

**OUTCOME OF STAPLED VERSUS HAND SEWN INTESTINAL ANASTOMOSIS: A COMPARATIVE STUDY**

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Article Received on 15/07/2020

Article Revised on 05/07/2020

Article Accepted on 25/08/2020

**ABSTRACT**

**Background:** Intestinal anastomosis is done in various ways and outcomes depends upon the techniques. There are no well-established data or information regarding comparison between traditional hand sewn and stapled anastomosis. The aim of this study is to measure the outcome of these two different surgical approaches. It will be helpful to standardize the most effective surgical approach to do intestinal anastomosis. **Methods:** This is an observational type of cross-sectional study which was held in the Department of Surgery, Dhaka Medical College Hospital, Dhaka. Study period was six months. Patients who underwent either stapling or hand sewing routine intestinal anastomosis within the study period between 20-60 years of age, irrespective of sex were included in this study. 50 patients were randomly allocated into two groups of 25. **Result:** Mean operation time in stapled group was 92.88(±11.28) mins and 102.60(±15.84) mins in Hand sewn group (p<0.01). Mean anastomotic time in stapled group was 16.16(±2.06) mins and 25.12(±3.98) mins in Hand sewn group (p<0.01). Mean post operative hospital stays in both groups were quiet similar. Post operative complications were- fever: in stapled group 2(8%) and Hand sewn 06(24%), wound infection: in stapled group 03(12%) and in Hand sewn group 04(16%), ileus/intestinal obstruction: in Stapled group 01(4%) and in Hand sewn 02(8%), anastomotic failure: in stapled group was 1(4%) and in Hand sewn group 02(8%). **Conclusion:** Stapling technique significantly reduce the time for anastomotic procedure. With reduce operating time and less tissue trauma due to less tissue handling, there is early restoration of gastrointestinal function, early resumption of oral feeding and early recovery.

**INTRODUCTION**

There are more than 6000000 surgical procedures performed each year in England alone.<sup>[1]</sup> Many non-modifiable factors are associated with poor surgical outcomes, including age pre-existing co-morbidities and type of surgery.<sup>[2]</sup> However there are also potentially modifiable factors which are associated with poor outcomes such as surgical site infection, wound dehiscence and other post-surgical complications.<sup>[3]</sup> Whilst each of these outcomes are treatable for the most part, in a significant minority they lead to further difficulties to treat complications, such as scarring and pain.<sup>[4]</sup> And in some cases complications might not respond to treatment and consequently lead to death.<sup>[5]</sup> Post surgical complications, including infection, lead to increased length of stay, additional treatment and care, and so are consequently costly for health care providers.<sup>[6,7]</sup> Many views have been expressed on

whether sutures or staples are associated with lower rates of complications; whilst staples are widely believed to result in decreased operating time.<sup>[8-15]</sup> Intestinal anastomosis is a surgical procedure to establish communication between two formerly distant portions of the intestine. This procedure restores intestinal continuity after removal of a pathological condition affecting the bowel. Intestinal anastomosis is one of the most commonly performed surgical procedure especially in the emergency setting, and is also commonly performed in the elective setting when resection are carried out for benign or malignant lesions of the gastrointestinal tract.<sup>[16,17,18]</sup>

The major problems associated with anastomoses are anastomotic leakage, stricture and bleeding.<sup>[19]</sup> A disastrous complication of intestinal anastomosis is anastomotic leak resulting in peritonitis, which is

associated with high morbidity and mortality. Contrast radiography is used in many studies to determine the true rate of leakage as many leaks are not manifested clinically.<sup>[20]</sup> Proper surgical technique and adherence to fundamental principles are imperative to ensure successful outcome after intestinal anastomosis. Intestinal anastomosis can be performed by a hand sewn technique using absorbable or nonabsorbable sutures or stapling devices. Sutured anastomosis (hand sewn technique) is the commonly used option because of the availability and affordability of suture materials and familiarity with the procedure. The increased availability of stapling devices for intestinal anastomosis has provided an alternative option to perform a rapid anastomosis. Stapled anastomosis are generally thought to have a lower rate of leakage, both clinically and radiologically.<sup>[21]</sup> Higher cost, limited availability and less familiarity are the main drawbacks of stapling devices. Stapling devices belong to the standard repertoire of modern gastrointestinal surgery especially since the successful advent of minimally invasive surgery. Based on the main principle of mechanical stapling, Hult from Budapest, Hungary developed the first linear stapler in 1909 to close the remnant stomach during gastrectomies. The handling of this instrument was hampered by its weight and bulk. Petz, another Hungarian surgeon, and Friedrich and Neuffer from Germany created lighter and more convenient stapling instruments during the 1920's. Driven by the lack of surgeons after world war II, the Russian Government encouraged the development of different mechanical devices for linear and circular stapling to help less well trained surgeon to safely perform standardized surgical procedures eg. gastrectomies and bowel resection. In the 1960 American surgeon Ravitch brought those instruments to the United States and focused on their improvement in terms of applicability and reliability. In partnership with industry, preloaded plastic cartridges, double-staggered stapled lines, and different lengths of staple lines were developed. Since the mid 1970's, surgeons first started to use intestinal staplers and spread worldwide.<sup>[22]</sup> Initially staplers were only used to divide tissue but later enabled stapling, transection and approximation of adjacent loops of intestine. The three main types of staplers are transverse stapler, linear stapling and cutting devices and circular staplers. Circular staplers are most frequently used for low colorectal anastomosis, applying one anvil transanally. Linear staplers, applied intra abdominally, create side to side anastomosis. The success of minimally invasive surgery promoted the development of miniature stapling devices during the past decade, such devices are now used routinely in many different operations.<sup>[23]</sup>

Gastrointestinal surgery is very ancient surgery and intestinal anastomosis is the most popular part of gastrointestinal surgery. Intestinal anastomosis is done in various ways and outcome depends upon the techniques. There are no well established data or information regarding comparison between traditional hand sewing

and stapling intestinal anastomosis. Outcome measures of these two different surgical approaches can be evaluated by the study. The study will be helpful to standardize the most effective surgical approach to do intestinal anastomosis.

## MATERIALS AND METHODS

This is an observational cross-sectional study which was held in the Department of Surgery of Dhaka Medical College Hospital, Dhaka. Study period was six months after approval of protocol. Patients were included in this study when they underwent either stapling or hand sewing intestinal anastomosis within six months, both sexes in between 20 to 60 years of age and routine cases after adequate gut preparation and taken informed consent to take part in this study. The patients were excluded from this study when they had features of acute intestinal obstruction, age over 60 years, severely ill with multiple comorbidities and could not give informed consent to take part in this study. Sample size was 50 cases and sampling method was systematic random sampling by lottery. Patients were randomly allocated into two groups of 25.

Data were collected in a predesigned data sheet. Linear cutting stapler and circular cutting stapler were used and surgery was done by surgeons ranked assistant professor or above. Clinical and laboratory data were prepared and organized by Microsoft word and analyzed by the software SPSS version 22. Test statistics were used to analyze the data and data processed on categorical scale was presented as frequency and percentage, while the data presented on continuous scale was presented as mean and standard deviation and analyzed with the help of student 't' test. The level of significance P value <0.05 was considered significant.

## RESULTS

Mean age of the study population was 48.48(±11.23) years in stapled group and 45.52(±13.37) years hand sewn group. Highest frequency was between 51 to 60 years age in both stapled group (14) and hand sewn group (12). Male were predominant: 38(76%) and female 12(24%). Male female ratio was 3.17:1. In Stapled group male and female were 88% and 12% and Hand sewn group 64% and 36% respectively. Majority of the patients was service holder; 13(52%) in stapled group and 10(40%) in Hand sewn group. Most of the cases came from lower socio-economic condition in both groups which was 13(52%) in stapled group and 19(76%) in hand sewn group. Incidence of the comorbidities were: hypertension 24% in staple group and 12% in hand sewn group, diabetes 12% in staple group and 12% in hand sewn group, IHD 12% in stapled and 06% in hand sewn group. A total of 20 patients had comorbidities.

Laboratory findings revealed mean Hb% were 11.31(±1.95) in stapled group and 10.88(±0.99) in Hand sewn group; mean total count of WBC-

9092.0( $\pm$ 4100.49) in Stapled group and 10544.0( $\pm$ 3963.06) in Hand sewn group, mean ESR 35.40( $\pm$ 18.51) in Stapled Group and 27.20( $\pm$ 9.44) in Hand sewn group, mean RBS 7.51( $\pm$ 2.84) in stapled

group and 5.88( $\pm$ 0.40) in Hand sewn group, mean Albumin 3.53( $\pm$ 1.0) in Stapled Group and 3.69( $\pm$ 0.72) in Hand sewn group, and mean protein 6.42( $\pm$ 0.32) in Stapled Group and 6.37( $\pm$ 0.57) in Hand sewn group.

**Table 1 Comparison of 'time required for anastomosis' (minutes) and 'total operation time (min) between stapled and hand-sewn groups.**

	Study population		P value
	Stapled Mean $\pm$ SD	Hand sewn Mean $\pm$ SD	
Operation time(min)	92.88( $\pm$ 11.28)	102.60( $\pm$ 15.84)	0.01
Anastomotic time(min)	16.60( $\pm$ 2.06)	25.12( $\pm$ 3.98)	<0.001

Table 1 shows mean operation time in stapled group was 92.88( $\pm$ 11.28) mins and 102.60( $\pm$ 15.84) mins in Hand sewn group ( $p$ <0.01) that was statistically significant.

Mean anastomotic time in stapled group was 16.60( $\pm$ 2.06) mins and 25.12( $\pm$ 3.98) mins in Hand sewn group ( $p$ <0.001) that was statistically significant.

**Table 2. Post operative hospital stay of the study population.**

	Study population		P value
	Stapled Mean $\pm$ SD	Hand sewn Mean $\pm$ SD	
Post operative Hospital stay (days)	6.44( $\pm$ 1.35)	7.00( $\pm$ 1.32)	0.14

Table 2 shows mean post operative hospital stay of stapled group was 6.44( $\pm$ 1.35) days and 7.00( $\pm$ 1.32) days

in Hand sewn group ( $p$ >0.05) that was not statistically significant.

**Table 3. Type of bowel being anastomosed.**

Type of bowel being anastomosed	Surgery		Total
	Stapled N(%)	Hand sewn N(%)	
Small intestine & small intestine anastomosis	10 (40)	13 (52)	23
Small intestine & large intestine anastomosis	15 (60)	09 (36)	24
Descending colon and rectum	00	03 (12)	03
<b>Total</b>	25 (100)	25 (100)	50

**Table 4. Return of bowel sound of the study population.**

Return of bowel sound	Surgery		Total
	Stapled N(%)	Hand sewn N(%)	
1st POD	00	03 (12%)	03
2nd POD	13 (52%)	03 (12%)	16
3rd POD	12 (48%)	19 (76%)	31
<b>Total</b>	25 (100)	25 (100)	50

Table shows return to bowel sound at 2<sup>nd</sup> POD 13(52%) in stapled group and 03(12%) were in Hand sewn group.

At 3<sup>rd</sup> POD 12(48%) were in stapled group and 19(76%) were in Hand sewn group.

**Table 5 Post operative events of the study population.**

Post operative complication	Surgery		Total n(%)
	Stapled n(%)	Hand sewn n(%)	
Fever	02 (08)	06 (24)	08 (16%)
Wound infection	03 (12)	04 (16)	07 (14%)
Ileus / intestinal obstruction	01 (04)	02 (08)	03 (06%)
Anastomotic failure	01(04)	02(08)	03(06%)
No complication	10(40)	06(24)	14(28%)
<b>Total</b>	25 (100)	25 (100)	50 (100%)

Table 5 shows different post operative complications: fever in Stapled group were 2(8%) and hand sewn 06(24%), wound infection in stapled group were 03(12%) and hand sewn 04(16%), Ileus/intestinal

obstruction in Stapled group were 01(4%) and hand sewn 02(8%), anastomotic failure in Stapled group were 1(4%) and hand sewn 02(8%).

## DISCUSSION

This study of 50 patients (stapled-25, hand-sewn-25) showed of both categorical and numerical data to identify the safer anastomotic technique. In this study the mean age was 48.48( $\pm$ 11.23) years in stapled group and 45.52( $\pm$ 13.37) years hand sewn group. Male were predominant with 38(76%) and female 12(24%). Male female ratio was 3.17:1. In Stapled group male and female were 88% and 12% and Hand sewn group 64% and 36%. Jawhar Lal Singha *et al*<sup>[40]</sup> study showed the mean age (39.67 yrs vs. 44.83 yrs) of patients showed no difference ( $p=$ .106) in both stapled and hand-sewn groups. Sex distribution showed more female (54.2% vs 45.8%) in stapled group and more male (71.2% vs 28.8%) in hand-sewn group of anastomosis. Though there is statistically significant ( $p=$ .010) difference it is reasonable in clinical study where convenient sampling was acceptable. In Tariq E Al-aubaidi study mean age of all patients with Hand sewn group is 41.71 years while for Stapled group is 37.29 years, these figures are similar to Scher *et al* in their study.<sup>[24,25,26]</sup>

In this study majority cases came from lower socio-economic condition in both group which was 13(52%) in stapled group and 19(76%) in hand sewn group.<sup>[27]</sup> In study of Jawhar Lal Singha *et al* showed socio-economic status has direct implication on the use of staplers for anastomosis as to the nutritional status upon anastomosis and wound healing. The patients were categorized as 'poor', 'average' and 'affluent' on the basis of profession and resources culminating in monthly income. Nutritional status of patients was assessed clinically and biochemically by serum albumin level. The categorization of 'poor', 'average' and 'good' showed no significant difference ( $p=$ .218).

In current study incidence of the co-morbidities were: hypertension 24% in staple group and 12% in hand sewn group, diabetes 12% both in staple group and 12% hand sewn group, IHD 12% in stapled and 06% in hand sewn group. Jawhar Lal Singha *et al* study showed the co-morbidities i.e. diabetes or hypertension and others showed no significant differences in between two groups ( $p=$ .933, .107, .228).<sup>[27]</sup>

In present study mean operation time in stapled group was 92.88( $\pm$ 11.28) mins and 102.60( $\pm$ 15.84) mins in Hand sewn group ( $p<$ 0.01) that was statistically significant. Mean anastomotic time in stapled group was 16.60( $\pm$ 2.06) mins and 25.12( $\pm$ 3.98) mins in Hand sewn group ( $p<$ 0.01) that was statistically significant. Mean post operative hospital stay stapled group was 6.44( $\pm$ 1.35) days and 7.00( $\pm$ 1.32) days in Hand sewn group ( $p<$ 0.01) that was statistically not significant. Jawhar Lal Singha *et al* study showed there was a statistically significant ( $p=$ .000) reduced 'time required' for stapled (mean-18.17 mins) compared to hand-sewn (mean-26.85 mins) anastomosis.<sup>[27]</sup> The overall difference between two groups (8.68 minutes) is far less than that of Professor WD George which was 14 minutes

(14.3 vs 28.1 min) but is supported by Fingerhut and Sarker as both of them showed it 8 minutes. Didolkar showed difference of 10 minutes (9- 19mins) supporting our initial experience.<sup>[28,29,30]</sup> With time, steeper learning curve might extend this period improving our expertise. Hospital stay showed no statistically significant outcome data in study. In stapled group, it was 13.44 days and in hand-sewn group it was 13.62 days. Other studies showed mean hospital stay of 13 vs 14 days, 13 days both and 10.6 days overall. So, our study strongly corresponded to above studies.

Fistula in Tariq E Al-aubaidi study occurred extraperitoneally, which means that the risk of complication is greater with distal colorectal anastomosis which is identical to Karanjia.<sup>[24]</sup> The mean time taken to perform anastomosis in Stapled group is 11.22 mins while Hand sewn group is 27.9 min ( $p<$ 0.02). This result is similar to Delcio and Puiyee Grace *et el* and Pakkastie TE *et al*.<sup>[31,32]</sup>

Current study showed post operative complications of fever in Stapled group-2(8%) and hand sewn 06(24%), wound infection in stapled group was 03(12%) and hand sewn 04(16%), Ileus/intestinal obstruction in Stapled group was 01(4%) and hand sewn 02(8%), anastomotic failure in Stapled group 1(4%) and hand sewn 02(8%). Similar results was found in study of Jawhar Lal Singha *et al*; they showed postoperative fever (18.8%) in Stapled group and (19.2%) in Hand sewn group, wound infection (27.1%) in Stapled group and 23.1% in Hand sewn group, Ileus/intestinal obstruction 10.4% in Stapled group and 13.5 % in Hand sewn group, anastomotic leakage 8.3% in Stapled group and 13.5 % in Hand sewn group. Almost equal number (27.1% and 23.1%) of patients had wound infection which was much more than that of Lustosa (4.3% vs. 5.9%). 10.4% and 13.5% patients had wound dehiscence respectively in the groups. Need of re-operation here in both patient groups was not taken into account in the study. Fever appeared in 18.8% (9/48) of stapled and 19.2% (10/52) of hand-sewn anastomotic patients.

The study has limitations. It was conducted upon a small size of population in a very limited area to represent and more extensive investigations could not be done due to lack of resources which would produce more informative study.

## CONCLUSION

In our present study, we found that stapling technique can significantly reduce the time for anastomotic procedure. With reduced operating time and less tissue trauma due to less tissue handling, there is early restoration of gastrointestinal function, early resumption of oral feeding and reduced duration of hospital stay which helps ultimately in early return to routine work. Technique related complications do not show significant differences which suggest that one can use staplers with same safety and accuracy as sutures. There is no doubt



however, that stapling techniques are quicker to perform, particularly in situations where access is difficult such as in low colorectal / coloanal anastomosis. Thus stapling technique can be used safely and effectively as a part of modern Surgeon's armory and one should be equally expert with stapler gun as with needle holder and suture.

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