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Comparison study stapled versus hand sewn method for large bowel anastomosis surgery

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Abstract

Background: Intestinal anastomosis is one of the most commonly performed procedure it required to re-establish gastrointestinal continuity after surgical resection, traumatic disruption or bypass procedures. In last decade, advances in intestinal stapling devices have led to an increased frequency of stapled anastomosis. There are a variety of proposed benefit from a stapled technique: better blood supply, reduced tissue manipulation, less oedema, uniformity of suture, adequate or perhaps wider, lumen at the site of anastomosis, ease and rapidity.

Objectives: To compare the relative safety and effectiveness of stapled anastomosis with that of hand sewn anastomosis for large bowel surgery.

Patients & Methods: A prospective study was conducted on 103 patients who suffered from benign and malignant disease in addition to trauma patients. They were divided into two groups (SA) group which involved (51) patients where the anastomosis were done by stapler and other group of (52) patients where the anastomosis were done by hand sewing named as (HS) group. All elective cases were prepared for surgery preoperatively by mechanical and chemical preparation while patients in emergency situation had the full criteria for primary anastomosis. Both groups had the same preoperative characters such as age and sex, and the types of outcome analyzed were specific mortality, clinical anastomotic leak, stricture, anastomotic haemorrhage, re-operation, wound infection, anastomotic duration and hospital stay.

Results: A total of 9 patients (17.6%) in SA group developed complications compared to 20 patients (38.5%) in H.S group (P. value >0.019). Nine patient developed fistula in HS group (17.3%) compared to two patients (3.9%) in SA group (P. value > 0.035). Mean postoperative hospitalization time for SA group (6.5) days while for HS group (8.8) days (P. value 0.75). There is a significant difference regarding fistula in favours of stapled anastomosis.

Conclusions: Staples anastomosis is safe and effective and associated with fewer leak than hand sewn anastomosis.

Keywords: Staples, anastomosis, leak

Introduction

Intestinal anastomosis is one of the most commonly performed intra-abdominal procedure. It required to reestablish gastrointestinal continuity after surgical resection, traumatic disruption or bypass procedures. There are several principles that are crucial for obtaining successful result including well nourished patient with no systemic illness, no fecal contamination either in the gut or in the surrounding peritoneal cavity, adequate exposure, well-vascularized tissue, absence of tension and meticulous technique. So it is most important for maintaining anastomosis integrity. In second century Galen talked about different views opposing intestinal anastomosis because of the significant risk of stricture and subsequent obstruction. In the 11th century, the school of Salernum reviewed the principles of Hippocrates and Celsus regarding the closure of intestinal injury and they advised a method of closure that made use of a variety of stent to prevent the stricture. Stent with removable sutures followed by approximation of the abdominal wound remained the standards of care until the 19th century when Larry first described his attempt at a two layer anastomosis. The process of intestinal anastomosis healing mimic that of wound healing elsewhere in the body divided in to an acute inflammatory (Ia) Phase, a proliferative phase and finally a maturation phase. As a rule, for any given technique, the location of the anastomosis seems not to influence the overall leakage rate. The one exception is low anterior anastomosis which is associated with leakage rate ranging from 4-5% to an incredible 70% [1].

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Stapled anastomosis are said to heal by primary intention Whereas sutured anastomosis are said to heal by secondary intention.

Hand-Sewn Sutures: Sutures act as foreign bodies in the anastomosis and thus produce an inflammatory reaction. The ideal sutures material are those that cause minimal inflammation and tissue reaction while providing maximum strength during the lag phase of wound healing has not been discovered clearly, however monofilament and coated braided sutures represent an advance over silk and other multifilament materials [2]. Both continuous and interrupted sutured are commonly used in fashioning intestinal anastomosis. Double-Layer anastomoses were described before single layer and they consist of inner layer of continuous or interrupted sutures and an outer layer of interrupted absorbable sutures. Traditionally, double layer anastomosis have been considered more secure, however for, sometimes, a single layer anastomosis have been performed in difficult location (e.g low in the pelvis or high in the chest) or in patient who is unstable or has multiple intra-abdominal injuries moreover, work suggest that the single layer technique has significant inherent advantages [3-5].

Staples: Surgical stapling devices were first introduced in 1908 by Hultil, the types most commonly used are the gastrointestinal anastomosis (GIA), stapler or transverse anastomosis stapler. Staplers may be used to create functional (GIA) plus TA or true anatomic (EEA) end-to- end anastomosis as well as side-to-side anastomosis. The blood flow to the divided tissues as a measure of outcome found that the best blood flow to the healing site was provided by stapled anastomosis [7]. Consistently safe method of anastomosis is still ideals, the achievement of which would not only lower the incidence of dangerous complications but possibly avoid the need for a defunctioning colostomy or ileostomy. Staplers have been used in many kind of anastomosis but most frequently in colorectal anastomosis a recent systemic review has shown that both technique hand sewn vs stapled anastomosis are effective and the choice may be based on personal preference [8].

Aims of the Study

1. To determine the safety and effectiveness of stapler anastomosis in term of morbidity and site specific complication mainly fistula, wound infection and anastomotic stricture.
2. To compare the outcome after SA and HS anastomosis in large bowel surgery.
3. To determine the safe technique for performing anastomosis.
4. To define patients selection criteria for performing SA.

Patients & Methods: A prospective study was carried out from 1st of May 2007- 1st of December 2008, involving 103 patients (59 male and 44 female) admitted in first surgical unit - Baghdad Teaching Hospital. The study focused on the comparison between the stapling and hand sewing in large bowel anastomosis in elective and emergency cases. The stapler suturing was done using different types of staplers mainly circular stapler. While H.S suturing were done by double layer interrupted sutures using 3/0 Absorbable suture material. The collected patients were suffering from different pathologies; forty three patients (41.7%) had tumours of the large bowel and were mainly adenocarcinoma. Forty patients (38.8%) were had penetrating injury to the large bowel. All underwent fecal

diversion by colostomy construction predominantly with temporary Hartmann's colostomy before (65-95) days. Ten patients (9.7%) presented as emergency cases with penetrating injury to large bowel with a full criteria for primary closure. Four patients (3.9%) suffered from ulcerative colitis of descending colon and rectum treated primarily with resection and anastomosis and 3 patients (2.9%) with sigmoid volvulus were treated primarily by anastomosis or protective colostomy then prepared for closure. Two patients (1.9%) had multiple polyposis and were prepared for surgery electively for resection and anastomosis, and one patient (1%) had TB of the caecum. Patients with Hartmann's colostomy underwent simple investigation. Contrast examination was done for all patients by enema per-rectum and per colostomy to asses for any evidence of obstruction and for assessment the length of the distal stump. Those patient who presented as emergency weather penetrating injury or acute abdomen due to other diseases, were investigated by base line investigations including Hb, P.C.V., Blood Group and Cross match and Blood urea. Radiograph for the head chest and abdomen were done for stable patients.

Stapled Anastomosis Group (S.A. Group): This group include 51 patients where age ranged between (16-75) years with mean age of (45.5ys). Twenty seven patients (52.2%) were male and 24 patients (47.1%) were female. Eighteen patients (35.2%) had tumours predominantly adenocarcinoma of Lt. Colon. Twenty two patients (43.9%) Hartmann's colostomy short distal stump. Two patients (3.9%) with sigmoid volvulus were treated primarily by resection and Hartmann's colostomy then prepared for closure by stapler. Five patients (9.8%) with emergency penetrating injuries to the bowel were anastomised primarily by stapler after resection. Two patients (3.9%) with ulcerative colitis were treated primarily by Hartmann's colostomy then prepared for second closure by stapler. Two patients (3.9%) with multiple polyposis of colon were prepared for surgery as elective case.

Hand Sewen Anastomosis Group (H.S. Group): This group include 52 patients where age ranged from (18-70) years with mean age of (44 years). Thirty two patients (61.5%) were male and 20 patients (38.5%) were femle. Twenty five patients (48%) had tumours of colon predominantly adenocarcinoma and two of them had carcinoid tumour of the appendix. Eighteen patients (34.6%) had Hartmann's colostomy, due to previous bullet injury to the abdomen. Five patients (9.6%) with emergency penetrating injury to the colon had the full criteria for primary anastomosis by hand sewing. Two patients (3.8%) with ulcerative colitis were prepared for surgery with resection and end-end anastomosis. One patient (1.9%) with sigmoid volvulus were treated in the same time with resection and anastomosis and one patients with TBcaecum (1.9%) presented with fistula after appendectomy treated in the same time with resection and anastomosis.

Technique: Preparation: All patients in elective surgery weather stapled or hand sewned anastomosis received prophylactic antibiotics, the patients were put on only clear fluid intake for 72 hrs. preoperatively, with adminastrations of laxative and enema 24 hrs. pre-operatively. Those patient in emergency surgery had the fallowing criteria including, absence of faecal contaminations, absence of shock, Blood transfusion less than six unit, time less than 6 hrs. Absence of major vascular injury and absence of multiple organ failure.

Operative Technique: Operative technique involved opening the Abdomen through midline laparotomy mobilization of the diseased segment of the colon then (Right hemicolectomy, Left hemicolectomy or segmental resection). in patients with Hartmann's colostomy also midline laparotomy released of the proximal and distal part of the colon and it is edges refreshed then anastomosis done by:

Stapled Anastomosis

A. End-End anastomosis: (E.E.A)

The anvil is placed in the proximal colon and the purse string suture tied into the groove on the rod. The stapler introduced in to the rectum from below or through colotomy. This should be performed extremely gently to prevent disruption of the rectal stump. The trocar is then removed and the anvil shaft inserted on to the rod, the staple is completely closed. The stapler is fired to make circular and inverted End-End anastomosis. The anastomotic line examined for any hemorrhage or leak.

B. Side to Side anastomosis

Align the antimesenteric border stapled end together place a croch stitch 6-8 cm from the stapled end just lateral to antimesenteric border, cut off the antimesenteric border of each stapler line. Insert one fork of GIA-type stapler into each line. Close stapler taking care to align antimesenteric border fire stapler smoothly moving only the trigger and not the body of the stapler remove the fork of the stapler. Inspect the staple line for bleeding. Close the colotomy opening by TA-type stapler and also inspect the staple line for haemostasis close the mesenteric defect.

Hand Sewn Anastomosis: Anastomosis by hand sewing were done between the two edges in double layer interrupted hand sewn suturing using 3/0 absorbable suture material (vicryl). Controlled anal stretch done at the end of operation to counteract the increase internal anal sphincter due to disused in the case of closure colostomy. All patient received antibiotic for 5-7 days including metranidazole 500 mg and ceftriaxone 1 gm given once time daily. Hospital stay for both group between 4-11 days and starting oral feeding with fluid diet after bowel sound become positive.

Results: A total of 103 patients were admitted to first surgical unit in Baghdad Teaching Hospital during the period from May 2007 to December 2008. The mean age for SA group was 37.29 years with arrange of (16-75) years and mean age for H.S group was 41.71 years with arrange of (18-70) years. The difference in age distribution between two group is not significant statistically (P. value 0.11). Twenty seven patients in SA group were male (52.9%) and 24 were female (47.1%) patients, where as H.S group include 32 patients male (61.5%) and 20 female (38.5%) patients. The difference in sex distribution between two group is not significant statistically (P. value 0.5) for male patients and 0.54 for female patients. Patients with tumors, total number were 43 patients (47.1%), 25 patients in H.S. group (48%) and 18 patients in SA group (35.29%). The difference in distribution of the cases according to the site of tumors between two group is not statistically significant (P. value 0.32). Fifty patients with trauma treated as an emergency with resection and closure or diversion colostomy done for them then closure after 8-12 weeks by SA or HS, 27 (52.9%) of them were SA group and 23(44.2%) patients were H.S group. No significant difference observed between the two groups of patients (P. value 0.637). Other data were collected from patients suffered from different diseases,

ulcerative colitis, sigmoid volvulus, multiple polyposis and TB intestine. Total number of patients were 10(9.7%) six of them (11.6%) was in S.A group and 4 patients (7.6%) in H.S group. No significant statistical difference between the two groups (P. value 0.49). Also there is no statistical difference significant between the two group in these cases all (P. value above 0.49).

Outcome and Complications: Comparing the post operative result. There are 4 mortalities in both groups, 3 of them (5.8%) in HS group and 1(2%) in SA group. These difference between two group regarding mortality is not significantly difference (P. value 0.89).

Regarding postoperative general complications. The number of complications in SA group was 3 complications (5.8%) compared to 11 complications (21.1%) in HS group, with overall morbidity regarding general complications was (13.5%). No statistical significant difference in general complication was noted between two groups (P. value 0.62). The number of local complications in SA group was 11 complications (21.5%) compared to 25 complications in HS group (48.07%), with over all morbidity was (34.95%) it mean that there is no statistical significant difference regarding local complications (P. value 0.061). Total number of patients who developed complication in SA group was 9 patients (17.6%), compare to 20 patients (38.4%) in HS group (P. value 0.019) which is a significant difference. Regarding general complications, 4 patients (7.7%) from HS group developed chest infection, compared to 1 patient (2%) from the SA group (P. value 0.635). Five patients (9.6%) from HS group developed UTI, compared to 2 patients (3.9%) from SA group (P. value 0.772). Two patients (3.8%) from HS group developed DVT, compare to one patient from SA group. Regarding local complications, 6 patients (11.6%) from HS group developed wound infection compared to 3 patients (5.9%) from SA group (P. value 0.317). Nine patients (17.3%) from HS group developed fistula compared to 2 patients (3.9%) from SA group and overall fistula rate (10.7%) (P. value 0.035) if means that there is significant statistical difference between two group regarding fistula formations. Two patients (3.8%) from HS group developed wound dehiscence compared to zero patient from SA group, two patient (3.9%) from SA group developed intra-abdominal collection compared to zero patients from HS group, three patients (5.8%) from HS group developed stricture compared to 1 patient (2%) from SA group (P. value 0.317). Three patients (5.8%) from HS group developed hemorrhage compared to two patients (3.8%) from SA group (P. value 0.997), only 2 patients (3.8%) from HS group required re-operation compare to 1 patient (2%) from SA group (P. value 0.564). Overall local complications compared between two group were statistically not significant a part from fistula rate was significant.

Discussion

In our study the mean age of all patients with HS group is 41.71 years while for SA group is 37.29 years the difference in age distribution between the two groups is not statistically significant (P. value 0.177) this is closed to Scher *et al.* in their study there is was no significant difference in age distribution [9]. Total number of deaths are 4, three in HS group and one in SA group (P. value 0.89) no significant statistical difference. One from each group death occurred due to the comorbid diseases (Diebetic, hypertension and ischemic heart disease) and another two deaths occurred in HS group due to anastomotic leak with wound dehiscence. The result similar to Delcio, 2002 show also no significant statistical difference in mortality but in his study

the most common cause of deaths was due to anastomotic leak^[10]. In our study, fistula rate after anastomosis in HS group was 9 patient (17.5%) while in SA group was 2 patients (3.9%) (P. value 0.035) it mean that there is significant statistical difference in fistula rate. Retrospective review in the most recent studies showed that stapled anastomosis had low leak rate which is identical to our study (Kracht *et al.*, Monero *et al.*, Cubertafound *et al.*, and S. Anwar *et al.*, 2004)^[11]. The stapled technique for ileo-transverse anastomosis differs from distal colonic anastomosis and leak rate is higher with Lt. sided colon (Lipska, 2006)^[12]. In our study we took the ileotransverse anastomosis with colonic anastomosis in the same study while (Lipska)^[12] said that we should take the ileotransverse anastomosis separately from colonic anastomosis. Delcio Matos the large bowel anastomosis only in a benign and malignant diseases^[10]. There are many principles of good anastomosis to avoid anastomotic leak including adequate blood supply to the end

including edge of anastomosis, absence of tension on the anastomosis, absence of tension on blood supply, proper technical placement of sutures or staples, adequate matching of lumen diameter and defunctioning proximal stoma (Pakkastic *et al.*, 1997)^[13]. The mean time taken to perform anastomosis in SA group is (11.2) min while in HS group is (27.9) min (P. value 0.021) it means that there is significant statistical difference in favour of SA group which closely similar to (Delciomatos and Puiyer Grace *et al.*)^[14]. The time taken to perform anastomosis when analyzed in isolation is importance because it influence the total length of operative procedure especially in those with concurrent diseases or those with emergency operations. Mean hospital stay for SA group was (6.5) days and for HS group was (8.8) days (P. value 0.75) show no statistical difference, our result agreed that of Naresh *et al.*, 2008 which showed no significant difference also^[15].

Table 1: Anastomoses according to the site.

Anastomosis	SA group	H.S group	Total
Ileo-colic	6(11.7%)	12(23%)	18
Colo-colic	10(19.6%)	28(53.8%)	38
Colorectal	26(50.9%)	12(23%)	38
Low colorectal	8(15.6%)	0(0%)	8
Leo-rectal	1(1.96%)	0(0%)	1
Total	51	52	103

Table 2: Post operative general complications.

Complications		Studied groups		Total	P-value	Sig.
		SA group	HS group			
Chest infection	N	1	4	5	0.635	NS
	%	2	7.7	4.9		
UTI	N	2	5	7	0.772	NS
	%	3.9	9.6	6.8		
DVT	N	1	2	2	0.654	
	%	2	3.8	1.9		
Mortality	N	1	3	4	0.891	NS
	%	2	5.8	3.9		
Total	N	5	14	18	0.134	NS
	%	7.9	26.92	17.48		

Table 3: Post operative local complications.

Complications		Studied groups		Total	P-value	Sig.
		SA group	HS group			
Wound infection	N	3	6	9	0.317	NS
	%	5.9	11.5	8.7		
Fistula	N	2	9	11	0.035	S
	%	3.9	17.3	10.7		
Dchiscence	N	0	2	2		NS
	%	0	3.8	1.9		
Intraabdominal collection	N	2	0	2		NS
	%	3.9	0	1.9		
Stricture	N	1	3	4	0.317	NS
	%	2	5.8	3.9		
Hemorrhage	N	2	3	5	0.997	NS
	%	3.9	5.8	4.9		
Re-Operation	N	1	2	3	0.564	NS
	%	2	3.8	2.9		
Total	N	11	25	36	0.061	NS

Table 4: Distribution of anastomotic duration (min.) and Hospital stay (Day).

	Studied groups	N	Mean	Std. Dev.	SE	Range		t-test (P-value)	Sig.
						Mini.	Maxi.		
Anastomotic duration (min.)	SA	51	11.22	1.27	0.18	10	15	0.021	S
	HS	52	27.92	1.86	0.26	25	30		
	Total	103							
Hospital stay (Day)	SA	51	6.5	1.23	0.17	4	9	0.751	NS
	HS	52	8.8	3.01	0.42	5	11		
	Total	103							

Table 5: Number of patients developed complication.

Development complications		Studied groups		Total	P-value	Sig.
		SA group	HS group			
Positive	N	9	20	29	0.019	S
	%	17.6	38.5	28.2		
Negative	N	42	32	74		
	%	82.4	61.5	71.8		
Total	N	51	52	103		
	%	100	100	100		

Conclusions & Recommendations

1. Outcome measures, mortality, overall anastomotic dehiscence stricture, hemorrhage, re-operation, and hospital stay show no significant difference while fistula rate, anastomotic duration and number of patients who developed complications, show significant difference.
2. Anastomotic devices should be standardized surgical intervention method in low rectal anastomosis.

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