

Single versus double layer small bowel anastomosis in adults – Randomized controlled study

Kapil Vishvakarama¹, Manjul Mohan^{2*}, Sujoy Mukherjee³, Rishi Jindal⁴

¹3rd Year Post Graduate, Department of General Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India

²Associate Professor, Department of General Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India

³Professor, Department of General Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India

⁴Associate Professor, Department of General Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India

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Abstract

Introduction: Intestinal anastomosis can be done via handsewn, stapler or laparoscopic intracorporeal suturing. Among which handsewn anastomosis is commonly performed because of availability and affordability of suture material. In this study hand sewn single- and double-layer small bowel anastomosis are compared. **Objective:** To compare single with double layer small bowel anastomosis in terms of time taken for anastomosis, complication, hospital stay and follow up. **Material and methods:** A prospective comparative study was carried out in Department of Surgery, RMCH, Bareilly, Uttar Pradesh from 01 November 2019 to 31 October 2020. 60 patients were included and equally divided into two groups who underwent elective and emergency small bowel anastomosis. Group A with single layer continuous/interrupted technique with PDS II and Group B with double layer (inner with PDS II and outer with Silk). All data was assessed using either Chi-Square or Unpaired t-test. **Results:** The mean duration of anastomosis was 18.9±2.09 and 28.3±2.44 minutes in Group A and Group B respectively (p<0.001). In Group A, two patients and in Group B only one patient developed anastomotic leak (P>0.05). Mean duration of hospital stay was 12.73±2.7 and 12.93±1.94 days with Group A and Group B respectively (p>0.05). In Group A, 27 patients and in Group B 29 patients had normal follow up (p>0.05). **Conclusion:** Single layer small bowel anastomosis was constructed in significant lesser time without significant delay in anastomotic healing, post-operative complications, recovery and hospital stay.

Keywords: Single layer small bowel anastomosis, double layer small bowel anastomosis, PDS II, anastomotic leak

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Introduction

Small bowel anastomosis is commonly performed procedure in our day-to-day surgical practice. The fundamental principles of bowel anastomosis were laid down more than 100 years ago by Travers, Lembert and Halsted.[1] By the time it undergone evolutions but today's most common techniques of handsewn anastomosis are single and double layer.[2]

Patients generally required resection and anastomosis for various pathologic condition of small bowel like multiple or large sized small bowel perforation, obstruction, bowel gangrene, multiple strictures, adhesions, volvulus, obstructed or strangulated ventral or groin hernias, ileostomy closure, benign or malignant tumours of the small bowel.[3]

It has been stated that the accurate approximation of two viable bowel ends with complete avoidance of tension is key to a successful anastomosis. An insecure small bowel anastomosis is unacceptable. The disruption of the suture line or the anastomosis which is inappropriate may result in haemorrhage, leakage, diverticula formation, stenosis, and ultimately faecal fistula with serious septic complication which can lead increase in morbidity and mortality.[4]

The technique in which seromuscular layer of the small bowel is approximated is known as the single-layer technique. Single layer technique took over in early eighties of 20th century and this technique includes the strongest layer (submucosa) of the bowel.[5] Historically double layer gastrointestinal anastomosis has been preferred technique until the late seventies of the last century. In double layered anastomosis where mucosa and sero-muscular layers are sutured separately.[6]

Anastomotic dehiscence is the major complication in the case of intestinal anastomosis and it should be considered a gold standard to judge the success of any given anastomosis. The anastomotic dehiscence rate following double layer and single layer anastomosis may guide surgeons that which technique should be adopted.[7]

In developing country hand sewn anastomosis is first choice because it can be performed in the appropriate time and at a lower cost to match the common man's economy. The use of single- or double-layer hand-sewn technique of intestinal anastomosis has always remained a debatable issue.[4] However, despite the huge amount of work done on both single layer and double layer methods, it is still unclear that which method is superior to another in the view of the

*Correspondence

Dr. Manjul Mohan

Associate Professor, Department of General Surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India.

E-mail: manjul.2710@gmail.com

outcome. Hence this comparative study compares the efficacy of single layer versus double layer small bowel anastomosis.

Materials and method

The present study is double blind randomized controlled study was carried out from 01 November 2019 to 31 October 2020 in the department of General Surgery at Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, India. All patient 18-65 years of age, who underwent resection and anastomosis of small bowel including emergency and elective cases were included in the study.

Sample size

A total of 60 patients were included in the study and divided equally into two groups, A and B requiring single layer small bowel anastomosis and double layer small bowel anastomosis respectively, comprising of 30 patients in each group.

Data were collected after taking clearance from the Institutional ethical committee. All participants were explained about the objective of the study and informed and written consent was taken. History taking, physical examination, essential radiological examinations, blood investigations were done, patients were explained about the purpose, risk and benefit of the operation.

Methods

All the patients with the various small bowel pathology were included in the study and followed until 4 weeks after the discharge from the hospital. Patients <18 and >65, patients with chronic illnesses were excluded from the study. Diagnosis was made on the basis of detailed clinical history, physical examination, laboratory and radiological investigations. Both elective and emergency procedures were included in the study. Patients were divided into two groups Group A and

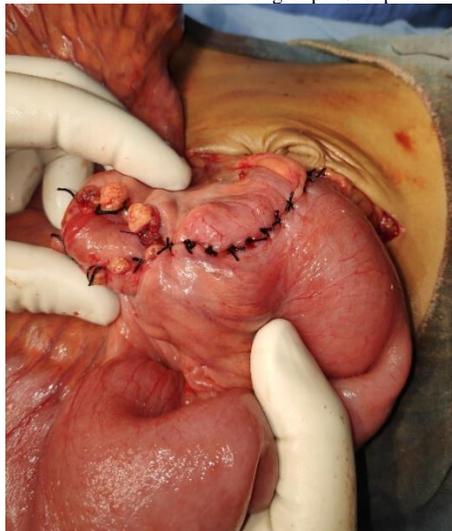


Fig 1: Double layer small bowel anastomosis

Group B. Group A (30 patients) requiring single layer small bowel anastomosis and Group B (30 patients) requiring double layer small bowel anastomosis.

Individual case was evaluated with reference to time taken to carryout intestinal anastomosis, postoperative complications, duration of hospital stay and postoperative recovery of the patient. The time duration of anastomosis was calculated from the placement of first suture bite on the bowel and ended with the last knot. Single layer anastomosis was done with the Polydioxanone (PDS) 2-0 with a length of 70 cm in continuous/interrupted fashion. Double layer anastomosis was done with Polydioxanone (PDS) 2-0 with a length of 70 cm in continuous/interrupted fashion (Inner layer) and Silk 2-0 (Lembert, outer layer) with a length of 90 cm. All the cases were followed up to discharge and 4 weeks after the discharge.

Technique

For all the patients, general anaesthesia and endotracheal tube with cuff was used. Patient was placed in supine position. Antibiotic was given as per standard protocol and part was painted and draped. For both elective and emergency laparotomy a long mid-line incision was given and for ileostomy closure, an elliptical para stomal incision was given.

Technique of single layer small bowel anastomosis, anastomosis was performed using PDS II 2-0 round body suture taking extra-mucosal bite (serosa, muscularis and sub-mucosa) in continuous/interrupted fashion. Double layer small bowel anastomosis technique was performed in two layers, inner layer with full thickness continuous/interrupted using PDS II 2-0 round body and outer layer using Silk 2-0 round body (Lembert sutures). At the end of the anastomosis two abdominal drain were placed whenever required.

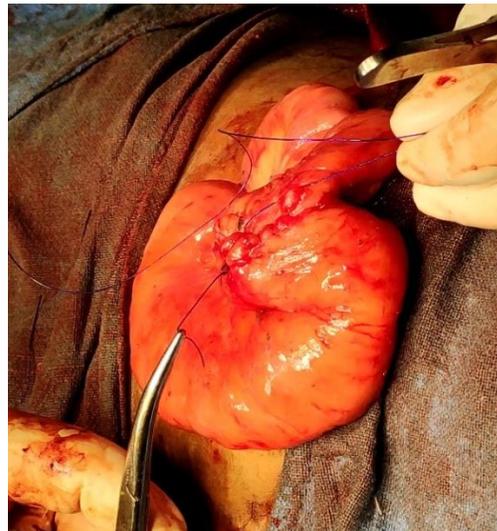


Fig 2: Single layer small bowel anastomosis

Statistical analysis

Data was analysed using the program Statistical Package for Social Science (SPSS) 23. The results were presented in frequencies, percentage and mean \pm standard deviation.

Ethics

Data were collected after taking clearance from the Institutional ethical committee.

Results

Table 1 showing distribution of patient according to mean age and gender. The mean age in group A (Single layer) was 34.36 ± 12.59

years and in group B (Double layer) it was 33.03 ± 12.50 years. Youngest patient in Group A was 18 years old while eldest was 62 years old, similarly in Group B youngest patient was 18 years old and eldest was 60 years old ($p > 0.05$). In our study the maximum number of the patients were of male gender, accounting for 47 patients (78.33%). 24 patients (80%) in group A and 23 patients (76.66%) in group B. Remaining were of female gender, accounting of 23 patients, among which 6 patients (20%) belonged to group A and 7 patients (23.33%) belonged to group B.

Table 1: Distribution of patients according to mean age and gender

	Group A	Group B	p-value
Number of anastomosis	30	30	
Mean age (in years)	34.36 ± 12.59	33.03 ± 12.50	0.682 ¹
Sex M/F	24/6	23/7	0.754 ²

¹ Unpaired t-test, ² Chi-square test

Table 2 and figure 1 showing distribution of patients according to disease. In the present study maximum number of the patients who required small bowel anastomosis were of ileostomy closure, comprising 26 patients (43.33%) followed by small bowel perforation (14 patients, 23.33%), small bowel obstruction (9 patients, 15%), Meckel’s diverticulum (3 patients, 5%), Intussusception (3 patients, 5%), traumatic mesenteric tear (2 patients, 3.33%), mesenteric cyst (1 patient, 1.66%), ileo-ileal volvulus (1 patient, 1.66%) and strangulated inguinal hernia (1 patient, 1.66%).

Table 2: Distribution of patients according to disease

Disease group	No. of patients	Percentage (%)	
Ileostomy	26	43.33%	
Small bowel perforation (n = 14)	Ileal perforation	11	18.33%
	Jejunal perforation	2	3.33%
	Both ileal and jejunal	1	1.66%
Small bowel obstruction	9	15%	
Meckel's diverticulum	3	5%	
Intussusception (n = 3)	Ileo-Ileal	2	3.33%
	Jejuno-jejunal	1	1.66%
Mesenteric tear (Traumatic)	2	3.33%	
Mesenteric cyst	1	1.66%	
Ileo-ileal volvulus	1	1.66%	
Strangulated Inguinal hernia	1	1.66%	
Total	60	100%	

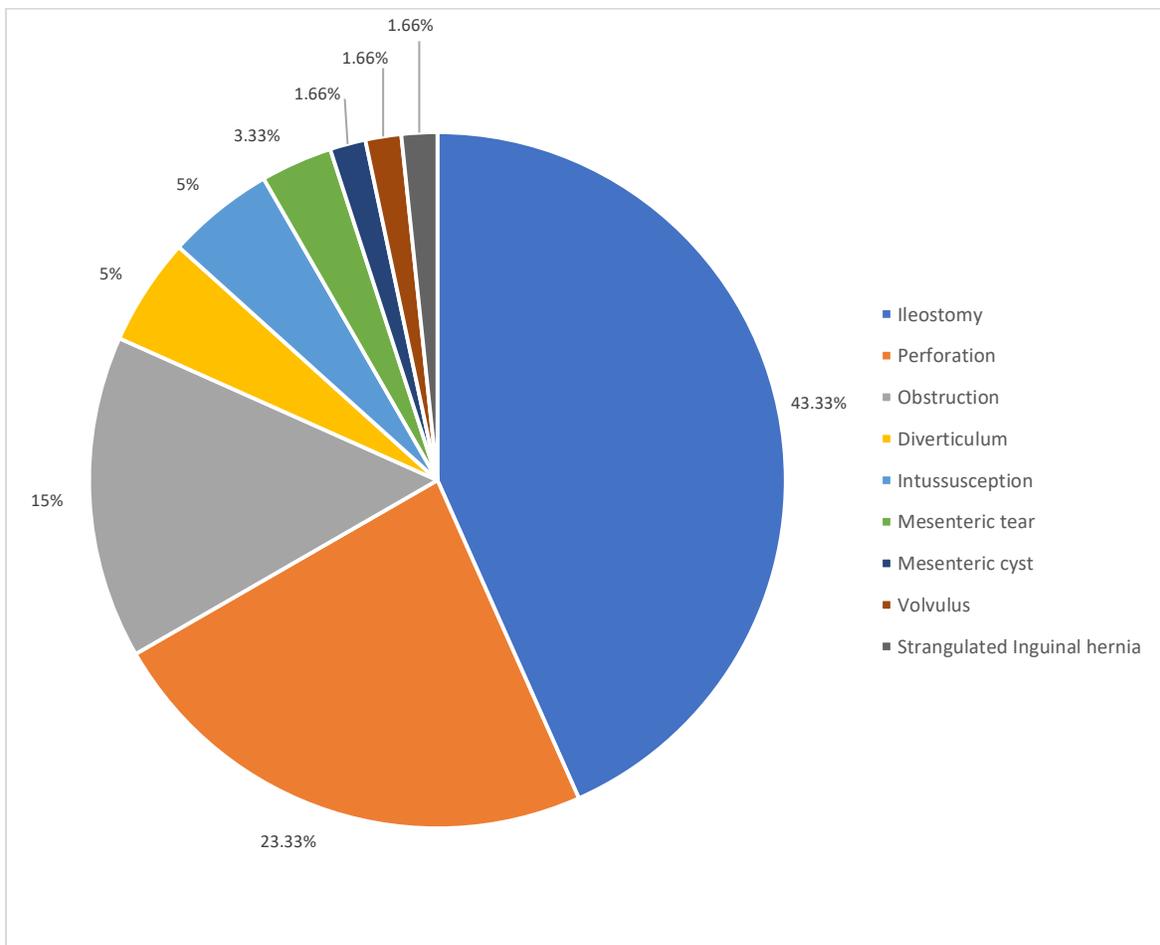


Fig 1: Distribution according to disease

Table 3 showing distribution of the patients according to elective and emergency surgery. A total of 33 patients (55%) underwent elective surgery including single layer and double layer, while emergency surgery was performed in 27 patients (45%). In this study Ileo-ileal anastomosis were performed in most of the cases accounting for 54 patients (90%) and remaining 6 anastomosis (10%) were jejunio-jejunal. All the anastomosis were end to end type.

Table 3: Distribution of patients according to emergency versus elective surgery

Group	Single layer n(%) (n=30)	Double layer n(%) (n=30)	Total patients (n=60)	p-value ²
Elective surgery	16 (53.33%)	17 (56.67%)	33 (55%)	0.795
Emergency surgery	14 (46.67%)	13 (43.33%)	27 (45%)	

² Chi-square test

Table 4 showing the comparison of mean duration of anastomosis and mean duration of hospital stay between two groups. In group A the mean duration of anastomosis was 18.9 ± 2.09 minutes, while in group B the mean duration of anastomosis was 28.3 ± 2.44 minutes with p value <0.0001 and is highly significant. In the present study among group A (Single layer anastomosis) minimum time required for anastomosis was 16 minutes while maximum time required was 22 minutes. Similarly in group B (Double layer anastomosis) minimum time required was 24 minutes while maximum time required was 32 minutes. The mean duration of hospital stay for group A (single layer) was 12.73 ± 2.7 (SD) and for group B (Double layer) is 12.93 ± 1.94 (SD), with mean difference of 0.2 and p value of 0.743 which is not significant.

Table 4: Showing comparison of mean duration of anastomosis and hospital stay

	Group A (Single layer)	Group B (Double layer)	p-value ¹
Mean duration of anastomosis (in minutes)	18.9 ± 2.09	28.3 ± 2.44	$<0.0001^*$
Mean duration of hospital stay (in days)	12.73 ± 2.7	12.93 ± 1.94	0.743

¹ Unpaired t-test, * Significant

Table 5 showing distribution of patients according to complication and post-operative recovery between the two groups. Although there are many complications related to the anastomosis but in this study, we only compared major complication that is anastomotic leak. Anastomotic leak was noted in 3 patients (4.6%). From which 2 patients (6.6%) belonged to single layer small bowel anastomosis and 1 patient (3.2%) belonged to double layer anastomosis. Most of the patient in our study 57 (95%) had normal recovery, but in group A (Single layer) 2 patients (6.6%) and in group B (Double layer) 1 patient (3.3%) had delayed recovery due to anastomotic leak with p value of 0.214, which is non-significant.

Table 5: Distribution of patients according to complication and post-operative recovery

	Group A (Single layer) n=30	Group B (Double layer) n=30	p-value ²
Complications			
Anastomotic leak	2 (6.66%)	1 (3.33%)	0.453
Surgical site infection	6 (20%)	8 (26.66%)	
Post-operative recovery			
Normal	28 (93.33%)	29 (96.66%)	0.214
Delayed	2 (6.66%)	1 (3.33%)	

² Chi-square test

In group A (Single layer) 3 (10%) patients lost in follow up and in group B (Double layer) 1 (3.33%) patient lost in follow up. There is normal follow up for rest of 27 (90%) patients in group A (single layer) and 29 (96.66%) patients in group B (Double layer).

Discussion

Small bowel anastomosis has been one of the most common abdominal surgical procedures since Travers, Lembert, and Halsted established the basic principle of intestinal suturing more than a century ago. Recent advancements in the procedure have been made. From hand-sewn anastomosis to the more recent stapling technique, surgical advancement has come a long way. However, still hand sewn technique is practised in modern era owing to cost, availability and easy learning curve. Small bowel anastomosis can be performed in either a single layer or a double layer method. Still, there is no generalized consensus on superiority among single or double layered anastomosis.[1,2] The present study was conducted in the Department of general surgery, Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh with objective to compare the efficacy of single versus double layer small bowel anastomosis. This study comprised of two groups, each comprised of 30 patients who were randomized and compared. The efficacy of both groups was compared in terms of time required to construct the anastomosis, post-operative complications (leak), duration of hospital stay and post-operative recovery. The mean age of the patients belonging to single layer anastomosis group was 34.36 years, while that of double layer group was 33.03 years. The youngest patient belonging to both single as well as double layered anastomosis group was 18 years while the oldest being 60 years for double layered group and 62 years for single layered anastomosis group. In a study done by Nemma SK et al.

reported mean age for single layer anastomosis was 33.55 years and double layer intestinal anastomosis was 35.85 years.[4] In both studies patients were of middle age group.

In the present study majority of the patient belonged to male gender (47 males, 78.33%) while rest were females (13 females, 21.66%). More number of males patients in the present study could be due to the higher prevalence of intestinal perforation in males.[8] The majority of the patients presented for ileostomy closure (43.3%) and 23.3% patients had intestinal perforation. This is in agreement with the results of Aniruthan D. et al. in their study done in 2020 which showed that most common condition requiring anastomosis was for ostomy closure (50%), while intestinal perforation accounted for only 12.5%.[2] Elective surgery was done in 33 patients (55%) and emergency surgery was performed in 27 patients (45%). In a study done by Mohan S. et al. in 2019 showed that elective surgery was done in 41.66% of the patient (including single- and double-layer anastomosis) and emergency surgery was done in 58.33% of the patients (including single- and double-layer anastomosis).[9]

In the present study majority of the patients required end to end ileo-ileal anastomosis which comprised of 54 patients (90%). While Jejunio-jejunal anastomosis was done in 6 cases (10%). None of the patient required end to end jejunio-ileal anastomosis. These findings are with concordance with the results of the study done by Kar S. et al. in 2017 which noted that the most common site of anastomosis of single layered group was ileo-ileal accounting for 58% of the cases

while jejunum-jejunal accounted for only 10% of the cases. Similarly, among double layered anastomosis group ileo-ileal was the most common site of anastomosis accounting for 46% of the cases.[10] In the present study, mean duration of time taken for anastomosis among patients who underwent single layered anastomosis was 18.9 ± 2.09 minutes while that for double layered anastomosis was 28.3 ± 2.44 , which was statistically significant (p value < 0.001). This is consistent with the finding noted by Sai K. L. & Sugumar C. in their study done in 2020 in which they noted that the mean duration of time required in anastomosis in single layer was 21.64 ± 1.60 minutes while for double layer anastomosis was 29.6 ± 2.02 minutes (p value < 0.001).[11] As part of complication anastomotic leak was the most dreaded one. Among patients belonging to single layer anastomosis technique group only 2 patients (3%) developed leak, while among double layered anastomosis group only 1 patient (1.6%) developed leak (p-value = 0.453, not-significant). This is in concordance with the finding noted by Garude et al. in 2013 where 4 patients (5.4%) belonging to single layer anastomosis group developed leak as compared to 3 patients (4.1%) of double layer anastomosis group.[12] The mean duration of hospital stay among single layer group was 13.4 ± 2.68 days while that of double layered group was 12.93 ± 1.94 days. A research conducted in 2020 by Kumar A. et al. showed that patients with single and double layered anastomosis required same duration of hospital stay, accounting for 11.08 days for single layer compared to 11.58 days for double layer anastomosis.[13] Among patients of single layer anastomosis group majority of the patients had normal recovery – 28 patients (93.3%) while only 2 patients (6.6%) had delayed recovery. Meanwhile among patients of double layered group majority of the patients had normal recovery – 29 (96.7%) while only 1 patient (3.3%) had delayed recovery (p-value = 0.214, not-significant). In a study done by Patil M. et al. in 2020 concluded that the difference in the post-operative recovery seems to be statistically non-significant and depends on underlying pathology, intra-operative bowel handling and electrolyte imbalance.[14] Among patients belonged to single layer anastomosis group, 3 patients (10%) were lost to follow up while the same was seen with 1 patient (3.33%) which belonged to double layer group. Rest of the patients had normal follow up.

Conclusion

Single layer small bowel anastomosis can be constructed in significant lesser time than double layer small bowel anastomosis with no statistically significant difference between post-operative recovery, mean duration of hospital stay and follow up. This observation suggests to carry out more studies on single layer small bowel anastomosis and double layer small bowel anastomosis and to include bigger number of cases and longer duration of follow up to assess any late complication.

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