

**A PROSPECTIVE STUDY ON EMERGENCY BOWEL
RESECTION AND ANASTOMOSIS**

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for the award of the degree of
M.S. DEGREE BRANCH - I
GENERAL SURGERY**

**GOVERNMENT MOHAN KUMARAMANGALAM
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CERTIFICATE

This is to certify that this dissertation “**A PROSPECTIVE STUDY ON EMERGENCY BOWEL RESECTION AND ANASTOMOSIS**” is a work done by **DR.VRINDA.S.RAJ** under my guidance during the period of 2009-2011. This has been submitted to the partial fulfillment of the award of M.S degree in General Surgery (Branch I) Tamil Nadu Dr. M.G.R Medical University, Chennai-32.

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DECLARATION

I solemnly declare that this dissertation “**A PROSPECTIVE STUDY ON EMERGENCY BOWEL RESECTION AND ANASTOMOSIS**” was prepared by me at Government Mohan Kumaramangalam Medical College and Hospital, Salem-636030 under the guidance and supervision of **Prof.Dr.R.KATTABOMMAN, M.S.,** HOD of General Surgery, Govt. Mohan Kumaramangalam Medical College and Hospital Salem. This dissertation is submitted to The Tamil Nadu Dr. M.G.R. Medical University, Chennai in fulfillment of the University regulations for the award of the degree of M.S. General Surgery (Branch I).

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INTRODUCTION

Bowel resection and anastomosis is one of the commonest and challenging surgeries performed by general surgeon as an emergency procedure. With wide range of conditions resulting in resection and anastomosis the surgeon should be aware of the commonest etiology. The success of an anastomosis lies in its sound healing. Wound healing is fundamental to surgery and sound healing of bowel anastomosis is essential to avoid morbidity and mortality resulting from its dehiscence and leakage. Keeping with these principles the study aims to discuss the various etiology, clinical presentation, types of anastomosis technical details and post operative complications and mortality.

AIM OF STUDY

1. To identify various etiologies that resulted in resection of bowel.
2. To discuss the clinical presentation.
3. Outcome in patients who has undergone bowel resection and anastomosis.
4. Various types of bowel resection and anastomosis.
5. Post-operative complications including mortality.

REVIEW OF LITERATURE

Historical highlights and pioneers in treatment.⁷

1. **HIPPOCRATES AND CELSUS (500 BC)** - Hippocrates, the father of medicine and Celsus the most distinguished medical authors followed the pattern of Egyptian treatment which was the administration of purgatives and enema for consecutive days once in a month to clear the bowels as a prophylactic measure.
2. **AMBROIS PARE (1510-1590)** - A French Physician who identified bowel obstruction for the first time and had reported a patient who died of twisted bowel.
3. **HEISTER (1772)** - Described a successful resection of strangulated intestine with diversion of fecal stream.
4. **ANTOXINE LEMBERT (1826)** – A French surgeon described a seromuscular suturing technique which has proved to be the main stay of gastrointestinal surgeries.
5. **NICOHALS SEN (1893)** of USA described a two layered technique of intestinal anastomosis.
6. **HALSTED** – described single layered closure without incorporation of mucosa.

7. **CONNELL⁸ (1903)** – interrupted single layer technique of gut anastomosis with knots lying intraluminally and bites going through all layers.
8. **MUIR (1968)** – On table colonic lavage can be used to prepare the bowel intra operatively for a primary anastomosis.
9. **MATHESON OF ABERDEEN** advocated current method of single layer extamucosal anastomosis.

SURGICAL ANATOMY²

The intestine which is the longest part of the digestive tube, is divided into the longer less distensible small intestine and shorter more distensible large intestine.

Small intestine

The small intestine extends from pylorus to the Ileocaecal junction. It is about 6 meters long. The upper fixed part is the duodenum. The lower mobile part of the intestine is the Jejunum and Ileum. The length of small bowel is highly variable and difficult to estimate. Length varies from 3.9 m to 9 m. If a substantial portion of bowel is resected, it is important to record how much viable small bowel is left behind. Owing to the degree of variation it is not useful to record the amount resected.

Duodenum:

Duodenum is 25 cm long. It is divided into four parts:

1. First or superior part – 5 cms
2. Second or descending part – 7.5 cms
3. Third or horizontal part – 10 cms
4. Fourth or ascending part – 2.5 cms.

The Duodenum is mostly retroperitoneal.

Jejunum and Ileum

The Jejunum and Ileum are suspended from the posterior abdominal wall by the mesentery and therefore enjoy considerable mobility. The Jejunum begins at the duodenojejunal flexure. The Ileum terminates at the Ileocaecal junction.

Large Intestine

The large intestine extends from the Ileocaecal junction to the anus. It is about 135 cms – 150 cms long.

It is divided into

- | | |
|---------------------|------------|
| 1. Caecum | - 6 cms |
| 2. Ascending colon | - 12.5 cms |
| 3. Transverse colon | - 50 cms |
| 4. Descending colon | - 25 cms |
| 5. Sigmoid colon | - 37.5 cms |
| 6. Rectum | - 12 cms |
| 7. Anal canal | - 4 cms |

In the angle between caecum and the terminal part of ileum there is a narrow diverticulum called vermiform appendix. The greater part of the large intestine is fixed except for the appendix, transverse colon and sigmoid colon

ARTERIAL SUPPLY

- Duodenum – Up to the level of the bile duct opening the duodenum is supplied by the superior pancreatico duodenal artery and below it by the inferior pancreatico duodenal artery.
- Ileum & Jejunum - Supplied by superior mesenteric artery.
- The caecum, ascending colon, right two thirds of the transverse colon are supplied by superior mesenteric artery
- The left one third of transverse colon, descending colon upto upper one third of rectum are supplied by the inferior mesenteric artery.
- The middle rectal artery arises from anterior division of internal iliac artery supplies the lower part of the rectum.
- The part of the anal canal above the pectinate line is supplied by the superior rectal artery.
- The part below the pectinate line is supplied by inferior rectal artery.

VENOUS DRAINAGE

The venous drainage of duodenum is into the splenic, superior mesenteric and portal veins.

The jejunum and ileum are drained by the superior mesenteric vein.

The caecum, ascending colon, right two third of transverse colon are drained by the Superior mesenteric vein.

The left one third of transverse colon, descending colon, sigmoid colon, and upper one third of rectum are drained by the inferior mesenteric vein.

The lower two third of the rectum is drained by the internal iliac vein.

The anal canal is drained by the superior and inferior rectal vein.

LYMPHATIC DRAINAGE OF SMALL INTESTINE

Most of the lymph vessels from the duodenum end in the pancreaticoduodenal nodes. From here the Lymph passes partly to the hepatic nodes, and then to the celiac nodes and partly to superior mesenteric nodes.

Lymph from ileum and jejunum drains into numerous lymph nodes present in the mesentery, and along the superior mesenteric artery.

LYMPHATIC DRAINAGE OF LARGE INTESTINE

The nodes are arranged on a plane common to all parts of the large and small intestine.

They are numerous and arranged in three groups.

(a) proximal

(b) intermediate

(c) distal

Proximal nodes

These nodes are situated on the main blood vessels to the gut, (i.e) superior mesenteric, ileocolic, right colic, left colic, middle colic, inferior mesenteric, superior rectal, sigmoid.

The Intermediate Nodes

The intermediate nodes are situated along the larger branches of the above named vessels.

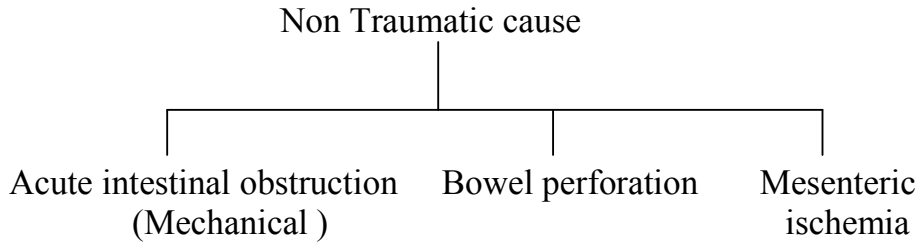
The Distal Nodes

The distal nodes are situated near the gut between the numerous small vessels entering the gut.

EMERGENCY BOWEL RESECTION AND ANASTOMOSIS-

ETIOLOGY

- Non traumatic
- Traumatic



Mechanical small bowel obstruction is responsible for most cases that need surgical intervention. The causes of bowel obstruction can be conveniently divided into intrinsic, extrinsic and intraluminal lesions

CAUSES OF SMALL BOWEL OBSTRUCTION ¹¹

1. Intrinsic Bowel lesions:

A. Congenital

1. Atresia
2. Stenosis
3. Malrotation
4. Meckel's diverticulum

B. Inflammatory:

1. Infections – e.g: Tuberculosis

2. Crohn's disease

3. Ischemia

4. Radiation Injury

C. Traumatic:

1. Hematoma

2. Ischemic stricture

D. Neoplastic:

1. Primary Neoplasm

2. Metastatic Neoplasm

3. Peutz Jeghers syndrome

E. Miscellaneous:

1. Intussusception

2. Extrinsic Bowel Lesions:

A. Congenital bands

B. Adhesions

C. Hernias

D. Volvulus

E. Carcinomatosis

F. Abscess

3. Intraluminal:

- A. Gallstone ileus
- B. Enterolith
- C. Bezoar
- D. Swallowed foreign body
- E. Balloons of intestinal tubes
- F. Parasites e.g: Ascaris

CAUSES OF LARGE BOWEL OBSTRUCTION

I. Within the lumen:

- Faecal Impaction
- Inspissated barium
- Foreign body

II. Within the wall:

- i. Tumors especially carcinoma
- ii. Inflammation
 - i. Diverticulitis
 - ii. Crohn's disease
 - iii. Tuberculosis
- iii. Congenital causes
 - i. Adult Hirschsprung's disease

iv. Ischaemia

v. Radiation

vi. Miscellaneous - Intussusception

III. Outside the wall:

- Bands and adhesions
- External hernias
- Internal hernias
- Volvulus
- Tumors in adjacent organs or lymph nodes.

Most common causes of small bowel obstruction are due to obstructed hernias, post operative intra abdominal adhesions and neoplasm.

Causes of Small bowel Perforation

- Duodenal ulcer perforation
- Inflammatory disease
 - ✓ Acute – Salmonella typhi enteritis
 - ✓ Chronic - Tuberculosis
- Vascular
 - ✓ Ischemic enterocolitis
 - ✓ Strangulated hernia

- Neoplasm
 - ✓ Rare
- Diverticulitis
 - ✓ Meckel's
 - ✓ Jejunal
 - ✓ Duodenal
- Miscellaneous
 - ✓ Iatrogenic

Causes of Large bowel Perforation

- Inflammatory disease
 - ✓ Tuberculosis
 - ✓ IBD
- Vascular
 - ✓ Ischemic enterocolitis
 - ✓ Strangulated hernias
- Neoplasm
- Diverticulitis
- Miscellaneous
 - ✓ Iatrogenic

- Mechanical small bowel obstruction is responsible for most causes that need surgical intervention.

HERNIAS:

Inguinal, Femoral, ventral hernias, incisional hernias and less frequently internal hernias are one of the common causes of Acute Intestinal obstruction in our country.

The obliquity of the inguinal canal and the higher frequency of occurrence makes inguinal hernia the most frequent variety associated with small bowel obstruction. The rigid fascial defect through which the herniated intestine must protrude makes hernias a particularly common cause of strangulation.

The occurrence of Small bowel obstruction in a patient without prior laparotomy should suggest a hernia as the cause.⁴ If no hernia is discovered on physical examination, internal hernias such as paraduodenal and obturator hernias must also be considered.

Incisional hernias have been reported in 20% of patients undergoing laparotomy. Multiple risk factors exist for its development -

surgeon specific - Patient specific. Wound infection is the most important prognostic factors in the development of incisional hernias.

Retro anastamotic and parastomal hernias are also important causes of intestinal obstruction in patients who have had operative procedures in which mesenteric defects may be present.

ADHESIONS

The most common etiology of small bowel obstruction is intra abdominal adhesions following laparotomy, accounting for about 66% to 75% of cases.

Causes of intra peritoneal adhesions:

1. Ischemic areas
2. Infections
3. Presence of foreign bodies
4. Inflammatory disease
5. Radiation enteritis

Lower abdominal or pelvic procedures have a higher risk of post operative adhesive obstruction than do upper abdominal procedures.⁴

NEOPLASMS:

In contrast to colonic obstruction, neoplasms are a relatively unusual cause of small bowel obstruction, accounting for about 10% of cases. Most commonly, the small intestine is obstructed by extrinsic compression or local invasion by advanced gastro intestinal (Pancreatic, colonic, gastric) or gynaecological (ovarian) malignancies. This mechanism accounted for 92% of neoplastic small bowel obstruction in a Mayo Clinic series.

Hematogenous metastases from breast adeno carcinoma and melanoma may also involve the intestine with subsequent obstruction. Primary neoplasms of the small intestine are the cause of obstruction in less than 3% of cases. Carcinoid tumors and adenocarcinoma have been variably reported as the most common malignancy of the small intestine. Adenocarcinoma of small intestine arises more frequently in the duodenum and jejunum than in ileum.

CROHN'S DISEASE

In Crohn's disease, bowel obstruction usually occur under two different conditions.

1. In the acute exacerbation of the disease, the bowel obstruction is the result, of a reversible inflammatory process within the bowel wall that causes a narrowing of the intestinal lumen.
2. Small bowel obstruction may also be the result of a chronic stricture.

RADIATION ENTERITIS (ENTEROPATHY)

Radiation injury to the bowel is a result of obliterative vasculitis and fibrosis consequent to radiation therapy. This progressive obliterative endarteritis is a dynamic, relentless process that may lead to a chronic recurrent low grade obstruction of the small intestine or cicatrization and bleeding in the colon and the rectum.

INTUSSUSCEPTION IN ADULTS

One segment of intestine (the intussusceptum) telescopes within an adjacent segment (the intussusciens), resulting in obstruction and possibly ischemic injury to the intussuscepting segment. In most adult patients (up to 93%) there is an underlying pathologic process, most commonly a tumor (benign in 52% and malignant in 48%). Congenital lesions (e.g.: meckel's diverticulum or small bowel duplications) or other localized abnormalities of the intestinal tract compose the remainder.

Primary idiopathic intussusceptions accounts for only a small percentage of all instances in adults.

PERFORATION

In case multiple perforations or large size perforations bowel segments should be resected.

MESENTRIC ISCHEMIA

The mortality rate of acute Mesentric ischemia varies between 60 to 85% because the condition is not common accounting for only 1-2% patients with acute abdominal pain and diagnosed late.

TRAUMATIC CAUSES

- a. Penetrating trauma
- b. Blunt trauma

In contrast to penetrating injuries injury to small bowel and mesentery is less common in blunt trauma. Blunt trauma is mostly due to Road Traffic Accident.

The widespread use of safety belt increased the incidence of hollow viscous injuries.

Extensive lacerations, devascularised segments, or multiple laceration in a short segment of bowel are better treated by resection and anastomosis.

Injury to the base of the mesentery associated with large hematomas may cause severe bowel ischemia to the entire length of bowel resulting in resection.

High risk colonic injuries are those associated with severe injuries will benefit for resection and colostomy.

INTRODUCTION - INTESTINAL ANASTOMOSIS ⁵

The creation of a joint between two bowel end is an operative procedure that is of central importance in the practice of general surgery. To minimize potential complication it is imperative to adhere to several well established principles. The main one relates to creation of tension free join with good opposition of the bowel edges in the presence of an excellent blood supply. The frequency of anastamotic leakage ranges from 1-24%. The consequences of postoperative dehiscence are dire and include peritonitis, blood-stream infection, further surgery, creation of a defunctioning stoma and death.

GENERAL CRITERIA FOR PRIMARY REPAIRS

1. Early diagnosis
2. Absence of prolonged shock and hypotension
3. Absence of gross contamination of peritoneal cavity
4. <6 unit blood transfusion.
5. Associated injuries absent

PRINCIPLES OF INTESTINAL ANASTOMOSIS ⁵

The term anastomosis has been derived from a Greek word with literal meaning of 'without a mouth'.

Defined as joining two hollow viscera with intention to restore continuity.

The need for anastomosis arises if a portion of hollow tubular viscous has been surgically removed or destroyed by trauma or there is distal obstruction.

Ideal anastomosis

An ideal anastamotic technique should have following features:

1. Zero leak rates
2. Promotes early recovery of function
3. No vascular compromise of the cut margins of a gut.
4. Should not narrow lumen of the gut
5. Easy to learn, teach and perform.

An ideal anastomosis should achieve,

1. Adequate Blood supply to anastamotic area
2. Water tight leak proof closure.

3. Meticulous haemostasis
4. Stoma of optimum size
5. No tension suture line
6. Isoperistaltic.

Types of bowel anastomosis ⁷

1. End to end anastomosis
2. End to side
 - ✓ End to side anastomosis - Mainly done after hemicolectomy as ileotransverse anastomosis.
3. Side to Side
 - ✓ Lateral (side to side anastomosis) - This technique is used to by pass an irresectable obstruction.

Bowel anastomosis involve

1. Jejunojunal
2. Ileoileal
3. Jejunoileal
4. Colocolic
5. Ileocolic
6. Jejunocolic

HEALING IN THE ALIMENTARY TRACT ⁵

- The process of intestinal anastomotic healing mimics that of wound healing in that it can be arbitrarily divided into an acute inflammatory phase, proliferative phase and a remodeling phase.
- Following bowel anastomosis a sequence of events occurs at wound edges and is characterized by cellular infiltrate within first 48-72 hours leading to a framework of macrophages, fibroblasts and neovascularisation.
- Integrity of anastomosis at this point of time solely depends on fibrin adherence between wound edges and sutures till new collagen is laid down. Collagen is the single most molecule determining wound strength.
- Sub mucosa is the strongest layer.
- Bowel anastomosis depends on a fine balance between synthesis and lysis of collagen, not on strength of sutures. MMP (Matrix Metalloproteinase's) is involved in lyses. In sepsis MMP level is decreased.
- Main factor is tissue perfusion.
- Stomach and small bowel have good vascularity.

- Tensile strength is low in bowel anastomosis for first 3 to 4 days, following which there is rapid gain coinciding with collagen synthesis.
- Complication may occur either due to excessive collagen lysis leading to anastomotic dehiscence and/or leakage or due to excessive collagen synthesis, which leads to scarring and stenosis
- Dehiscence – defined as separation of anastomosis – while leakage is the escape of intraluminal faecal content outside the bowel. Thus dehiscence can exist without leakage but leakage is always associated with dehiscence.

Factors affecting healing of bowel anastomosis ⁶

Integrity of bowel anastomosis depends on a delicate balance between collagen synthesis and lysis. This synthesis- lysis equation may be influenced by local and systemic factors.

LOCAL FACTORS ⁵

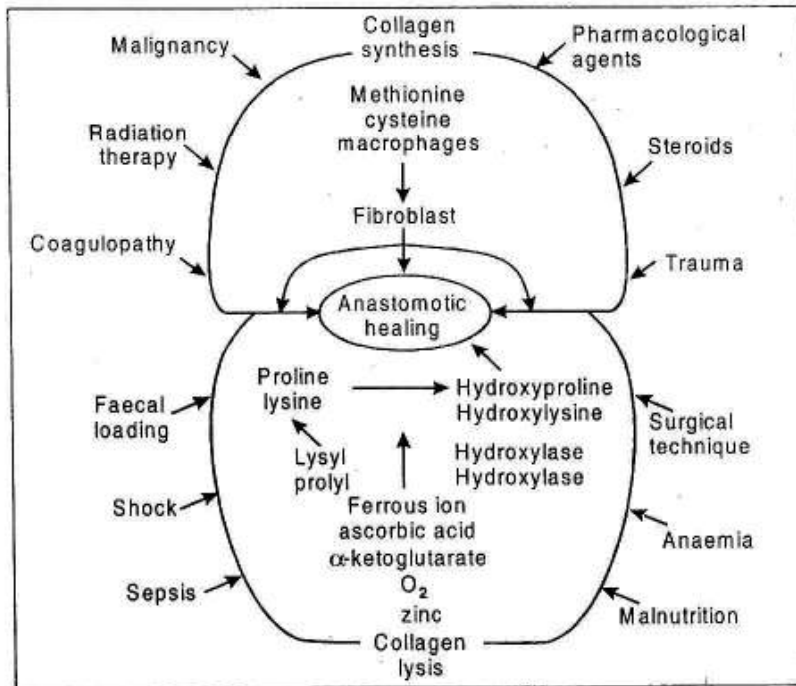
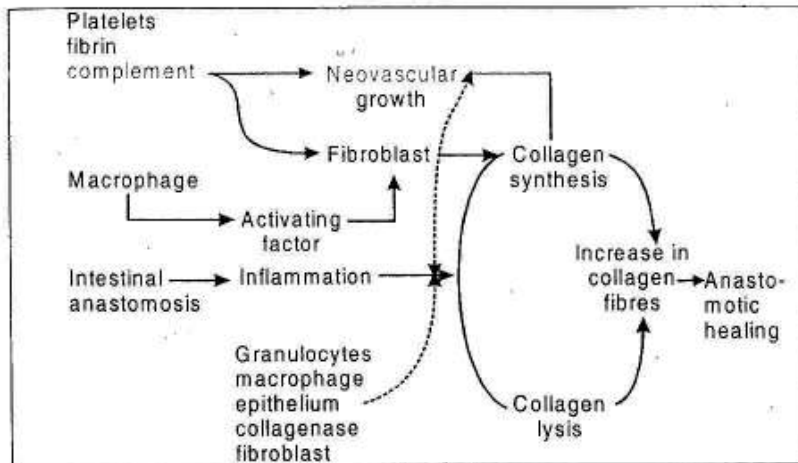
Hypoxia and Hypovolaemia

Local tissue oxygenation depends on adequate blood flow and arterial oxygenation. Blood supply at cut ends of the bowel should demonstrate pulsatile flow prior to anastomotic reconstruction. Colon is particularly vulnerable to change in blood volume and hence

hypovolemia should be avoided. Similarly there should not be any compromise on vascularity during esophageal reconstruction. It has been observed that administration of oxygen in the immediate postoperative period is helpful.

Faecal Loading

It is believed that inadequate bowel preparation has adverse effect on colonic healing. Even for small bowel surgery, any leakage will contaminate the peritoneal cavity. Ideally, faecal loading should be reduced by whole -gut irrigation with PEG/LAC. It is likely that adverse effect of faecal loading may be due to intraluminal distortion and subsequent local trauma and ischaemia. However, there have been instances where no adverse effects were noticed when bowel could not be prepared prior to surgery. Presence of faecal loading increases chances of anastomotic leakage and delays healing especially if the peritoneum is also inflamed .



Obstruction

Primary anastomosis may fail in an obstructed colon. This is more common in left colon than in the right colon. Proximal faecal diversion may not prevent anastomotic dehiscence but may reduce septic

complications. Healing problems in an obstructed bowel are due to diminished blood supply, faecal loading and changes in bacterial flora. These factors delay angiogenesis and inhibit normal healing.

Irradiation

Preoperative radiotherapy for colorectal carcinoma may result in microangiopathy and this leads to anastamotic failure. Surgery should be properly timed following radiotherapy.

Trauma

Adverse effects of trauma on anastamotic healing are due to diminished tissue perfusion. Profound blood loss in traumatic conditions results in hypoxia and may be associated with poor healing specially in colonic anastomosis due to immunosuppressive effect.

Drains

The role of drainage in bowel anastomosis is unsettled. Drains are used so that the exudates accumulated near the anastomosis may drain out and prevent dehiscence. Presacral drains do not decrease the dehiscence rate of colorectal anastomosis. Effect of drainage material near an

anastomosis may prevent local adhesions, which normally help to seal the suture line. Latex material is known to produce a marked tissue reaction.

Infection

It is uncertain to predict whether sepsis adjacent to bowel anastomosis is the cause or the effect. The collagen content of the healing tissue is diminished in presence of infection due to disturbed collagen metabolism as it results in more lysis than synthesis through a depressant effect on fibroblasts. This is due to increased local inflammatory cell activity which leads to increase in enzyme collagenase. This may lead to diminished tensile strength resulting in anastamotic dehiscence. If infection is localised, the anastomosis may heal well but it may give way when there is gross peritoneal contamination.

Factors contributing to infection are many and varied. Local factors are impaired blood supply, haematoma, devitalised tissue, poor surgical technique, inadequate preparation of bowel and use of bulky braided sutures. General factors are presence of uncontrolled diabetes, malnutrition, anaemia, malignancy and a remote septic focus in the body. Perioperative antibiotics have been shown to reduce infective complications following colonic surgery. These should be broad spectrum in nature and cover gram negative as well as anaerobic bacteria.

Systemic

Systemic factors which affect healing of bowel anastomosis are: nutrition, hypoproteinaemia, vitamin deficiency, steroid therapy, age, metabolic disorders, anaemia and malignancy. Sometimes more than one factor is present and may be associated with local factors also.

Age It is the most important variable to influence anastomotic healing specially in colonic surgery. Morbidity and mortality rates are higher as the age advances beyond 60 years and this is due to advanced atherosclerosis and poor nutrition may be contributory.

Anaemia Acute blood loss during surgery is associated with hypovolaemia and profound fall in local tissue PO_2 which affects healing. Normovolaemic anaemia does not interfere with healing. It has been mentioned that blood transfusion should be avoided in colonic surgery as it would lead to immunosuppression and affect anastomotic healing.

Malignancy: Extra colonic malignancy should not affect the healing of colonic anastomosis but its effects are rather complex and there is experimental evidence that malignancy at another site can impair healing in colon. It may be because it is associated with hypoproteinaemia, anaemia and vitamin deficiency.

Nutrition: Aged patients who have higher incidence of malnutrition, vitamin deficiency and anaemia may show increased incidence of anastamotic dehiscence especially following esophageal and colonic resections.

Malnutrition is mainly due to hypoproteinaemia and vitamin deficiency. Serum albumin is the key factor in wound healing as it promotes collagen synthesis. It is doubtful whether parenteral nutrition will improve morbidity and mortality in esophageal resections. Vitamin C deficiency may cause decreased collagen synthesis.

Steroids: In clinical practice, therapeutic levels of steroid therapy appear to influence anastamotic healing as is evident in inflammatory bowel disease.

Small Bowel

It has a generous blood supply and hence is a very low incidence of anastamotic leakage. Anastomosis may be end-to-end, end-to-side, or side-to-side and most of the time it is hand sewn but staplers can be used. Classical two layered anastomosis is usually performed with inner continuous with synthetic absorbable suture and outer seromuscular layer either continuous or interrupted, which is either absorbable or non-absorbable.

Colon and Rectum

Anastamotic leakage may occur in colonic and rectal anastomosis when bowel is not prepared, there is localized infection as in case of diverticulitis and pericolic abscess and when there is a malignant lesion. Anastomosis should be performed meticulously taking utmost care of the blood supply and after adequate mobilization of the colon. Conventionally, the two-layer anastomosis is carried out with 3-0 PDSII suture used as a continuous inner layer followed by interrupted outer seromuscular layer using Silk or PROLENE. Some surgeons prefer a single layer anastomosis by interrupted all-layer technique with either PDSII or a non-absorbable material. It is believed that with single layer suturing there is minimal interference with blood-supply and less chances for stenosis.

Intraluminal stapler has revolutionized the management specially of low colorectal anastomosis as it helps to achieve it very low down into the pelvis where hand-sewn anastomosis may be difficult. It helps to avoid a permanent end-colostomy and preserves the sphincteric control and anorectal sensation. It is of great help specially in the construction of pouch and for ileoanal anastomosis.

ANASTOMOTIC TECHNIQUES ⁵

There are many techniques and most times achieve sound healing provided basic principles are adhered to. Bowel anastomosis does not require great strength against distracting forces in the case of abdominal wall. A leak proof repair is all that is required till the new laid down collagen provides sufficient intrinsic strength by about 10-15 days.

Traditionally anastomosis is fashioned in 2 layers.

- An inner haemostatic all layers continuous suture.
- Followed by an outer interrupted seromuscular reinforcing suture which helps inversion.
- Inverted anastomosis is preferred to an everted one.
- Controlled trials of Goligher et al have shown that everting technique of anastomosis should not be used in colonic surgery since morbidity and mortality is higher with everting technique.
- Corners of anastomosis should be properly inverted by special inverting suture, e.g. loop on mucosa Connell suture.
- Anastomosis should be commenced at the Mesentric end.
- Excessive inversion should be avoided to prevent narrowing and obstruction.
- In children one layer anastomosis is performed as lumen is narrow.

- End to end anastomosis gives good result and is most commonly performed in small bowel, colon, rectum and wherever two ends of bowels are of equal dimension.
- If ends of the bowel are slightly unequal a small cut may be made on the antimesenteric part of bowel - Cheatles manoeuvre.
- Side to side anastomosis is done when the lumina is unequal.
- A wide range of sutures – absorbable, and non absorbable are now available to achieve sound healing of anastomosis. Absorbable sutures commonly preferred are polygalactin 910 (coated vicryl).
- Polyglecaprone 25 (monocryl)
- Polydiaxanone (PDS II)
- Size vary from 4-0 to 2-0.
- Only eyeless needled sutures should be used on round bodied or JB-intestinal needles to avoid tissue trauma and contamination. They split the tissues without disruption opening created by needle is closed by suture. The following are recommended for bowel:

Small bowel – Polygalactin 910 or Polyglecaprone 25-3/0,

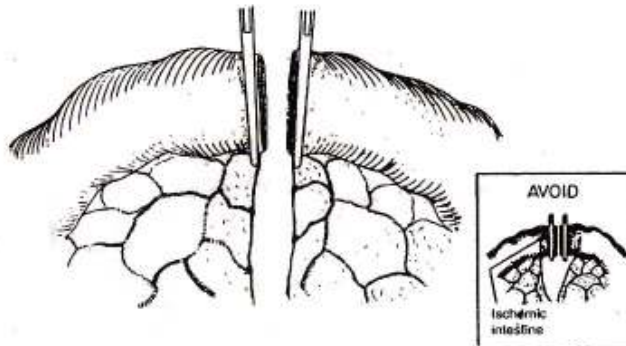
Silk 3/0

Colon and rectum – Polygalactin 910 or Polydiaxanone 2/0 or

3/0; Silk – 3/0

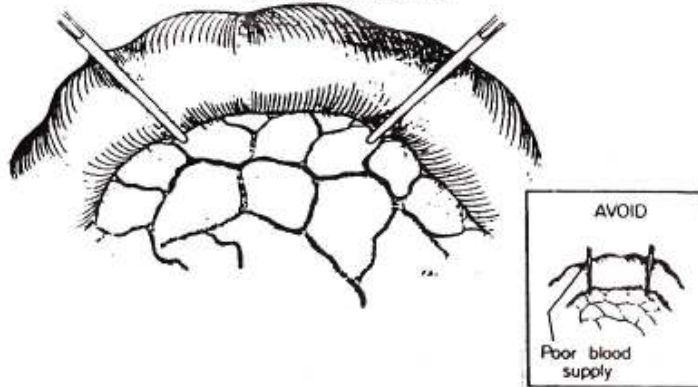
- Absorbable sutures may be used for both the layers or absorbable sutures for the inner layer and non-absorbable for the outer layer.
- Most surgeons prefer absorbable suture for inner layer.
- Continuous suturing to achieve adequate haemostasis and apply interrupted sutures-of non absorbable type for outer layer.
- Synthetic absorbable sutures are material of choice compared to surgical gut since they maintain prolonged tissue integrity during critical period of wound healing.
- Monofilament sutures are more preferable for colonic anastomosis because braided material may potentiate infection by harboring bacteria in the interstices.
- It is usually performed by interrupted all layer Gambee technique or by a single layer interrupted serosubmucosal suture as advised by Matheson and Irving.
- Both techniques give satisfactory results.
- Surgeons who are well versed with the use of mechanical wound closure devices would prefer to use staplers for anastomosis. A wide range of staplers are now available.

LEAVE ADEQUATE BLOOD SUPPLY
FROM MESENTERY



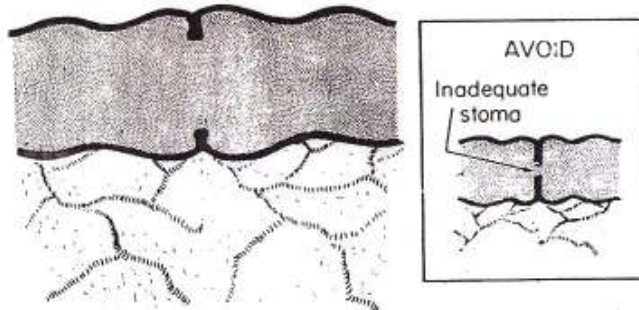
Excessive stripping of mesentery
from the bowel must be avoided

Divide intestine at angle to ensure blood supply to
entire bowel wall



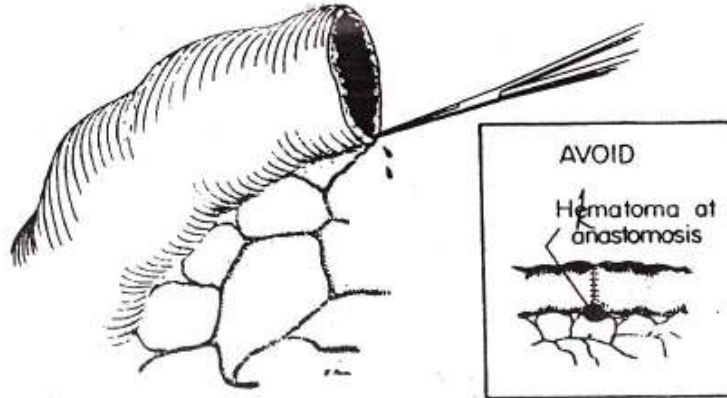
Compromise of circulation to the antimesenteric
border of the bowel must be avoided

INVERT SMALL AMOUNT OF BOWEL WALL

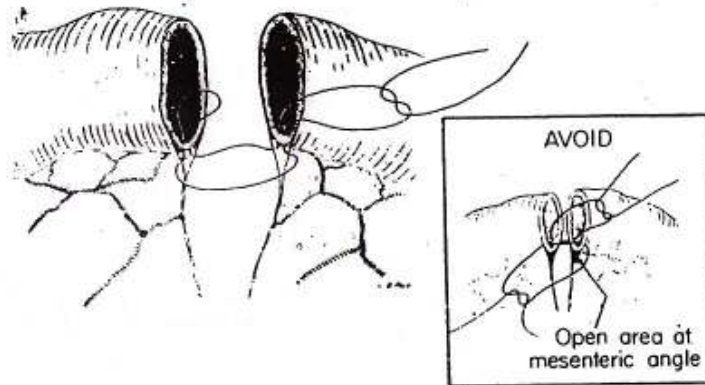


Excessive inversion of the bowel wall cause
postoperative obstruction

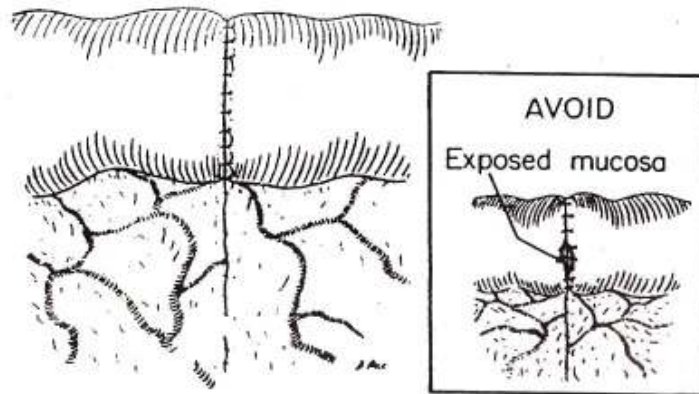
Control Bleeding From End of Bowel

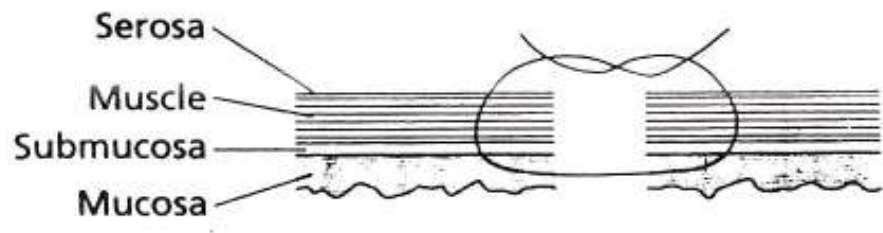


Close Mesenteric Angle

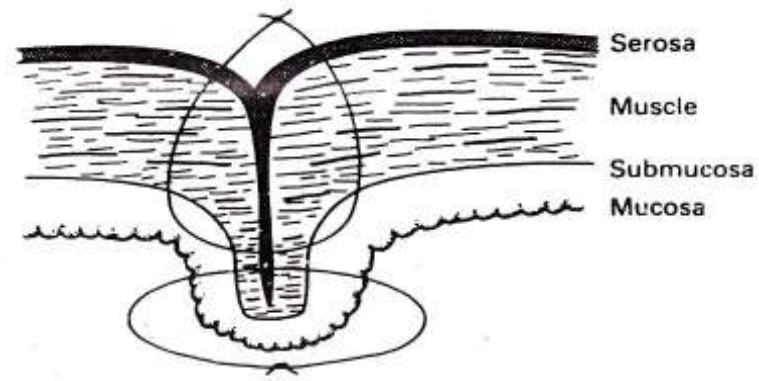


SEROSA-TO-SEROSA ANASTOMOSIS

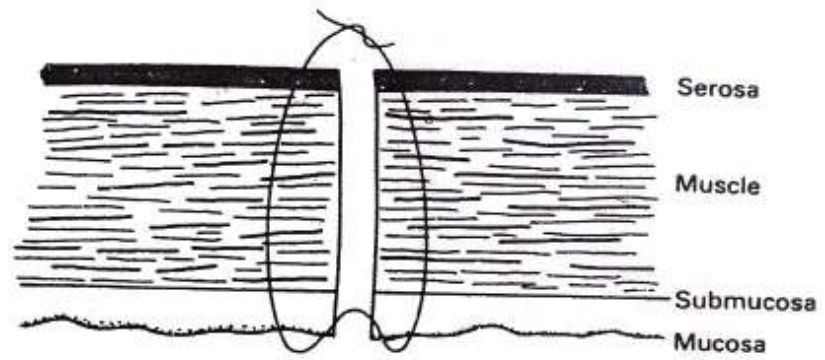




Placement of the appositional serosubmucosal suture (Matheson-single layer and interrupted)



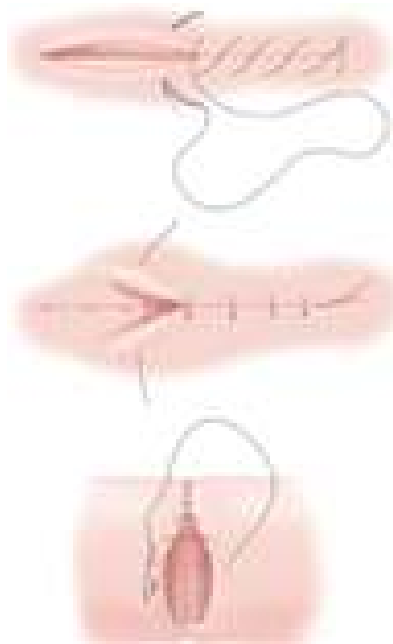
Conventional two-layer anastomosis



Gambee suture technique (interrupted-all layers)

Suturing Technical Issues ⁸

- ✓ *Choice of suture material* – Ideal suture material is one that elicits little or no inflammation while maintaining the strength of the anastomosis during the lag phase of healing. This ideal substance has yet to be discovered, but newer generation sutures includes the monofilament sutures and coated braided sutures.
- ✓ *Continuous- vs - interrupted sutures-* Retrospective studies showed no advantage over one another.



Continuous over and over suture ⁸

Interrupted Lembert (seromuscular) ⁸

The Connel suture (For anterior layer) ⁸

- ✓ *Single layer –vs.- Double layer Anastomosis* – The technique of double-layer anastomosis, originating from work done by Travers and Lembert, has been used traditionally for more than 100 years. A double layer anastomosis consists of an inner layer of continuous

or interrupted absorbable suture. The technique of single layer anastomosis was championed because of potential advantages such as reduced operating time and lower cost. The main issue to consider, however, is safety. Studies concluded that there was no evidence that two layer anastomosis yielded a lower rate of postoperative leakage than single layer anastomosis.

Different Methods of Anastomosis are : ¹⁴

Conventional Methods

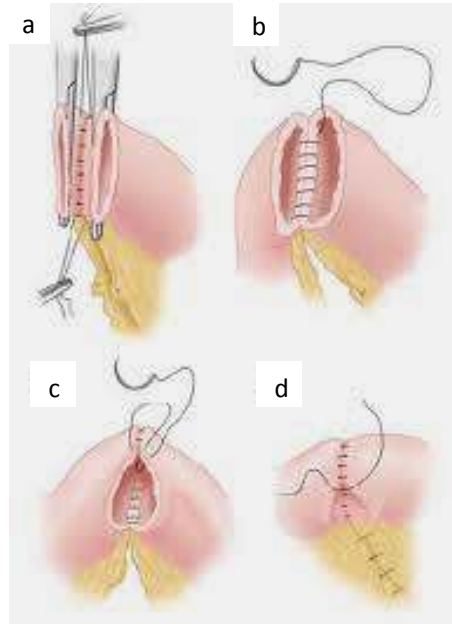
1. Hand sutured
2. Stapled

Unconventional methods

1. Compression rings
 - a) Biodegradable Anastamotic Ring(BAR)
 - b) Non-degradable
2. Tissue glue
3. Laser welding

Different Techniques of Bowel Anastomosis³

1. *Double Layer Anastomosis*⁸



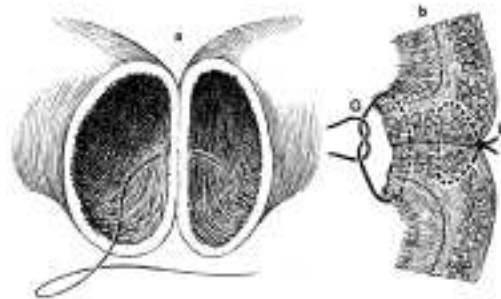
- a) Interrupted Lembert stitches are used to form the posterior outer layer.
- b) A full thickness continuous over and over stitch is used to form posterior inner layer.
- c) Connells stitch form anterior layer
- d) Interrupted Lembert are used to form anterior outer layer.

2. *Closed Single layer anastomosis*

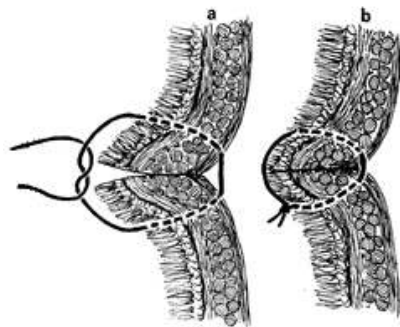
3. *Single layer seromuscular anastomosis (Single layer extramucosal anastomosis)*

4. *Gambee Technique of End to End Anastomosis of Bowel*¹⁴

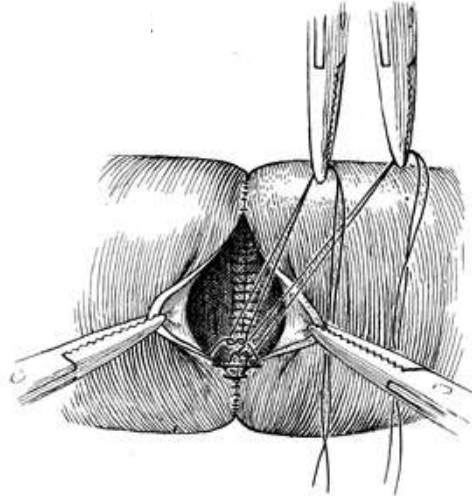
- ✓ The Gambee technique is a single-layer through and through anastomosis; all knots are tied within the lumen of the bowel. . The initial Lembert suture (L) placed at the mesenteric border of the bowel has been tied and thus tends to invert the edges of the mucosa. The Gambee suture (G) has been placed through the mucosa; the entire wall of the bowel exits the serosa, enters the serosa of the bowel on the opposite side, passes the bowel wall, and emerges from the mucosa. When tied, it further inverts the edge of the bowel.



- ✓ Each successive Gambee suture is placed approximately 3 mm apart around the entire circumference of the bowel.



- ✓ The process has been almost completed around the entire circumference of bowel.



- ✓ When all but a 5-mm defect in the bowel remains, the near-far inverting suture can be applied. . When tied, it will dramatically invert the entire suture line.
- ✓ Four tension-relieving Lembert sutures of 3-0 Dexon are placed north (N), east (E), and West (W) of the bowel.
- ✓ The mesentery of the small intestine is closed with interrupted 3-0 synthetic absorbable sutures to prevent internal hernia.

STAPLING : TECHNICAL ISSUES ⁸

Choice of Stapler

Surgical stapling devices were first introduced by Hülthl in 1908.

Three different types of stapler are commonly used for fashioning

intestinal anastomosis. The **transverse anastomosis (TA)** stapler is the simplest of these. This device places two staggered rows of B-shaped staples across the bowel but does not cut it; the bowel must then be divided in a separate step. The **gastrointestinal anastomosis (GIA)** stapler places two double staggered rows of staples and simultaneously cuts between the double rows. The **circular, or end-to-end anastomosis (EEA)**, stapler places a double row of staples in a circle and then cuts out the tissue within the circle of staples with a built in cylindrical knife. All of these staplers are available in a range of lengths or diameters. Staplers may be used to create functional or true anatomic end-to-end anastomosis as well as side-to-side anastomosis. The original staplers were all designed for use in open procedures, but there are now a number of instruments (mostly of the GIA type) available for use in laparoscopic procedures. The staples themselves are all made of titanium, which causes little tissue reaction. They are not magnetic and do not cause subsequent difficulties with magnetic resonance imaging (MRI).

In a functional end-to-end anastomosis, two cut ends of bowel (either open or stapled closed) are placed side by side with their blind ends beside each other. If the bowel ends are closed, an enterotomy must be made in each loop of bowel to allow insertion of the stapler.

A cutting linear (i.e., GIA) stapler is then used to fuse the two bowel walls into a single septum with two double staggered rows of staples and to create a lumen between the two bowel segments by dividing this septum between the rows. A noncutting linear (i.e., TA) stapler is then used to close the defect at the apex of the anastomosis where the GIA stapler was inserted. An alternative and cheaper method of closing the defect is to use a continuous suture. The cut and stapled edges of the bowel should be inspected for adequacy of haemostasis before the apex is closed. It is also important to offset the two inverted staple lines before closing the apex.

True anatomic end-to-end stapled anastomosis may be fashioned with a linear stapler by triangulating the two cut ends and then firing the stapler three times in intersecting vectors to achieve complete closure. The potential drawback of this approach is that the staple lines are all everted.⁸

Staple Height

TA and GIA staplers are available with a variety of inserts containing several different types of staples. These inserts vary with respect to width, the height (or depth) of the closed staple, and the

distance between the staples in the rows. They are designed for use in specific tissues, and it is important to choose the correct stapler insert for a given application. In particular, inserts designed for closing blood vessels should not be used on the bowel, and vice versa. With TA and EEA staplers, it is possible to vary the depth of the closed staples by altering the distance between the staples and the anvil as the instrument is closed. The safe range of closure is usually indicated by a colored or shaded area on the shaft of the instrument. Thus, if full closure would cause excessive crushing of the intervening tissues, the stapler need not be closed to its maximum extent.

Single-Stapled versus Double-Stapled Anastomosis

To accomplish many of these anastomosis, intersecting staple lines are created. Initially, some concern was expressed about the security of these areas and about the ability of the blade in the cutting staplers to divide a staggered row of staples. Animal studies, however, demonstrated that even though nearly all (> 90%) of the staple lines that were subsequently transected by a second staple line contained bent or cut staples, the integrity of the anastomosis was not compromised in any way, nor was healing adversely affected.

STAPLED VERSUS HANDSEWN ANASTOMOSIS ⁸

There are no data to indicate that hand sewing a gastrointestinal anastomosis is superior to stapling, or vice versa. Experienced surgeons have published reports of leak rates as low as 0-3 percent after suturing and also after stapling, with mortality rates as low as 1 %.. However, successful stapling adds to the efficiency of constructing an anastomosis and is especially welcome in complex operations requiring several anastomosis. From the available literature, it may be safely concluded that there is no significant difference in the occurrence of leakage when comparing stapled with sutured anastomosis for oesophagostomy, oesophagojejunostomy, gastrojejunostomy, duodenal stapling, small bowel anastomosis and colocolic anastomosis. Finally in the area of surgery for rectal carcinoma, the impact of surgical stapling has dramatically affected surgical practice. There is an obvious reduction in abdominoperineal (AP) resections performed over the past twenty years versus sphincter preserving procedures, such as low anterior resections as a result primarily of the introduction of the circular stapler. It has helped many patients to live a better quality life without a permanent colostomy.

Essential preliminary steps and procedure in bowel anastomosis ⁸

- ✓ Patient Positioning and Incision
- ✓ Exposure, Mobilization and Dissection

Tension is rarely a problem with small bowel anastomosis, but with colonic or esophageal anastomosis, it is absolutely vital that the two ends of bowel to be joined lie together easily. For a large bowel anastomosis, this means that the splenic flexure or the hepatic flexure or sometimes, both must be adequately mobilized.

- ✓ Bowel Resection
 - Preparation
 - Division of Bowel
- ✓ Anastomosis
 - End to End
 - End to Side
 - Side to Side – comes in case of Bypass procedures

Use of Omentum

Omentum is routinely utilized for managing perforated duodenal ulcer and perforations in small bowel. It may be used to support a bowel anastomosis in selected cases which has a potential to leak. Reports in the literature regarding use and advantages of omentum are controversial.

In the gastrointestinal system, the omentum may be used to protect anastomosis from the oesophagus down to the rectum. Anastamotic leakage usually occurs as a consequence of infection, necrosis and local abscess formation. A pedicled omentum once anchored around the anastomosis could rapidly form adhesions and a network of new blood vessels with the underlying tissue. If infection does take place at the anastomosis, the histiocytes, monocytes and granulocytes in the omentum could play a phagocytic role serving to absorb the bacterial products and toxins, preventing the infection from developing into a local abscess, thus protecting the anastomosis, the omentum can be used with its blood supply carefully preserved as a cuff to wrap around the anastomosis, high colorectal surgery, prevention of anastamotic leakage has been controversial. Omentum has been used and studied by many authors but the use of omentoplasty has been shown to be ineffective in a prospective randomized study.

MANAGEMENT OF ANASTOMOTIC LEAKAGE⁵

Incidence, mortality and morbidity following anastamotic leakage have substantially decreased in recent years and is related to refinement in anastamotic techniques and more to progress in modern perioperative management. As to the management, most leaks can be treated

conservatively and re-intervention surgery is rather exceptional. Anastamotic leakage is more common following esophageal, colonic and pancreatic surgery compared to that of gastric and small bowel surgery.

MATERIALS AND METHODS

This is a prospective study of 40 patients who had undergone emergency bowel resection and anastomosis at the Govt. Mohan Kumaramangalam Medical College Hospital, Dept. of General Surgery from 2009 to 2011. From the time of presentation the cases were followed up till the time of discharge/death. As all the cases presented with acute abdomen an X-ray abdomen erect was routinely taken. All patients who presented with abdominal trauma underwent FAST. The type of clinical presentation, area of involved bowel, cause for which bowel went for resection, type of anastomosis involved, and outcome of surgery have all been recorded and tabulated in a master chart for reference and comparison.

OBSERVATIONS AND RESULTS

- A total of 40 cases who had undergone emergency bowel resection and anastomosis were included in the study from 2009 to 2011.
- After admission all the cases were followed-up and the relevant details recorded.
- This was summarized into a master chart.
- The comparable tabulations permit certain statistical inferences to be made that are presented below.

Age and Sex Incidence

Age Distribution

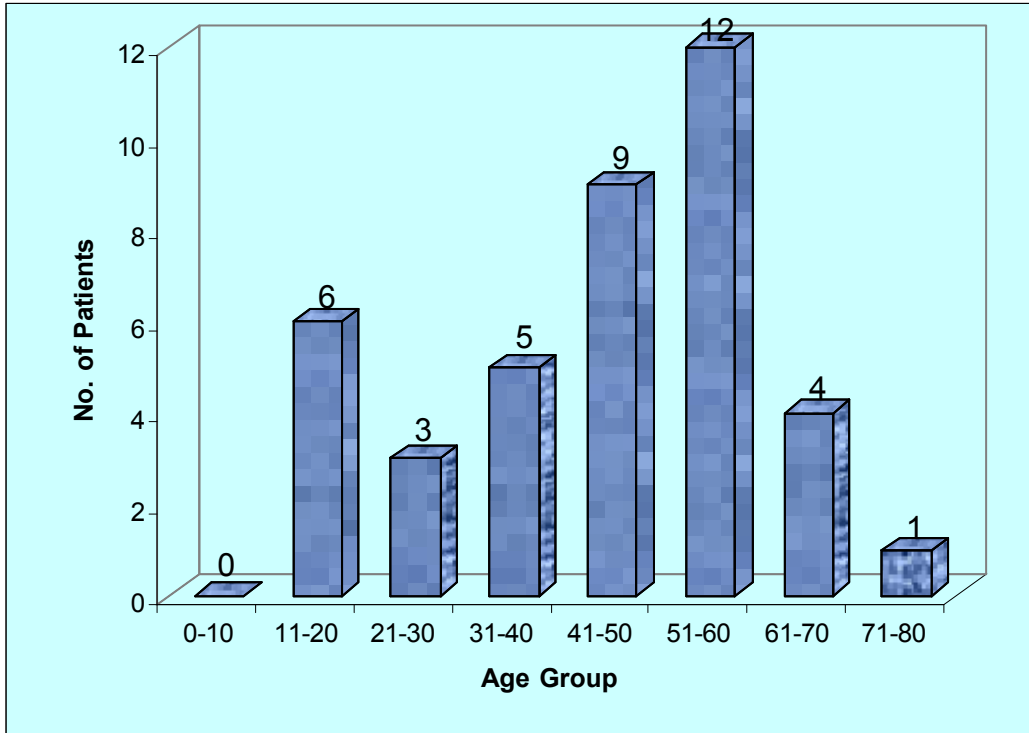
There is no age bar among the patients undergoing emergency bowel resection and anastomosis.

Table – 1

Ageing Group	No. of Patients
0-10	0
11-20	6
21-30	3
31-40	5
41-50	9
51-60	12
61-70	4
71-80	1

The most common age group who underwent bowel resection and anastomosis was between 51-60 years.

Diagram – 1



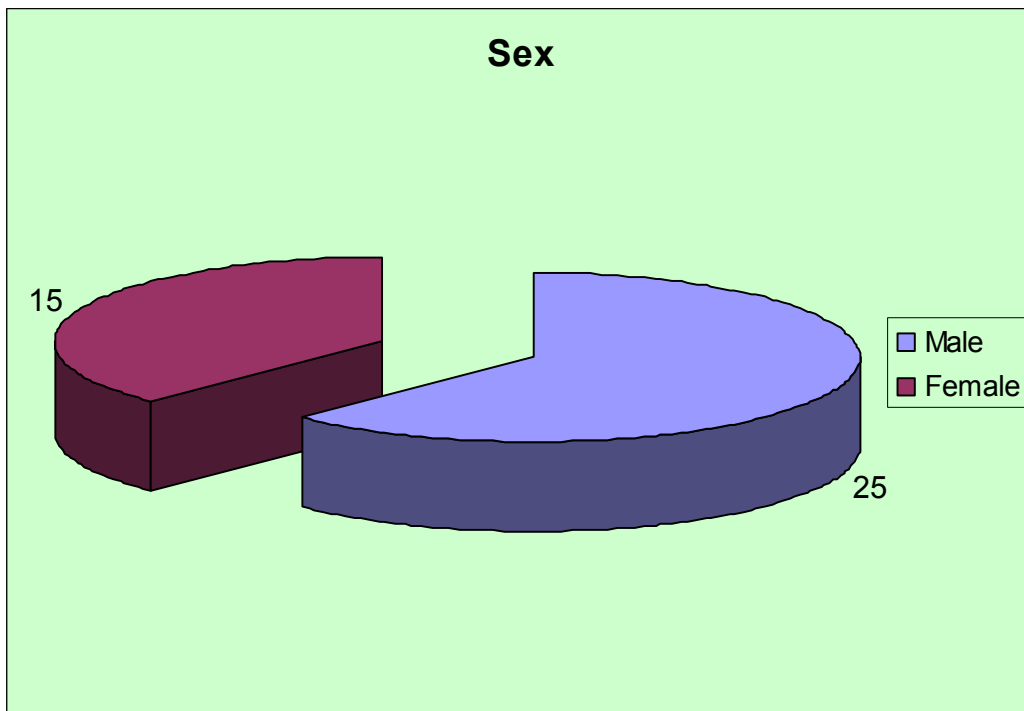
Sex Distribution

Table – 2

Sex	No. of cases	Percentage
Male	25	62.5
Female	15	37.5

There is a male preponderance among the patient. Male to female ratio is 5:3.

Diagram – 2



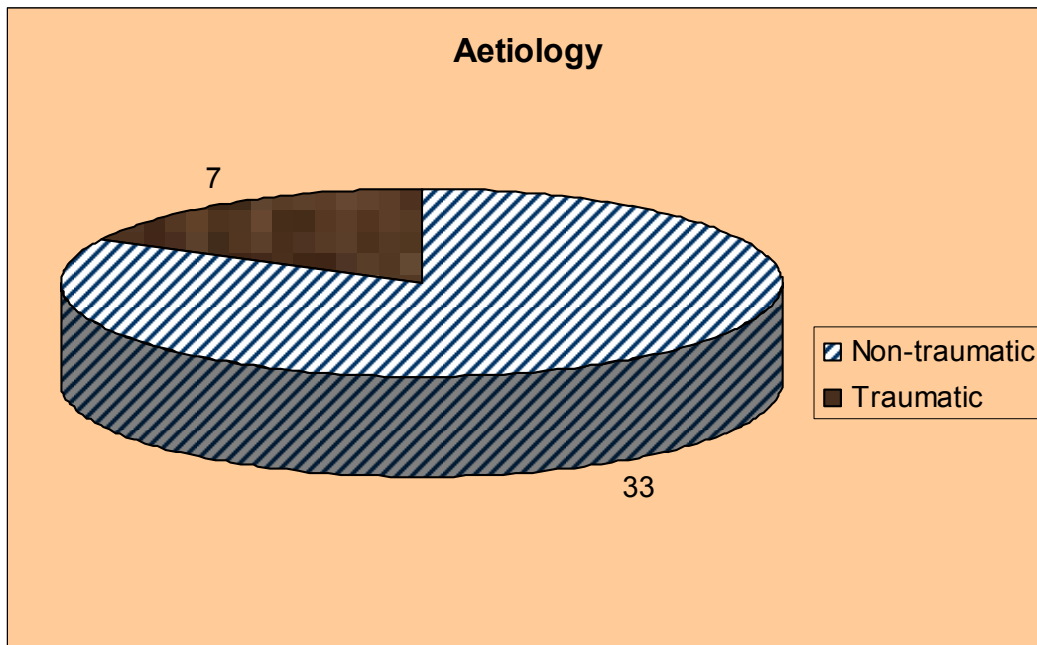
Clinical Symptomatology

Table – 3

Etiology	No. of cases	Percentage
Non-traumatic	33	82.5
Traumatic	7	17.5

Majority of cases went for resection and anastomosis of bowel presented with clinical features of intestinal obstruction, obstructed hernias or peritonitis (Non-traumatic).

Diagram – 3



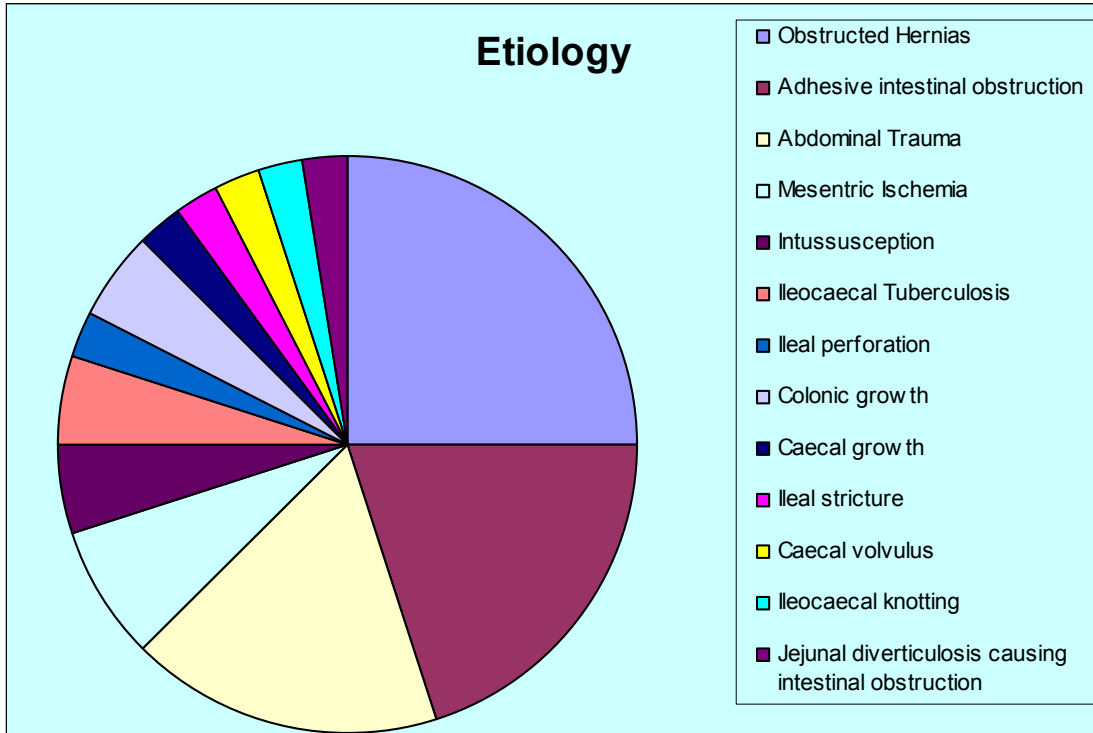
Disease Spectrum

Strangulated hernias and adhesive intestinal obstruction were the commonest cause resulted in gangrenous bowel which went in for resection of gangrenous bowel segment and anastomosis.

Table – 4

Etiology	No. of cases	Percentage
Obstructed Hernias	10	25
Adhesive intestinal obstruction	8	20
Abdominal Trauma	7	17.5
Mesentric Ischemia	3	7.5
Intussusception	2	5
Ileocaecal Tuberculosis	2	5
Ileal perforation	1	2.5
Colonic growth	2	5
Caecal growth	1	2.5
Ileal stricture	1	2.5
Caecal volvulus	1	2.5
Ileocaecal knotting	1	2.5
Jejunal diverticulosis causing intestinal obstruction	1	2.5

Diagram – 4



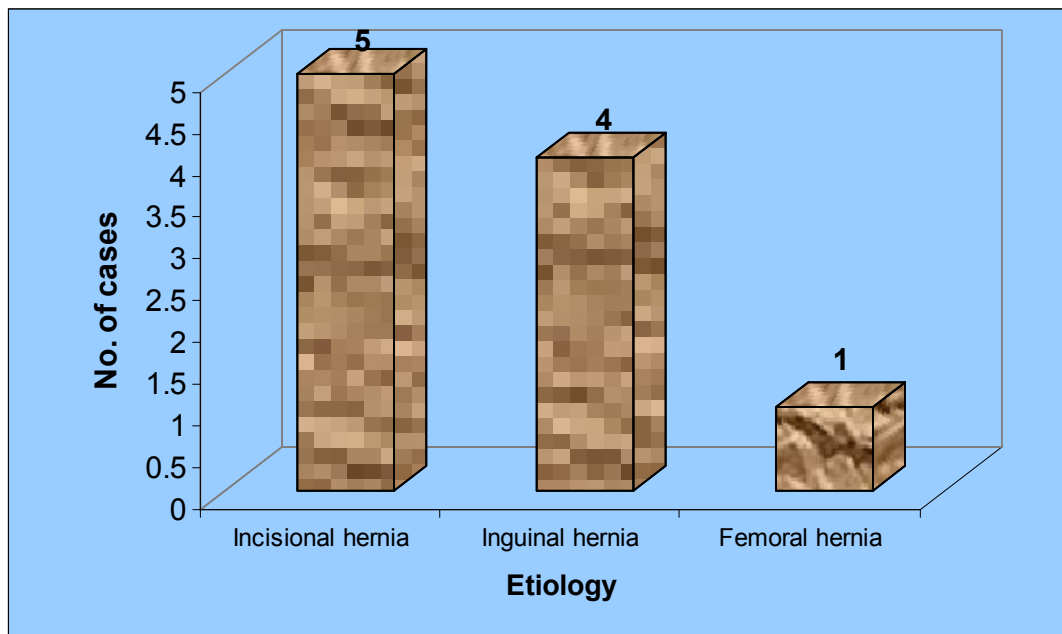
Obstructed Hernias were the most common cause for resection of bowel as it was found to gangrenous due to late presentation.

Types of obstructed hernia on exploration showed gangrenous bowel in this study are shown below.

Table – 5

Etiology	No. of cases	Percentage
Incisional hernia	5	50
Inguinal hernia	4	40
Femoral hernia	1	10

Diagram-5



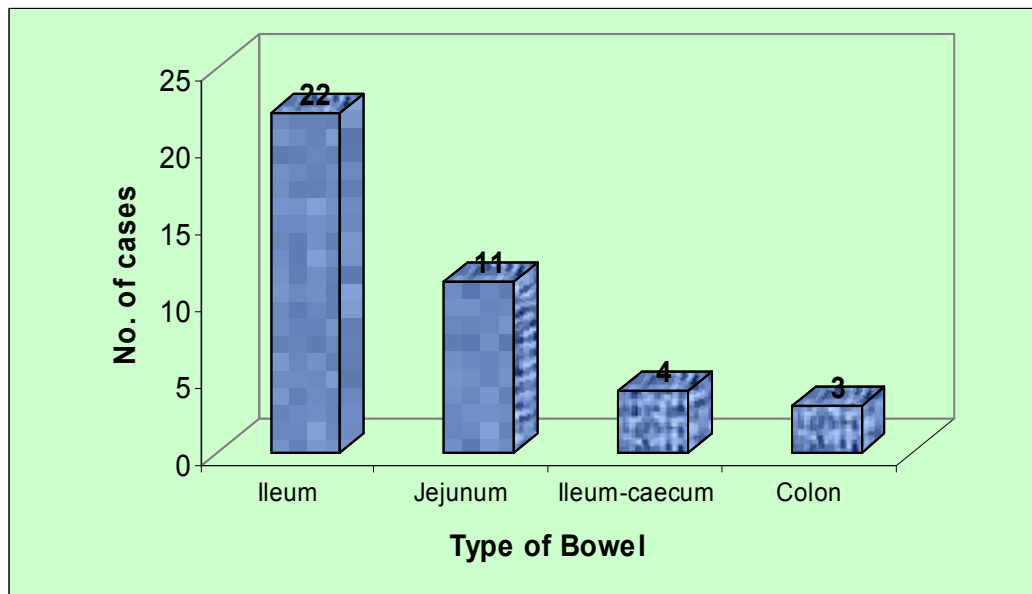
Area of bowel resected out

Table – 6

Type of Bowel	No. of cases	Percentage
Ileum	22	55
Jejunum	11	27.5
Ileum-caecum	4	10
Colon	3	7.5

Most of common part of bowel went in for resection in this study was ileum (22 cases) followed by jejunum (11 cases), colon (3 cases) ileum and caecum (Limited resection) in 4 cases.

Diagram – 6

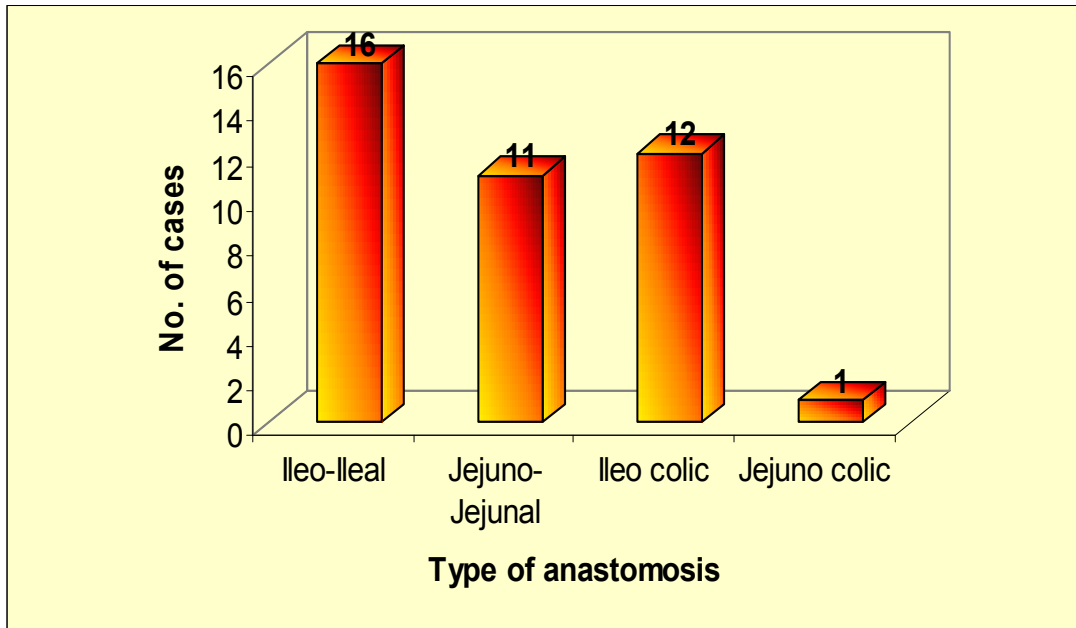


Type of bowel anastomosis

Table – 7

Type of anastomosis	No. of cases	Percentage
IleoIleal	16	40
Jejunojenulal	11	27.5
Ileocolic	12	30
Jejunocolic	1	2.5

Diagram – 7



Most common bowel to bowel anastomosis done in this study was of ileoileal type (end to end) 16 cases.

Ileocolic anastomosis done for 12 cases, ileum was anastomosed to ascending colon, transverse colon and sigmoid colon. End to end and End to side was done according to the pathology.

3rd type of anastomosis was of jejunojejunal type – 11 cases. jejunocolic anastomosis – 1 case.

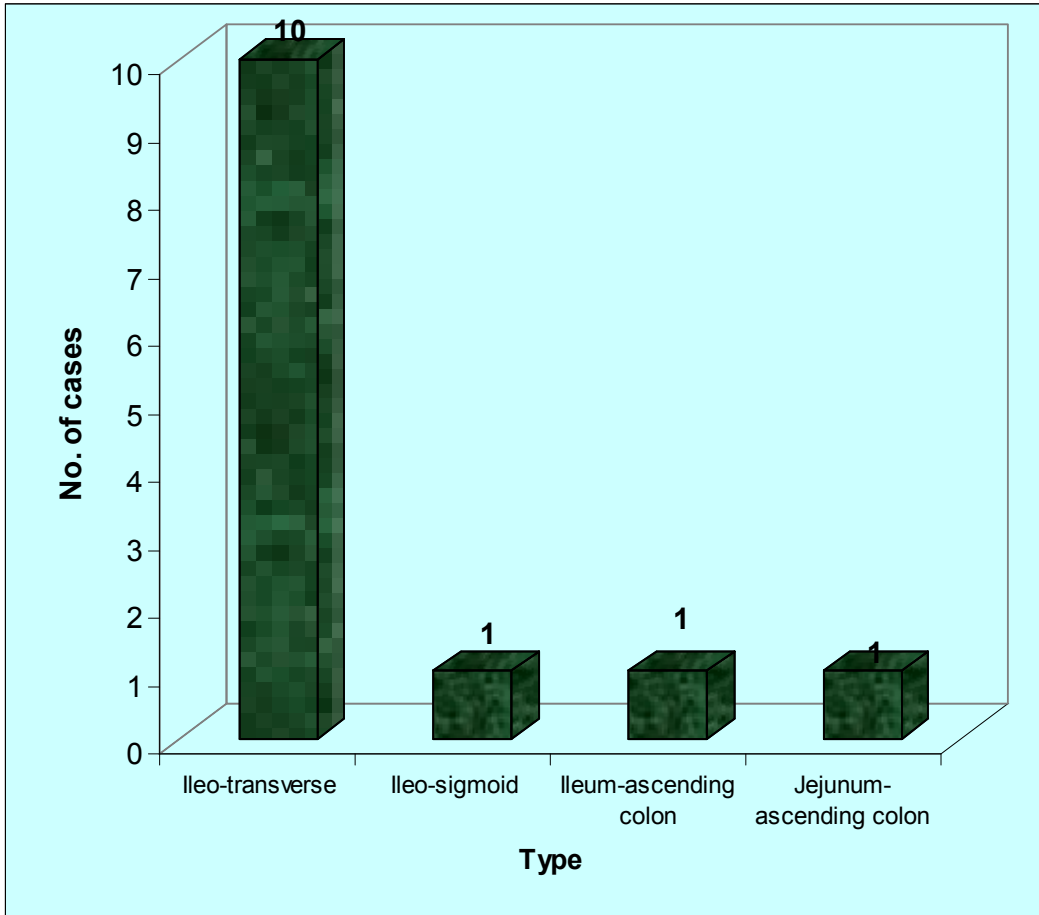
Small Bowel versus Large Bowel Anastomosis

Among the 13 cases which went for a small bowel to large bowel anastomosis, in 10 cases ileum was anastomosed with transverse colon.

Table – 8

Type	No. of cases	Percentage
Ileotransverse	10	76.92
Ileosigmoid	1	7.7
Ileum-ascending colon	1	7.7
Jejunum-ascending colon	1	7.7

Diagram – 8



End -to -End –vs- End to Side

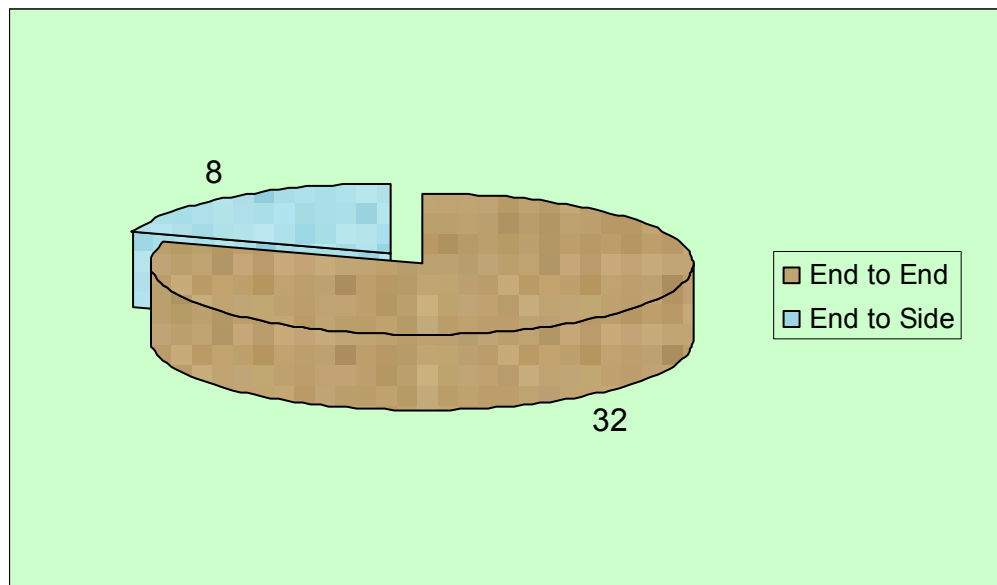
Majority of cases End -to -End anastomosis was done.

Table – 9

Type	No. of cases	Percentage
End -to -End	32	80
End- to -Side	8	20

All end -to -side anastomosis were of ileotransverse type

Diagram – 9



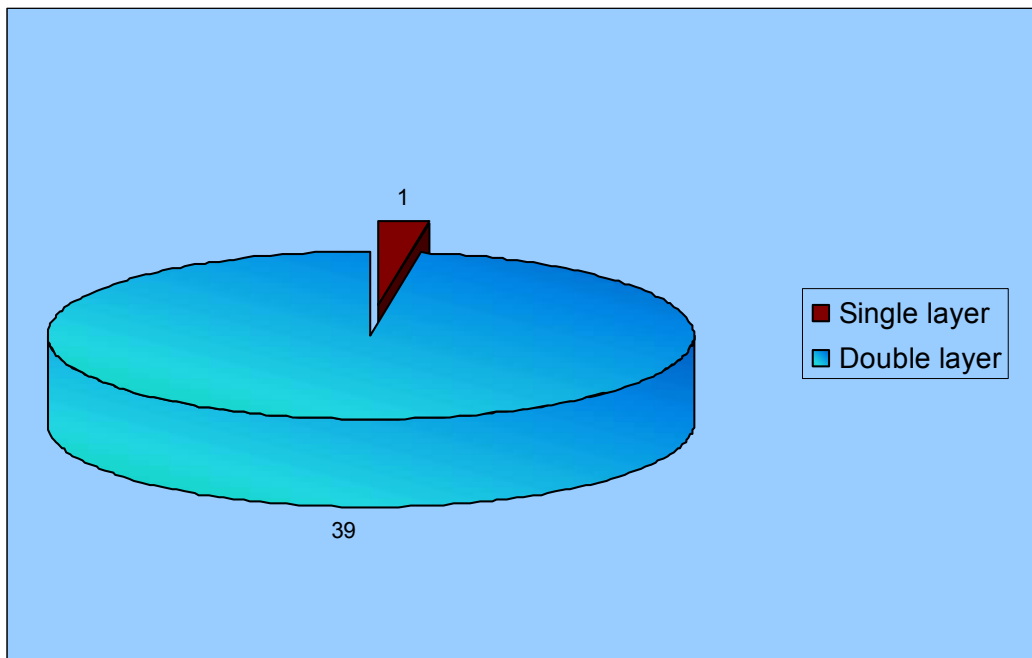
Single Layer- vs -Double layer closure

Except for one case all others went in for a double layer closure.

Table – 10

Type	No. of cases	Percentage
Single layer	1	2.5
Double layer	39	97.5

Diagram – 10



Outcome

Outcome was graded into 4 classes.

Grade I was an uneventful full recovery

Grade II was with minor morbidity

Grade III was with major morbidity

Grade IV was death post operatively

Minor morbidity was defined as wound infection, mild cardiopulmonary deficit, post operative ileus and self limiting intestinal leak.

Major morbidity was defined as wound dehiscence moderate to severe cardiopulmonary deficit, enterocutaneous fistula and relaparotomy.

Table – 11

Outcome	No. of cases	Percentage
Grade I	25	62.5
Grade II	5	12.5
Grade III	4	10
Grade IV	6	15

62.5% had an uneventful recovery. Mortality rate is 15%.

Diagram – 11

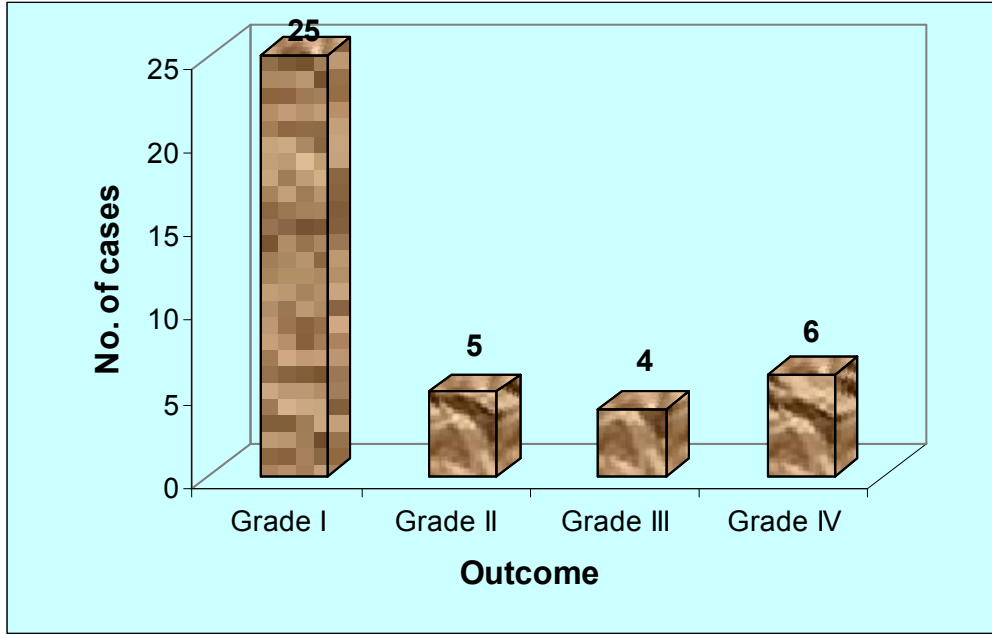


PLATE - 1



ADHESION BAND



ADHESION BAND

PLATE - 2



BOWEL TRANSECTION IN TRAUMA



TRAUMATIC JEJUNAL PERFORATION

PLATE - 3



CAECAL VOLVULUS



ILEO CAECAL KNOTTING

PLATE - 4



RESECTED GANGRENOUS BOWEL SEGMENT



**GANGRENOUS MECKELS DIVERTICULUM
WITH ILEAL GANGRENE**

PLATE - 5



JEJUNAL DIVERTICULUM



JEJUNO-JEJUNAL INTUSSUSCEPTION

PLATE - 6



RESECTED ENDS OF ILEUM



OBSTRUCTED INGUINAL HERNIA

PLATE - 7



MESENTRIC ISCHEMIA



ILEAL PERFORATION

DISCUSSION

In the study all the cases presented in the emergency department as acute abdomen with features of intestinal obstruction or peritonitis as non-traumatic causes (82.5%) and 7 cases (17.5%) presented with history of abdominal trauma resulting in serious bowel injury. Cases were taken up for surgery based on clinical and radiological findings. Base line investigations were same for all patients including random blood sugar, renal function test, ecg all leads, chest x-ray pa view and plane x ray abdomen erect. All abdominal trauma cases had undergone an ultrasound abdomen.

Disease Spectrum

- ✓ Among the 40 cases the commonest cause which resulted in bowel resection and anastomosis was obstructed hernia.
- ✓ 5 cases were obstructed incisional hernias – all were female patient who underwent total abdominal hysterectomy. 4 cases were obstructed inguinal hernias. 1 case was that of obstructed left sided femoral hernia.
- ✓ Next common pathology was adhesive intestinal obstruction-8 cases. Among that 7 cases the cause of obstruction was due to post operative adhesions. Only one case the adhesion was due to

congenital cause ,a band connecting umbilicus and Meckels diverticulum causing constriction resulting in ileal gangrene with gangrene of Meckels Diverticulum.

- ✓ 3rd most common presentation –resulted in bowel resection and anastomosis was abdominal trauma. In this study all cases of abdominal trauma belonged to blunt injury abdomen either due to road traffic accident or assault. On laparotomy the pathology was bowel transection, mesenteric injury causing bowel ischemia, bowel perforation.
- ✓ Another important cause that resulted in bowel gangrene was due to mesenteric ischemia. Most of the cases presents with doubtful clinical picture of peritonitis. Three cases presented with the clinical picture suggestive of mesentric ischemia.
- ✓ In this study 2 cases on laparotomy showed intussusception one was jejunojejunal and another one ileocolic.
- ✓ 2 cases with features of intestinal obstruction on laparotomy showed features of ileocaecal tuberculosis undergone limited resection-followed by ileotransverse anastomosis.
- ✓ The study also showed colonic growth as important cause of intestinal obstruction resulted in bowel resection. A case of Splenic flexure growth total colon was resected and ileo Sigmoid anastomosis done. Another case showed growth in ascending colon

Right hemicolectomy done followed by Ileotransverse anastomosis. Rare cases like ileocaecal knotting, carcinoma caecum, ileal stricture and multiple ileal perforation all resulted in bowel resection and anastomosis.

Area of bowel resected

Ileum was the most common part of the bowel underwent resection (55%). And the second most common part resected was jejunum (27.5%).

Limited resection involving ileum and caecum was done in four cases (10%). Right hemicolectomy done in two cases (5%). Entire colon followed by ileosigmoid anastomosis done in one case (2.5%).

Types of bowel Anastomosis

In this study most common anastomosis performed was of Ileoileal type (40%). followed by Ileocolic anastomosis (30%). Jejunojejunal anastomosis came about (27.5%) and Jejunocolic anastomosis came about (2.5%).

Among small bowel to large bowel anastomosis Ileotransverse anastomosis was the most common procedure done in this study (76.92%), followed by Ileosigmoid (7.7%), Ileocolic (7.7%) and Jejunocolic anastomosis (7.7%).

In this study end to end anastomosis was done in about 80% of cases end to side anastomosis was done in 20% of cases all were of Ileotransverse type.

Except for one case all others went in for a double layer closure of bowel-inner layer continuous with absorbable sutures using vicryl and outer layer interrupted using black silk. All patients who underwent resection and anastomosis received atleast one unit of blood transfusion.

Outcome

Majority (62.5%) of patients had an uneventful recovery .Minor morbidities like wound infection, post operative ileus and self limiting wound leak seen in 12.5% of cases.

Major morbidity occurred in 4 cases (10%) among which two cases of mesenteric ischemia with ileal gangrene underwent Ileoileal anastomosis and developed wound dehiscence for which relaparotomy done followed by ileostomy. Another case of multiple ileal perforation underwent Ileoileal anastomosis developed enterocutaneous fistula. A case of intestinal obstruction - ileal gangrene due to adhesion band also developed the enterocutaneous fistula.

Death occurred in 6 cases (15%). 3 cases expired on 3rd post operative day, all of them were on Mechanical ventilation as they could not be extubated due to poor general condition. 3 cases who underwent Ileocolic anastomosis went for anastamotic breakdown and sepsis died on 7th and 8th post operative days.

CONCLUSION

- ✓ In this study laparotomy was noticed as a major risk factor. It leads to intra abdominal adhesions resulting in bowel obstruction and gangrene and also incisional hernias leading to obstruction and gangrene.
- ✓ In suspected mesenteric ischemias an ileostomy is a preferred choice than an anastomosis.
- ✓ Emergency bowel anastomosis involving large bowel always bears a risk for anastamotic breakdown and sepsis.
- ✓ In patients presenting with poor general condition and gross faecal contamination of peritoneal cavity - primary anastomosis is not preferred, an ileostomy/colostomy is the choice.

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PROFORMA

NAME :

AGE :

SEX :

IP NO. :

I. PRESENTING FEATURES :

- A. ABDOMINAL PAIN
- B. VOMITTING
- C. CONSTIPATION
- D. OBSTIPATION
- E. ABDOMINAL DISTENSION
- F. ABDOMINAL TRAUMA

II. PAST HISTORY :

- A. H/O ANY SURGERY
- B. H/O OF TUBERCULOSIS

III. MENSTRUAL AND OBSTRETIC HISTORY

IV. FAMILY HISTORY

H/O TB	YES	NO
H/O MALIGNANCY	YES	NO

V. GENERAL EXAMINATION

PULSE RATE

BLOOD PRESSURE

SIGN OF DEHYDRATION

ANEMIA

FEVER

VI. ABDOMINAL EXAMINATION

- SURGICAL SCAR
- VGP + OR NOT
- ABDOMINAL DISTENTION
- TENDERNESS
- GAURDING
- RIGIDITY
- ANY MASS
- BOWEL SOUNDS
- PER RECTAL EXAMINATION
- HERNIAL ORIFICES
- P/V- EVIDENCE OF ANY GYNAECOLOGICAL MALIGNANCY

VII. EXAMINATION OF OTHER SYSTEM

CVS

RS

CNS

VIII. INVESTIGATIONS

RANDOM BLOOD SUGAR

BLD UREA

S.CREATININE

S.ELECTROLYTES

X-RAY ABDOMEN ERECT

CHEST X-RAY PA VIEW

USS ABDOMEN

IX. SURGERY UNDERGONE

X. INTRAOPERATIVE FINDINGS

1. PATHOLOGY
2. REASON FOR RESECTION OF BOWEL
3. PART OF BOWEL RESECTED
4. DETAILS OF BOWEL ANASTOMOSIS
5. AREAS ANASTOMOSED
6. DOUBLE LAYER / SINGLE LAYER
7. SUTURE MATERIAL USED
8. OMENTAL WRAPPING

XI. POST-OPERATIVE FOLLOW UP

1. BLOOD TRANSFUSION

2. COMPLICATION

GRADE 1

GRADE 2

GRADE 3

GRADE 4

MASTER CHART

S. No.	Name	Age	Sex	IP No.	Presented with	H/O Previous	Investigation		Details of Surgery (Intra OP)			Types of Anaestomosis			Outcome
					Clinical features of	Surgery	AXR	USG	Pathology	Area of Bowel Involved	Area of Bowel Resected	Bowels Anastomosed	E-E/E-S	SL/DL	Grade
1	Kaviyarasan	21	M	36900	IO	A	DBL MFL	-	AB-SBG	I	I	I-I	E-E	DL	I
2	Malarkodi	46	F	27921	IO	AH	DBL MFL	-	AB-SBG	I	I	I-TC	E-S	DL	I
3	Manimegalai	17	F	31216	IO	-	MFL	Target Sign +	INS	J	J	J-J	E-E	SL	I
4	Dhanamani	70	F	35612	OH (Incisional)	L	-	-	SBG	J	J	J-J	E-E	DL	I
5	Thankammal	53	F	11810	OH (Incisional)	AH	DBL	-	SBG	I	I	I-TC	E-S	DL	I
6	Vasugi	48	M	42761	IO	-	DBL	-	CAB (MD)	I	I	I-I	E-E	DL	I
7	Dhanapal	36	M	21620	P (AT)	-	-	FF	BT	I	I	I-I	E-E	DL	I
8	Perumal	72	M	42652	P (AT)	-	-	FF	BT	J	J	J-J	E-E	DL	II

9	Perumal	60	M	21167	(OH) Inguinal	-	MFL	-	SBG	J	J	J-J	E-E	DL	I
10	Suresh	20	M	32630	P (AT)	-	A D	FF	BT	J	J	J-J	E-E	DL	I
11	Abraham	50	M	24088	(OH) Inguinal	-	DBL	-	SBG	I	I	I-I	E-E	DL	I
12	Jeyalakshmi	68	F	2409	IO	AH	DBL MFL	-	SBG	I	I	I-I	E-E	DL	I
13	Jeyaman	35	F	8873	IO	AH	MFL	-	ICK	I	I	I-TC	E-S	DL	II
14	Selvam	45	M	2321	P (AT)	-	-	FF	SBG	I	I	I-I	E-E	DL	I
15	Kalidas	40	M	36124	P	L	DBL	-	MIGB	I	I	I-I	E-E	DL	III
16	Kaveriyammal	53	F	11810	OH (Incisional)	AH	DBL	-	SBG	I	I	I-TC	E-S	DL	I
17	Moorthy	58	M	21262	IO	-	DBL MFL	-	SFG	C	C	I-S	E-E	DL	IV
18	Malarkodi	41	F	34132	IO	L	DBL MFL	-	CG	I/CA	I/CA	I/AC	E-E	DL	IV
19	Saravanan	42	M	34317	P	-	-	-	MIGB	I	I	I-I	E-E	DL	III

20	Suresh	20	M	31111	IO	-	DBL MFL	DBL	ICTB	I/CA	I/CA	I-TC	E-S	DL	II
21	Sekhar	45	M	53107	(OH) Inguinal	-	MFL DBL	-	SBG	I/CA	I/CA	J-AC	E-E	DL	I
22	Valli	38	F	12401	OH (Incisional)	AH - 1 LSCS - 2	DBL	-	SBG	I	I	I-I	E-E	DL	I
23	Vishnu	13	M	38839	IO	L	DBL	-	IS	I	I	I-I	E-E	DL	I
24	Karuppayee	55	F	11067	IO	-	MFL	-	ACG	AC	RHC	I-TC	E-S	DL	IV
25	Ponnusamy	60	M	67780	P (AT)	-	-	FF	GB	I	I	I-T	E-S	DL	II
26	Sumithra	28	F	78595	IO	-	MFL DBL	-	INS	I	I	I-I	E-E	DL	I
27	Kaveriyammal	50	F	31861	OH (Incisional)	AH	DBL	-	IGBI	J	J	J-J	E-E	DL	I
28	Thanavel	40	M	32187	IO	L - 2	DBL MFL	-	AB - SBG	J	J	J-J	E-E	DL	II
29	Mariyappan	70	M	16970	IO	-	DBL MFL	-	ICK GB	I	I	I-TC	E-S	DL	IV
30	Peiryasamy	60	M	39926	P (AT)	-	-	FF	PB	J	J	J-J	E-E	DL	I

31	Muniyammal	52	F	21896	OH (Femoral)	-	-	-	SBG	I	I	I-I	E-E	DL	I
32	Devarajan	60	M	23581	IO	L	MFL DBL	-	ABGB	J	J	J-J	E-E	DL	I
33	Santhosh	17	M	37210	P	-	A D	-	MBP	I	I	I-I	E-E	DL	III
34	Devaki	65	F	81625	IO	-	MFL DBL	-	CV	CIC	RHC	I-TC	E-S	DL	IV
35	Palanisamy	60	F	36656	IO	-	DBL	-	ICTB	IC	I/CA	I-TC	E-S	DL	I
36	Murali	25	M	44303	P	-	-	-	MIGB	I	I	I-I	E-E	DL	IV
37	Ranganathan	60	M	98617	P (AT)	-	DBL	-	SBG	J	J	J-J	E-E	DL	I
38	Mohan	38	M	38421	IO	-	DBL MFL	-	AB- SBG	I	I	I-I	E-E	DL	III
39	Subramani	29	M	58214	IO	-	DBL	-	MJD- IO	J	J	J-J	E-E	DL	I
40	Periyannan	56	M	62181	(OH) Inguinal	-	DBL	-	SBG	I	I	I-I	E-E	DL	I