

Research Article

A prospective comparative study of intestinal anastomosis, single layer extramucosal versus double layer

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ABSTRACT

Background: Intestinal anastomosis is an operative procedure that is of central importance in the practice of surgery. Intestinal anastomosis after resection of bowel may be of various types and techniques. This prospective comparative study is performed to evaluate the safety in term of anastomotic leak of single layer interrupted extramucosal technique as compared to conventional double layer technique.

Methods: The patients selected for this study are those who were admitted with various clinical conditions requiring resection and anastomosis of small or large bowel presented to P.D.U. Medical College & Hospital, Rajkot between a period of August 2012 to December 2014. A total of 50 patients were included in the study. All the patients above the age of 18 years and less than 60 years, requiring intestinal anastomosis on emergency or electively, were included in the study and those requiring anastomosis to esophageal, gastric and duodenal anastomosis were excluded and randomly allotted single layer and double layer groups and results such as anastomotic leak rate, duration for anastomosis, number of suture material required noted.

Results: Mean duration required for single layer anastomosis was 19.6 minutes and for double layer anastomosis was 29.5 minutes and double number of suture material used in double layer anastomosis with equal anastomotic leak rate (6%) in each group.

Conclusions: Single layer interrupted extramucosal technique required significantly less duration for anastomosis, is cost effective with no significant difference in anastomotic leak rate and as safe as conventional double layer technique.

Keywords: Single layer anastomosis, Double layer anastomosis, Anastomotic leak

INTRODUCTION

Intestinal anastomosis is an operative procedure that is of central importance in the practice of surgery. Intestinal anastomosis after resection of bowel may be of various types and techniques. The anastomotic technique depends upon site of anastomosis, bowel caliber, quality and underlying disease process but one important factor in making decision to perform a particular anastomosis, however, remains individual surgical experience and personal preference.¹

Various complications following bowel anastomosis are anastomotic leak resulting into peritonitis, abscess, fistula, necrosis, stricture. Unfortunately, however, despite the “perfect patient”, healthy bowel and meticulous technique some anastomoses continue to leak resulting in significant morbidity and mortality. The frequency of anastomotic leakage ranges from 1 to 24%.² To minimize the risk of potential complications, it is imperative to adhere to several well-established principles. The main ones relate to the creation of a

tension-free join with good apposition of the bowel edges in the presence of an excellent blood supply.²

In double layer anastomosis in most of cases it fails to oppose clean serosal surfaces and it results in large amount of ischemic tissue within suture line which increases the chances of leakage. Further excessive inversion leads to narrowing of lumen.³

In contrast single layer anastomosis causes least damage to submucosal vascular plexus, least chances of narrowing of lumen, incorporates strongest submucosal layer and accurate tissue apposition.^{4,5}

This prospective comparative study is performed to evaluate the safety of single layer interrupted extramucosal technique as compared to conventional double layer technique.

METHODS

The comparative study was done on patients presenting Department of Surgery, P.D.U. Govt. Medical College & Hospital, Rajkot, Gujarat, either in emergency or elective undergoing resection anastomosis of bowel from August 2012 to December 2014.

The patients selected for this study are those who were admitted with various clinical conditions requiring resection and anastomosis of small or large bowel. A total of 50 patients were included in the study. All the patients above the age of 18 years and less than 60 years, requiring intestinal anastomosis on emergency or electively, were included in the study. Based on detailed history, thorough clinical examinations, radiological examinations and ultrasound of abdomen, the diagnosis was made. Those requiring anastomosis involving the esophagus, stomach & duodenum were excluded. The patients were alternatively allotted single-layered intestinal anastomosis group and double layered group. Informed written consent was obtained and the procedure and its probable outcome were well explained to patients.

A minimum of 50 cases with the following inclusions and exclusion criteria were selected for the study and were allocated alternatively to each of the comparative study group.

Inclusion criteria:

1. Patients undergoing resection and anastomoses of small bowel and large bowel at our hospital for causes like intestinal obstructions due to bowel ischemia, strangulated hernia, traumatic bowel injury, bowel tumours etc.
2. Age more than 18 years and less 60 years.

Exclusion criteria:

1. Esophageal, gastric and duodenal anastomosis.

2. Age less than 18 years and more than 60 years.

Technique:

The affected segment of bowel was resected as per the standard technique. The bowel ends were cleaned with 5% povidone iodine swab and approximated.

Double layer anastomosis:

The inner transmuscular layer was constructed in a continuous manner using silk 3-0 suture. The outer seromuscular sutures were taken in an interrupted manner, inverting the inner layer using 3-0 silk suture.

Single layer anastomosis:

All the single layered intestinal anastomoses were performed using an interrupted 3-0 silk that began at the mesenteric border, incorporating all the layers except the mucosa. Each bite included 4-6 mm of the wall from the edge and about 5 mm from each other. The larger bites were used at the mesenteric border to ensure an adequate seal. Only enough pressure was applied to the suture to avoid ischemia of the anastomosis. The edges of the mesentery were closed to prevent any internal herniation. The patency of the anastomosed segment was confirmed by gently palpating the anastomosis between the thumb and the index finger.

Each case was analyzed with respect to duration required to perform intestinal anastomosis & post-operative complications like anastomotic leak. The duration of anastomosis begins with placement of first stitch on the bowel and ended when the last stitch was cut. All single layer anastomoses were done with silk 3-0 pack which had a suture material of 90 cm length. For double layer, 3-0 silk was used taking through all layers and seromuscular layer with 3-0 Silk pack which had suture material measuring 90 cm.

Anastomotic leak was defined as fecal discharge in the drain or from the wound or a visible disruption of the suture line during re-exploration. Histopathological diagnoses were confirmed and patients were advised necessary treatment at the time of discharge.

On discharge, the patients were followed up at 1st week, 3rd week and on 3rd month basis thereafter. The patients were evaluated for gastrointestinal complaints and other complaints, if any.

A pretested performa used to collect relevant information (patient data, clinical findings, laboratory investigations, follow up events etc.) from all the selected patients. Data collected and compared with percentage/rate of parameter as sample size is small.

RESULTS

Twenty-five patients were selected in each group; in single layer 76 % of the patients were male while in double layer 66% were male. The mean age for single layer was 40.6 years and in double layer was 46.5 year. Maximum anastomosis done in patients with intestinal obstruction with mesenteric vascular thrombosis 11 (22%), of which 5 (20%) in single layer and 6 (24%) in double layer (Table 1). Large numbers of procedures (80%) were performed in emergency conditions. In maximum cases (23 in single layer and 25 in double layer) end to end type of anastomosis was done (Table 2). Single pack of suture material (silk) used in single layer and two pack of silk used in double layer anastomosis (Table 3).

Mean duration required for single layer anastomosis was 19.6 minutes and for double layer anastomosis was 29.5 minutes (Table 4).

The mean duration of hospital stay in single layer was 8.24 days and in double layer 8.48 days (Table 5). Overall anastomotic leak was noted in 6 out of 50 patients (12%) i.e. 3 (6%) patients in each group. So anastomotic leak rate was noted equal in both groups (Table 6). So when the data was compared, hospital stay and the number of patients developing complication (anastomotic leak rate) in the single-layered group was not found to be significant, whereas the mean time required for construction of anastomosis and no. of sutures used was found to be highly significant when compared with the double-layered group.

Table 1: Disease group and patients.

Disease Group	No. of Cases	n %
Blunt Trauma Abdomen	2	4%
Ileostomy in situ	7	14%
Intestinal Obstruction with MVT	11	22%
Penetrating Abdominal Injury	3	6%
Intususception	4	8%
Strangulated Inguinal Hernia	3	6%
Strangulated Femoral Hernia	2	4%
Intestinal Obstruction with Koch's Abdomen	5	10%
Intestinal Obstruction with caecal mass	1	2%
Ileal Perforation	3	6%
Gastric Outlet Obstruction	3	6%
Intestinal Obstruction with Ileal Stricture	1	2%
Intestinal Obstruction with internal herniation	1	2%
Intestinal Obstruction with sigmoid volvulus	1	2%
Intestinal Obstruction with Jejunal Stricture	3	6%

Table 2: Comparison of sites of anastomosis.

Site of Anastomosis	Present Study		Burch et al. Study ⁹		Gaurede et al. Study ¹⁰	
	Group A (Single Layer) n = 25	Group B (Double Layer) n = 25	Group A n = 65	Group B n = 67	Group A n = 73	Group B n = 72
Entero-Enteric	92%	100%	37%	28%	63%	64%
Entero-Colic	4%	0%	29%	40%	20%	22%
Colo-Colic	4%	0%	34%	32%	17%	14%

Table 3: Comparison of number of suture material used.

Groups	No. (mean) of suture material (Type of material)			
	Present Study	Garude et al Study ¹⁰	Burch et al Study ⁹	Niyaz Ahmed Study ¹¹
Group A (Single Layer)	1 (Silk)	1 (Prolene)	1 (Prolene)	1 (PDS)
Group B (Double Layer)	2 (Silk)	2.5 (1.5 Silk + 1 Polyglyctin)	3 (Silk)	2 (1 Silk + 1 Polyglyctin)

Table 4: Comparison of duration of anastomosis of different studies with present study.

Groups	Mean duration of anastomosis (in minutes)			
	Present Study	Garude et al. Study ¹⁰	Burch et al. Study ⁹	Khan et al ¹² Study
Group A (Single Layer)	19.6	9.5	20.8	20
Group B (Double Layer)	29.5	19.3	30.7	35

Table 5: Comparison of duration of hospital stay.

Group	Hospital Stay (mean days)			
	Present Study	Niyaz Ahmed Study ¹¹	Garude et al ¹⁰	Burch et al ⁹
Group A (Single Layer)	8.24	7.32	12	7.9
Group A (Double Layer)	8.48	7.92	12	9.9

Table 6: Comparison of percentage of anastomotic leak.

Groups	Anastomotic leak n (%)				
	Present study n-25/25	Garude et al Study ¹⁰ n-73/72	Burch et al Study ⁹ n-65/67	Khan et al Study ¹² n-28/36	Niyaz Ahmed Study ¹¹ n-25/25
Group A (Single Layer)	3 (12%)	4 (5.4%)	2 (3.1%)	1 (6%)	1 (4%)
Group B (Double Layer)	3 (12%)	3 (4.1%)	1 (1.5%)	2 (12%)	2 (8%)

DISCUSSION

This study assessed the efficacy and safety of single layered anastomosis in comparison with double layer anastomosis after intestinal resection. The study included two groups: Group A-Single layer and Group B-Double layer, each group had 25 cases altogether 50 cases. Cases were allotted to either group alternatively, requiring single layer anastomosis or double layer anastomosis for various clinical conditions of small and large bowel. Anastomosis was done at different levels of intestine and depending up on the position of the viscera. The efficacy of both groups was compared in terms of duration required to perform intestinal anastomosis, cost effectiveness and post-operative complications like anastomotic leak.

In our study majority of procedures involved were of entero-enteric type of anastomosis (Single layer-92 % and Double layer - 100%) and we have selected mainly

small bowel for anastomosis In our study the mean duration required to construct a single layer anastomosis was 19.6 minutes and 29.5 minutes for double layered anastomosis. Therefore there significant difference between time requirement for single and double anastomosis which ranges from nearly 10 to 15 min in other studies as well as in our study. So, less time duration required for single layer anastomosis. But time requirement may vary from surgeon to surgeon, from inexperienced to experience surgeon but overall single layer definitely required less time.

Single layered found to economical compare to double anastomosis as the total number of suture (silk) packs required in double-layered anastomosis was 2, whereas in single-layer anastomosis only one pack of silk was used. In our study we used silk as suture material because it is cheap and easily available. But in other studies (Table 3) different suture materials were used but comparing the anastomotic leak rate (Table 6), no significant difference

was noted in our and other studies by using different suture material.

In our comparative study the mean duration of hospital stay in single layer was 8.24 days and in double layer it is 8.48 days which almost equal to mean duration of stay in Niyaz Ahmed study (7.32 and 7.92) where as in Garude et al. study duration of stay is equal in each group (12 and 12) and in Burch et al study (7.9 and 9.9), 2 days more in double layer was noted. But in our study, no significant change noted on duration of hospital stay (Table 5).

The number of anastomotic leak in our study was 3 (12%) patient in single layer and 3 (12%) in double layered anastomosis. In Garude et al. study 4 (5.4 %) patients had anastomotic leak in single layer and 3 (4.1%) had anastomotic leak in double layer whereas in Burch et al Study 2 (3.1%) patient had anastomotic leak in single layer and 1 (1.5%) of patients had anastomotic leak in double layer. Whereas in Khan et al. study 1 (6%) leak in single layer and 2 (12%) in double layer while in Niyaz Ahmed study 1 (4%) leak was present in single layer and 2 (8%) in double layer. So there was no significant difference found in occurrence of anastomotic leak in single and double layer anastomosis type in our study and other studies.

However in our study, anastomotic leak rate is more compared other studies as large no. of procedures were performed in emergency basis and having associated conditions like septicemia, mesenteric vascular thrombosis etc. Out of 6 patients which had anastomotic leak, 4 patients had undergone re-exploration and 2 patients were managing conservatively, no mortality noted in our study.

Intestinal anastomosis has been intensely studied and many comparisons between alternative techniques and suture materials have been made. Double-layered intestinal anastomosis was first performed by Travers and Lembert^{6,7} in the early 19th century. Since then double layer technique was used widely over the years. The single-layered interrupted anastomosis was first described by Hautefeuille⁸ in 1976.

Outcome of any intestinal anastomosis depends upon its ability to heal without leakage. Healing process in gastrointestinal tract proceeds through same stages as wound healing elsewhere in body. Several factors like blood supply is less compromise, less damage to submucosal venous plexus, excessive inversion of tissue or very less narrowing, may responsible for good outcome in single layer anastomosis.

In our institute like government hospitals where large number of emergency procedures perform and most of patients are poor with economic problems, single layer anastomosis method is beneficial as it reduces operative time, time of anesthesia and less suture material required so economical and equally safe.

CONCLUSION

Though a large number of patients need to be studied to do a dogmatic conclusion, based on the observations and results obtained in the present study following conclusions can be drawn:

1. Duration required to perform a single layer intestinal anastomosis is significantly less when compared to double layer.
2. Less suture material required for single layer anastomosis than double layer (Single layer anastomosis is cost effective).
3. There is no significant difference in anastomotic leak rate between two groups.
4. Single layer interrupted extramucosal technique is as safe as conventional double layer technique.

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