



Comparative Study of Gut Anastomosis Single Layer Hand Sewn v/s Stapler in our Institute

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Abstract

Bowel anastomosis is common practice in surgery deptt. of any hospital. Anastomosis can be done by various methods. Single layer hand sewn, double layer hand sewn, or stapler anastomosis. We are going to compare the single layer hand sewn to stapler anastomosis. In our institute IGIMS seikhpura, patna. we have included 71 pt. in the study of which 39 patients were in hand sewn group & 32 pt in stapler groups.

Keyword: bowel, anastomosis, hand sewn, stapler, cost.

Introduction

Anastomosis is a surgical procedure where in two hollow viscera are approximated together to establish the continuity. It may be following the excision of a diseased segment or as a by-pass.

The first resection and anastomosis was done by Jean Reybard in 1823 for obstruction tumour in sigmoid colon in male.

In 1826 Antoine Lambert proposed that serosa to serosa apposition of the intestinal ends was the best basis for intestinal sutures and this concept formed the basis for devices used for compression induced anastomosis.

Single layer anastomosis was first advocated by William Halsted in 1827.

Double row suture was introduced by the Czerny in 1980.

Anastomosis

- It may be everted or inverted.
- It may be- end to end (between ends of the segment)
- Side to side (between end of one segment and side of other segment)
- It may be – hand sewn-
 - Single layer
 - Double layer
 - Stapled

Suture: Suture line may be interrupted or continuous.

Suture Material

- Absorbable monofilament or braided.

- Non absorbable monofilament or braided.

Hand sewn technique is commonly used option because of availability and affordability of suture materials and familiarity with the procedure.

The initial staplers were invented by the Hungarians. Humer Hutul is considered to be the father of superficial stapling and he developed the first stapler in 1908.

Indications: Indications for intestinal anastomosis can be divided into following categories:

1. Restoration of bowel continuity following recession of diseased bowel.
2. By pass of unrespectable diseased bowel.
3. As a 2nd stage procedure, when previously stoma formed in emergency or elective settings.

Principles of Successful anastomosis

- Well – nourished patient with no systemic illness.
- No faecal or purulent contamination either within the Gut or in the surrounding or peritoneal cavity.
- Adequate exposure and access.
- Gentle tissue handling.
- Well vascularised tissue and adequate haemostasis.
- Absence of tension and distal obstruction.
- Approximation of well vascularised cut ends of the bowel.
- Meticulous surgical techniques.

Factors contributing to anastomotic failure

- a) Type & Location
- b) Bowel preparation
- c) Associated disease and systemic factors.

Postoperative complications of anastomosis

- a) Anastomotic leak
- b) Bleeding
- c) Wound infections
- d) Anastomotic stricture
- e) Prolonged functional illness especially in children.

Hand Sewn Technique

- a) Single layer anastomosis.

- b) Double layer anastomosis.

Advantages of single layer hand sewn

1. Over Double layer hand sewn

- Short time for construction.
- Lower cost due to less suture material used.
- Lower rate of anastomotic leakage.
- Good vascularity maintained at anastomotic site.

2. Over stapler

- More complete healing of anastomosis.
- Reduced tendency to stricture formation (stricture/ Stenosis at anastomotic sites seems to be more common in stapled anastomosis).
- Easy- availability and affordability of suture material.
- Familiarity with the procedure.

Disadvantages of single layer hand sewn

1.) Over stapler

- More time consuming than stapler.
- More chances of leakage than stapler.
- More post-operative hospital stays after operation and more chances of post-operative complications than stapler.
- Difficulties in maintaining equal distances between two stitches and at equal pressure.

Stapler Anastomosis

Types of surgical stapler used in anastomosis:-

- 1.) Circular staplers- curved circular stapler.
- Straight circular stapler.
- 2.) Linear stapler.
- 3.) Linear cutting stapler.

Advantages

- More speedy and less time consuming procedure.
- Least chances of leakage and post-operative complications.
- More accurate in maintaining distances between two stitches and at equal pressure, so vascularity not compromised.

- Least post-operative hospital stay and faster recovery with early gut motility.

Disadvantages

- Costly
- Less familiarity of surgeon with this procedure.
- Non availability of stapler at all hospitals.
- More chances of Stenosis at anastomotic site than hand sewn, because anastomosis cannot be checked at every stage of procedure.

Review of Literature

Surgical Anatomy of the Gut wall

The sub mucosa provides the GI tract with most of the tensile strength and is responsible for anchoring the sutures that hold the anastomosed bowel ends together. The sub mucosa consists mainly of coarse, loosely interwoven, collagenous and elastic fibres together with a sub mucosal plexus of nerve ganglia and many blood and lymphatic vessels.

The mucosal component of intestinal anastomosis is repaired by migration and hyperplasia of the epithelial cells which cover over the granulation tissue of the wound and thus seal the defect and create a barrier to the luminal contents. The sealing can be completed in a minimum of three days if the layers of the bowel wall are directly apposed.

The Serosa consists of a thin layer of connective tissue covering the muscularis externa. It is covered on its outer aspect by the mesothelial lining of the peritoneal cavity. Good serosal apposition is necessary to minimize the risk of leakage. Extra peritoneal segments of the intestinal tract without a serosal covering lack this component of anastomotic protection and are at a higher risk of complications as seen in the oesophagus and lower third of the rectum.

Incising the gut wall evokes an initial haemostatic vasoconstriction followed by a secondary vasodilatation and increased vascular permeability. This process results in oedema and swelling of the tissue end. The outcome must be borne in mind; while trying sutures, because

ischemic necrosis may develop as the suture strangulates the swollen tissue. The appearance of granulation tissue in the anastomosis marks the beginning of the proliferative phase of healing. The greater omentum plays a critical role in the intraperitoneal anastomosis by wrapping around the suture line and adding to the granulation tissue production.

During the proliferative phase of healing, wound collagen is undergone the lysis and synthesis, with a predominance of the latter in normal healing. collagen plays an important role in determining anastomotic integrity and suture holding capacity in the few days of healing. This protein is up regulated in tissue adjacent to the suture line as well as throughout the intestinal tract. Understanding these mechanisms provide means to manipulate the healing process.

Blood Supply

A good blood supply is vital for the healing of the anastomosis. the only absolute criteria of adequate blood supply are the presence of free arterial bleeding from the cut edges of the bowel. Oxygen is needed for the hydroxylation of proline and lysine cell migration and cell multiplication. A 10 percent loss of blood volume can reduce the blood flow. Factors such as trauma, shock, coagulopathy, & radiation increases blood viscosity, and infection can directly or indirectly interface with anastomotic oxygenation and be the causer of increased anastomosis leakage.

The good supply to an anastomosis may be comprised in several ways, suture tension line resulting from inadequate mobilization of viscera, devascularisation of bowel during mobilization or preparation for the anastomosis, strangulation of tissue tightly knotted suture and excessive use of diathermy coagulation to achieve homeostasis of cut ends of bowel

Effect of Faecal Loading

Inadequate bowel preparation has adverse effect on colonic healing. Even for small bowel surgery, any leakage will contaminate the peritoneal cavity.

Effect of Distal Bowel Obstruction: (RAS-9)

Primary anastomosis may fail in an obstructed colon.

Effect of Trauma

Adverse effects of trauma on anastomotic healing are due to diminished tissue perfusion.

Affect of Abdominal Drain

Peritoneal drainage is of the subject of considerable controversy, with two basic schools of thought. The argument in favour of the claim that they drain fluid accumulation near the anastomotic margin before the infection occurs, and also gives the indication of anastomotic leak. Those opposed to the use of drain and claim that the drain provides the retrograde conduit for organism to enter the peritoneal cavity from outside, may erode the anastomosis, promote adhesive formation and cause discomfort to the patient.

Effect of Infection on Anastomosis

Bacterial contamination of the anastomotic site is a significant factor which influences the outcome.

Systemic Factors

Systemic factor affecting the healing of bowel anastomosis are nutrition, hypoproteinemia or vitamin deficiency, steroid therapy as metabolic disorder anemia and malignancy, jaundice, uremia, HIV infection.

age

Morbidity and mortality higher as the age advances beyond 60 year and this is due to atherosclerosis and poor nutrition.

Abdominal Sepsis

Septic process increases the collagenolytic activity. The synthesis of collagen in presence of sepsis is also decreased.

Nutritional Status

The prolonged and short term malnutrition diminished anastomotic healing this is probable due to lack of essential amino acids for collagen synthesis or deterioration in the patient immunocompetence.

Blood Transfusion

Blood transfusion are known to have immunosuppressive effect as a result, tumor growth may be enhanced, the incidence of tumor recurrence may be high.

Medication

The (NSAIDs) decreases the collagenolysis 5FU decreases collagen synthesis and therefore compromises healing of small and large bowel anastomosis.

The Role of Nasogastric Decompression

In retrospective and prospective, randomized controlled trials, routine use of nasogastric tube conferred no significant advantages.

Malignancy

Extra colonic malignancy should not affect the healing of colonic anastomosis and there is experimental evidence that malignancy has another side effect that can impair healing in colon. It may be because it is associated with hypoproteinemia, anemia and vitamin deficiency.

Malnutrition

Protein depletion and album less than 3.5 gm per litre is associated with higher incidence of anastomotic dehiscence. deficiency of vitamin, zinc Copper and iron will delay collagen vitamin C is needed for enhancing the conversion of proline and lysine to hydroxylysine.

Steroids

Steroids have an anti inflammatory effect and can impair macrophage and phagocyte function making a wound more prone to infection and delayed healing

Material and Method

The present study was conducted in the development of surgery IGIMS, Patna College & hospital, Patna during the period from March 2016 – March 2017.

All cases requiring routine gastrointestinal anastomosis were considered eligible for study. These include intestinal anastomosis to the rectum, colon, small bowel, gastrojejunostomy etc.

Total 70 cases (50 male, 20 females) where anastomosis was performed as an elective procedure in the department of surgery of this hospital for various gastrointestinal conditions, were included in the study.

All patients were categorized in two group based on type of anastomosis either stapled anastomosis or hand sewn single layer anastomosis. In first group 35 patient's single layer hand sewn anastomosis were constructed using interrupted 2-0/3-0 silk. In second group of 28 patients, stapled anastomosis with the help of stapler was done.

The time recorded for the construction of anastomosis in both conditions. Calculation of cost of materials were based on actual hospital cost for suture materials and cartridges (of stapler) used.

For single lauyer hand sewn anastomosis 2 pievces of silk 3-0 were used. Each packet of silk

cost rs. 90.00 where as cost of single cartridges is about 2500.00.

Performa were used to collect per-operative data and all patients were followed up in post-operative period of about 7 days for development of any complications, time of recovery and subsequent monthly checkups for at least 6 months.

Observations

Present day was conducted on 63 patients, who requiring routine gastrointestinal anastomosis. The study was conducted in the department of surgery, IGIMS PATNA, during the period from march 2016- march 2017.

Results of observations are shown by various tables and graphs as follows:

Table 1: age distribution of G.I Anastomosis

Age (in yrs)	No. of cases	Percentage (%)
<20	09	12.69
20-29	08	11.11
30-39	12	17.46
40-49	18	26.98
50-59	13	19.04
60-69	8	11.11
>70	3	1.58

- The total no. of surgical G.I anastomosis done in surgical ward of IGIMS Patna during the period of study was 70.
- The above table shows that majority of cases (26.98) were in age group of 40-49 yrs.
- Minimum no of cases were in >70 yrs ager group (1.58%)

Table 2: ex distribution In single layer anastomosis versus stapler anastomosis, in various age groups:

Age (in yrs)	Male (47)	Female (16)
<20	7	2
20-29	6	2
30-39	9	3
40-49	17	4
50-59	9	5
60-69	2	4
>70	1	0

- The majority of cases (26.98) were in age group of 40-49 yrs, in which 15 male and 4 female, out of total 51 male and 19 female.
- Minimum no. cases were in >70 yrs age group in which only one (1) male and no female (0).
- The majority of cases (26.98%) were in age group of 40-49 yrs, in which 16 male and 4 female, out of total 51 male and 19 female.
- Minimum no. of casers were in >70 yrs age group in which only one (1) male and no female (0)

Table 3: Showing sex incidence of patient with G.I Anastomosis

SEX	NO. OF CASES	PERCENTAGE %	SEX RATIO
MALE	51	74.6	2.68:1
FEMALE	20	25.39	

- In our study, male patient had high percentage and number (74.6%), 51 no.) as compared to female (25.39%, 19 no.)
- The ration between male and female was 2.68:1.

Table 4: Showing no. of cases with single layer and stapler anastomosis done

SEX	NO. OF SINGLE LAYER	% OF SINGLE LAYER ANASTOMOSIS	NO. OF STAPLER ANASTOMOSIS	% OF STAPLER ANASTOMOSIS
MALE (51)	27	71.42	24	78.57
FEMALE (20)	12	28.57	8	21.42
TOTAL	39	55.55	32	44.44

- The majority of cases (i.e. 35 in no.) had single layer hand-sewn anastomosis and 28 cases were done by stapler anastomosis with percentage of occurrence 55.55% in single layer hand-sewn and 44.44% in stapler anastomosis, respectively.

Table 5: Showing time taken during G.I anastomosis in single layer and stapler anastomosis

PROCEDURE	TIME TAKEN (IN MIN)	RANGE (IN MIN)
SINGLE LAYER	22.78	18-30
STAPLER ANASTOMOSIS	10.33	8-12

- In single layer hand- sewn meantime taken for anastomosis was 22.78 minute (range 18-30) and for stapler anastomosis this meantime was 10.33 minute (range 8-12 minute).

Table 6: Showing total operative time taken in single layer and stapler anastomosis

PROCEDURE	TIME TAKEN (IN MIN)	RANGE (IN MINUTE)
SINGLE LAYER	55.42	50-62
STAPLER	42.33	35-45

- In our study, total operative time in single layer hand sewn was 55.42 minute (range 50-62 mint) and in stapler anastomosis was 42.33 minute (range 35-45 minute)

Table 7: Duration of post OP hospital stay (in days)

PROCEDURE	POST OP HOSPITAL STAY (DAYS)
SINGLE LAYER	7.88
STAPLER	5.78

- In the present study, there were 35 patients for single layer anastomosis with mean duration of post OP hospital stay 7.88days and 28 patients for stapler anastomosis with mean duration of post OP hospital stay 5.78 days.

Table 8: Cost effectiveness I single layer and stapler anastomosis.

PROCEDURE	NO. OF ANASTOMOSIS	EXPENDITURE (IN RS)	SUTURE USED
SINGLE LAYER	39	230	SILK 2 OR 3
STAPLER	32	2500	SINGLE CARTRIDGE

- In single layer anastomosis , 1 to 2 silk was used for which expenditure was average 180/-
- In stapler anastomosis, the cost of single cartridge was 2500/-

Table 9: Showing relation of faecal soiling and anastomotic leak

FECAL SOILING	NO. OF PATIENT	LEAKAGE	PERCENTAGE (%)
WITH FECAL SOILING	11	1	14.28
WITHOUT FECAL SOILING	60	2	3.57

- Intestinal anastomosis soiled with faecal material during operation had higher rate of leakage (14.28 %) as compared to anastomosis without faecal soiling (3.57%).

Table 10 Showing anastomosis leakage in single layer hand-sewn and stapler anastomosis

PROCEDURE	NO. OF ANASTOMOSIS	LEAKAGE	PERCENTAGE (%)
SINGLE LAYER	39	2	5.71
STAPLER	32	1	3.57

- Single layer anastomosis had slightly higher leak rate (5.71%) as compared to stapler anastomosis (3.57%)

Table 11: showing relation of prolonged Ileus with G.I anastomosis

PROCEDURE	NO.OF GI ANASTOMOSIS	NO. OF PATIENT DEVELOPING ILEUS	PERCENTAGE (%)
SINGLE	39	2	14.28
STAPLER	32	1	7.14

- Single layer hand- sewn anastomosis had more frequent prolonged Ileus (14.28) as compared to stapler anastomosis (7.14%).

Table 12: Incision site wound infection after G.I anastomosis:

PROCEDURE	NO.OF PATIENT	NO.OF PATIENT WOUND INFECTION	PERCENTAGE (%)
SINGLE LAYER	39	2	5.71
STAPLER	32	1	3.57
TOTAL	71	3	4.76

- According to above table, single layer hand-sewn anastomosis had slightly more chances of incision site wound infection after operation than staple anastomosis.

Table 13: showing no of anastomosis found under tension in single layer and staple anastomosis

PROCEDURE	NO. OF ANASTOMOSIS	NO. OF ANASTOMOSIS IN TENSION	PERCENTAGE (%)
SINGLE LAYER	35	5	14.28
STAPLER	28	2	7.14

- Chances of anastomosis under tension had less with stapler anastomosis (7.14%) than hand-sewn anastomosis (14.28%).

Table 14 Showing incidence of leak in case of anastomosis under tension

PROCEDURE	NO. OF ANASTOMOSIS IN TENSION	LEAKAGE	PERCENTAGE (%)
SINGLE LAYER	5	1	20
STAPLER	2	0	0

- If anastomosis done under tension, chances of leak was more single layer hand-sewn (20%) than stapler anastomosis (0%).

Table 15: Showing follow up complications (up to 6 months follow up):

PROCEDURE	NO. OF ANASTOMOSIS	NO IN WHICH COMPLICATION OCCURED	PERCENTAGE (%)
SINGLE LAYER	39	3	8.57
STAPLER	32	1	3.57

- In follow up to 6 months, single layer hand- sewn had higher chances to develop complication (8.57%) as compared to stapler anastomosis.

Table 16: showing post anastomotic SAIO.

(SAIO: sub- Acute intestinal Obstructions)

PROCEDURE	NO. OF ANASTOMOSIS	NO. OF SAIO	PERCENTAGE (%)
SINGLE LAYER	39	1	2.85
STAPLER	32	1	3.57

- In single layer hand- sewn anastomosis, 1 in 39 patient was develop post anastomotic SAIO (3.57%)

Table 17: Showing the primary G.I tract disease requiring G.I anastomosis

PRIMARY DISEASE	NO. OF ANASTOMOSIS	PERCENTAGE (%)
ILEOSTOMY CLOSURE	25	35.21
COLOSTOMY CLOSURE	17	23.9
SUBACUTE INTESTINAL OBSTRUCTION	10	14.08
GASTROJEJUNOSTOMY	13	18.30
APR AND ANASTOMOSIS	5	7.04

Summary and Conclusion

On conclusion, it appears that through being costlier stapler anastomosis is advantageous over single layer hand sewn anastomosis in terms of

- Time saving
- Less operative time
- High speed of work
- Less tissue trauma
- Less hospital stay
- Less post operative complication like SAIO, wound dehiscence, leakage etc.
- In this technique vascularity of gut is well maintained and is tension free anastomosis.
- Healing is more reliable than in hand sewn.
- Early post operative gut motility (less chances of Ileus).

So, overall stapler anastomosis is much better than hand sewn anastomosis, of course proper training for its effective use should be there.

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