	33	24	57	61.95
>96 hours	6	22	28	30.43%
Average	82.01 hours	96.0 hours		p<0.01

Table 5: Postoperative complications (N=92)

Complication	Single layer	Double layer
Wound Infection	3 (6.66%)	6 (12.56%)
Anastomotic leakage	2 (4.40%)	5 (10.64%)
Death	0 (00%)	1 (2.12%)

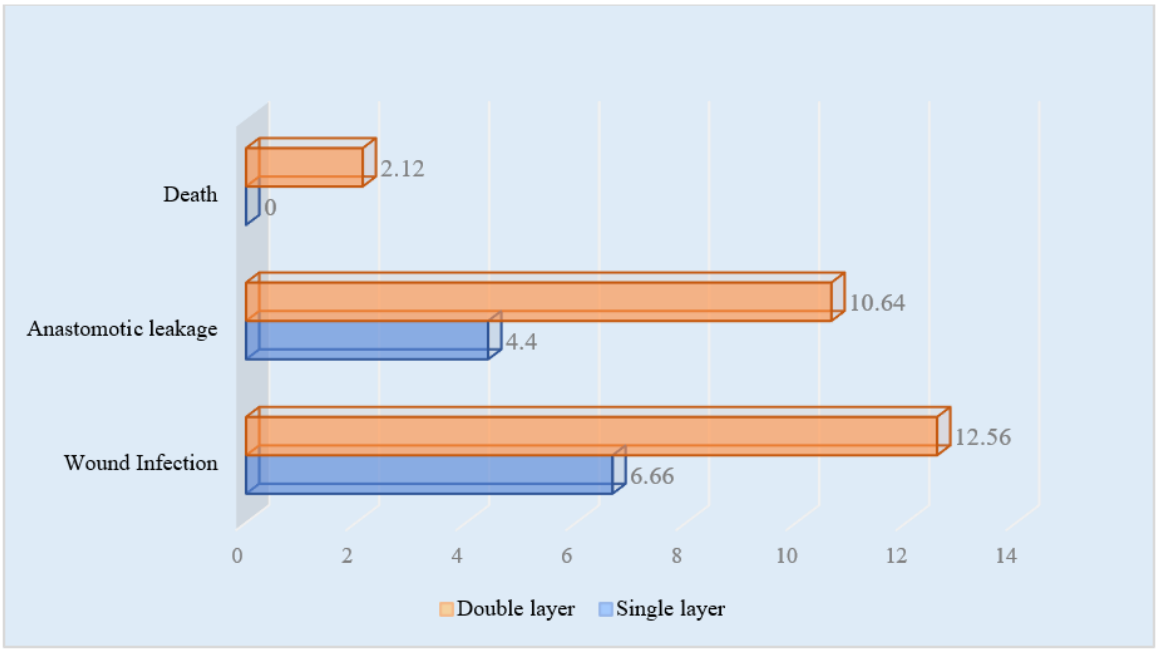

Figure II: Bar chart showed postoperative complications of the patients (N=92)

Table 6: Length of postoperative hospital stay (N=92)

Duration	Group-I	Group-II
Within 7 days	2 (2.3%)	0
7 to 14 days	39 (86.66%)	37 (78.72%)
More than 14 days	4 (8.88%)	10 (21.27%)
Average	9.42 days	10.8 days

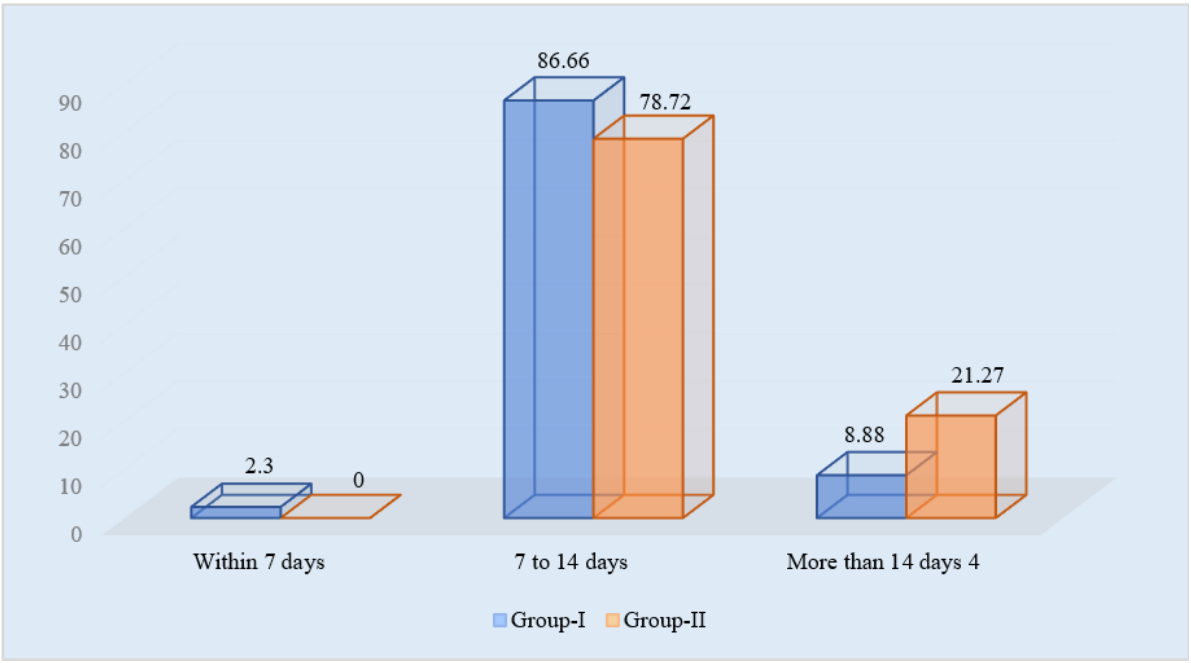

Figure III: Column chart showed duration wise length of postoperative hospital stay among patients (N=92)

DISCUSSION

Bowel movement (flatus) occurred within 24-48 hours postoperatively in 3.2% of group I patients, while none in group II showed bowel movement within this period. Between 48-72 hours, bowel movement was observed in 40% of group I and 14.89% of group II patients. The highest number of patients regained bowel movement within 72-96 hours (22 in group I vs. 32 in group II). The average time for bowel movement was significantly shorter in group I (70.71 hours) compared to group II (84.25 hours, $p<0.01$). Maurya *et al.*, (1984) reported similar findings, with earlier bowel function in

single-layer anastomosis [12]. Postoperatively, oral feeding began with sips of water followed by a liquid diet. Within 48-72 hours, 13.33% of group I and 2.12% of group II patients started oral feeding. Between 72–96 hours, this increased to 33.3% in Group I and 17.02% in Group II. After 96 hours, 53.33% of group I and 80.85% of group II patients began oral feeding. No patient started feeding before 48 hours. The difference between groups was statistically significant ($p<0.01$). The quicker return of bowel function in the single-layer group aligns with findings by Maurya *et al.,* [12]. Early oral feeding is a key consideration in modern surgery, promoting faster recovery and reducing morbidity. Single-layer anastomosis supports earlier bowel function return, enabling earlier feeding. Among the 92 patients in this study, 15 (19.56%) developed postoperative complications. Wound infections occurred in 7 patients: 3 (8.86%) in group I and 6 (12.76%) in group II, showing a significant difference ($p<0.01$). Literature reports wound infection rates of 2 to 11% [13]. A 14-month case-control study by Askarpour *et al.,* found wound infections in 7.9% of single-layer anastomosis patients compared to higher rates in the two-layer group. In this study, 7 patients (11.1%) experienced wound infections, a rate consistent with similar research. Anastomotic leakage occurred in 2 of 45 patients (4.44%) in the single-layer group and 5 of 47 patients (10.58%) in the double-layer group, showing a significant difference ($p<0.01$). Comparable studies reported leakage rates of 6% for single-layer and 12% for double-layer techniques at Allied Hospital, Faisalabad, Pakistan. Samiullah *et al.,* observed rates of 3.8% and 13.11%, respectively [14]. Double-layer anastomosis often includes ischemic tissue in the suture line, increasing tension, leakage, and lumen narrowing. In contrast, single-layer anastomosis minimizes submucosal vascular damage and preserves gut lumen integrity [15]. In group I, the two patients who experienced leakage were successfully managed conservatively. In group II, three patients with fecal fistula were also treated conservatively, while two required re-exploration, stomal diversion, and peritoneal toileting. However, one group II patient, a 50-year-old woman who underwent resection and primary anastomosis for sigmoid volvulus, developed leakage and did not respond to treatment. Despite re-exploration and colostomy, she later developed a pelvic collection, sepsis, and multi-organ failure, resulting in mortality. The mortality rate in group I was 0%, whereas in group II, it was 2.12%, consistent with reported rates in the literature 3.1% [16]. In the study by Samiullah *et al.,* the mortality rate was 0% in the single-layer group and 3.27% in the double-layer group, which aligns closely with our findings. The average postoperative hospital stay was 8.42 days (SD ±2.41) for Group I and 10.8 days (SD ±3.26) for Group II. The hospital stay was significantly longer in the double-layer group ($P < 0.05$), likely due to the higher rates of wound infection and anastomotic leakage. This finding is consistent with the study by Khan AA *et al.,* [17], which showed an average stay of 168 hours (7 days) in the single-layer group and 216 hours (9 days) in the double-layer group. Our study's hospital stay was slightly longer, possibly due to our practice of discharging patients later.

LIMITATION OF THE STUDY

The limitations of this study include a relatively small sample size and a short study duration, which may limit the generalizability and long-term applicability of the findings. Additionally, the long-term outcomes of the operative procedure could not be assessed, and only a limited number of postoperative complications were observed.

CONCLUSION & RECOMMENDATION

The single-layer anastomosis technique offers significant advantages over the double-layer conventional method. It enables a faster postoperative return of bowel function and earlier initiation of oral feeding. Moreover, this approach is linked to a reduced incidence of anastomotic failure and septic complications. Given these benefits, single-layer anastomosis proves to be both a safe and cost-effective option for surgical treatment. Further studies may be warranted to confirm long-term outcomes and establish it as the standard procedure in certain surgical settings.

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