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General Surgery

RESECTION AND ANASTOMOSIS OF BOWEL SEGMENTS – ANALYSIS IN SURGICAL PRACTICE

Dr. M Sairam Prasad — Associate Professor Department Of General Surgery Alluri Sitarama Raju Academy Of Medical Sciences Eluru – 534005 West Godavari District, Andhra Pradesh, India

Dr. B. Sandeep* — Assistant Professor Department Of General Surgery Alluri Sitarama Raju Academy Of Medical Sciences Eluru – 534005 West Godavari District, Andhra Pradesh, India
*Corresponding Author

ABSTRACT **Background and objectives :** Many different techniques are currently used to join segments of the gastrointestinal tract following resection. This study is intended to study the feasibility of single layer technique in our setup, to study the disease groups undergoing gastrointestinal resection and anastomosis, and to study safety and efficacy of vicryl in single layer gastrointestinal anastomosis in terms of early postoperative leak

KEYWORDS : anastomosis, postoperative leaks, single layer

INTRODUCTION

The technique of resection and anastomosis since the inception have been experimentally evolved for better and efficient healing of the anastomotic site. The evolution includes various methods like hand sutured anastomotic techniques with various suture materials and the use of stapling devices, suture less biofragmentable rings, laser welding and fibrin glues. But sutures remains the main stay for anastomosis in developing countries like India because the above mentioned other devices are very costly. Anastomosis can be end to end, end to side, or side to side.

The „sina qua non" of intestinal anastomosis is conceded to be adequate blood supply, the absence of distractive tension and satisfactory decompression. The aim of intestinal anastomosis is to make a sound alignment of bowel through which the contents will pass as soon as possible. Initially the anastomosis should be water tight and haemostatic. The amount of tissue trauma inflicted while making the anastomosis will also affect the eventual strength of anastomotic site and the rate at which normal bowel function returns. Although these local factors are vitally important in the healing of an intestinal anastomosis, the technique and tissue handling while performing the anastomosis must also be regarded as a significant determinant of its outcome.

The safety of intestinal anastomosis is usually measured by its complication rate especially the incidence of anastomotic leak. Several studies show that two-layer investing stitch is associated with obstruction of lumen leading to formation of adhesions, clinical morbidity and delayed intestinal motility. But single-layer technique maintains a wide-lumen, good blood supply of anastomotic stoma, is easily learnt, flexible in its application, incurs less cost and time saving. It can be used when access is not so easy as in trans abdominal oesophagogastric anastomosis, after low anterior resection, disparity in the bowel lumen and in the absence of serosa.

The important complications of any anastomosis include leakage, haemorrhage and narrowing of the stoma. These are not always preventable, but can be minimized by adopting a single layer closure of intestinal anastomosis. The technique reliably creates a wide lumened anastomosis, with minimal tissue reaction and a low incidence of postoperative complications, and does so at a lower cost to the patient than most other techniques

AIMS AND OBJECTIVES

- To study disease group undergoing gastrointestinal resection and anastomosis
- To study safety and efficacy of vicryl(polyglactin/polyglycolic acid) in single-layer intestinal anastomosis in terms of early postoperative anastomotic leak.
- To study the factors affecting anastomosis of bowel

METHODOLOGY

The study was conducted in patients who came to ASRAM medical college, Malkapuram, Eluru, Andhrapradesh for treatment during the period from November 2013 to September 2015 (which included the follow up of 3 months).

A total of 170 gastrointestinal anastomosis in ASRAM medical college were performed during this period. A total of 50 patients, who underwent, single layered intestinal anastomosis using vicryl during this 2 year period were prospectively selected randomly to represent different disease groups from jejunum to rectum in different age groups.

The patients were subjected to detailed history, thorough clinical examination, relevant laboratory investigations, feasible radiological, sonological and endoscopic investigations to confirm diagnosis. Bowel preparation, if possible was achieved, antibiotics were given at induction of anaesthesia. Patient underwent laparotomy, exploration and resection and end to end anastomosis of intestinal tract at various levels with single layer technique using vicryl as suture material. All patients remained on intravenous fluids with no oral intake until evidence of gastrointestinal motility was present. Fluids were then given orally in gradually increasing amounts and then food started. Abdominal wound assessed during inpatient stay and follow up.

Inclusion criteria :

- Patients of various intestinal diseases of all age groups requiring resection and anastomosis at various levels.
- Anastomosis performed by single-layer technique using interrupted sutures of vicryl as the suture material.
- Only end to end anastomosis cases are included.
- Patients undergoing single anastomosis.

Exclusion criteria :

- Patients undergoing two layered anastomosis.
- Patients undergoing end to side and side to side anastomosis
- Patient undergoing anastomosis with suture material other than vicryl.
- Patients undergoing multiple anastomosis.
- The disease group undergoing gastrointestinal anastomosis, factors influencing healing, anastomotic leak and surgical procedures were studied in association with complications. The patients were followed up for 3 months after discharge once in every 2 weeks on OPD basis

OPERATIVE PROCEDURE

TYPES AND TECHNIQUES OF ANASTOMOSIS

B. METHODS OF ANASTOMOSIS :

The following methods are used for uniting parts of the gastrointestinal tract:

1. The open end-to-end, two-layer technique :
The divided ends of the bowel are held in crushing clamps and light occlusion clamps are applied across the bowel, avoiding the mesentery. The outer posterior layer of sutures are placed usually in a continuous manner but interrupted sutures can also be used. The crushing clamps are then cut away.The inner layers of sutures are then inserted commencing at the antimesenteric border with the knot on the serosal surface. A continuous over-and-over technique is used, care being taken to include all coats of the bowel wall and avoiding grasping the mucosa with forceps.

The mesenteric corner of the anastomosis is securely invaginated by using a Connel suture and the anterior aspect closed using a continuous Conneltechnique or a simple over and over technique. The suture is then tied to its other end. The anastomosis is completed by an anterior row of serosal sutures either continuous from the posterior layer or interrupted. The mesentery of the small intestine must be closed in every case and the anastomosis checked for patency.

2. The open end-to-end, one layer technique:
This method is increasingly favoured for end-to-end anastomosis in areas of gastrointestinal tract where the blood supply is poor, where there is no serosal coat or the lumen is small. In infants, a one layer technique is the rule, many surgeons favour the use of a one layer open technique for the oesophagus and lower rectum.

After preliminary corner stitches are inserted to steady and approxiamte the posterior walls of the anastomosis, a series of interrupted deep "all coats" sutures of delayed - absorbable material (Dexon, vicryl, PDS, silk or linen are all suitable) are inserted 5mm apart. After the corners have been reached, the suturing is continued along the anterior walls as interrupted Lembert stitches with a wide margin of muscle coat, some surgeons use interrupted Connell sutures, but these are less haemostatic and turn in more tissue than the technique illustrated.

3. The closed end-to-end, single-layer technique :
The single-layer inverting closed anastomosis with interrupted non-absorbable sutures was first advised by Halsted. The technique has been modified to incorporate the submucosa so that only the mucosa is excluded. It is commenced by inserting two angle stitches which are held untied. Posterior sutures are then placed longitudinally approximately 5mm apart. Once finished, the anterior layer is inserted in a similar fashion. When this layer is in place the clamps are slipped out, the angle sutures tied and lastly the anterior ones. Patency must always be checked with finger and thumb.

4. End-to-side anastomosis :
This technique is used particularly in surgery of the esophagus, stomachin creating a Roux en-y limb and when there is significant disparity between two ends of intestine. This size of the lateral opening in the intestine should be equivalent to that of the lumen of the intestine to be anastomosed. This stoma should be made at a distance from the mesenteric resection to avoid injury of the mesenteric vascular supply. This anastomoses may be accomplished with
a suturing or staple technique.

5. Side-to-side anastomosis :
This is most commonly performed to bypass an obstructed segment of the intestine, leaving the segment in place. An adequate stoma is ensured, and there is no problem about the disproportionate diameters of the proximal and distal bowel. The anastomoses should be effected in the antimesenteric portion, by employing a suturetechnique or the GIA stapler. When side-to-side or end-to-side anastomosis is carried out with the proximal segment is transected and it is important that no more than 1.5 cm of proximal jejunum; ileum or colon be allowed to extend beyond the anastomoses, because the pouch may perforate or may gradually enlarge, or balloon, producing symptoms of indigestion, abdominal pain, distension and even recurrent intestinal obstruction. This condition is termed as the "blind loop" syndrome, may cause malnutrition, a sprue-like state and microcytic and macrocytic anaemia.

6. Stapling Techniques :
Preliminary closure of the bowel ends can be performed using linear staples which can be cut away once the purse string suture is in place. End-to-end anastomosis is performed using circular stapling devices like premium EEA (Autosuture) and ILS (Ethicon). Purse-string sutures must be carefully placed and for this the furness clamp can be utilised. Circular staples are very useful for oesophageal and rectal anastomosis. The double stapling technique: The recent availability of an adjustable angle linear stapler, the reticulator (auto suture) has added a new dimension to stapling technique, further facilitating low rectal anastomoses. Together with the premium EEA (End-to-end anastomosis instrument),a low rectal anastomoses is technically easier and safer. The anastomosis of colon to rectum is efficient using the premium EEA circular stapler through the rectal reticulator linear staple line.

DISCUSSION

A total of 50 patients who underwent single layer gastrointestinal anastomosis at various sites were studied and results are compared with the previous available studies. There are certain disparities in the results, since our study is in small series.

The safety and effectiveness of a technique of the single layer anastomosis may be measured by the number of postoperative complications, especially the clinically suspected anastomotic leak.
The comparison of number of anastomotic leaks as related to the level of anastomosis between the present series and Matheson NA and Irving AD series (1975).

Abstract of Matheson NA and Irving AD Series

Anastomosis after resection of the rectosigmoid colon is often followed by leakage at the suture line. When occult leakage discovered on routine contrast study is included incidence rates of over 50 per cent have recently been reported. A single layer interrupted seromuscular inverting technique was used for the anastomosis after elective rectosigmoid resection in 52 consecutive patients. The total incidence of suture line leakage was 6 percent. Therefore a high incidence of anastomotic dehiscence in the rectum can be avoided and it is concluded that a single layer technique is sound.

Comparison Anastomotic Leaks of Matheson NA and Irving AD Serieswith Present Study :

Level of Anastomosis	Matheson and Irvin Series[16,17]		Present Series	
	No. of Cases	No. of Leaks	No. of Cases	No. of Leaks
I) Upper GIT Oesophogastric	24	1 (4.28%)	-	0
Gastroduodenal	118	2 (1.6%)	6	0
ii) Lower GIT : Enteroenteric	171	2 (1.2%)	18	0
Ileocolic	26	2 (8%)	15	1 (6%)
Colocolic	18	0	3	0
Colorectal	52	3 (6%)	7	1 (14%)

In Matheson and Irving series there were 24 cases that required oesophagogastric anastomosis out of which 1 case had anastamotic leak whereas there no cases of oesophagogastric anastomosis in this study.

There were 118 cases of gastroduodenal anastomosis in which 2 had anastamotic leak compared to 6 cases in this study which had no anastamotic leak.

There were 171 cases of Enteroenteric anastomosis out of which 2 developed leak compared to 18 in this study .

There were 26 cases of Ileocolic anastomosis out of which 2 developed anastamotic leak compared to 15 in this study out of which 1 developed leak.

There were 18 cases of colocolic anastomosis out of which none developed leak compared to 3 in this study who had not suffered any leak.

There were 52 cases of colorectal anastomosis out of which 3 developed anastamotic leak compared to 7 in this study out of which 1 developed anastamotic leak.

Comparison of disease groups between the present study & study conducted by Sarin.S and Lightwood R.G. series is shown in the table.

Comparison of disease groups in present study with Sarin S and Lightwood RG Series.

Upper gastrointestinal tract and Lower gastrointestinal Tract (excludingcolon)		
Disease groups	**Sarin S, and Lightwood RG series[5]**	**Present Series**
Carcinoma oesophagus	-	-
Carcinoma stomach	23	4
Gastric ulcer	7	2
Strangulated hernia	5	6
Carcinoma of the pancreas and Ampullary carcinoma	20	-
Meckel"s diverticulum	-	5
Small bowel stricture/ perforation	-	6
Others	11	1
Total	66	27

Lower gastrointestinal tract (colonic resections)		
Disease groups	**Sarin S, and Lightwood RG series[5]**	**Present Series**
Carcinoma of the colon	52	13
Ileocaecal TB	1	6
Superior mesenteric artery Infarction	2	1
Sigmoid volvulus	1	1
Others	9	3
Total	65	24

Abstract of S Sarin and RG Lightwood series

Single-layer bowel anastomosis have conventionally been constructed using an interrupted suture technique. A single-layer continuous technique has been avoided on the grounds that it may predispose to ischaemia of the bowel ends. We have routinely used a single-layer continuous suture technique with an absorbable suture material (polyglycolic acid) to construct all recent intraperitoneal bowel anastomosis, and we present a 3-year audit of this technique. A total of 131 patients were studied of whom 66 had undergone upper gastrointestinal resections and lower gastrointestinal resections (other than colonic) and 65 had colonic resections. Twenty-two patients had emergency operations. Anastomotic failure was noted in 4.5 and 6.2 percent of patients in each group respectively. The incidence of minor wound infection was 1.5 and 7.7 per cent respectively. The overall mortality rate was 8.4 per cent. This study suggests that a single-layer continuous suture technique gives acceptably reliable results when used in gastrointestinal anastomosis.

There were no cases of carcinoma oeophagus in Sarin S and Light Wood RG series as well as in this study.

There were 23 cases of Carcinoma stomach compared to 4 in this study.
There were 7 cases of gastric ulcer compared to 2 in this study.
There were 5 cases of strangulated hernia compared to 6 in this study.
There were 20 cases of Carcinoma Pancreas and Periampullary carcinoma compared to none in this study.

There were no cases of Meckel"s diverticulitis compared to 5 in this study.

There were no cases of Small bowel stricture or Perforation compared to 6 in this study.

There were 52 cases of Carcinoma Colon compared to 13 in this study.
There is 1 case of Ileocaecal tuberculosis compared to 6 in this study.

There were 2 cases of Superior mesenteric artery infarction compared to 1 in this study.

There was 1 cases of Sigmoid volvulus in both studies.
The other cases were 20 compared to 4 in this study.

The two deaths were not attributed to the anastomotic leak. One case of carcinoma descending colon 66 years male died of aspiration pneumonia on 4th postoperative day. Another case of carcinoma stomach, a 53 year old male died on the 6th postoperative day probably due to cardiovascular problems.

Comparison with Ernest Max series

	Leak	**Obstruction**	**Wound infection**	**Death**
Ernest Max19 series of 1000 patients	1 %	2 %	2 %	1 %
Present series of 50 patients	4 %	2 %	18 %	4 %

Abstract of Ernest Max Series

There was 1% leak in the Ernest Series of 1000 patients compared to 4% in this study.

2% of the cases presented with Obstruction later on similar to this study.

There was a Wound infection rate of 2% compared to 18% in this study.

1% deaths were encounted in the Ernest series compared to 4% in this study.

Comparison of anastomotic leaks with McDonald CC and Baird RL:

	No.of cases	**Leak**
McDonald CC and Baird RL18	327	0.6 %
Present series	50	4 %

Abstract of McDonald CC and Baird RL Series

Reported are 305 patients undergoing 327 intestinal anastomosis with polyglactin (Vicryl, Ethicon) suture. The technique of one-layer interrupted absorbable suture anastomosis is discussed. A leak rate of 0.6 percent is recorded and indicates this method is acceptable.

There was 0.6% leak out of 327 cases in the McDonald CC and Baird RL Series out of 327 cases whereas there was 4% leak out of 50 cases in this study.

Even though the leak rate of 1% is present in the Ernest Max series and 0.6% in McDonald CC and Baird RL. These series were compared with a number of other series in which anastomosis at all levels are included, the incidence of clinical anastomotic leak ranged from 1% to 9%, with the average rate of clinically suspected leak was 5%. Hence the leak rate in the present series is 4%, which is well with in the average limit.

The wound infection rate in our series is 18% which is attributed to improper sterilization of the instruments, unhygenic condition of the patients, nutritional status, cross infection in the wards, and also the type of surgery i.e., whether it is elective or emergency surgery, since, surgery on an unprepared bowel or the presence of intra abdominal sepsis have a high incidence of wound infection and wound dehiscence

CONCLUSION AND SUMMARY

Our study included 50 patients who underwent single layer gastro intestinal anastomosis. I conclude that single layer anastomosis of gastro-intestinal tract is simple and safe method which can be done quickly. It maintains a water tight and normal sized lumen with less tissue trauma and early vascularization, hence restored normal anatomy with less complications.

I have studied the present series of 50 patients who underwent single layered gastrointestinal anastomoses using vicryl. Analysing them, the following summary were drawn.

Majority of patients belonged to age group 41-60 years which accounting for 22 patients (44%).

Patients undergoing resection and anastomosis was more common in males 31 (62%) than females 19 (38%).
Anastomoses performed in elective surgeries heal well without complications as compared to those performed in emergency surgeries.

Clean bowel is the key to success of gastrointestinal anastomosis. Anastomosis performed on an unprepared bowel met with higher incidence of complications.

Leak is more in the anastomosis done in the areas where serosal coat is

absent.

There was also demonstrable relationship between the general status of the patient on anastomotic healing like anaemia, malignancy, sepsis and Hypotension, which increases the incidence of leak and wound infection. However the effect of jaundice and uremia could not be studied in the present series.

Wound infection is the commonest complication followed by seroma and anastomotic leak in our series.

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