

### A Study of Hand Sewn Bowel Anastomosis Technique Versus Stapler Assisted Bowel Anastomosis Technique In Gastrointestinal Surgeries.

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#### Abstract :

**Background:-** Both the techniques of anastomosis (hand sewn and stapler assisted) of gastro-intestinal tract are well accepted and well established with their own advantages and disadvantages. Type of surgery depends on underlying disease, site of anastomosis and the caliber of bowel. The purpose of this study was to compare the outcomes of both these techniques. **Method:** A retrospective comparative study was done in 95 cases of gastrointestinal surgeries involving resection and anastomosis of bowel between January 2017 to May 2018, among which 43 were stapler assisted anastomoses and 52 were hand sewn anastomoses. These surgeries were evaluated for operation time, post-operative anastomotic integrity, return of bowel activity, and length of hospitalization. **Results :** No significant variation was noted in both the suturing techniques in terms of their outcomes as post-operative anastomotic leakage, and return of bowel activity. However, operation time were significantly reduced in stapler assisted technique than hand sewn technique. **Conclusion :** Both suturing techniques are more or less equally effective, however, stapler assisted suturing technique significantly reduces the operative timing and less bowel handling and reduced tissue injury, easier at difficult access sites like deep pelvis, quick to perform. Hence, the implementation of a particular suturing technique in a particular surgery

remains solely the surgeons' choice.

**Keywords :** Bowel anastomosis, Stapler assisted anastomosis, Hand-sewn anastomosis, Linear stapling device, Circular end-to-end anastomosis device, anastomotic leak.

**Introduction :** Intestinal anastomosis is the basic and commonly done procedure by a surgeon in elective as well as emergency surgeries. Different types of anastomosis techniques have been evolved with the course of time based on some basic principles like accurate approximation of segments to be anastomosed, good blood supply to the anastomosis, and the anastomosis should be without tension.<sup>(1,2)</sup>

Prior to 19th century, intestinal surgery was limited to exteriorization by means of stoma or closure of simple laceration, until Lembert in 1826 described seromuscular suture technique for bowel anastomosis and in 1887, Halsted favoured one layer extra mucosal closure and was subsequently advocated by Matheson as it was felt to cause least tissue necrosis or luminal narrowing. However, now-a-days, most widely practiced suturing technique is one which is described by Connell in 1892 in which an inner row of continuous inverting suture through all 3 layers is strengthened by an outer row of interrupted seromuscular layer which has become mainstay in gastrointestinal surgeries for almost another century.<sup>(2,3,4)</sup>

With the advent of technology, mechanical suturing devices were developed. These mechanical suturing devices were being portrayed as a revolution in surgical field having many advantages over conventional hand-sewn suturing techniques being easier and quick to perform and hypothetically less chances of anastomotic leak, anastomotic haemorrhage and stricture formation.<sup>(5)</sup>

The Stapling devices were first used by Humer Hultl in 1908 in Hungary. But the instruments were difficult to use and were unreliable. In recent past, reliable, user friendly and disposable stapling devices have been developed which have resulted in much lower failure rates than previous devices.<sup>(3)</sup> This has resulted in revolution in gastrointestinal surgeries. Now-a-days, various kinds of stapling devices are available and are being frequently used.

Today, wide range of stapling devices are available as –

1. Circular end-to-end anastomosis stapler,
2. The gastro-intestinal anastomosis stapler or Linear cutting stapler,
3. Transverse anastomosis stapler.
4. Endoscopic stapling device (endo GIA gun)

The objective of this study is to evaluate the advantages of stapler anastomosis over the conventional hand-sewn anastomosis in our institution.

**Materials and Methods :** A retrospective comparative study was done in a tertiary care hospital with an attached teaching institute from January 2017 to May 2018 in elective as well as emergency gastrointestinal surgeries.

A total of 95 cases met the inclusion and exclusion criteria and were included in study.

**Inclusion Criteria :** Patients who underwent bowel anastomosis in elective as well as emergency gastrointestinal surgeries.

**Exclusion Criteria:**

1. Patients below the age of 12 years.
2. Patients with associated coagulopathies and patients on antiplatelet drugs.
3. Patients with preoperative septicaemia.
4. Patients with prior chemo-radiation.

Patients were divided in two groups – according to the type of anastomosis – hand-sewn bowel anastomosis and Stapler assisted bowel anastomosis.

Out of 95 cases, 43 were stapler assisted and remaining 52 were hand-sewn bowel anastomosis. Both these groups were then further categorised as –

Group 1 – Esophageal anastomosis

Group 2 – Gastrojejunal + small bowel anastomosis

Group 3 – Ileo-colic + colo-colic anastomosis

Group 4 – Colorectal + Ileo-anal anastomosis.

The group 1 has 13 cases out of which 8 cases are stapler assisted and 5 are conventional hand-sewn ones. Group 2 has 42 cases out of which 17 cases are stapler assisted bowel anastomosis and 25 are conventional hand-sewn anastomosis. Group 3 has 22 cases out of which 10 cases are stapler assisted bowel anastomosis and 12 cases are hand-sewn anastomosis. Group 4 has 18 cases out of which 10 cases are stapler assisted anastomosis and 8 are hand-sewn anastomosis.

All the anastomoses were done by equally experienced surgeons. Oncological surgeries have been performed according to oncological principles.

All the hand-sewn anastomoses were double layered with inner layer taken with continuous type of sutures and outer layer taken as intermittent type and suture materials used are silk 2-0/3-0 with round body needle.



**Image 1: Conventional Hand-sewn small bowel anastomosis being performed**



**Image 2: Hand-sewn anastomosis completed**

Staplers used are Linear cutter stapler, Circular end to end anastomosis stapler, Transverse anastomosis staplers.



**Image 3: Linear cutter stapler being used for small bowel anastomosis.**

All the cost of staplers and cartridges were taken up off patients' expenses.

Evaluation was done on following parameters

**1. Anastomotic integrity :** Anastomotic integrity was evaluated based on evidence of anastomotic leak either clinically or radiologically. Clinically, it is the anastomotic dehiscence confirmed by either development of enterocutaneous fistula, or confirmed by re-operation, or appearance of bowel contents from drains or peritonitis associated with sepsis, and dye studies – with methylene blue for appearance in drains.

In esophageal and colo-rectal anastomosis, anastomotic integrity was also confirmed radiologically with contrast studies on post-operative days 4-14 and looked for any extravasation of contrast from the anastomosis which was demonstrated radiologically.

**2. Duration of procedure (in minutes) :** Duration of procedure was counted from time of incision to closure.

**3. Return of bowel activity :** Assessed by the day of return of bowel sounds after the surgery.

**4. Hospital stay (in days) :** Post-operative hospital stay has been considered.

#### Results :

**Statistical Analysis :** The observations were analysed statistically by independent samples T-test to compare mean values between methods and Chi-square test used

to compare proportion of two values. The above mentioned parameters in four groups as described above are compared and results are as follows:

**1. Basic features :** In order to assess the comparability and avoid the biases the two groups (stapler assisted bowel anastomosis and hand-sewn anastomosis) were compared on the basis of age, gender, weight, co-morbid conditions, haemoglobin and malignant or benign conditions.

**Age:** In this study, the mean age of patient who underwent stapler assisted anastomosis is  $48.2 \pm 10.2$  years with a range of 24 - 82 years, while hand-sewn anastomosis group mean age was  $53.4 \pm 15.4$  years with range of 22 – 84 years.

**Weight :** The mean weight of patient of stapler assisted anastomosis group was  $52 \pm 8.4$  kgs with range of 40-98 kgs while the hand-sewn anastomosis group had mean weight of  $46 \pm 9.3$  kg with range of 36–84 kg.

**Haemoglobin :** The stapler assisted anastomosis group had the mean percentage of haemoglobin  $10.6 \pm 1.2$  gm% with a range from 7.8 to 14.3 gm%. In hand-sewn anastomosis group the mean haemoglobin  $9.6 \pm 1.6$  gm% with a range of 7.4–13.2 gm%.

**Gender :** In stapler assisted anastomosis group had 46% males and 54% females and the hand-sewn anastomosis group had 55% males and 45% females.

**Co-morbid conditions :** Based on the presence or absence of co-morbid conditions like Diabetes Mellitus, Hypertension, Asthma, Jaundice, nutritional anemia, etc, stapler assisted anastomosis group had 28% patients with co-morbid conditions and the hand-sewn anastomosis group had 22% patients.

In the stapler assisted anastomosis group, 75% patients were operated for malignant conditions and 25% patients were operated for benign conditions. And in the hand-sewn anastomosis group 54% patients were operated for malignant and 46% were operated for benign conditions.

The two groups showed that they were quiet comparable on basic features, hence the biases and confounding factors were taken care of.

**2. Anastomotic leak :** The leaks- either clinical or radiological were assessed as per described previously. In stapler assisted anastomosis group, Group 1 showed one radiological anastomotic leak. Group 2 also had one clinical anastomotic leak. Group 3 had 1 case of anastomotic leak demonstrated radiologically. And group 4 shown 2 cases of radiological anastomotic leak. In hand-sewn anastomosis group, group 1 shown 1 case of radiological anastomotic leak, group 2 demonstrated two cases of leak- one clinical and one radiological leak. Group 3 demonstrated 2 cases of clinical leak with intestinal contents appearing in the drains. Group 4 had 2 cases of anastomotic leak, one clinical and one radiological leak.

The Chi square test value is 0.34 and p value is 0.95 which is non-significant at  $p < 0.05$ .

**Table I. Anastomotic Leaks -**

	Stapler		Hand-sewn	
	Present	Absent	Present	Absent
Group 1	1	7	1	4
Group 2	1	16	2	23
Group 3	1	9	2	10
Group 4	2	8	2	6

**3. Duration of procedure :** Use of the stapling devices has reduced the procedure time significantly for esophageal and colorectal anastomosis. The operative procedure has also shown to be completed earlier in other small and large bowel anastomosis with stapler than with the hand-sewn technique.

**Table II. Duration of Procedure - (in minutes)**

Duration of procedure	Stapler		Hand-sewn	
	Mean	SD	Mean	SD
Group 1	212	12.2	280	18.6
Group 2	90	14.6	128	15.1
Group 3	92	17.3	126	20.1
Group 4	140	26.3	188	28.5

The Chi-square value applied for these mean operative durations is 12.55 and p value is 0.005 which is significant at  $p < 0.05$ .

**1. Return of bowel activity :** Stapled esophageal anastomosis required less time for return of bowel sounds. The mean time required was  $4.83 \pm 0.58$  days in stapler group and  $5.92 \pm 1.8$  days in hand-sewn anastomosis group - The unpaired T test was applied to all groups. In Group 1 i.e. esophageal anastomosis group and p value is 0.13 which is statistically not significant. Similarly, bowel activity was noted earlier in stapler anastomosis group with other small and large bowel anastomosis group. In group 2, the mean time was  $3.6 \pm 0.48$  days for stapler group and  $5 \pm 1.2$  days in hand-sewn group with p value of 0.0001 which is statistically significant. In the group of ileo-colic anastomosis, the mean time of return of bowel activity was  $3.8 \pm 0.7$  days in stapler group and  $5.3 \pm 1.1$  days in hand-sewn anastomosis with p value of 0.0013 which is statistically significant. In group 4, Colo-rectal anastomosis group, stapler group had mean time of return of bowel activity was  $3.3 \pm 0.9$  days and hand-sewn anastomosis group had  $4 \pm 0.8$  days with p value of 0.10 which is statistically insignificant.

**2. Hospital stay :** In group 1, mean post-operative hospital stay in stapler group was 16 days while in hand-sewn anastomosis group was  $19.35 \pm 2.2$  days. This group did not show any significant difference in statistical analysis ( $p=0.09$ ). The mean post-operative hospital stay in group 2 was  $12 \pm 1.1$  days in stapler assisted anastomosis group which was significantly less than  $16.2 \pm 1.5$  days in hand-sewn anastomosis group ( $p=0.029$ ). For group 3, there was no significant statistical difference between mean post-operative hospital stay with  $14.1 \pm 0.4$  days for stapler assisted anastomosis group and  $16 \pm 0.8$  days for hand-sewn anastomosis group. ( $p=0.08$ ).

However, for group 4, favourable results were achieved in stapler assisted anastomosis group with mean post-operative hospital stay of  $15.4 \pm 0.8$  days compared to  $24 \pm 2.2$  days in hand-sewn anastomosis group ( $p=0.016$ ).

**Discussion :** The introduction of the stapling devices for intestinal anastomosis by Humer Hultl in 1908, has revolutionised the gastrointestinal surgeries and the recent past has witnessed the development of easy to use, disposable stapling devices in the hands of the operating surgeon. Many studies have been conducted since then to compare the two techniques i.e. stapler assisted bowel

anastomosis and conventional hand-sewn anastomosis on the basis of anastomotic leak, duration of procedure and mortality. This study is designed to compare the two techniques of anastomosis at different sites simultaneously. Matos systematically reviewed nine studies involving 1233 patients (622 stapled and 611 hand-sewn) and found that the leaks were 13% versus 13.4%. Clinically it was 6.3% versus 7.1% and radiologically it was 7.8% versus 7.2%. The results were insignificant to prove one technique superior over another.<sup>(6)</sup> Our study has went on the parallel lines with 11.6% anastomotic leaks with stapler assisted anastomosis group and 13.4% anastomotic leaks with hand-sewn anastomosis group. The Chi square test value is 0.34 and p value is 0.95 which is non-significant at  $p < 0.05$ . Both the techniques of anastomosis are equivocal in terms of anastomotic leaks. These findings are on parallel lines with previous studies by Saluja SS et al, Worrel S et al, Leuchakiattisak et al.<sup>(7,8,9)</sup>

Though the colorectal anastomosis with hand-sewn technique has more leak rates than stapler anastomosis, it was not statistically significant. In the present study, the hand-sewn anastomosis group and stapler assisted anastomosis group were found comparable on the basis of age, gender, weight, pre-operative haemoglobin, presence or absence of co-morbid conditions and the underlying pathology (benign or malignant), thereby removing the bias. These findings are consistent with the previous studies by Hassansen et al comparing hand-sewn anastomosis and stapled anastomosis of large bowel and Sao SH et al comparing hand-sewn and stapled gastrojejunostomy.<sup>(10,11)</sup>

The mean duration of procedure was significantly less in stapler assisted anastomosis group compared to hand-sewn anastomosis group in all four groups of anastomosis i.e. in esophageal anastomosis, gastrojejunal and small bowel anastomosis, ileo-colic and colo-colic anastomosis as well as colorectal and ileo-anal anastomosis. The difference in the mean operative procedure timing was statistically significant with p value of 0.005. These findings are consistent with previous studies like Leuchakiattisak et al, Hsu HH et al, and Law S et al which compared esophageal anastomosis time.<sup>(12,13,14)</sup> Seo SH et

al, Damesha et al which compared gastrojejunal anastomosis time,<sup>(10,15)</sup> and Beuran et al and West of Scotland and Highland Anastomosis Study Group.<sup>(16,17)</sup>

Early restoration of bowel activity was noted in stapler assisted anastomosis group in all four categories of anastomosis. But the difference was statistically insignificant in esophageal and colorectal anastomosis group whereas statistically significant earlier restoration of bowel activity was noted in gastrojejunal and small bowel and ileo-colic anastomosis. Previous studies like Seo SH et al, Damesha N et al also revealed earlier bowel functioning in stapler assisted anastomosis group but the difference was statistically insignificant for gastrojejunal anastomosis and regarding colorectal anastomosis, the present study has findings consistent with Damesha n et al.

Post-operative hospital stay was relatively shorter in stapler assisted anastomosis group compared to hand-sewn anastomosis group in all four categories of anastomosis which was statistically significant in gastrojejunal and small bowel anastomosis and colorectal anastomosis categories whereas, it was statistically insignificant in esophageal and large bowel and ileo-colic anastomosis group. These findings are in parallel lines with the previous study of Craig et al.<sup>(18)</sup>

However, Sao SH et al and Damesha et al shown no significant difference in post-operative hospital stay in gastrojejunal and small bowel anastomosis and colorectal anastomosis categories, but present study shows contradictory results as the difference in post-operative hospital stay in stapler assisted anastomosis and hand-sewn anastomosis group in gastrojejunal and small bowel anastomosis and colo-rectal anastomosis categories is statistically significant.

**Conclusion :** Both the techniques of intestinal anastomosis are well established and are being widely practiced all over the world. Both these techniques have their own advantages and disadvantages adding the dilemma in surgeon's mind about the implementation of the suturing technique. Hence, this retrospective study was undertaken evaluate both the techniques in our tertiary care hospital.

In this study, it was found that the stapling devices reduced the procedure time significantly thereby reducing the bowel handling intra-operatively and reduces the chances of bowel ischaemia and exposure of patient to anesthesia. This results in better post-operative results in terms of early restoration of bowel functions and early resumption of oral feeds. This ultimately results in reduced hospital stay. These stapler anastomosis are relatively easier to perform and are much quicker than the conventional anastomosis technique.

Staplers have advantage that they can be used in anastomotic sites which are difficult to access like low colorectal anastomosis and esophageal anastomosis. In experienced hands, the complication rates related to the technique of firing the stapling devices are relatively negligible. Thus the reliability of the technique depends on the expertise of the operating surgeon with the stapling devices and the use of stapling devices can be mastered with frequent use and time. Thus the use of these devices is safe as good as conventional hand-sewn technique.

At the same time, the use of these devices has some limitations in terms of bowel caliber, it can not be used on edematous, friable, avascular bowel and whenever there is discrepancy in the lumen of the bowels which are to be anastomosed. Another disadvantage in the use of these stapling devices is their availability and the cost. In remote areas the availability of these stapling devices is often limited or at times these devices are not available. High cost is another major disadvantage.

However, both these techniques have shown comparable results in anastomotic integrity and post-operative results with their own advantages and disadvantages which can not be weighed out. Hence, the decision of implementation of the particular technique in a particular situation remains solely the surgeons' choice.

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