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RESEARCH ARTICLE

THE ASSESMENT OF TECHNIQUES OF BOWEL ANASTOMOSIS IN LAPAROSCOPIC COLORECTAL SURGERY: AN OBSERVATIONAL PROSPECTIVE STUDY.

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ABSTRACT

Laparoscopic colorectal surgery has gained momentum over the last one and a half decade and has become the standard procedure for both colonic and rectal tumors. Colorectal anastomotic leak is one of the most feared post operative complications after any anastomosis made on the bowel. However different techniques of anastomosis have been studied viz a viz the bowel anastomosis leak rate. The various techniques performed for restorative bowel anastomosis are End to End (EE), End to side(ES) and Side to Side(SS). The physiological and anatomical anastomosis however, difficult to perform is End to End anastomosis as it maintains the continuity of the bowel and less leak rate is reported thereby. We took up a study and became interested in evaluating the techniques of anastomosis with the objectives of technical feasibility, return of bowel sounds and time of completion with each technique. Our results were quite satisfying as only one patient (3.8%) in our series developed leak in the technique of Side to Side anastomosis which is the most favoured and commonly performed bowel anastomosis in laparoscopic colorectal surgery. Due to small sample size we could not better evaluate the return to bowel sounds in each technique.

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INTRODUCTION

Intestinal anastomosis is a surgical procedure performed to establish communication between two formerly distant portions of the intestine. This procedure restores intestinal continuity after removal of a pathologic condition affecting the bowel. The type of GI anastomosis depends on personal preference; but irrespective of the technique used, principles that ensure a successful outcome include: good vascular supply to the segments being approximated, no distal obstruction, and a tension free repair. Colorectal resection surgery is often performed to remove malignant colon tissue in patients with colon cancer or rectal cancer. The healthy sections of the colon are reconnected by an anastomosis, which can be created by suturing or by using a stapling device and surgery can be performed using an open or a minimally invasive approach. A number of linear and circular staplers are currently in the market to facilitate a laparoscopic procedure. Both suturing and stapling have advantages and disadvantages[1,2]. Recent results suggest that a combination of stapling and hand-sewn reinforcement of the staple line may be useful[3]. We generally use a double–layer technique for intestinal anastomosis but appreciate that a single – layer continuous anastomotic technique has also been shown to be safe and may be favored by many surgeons[4].There are different techniques for anastomosis commonly used in G.I. Surgery like end-to-end, end-to-side, or side-to-side[5].They can be handsewn in one or more layers, using interrupted or continuous sutures in a variety of sizes, needle configurations and materials, or stapled using linear or circular proprietary devices[6]. Anastomotic leaks are one of the most serious complications of colorectal resections. Anastomostic leakage following colorectal surgery occurs in5-15% of cases. Postoperative anastomotic leaks have serious sequelae like infection, abscesses, or peritonitis and can be difficult to detect[7]. They have been shown to increase the patient's risk of cancer recurrence and death[8-11].Intra-operative leak testing is often performed to assess the integrity of the anastomosis. A recent systematic review found that intra-operative testing was performed in 86.5% of patients in the reviewed studies and intra-operative leaks were identified in 6.3% of all patients who were tested[12]. Laparoscopic digestive anastomosis is a technically demanding procedure that requires advanced skills in laparoscopic surgery[13-14]. Furthermore, its complications are responsible for a large proportion of the ensuing mortality and morbidity (leak, fistula, intra-abdominal abscess, stenosis).

Anastomotic leaks may have a negative impact on the long-term prognosis of patients undergoing surgery for digestive cancer[15]. Standardized mechanical techniques of anastomosis (e.g. colorectal Knight's technique for colorectal anastomosis, side-to-side jejunojejunostomy) achieve reproducible and easy-to-teach procedures. But some anastomoses require sutures for the closure of intestinal openings after completion of the mechanical side-to-side anastomosis or hand-sewn techniques[13,14, 15-17]. This step is the most challenging one because laparoscopic intracorporeal suturing and knot tying are considered the most difficult laparoscopic skills that need constant traction to keep the tension of the suture during running suture. All efforts to standardize these techniques and to make them safe, quick, reproducible, and easy to teach to training surgeons are welcome. The knotless barbed suture has been proposed to make laparoscopic suturing easier. To date, the efficacy and safety of these sutures in gynecologic[19, 20, 21], plastic[22-23], urologic[24] and orthopedic surgery[25] have been reported. Their use has been limited mainly to wall and parenchymatous sutures (uterus, kidney). Recently, they have been extended successfully to vesico-urethral anastomoses, reducing the time required to complete the anastomosis[26-29]. In digestive surgery, they have been used for laparotomy and mesenteric closure, but only a few studies have proved their safety and reproducibility in terms of anastomotic leaks or stenosis.

Laparoscopic gastrointestinal hand sewn anastomosis approach combines the advantages of laparoscopic surgery: as excellent operative field vision, minimal trauma, small scars, lower postoperative pain, and reduced hospital stay with the potential advantages of a hand-sewn anastomosis. The specially developed laparoscopic clamps play a crucial part in the success of the techniques. The clamps prevented fecal contamination of the abdominal cavity and facilitated the performance of the anastomosis. The end-to-end single-layer colorectal anastomosis with the absorbable suture has been shown to be safe and effective in open surgery,[30]. We believe that the staple-free hand-sewn laparoscopic colonic anastomosis (CSHLCA) technique offers considerable advantages, compared to stapling, in laparoscopic colonic surgery. The first is the lower cost of the procedure, since both circular and linear mechanical staplers are no longer necessary during a laparoscopic colectomy. CSHLCA may be ergonomically superior to stapled anastomosis when access can be difficult (e.g., splenic angle colic resection). In addition, the performance of an intracorporeal hand-sewn anastomosis, as opposed to the extracorporeal hand-sewn method that is practiced by some surgeons following delivery of the specimen through a small abdominal incision is probably safer, as it is not associated with traction injuries and subsequent vascular compromise and bleeding as is theoretically possible with the latter method.

AIMS AND OBJECTIVES

- To observe the functional outcome of techniques of bowel anastomosis viz-a-viz.
- Return of bowel sounds (first flatus)
- Post operative anastomotic leak in each technique
- Time taken for each anastomotic technique.

MATERIALS AND METHODS

After obtaining the ethical clearance from the concerned ethical committee, the present observational study was conducted in the Postgraduate Department of Surgery, Government Medical College, Srinagar. This was a prospective observational study. Patients were enrolled after they fulfill the selection criteria and gave consent for the study. Patients were taken for diagnostic laparoscopy after proper clinical evaluation and imaging study. Patients were also informed about the possible complications of the procedure. The patient's age, sex, and other demographic features, anthropometry, underlying co morbid conditions, and relevant family history were recorded. The presenting clinical features of any G.I conditions and any treatment received for it prior to hospitalization were recorded.

All the patients were evaluated according to preformed proforma including an elaborate history, detailed clinical examination, routine investigations and specific investigations such as USG, CECT, and colonoscopy and tumormarkers, e.g. CEA. All such patients having benign or malignant condition involving G.I tract where resection anastomosis was required underwent diagnostic laparoscopy and assessment of lesion, localization, local spread and distant spread was assessed. The resection was done on the basis of findings of diagnostic laparoscopy. Resection was done and anastomosis was performed to restore the continuity of the bowel. The vicryl/ barbed sutures wereused in a continuous single layer fashion.

RESULTS

In the present study 26 patients were enrolled with age between 29-75 years. Mean age of the patients was 51.4±12.76 years. The most common age group affected was 51-60 years.(Table 1). The male to female ratio was 3.3:1. Most common presenting symptom was pain abdomen in 14 (53.8%) followed by bleeding per rectum in 10 (38.5%), chronic constipation in 9 (34.6%), generalized body weakness in 5 (19.2%), swelling RIF and vomiting. The final diagnosis was ascending colon growth in 7 (26.9%) patients, hepatic flexure growth in 5 (19.2%) patients, growth in sigmoid colon and recto-sigmoid growth in 3 (11.5%) patients each, growth of caecum and rectal growth in 2 (7.7%) patients each while 1 (3.8%) patients each had descending colon growth, ileal stricture, SAIO with internal herniation of jejunoileal segment and splenic flexure growth. Laparoscopic right hemicolectomy was the most common procedure used in 10 (38.5%) patients followed by Laparoscopic LAR in 3 (11.5%) (Table 2).

Figure 1. Port placement for right Hemicolectomy

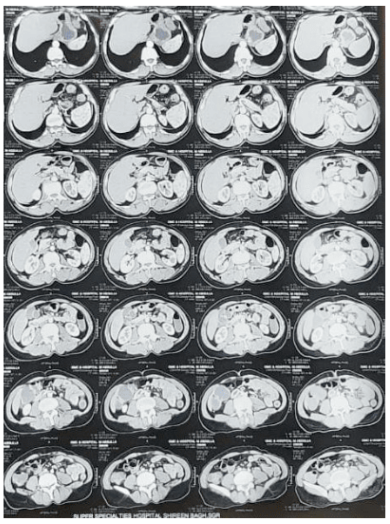


Figure 2. CECT abdomen of asending colon growth

Figure 3. Port placement for left hemicolectomy

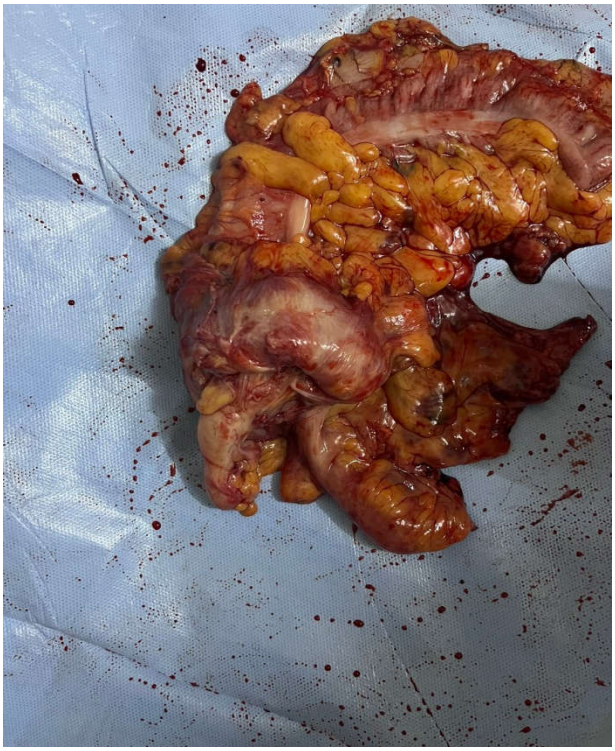


Figure 4. Specimen of right D 3 hemicolectomy

Type of anastomosis was side to side in 9 (34.6%) patients, end to side in 8 (30.8%) patients and end to end in 9 (34.6%) patients. Based on type of anastomosis patients were divided into three groups, Group SS (side to side), Group ES (end to side) and Group EE (end to end). Mean age of patients in Group SS, Group ES and Group EE were 53.1±14.93 years, 49.3± 12.89 years and 52.7±11.21 years, respectively. The difference was statistically insignificant with a p value of 0.712. Male dominance was observed in all the three study groups with 88.9% in Group SS, 75% in ES and 66.7% in Group EE. The difference observed was statistically insignificant with a p value of 0.528. Significant difference was observed when duration of surgery (minutes) was correlated between two study groups with a p value of < 0.05 years. Increase in the duration of surgery was observed in three study groups (Group SS 158.6 minutes; Group ES 166.3 minutes and Group EE 170.2 minutes). Duration of anastomosis was highly significant when compared between two groups at a time.

Figure 5. Specimen of right extended hemicolectomy with omentectomy

Mean duration of anastomosis in Group SS was 20.6 minutes, in Group ES was 22.8 minutes and in Group EE it was 24.7 minutes (Table 3). There was no statistically significant difference when three study groups (p 0.619) were compared on the basis of intraoperative bleeding (ml). Mean intraoperative bleeding in Group SS was 135.1 ml, in Group ES was 135.4 ml and Group EE was 137.2 ml. Only 1 (11.1%) patient in Group SS has anastomotic leak. None of the patient in other two groups had anastomotic leak. The difference obtained was statistically insignificant. Almost equal time was required by patients in all the three study groups to return to bowel sounds with 3 days in Group SS, 2.9 days in Group ES and 2.8 days in Group EE. No statistically significant difference was obtained (p 0.892). No statistically significant difference was seen when duration of hospital stay (days) was observed in three study groups with a p value of 0.709. Mean hospital stay was 7.1 days in Group SS, 6.5 days in Group ES and 6.8 days in Group EE, respectively.

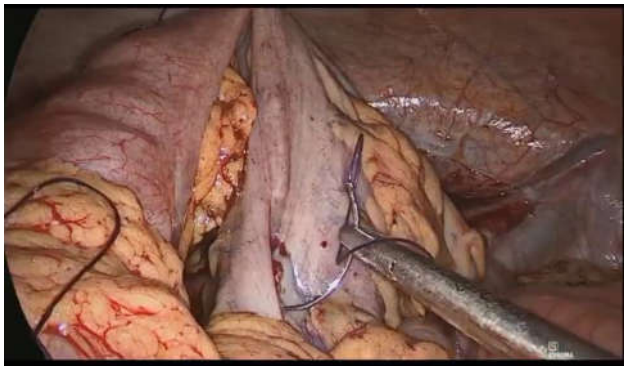


Figure 6. Laparoscopic side to side colorectal anastomosis

DISCUSSION

Earlier open gastrointestinal anastomosis used to be the only method to relieve colonic pathology, owing to the introduction of laparoscopic surgery, lesser and lesser invasive approaches are now more commonly being used with the advent of laparoscopic and minimal access techniques. Now a day's diagnostic laparoscopy is a standard technique followed in all gastrointestinal malignancies for staging the disease and plan its treatment whether palliative or curative.

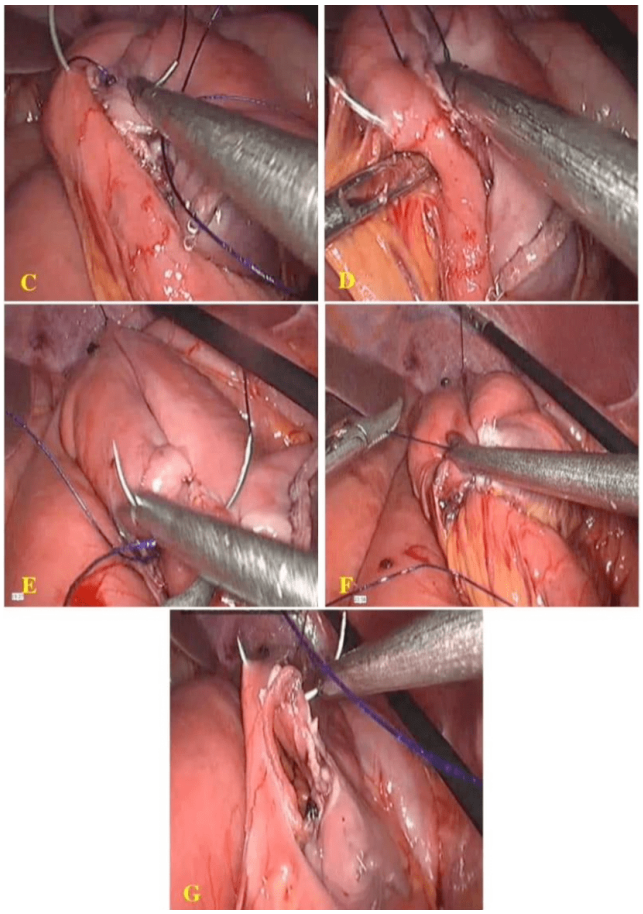


Figure 7. laparoscopic jejunojejunal anastomosis using V lock suture

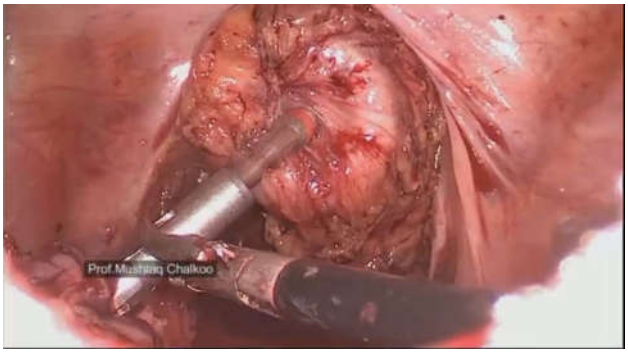


Figure 8. Laparoscipic end to end anastomosis using circular stapler

Table 1. Age distribution of study patients

Age (Years)	Number	Percentage
≤ 40	6	23.1
41-50	7	26.9
51-60	9	34.6
> 60	4	15.4
Total	26	100
Mean ±SD (Range)=51.4±12.76 (29-75 Years)		

The anastomotic technique selected for colectomy depends upon the site of cancer, bowel diameter, and surgeon's personal experience[33-35]. In the present study 26 patients were enrolled with age between 29-75 years. Mean age of the patients was 51.4±12.76 years. The most common age group affected was 51-60 years. In our study Males were predominant with 20 (76.9%) versus 6 (23.1%) females with a male to female ratio of 3.3:1. Liu Z *et al*., (2014)[36] also confirmed male dominance in their study. Most common presenting symptom was pain abdomen in 14 (53.8%) followed by bleeding per rectum in

Table 2. Distribution as per type of surgery

Type of surgery	Number	Percentage
Laparoscopic right hemicolectomy	10	38.5
Laparoscopic LAR	3	11.5
Laparoscopic left hemicolectomy	2	7.7
Diagnostic lap with resection anastomosis of herniated gut loop	1	3.8
Laparoscopic anterior resection	1	3.8
Laparoscopic left hemicolectomy with omentectomy	1	3.8
Laparoscopic pallative right hemicolectomy	1	3.8
Laparoscopic resection of sigmoid growth with omentectomy	1	3.8
Laparoscopic right extended hemicolectomy with omentectomy	1	3.8
Laparoscopic right extentedhemicolectomy	1	3.8
Laparoscopic right extented radical hemicolectomy	1	3.8
Laparoscopic right quasi hemicolectomy	1	3.8
Laparoscopic total colectomy	1	3.8
Laparoscopic ultra low LAR	1	3.8
Total	26	100

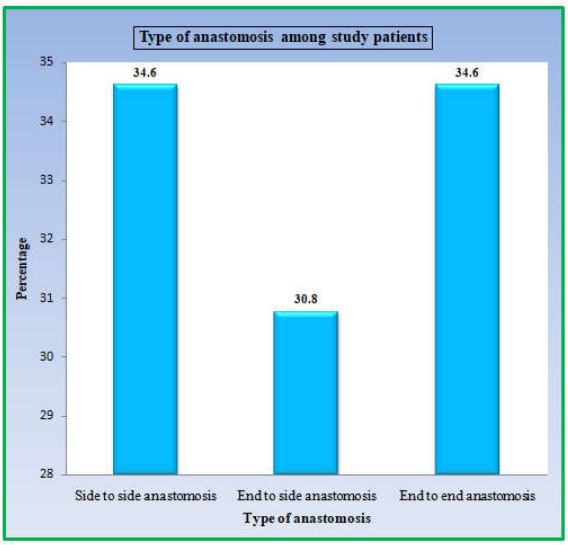
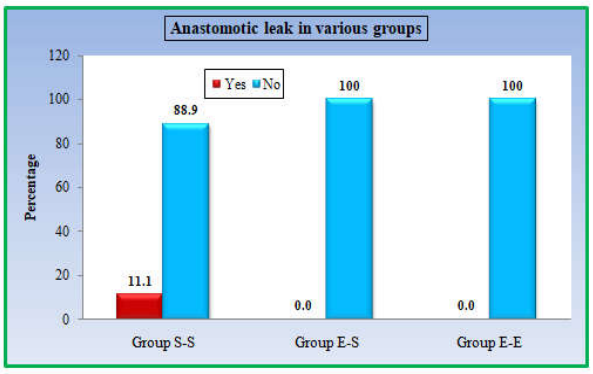


Table 3. Duration of surgery (minutes) in various groups

Group	N	Mean	SD	Range	Comparison	P-value
Group S-S	9	158.6	5.22	150-166	S-S vs E-S	0.015*
Group E-S	8	166.3	8.51	154-182	E-S vs E-E	0.042*
Group E-E	9	170.2	11.37	155-186	E-E vs S-S	0.007*



10 (38.5%), chronic constipation in 9 (34.6%), generalized body weakness in 5 (19.2%), swelling RIF and vomiting. Most common final diagnosis was ascending colon growth in 7 (26.9%) patients, hepatic flexure growth in 5 (19.2%) patients, growth in sigmoid colon

and recto-sigmoid growth in 3 (11.5%) patients each, growth of caecum and rectal growth in 2 (7.7%) patients each while 1 (3.8%) patients each had descending colon growth, ileal stricture, SAIO with internal herniation of jejunoileal segment and splenic flexure growth. Laparoscopic right hemicolectomy was the most common procedure used in 10 (38.5%) patients followed by Laparoscopic LAR in 3 (11.5%).Laparoscopic TME has replaced open TME as the gold standard for rectal cancer surgery.Type of anastomosis was side to side in 9 (34.6%) patients, end to side in 8 (30.8%) patients and end to end in 9 (34.6%) patients. Puleo S *et al*., (2012)[37] did a study 999 patients.The positioning of the anastomosing bowel was side-to-side in 60.5% of the patients, end-to-side (E–S) in 38.1 % of the patients and end-to-end in 1.3 % of the patients. Mean age of patients in Group SS, Group ES and Group EE were 53.1±14.93 years, 49.3± 12.89 years and 52.7±11.21 years, respectively. The difference was statistically insignificant with a p value of 0.712.Male dominance was observed in all the three study groups with 88.9% in Group SS, 75% in ES and 66.7% in Group EE. The difference observed was statistically insignificant with a p value of 0.528. Liu Z *et al*., (2014)[36] observed a mean operation time of 150.5 ± 20.1 minutes in Group End-to-side anastomosis and 140.4 ± 14.9 minutes Group functional end-to-end anastomosis with statistically significant difference (p 0.001). Increase in the duration of surgery was observed in three study groups (Group SS 158.6 minutes; Group ES 166.3 minutes and Group EE 170.2 minutes). Mean duration of surgery in colorectal anastomosis was 170.00±45.826 in a study done by Chalkoo M *et al*., (2021)[38]. Mean duration of anastomosis in Group SS was 20.6 minutes, in Group ES was 22.8 minutes and in Group EE it was 24.7 minutes. Duration of anastomosis in Chalkoo M *et al*., (2021)[38] was 40.0±8.660 minutes in colorectal anastomosis. Mean anastomosis time of 40 ± 8.660 minutes with range of 35-50 minutes was observed in a study done by Liu Z *et al*., (2014)[36]. There was no statistically significant difference when three study groups (p 0.619) were compared on the basis of intraoperative bleeding (ml). Mean intraoperative bleeding in Group SS was 135.1 ml, in Group ES was 135.4 ml and Group EE was 137.2 ml. Similar results were observed by Liu Z *et al*., (2014)[36]. Only 1 (11.1%) patient in Group SS has anastomotic leak. None of the patient in other two groups had anastomotic leak. The difference obtained was statistically insignificant. Liu Z *et al*., (2014)[36] also confirmed anastomotic leak in 3 (1.8%) patients in end to side anastomosis group and 1 (0.5%) patients in functional end to end anastomosis group. Almost equal time was required by patients in all the three study groups to return to bowel sounds with 3 days in Group SS, 2.9 days in Group ES and 2.8 days in Group EE. No statistically significant difference was seen when duration of hospital stay (days) was observed in three study groups with a p value of 0.709. Mean hospital stay was 7.1 days in Group SS, 6.5 days in Group ES and 6.8 days in Group EE, respectively.

CONCLUSION

Laparoscopic gastrointestinal anastomosis has longer operative time, less blood loss, lower analgesic use, earlier passage of flatus, and quickerresumption of oral intake, earlier hospital discharge, and fewer postoperative complications. The Side to Side anastomosis in laparoscopic colorectal anastomosis is technically easy. However, among the three techniques of bowel anastomosis, End to End anastomosis is most challenging but most favored and physiological.

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