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### A comparative study of single layer interrupted extramucosal (serosubmucosal) and double layer intestinal anastomosis

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#### ABSTRACT

##### INTRODUCTION

Intestinal anastomosis is the establishment of communication between two formerly distant portions of the intestine. A significant proportion of the operations on the gastrointestinal tract involve the repair of the gut and it is this aspect of surgery of alimentary canal which is associated with dangerous complications. The breakdown of suture line or repaired site may result in peritonitis, fecal fistula and serious or fatal septic complications. Anastomotic breakdown remains a major cause of morbidity and mortality and prolonged stay after operations on the gastrointestinal tract. Of the various methods of intestinal anastomosis, two layered interrupted anastomosis using various types of suture material is the most common type used by surgeons worldwide. However, recently several reports have appeared advocating the benefits of single layer extramucosal (serosubmucosal) anastomosis which causes less narrowing of the lumen and maintains good vascularity of anastomotic site. Further, this anastomosis requires less time to fashion, costs less than any other method and have a lower risk of complications and leakage.

##### OBJECTIVE

The purpose of this study is to compare the utility of single layer interrupted extramucosal (serosubmucosal) anastomosis over the conventional double layer intestinal anastomosis in emergency as well as elective laparotomy cases and to compare their results.

##### MATERIALS AND METHODS

Total 50 patients were included, divided into two groups of 25 each. In study group, Single Layer Extramucosal Anastomosis using Silk 3-0 Round Body was performed. In control group, conventional Double Layer Anastomosis using Vicryl 3-0 Round Body and Silk 3-0 Round Body was performed.

##### RESULTS

- The time taken for anastomosis in single layer anastomosis was less than that in control group in both elective as well as emergency cases.
- Early return of bowel function with less complication rates in study group.
- Single layer anastomosis costs less than two layer technique.

## CONCLUSION

Single layer interrupted extramucosal (serosubmucosal) anastomotic technique can be easily applied in surgical practice especially in emergency situations because it will not only save the precious time of surgeons as well as anesthetists, but also will be beneficial to the patient.

## INTRODUCTION

The word anastomosis comes from the Greek words 'ana' meaning without, and 'stoma' meaning a mouth, i.e. when a tubular viscous (bowel) or vessel (mostly arteries) is joined after resection or bypass without exteriorization with a stoma or having been tied off. Intestinal anastomosis is the establishment of communication between two formerly distant portions of the intestine. There are basically three ways of referring to this procedure - enteroenterostomy, enteroanastomosis, and intestinal anastomosis. The most frequently encountered intestinal anastomoses in routine surgical practice are gastroenteric, enteroenteric, enterocolic, colocolic, enterobiliary etc.<sup>(1)</sup>

A significant proportion of the operations on the gastrointestinal tract involve the repair of the gut and it is this aspect of surgery of alimentary canal which is associated with dangerous complications. The breakdown of suture line or repaired site may result in peritonitis, fecal fistula and serious or fatal septic complications. Various factors influencing the healing of anastomosis include age, general condition of the patient, type of surgery, presence of infection, suture line tension, effective bowel preparation, avoidance of ischemia and anastomotic technique etc. Of these factors, techniques of anastomosis play an important role in maintenance of anastomotic integrity. Anastomotic breakdown remains a major cause of morbidity and mortality and prolonged stay<sup>(2)</sup> after operations on the gastrointestinal tract.

Of the various methods of intestinal anastomosis two layered interrupted anastomosis using various types of suture material is the most common type used by surgeons worldwide. In this anastomosis inner layer mucosal approximation is done using continuous transmural absorbable suture to prevent leakage, which is further reinforced by seromuscular suture leading to approximation of the serosal surface of the bowel using interrupted silk suture<sup>(3)</sup>. The shortcoming of the double layered anastomosis is that it is a bit tedious, time consuming to fashion, and leaves an invaginated cuff of tissue with impaired vascularity protruding into the lumen of intestine

thereby producing narrowing, also the invaginated tissue produces more of inflammation and ischemic necrosis, predisposing the repaired site to diminished tensile strength and increased chance of leakage. Recently, several reports have appeared advocating the benefits of single layer extramucosal (serosubmucosal) anastomosis. The proponents of single layer extramucosal anastomosis advocate that it causes less narrowing of the lumen and maintains good vascularity of anastomotic site. Further, this anastomosis requires less time to fashion, costs less than any other method and have a lower risk of complications and leakage<sup>(3, 4, 5)</sup>. Of late many reports have suggested the single layer interrupted extramucosal (serosubmucosal) anastomosis as the gold standard for anastomosis involving large or small bowel<sup>(6)</sup>.

The present study has been conducted to compare the utility of single layer interrupted extramucosal (serosubmucosal) anastomosis using silk 3-0 with round body needle over the conventional double layer intestinal anastomosis in emergency as well as elective laparotomy cases and to compare their results.

## AIMS AND OBJECTIVES

To study and compare single layer interrupted extramucosal (serosubmucosal) versus double layered intestinal anastomosis in terms of:

1. complications like wound infection, fecal fistula, and peritonitis.
2. morbidity and mortality.
3. time required for anastomosis . and,
4. cost effectiveness

## MATERIALS AND METHODS

In this study, 50 patients (both males and females) requiring intestinal anastomosis admitted in the Department of General Surgery P.B.M. Hospital from March 2009 to September 2010 were included. All the patients requiring gastrointestinal anastomosis, both elective as well as emergency were chosen randomly. Patients suffering from other systemic diseases and those requiring anastomosis to the stomach, and duodenum were excluded from the study. . The

patients were randomly divided into two groups of 25 each. In 25 cases [study group], Single Layer Extramucosal Anastomosis using Silk 3-0 Round Body was performed. In other 25 cases [control group], the inner layer was sutured with continuous 3-0 vicryl suture on round body needle whereas the outer seromuscular layer was sutured with interrupted silk 3-0 suture on round body needle.

In post operative period, patient was monitored for any unexplained fever, distension of abdomen, time taken for bowel movements to come, postoperative day on which patient passed flatus, and postoperative day on which patient tolerated the food. The patients were also monitored for anastomotic leak, wound infection, intra-abdominal abscess. USG abdomen was done wherever required.

Cost effectiveness was calculated based on the number and type of suture used for the anastomoses. Return of the bowel function was assessed by the time when the patient first passed flatus, first signs of bowel sound, postoperative day when the patient was started orally, and the day when the patient passed motion. Total postoperative hospital stay of the patient was noted.

## OBSERVATION

The time taken for anastomosis in single layer anastomosis was less than that in control group in both elective as well as emergency cases. In elective cases average time taken for anastomosis was about 12 minutes short in study group than that was in control group. In emergency cases average time taken for anastomosis was about 13 minutes less in the study group than that was in the control group. p value at 5% was significant for both elective cases as well as emergency cases.

The incidence of postoperative pyrexia was 4% in the study group as compared to 20% in control group. Difference was statistically significant.

Abdominal distension developed in two patients (8%) in the control group as compared to none in the study group and the cause was paralytic ileus in both the patients which was resolved after correction of electrolyte imbalance. The incidence of wound infection was equal in both study and control group. Three cases (12%) had wound infection in both groups and were treated conservatively with removal of infected sutures, daily antiseptic dressings and antibiotics according to culture sensitivity. Difference was not statistically significant. Postoperative intra-

abdominal fluid collection was observed in 2 patients in control group as compared to none in the study group. In both cases it resolved spontaneously. Two patients (8%) developed anastomotic leakage in the control group as compared to none in the study group. One patient (4%) out of these two in control group developed fecal fistula and the patient later expired on 8<sup>th</sup> post operative day due to multiorgan failure.

The return of bowel activity was earlier in the patients of study group (mean 2.6 days) than the patients of control group (mean 2.8 days). Oral feeding was commenced earlier in patients of study group i.e. 24-36 hours earlier than the patients of control group.

The patients in the study group were discharged earlier (the mean hospital stay 11.6 days) than the patients in the control group (the mean hospital stay 12.8 days).

Relaparotomy was not required in any of the patients in either group. There was one mortality in the control group as compared to none in the study group. The cause of death was anastomotic disruption with septicemia with multiorgan failure.

The cost incurred (suture material used for anastomosis) in the single layer was significantly less than the double layer technique.

## DISCUSSION

Anastomotic integrity is an important determinant of immediate outcome in gastrointestinal surgery and anastomotic technique is an important factor in healing. The major determinant of morbidity and mortality after operations on the gastrointestinal tract is fear of the anastomotic disruption. A wide variety of techniques have been proposed for gastrointestinal anastomosis for the last 150 years<sup>(3)</sup>, but the ideal surgical procedure has not been discovered as yet. Anastomotic techniques should be safe, easy to learn, rapidly performed and at the same time it should not add significantly to the cost of medical care.

Since 19<sup>th</sup> century a two layer interrupted anastomosis is widely practiced. In this anastomosis inner layer mucosal approximation is done using continuous transmural absorbable suture to prevent leakage, which is further reinforced by seromuscular suture leading to approximation of the serosal surface of the bowel using interrupted silk suture.

Nowadays a single layer interrupted extramucosal anastomosis using silk suture is advocated by a number of investigators because it causes less

narrowing of the lumen and a smaller amount of tissue is strangulated. Further, this anastomosis requires less time to fashion, costs less than any other method and may have a low risk of leakage<sup>(3,7,8)</sup>.

The present study was conducted in 50 patients who required resection and anastomosis in the Department of General Surgery, P.B.M. Hospital, Bikaner from March 2009 to September 2010. These cases were from different parts of Western Rajasthan, Punjab, and Haryana. These patients required resection anastomosis of intestine for different causes like acute intestinal obstruction, acute generalized peritonitis, colostomy closure, carcinomas, penetrating injury abdomen etc.

The time taken for anastomosis in single layer anastomosis was less than that in control group in both elective as well as emergency cases. In study group average time taken for anastomosis was 22.5 minutes and 22.7 minutes in elective & emergency cases respectively as compared to 34.2 and 35.8 minutes in control group. Minimum time taken in single layer anastomosis was 18 minutes and maximum time taken for anastomosis was 27 minutes whereas in double layer anastomosis minimum time taken was 32 minutes and maximum time taken was 38 minutes. In elective cases, average time taken for anastomosis was about 12 minutes short in study group than that was in control group. In emergency cases, average time taken for anastomosis was about 13 minutes short in the study group than that was in the control group. There was significant difference in time taken for anastomosis in the study group as compared to control group (p value at 5% was significant). Various studies have shown that double layer anastomosis is tedious and time consuming to perform<sup>(3,9,10)</sup>.

A greater number of patients (5 cases i.e. 20%) with two layer anastomosis had post operative pyrexia as compared to only one patient (4%) in single layer anastomosis. The difference was statistically significant (p value 0.05). Abdominal distension developed in two patients (8%) in the control group as compared to none in the study group. The cause of abdominal distension was paralytic ileus in both the patients. On USG, there was no free fluid, gut loops were dilated and peristalsis was seen. The patients were conservatively managed and the distension resolved after four days of conservative treatment.

The various factors, which may cause wound infection, are hematoma at the sutured site, inadequate

bowel preparation, inadequate peritoneal toileting, suture material etc<sup>(12,13)</sup>. Halsted<sup>(14)</sup> in 1924, Whipple<sup>(15)</sup> in 1933 and Shambaugh<sup>(16)</sup> in 1937 emphasized the role of suture material as a cause of wound infection.

In the present study wound infection was defined as erythema, warmth, or purulent discharge at the incision site. Total 6 patients in the study developed wound infection. 3 patients out of 25 (12%) in both study and control group developed wound infection. All except one patient in control group were managed conservatively with antibiotics, removal of infected sutures and daily antiseptic dressings. One patient from control developed peritonitis & anastomotic disruption & later expired on 8<sup>th</sup> post-operative day. Anastomotic leakage was defined as radiographic demonstration of a fistula or non-absorbable material draining from wound after oral administration of contrast or visible disruption of suture line during re-exploration. In the present study there was evidence of anastomotic leakage in 2 patients (8%) in the two layer anastomotic technique as compared to none in the single layer anastomotic technique. Difference in the incidence of anastomotic breakdown was not statistically significant (p value 0.25). Both cases occurred in patients operated in emergency. In both these cases there was discharge of fecal matter from the main wound or the drain. One patient out of the two died due to multi organ failure whereas the other developed fecal fistula and was managed conservatively on the principles of management of fecal fistula. In the study by N.J. Carty et al<sup>(17)</sup> of 461 patients with 500 anastomosis, there were 11 cases (2.2%) of anastomotic dehiscence, which were clinically evident.

In the present study the return of bowel movements took longer time to appear in double layer anastomosis (average 2.8 days) as compared to patients in single layer anastomosis (average 2.6 days). In 84% of cases in the study group bowel sound appeared in first 3 days whereas in control group it appeared in 64% of the cases. The difference was statistically significant. Various other studies showed similar findings. Gambee L.P.<sup>(7)</sup> in their 10 year study showed the return of bowel movements in a similar time period. A.W. Bronwell et al<sup>(18)</sup> in their study showed the similar findings. 13 patients (52%) in the study group tolerated liquids by 4<sup>th</sup> post operative day as compared to only 1 patient (4%) in control group. In study group remaining 12 patients

accepted oral feed by 7<sup>th</sup> post operative day whereas most of the patients i.e 14 tolerated food on 5<sup>th</sup> post operative day in control group. This difference was statistically significant at 5%. In the study group the patients accepted normal diet on an average of 8.15 days, whereas in control group the normal diet was accepted on an average of 9.3 days. A.W. Bronwell<sup>(18)</sup> in his study on 327 patients showed that the patients with single layer anastomosis tolerated food about 24-36 hours earlier than that of double layer anastomosis because of less oedema at the suture line which was comparable to our study.

The mean hospital stay in the present study was 12.9 days. In the study and control group it was 11.6 days and 12.8 days respectively. This difference in mean was not statistically significant (p value = 0.197). But the distribution of patients in both groups for postoperative stay was statistically significant (p value = 0.0001). Patients in the study group significantly stayed for shorter time in hospital after surgery. The minimum duration for hospital stay following operation was 8 days and maximum hospital stay postoperatively was 26 days. The reasons for longer hospital stay were wound infection, intra abdominal abscess formation and anastomotic breakdown.

In the present study there was one death (4%). The patient died on 8<sup>th</sup> postoperative day and the cause of death was septicemia with multi organ failure due to contamination of peritoneal cavity due to leakage from the anastomotic dehiscence.

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The cost incurred (suture material used for anastomosis) in the single layer (Rs. 126) was significantly less than the double layer (Rs. 343) technique.

Several studies by Jon M. Burch<sup>(3)</sup>, Ernest Max<sup>(8)</sup> and N.J. Carty<sup>(17)</sup> concluded that single layer anastomosis costs less as compared to the double layer anastomosis.

The present study showed that the single layer interrupted extramucosal (serosubmucosal) anastomosis can be constructed in significantly less time, with no higher rate of complications and lesser cost as compared to a double layer technique.

## CONCLUSION

A single layer interrupted extramucosal (serosubmucosal) anastomosis can be constructed in significantly less time, with no higher rate of complications as compared to a double layer technique. Return of bowel function is quicker in single layer group as compared to double layer group. It also costs less than two layer technique because of less quantity of suture used. So, single layer interrupted extramucosal (serosubmucosal) anastomotic technique can be easily applied in surgical practice especially in emergency situations because it will not only save the precious time of surgeons as well as anesthetists, but also will be beneficial to the patient.

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