A COMPARATIVE STUDY ON THE OUTCOME OF STAPLER ANASTOMOSIS VS. HAND-SEWN ANASTOMOSIS IN ELECTIVE GASTROINTESTINAL SURGERIES

R. Lakshmana¹, R. Sivamarieswaran², Athira Gopinathan³

¹Assistant Professor, Department of General Surgery, SRM Medical College Hospital and Research Centre, Kancheepuram, Tamilnadu.

²Postgraduate Student, Department of General Surgery, SRM Medical College Hospital and Research Centre, Kancheepuram, Tamilnadu.

³Senior Resident, Department of General Surgery, SRM Medical College Hospital and Research Centre, Kancheepuram, Tamilnadu.

ABSTRACT

BACKGROUND

Gastrointestinal anastomosis plays a pivotal role in gastrointestinal surgeries. GI anastomosis can be done either by hand-sewn or stapler method. Recently stapling devices have created a great impact in GI anastomosis. Aim of this study is to compare the outcome of stapler versus hand-sewn anastomosis in elective GI surgeries.

MATERIALS AND METHODS

In this study, 50 patients requiring elective GI surgeries were included after satisfying the inclusion criteria. Patients were divided into four groups based on the site of anastomosis. Comparison between hand-sewn and stapled anastomosis in each group in terms of duration of anastomosis, duration of surgery, return of bowel activity, starting of oral feeds, acute postoperative complications and length of post-operative hospital stay were done.

RESULTS

In this study, we found significant difference between hand-sewn and stapler anastomosis in each group in terms of duration of anastomosis, duration of surgery, return of bowel activity, oral feeds starting day and length of postoperative hospital stay. It was stapled anastomosis that took lesser time for anastomosis, total operating time, return of bowel activity and length of hospital stay. Chi-square test was used to differentiate acute post-operative complications, which was insignificant between hand-sewn and stapler method with p-value > 0.05.

CONCLUSION

Due to shortened operating time, staplers are favourable for patients with poor general condition who would not tolerate prolonged anaesthesia. The insignificant difference in acute postoperative complications suggests both hand-sewn and stapled method can be done with same safety and accuracy when done with proper technique.

KEY WORDS

Stapler Anastomosis, Hand-Sewn Anastomosis, Gastrointestinal Surgeries.

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BACKGROUND

The restoration of intestinal continuity after removal of a pathological lesion affecting the bowel, by joining the two ends is called as anastomosis. Numerous surgical conditions require the resection of bowel segments and the creation of reliable anastomosis. As such, anastomotic techniques have been central to the development of modern surgical practice. Back in 1000 BC, Sushruta "Father of Indian Surgery" described the use of black ants for the intestinal suturing.^[1] Later in 18th century Lembert and Halsted established the basic principles and different methods of intestinal suturing.^{[2],[3]} The most important aspect to create a healthy and tension-free anastomosis is to form a good opposition of the bowel edges in presence of excellent blood supply.^[4]

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Corresponding Author:

Dr. Gopinathan Athira,
S-1, Plot No. 247, Abhi's Aradhana,
E-Block, Parvathy Nagar South,
3rd Cross Street, Madambakkam,
Chennai-600126, Tamilnadu.
E-mail: drathirag@gmail.com
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Gastrointestinal anastomosis can be done either by hand-sewn technique or using mechanical stapling devices. Hand-sewn anastomosis in which absorbable and non-absorbable suture materials are used to create an anastomosis is world-wide established and accepted by the surgeons since 19th century.^[5] Mechanical stapling devices which came to use around early 1910's was not successful and accepted by the surgeons in the beginning due to mechanical difficulties and non-reliability.^[6] But the evolution of the mechanical surgical stapling devices to create gastrointestinal anastomosis has become a real technological advancement in the field of surgery and has been widely used with ease by the surgeons nowadays.

Many surgeons now consider stapling technique as a better alternate to conventional hand-sewn technique for speed, safety, efficacy and accessibility. Presently, surgical staplers play a major role in major gastro-intestinal surgeries. Anastomotic dehiscence and leak are the 2 most important and deadly complications of GIS. If following basic surgical principles such as meticulous technique with avoidance of tension at the site of anastomosis, maintaining optimal tissue vascularity, avoidance of associated systemic illnesses, proper perioperative nutritional optimization, proper perioperative control of medical comorbidities, one can

create a safe and reliable anastomosis. The rate of stricture at the anastomotic site is considerably higher with stapled anastomosis than with hand-sewn anastomosis.

Previous individual trials made to compare between the conventional hand-sewn technique and stapler anastomosis have not shown either of the technique superior to the other.^{[7][8][9]} Most recent studies done specifically to compare between the hand-sewn anastomosis versus stapled anastomosis in elective gastrointestinal surgeries were lacking adequate information on outcome assessment. The aim of this study is to compare the above-mentioned parameters between the conventional hand-sewn anastomosis versus stapled anastomosis in elective gastrointestinal surgeries.

MATERIALS AND METHODS

This prospective non-randomised interventional study included 50 patients who are admitted in surgical wards of SRM Medical College Hospital and Research Centre, Kancheepuram District, Tamilnadu, requiring elective gastrointestinal surgeries. A complete detailed history and physical examination was done. Data collection was done from March 2016 to August 2017. This study included male or female subjects (between the ages of 18 to 80 years) undergoing elective surgery requiring a gastric, small or large bowel anastomosis. As all the patients who met the inclusion criteria between March 2016 and August 2017 were planned to include in the study, sample size calculation was not done.

Exclusion criteria for this study were patients less than 18 years, gastrointestinal anastomosis done in emergency setting, biliary-enteric anastomosis, patients refused to give the consent, patients with prior chemo-radiation, patients with severe systemic illness and pregnant women.

The study was started after obtaining ethical committee clearance. A well-explained informed and written consent was also obtained from the patient. Patients were divided into four groups based on the site of anastomosis. Out of 50 patients 6 total gastrectomy, 22 subtotal gastrectomy, 14 right hemicolectomy and 8 anterior resection were performed. Patients were allocated into hand-sewn group and stapler group alternatively. In each group, one-half was operated with hand-sewn technique and other half with stapled technique for GI anastomosis. The hand-sewn anastomosis method included cases with at least one bowel anastomosis without the use of staplers. The stapler anastomosis method included cases with at least one bowel anastomosis done with a stapler. It also includes cases with multiple bowel anastomosis done with both hand-sewing and stapler.

In total gastrectomy group, post total gastric resection, end-to-end oesophagojejunostomy with side-to-side jejunojejunostomy was done by stapler or hand-sewn technique. In subtotal gastrectomy group (Gastrojejunostomy), after subtotal resection of stomach, end-to-side gastrojejunostomy was done with stapler or hand-sewn method. In right hemicolectomy group (ileotransverse anastomosis), approximately 10 cm of terminal ileum, caecum along with appendix, ascending colon and one-third of the proximal transverse colon was resected and side-to-side anastomosis was done using hand-sewn or stapler method. In anterior resection group (colorectal anastomosis), after the resection of the pathology involving

rectosigmoid region, end-to-end colorectal anastomosis is done either by hand suturing or staplers. Hand-sewn anastomosis was done in either single layer or double layer anastomosis using 2-0/ 3-0 Vicryl (polyglactin) and 3-0 silk for the outer seromuscular layer. Linear cutting staplers (TLC 55, TLC 75), Linear anastomosing staplers (TCR 55, TCR 75), Circular anastomosing staplers (CDH 25, CDH 29) were used based on the need in stapler anastomosis.

Operational Definitions

Duration of anastomosis was counted from resection of the specimen till the end of anastomosis. Duration of surgery was counted from start of skin incision till skin closure. Return of bowel activity was assessed by return of bowel sounds postoperatively. Resumption of oral feeds included the number of days taken to start oral feeds postoperatively. Acute postoperative complications assessed anastomotic leak and wound infection. Anastomotic leak was assessed by appearance of gastric or intestinal contents through the drain. Wound infection was assessed by purulent discharge from the skin incision site.

Statistical analysis was performed using Statistical Package for Social Science (SPSS, version 17) for Microsoft Windows. Since data was not normally distributed, non-parametric tests (Mann-Whitney test) were performed. Descriptive statistics were presented as numbers and percentages. The data were expressed as Mean and SD. Mann-Whitney test were used to compare continuous variables between two groups. A chi-squared test was used for comparison between percentages. A two-sided p-value < 0.05 was considered statistically significant.

RESULTS

Out of 50 patients 6 total gastrectomy, 22 subtotal gastrectomy, 14 right hemicolectomy and 8 anterior resection were performed. Each group has two subgroups (A) and (B), in which (A) belongs to hand-sewn anastomosis group and (B) belongs to stapled anastomosis group.

Group 1: Total Gastrectomy.

Group 1A: Hand-sewn anastomosis- 3 cases.

Group 1B: Stapler anastomosis- 3 cases.

Majority of the patients, 66.7% are males in hand-sewn group and 100% in stapler group. The mean age of patients in hand-sewn group is 52 years and mean age of patients in stapler group is 57.3 years. Mean duration taken for oesophagojejunostomy in hand-sewn group is 32 mins and in stapler group is 25 mins. Mean duration taken for jejunostomy-jejunostomy in hand-sewn group is 27 mins and in stapler group is 23 mins. The mean time taken for total gastrectomy in hand-sewn group is 178.67 mins and in stapler group is 165.67 mins. The average number of days taken for return of bowel sounds in hand-sewn group is 5.67 days and in stapler group is 3.67 days. Average number of days taken to start oral feeds in hand-sewn group is 6.33 days and in stapler group is 4 days. Average number of postoperative hospital days of patients in hand-sewn is 15.33 days and in stapler group is 13.33 days. There is no significant difference in age, duration of anastomosis, duration of surgery, return of bowel activity, oral feed starting day, post-operative hospital stay with the p-value >0.05 (Mann-Whitney test).

Variable	Group	Mean	Std. Deviation	P value
Age	Group 1a	52.00	13.748	0.7
	Group 1b	57.33	6.658	
OJ (Duration of anastomosis)	Group 1a	32.00	2.000	0.1
	Group 1b	25.00	1.000	
JJ (Duration of anastomosis)	Group 1a	27.00	1.000	0.1
	Group 1b	23.00	1.000	
Duration of surgery	Group 1a	178.67	3.055	0.1
	Group 1b	165.67	4.041	
Return of bowel activity	Group 1a	5.67	.577	0.1
	Group 1b	3.67	.577	
Oral feeding starting day	Group 1a	6.33	.577	0.1
	Group 1b	4.00	.000	
No. of hospital days	Group 1a	15.33	.577	0.1
	Group 1b	13.33	.577	

Table 1. Comparison between Hand-Sewn Anastomosis and Stapler Anastomosis in Total Gastrectomy Cases

Early Postoperative Complications

One patient (33.3%) from hand-sewn group developed wound infection postoperatively and no patients from stapler group had early postoperative complications. This difference was not significant ($p > 0.05$) (Figure 1) (Chi-square test).

Figure 1. Acute Postoperative Complications Hand-Sewn Anastomosis and Stapler Anastomosis in Total Gastrectomy Cases

Group 2: Subtotal Gastrectomy (Gastro-Jejunostomy)

Group 2A: Hand-sewn anastomosis- 11 cases.

Group 2B: Stapler anastomosis- 11 cases.

Majority of the patients, 72.7% are males in hand-sewn group and 81.8% are males in stapler group. The mean age of patients in hand-sewn group is 60.45 years and mean age of patients in stapler group is 55.82 years. Mean duration taken for gastro-jejunosomy in hand-sewn group is 31.09 mins and in stapler group is 22 mins. The mean time taken for total gastrectomy in hand-sewn group is 186.27 mins and in stapler group is 156.55 mins. The average number of days taken for return of bowel sounds in hand-sewn group is 5.91 days and in stapler group is 4.09 days. Average number of days taken to start oral feeds in hand-sewn group is 6.36 days and in stapler group is 4.82 days. Average number of postoperative hospital days of patients in hand-sewn is 15.55

days and in stapler group is 13.55 days. There is a significant difference in duration of anastomosis, duration of surgery, return of bowel activity, oral feed starting day, postoperative hospital stay (Table 2) (Mann-Whitney test).

Variable	Group	Mean	Std. Deviation	P value
Age	Group 2A	60.45	10.073	0.261
	Group 2B	55.82	8.670	
OJ (Duration of anastomosis)	Group 2A	31.09	1.921	0.000
	Group 2B	22.00	1.612	
JJ (Duration of anastomosis)	Group 2A	186.27	6.198	0.000
	Group 2B	156.55	3.588	
Duration of surgery	Group 2A	5.91	.302	0.000
	Group 2B	4.09	.302	
Return of bowel activity	Group 2A	6.36	.505	0.000
	Group 2B	4.82	.603	
Oral feeding starting day	Group 2A	15.55	.522	0.000
	Group 2B	13.55	.820	

Table 2. Comparison between Hand-Sewn Anastomosis and Stapler Anastomosis in Subtotal Gastrectomy Cases

Early Postoperative Complications

Two patients (18.2%) from hand-sewn group and one patient (9.1%) from stapler group developed wound infection postoperatively. One patient from hand-sewn group developed anastomotic leak. No significant difference in early postoperative complications between hand-sewn group and stapler group ($p > 0.05$) (Figure 2) (Chi-square test).

Figure 2. Comparison of Acute Postop Complications between Hand-Sewn and Stapler Group

Group 3: Right hemicolectomy group (Ileotransverse anastomosis).

Group 3A: Hand-sewn anastomosis- 7 patients.

Group 3B: Stapler anastomosis- 7 patients.

Among 7 patients, 5 (71.4%) are males and 2 patients (28.6%) are females in both hand-sewn group and stapler group.

The mean age of patients in hand-sewn group is 48.14 years and mean age of patients in stapler group is 39.57 years. Mean duration taken for ileo-transverse anastomosis in hand-sewn group is 35.86 mins and in stapler group is 25.71 mins. The mean time taken for right hemicolectomy in hand-sewn group is 180.14 mins and in stapler group is 147.71 mins. The average number of days taken for return of bowel sounds in hand-sewn group is 5.71 days and in stapler group is 3.86 days. Average number of days taken to start oral feeds in hand-sewn group is 6.43 days and in stapler group is 4.43 days. Average number of postoperative hospital days of patients in hand-sewn is 15.29 days and in stapler group is 11.86 days. There is a significant difference in duration of anastomosis, duration of surgery, return of bowel activity, oral feed starting day, postoperative hospital stay between Group A and B with p-value > 0.05 (Mann-Whitney test) (Table 3)

Variable	Group	Mean	Std. Deviation	P value
Age	Group 3A	48.14	19.895	0.805
	Group 3B	39.57	10.690	
Ileotransverse anastomosis time	Group 3A	35.86	1.952	0.001
	Group 3B	25.71	.756	
Time taken for hemicolectomy	Group 3A	180.14	7.221	0.001
	Group 3B	147.71	1.890	
Return of bowel activity	Group 3A	5.71	.488	0.001
	Group 3B	3.86	.378	
Oral feeding starting day	Group 3A	6.43	.535	0.001
	Group 3B	4.43	.535	
Duration of postoperative stay	Group 3A	15.29	.951	0.001
	Group 3B	11.86	.900	

Table 3. Comparison between Hand-Sewn Anastomosis and Stapler Anastomosis in Right Hemicolectomy Group

Early postoperative complications in right hemicolectomy group. Two patients (28.6%) from hand-sewn (3A) group developed wound infection postoperatively respectively and none from stapler group (Figure 3) (p > 0.05) (Chi-square test).

Figure 3. Comparison of Acute Postop Complications between Hand-Sewn and Stapler Group in Hemicolectomy Patients

Group 4: Anterior Resection (Colorectal anastomosis)
Group 4A: Hand-sewn anastomosis– 4 patients.
Group 4B: Stapler anastomosis– 4 patients.

Among 4, three patients (75%) are males and one (25%) female in hand-sewn group. All 4 (100%) patients in stapler group are males. The mean age of patients in hand-sewn group is 52.75 years and mean age of patients in stapler group is 66.75 years. Mean duration taken for colorectal anastomosis in hand-sewn group is 33.75 mins and in stapler group is 28.75 mins. The mean time taken for anterior resection in hand-sewn group is 212.75 mins and in stapler group is 187 mins. The average number of days taken for return of bowel sounds in hand-sewn group is 5.5 days and in stapler group is 3.5 days. Average number of days taken to start oral feeds in hand-sewn group is 6.23 days and in stapler group is 4.5 days. Average number of post-operative hospital days of patients in hand-sewn group is 15 days and in stapler group is 13.75 days. As per Mann-Whitney test, there is a significant difference in duration of anastomosis, duration of surgery, return of bowel activity, oral feed starting day, post-operative hospital stay (Table 4).

Variable	Group	Mean	Std. Deviation	P value
Age	Group 4A	52.75	14.361	0.20
	Group 4B	66.75	12.606	
Colorectal anastomosis time	Group 4A	33.75	1.708	0.029
	Group 4B	28.75	.957	
Anterior resection time	Group 4A	212.75	5.737	0.029
	Group 4B	187.00	2.582	
Return of bowel activity	Group 4A	5.50	.577	0.029
	Group 4B	3.50	.577	
Oral feeding starting day	Group 4A	6.25	.500	0.029
	Group 4B	4.50	.577	
Duration of postoperative stay	Group 4A	15.00	.816	0.114
	Group 4B	13.75	.957	

Table 4. Comparison between Hand-Sewn Anastomosis and Stapler Anastomosis in Right Hemicolectomy Group in Anterior Resection Patients

Early Postoperative Complications

One patient (25%) from stapler group (4B) developed wound infection postoperatively and none from stapler group (p>0.05) (Figure 4) (Chi-square test).

Figure 4. Comparison of Acute Postop Complications between Hand-Sewn and Stapler Group in Anterior Resection Cases

DISCUSSION

A comparative study between hand-sewn and stapler anastomosis in elective gastrointestinal surgeries in 50 patients was done and the results obtained were analysed and compared with previously done and published studies.

In our study, we found statistically significant reduction in anastomotic time in stapled group than hand-sewn group in oesophagojejunostomy and jejunojejunostomy, gastrojejunostomy, ileocolic anastomosis and colorectal anastomosis with p -value < 0.05 . Similar results were seen in a study done by Subhakar Bhandary et al^[7] in 2016.

Scher et al^[10] study revealed insignificant difference in total operating time between hand-sewn and stapled method in gastric surgeries. Reiling et al^[11] too reported the same. Contrary to these studies, we found statistically significant reduction in total operating time in stapled group than hand-sewn group in total gastrectomy, subtotal gastrectomy, right hemicolectomy and anterior resection with p -value < 0.05 .

Previously done studies by PB Nichkaode et al (2013),^[12] Luechakiattisak P et al (2008)^[13] and Hsu HH et al (2004)^[14] comparing oesophageal surgeries between hand-sewn and stapled method reported that total operating time was lesser in stapled group compared to hand-sewn group.

We found mean total operating time for subtotal gastrectomy with gastrojejunostomy was lesser in stapled anastomosis when compared to hand-sewn anastomosis group. Similar results were seen in previous studies done by Hollender et al^[15] and George et al.^[16]

Scher et al^[10] and Reiling et al^[11] described insignificant difference in total operating time in right hemicolectomy between stapler and hand-sewn anastomosis. In our study we found statistically significant difference between two groups with stapled anastomosis group being shorter duration than hand-sewn group.

Adloff et al^[17] in his study on colorectal surgeries reported that there is no significant difference in operating time of colorectal surgeries between stapler and hand-sewn anastomosis. In our study we found statistically significant shorter total operating time for colorectal surgeries in stapled group than hand-sewn group with p -value < 0.05 . This was parallel to the previous studies done by PB Nichkaode et al^[12] and Beuran et al.^[18]

PB Nichkaode et al^[12] and Damesha N et al^[19] in their studies reported early return of bowel activity in oesophageal surgeries done by stapler anastomosis than hand-sewn anastomosis. Our study results were found similar with statistically significant p -value < 0.05 .

In gastrojejunostomy group, we found early return of bowel activity in stapled group than hand-sewn group with statistically significant p -value < 0.05 . Similar results were seen in studies conducted by PB Nichkaode et al^[12] and Damesha N et al.^[19]

Scher et al^[10] reported there was no significant difference in return of bowel activity between hand-sewn and stapled group in ileocolic surgeries. In our study, we found statistically significant early return of bowel activity in stapled group than in hand-sewn group among right hemicolectomy surgeries which runs parallel with results of study by Damesha N et al.^[19]

PB Nichkaode et al^[12] reported there was significant early return of bowel activity between hand-sewn and stapled group in colorectal surgeries. Similarly, in our study we found

statistically significant early return of bowel activity in stapled group than in hand-sewn group. This contrary to results from study done by Damesha N et al.^[19]

We found statistically significant early resumption of oral feeds in stapled group than hand-sewn group in all four surgeries. Similar results were found in study done by Damesha N et al^[19] for gastrojejunostomy and anterior resection. In right hemicolectomy no significant difference in resumption of oral feeds were reported in Damesha N et al^[19] and Scher et al.^[10]

We found there was significant reduction in postoperative hospital stay in stapled oesophagojejunostomy group than hand-sewn group. This is contrary to previous studies done by PB Nichkaode et al^[12] and Craig SR et al (1996).^[20] Seo SH et al (2012)^[21] and Damesha N et al^[19] reported no significant difference in postoperative hospital stay between hand-sewn and stapled group. In our study, we found significant reduction in postoperative stay in stapled group than hand-sewn group with p -value < 0.05 . This is similar with the results seen in study done by PB Nichkaode et al.^[12] In our study, stapled right hemicolectomy led to lesser postoperative hospital days than hand-sewn group. This was found contrary to the results from studies done by Damesha N et al,^[19] Scher et al^[10] and Reiling et al^[11] where insignificant difference was seen between both groups. Previous studies done by Himabindu Bangaru et al,^[22] Finger et al^[23] and Damesha N et al^[19] showed insignificant difference in postoperative hospital days between hand-sewn and stapled colorectal surgeries. Similarly, in our anterior resection group, the post-operative hospital stay was insignificant with p -value > 0.05 between stapled and hand-sewn group.

Out of 11 hand-sewn subtotal gastrectomy with gastrojejunostomy, one patient developed anastomotic leak which was treated conservatively. None of the patients had anastomotic leak in stapled group. PB Nichkaode et al^[12] and Seo S et al^[21] also described the insignificance of anastomotic leak between two groups. None of the patients from total gastrectomy, right hemicolectomy and anterior resection had anastomotic leak postoperatively. This shows there is no significance between stapled and hand-sewn method in terms of anastomotic leak.

Previous studies done by Saluja SS et al^[24] showed the insignificant difference in oesophageal anastomosis. Insignificance in colorectal surgery was described by studies done by Nasirkhan et al.^[25] Damesha N et al report insignificant difference in anastomotic leak seen in right hemicolectomy surgeries between stapled and hand-sewn anastomosis. Two out of 25 patients from stapled group and 5 out of 25 from hand-sewn group had skin wound infection which was insignificant statistically and treated conservatively. No mortality among the study group.

The limitation of this study was small sample size. Results with higher sample size may vary or show different results.

CONCLUSION

Due to shortened operating time, staplers are favourable for patients with poor general condition who would not tolerate prolonged anaesthesia. The insignificant difference in acute postoperative complications suggests both hand-sewn and

stapled method can be done with same safety and accuracy when done with proper technique.

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