

**Single Versus Double Layer Anastomotic Closure In Emergency Colonic Surgery: A Prospective Study**

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**Abstract**

**Aims & Objective:** General objective: To compare the safety and cost effectiveness of single layer and double layer anastomotic technique in emergency colonic surgery.

**Specific objective:** To compare the duration of anastomosis and average length of stay in hospital.

Secondary objective: To find out the morbidity pattern among both the study group.

**Material & Methods:** “Single Versus Double Layer Anastomotic Closure In Emergency Colonic Surgery: A Prospective Study”. Was done on patient presenting Department of Surgery, VSSIMSAR, Burla, undergoing resection anastomosis of large bowel during emergency surgery from November, 2016 to September, 2018.

A total of 134 (69 SL+65DL) cases aged 18-65 years of either sex who met the criteria and consented for the study were included in the study. Only emergency procedures with colo-colic & high intra peritoneal colo-rectal end to end type anastomoses were taken for the study. Both single and double layer anastomosis were done in interrupted manner by using non-absorbable atraumatic silk 2.0 .Single layer incorporate all the layers except the mucosa where as inner most layer of double layer is transmural and outer most is seromuscular Lembert sutures.

**Results:** In this study majority of patient undergoing resection and anastomosis are volvulus of the colon 84.33%. Mean duration of intestinal anastomosis for SL is 20.87±2.07 min and for DL is 32.77±2.08 min. Mean duration of hospital stay for SL anastomosis is 8.85±3.88 days & for DL anastomosis is 10.26±3.98 days. Median expenditure for SL and DL anastomosis is Rs 426 & 568 respectively. Double layer anastomosis had slightly higher leak rate 6 (9.23%) than single layer anastomosis 5 (7.25%) with total leak rate of 11 (8.20%). Tension during anastomosis and faecal soiling significantly increased leak rate. Post-operative return of bowel sound for SL anastomosis is 2.67±0.97 days & for DL anastomosis is 3.52±0.94 days. Out of 11 patients of anastomotic leak 4 Undergone re-exploration and 7 managed conservatively. DL anastomosis had higher post-operative complication in compared to SL anastomosis though statistically insignificant but there is significant difference in terms of time taken for the anastomosis , duration of hospital stay and cost of suture material used between the two study groups.

**Conclusion:** Single layered anastomosis more safer than DL technique in emergency colonic surgery .

**Keywords:** Single layered interrupted anastomosis, double layered anastomosis, anastomotic leak.

## Introduction

Anastomosis is a surgical procedure where in two hollow viscera are approximated together to establish the continuity. It may be following the excision of a disease segment or as a bypass.

Within the last 200 years, gastrointestinal anastomosis has been transformed from a life threatening venture into a safe and routinely performed procedure. In the early 19th century through the experimental work of Travers[1] and Lembert[2], double layered intestinal anastomosis was 1st performed. The single-layered interrupted anastomosis was 1st described by Hautefeuille in 1976.[3]

Anastomosis may be everted or inverted and could be end to end, side to side and end to side, may be approximated in single layer or double layer, may be hand sewn or stapled, suture line may be interrupted or continuous, suture may be absorbable monofilament or braided, nonabsorbable monofilaments or braided or both. Hand sewn intestinal anastomosis is the most commonly used technique worldwide because of the availability and affordability of suture materials and familiarity with the procedure.

A disastrous complication of intestinal anastomosis is anastomotic leak resulting in peritonitis, fecal or biliary fistula, which is associated with high morbidity and mortality. Late complication like sub-acute or acute obstruction, occurring weeks and months after surgery pose a vexing and unsatisfactory treatment. Proper surgical technique and adherence to fundamental principle is imperative to ensure successful outcome. The ideal anastomosis should achieve adequate blood supply to the anastomotic area, water tight leak proof closure, meticulous haemostasis, stoma of optimum size, no tension on suture line, healthy tissue edge, absence of distal obstruction. An anastomotic leak greatly increases

the morbidity and mortality associated with the operation, it can double the length of hospital stay and increase the mortality as much as three fold. [4]. The present study was design to compare the safety and cost effectiveness of single layer interrupted intestinal anastomosis vs double layer method.

## Aims & Objective

**General objective:** To compare the safety and cost effectiveness of single layer and double layer anastomotic technique in emergency colonic surgery.

**Specific objective:** To compare the duration of anastomosis and average length of stay in Hospital.

**Secondary objective:** To find out the morbidity pattern among both the study group.

## Material and Method

“Single Versus Double Layer Anastomotic Closure In Emergency Colonic Surgery: A Prospective Study”. Was done on patient presenting Department of Surgery, VSSIMSAR, Burla, undergoing resection anastomosis of large bowel during emergency surgery from November, 2016 to September, 2018. A total of 134 (69 SL+65DL) cases aged 18-65 years of either sex who met the criteria and consented for the study were included in the study. Only emergency procedures with colo-colic & high intra peritoneal colo-rectal end to end type anastomoses were taken for the study. Patients admitted were subjected to physical examination, routine blood investigations and imaging (x-ray abdomen erect or ultrasonography) as appropriate. Based on detailed history, thorough clinical examinations, radiological examinations, the diagnosis was made. A minimum of 134 cases with the following inclusions and exclusion criteria were selected for the study.

### **Inclusion criteria**

1. All patient above 18 year and less than 65 year, admitted to surgery ward with clinical and radiological feature suggestive of large bowel obstruction or injury, undergoing resection and anastomosis.
2. Informed consent of all patient
3. only haemo-dynamically stable patient with haemoglobin level >7gm/dl were included.

### **Exclusion criteria**

1. patient having co-morbidity condition like DM, HTN , Immunodeficiency, bleeding disorder.
2. Patients requiring gastric, duodenal, small bowel anastomosis or low rectal anastomosis were not included.
3. patients in whom staplers used were excluded from the study.
4. Cases in which delayed recovery was expected i.e., septicemic or hypovolemic shock; severely cachectic patients requiring simultaneous total parenteral nutrition; patients requiring intensive care in postoperative period; Participants were randomly assigned to undergo either single layered extramucosal intestinal anastomosis or double layered intestinal anastomosis by opening a sealed opaque envelope indicating the technique to be used was performed using random permuted blocks of size 20. Nasogastric tube was inserted preoperatively in all patients .Intraoperative findings, haemodynamics and complications if any, quantity and cost of suture material used, were noted. All patients received post-operative piperacillin & tazobactam and metronidazole and standard Postoperative care. Both single and double layer anastomosis were done in interrupted manner by using nonabsorbable atraumatic silk 2.0 .Single layer incorporate all the layers except the mucosa where as inner most layer of double layer is transmural and outer most is seromuscular Lembert sutures. 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 while approximating the bowel ends so as to make the anastomosis watertight and at the same time avoid ischemia. 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.

### **Outcome Factors**

**Anastomotic Integrity:** 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. Postoperative leakage was assessed clinically. Ultrasound abdomen and pelvis and X-ray abdomen erect view were done in doubtful cases only.

**Duration of anastomosis (in minutes):** The duration of anastomosis begins with placement of first stitch on the bowel and ended with cutting of extra suture material from the last stitch of anastomosis.

**Surgical site infection:** Defined as a purulent discharge in, or exuding from, the wound, or a painful, spreading erythema indicative of cellulitis irrespective of the bacteriological assessment.

### **Intra -abdominal collection**

Intra-abdominal abscess without visible discharge was seen in patients as fever, persistent abdominal pain, tachycardia, and raised leucocyte count and was confirmed on ultrasound of the abdomen.

**Return of gastrointestinal function** Assessed by the day of return of bowel sounds and the day on which oral intake exceeded 500 ml over 24 hours.

**Postoperative ileus:** Defined as interval from surgery until Passage of flatus or stool and tolerance of an oral

diet these events should occur before day 4 postoperatively.

**Prolonged postoperative ileus:** Defined if two or more of the following five criteria are met on or after day 4 postoperatively without prior resolution of “postoperative ileus”

- a. Nausea or vomiting.
- b. Inability to tolerate an oral diet over last 24 hour
- c. Absence of flatus over last 24 hour
- d. Abdominal distension
- e. Radiologic confirmation

**Day of removal of drain:** Removed on the day when drain output was less than 25 ml over 24 hours.

**Re-exploration:** Re-exploration defined as an invasive intervention for anastomotic leak.

**Hospital Stay (in days):** Counted from the day of operation as there were a number of patient and hospital related factors which lead to a delay in the operation from the date of admission.

**Mortality :** The 30-day in hospital mortality was taken into account.

**Statistical analysis:** Descriptive Statistics: Data was made using Mean ± standard Deviation for continuous variables like patient's age, duration of hospital stay and time taken for procedure

Analytical Statistics: Differences between the two groups were assessed using the Chisquare test with or without Yates correction for categorical data and student t-test for continuous variables. p value was calculated and a value of less than 0.05 was considered as statistically significant. Data collection was done using a prepared proforma.

**Ethical clearance:** The study protocol was approved by the institutional ethical committee.

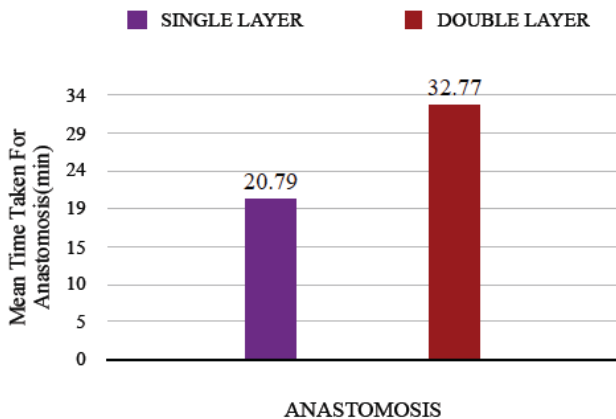
**Follow up :**On discharge, the patients were followed up at 1st week, 4th week and thereafter every month for 6 month. The patients were evaluated for gastrointestinal complaints and other complaints, if any.

**Results:** Total of 134 cases of single layer and double layer anastomosis were performed over a period span of 2 years, out of which 69 cases were done as single layer and 65 cases as double layer anastomosis .In this study majority of patient undergoing resection and anastomosis are volvulus of the colon 84.33% followed by Ca. left sided colon 4.48% presented as acute abdomen. Majority of cases (78.35%) were above the age group of 40 years. Male patients have a high rate (66.42%) of large bowel anastomosis as compared to female patient (33.58%) in emergency surgery. The ratio between male and female was 1.9:1.Mean duration of intestinal anastomosis for single layer is 20.87±2.07 and for double layer is 32.77±2.08 with range off 18 to 27 minutes for S.L & 29 to 39 minutes for D.L anastomosis. Mean duration of hospital stay for SL anastomosis is 8.85±3.88 days & for DL anastomosis is 10.26±3.98 days.

Observed parameter	Single layered (n=69)	Double Layered (n=65)
Time Taken For Anastomosis In Min. (Mean±S.D)	20.87±2.07	32.77±2.08
Duration Of Hospital Stay (Mean±S.D)	8.85±3.88	10.26±3.98
Sutute Expenditure In Rs (Median±S.D)	426±91.59	568±75.82
Post Operative Day Return Of Bs	2.67±0.97 (n=66)	3.52±0.94 (n=64)
Duration Of Ryles Tube Kept Insitu (Days)	3.64±1.77 (n=66)	4.48±1.46 (n=63)
Post Operative Complication	18 (26.09%)	18 (27.69%)
Post Operative Removal Of Drain(Days)	7.4±3.9 (n=53)	7.4±2.19 (n=53)
No. Of Death	3 (4.35%)	5 (7.69%)

**Table-1:** Showing the Characteristics of Patient Undergoing Single Layer Extra Mucosal Versus Double Layer Anastomosis.

Single layered anastomosis found to be economical compared to double layered anastomosis as the total number of suture (silk) packs required in double-layered anastomosis was 4, whereas in single-layer anastomosis only 3 pack of silk was used. In the present study, single layer anastomosis has median expenditure of Rs 426 in comparison to double layer with median expenditure of Rs 568 as each packet of silk 2.0 cost Rs 142. Faecal soiling during the operation had higher leak rate i.e. 22.22% as compared to surgery without faecal soiling (3.06%). Double layer anastomosis had slightly higher leak rate (9.23%) than single layer anastomosis (7.25%) with total leak rate of 8.20% noted in emergency large bowel anastomosis. Patient with intra-abdominal drain has 8.85% anastomotic leak in comparison to patient without drain (4.76%).



**Chart -1.** Bar Chart Showing Mean Duration Of Hospital Stay.

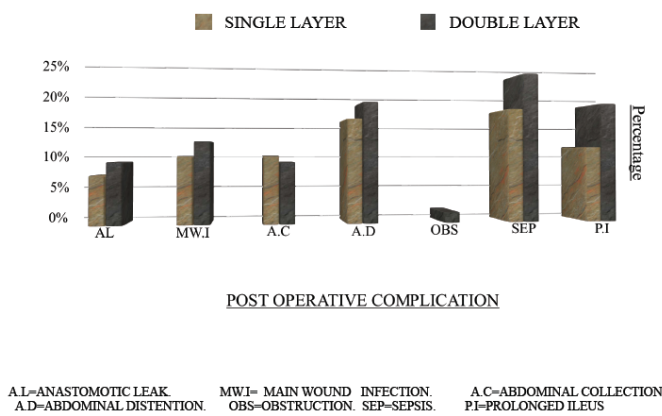
Table-2			
Post operative complication	Single layered (n=69)	Double layered (n=65)	P -value
Anastomotic leak	5 (7.25%)	6 (9.23%)	0.676
Main wound infection	7 (10.15%)	8 (12.31%)	0.691
Abdominal collection	7 (10.2%)	6 (9.2%)	0.858
Abdominal distension	11 (15.9%)	12 (18.5%)	0.699
Obstruction	0 (0%)	1 (1.54%)	0.301
Prolonged ileus	8 (11.6%)	12 (18.5%)	0.265
Sepsis	13 (17.5%)	15 (23.08%)	0.547

**Table-2:** Showing The Distribution Of Post Operative Complication During Hospitalisation In Relation To Method of Anastomosis Post-operative return of bowel sound for SL anastomosis is  $2.67 \pm 0.97$  days & for DL anastomosis is  $3.52 \pm 0.94$  days. The range varies from 1 to 6 in single layer and 2 to 5 in double layer. Mean duration of Ryles tube keep insitu in S.L anastomosis is  $3.64 \pm 1.77$  days & for D.L anastomosis is  $4.48 \pm 1.46$  days. Double layer anastomosis had higher complication rate 26.09% than single layer anastomosis (17.69%) with total complication 26.87% noted. Double layer anastomosis had slightly higher leak rate 6 (9.23%) than single layer anastomosis 5 (7.25%) with total leak rate of 11 (8.20%). DL anastomosis had higher prolonged ileus, 18.5% than SL anastomosis (11.6%) with total prolonged ileus 14.92%. Post-operative sepsis in DL is higher (23.08%) than single layer anastomosis (17.5%) with total post-operative sepsis 20.9% noted. The main wound infection reported was less in single layer than in double layer anastomosis. (10.15% vs 12.31%). On discharge, the patients were followed up, at 1st week, 4th week and thereafter every month for 6 months and found 3 cases of sub acute intestinal obstruction and one case of continuation of fistula. Total sub-acute intestinal obstruction is 3 (2.48%) which included 1 (1.56%) of S.L operation and 2 (3.50%) of double layer operation. One

case of continuation of fistula seen at 1 week of follow up which belong to single layer anastomosis.

Observed parameter	Tension		Faecal soiling		Drain given	
	+	-	+	-	+	-
	(n=11)	(n=123)	(n=36)	(n=98)	(n=113)	(n=21)
Anastomotic Leak	3 (27.3%)	8 (6.50%)	8 (22.22%)	3 (3.06%)	10 (8.85%)	1 (4.76%)

**Table-3:** Showing The Effect Of Tension ,Faecal Soiling And Drain On Anastomotic Leak.



**Chart -2:** Bar Chart Showing Percentage Of Cases With Different Complication In Relation To Anastomotic Procedure.

**Discussion:** The single layer anastomosis promised better patient compliance and consume less operative time, thus reduced prolong anaesthetic hazards and further pulmonary complication. Burch et al. Study 2000 [5] found that, mean time taken for single layer anastomosis was 20.8 min and that of double layer, 30.7 min. Khan et al Study:[8] found that mean time taken for single layer and double layer anastomosis was 20 min & 35 min respectively. There is 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. Time requirement may vary from surgeon to surgeon, from inexperienced to experienced surgeon but

overall single layer definitely required less time. Mean duration of hospital stay for S.L anastomosis is 8.85±3.88 days & for D.L anastomosis 10.26±3.98 days. Burch et al. found that, mean duration of hospital stay for single layer anastomosis was 7.9 days and that of double layer, 9.9 days. Garude et al Study: 2013 found that mean duration of hospital stay for single layer and double layer anastomosis was 12 days & 12 days respectively. Pravin P. Dandi et al: [6] 2015 found that mean duration of hospital stay in single layer was 8.24 days and in double layer 8.48 days. The present study is quite similar to that of the observations of above authors. The post-operative hospital stay was seen to be more in double layer anastomosis, which explained for either minor leak or delayed anastomotic vascularisation for this prolongation. Median expenditure for SL and DL anastomosis is Rs 426 & 568 respectively. Burch et al, Garude et al Study, found that single layer operation was cheaper to the patients which agree without finding but the no. of suture pack required both in S.L & D.L is higher in our study as compared to other study because our anastomosis is mostly colo-colic with few intra peritoneal colorectal anastomosis which have large lumen, all done in emergency setting. Other study taken into enteroenteric, entero-colic and colo-colic anastomosis done both in emergency as well as elective setting. Tension during anastomosis and faecal soiling significantly increased leak rate. Ryles tube was kept somewhat longer time in comparison to Kar Sibabrata et al study [7] probably due to late return of bowel function as a result of sepsis. Single layer hand sewn anastomosis proved best for emergency large gut anastomosis where vascular jeopardisation with infection would have given more leak in double layer anastomosis. 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 to Garude et al. study, Niyaz Ahmed study etc as all the procedures were performed in emergency basis with unprepared bowel. Out of 11 patients which had anastomotic leak, 4 patients had undergone re-exploration and 7 patients were managed conservatively, out of 8 patient died, 3 (2 in DL & 1 in SL) patient had anastomotic leak, sepsis and other related complication. Though prophylactic drain can identify early leak, it predisposes to anastomotic dehiscence and leak. Majority of the anastomotic leakage was encountered from 5th to 9th post-operative days (mean-7.09 day). In all cases of anastomotic leakage, the main complaint was leakage of faeculent matter from drain site and fever. Maximum number of anastomotic leak were managed conservatively.

**Conclusion:** Though statistically there is no significant difference in the risk of leakage and other postoperative complication but there is significant difference in terms of time taken for the anastomosis, duration of hospital stay and cost of suture material used between the two study groups. A single layer interrupted extra mucosal large bowel anastomosis has better results than the double layer technique. Ideally an anastomosis should be well vascularised, free of tension, free of faecal loading and faecal soiling. Prompt attention, early ambulation, sustained enteral and parenteral nutritional support and improvement of general condition of patients are important factors for better result.

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