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Comparative Study of Outcomes of Single Versus Double Layer Gut Anastomosis in Case of Elective Large Gut Surgeries

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ABSTRACT

Objective: To compare the outcomes and complications of the single and double-layer anastomosis for large gut pathologies.
Study Design: Comparative prospective study.
Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi, Pakistan, from Feb to Nov 2022.
Methodology: A total of 83 patients, age over 18 years, were incorporated into the study by convenience sampling. All the patients had been diagnosed with a colonic pathology and planned to undergo an elective, large gut anastomosis. Individuals with a prior history of gastrointestinal surgery, medical comorbidities, or deranged clotting profile were excluded. The mean durations of operation and hospital stay were calculated while the incidence of postoperative complications was also assessed. Time until the return of bowel sounds was also noted.
Results: Thirty-eight patients (45.8%) underwent single layer (Group-A), whereas 45 cases (54.2%) were intervened through double layer (Group-B) anastomosis. Mean age for the two groups was 49.0±13.7 and 50.5±16.0 years respectively. Colon and/or rectum cancer were the most prevalent indication for colonic anastomosis (single layer, n=21, 55.3%; double layer, n=23, 51.1%). Single layer anastomosis required 23.1±3.9 minutes in contrast to 28.7±4.2 minutes for its counterpart. Postoperative anastomotic leak was observed in 7(18.4%) cases with single layer and 10(22.2%) cases with double layer surgery. Bowel sounds were reestablished earlier within the former group (2.5±0.7 days) than the latter (2.2±0.6 days).
Conclusion: Both the single- and double-layer anastomosis of large gut are equally safe and efficient.

Keywords: Anastomosis, Anastomotic Leak, Colon, Colorectal Cancer, Postoperative Complications.

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INTRODUCTION

Large intestinal resection and anastomosis is a commonly pursued surgical intervention in both elective and emergency departments.[1] Indications include blunt abdominal injury, intestinal perforation, hernial strangulation, colorectal cancer, ischemic colitis among adults, Hirschsprung's disease, malrotation of gut, and necrotizing enterocolitis in the pediatric population.[2,3] The procedure per se, can be carried out via different approaches; however, the hand-sewn method is the most widely used technique in terms of establishing the continuity of large gut.[4]

In the large intestine, hand-sewn or manual anastomosis can be completed through single or double-layered method and by using a multitude of suturing techniques. Double-layer gut wall anastomosis is used in preference to single-layer surgery, and commonly employs the application of an absorbable suture along the inner gut layer and a non-absorbable variety for the outermost layer. Contrariwise, the single-layer technique involves the continuous or interrupted application of an absorbable suture material.[5] The type of anastomotic technique is largely determined by the overall risk of pertinent complications, quality of available surgical equipment, and surgeon's skills, or familiarity with the procedure. In terms of procedural simplicity, cost-efficiency, and time management, the single-layer method performs relatively better as compared to the double-layer approach.[6,7]

A major benchmark which is often used to debate the relative efficacy of single versus double layer techniques is the postoperative risk of anastomotic leak. Several authors have not found any statistically significant variability in the incidence of postoperative leaks between the single- and double-layer intestinal anastomosis.[8-10]

This prospective study was conducted to evaluate and compare the overall outcomes of single versus double layer intestinal anastomotic techniques

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undertaken to correct abnormalities pertinent to the integrity of the colon among adult patients.

METHODOLOGY

A comparative prospective study was carried out at the Department of General Surgery, Combined Military Hospital, Rawalpindi, Pakistan from February to November, 2022. In addition, approval was also granted by the Institutional Ethical Review Board (E-2005/A/2).

Inclusion Criteria: Patients of either gender, aged above 18 years, who were planned to undergo an elective, manual anastomosis of the colon secondary to a confirmed radiological diagnosis of a colonic pathology and with a non-significant history of gastrointestinal disorders, were included.

Exclusion Criteria: Patients who had a prior history of major abdominal surgeries, or those who were planned to undergo bowel surgery involving the upper gastrointestinal tract (esophagus and stomach), those possessing a significant history of medical comorbidities e.g., uncontrolled diabetes mellitus, hypertension, or potentially life-threatening cardiovascular disease, or a deranged clotting profile were excluded.

A sample size of 98 patients was estimated by using the expected percentage of patients undergoing single-layer and double-layer anastomosis as 49% and 51%, respectively.[7] Non-probability convenience non-probability sampling technique was used to recruit patients.

Following initial patient selection, the study experienced a deduction of up to 15 cases as the exclusion criteria were implemented. A total of 83 patients were randomly assigned to either of the two intervention groups: single-layer (Group-A) and double-layer (Group-B) surgery.

Before undergoing an elective colonic intervention, the selected participants were evaluated for surgical fitness through electrocardiogram (ECG) or echocardiography, chest X-ray, and baseline blood investigations. All the patients voluntarily consented for their participation in the study. while the authors adhered to the standardized research guidelines of the Helsinki Protocol.[11]

The following parameters were assessed to quantitatively analyze the postoperative outcomes: (1) Length of operation; (2) Postoperative duration of hospital admission; (3) Occurrence of anastomotic leakage. The incidence of other postoperative complications i.e., surgical site infections, intra-abdominal pus collection, and enterocutaneous fistula was also noted. Furthermore, the two groups of patients were compared with regards to relevant indication of the colonic procedure and the type of surgical intervention carried out. After their discharge, the patients were also followed for a period of at least 1 week.

Data was analyzed using Statistical Package for Social Sciences (SPSS) 23. The Mean±SD values were calculated for quantitative variables including patient age, length of patient operation, time till return of bowel motility and hospital stay. Independent samples t-test and chi-square ($\chi 2$) test were applied to check for compare means and association between variables respectively. A p-value≤0.05 was considered statistically significant.

RESULTS

Out of a total of 83 cases, forty-five individuals (54.2%) were placed into the double layer group (Group-B) whereas thirty-eight patients (45.8%) were incorporated into the single layer group (Group-A). Table-I shows the baseline characteristics of the study participants. Mean age for the patients undergoing single- and double-layer anastomosis was recorded as 49.0±13.7 and 50.5±16.0 years respectively. The majority of the patients in both groups were males: 25(65.8%) and 27(60.0%) cases respectively. Carcinoma of the colon and/or rectum was found to be the commonest indication for colonic anastomosis (Group-A, n = 21, 55.3%; Group-B, n = 23, 51.1%).

Table-I: Baseline Parameters of Patients undergoing Single Versus Double Layer Anastomosis (n=83)

Patient-based Parameters		Type of Colonic Anastomosis (n=83)		*p*-value
		Group-A (n=38)	Group-B (n=45)	
Age in years (Mean±SD)		49.0±13.7	50.5±16.0	0.648
Gender	Male	25(65.8%)	27(60%)	0.587
	Female	13(34.2%)	18(40.0%)	
Indication for procedure	CA colon	12(31.6%)	10(22.2%)	0.804
	CA rectum	5(13.2%)	5(11.1%)	
	Colorectal CA	4(10.5%)	8(17.8%)	
	Ileocecal Tuberculosis	6(15.8%)	7(15.6%)	
	Idiopathic Intestinal Obstruction	11(29.0%)	15(33.3%)	

CA = Carcinoma

End-to-end anastomosis was the most commonly carried out anastomotic procedure for the large gut. Table-II shows that up to 20(52.6%) in Group-A, and

28(62.2%) in Group-B patients were managed by means of an end-to-end anastomosis. Furthermore, an equivalent incidence of anastomotic leakage (7, 18.4%; 10, 22.2%) and other postoperative complications was observed in both groups A and B, respectively, while the total length of stay at the hospital also did not show any significant intergroup variation (p=0.331). Nonetheless, the total time spent to secure a colonic anastomosis was found significantly raised among patients treated with the double layer technique as compared to cases undergoing single layer anastomosis (23.1±3.9 versus 28.7±4.2 minutes). Moreover, the overall time taken for the postoperative reappearance of bowel sounds was significantly higher within the double layer group (2.5±0.7 days) in contrast to single layer patients (2.2±0.6 days), as indicated in Table-II. The follow-up period found zero mortality in both the intervention groups.

Table-II: Postoperative Outcomes for Patients undergoing Single Versus Double Layer Anastomosis (n=83)

Postoperative Outcomes		Type of Colonic Anastomosis (n=83)		*p*-value
		Group-A (n=38) n (%)	Group-B (n=45) n (%)	
Type of Intervention	End-to-end colocolic anastomosis	20(52.6%)	28(62.2%)	0.551
	End-to-side colocolic anastomosis	12(31.6%)	13(28.9%)	
	Left anterior resection and colorectal anastomosis	6(15.8%)	4(8.9%)	
Length of operation in minutes (Mean ±SD)		23.1±3.9	28.7±4.2	<0.001
Duration of hospital admission in days (Mean±SD)		9.3±3.4	8.6±3.3	0.331
Reappearance of bowel sounds in days after surgery (Mean ±SD)		2.2±0.6	2.5±0.7	0.048
Anastomotic leak		7(18.4%)	10(22.2%)	0.669
Enterocutaneous fistula		5(13.2%)	6(13.3%)	0.981
Surgical site infections/Intra-abdominal abscess		10(26.3%)	11(24.4%)	0.845

DISCUSSION

The study showed a relatively superior performance of single layer colon anastomosis in terms of time management. Moreover, postoperative recovery of bowel function is potentially accelerated following an anastomosis involving only a single layer of the large gut. However, both the single- and double-layer methods are equally safe since a comparable incidence of postoperative leakage was noted by the authors. This study, therefore, provides potential evidence that single layer anastomosis can be as safe and effective as its double layer counterpart while it is significantly more time-efficient and achieves the desirable bowel motility earlier. Given the fact that the number of studies focusing solely on the outcomes of large gut anastomosis is considerably low, this evidence is of paramount significance.

The debate whether to opt for the single- or the double-layer gut anastomosis has continued for several decades. It is a recognizable fact that a single anastomotic leak can lead to a substantially prolonged hospital stay while also deteriorating cost-effectiveness of the surgical intervention.[12] Although postoperative complications tend to occur at a comparable frequency, a few authors have selected the single layer method owing to its safe and cost-effective application.[13,14] In a comparative study by Dhamnaskar *et al*., a significantly shorter operative duration rendered the single layer anastomosis an efficient choice for establishing the gut continuity. Moreover, single layer intervention requires a significantly less suture length which also qualifies the latter as an economic option during large bowel anastomosis.[13]

The surgical outcomes and postoperative complications of single- and double-layer intestinal anastomosis have been compared in a multitude of studies. Regardless of the study setting, and the surgeon's expertise or operative skills, comparable findings have been reported. One study found no significant difference in the cumulative incidence of anastomotic leakage or other complications.[14] Moreover, the length of hospital stay remained significantly uniform between the patients undergoing single-and-double-layer gut procedures. In one study comprising 100 patients, the time required for completion of a single layer gut anastomosis (16-20 minutes) was significantly shorter than double layer anastomosis (26 to 30 minutes).[15] This has been mainly attributed to a meticulous excision of the intestinal mesentery and other associated connective tissue structures when there is anastomotic involvement of two gut layers.[16] Additionally, comparable data have been provided by other authors addressing the efficient outcomes and safety profile of single versus double-layered suturing of the intestinal walls.[17,18]

LIMITATIONS OF STUDY

Our study had certain limitations. The study collected and analysed data from a single setting which could possibly undermine the impact of the surgeon's practical skills. Moreover, the follow-up duration was kept short and this could have affected the accuracy of estimation of the

postoperative outcomes. Lastly, the authors acknowledge that the study focussed on elective cases only which minimizes the overall outreach of the main outcomes observed in this prospective study.

CONCLUSION

The single layer, hand-sewn anastomosis of large gut is as effective as the double layer technique and is considerably time-efficient.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

FR & UG: Data acquisition, data analysis, critical review, approval of the final version to be published.

HR & MRS: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SHT & SAA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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