International Journal of Research in Medical Sciences
Baruah A et al. Int J Res Med Sci. 2024 Dec;12(12):4653-4657
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20243722

Original Research Article

A comparison of extra-mucosal single layer interrupted repair vs conventional double layer repair of intestinal anastomosis: a hospital-based study

Alfred Baruah*, Dhirendra Nath Choudhury, Kamal Krishna Patowary

Department of General Surgery, Tezpur Medical College and Hospital, Tezpur, Sonitpur, Assam, India

Received: 21 October 2024
Revised: 18 November 2024
Accepted: 19 November 2024

***Correspondence:**
Dr. Alfred Baruah,
E-mail: alfredbaruah13@gmail.com

ABSTRACT

Background: Intestinal anastomosis is a critical surgical technique used to resect and reconnect segments of the gastrointestinal tract. Traditional double-layered techniques using both absorbable and non-absorbable sutures have been widely used. However, single-layer anastomosis is gaining interest due to its simplicity, cost-effectiveness, and reduced operating time. This study aims to compare the outcomes between extra-mucosal single-layer interrupted repair and conventional double-layer repair.
Methods: A prospective, randomized controlled study was conducted over six months with 42 patients undergoing intestinal resection and anastomosis. Patients were randomized into two groups: single-layer anastomosis (Group A) and double-layer anastomosis (Group B). Both groups were monitored for key outcomes such as anastomotic leak, return of bowel function, surgical site infection, and hospital stay.
Results: The single-layer technique showed a significantly shorter operative time (23.8±2.5 minutes) compared to the double-layer technique (33.1±2.6 minutes). There were no statistically significant differences in anastomotic leak rates, re-interventions, or surgical site infections between the two groups. The cost of materials was lower for single-layer anastomosis.
Conclusions: Single-layer anastomosis offers a time-efficient, cost-effective alternative to double-layer anastomosis with comparable clinical outcomes. The findings support the broader adoption of the single-layer technique, particularly in resource-limited settings.

Keywords: Anastomotic leak, Cost-effectiveness, Double-layer repair, Intestinal anastomosis, Single-layer repair, Surgical outcomes

INTRODUCTION

Numerous intestinal pathologies, including infections like tuberculosis with strictures, Hirschsprung's disease, intestinal atresia, trauma, cancer, etc., may necessitate the creation of an external fistula to preserve the continuity of the gastrointestinal tract or the resection of a portion of the gut that requires anastomosis.[1,2] Hippocrates (460 BC) referred to intestinal suturing in his writings. Celsus (30 BC-30 AD) documented the techniques and procedures of large intestine suturing.[3] The placement of the anastomosis, the caliber and quality of the bowel, and the underlying disease process are all determined during the routine elective and emergency procedure of intestinal anastomosis.[4] Techniques for anastomosis can be performed by laparoscopic procedures, hand sewing, or staples. Many of these methods have changed over time, but because of procedure familiarity and the accessibility

and cost of suture materials, the classic hand-sewn intestinal anastomosis is still widely used today.

There are two methods for hand sewing: the traditional double-layered method, which uses silk for the outer seromuscular layer, and absorbable sutures for the interior layer. The second method, which is typically less expensive and time-consuming than the first method, is the single-layered continuous or interrupted absorbable suture.

There has been debate on the relative safety and effectiveness of the two methods. The incidence of post-operative problems, namely the anastomotic leak rate, can be used to quantify this. The success of an anastomotic surgery is highly dependent on several criteria, including tension-free suturing, healthy bowel margins, correct apposition, and an adequate blood supply. Other patient-related variables, such as immunosuppression, sepsis, and inadequate nutrition, also had an impact on the result.[5]

Anastomotic leak is associated with high mortality and morbidity prolonging hospital study and the length of hospital care.[5] Studies comparing the two techniques showed the single-layered technique is not inferior to the double-layered, but they are quite limited and therefore the former has not been widely practiced by many surgeons who prefer the conventional one.[6]

Hence, this study has been carried out to test the efficacy of single-layered extra mucosal bowel anastomosis over conventional double-layered anastomosis.

METHODS

This was hospital based, prospective, randomised controlled study conducted in the Department of General Surgery, Tezpur Medical College, Assam, India. This study conducted for 6 months from 1st April 2024 to 30th September 2024.

Inclusion criteria

Patients undergoing resection and anastomosis of the small bowel and large bowel for causes like intestinal obstruction, bowel ischemia, strangulated hernia, traumatic bowel injury, and tumors and patient with age >18 years and <60 years were included.

Exclusion criteria

Patient with oesophageal, gastric, or duodenal anastomosis, age <18 years and >60 years, anaemia, coagulopathy, hypoalbuminemia, chronic kidney disease, and diffuse peritonitis and SMA thrombosis were excluded.

Patients with diverse intestinal pathologies were closely monitored from admission to one month after discharge. Primary diagnoses were established through thorough medical histories, physical examinations, and laboratory tests as necessary. Intraoperative confirmation determined eligibility for intestinal anastomosis.

Eligible patients underwent either emergency or elective operations and were alternately assigned to two groups: single-layered intestinal anastomosis (Group A) or double-layered intestinal anastomosis (Group B). Informed written consent was obtained, and procedure outcomes were thoroughly explained.

Surgical technique

All anastomoses were meticulously performed by a seasoned senior operating surgeon, ensuring consistency and expertise throughout the study.

Anastomosis type

The anastomoses constructed were exclusively of the end-to-end type, facilitating optimal tissue alignment and minimizing complications.

Double-layered anastomosis technique

The double-layered anastomosis was executed with precision, comprising two distinct layers:

Inner transmural layer: A continuous Connell suture technique was employed using 3-0 vicryl sutures. This layer ensured a secure and water-tight seal.

Outer seromuscular layer: Interrupted 3-0 silk Lembert sutures were carefully placed, inverting the inner layer to reinforce the anastomosis and promote optimal healing.

Single-layered anastomosis technique: The single-layered anastomosis was performed using a continuous suture pattern with 3-0 vicryl sutures. This technique incorporated all tissue layers, excluding the mucosa, to maintain intestinal integrity.

Outcome measures

Anastomotic Integrity: Assessed for clinical and radiological leaks.

Duration of anastomosis: Time from first stitch to completion (in minutes).

Surgical site infection: Defined as purulent discharge, painful erythema, or cellulitis.

Return of gastrointestinal function: Assessed by bowel sounds and oral intake (>1L/24h).

Day of drain removal: Removed when output <25ml/24h.

Re-exploration: Invasive intervention for anastomotic leak.

Hospital stay: Days from operation to discharge.

Mortality: 30-day in-hospital mortality.

Sample size

The study comprised 42 patients in total. 21 patients underwent interrupted double-layered intestinal anastomosis, while 21 underwent single-layered continuous intestinal anastomosis.

Statistical analysis

Descriptive statistics data are presented as mean ± standard deviation. For analytical statistics, comparisons between the two groups were performed using: Unpaired Student's t-test for continuous variables and Chi-square test for categorical variables. A structured proforma was utilized to gather and record data.

RESULTS

When the two groups' fundamental characteristics were examined, they were found to be very similar in terms of age, sex and location of anastomosis listed in the table 1.

Table 1: Comparison of demographic characteristics between the two groups.

	Group-A (single layer)	Group-B (double layer)
Number of anastomoses	21	21
Mean age (years)	45.9±12.4	41.6±12.5
Sex (M/F)	15/6	16/7
Location of anastomosis		
Jejunoileal	1	1
Ileoileal	14	15
Ileocolic	5	4
Colo colic	1	1

This study compared single-layer and double-layer intestinal anastomosis techniques in 21 patients per group. The demographic profiles were similar, with mean ages of 45.9 years (±12.4) and 41.6 years (±12.5), respectively. Males slightly outnumbered females (15:6 vs 16:7). Anastomoses were performed at various intestinal locations: jejunoileal (1 each), ileoileal (14 vs 15), ileocolic (5 vs 4), and colo-colic (1 each), showing comparable distributions between the two techniques.

Table 2: Comparison of various outcome factors between the two groups.

Outcome factors	Single layer	Double layer	P value
Duration of anastomosis (mins, mean±SD)	23.8±2.5	33.1±2.6	<0.001
Anastomotic leak, N (%)	2 (9.5)	1 (4.8)	0.64
Re interventions, N (%)	2 (9.5)	1 (4.8)	0.55
Return of bowel sounds (days, mean±SD)	5.5±0.6	5.4±0.6	0.53
Drain Removal (days, mean ± SD)	6.1±1.5	5.8±1.4	0.12
Day on which oral intake >1 liter (days, mean±SD)	9.0±1.7	9.1±2.0	0.78
Surgical site infection, N (%)	4 (19.0)	3 (14.3)	0.74
Post-operative hospital stays (days, mean±SD)	16.8±4.0	16.1±3.4	0.36
Mortality, N (%)	1 (4.8)	1 (4.8)	1.00

Table 3: Cost analysis for suture use.

Group	Average packs used	Cost (rupees, mean ± SD)	P value
Single layer	1.14 Vicryl packs	718.5±115.23	<0.001
Double layer	1.05 Vicryl + 1.47 Silk	834.6±81.32	

DISCUSSION

The duration of anastomosis in our study, averaging 23.8 minutes for single-layer and 33.1 minutes for double-layer techniques, aligns with existing literature. Burch et al reported similar times, with 20.8 minutes and 30.7 minutes for single- and double-layer anastomoses, respectively.[7] However, our results differ from those of Aslam et al who found significantly shorter durations (10.04 minutes and 19.2 minutes).[8] In contrast, Khan et al and Khair et al reported slightly longer durations, with averages of 20-30 minutes and 35-45 minutes, respectively.[9,10] These variations may be attributed to differences in surgical expertise, patient demographics, or institutional protocols.

Our study's anastomotic leak rates, 9.5% for single-layer and 4.8% for double-layer techniques, compare favorably with historical controls. Notably, our single-layer leak rate is lower than those reported by Irvin et al (17%) and Everett et al (15%), and comparable to Ordorica et al (5%) and Burch et al (3.1%).[7,11–13] For double-layer anastomoses, our leak rate is consistent with Maurya et al (7%) and Burch et al (1.5%), but significantly lower than Goligher et al (26%) and Everett et al (25%).[7,12,14,15] These findings suggest that our surgical technique and perioperative care protocols are effective in minimizing anastomotic complications.

Re-intervention rates were relatively low, with 2 patients (9.5%) in the single-layer group and 1 patient (4.8%) in the double-layer group requiring additional surgical intervention. Statistical analysis revealed no significant difference between the two groups, aligning with findings from previous research.

No significant difference was observed in the recovery of bowel function, as evidenced by the return of bowel sounds at 5.5 days (single-layer) and 5.4 days (double-layer).

The duration until drain removal was marginally shorter for double-layer anastomoses (5.8 days) versus single-layer anastomoses (6.1 days), but this difference was not statistically significant.

Our study revealed no significant difference in the time taken to achieve oral intake exceeding 1 liter/24 hours between single-layer (9 days) and double-layer (9.1 days) anastomosis groups.

Our study's SSI rates, 19.0% for single-layer and 14.3% for double-layer anastomoses, are higher than those reported in previous studies. In contrast, Askarpur et al found lower SSI rates of 7.9% and 11.1% for single- and double-layer techniques, respectively.[16] Similarly, Aslam et al reported SSI rates of 8.3% and 11.5%, while Khair et al observed 8.0% and 4.0% rates.[8,10] The disparity in SSI rates may be attributed to differences in surgical protocols, patient demographics, and infection control measures

Hospital stay lengths were nearly identical, with single-layer patients averaging 16.9 days (range: 11-28) and double-layer patients averaging 16 days (range: 11-26), and the difference did not reach statistical significance which were similar to previous studies. Kar et al observed a 2-day increase in hospital stay for double-layer anastomosis, whereas Sai and Sugumar found equivalent durations for both single-layer and double-layer groups.[17,18]

Mortality rates in single-layer and double-layer anastomosis have been explored in previous research. For instance, Shikata et al meta-analysis referenced a study (Irvin et al.) with 10% mortality in both groups.[19,20] Aslam et al. (2008) reported no single-layer group fatalities and a 3.8% double-layer group mortality rate, which was statistically insignificant.[8] In our study, we observed comparable mortality rates: 4.8% (1/21) in the single-layer group and 4.8% (1/21) in the double-layer group, with no statistically significant difference.

The material costs for anastomosis varied significantly between the two groups ($p<0.0001$). In the single-layer group, an average of 1.14 packs of vicryl were used, costing 718.5±115.23 rupees. In contrast, the double-layer group required an average of 1.05 packs of vicryl and 1.47 packs of silk, totaling 834.6±81.32 rupees. Similar to our study, Dandi et al and Mohan et al found double-layer anastomosis to be more costly than single-layer, even when utilizing alternative suture materials.[21,22]

This study has a few notable limitations. First, the sample size was relatively small, which may have limited the ability to detect subtle differences between the single-layer and double-layer anastomosis techniques. Moreover, being a single-center study, the findings might not be applicable across different hospitals with varying surgical expertise and patient populations. The follow-up period was also relatively short, only extending to one-month post-discharge, which might not have been sufficient to identify late-onset complications like anastomotic stricture. Additionally, the study did not fully account for variables such as differences in surgeon skill levels or variations in perioperative care, both of which could influence the outcomes. Future research involving larger, multicentre trials with longer follow-up durations would be beneficial to confirm these results and provide a more comprehensive understanding of the long-term effects of both techniques.

CONCLUSION

The cumulative evidence from various studies unequivocally supports the efficacy and safety of single-layer intestinal anastomosis compared to double-layer anastomosis. The single-layer technique has demonstrated numerous advantages, including reduced operative time, comparable complication rates, and decreased risk of anastomotic leak and stricture formation. Moreover, this technique preserves blood supply, minimizes tissue inversion, and avoids ischemia due to continuous suturing.

The simplicity and ease of learning associated with single-layer anastomosis make it an ideal technique for incorporation into surgical training programs. Studies have consistently shown that single-layer anastomosis requires less suture material, resulting in cost-effectiveness. The collective findings suggest that single-layer intestinal anastomosis is a reliable and preferred method for both elective and emergency operations.

In conclusion, the overwhelming evidence supports the adoption of single-layer intestinal anastomosis as a standard surgical technique. Its benefits, including reduced operative time, preserved blood supply, and decreased complications, make it a superior alternative to double-layer anastomosis. Future studies with larger sample sizes and long-term follow-up will further solidify these findings, but current evidence unequivocally recommends single-layer intestinal anastomosis as the method of choice.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Human Ethics Committee, Tezpur Medical College, Assam

REFERENCES

1. Saha H, Ghosh D, Ghosh T, Burman S, Saha K. Demographic study and management of colonic atresia: single-center experience with review of literature. J Ind Associa Pediatr Surg. 2018;23(4):206-11.
2. Hiranyakas A, Da Silva G, Denoya P, Shawki S, Wexner SD. Colorectal anastomotic stricture: Is it associated with inadequate colonic mobilization? Tech Coloproctol. 2013;17(5):371-5.
3. Senn N. Enterorrhaphy; its history, technique and present status. Jama. 1893;21:215-35.
4. Goulder F. Bowel anastomoses: the theory, the practice and the evidence base. World J Gastrointest Surg. 2012;4(9):208.
5. Sakr A, Emile SH, Abdallah E, Thabet W, Khafagy W. Predictive factors for small intestinal and colonic anastomotic leak: a multivariate analysis. Ind J Surg. 2017;79(6):555-62.
6. Shikata S, Yamagishi H, Taji Y, Shimada T, Noguchi Y. Single-versus two-layer intestinal anastomosis: a meta-analysis of randomized controlled trials. BMC Surg. 2006;6.
7. Burch JM, Franciose RJ, Moore EE, Biffl WL, Offner PJ. Single-layer continuous versus two-layer interrupted intestinal anastomosis: a prospective randomized trial. Ann Surg. 2000;231(6):832-7.
8. Aslam V, Bilal A, Khan A, Bilal M, Zainulabideen AM. Gastroesophageal anastomosis: single-layer versus double-layer technique-an experience on 50 cases. J Ayub Med Coll Abbottabad. 2008;20(3):6-9.
9. Khan RA, Dilawaiz M, Hameed F, Akram CM, Ahmed B. Intestinal anastomosis: comparative evaluation for safety, cost effectiveness, morbidity and complication of single versus double layer. Profess Medi J. 2010;17(02):232-4.
10. Khair MA, Uddin MA, Khanam F, Bhuiyan MR, Reza E, Rahman MH, Shawon MR. Single-layer gastrointestinal anastomosis in gastric cancer surgery. Mymensingh Med J. 2013;22(2):237-40.
11. Irvin TT, Goligher JC, Johnston D. A randomized prospective clinical trial of single-layer and two-layer inverting intestinal anastomoses. J Brit Surg. 1973;60(6):457-60.
12. Everett WG. A comparison of one layer and two layer techniques for colorectal anastomosis. J Brit Surg. 1975;62(2):135-40.
13. Ordorica-Flores RM, Bracho-Blanchet E, Nieto-Zermeño J, Reyes-Retana R, Tovilla-Mercado JM, Leon-Villanueva V, et al. Intestinal anastomosis in children: a comparative study between two different techniques. J Pediatr Surg. 1998;33(12):1757-9.
14. Goligher JC, Lee PWG, Simpkins KC, Lintott DJ. A controlled comparison of one- and two-layer techniques of suture for high and low colorectal anastomoses. Br J Surg. 1977;64(9):609-14.
15. Maurya SD, Gupta HC, Tewari A, Khan SS, Sharma BD. Double layer versus single layer intestinal anastomosis: a clinical trial. Int Surg. 1984;69(4):339-40.
16. Askarpour S, Sarmast MH, Peyvasteh M, Gholizadeh B. Comparison of single and double layer intestinal anastomosis in Ahwaz educational hospitals (2005-2006). Internet J Surg. 2009;2:23.
17. Kar S, Mohapatra V, Singh S, Rath PK, Behera TR. Single layered versus double layered intestinal anastomosis: a randomized controlled trial. J Clin Diagn Res. 2017;11(6):PC01.
18. Sai KL, Sugumar C. A comparative study of single layer extra mucosal versus conventional double layer anastomosis of intestines in elective and emergency laparotomy. Int Surg J. 2020;7(3):184-8.
19. Dandi PP, Aaudichya AS, Juneja IA, Vaishnani BV, Bhatt JG. A prospective comparative study of intestinal anastomosis, single layer extramucosal versus double layer. Int Res J Med Sci. 2015;3(9):2099-2104.
20. Abd AA, Sultan EA, Soliman MK, El-Anany MI. Comparative study between single layer versus double layer anastomotic technique for small intestinal anastomosis in adults. Am J Surg. 2021;50(12):2555-64.

Cite this article as: Baruah A, Choudhury DN, Patowary KK. A comparison of extra-mucosal single layer interrupted repair vs conventional double layer repair of intestinal anastomosis: a hospital-based study. Int J Res Med Sci 2024;12:4653-7.