International Surgery Journal
Kanagala R et al. Int Surg J. 2019 May;6(5):1723-1728
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20191897

Original Research Article

A study of various techniques, various suture materials and important factors which determine the healing of gastro intestinal anastomosis

Rajesh Kanagala, Viswanath Nallapaneni*

Department of General Surgery, Katuri Medical College, Katuri Nagar, Guntur, Andhra Pradesh, India

Received: 14 February 2019
Revised: 24 March 2019
Accepted: 28 March 2019

***Correspondence:**
Dr. Viswanath Nallapaneni,
E-mail: drvisu@gmail.com

ABSTRACT

Background: Knowledge of gastro intestinal surgery had developed gradually over centuries with much emphasis placed on suture materials and methods of anastomosis with recent advanced knowledge of gastrointestinal anastomotic healing. Objective was to study various techniques, various suture materials and important factors which determine the healing of gastro intestinal anastomosise.
Methods: Resection and anastomosis was carried out in all 36 patients. The patients presented with various pathological conditions of the intestines for which resection and anastomosis was required. Data pertaining to diagnosis, type of surgery performed, and type of bowel like small or large bowel as well as outcome was recorded.
Results: The disease was found to be affecting more males than females. 52.8% of the cases were operated as they had intestinal obstruction; 25% of the cases due to malignancy. The leakage was seen in one case (16.7%) that underwent anastomosis of the small bowel using single layered interrupted technique and catgut 2-0 + silk 2-0 suture material. The leakage was also seen in one more case (100%) that underwent anastomosis of the large bowel using single layered continuous technique and Vicryl 2-0 suture material. There was one case of leakage (33.3%) that underwent anastomosis of the large bowel using single layered interrupted technique Silk 2-0 suture material. One more case of leakage (10%) was seen in small bowel to large bowel anastomosis using single layered interrupted technique and Catgut + silk suture material.
Conclusions: Single layered intermittent for large bowel and single layered continuous technique for small bowel are preferred techniques for prevention of leak.

Keywords: Factors, Healing, Intestinal anastomosis, Techniques, Suture materials

INTRODUCTION

At present it has been noticed that resection of the intestine and then performing the anastomosis has been considered as by the surgeons of present age being as commonest one of the procedure done.[1-3]

Resection of the intestines is generally carried out to treat or cure various causes of pathological in nature. But this has to be followed by the anastomosis. Anastomosis is done to maintain the continuity of the intestines. But this is not the simple case as thought. It is associated with dangerous complications which can be life threatening.[4,5]

Knowledge of gastro intestinal surgery had developed gradually over centuries with much emphasis placed on suture materials and methods of anastomosis with recent advanced knowledge of gastrointestinal anastomotic healing. Modern medicine has acquired great deal of knowledge related to the various factors which can affect the healing of the site in the intestines where anastomosis was performed.[6,7]

Even though with great deal of knowledge with the modern medicine, the leakage from the anastomosis site and dehiscence are the complications associated with the surgery. These are also causes of increased morbidity and mortality among the patients who recover from such operations. The suture line may get broken and this results in the peritonitis. This is one more likely complication of the anastomosis surgery of the intestines. There can be occurrence of the fecal fistulation in some patients and this is one more likely complication of the anastomosis surgery of the intestines. This has been considered as one of the most fatal complication associated with the anastomosis surgery of the intestines.[8]

Present study was carried out to study various techniques, various suture materials and important factors which determine the healing of gastro intestinal anastomosis.

METHODS

The study was conducted in Sree Siddhartha Medical College Hospital and District Hospital, Tumkur during the period of September 2006 to August 2008.

It included all the patients admitted to the male and female surgical wards of Sree Siddhartha Medical College Hospital and District Hospital, Tumkur during this period of 2 years.

Institutional ethics committee permission was taken and patients were informed about the nature of the study and their informed consent was obtained for inclusion in the present study

Inclusion criteria

Inclusion criteria were patients with pathological conditions of intestine requiring resection and anastomosis, patients willing to be part of the present study.

Exclusion criteria

Exclusion criteria were seriously ill patients, patients not willing to be part of the present study.

During the study period, it was possible to study 36 cases. Resection and anastomosis was carried out in all 36 patients. The patients presented with various pathological conditions of the intestines for which resection and anastomosis was required. Data pertaining to diagnosis, type of surgery performed type of bowel like small or large bowel as well as outcome was recorded in a pre tested, pre designed, semi structured study questionnaire used for the present study which was prepared based on extensive review of literature.

Some patients underwent emergency surgery and others elective depending upon the need of the hour. Some patients were operated with bowel preparation and other without it depending upon the need of the hour. Various pathological conditions that led the patients to come to the hospital for this type of surgery were malignancy of the intestine, trauma and perforations of the bowel and ischemia of the bowel.

Various suture materials were used and different techniques of anastomosis was done and use of staplers in large bowel anastomosis is also included.

Different factors like anemia, hypoprotinemia, septicemia, bacterial peritonitis, old age, affecting healing of anastomosis have been included. Anastomosis between the intestine and other abdominal organs (like biliary enteric anastomosis i.e. cholecystojejunostomy, cystogastrostomy, pancreaticojejunostomy) are excluded. Malignant conditions that have undergone preoperative radiotherapy before resection and anastomosis and steroid dependent, immuno compromised conditions are excluded from the study

Statistical analysis

The data was entered in the Microsoft excel work sheet. The data was analyzed using proportions.

RESULTS

Table 1 shows distribution of study subjects as per sex. In the present study there were 26 male patients (72.22 %) and 10 female patients (27.78%). The male to female ratio was 2.6:1. Thus the disease was found to be affecting more males than females as per the findings of the present study.

Table 1: Distribution of study subjects as per sex.

Sex	Number	%
Male	26	72.2
Female	10	27.8
Total	36	100

Table 2: Distribution of study subjects as per age.

Age (years)	Number	%
<20	3	9.1
20-50	23	63.9
>50	10	27.0
Total	36	100

Table 2 shows distribution of study subjects as per age. In the present study there were 3 patients in less than 20 years and 23 patients in 20-50 year age group and 10 patients in more than 50 age group. Thus majority of the study subjects belonged to the age group of 20-50 years and only 9.1% belonged to the age group of less than 20 years of age.

Table 3 shows distribution of study subjects as per mode of operation. As mentioned in the methods section, some patients (47.22%) underwent surgery under emergency conditions and others (52.8%) underwent the elective surgery. The proportion of patients undergoing elective surgery was more than those undergoing the emergency operation. But the difference was not much. This shows that even today most of the patients report themselves very late at the tertiary care centers. Out of 36 patients studied in this group, anastomotic leak observed in 4 patients (11.11%). Out of which 3 patients were operated on emergency basis and 1 patient in elective group. The leak proportion was significantly more in patients who were operated on emergency basis compared to only one case of leakage in elective surgeries.

Table 3: Distribution of study subjects as per mode of operation.

Mode of operation	Number	%	Leak present	
			Number	%
Emergency	17	47.2	3	17.6
Elective	19	52.8	1	5.3
Total	36	100	4	11.1

Table 4: Indications for intestinal resection.

Indications		Number	%
Intestinal obstruction (n=19 (52.8%)	Intestinal tuberculosis	6	16.7
	Intestinal gangrene	4	11.1
	Strangulated hernia	3	8.3
	Sigmoid volvulus	2	5.6
	Intussusceptions	3	8.3
	Pyloric stenosis	1	2.8
Malignancy (n=9 (25%)	Ca colon	4	11.1
	Ca cecum	2	5.6
	Ca stomach	1	2.8
	Ca tumor small intestine	1	2.8
	Ca rectum	1	2.8
Illeal perforation		5	13.9
Trauma (n=3) (8.3%)	Penetrating injury	1	2.8
	Bull gore injury	2	5.6
Fecal fistula		1	2.7
Total		36	100

Table 4 shows indications for intestinal resection. 52.8% of the cases were operated as they had intestinal obstruction; 25% of the cases due to malignancy; 13.9% of the cases due to illeal perforation; 8.3% of the cases due to trauma and one case was operated as the patient was having fecal fistula. Among the cases with intestinal obstruction, intestinal tuberculosis was the most common cause of intestinal obstruction followed by intestinal gangrene.

Among the cases due to malignancy, carcinoma of the colon was the most common followed by carcinoma of the cecum. Among trauma cases, bull gore injury was the most common cause.

Table 5: Distribution of study subjects as per pattern of anastomosis.

Type of anastomosis	Number	%	Leak present
Small bowel-small bowel	16	44.4	1
Small bowel-large bowel	13	36.1	1
Large bowel	5	13.9	2
Gastro jejunal	2	5.6	0
Total	36	100	4 (11.1%)

Table 5 illustrate distribution of study subjects as per pattern of anastomosis. Out of total four cases of leakage, one was seen in small bowel to small bowel anastomosis, one was in small bowel to large bowel anastomosis and two cases were in large bowel anastomoses. The most common type of anastomosis performed was small bowel to small bowel in 44.4% of the cases followed by small bowel to large bowel in 36.1% of the cases. Five cases were purely large bowel anastomosis while two cases were done at gastro-jejunal junction.

Table 6: Technique of anastomosis for various resections.

Type of anastomoses	Technique of anastomoses	Number	%
Small bowel anastomoses	Single layered interrupted	6	37.5
	Single layered continuous	10	62.5
Large bowel anastomoses	Single layered continuous	1	20
	Single layered interrupted	3	60
	Stapled anastomoses	1	20
Small bowel to large bowel anastomosis	Single layered interrupted	10	76.9
	Single layered continuous	2	15.4
	Stapled anastomosis	1	7.7

Table 6 shows technique of anastomosis for various resections. Among 16 cases of small bowel anastomosis, single layer interrupted technique was done in 6 cases and single layered continuous technique was used in 10 cases. Among five cases of large bowel anastomosis, one case was operated using single layered continuous technique, three cases using single layered interrupted technique and one case using stapled anastomosis technique. Among 13 cases of small bowel to large bowel anastomosis, single layered interrupted technique was used in 10 cases, single layered continuous technique was

used in two cases and stapled anastomosis technique was used in one case.

Table 7 shows correlation of technique used with anastomotic leak. The leakage was seen in one case (16.7%) that underwent anastomosis of the small bowel using single layered interrupted technique. The leakage was also seen in one more case (100%) that underwent anastomosis of the large bowel using single layered continuous technique. There was one case of leakage (33.3%) that underwent anastomosis of the large bowel using single layered interrupted technique. One more case of leakage (10%) was seen in small bowel to large bowel anastomosis using single layered interrupted technique.

Table 7: Correlation of technique used with anastomotic leak.

Type of anastomosis	Anatomical segment	Number	Leak present	
			Number	%
Single layered interrupted	Small bowel	6	1	16.7
Single layered continuous	Small bowel	10	0	0
Single layered continuous	Large bowel	1	1	100
Single layered interrupted	Large bowel	3	1	33.3
Stapled anastomosis	Large bowel	1	0	0
Single layered interrupted	Small bowel-large bowel	10	1	10
Single layered continuous	Small bowel-large bowel	2	0	0
Stapled anastomosis	Small bowel-large bowel	1	0	0

Table 8: Suture materials used for different techniques of anastomosis and leak present.

Type of anastomosis	Anatomical segment	Suture material used	Number	Leak present	
				Number	%
Single layered interrupted	Small bowel	Catgut 2-0 + silk 2-0	6	1	16.7
Single layered continuous	Small bowel	Vicryl 2-0+ silk 2-0	10	0	0
Single layered continuous	Large bowel	Vicryl 2-0	1	1	100
Single layered interrupted	Large bowel	Silk 2-0	3	1	33.3
Stapled anastomosis	Large bowel	-	1	0	0
Single layered interrupted	Small bowel-large bowel	Catgut + silk	10	1	10
Single layered continuous	Small bowel-large bowel	Vicryl + silk	2	0	0
Stapled anastomosis	Small bowel-large bowel	Stapled	1	0	0

Table 9: Outcome in terms of mortality in the present study.

Leak	Mortality				Total	
	Yes		No			
	Number	%	Number	%	Number	%
Present	1	25	3	75	4	11.1
Absent	2	6.3	30	93.7	32	88.2
Total	3	8.3	33	91.7	36	100

Table 8 shows suture materials used for different techniques of anastomosis and leak present. The leakage was seen in one case (16.7%) that underwent anastomosis of the small bowel using single layered interrupted technique and catgut 2-0 + silk 2-0 suture material. The leakage was also seen in one more case (100%) that underwent anastomosis of the large bowel using single layered continuous technique and Vicryl 2-0 suture material. There was one case of leakage (33.3%) that underwent anastomosis of the large bowel using single layered interrupted technique Silk 2-0 suture material. One more case of leakage (10%) was seen in small bowel to large bowel anastomosis using single layered interrupted technique and Catgut + silk suture material.

Table 9 shows outcome in terms of mortality in the present study. Total in patient mortality is 3 patients. Total anastomotic leaks are observed in 4 patients out of whom 3 patients were managed by laparotomy. Out of 3 patients subjected laparotomy 2 patients recovered by re-resection and anastomosis and 1 patient was subjected to temporary illeostomy.

There were no long term post op complications after re laparotomy. Mortality in leak group was 1 patient. Mortality in non leak group is 2 patients. 2 patients died of septicemia shock with multiple organ dysfunction syndromes with ARDS.

DISCUSSION

In the present study the male to female ratio was 2.6:1. Thus the disease was found to be affecting more males than females as per the findings of the present study. Majority of the study subjects belonged to the age group of 20-50 years and only 9.1% belonged to the age group of less than 20 years of age. In a study conducted by Golub et al the average age of patient undergoing resection and anastomosis was 68.3% which is comparable to our study with average age (56%) with a range of 20-70 yrs.[9]

The total mortality observed in the study was 3 patients (8.33%). Golub et al, reported an overall mortality of 7.8 % in study group undergoing resection and anastomosis which is comparable to our study.[9]

A total of 4 patients (11.11%) developed anastomotic leak, out of which 3 patients survived after re-laparotomy, however 1 patient died due to anastomotic leak related septic complications. In the study conducted by Irvin TT et al, over all anastomotic dehiscence noted in 14 % of cases which is comparable to our series.[10]

Among 3 patients survived after re-laparotomy, 2 of them underwent re-resection and anastomosis and recovered. 1 patient underwent temporary illeostomy where patient was followed for one month and patient recovered with illeostomy. Mortality among patient who leaked was 1 out of 4 (25%). In a study conducted by Golub et al [9] mortality rates in patients with leak was reported as 39.3% when compared, is low in our study (25%). In a study conducted by Irvin et al, mortality in leak group was 35% comparable to our study.[10]

After one month follow up none of patients developed anastomotic or wound related complications. 9 patients out of 36 patients (25.0%) has hemoglobin less than 8.5 gm. Out of these 9 patients 2 patients had anastomotic leak (22.22%). 11 patients out of 36 patients (30.55%) had serum total protein below normal. Out of these 11 patients who presented with hypoprotinemia 2 patients developed anastomotic leak (18.18%). In a study conducted by Irvin et al, serum protein values of 106 cases were available and anastomotic dehiscence noted in 17 % of cases which is very much comparable with our study.[10] More than 50% patients who developed anastomotic leak were more than 60 yrs which is comparable to our study. [10]

Out of 16 patients operated on small bowel for various causes, 4 leaks observed (25%). In the study conducted by Golub et al, the anastomotic leak recorded was around 9% where it was comparably high in our study (25%) as most of the anastomosis done in small bowel in our study is associated with mesenteric infarction and septicemia.[9]

Of these 4 leaks, 2 leaks were observed in patients with mesenteric infarction and 2 leaks are associated with local sepsis. The leakage was seen in one case (16.7%) that underwent anastomosis of the small bowel using single layered interrupted technique. The leakage was also seen in one more case (100%) that underwent anastomosis of the large bowel using single layered continuous technique. There was one case of leakage (33.3%) that underwent anastomosis of the large bowel using single layered interrupted technique. One more case of leakage (10%) was seen in small bowel to large bowel anastomosis using single layered interrupted technique. In a study by Matheson et al, anastomotic leak was reported as 0 % in colocolic anastomosis.[11]

Serin et al, reported a leak of 4 % in anastomosis done by single layer in lower gastro intestinal tract which is comparably low in our study which accounts for 0%.[12]

CONCLUSION

Anastomotic leak is more common in old age. Single layered intermittent for large bowel and single layered continuous technique for small bowel are preferred techniques for prevention of leak. Adequate blood supply to cut mucosal edge is essential. Irrespective of suture material anastomosis will heal. The preferred suture material was vicryl. No effect of gender in anastomotic leaks. Anastomotic leaks were independent predictor of mortality. Anastomotic leak is more in emergency surgeries. Bacterial peritonitis and septicemia are significant risk factors affecting healing of intestinal anastomosis in our study. Anemia and hypoprotinemia are also significant factors in development of leak.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Burch JM, Franciose RJ, Moore EE, Biffl WL, Offner PJ. Single layer continuous versus two layer interrupted intestinal anastomosis: a prospective randomized trial. Ann Surg. 2000;231(6):832-7.
2. Orlando MD, Chendrasekhar A, Bundz S, Burt ET. The effect of peritoneal contamination on wound strength of small bowel and colonic anastomoses. Ann Surg. 1999;65(7):673-5.
3. Ahrendt GM, Tantry US, Barbul A. Intra abdominal sepsis impairs colonic reparative collagen synthesis. Am J Surg. 1996;171(1):102-7.
4. Rullier E, Laurent C, Garrelon JL, Michel P, Saric J, Parneix M. Risk factors for anastomotic leakage after resection of rectal cancer. Br J Surg. 1998;85(3):355-8.
5. Irvin TT, Goligher JC, Johnston D. A Randomized Prospective Clinical Trial of Single-Layer and Two-Layer Inverting Intestinal Anastomoses. Br J Surg. 1973;60(6):457-60.

6. McDonald CC, Baird RL. Vicryl intestinal anastomosis: analysis of 327 cases. Dis Colon Rectum. 1985;28(11):775-6.
7. Jonsell G, Edelmann G. Single layer anastomosis of colon. Am J Surg. 1978;135(5):630-2.
8. Ravitch MM, Canalis F, Weinshelbaum A, McCormick J. Studies in intestinal healing. 3. Observations on everting intestinal anastomoses. Ann Surg. 1967;166(4):670-80.
9. Golub R, Golub RW, Cantu JR, Stein HD. A multivariate analysis of factors contributing to leakage of intestinal anastomosis. J Am Coll Surg. 1997;184:364-72.
10. Irvin TT, Goligher JC. Etiology of disruption of intestinal anastomoses. Br J Surg. 1973;60:461-4.
11. Matheson NA, Irving AD. Single layered anastomosis in GI tract. Surg Obst Gyn. 1976;143:619-24.
12. Sarin S, Lightwood RG. Continuous single layer gastrointestinal anastomosis: a prospective audit. Br J Surg. 1989;76:493-5.

Cite this article as: Kanagala R, Nallapaneni V. A study of various techniques, various suture materials and important factors which determine the healing of gastro intestinal anastomosis. Int Surg J 2019;6:1723-8.