ORIGINAL RESEARCH PAPER

Volume-7 | Issue-4 | April-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

SINGLE LAYER INTERRUPTED EXTRAMUCOSAL VERSUS DOUBLE LAYER CONTINUOUS INTESTINAL ANASTOMOSIS: A COMPARATIVE STUDY

Surgery

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ABSTRACT

Background: Resection and anastomosis of bowel is an integral part of general surgery. It may be done with the help of stapling devices, by using single layer suturing technique or double layer technique of anastomosis. 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. This prospective study was conducted to evaluate the safety, operative time and cost effectiveness of single layer interrupted extramucosal intestinal anastomosis in comparison with continuous double layer conventional methods of intestinal anastomosis.

METHODS: In this comparative study, 83 patients who had an indication for intestinal anastomosis (urgent or elective) were selected. Each technique was used alternatively in the patients requiring resection and anastomosis. So out of 83 patients, in 41 single layer interrupted extramucosal anastomosis was done and in another 42 patients double layer continuous anastomosis was done. Post operative complication was evaluated for anastomotic leak.

Results: In the present study, mean amount of 2-0 polyglactin used in single layer anastomosis was 1.21 and the silk 2-0 round body was not used in single layer. In double layer continuous anastomosis, a mean number of 1.90 polyglactin 2-0 round body and 1.0 silk 2-0 round body was used for inner mucosal and outer serosal layer respectively. The mean duration of operative time in single layer interrupted extramucosal anastomosis, double layer continuous amastomosis were 18.66 minutes and 26.93 minutes respectively. P value was < 0.001 which was statistically very significant.

Conclusion: Results of our study demonstrate that single layer interrupted extra mucosal technique is as safe as conventional double layer technique.

KEYWORDS

Single layered, interrupted, extramucosal intestinal anastomosis

Introduction:
The word anastomosis comes from the Greek word 'ανα', without, and'στομα', a mouth, i.e. when a tubular viscous (bowel) is joined after resection or bypass without exteriorization with a stoma.[1]

Intestinal anastomosis dates back to 1000 B.C., the era of Sushruta "The Great Indian Surgeon" where he described the use of head of black ants for intestinal anastomosis.[2] Lembert described his seromuscular suture technique for bowel anastomosis in 1826.[1]

Senn advocated a two-layer technique for closure; Halsted favoured a one-layer extramucosal closure. Connell used a single layer of interrupted sutures incorporating all layers of the bowel.[1] 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.

Historically two-layer anastomosis using interrupted silk sutures for an outer inverted seromuscular layer and a running absorbable suture for a trans mural inner layer has been standard for most surgical situations.[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. The single-layer extramucosal anastomosis, advocated by Matheson, causes the least tissue necrosis or luminal narrowing.

The rationale for extra mucosal technique is that the suture include the strongest part of the bowel wall (sub mucosa) while not incorporating the mucosa with risk of inducing ischemia.[4]

For the purpose of a bowel anastomosis, it is important to keep in mind that the serosa (i.e. the visceral peritoneum) holds suture better than the musclar layers of bowel.

The aim of present study was to know the efficacy of single layer interrupted extramucosal anastomosis over continuous double layer anastomosis in terms of anastomotic leakage, time consumed for the completion of anastomosis and cost effectiveness.

Methods:
Study populations (source of data):

It was a prospective cohort study in which 41 patients (cases) of single layer interrupted extramucosal anastomosis were compared with 42 patients (control) of double layer continuous anastomosis, in a 2 year (2015 to 2017) time period.

All patients who were admitted with various clinical conditions requiring resection and anastomosis of small and large bowel in one surgical unit of Dr. Sushila Tiwari government Hospital, Haldwani during the study period was included in the study. Each technique was used alternatively in (41 single layer interrupted extramucosal anastomosis and 42 patients double layer continuous anastomosis) the patients requiring resection and anastomosis.

Inclusions criteria:
A) Patients undergoing intestinal resection and anastomosis either because of primary bowel pathology or as a part of another operative procedure.
B) Patients who gave consent for operation and want to be part of the study.

Exclusion criteria:
A) Those who not give the consent for operation.
B) Those patient not fit for surgery.

Technique:
In double layer anastomosis, we performed two layer anastomosis using a 2/0 polyglactin (vicryl) continuous suturing for inner mucosal layer and a 2/0 silk interrupted for outer seromuscular layer.

All single layer extramucosal interrupted anastomosis were constructed using a 2/0 polyglactin round body needle suture that began at the mesenteric border.

Period of follow- up
Patients were discharged once they tolerated enteral feed and passed stools and flatus. Patient was asked to follow up on out patient basis 1 week later.

Statistical analysis:
Data was entered and analysed using Statistical Package for Social Sciences (SPSS software version 21).

Decriptive stastistics i.e. mean with standard deviation were calculated

for continuous variables like patient's age and time taken for procedure.

Risk ratio was calculated along with their 95% confidence interval for the risk of leakage in both the study groups. Unpaired T-test was applied for comparison of means of duration of the procedure.

Results:
In this comparative study 83 patients were divided into two groups: In group 1 (N = 41) patients of single layer anastomosis and in group 2 (N =42) patients of double layer continuous anastomosis were placed. Total number of male patients were 45 and 38 females.

In present study, operative procedure performed in different bowel pathology were mainly because of either to operate for intestinal obstruction, intestinal perforation or reversal of ileostomy or colostomy stoma.

Table-1: Different procedures done by different anastomotic technique

No	Disease group	No of cases			N %
		Total procedures	Single layer	Double layer	
1.	Ileostomy closure	20	10	10	24%
2.	Intussusception	02	00	02	04%
3.	Colostomy closure	04	01	03	04.8%
4.	Strangulated inguinal hernia	01	00	01	01.2%
5.	Meckel`s diverticulitis	02	00	02	02.4%
6.	Intestinal perforation	21	09	12	25.30%
7.	Intestinal obstruction	17	07	10	20.48%
8.	Appendicular abscess leading to Rt hemicolectomy	04	03	01	04.80%
9.	Rectal prolapse	05	04	01	06.02%
10.	Anastomosis as a part of ileal conduit and biliary enteric anastomosis	07	06	01	08.41%

Table no-2: Different sites of anastomosis

Geometry of anastomosis	End-to-end fashion	End-to-side fashion
No of patients	79 patients	04 patients

Table no-3: Site of repair

Site of anastomosis	Single layered	Double layered	Total
enteroenterostomy	27	28	55
enterocolostomy	08	06	14
colocolostomy	06	08	14
Total patients	41	42	83

Table no-4: Suture material and cost

Suture material	Single layered	Double layered
2-0 polyglactin	1.12	1.90
2-0 silk	00	01
cost	629	1202

Table no-5: Time taken to perform anastomosis

Type of anastomosis	Mean duration of anastomosis (in minutes)	Standard deviation(SD)	P value
Single layer interrupted extra mucosal anastomosis	18:66 minutes	01:83	P < 0.001
Continuous double layer anastomosis	26:93 minutes	03:80	

Table no-6: Postoperative complications

complication	Single layer interrupted extra mucosal anastomosis	Continuous double layer anastomosis
Anastomotic leak	03	03

DISCUSSION:
In this study the efficacy and safety of the single layer interrupted extramucosal anastomosis was compared with traditional double layer continuous anastomosis mainly in view of anastomotic failure (leak), time taken to construct the anastomosis and cost effectiveness.

The different parameters that were analyzed in this study are discussed below:

Majority of the patients of all age group were having pathology of small bowel either in the form of ileostomy stoma in situ, ileal or jejunal perforation or small bowel obstruction due to Koch's abdomen, ileal band. So the most common site of repair was enteroenteric anastomosis (66.26 %). Enterocolic and colocolic anastomosis (16.86%) were performed in similar number of patients.

Table No. 7: Comparison of site of repair

Site of anastomosis	**Present study**		Dandi P. Pravin[5]		Garude K.[6]		Ab. Hamid Wani[7]	
	Single layer (n=41)	Double layer (n=42)	Single layer (n=25)	Double layer (n=25)	Single layer (n=73)	Double layer	Single layer (n=40)	Double layer
Entero-Enteric	27 (32.5 %)	28 (33.73 %)	92%	100%	63%	64%	55%	-
Entero-Colic	08 (09.63 %)	06 (07.22 %)	4%	0%	20%	22%	0%	-
Colo-Colic	06 (07.22 %)	08 (09.63 %)	4%	0%	17%	14%	45%	-

Time taken to perform anastomosis by different techniques
The mean duration of operative time in single layer interrupted extramucosal anastomosis and double layer continuous anastomosis were 18.66 minutes and 26.93 minutes respectively. P value was < 0.001 which was statistically very significant. The less time was required in single layer interrupted extramucosal anastomosis as compared to continuous double layer anastomosis.

Table- 8. Comparison of duration of anastomosis as per literature survey:

Study	Average duration of Anastomosis (In minutes)	
	Single Layer anastomosis	Double layer anastomosis
Our study	18.66	26.93
Tawar R et al[8] (2012)	16-22	26-36
Saboo R et al[9](2013)	23.6	33.06
Dandi P et al[5](2014)	19.6	29.5
Garude K[6]	9.5	19.3
M. yasir	18.30	25.87

Mean suture material used in different type of technique
Mean amount of 2-0 polyglactin used in single layer anastomosis was 1.12 and the silk 2-0 roundbody was not used in single layer interrupted extramucosal anastomosis. In double layer continuous anastomosis a mean number of 1.90 of polyglactin 2-0 roundbody was used and additional to that one silk 2-0 round body was used in each operative procedure. So the number of suture material used were more in double layer continuous anastomosis in terms of 2-0 polyglactin and additional use of silk 2-0 round body in each procedure.

In 2014 to 2016 **Bhargava G S, et al** [10]also concluded from their study [Double layer (group "A") and single layer extra mucosal anastomosis (group "B") groups of 42 patients each] over a period of 2 years that single layer extramucosal anastomosis is cost effective and time saving procedure as compared to double layer method.

Table 9. Comparison of number of suture material used:

Groups	Number and Type of suture material used			
	Our study	Dandi P. Pravin	Garude Kirti	DR.K.S.Gokulnath Premchand et al.[11]
Group A (Single layer interrupted extra mucosal anastomosis)	1.12 (Polyglactin)	1 (Silk)	1 (3-0 Polypropylene)	1 (Silk)
Group B (Double layer continuous anastomosis)	2.90 (1.90 Polyglactin + 1 silk)	2 (Silk)	2.5 (1 Polyglactin + 1.5 Silk)	2 (1 Polyglactin + 1 Silk)

Post operative complications in different types of technique
Although there were various early and late complications, but in this study discussion over most significant complication i.e anastomotic leak was done.Number of patients having anastomotic leakage were equal in both the groups (3 patients in each group).

Premchand KSG, et al in 2010 analyze the advantages of single layer intrrupted extramucosal anastomosis over continuous double layer anastomosis of bowel. This study was conducted in 30 patients with single layer anastomosis and 30 patients with double layer anastomosis. In this study they found that, anastomotic leakage in single layer group was 3.3% and the double layer group also shows anastomotic leakage around 3.3%.They concluded that there is no much difference in the development of the complication in both the methods.

Table no 10. Comparison of percentage of anastomotic leak.

Groups	Group A (single layer interrupted extramucosal anastomosis)	Group B (double layer continuous anastomosis)
Our study	3 patients (7.31%)	3 patients (7.14%)
Dr. Shashirekha C A et al[12](2016 – 2017)	1 patient (1.67%)	1 patient (1.67%)
Bhargava S. Gopal et al (2014 -2016)	2 patients (4.7%)	1 patient (2.38%)
Ali Zia Liaqat et al.[13] (2013-2014)	3 patients (8.57%)	7 patients (20%)
Saboo Rahul et al. (2011-2013)	3 patients (10%)	2 patients (6.67%)

CONCLUSION:
Anastomotic techniques have greatly improved over the period of time, and postoperative complications have fallen accordingly. The principles of successful intestinal anastomosis are: well nourished patient with no systemic illness, no fecal or purulent contamination, adequate exposure and access, gentle tissue handling, well vascularized tissues, absence of tension and distal obstruction, approximation of well vascularized cut ends of the bowel, and meticulous surgical technique. The studies were done have shown an inclination towards single layer interrupted extra mucosal anastomosis as a better technique in terms of duration of surgery, post operative complications and cost effectiveness.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE:
Written informed consent was obtained from the patient for publication of this study and any accompanying images.

Ethical approval: This comparative study was approved by ethical committee of Government Medical College, Haldwani, Nainital (Uttarakhand).

CONSENT FOR PUBLICATION:
Not applicable

AVAILABILITY OF DATA AND MATERIALS:
The data sets generated and analysed during the current study are available from the corresponding author on reasonable request. Articles referred to can be found in the reference list.

COMPETING INTERESTS:
The authors declare that they have no competing interests.

FUNDING:
No separate funding was required for this study.

AUTHORS' CONTRIBUTIONS: SC and BC analyzed the existing data concerning the treatment of the patient regarded, wrote the manuscript and designed the tables by analyzing the existing literature on the issue. All authors read and approved the final version of the manuscript.

ACKNOWLEDGEMENTS:
There is nothing to be acknowledged.

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