A Dissertation on

‘’ A COMPARATIVE STUDY BETWEEN STAPLER AND HANDSEWN ANASTOMOSIS IN GASTROINTESTINAL SURGERIES IN COIMBATORE MEDICAL COLLEGE HOSPITAL COIMBATORE’’

Dissertation Submitted to

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CHENNAI- 600032

with partial fulfillment of the regulations

for the award of the degree of

M.S. GENERAL SURGERY

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Coimbatore Medical College

COIMBATORE, TAMILNADU, INDIA - 641 014

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DECLARATION

I Solemnly declare that the Dissertation titled **"A COMPARATIVE STUDY BETWEEN STAPLER AND HANDSEWN ANASTOMOSIS IN GASTROINTESTINAL SURGERIES IN COIMBATORE MEDICAL COLLEGE HOSPITAL COIMBATORE"** was done by me at Coimbatore Medical College during the academic year July 2016 – June 2017 under the guidance of **Prof. Dr.V.Elango, M.S.** this Dissertation is submitted to the Tamilnadu Dr.M.G.R Medical University towards the fulfillment of the requirement for the award of **M.S. Degree in General Surgery (Branch).**

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CERTIFICATE – II

This is to certify that this dissertation work titled **"A COMPARATIVE STUDY BETWEEN STAPLER AND HANDSEWN ANASTOMOSIS IN GASTROINTESTINAL SURGERIES IN COIMBATORE MEDICAL COLLEGE HOSPITAL COIMBATORE"** of the candidate **Dr.MAGESHWARAN.B** with registration Number **221511307** for the award of **M.S in the branch of General Surgery**, I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains 84 pages from introduction to conclusion and the result shows 10**% (Ten)** percentage of plagiarism in the dissertation.

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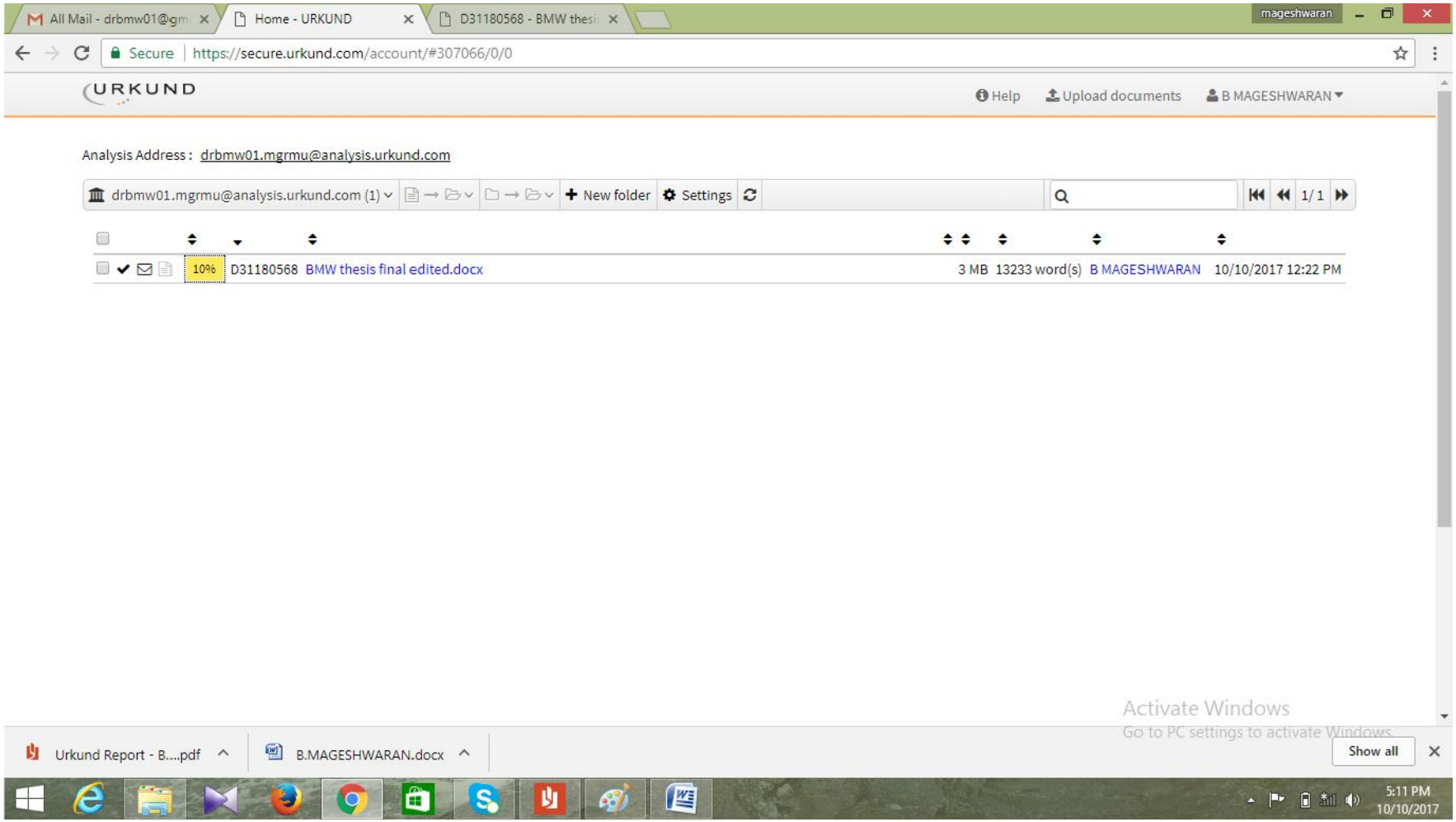
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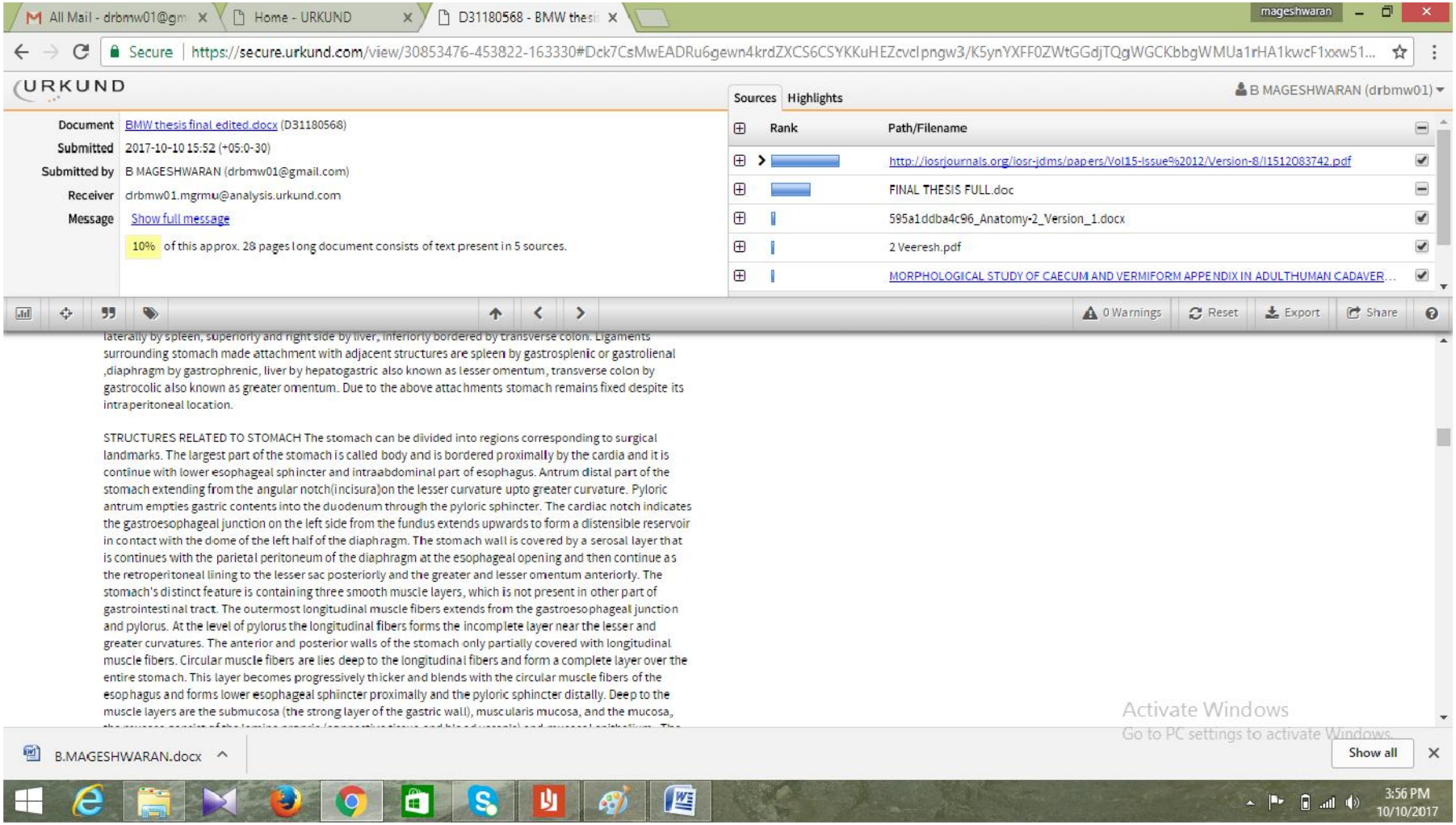
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laterally by spleen, superiorly and right side by liver, inferiorly bordered by transverse colon. Ligaments surrounding stomach made attachment with adjacent structures are spleen by gastrosplenic or gastrolienal ,diaphragm by gastrophrenic, liver by hepatogastric also known as lesser omentum, transverse colon by gastrocolic also known as greater omentum. Due to the above attachments stomach remains fixed despite its intraperitoneal location.
STRUCTURES RELATED TO STOMACH The stomach can be divided into regions corresponding to surgical landmarks. The largest part of the stomach is called body and is bordered proximally by the cardia and it is continue with lower esophageal sphincter and intraabdominal part of esophagus. Antrum distal part of the stomach extending from the angular notch(incisura)on the lesser curvature upto greater curvature. Pyloric antrum empties gastric contents into the duodenum through the pyloric sphincter. The cardiac notch indicates the gastroesophageal junction on the left side from the fundus extends upwards to form a distensible reservoir in contact with the dome of the left half of the diaphragm. The stomach wall is covered by a serosal layer that is continues with the parietal peritoneum of the diaphragm at the esophageal opening and then continue as the retroperitoneal lining to the lesser sac posteriorly and the greater and lesser omentum anteriorly. The stomach's distinct feature is containing three smooth muscle layers, which is not present in other part of gastrointestinal tract. The outermost longitudinal muscle fibers extends from the gastroesophageal junction and pylorus. At the level of pylorus the longitudinal fibers forms the incomplete layer near the lesser and greater curvatures. The anterior and posterior walls of the stomach only partially covered with longitudinal muscle fibers. Circular muscle fibers are lies deep to the longitudinal fibers and form a complete layer over the entire stomach. This layer becomes progressively thicker and blends with the circular muscle fibers of the esophagus and forms lower esophageal sphincter proximally and the pyloric sphincter distally. Deep to the muscle layers are the submucosa (the strong layer of the gastric wall), muscularis mucosa, and the mucosa,
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ABBREVATIONS

GIT-Gastro Intestinal tract

VIP-Visible intestinal peristalsis

VGP-Visible Gastric peristalsis

GJ-Gastro Jejunostomy

JJ-Jejuno jejunostomy

APR-Abdomino perineal resection

CAA-Colo anal anastomosis

OGD-Oesophago gastro duodenoscopy

CECT-Contrast Enhanced Computerised Tomography

LFT-Liver function test

PR-Per rectal

D.O.A-Date of admission

D.O.S-Date of surgery

D.O.D-Date of discharge

I.P.NO-In patient number

INTRODUCTION

Intestinal anastomosis is a procedure to create a communication between two blind ends of the intestine. This procedure is useful to restore the intestinal continuity after the excision of pathological conditions like carcinoma ,gangrene of the affected bowel. Intestinal anastomosis is a very common procedure done in both elective and emergency surgical conditions, whenever removal or resection of the tumors of the gastrointestinal tract, which includes benign and malignant tumors. Intestinal anastomosis can be done by two methods:

1.Hand-sewn technique by using suture materials either absorbable or non-absorbable sutures.

2.Mechanical stapling devices or biological glues. Hand-sewn technique is the commonly used method. The newer technique by stapling devices for intestinal anastomosis has given a alternate to faster the anastomosis.The main disadvantage is increased cost of device and need experience for procedure. The choice of anastomotic technique is decided by operating surgeon, by accessibility or site, edema and diameter of the bowel ends, time availability and equipment availability, contamination of the wound and involving pathological conditions. So the type of anastomotic technique decided by operating surgeon which depends on individual surgeon experience and personal priority .A successful anastomosis

need a accurate union of two viable bowel ends without any tension. Complications of the anastomosis are local and general. Local complications are wound infection, fistula due to anastomotic leak.General complications are lower respiratory tract infection, urinary tract infection. Failure of the anastomosis is associated with considerable postoperative morbidity and mortality. For accurate successful anastomosis, the following factors to be considered, meticulous technique, Tension free anastomosis, maintaining good tissue vascularity, perioperative nutritional optimization and effective management of systemic diseases, postoprative management of medical co-morbidities like diabetesmellitus, systemic hypertension, coronary artery disease, and Avoidance of certain drugs such as steroids and vasopressors. Surgical staplers have been there since the early 20th century, Surgical stapling devices were first introduced by Hültl in 1908; but they are not used for routine procedures until 40 years back, when their design became much more convenient and efficient. But today, staplers are an integral part of most major abdominal resection and anastomosis operations. This study has been done for comparing the advantages of staplers over conventional handsewn anastomosis in respect of following factors: 1.Time taken for surgery2.Post operative duration for appearance of bowel sounds and starting of oral feeds,3. Post operative hospital stay,4.Complications of surgery like anastomotic leak,wound infections,wound gapping etc.

AIM OF THE STUDY

1. To compare the handsewn anastomosis and stapler anastomosis techniques.

2. To compare the time duration of surgery, hospital stay, duration of restoration of bowel functions and postoperative morbidity.

REVIEW OF LITERATURE

METHODS OF HANDSEWN SUTURING

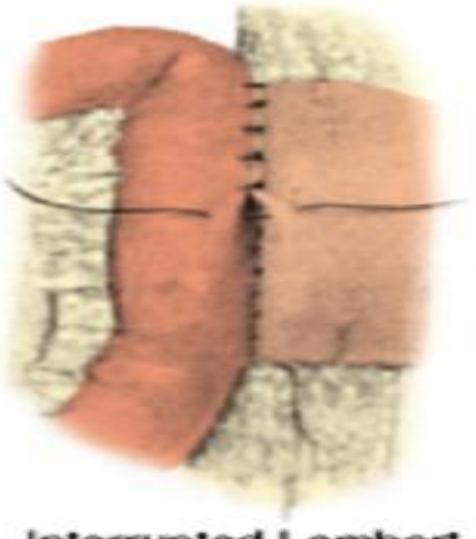
Suture lines can be created either in a simple (interrupted) or continuous running manner. The advantage of a continuous suture is that the suture line is more watertight with the disadvantage of the integrity of the entire suture line is based on one stitch. Hemostasis is also improved with a continuous suture with the converse effect being that continuous suturing may constrict anastomotic blood flow leading to ischemia and anastomotic dehiscence.

ANASTOMOSIS PRINCIPLES

The anastomosis must be watertight and must have mucosal apposition; the submucosa must be included into the closure; and care must be taken not to strangulate or instrument the edges of the bowel during closure in order to avoid stricture or necrosis and subsequent anastomotic leakage. A lack of tension, or distraction, on suture lines is a must.

LEMBERT SUTURE

Continuous Lembert



Interrupted Lembert

Lembert suture is the most commonly used suture in gastrointestinal surgery. It is used as the second layer of a two-layer bowel anastomosis and to repair seromuscular tears in the bowel wall. This stitch is started approximately 3 to 4 mm lateral to the incision and placed at a right angle to the long axis of the incision. It involves only the seromuscular layer in continuous or interrupted manner.Material for a Lembert suture is either silk or PDS.

HORIZONTAL MATTRESS(HALSTED)

HALSTED

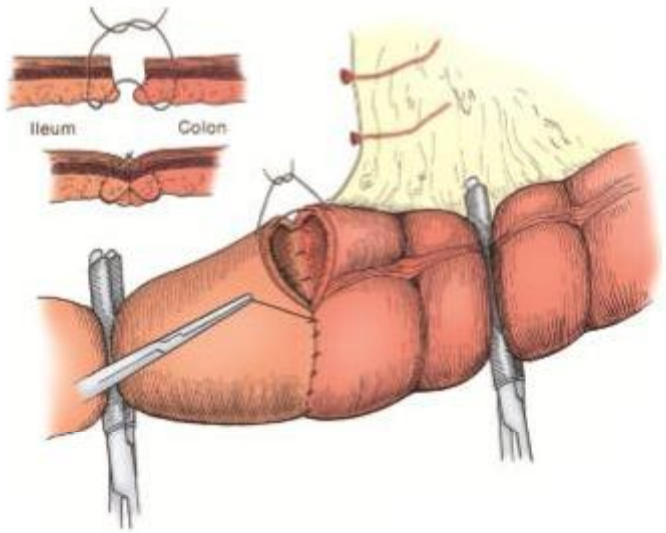
Horizontal Mattress Suture,is commonly used for seromuscular apposition in multilayer bowel anastomosis. This stitch is particularly useful in damaged, inflamed,or abnormal tissue where a Lembertsuture pulls through the tissue. The horizontal mattress stitch create a tension in a plane perpendicular to that of a Lembert suture and it causes good apposition of tissues with a less crushing effect on them.

CONNELL SUTURE

It is a full-thickness, continuous ,inverted,full thickness suture . It usually serves as an inner layer of a two-layer anastomosis. The suture is started at the edge of the anastomosis and brought full thickness, from inside to out on one side and then outside to in on the opposite side. The suture is tied so that the knot is inside the lumen. The suture is then passed through the tissues from inside to out on one side to begin the Connell stitch. On the other limb of the anastomosis the suture is driven through the tissues, full thickness, from outside to in. On the inside of the bowel lumen the stitch is

advanced 2 to 3 mm along the wall and then driven through the bowel wall from inside to out on the same side. With the suture now on the outside of the bowel, the next pass is performed on the opposite side in an identical manner. This forms a U-shaped, full-thickness, running inverted suture line. Commonly chromic or Vicryl are used.

GAMBEE SUTURE



The Gambee suture is an interrupted, full thickness, single layer suture that inverts the mucosa into the lumen . The suture is brought full-thickness from outside to in and then passed back through the mucosa to exit through the submucosal layer on the same side. It is then passed from the submucosa through the mucosa on the opposite limb. The final pass is a full-thickness one from inside to out on this side. The suture is tied extraluminally. This creates a full-thickness, inverting suture line. Absorbable sutures are typically used for this type of anastomosis.

Inverted Versus Everted Intestinal Anastomosis

The majority of hand-sewn anastomoses are currently performed in an inverting fashion in either one or two layers. In 1956, Gambee et al published a 156-patient series of various large bowel anastomoses in which they used a single-layer, full-thickness, interrupted, inverting technique with silk suture. They reported five deaths as a result of anastomotic leaks with a mortality of 3%. The incidence of all anastomotic complications was 8.6%, with the majority being radiographic leaks that were not clinically evident.

In 1966, Getzen published a clinical series of 136 everted gastrointestinal anastomoses in which only one leak occurred (resulting in death).Getzen compared inverting and everting bowel anastomoses in a canine model.

In 293 anastomoses in dogs, there was no evidence of mucocele or fistula formation. Anastomotic edema was more pronounced in the everted group up to 21 days after surgery. The tensile strength of the inverted anastomosis was two-thirds that of the everted group up to 21 days after surgery. Anastomotic strength was comparable in the two groups after 21 days. There were no deaths attributable to everted mucosa.

The mode of intestinal healing is by primary intention. This is accomplished when the individual layers of the intestine reconnect at each side of the anastomosis. Of all layers, the submucosa is particularly important because it harbors fibroblasts that will produce the collagen that ultimately holds the anastomosis together. Inversion of the anastomosis

presents the ends of mucosa to the lumen where they are further degraded until the submucosa of one side is apposed to the submucosa on the other side. In an everted anastomosis, the exposed submucosa tends to become adherent to any surrounding structure thereby eliciting adhesions and delaying healing into a secondary intention process.

STAPLERS AND STAPLING TECHNIQUES

In 1826, Henroz first described a device made from two metal rings that would approximate two open ends of bowel and would then be excreted once anastomotic healing had taken place. He successfully tested the device on dogs. One of the first stapling devices used in humans was the Hültl stapler . This stapler was used to close the stomach during gastrectomies. The staplers now available cover a wide array of anastomoses to be performed via laparotomy or laparoscopically. Modern-day staplers deliver staples of various staple height. A vascular stapler has a closed staple length of 1 mm. Tissue staplers have “blue” cartridges and “green” cartridges that are used for thin tissues and thick tissues, respectively.

The closed staple length of a “blue” stapler is 1.5 mm is used for small bowel, colon, and esophagus. The closed staple length of a “green” stapler is 2 mm is used for thicker tissues like stomach or rectum. Some staplers create staple heights within a “firing” range at the point the surgeon believes appropriate, depending on the force used in the approximation of tissues. Tissue staplers deliver two staggered rows of staples on each side of the

divided bowel, whereas vascular staplers deliver three staggered rows of staples on each side and are used to divide large-caliber vessels while maintaining hemostasis.

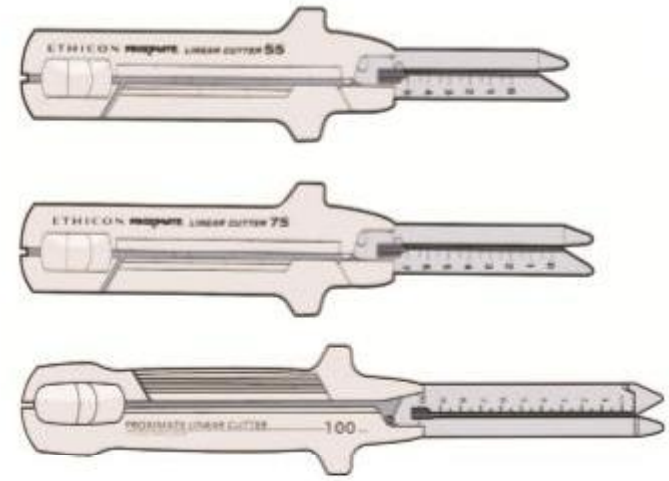
TYPES OF STAPLERS

LINEAR NON-CUTTING STAPLERS

Linear non-cutting staplers deliver a double staggered row of staples (e.g., thoracoabdominal [TA] staplers). They are used for closure of a hollow viscus, such as the common enterotomy in a side-to-side bowel anastomosis, closure of gastrotomies, and division of large vessels. Staple length varies and they can be articulating and nonarticulating.

LINEAR CUTTING STAPLERS

Linear cutting staplers both transect and close hollow viscera by delivering two double-staggered rows of staple lines and deploying a knife to divide the tissue between the staple lines .



They are used for the formation of enteroenterostomies and gastroenterostomies, and the resection of solid organs, such as the liver or pancreas. Laparoscopic linear cutting staplers come in different lengths but similar diameter (12 mm). The staple length varies and the instrument is available in both articulating and nonarticulating varieties.

CURVILINEAR CUTTING(CONTOUR) STAPLERS

Curvilinear cutting(contour) staplers are curved shape and have a two double-staggered staple lines and a knife to divide in between these lines.The staple length is fixed and the stapler is non-articulating. The contour stapler

offers an advantage in a transabdominal proctectomy or very-low anterior resection of the rectum as it is able to fit into the narrow confines of the pelvis.

CIRCULAR STAPLERS

Circular staplers (e.g., end-to-end anastomosis [EEA], intraluminal, and procedure for prolapse and hemorrhoid [PPH] staplers) are used for inverted end-to-end and end-to-side anastomoses.

TECHNIQUES AND PITFALLS IN SURGICAL STAPLING

A Functional End-to-End Anastomosis , first done in 1960s, by apposing the anti-mesenteric surfaces of two segments of bowel and placing one arm of the GIA stapler in each lumen and firing the stapler to create a common lumen. The lumen is examined and the staple line is checked for hemostasis; bleeding points along the staple line in the lumen may be controlled with fine suture. Should not use cautery because the current is transmitted along the staple line and cause harm to healthy tissue. The common enterotomy is grasped with allis clamps include the full thickness, and ensure that the serosa and muscularis do not slip under the staple after the stapler is approximated. A single firing of the TA stapler

is used to close the common enterotomy. Before firing, an important technical point is to ensure that both anterior and posterior termination of the GIA staple line are staggered to avoid the crossing of three staple lines. When multiple staple lines cross at the same point, the staples may not close properly, which could lead to anastomotic leakage.

The staple line that closes this common enterotomy is actually an everting one and may thus predispose to the formation of adhesions. This may be addressed by placing seromuscular sutures to cover the staple line. Alternatively, the common enterotomy may be closed in an inverting two-layer hand-sewn.n Hocking et al demonstrated in a canine model that creation of a functional end-to-end anastomosis alters small bowel motility to a greater degree than an end-to end anastomosis and that this may predispose to bacterial overgrowth. Even 2 years after surgery, only 50% of the myoelectrical impulses crossed the functional end-to-end anastomosis. Case reports have also shown that this dysmotility and bacterial overgrowth can lead to massive luminal dilation and subsequent volvulus.

STAPLED END-TO-END ANASTOMOSIS

This is performed with a circular stapler and is commonly used for the creation of a coloproctostomy, and used for gastroenterostomies and esophagogastrostomies also. In colorectal anastomosis, the proximal end of the two ends to be anastomosed is opened and EEA sizers are placed into the lumen to assess the size of the stapler to be used. Optimal size for these

anastomoses are either 29 or 31 mm because using a smaller size may predispose to anastomotic stricture. Care should be taken to avoid creating serosal or muscular tears in the colon. By administering intravenous glucagon, 1 mg smooth muscles will be relaxed to prevent tears in serosal or muscular layers. The anvil for the EEA is then placed into the open end of the colon and a monofilament purse-string suture is placed around the rod of the anvil and tied tightly around the rod. Alternatively, an automatic purse-string device may be used, although this may not consistently include the full thickness of the bowel end. Specialized clamps that allow for manual passage of a straight needle through the full thickness of the bowel wall resolve this issue. If there are any gaps in the purse-string suture, the staple line might be incomplete and a leak could ensue. A mattress suture may be placed around the rod to reinforce the purse-string suture. Care must be taken to dissect free any fat that may be incorporated into the staple lines because this may predispose the anastomosis to leakage. The blood supply should also not be too close to the ends for fear of intraluminal bleeding after the stapler is fired.

The stapling device is inserted into the rectum transanally. Contour of the rectum and sacrum should be maintained to avoid perforating the posterior wall of the rectum, and to avoid includes the urinary bladder or the vaginal wall in females. The stapler should be positioned at the upper end of the rectum ,so that the pin of the EEA comes out in the middle of the staple line

at the portion of rectum that has been cleaned rather than advancing the pin at any other point such as through the mesorectum. Once the pin is advanced, the anvil and stapler are engaged and the device is closed tightly.

HAND-SEWN VERSUS STAPLER BOWEL ANASTOMOSES

Beart and Kelly randomized 80 patients to hand-sewn versus stapled coloproctostomies and found no differences in postoperative complications. In a prospective multicenter randomized study, Docherty et al compared manually constructed and stapled colorectal anastomoses in 732 patients. Despite a significant increase in radiologic leak rates in the sutured group (14% vs. 5%), there was no difference in clinical anastomotic leak rates, morbidity, and postoperative mortality. Univariate analysis, correcting for tumor stage, demonstrated that the rate of tumor recurrence and cancer-specific mortality was higher in the sutured patients (7.5% and 6.5%, respectively) and in patients with anastomotic leaks. A meta analysis of 13 studies that examined manual versus stapled colon and rectal anastomoses found no differences in leak rate, morbidity, mortality, and cancer recurrence. It did, however, demonstrate a higher rate of intraoperative technical problems and a higher rate of anastomotic strictures after stapled anastomoses. This higher rate of stricture in stapled anastomoses is counterintuitive based on the fact that in animal models, the blood flow rate through stapled anastomoses is significantly higher than the flow rate through the standard two-layer or Gambee anastomoses. Another observation

in experimental animals is that stapled anastomoses tend to heal by secondary intention as compared with hand-sewn anastomoses which heal by primary intention. This is most noticeable in the functional end-to-end type. Leakage from this anastomosis tends to take place at its closure with the TA stapler and often occurs weeks after being created rather than typical first week. During reoperation, the anastomosis is found to be attached by the everted TA line to some raw surfaces of the laparotomy.

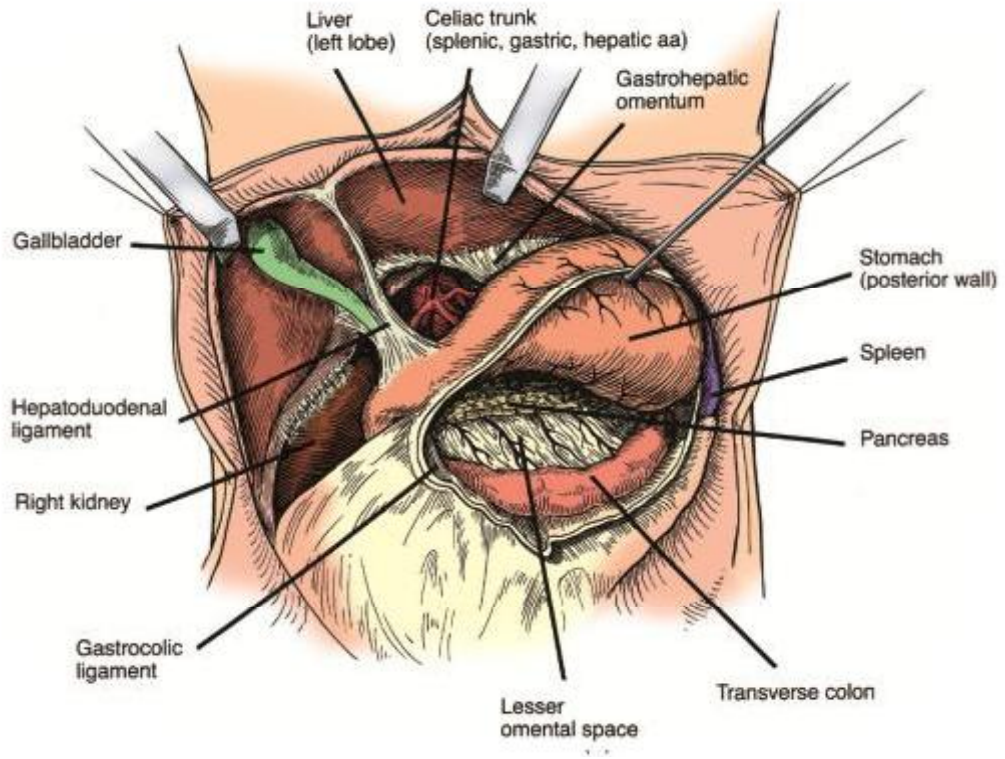
MICROSURGICAL ANASTOMOSIS

A new area of research is that of microsurgical anastomosis. This type of anastomosis would most closely approximate an exact end-to-end anastomosis. Hart et al hypothesized that by utilizing very fine filament suture material while operating under a microscope, the myoelectric propagation across transected bowel would be improved as compared to a standard two-layer anastomosis. In an experimental animal model, they indeed showed that propagation of pacesetter potentials was restored across a microsurgical anastomosis but not across a conventional one. There have not yet been any studies evaluating this method in humans, but it does merit further examination as this type of anastomosis may greatly diminish post transection bowel dysmotility and subsequent bacterial overgrowth.

ANATOMY OF THE STOMACH

The stomach located in upper abdomen below the diaphragm with the major part of it located to the left of the midline at the level of the first

lumbar vertebrae . Its relations are the pancreas posteriorly, laterally by spleen, superiorly and right side by liver, inferiorly bordered by transverse colon. Ligaments surrounding stomach made attachment with adjacent structures are spleen by gastrosplenic or gastrolienal ,diaphragm by gastrophrenic, liver by hepatogastric also known as lesser omentum, transverse colon by gastrocolic also known as greater omentum. Due to the above attachments stomach remains fixed despite its intraperitoneal location.

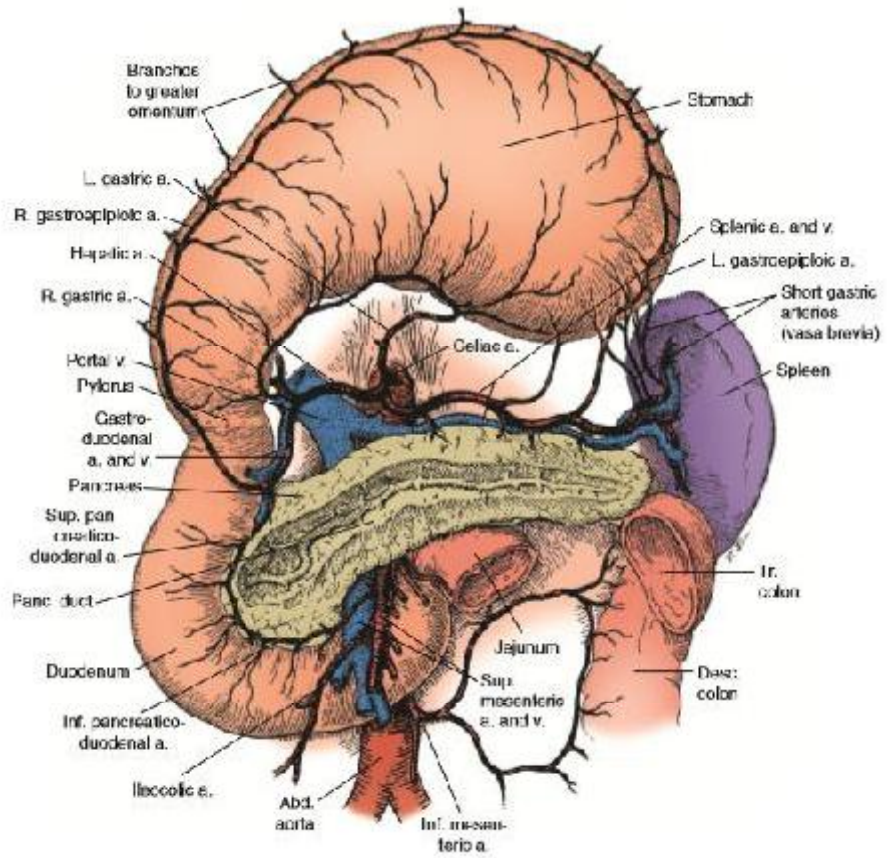


STRUCTURES RELATED TO STOMACH

The stomach can be divided into regions corresponding to surgical landmarks. The largest part of the stomach is called body and is bordered proximally by the cardia and it is continue with lower esophageal sphincter and intraabdominal part of esophagus. Antrum distal part of the stomach

extending from the angular notch(incisura)on the lesser curvature upto greater curvature. Pyloric antrum empties gastric contents into the duodenum through the pyloric sphincter. The cardiac notch indicates the gastroesophageal junction on the left side from the fundus extends upwards to form a distensible reservoir in contact with the dome of the left half of the diaphragm. The stomach wall is covered by a serosal layer that is continues with the parietal peritoneum of the diaphragm at the esophageal opening and then continue as the retroperitoneal lining to the lesser sac posteriorly and the greater and lesser omentum anteriorly. The stomach's distinct feature is containing three smooth muscle layers, which is not present in other part of gastrointestinal tract. The outermost longitudinal muscle fibers extends from the gastroesophageal junction and pylorus. At the level of pylorus the longitudinal fibers forms the incomplete layer near the lesser and greater curvatures. The anterior and posterior walls of the stomach only partially covered with longitudinal muscle fibers. Circular muscle fibers are lies deep to the longitudinal fibers and form a complete layer over the entire stomach. This layer becomes progressively thicker and blends with the circular muscle fibers of the esophagus and forms lower esophageal sphincter proximally and the pyloric sphincter distally. Deep to the muscle layers are the submucosa (the strong layer of the gastric wall), muscularis mucosa, and the mucosa, the mucosa consist of the lamina propria (connective tissue and blood vessels) and mucosal epithelium . The mucosal surface is containing the folds termed as rugae which increase the surface area of the stomach

and there by allowing the stomach to expand for accommodate meals. The mucosa of the body and fundus is rich in acid-secreting oxyntic glands . Oxyntic glands are oriented in columns and contain surface epithelial cells, mucous cells, parietal cells, zymogenic (chief) cells, and enterochromaffin-like (ECL) cells. The main products of the parietal and chief cells are hydrochloric acid in the former and intrinsic factor and pepsinogen in the later. Histamine is a substance which is secreted by ECL cells, a powerful stimulus for parietal cell acid production. Antral mucosa is distinct from fundus/body mucosa by producing greater amount of gastrin but lesser amount of acid.

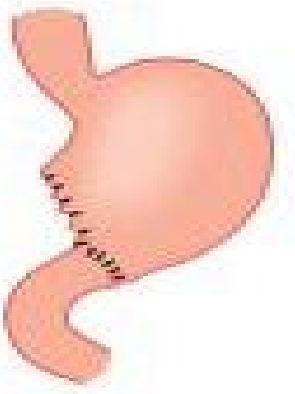


BLOOD SUPPLY OF FOREGUT

The vascular supply of the stomach is formed by multiple anastomosing arcades arising from the branches of the celiac trunk. Because of this high vascularity , it is uncommon for the stomach to become ischemic. The lesser curvature supplied by left gastric artery, a direct branch of the celiac trunk, and the right gastric artery. The smaller right gastric artery commonly origin from the common hepatic artery. The greater curvature is supplied by the right and left gastroepiploic arteries and the short gastric arteries . Venous drainage of the stomach similar as arterial supply with right and left gastric, right and left gastroepiploic, and short gastric veins emptying into the portal vein directly (through right and left gastric veins or through the superior mesenteric vein (right gastroepiploic) or splenic vein (left gastroepiploic, short gastrics). Gastric lymphatic drainage is similarly rich and complex. Gastric carcinoma may spread diffusely within the lymphatics to multiple draining lymph node regions like splenic hilum, pyloric nodes,along lesser curve and esophageogastric junction. All lymph drainage of the stomach ends at the celiac lymph nodes and which empties into the cysterna chyli and thoracic duct. The stomach receives input from both the sympathetic and parasympathetic nervous systems and also originates afferent fibers of the enteric nervous system (ENS) , it is recognized that it contains as many neurons as the spinal cord and can function autonomously.

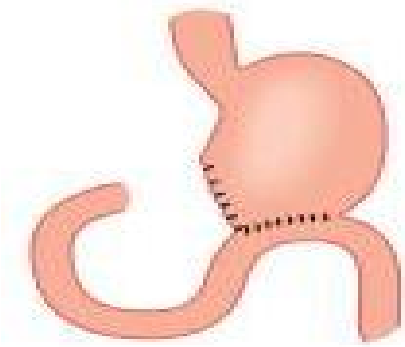
GASTRIC RESECTION PROCEDURES

The subtotal gastrectomy was employed for the treatment of duodenal ulcer disease in the past but today it is most commonly done for distal gastric malignancies and duodenal ulcers. The most common gastric resection performed for intractable duodenal ulcer is antrectomy (40% distal gastrectomy) with a Truncal or Selective Vagotomy. The purpose of vagotomy and antrectomy is to abolish the cholinergic and gastrin stimulus for acid secretion. By vagotomy and antrectomy basal acid secretion is decreased by 80%. After resection of antrum gastrointestinal continuity retained by various types anastomosis. The remaining gastric end is anastomosed with duodenum by billroth type 1 anastomosis,



Billroth I

or after closing the duodenal stump ,remaining gastric end anastomosed with jejunum at the level distal to ligament of treitz.



Billroth II

Advantages of Billroth I anastomosis:1.Restorage of normal gastrointestinal motility, 2.Leave the duodenal mucosa next to the gastric mucosa ,3.Avoiding problems with an afferent and efferent limb 4.Easy accesibility for upper oesophagogastroduodenoscopy and endoscopic retrograde cholangiopancreatography (ERCP),5.Decreased incidence of gastric cancer in the remnant of stomach.All these factors are only theoretical, no other functional differences have been demonstrated between these anastomosis. Although Some studies shows a higher fecal fat loss following a Billroth II anastomosis , but this is seems to be less significance. The cancer risk is high in billroth 2 compare with billroth 1. The type of anastomosis depends upon duodenal scarring, Easy to bring together remnant of stomach and duodenum for anastomosis. Both type of Billroth anastomosis can lead to bile reflux, which can produce disabling symptoms. To prevent these complications, some surgeons prefer to do Roux-en-Y anastomosis.Roux en Y type anastomosis have better patient satisfaction and better endoscopic appearance of the esophagus and the gastric remnant.

Billroth 2 has lesser incidence of bile reflex but disadvantage of staple line dehescence leads to alkaline gastritis.

GASTROJEJUNOSTOMY

Gastrojejunostomy was first done as alone in 1881 and was faced by two problems: vomiting due to kinking of excess jejunal afferent length, ulcers due to nonperformance of the vagotomy. These problems were solved by doing vagotomy and anastomosis of a shorter jejunum as afferent loop. Gastrojejunostomy is most commonly performed along with vagotomy, gastrojejunostomy mostly done as retrocolic technique.

COMPLICATIONS OF POSTGASTRECTOMY SURGERIES

After surgery on the stomach, many of chronic problems may develop. All these symptoms collectively called as post gastrectomy syndromes. All the patients change their food habits and 20% of people affected by this

problem. 5% of them develop lifetime symptoms,1% develop significantly debilitated problems.

EARLY SATIETY

Early satiety is due to postsurgical atony, gastric stasis due to denervation, and may be due to small gastric remnant syndrome following gastric resection. Symptoms are of epigastric fullness followed by vomiting. These symptoms improved by prokinetic drugs examples are metoclopramide and erythromycin. Small gastric remnant syndrome improve by small frequent meals.

POST VAGOTOMY DIARRHEA

Postvagotomy diarrhea due to rapid passage of unconjugated bile salts from the denervated biliary tract drain into the large bowel and these bile salts stimulate secretion. Most patients are self limiting; oral cholestyramine effective for these patients.

DUMPING SYNDROME

Dumping syndrome has two types early and late dumping ,Early dumping due to high carbohydrate meal which is hyper osmolar in nature and causes absorption of fluids in to the bowel leads to nausea, epigastric distention, cramps, diarrhea, and palpitations. This condition is prevented by avoidance of and such aggravating foods and by small frequent food with low carbohydrate. For Refractory patients octreotide may be useful. Late Dumping develops after 2 to 3 hrs of food intake , reactive hypoglycemia

due to excess insulin release. So late dumping is relieved by administration of sugar.

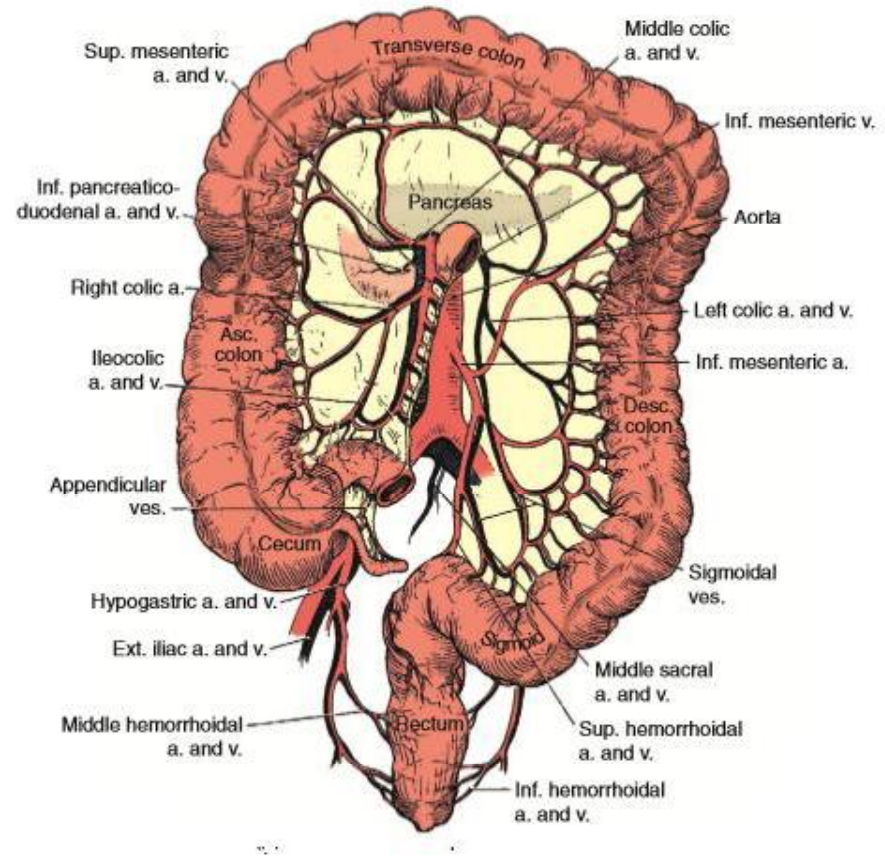
ALKALINE REFLUX GASTRITIS

This is due to reflux of bile into the stomach is common. Only 2% of patients develop alkaline reflux gastritis, symptoms of persistent burning epigastric pain and chronic nausea that is aggravated by meals. ursodeoxycholic acid may be useful. In severe cases, drainage procedure like Roux-en-Y anastomosis is useful.

AFFERENT AND EFFERENT LOOP SYNDROME

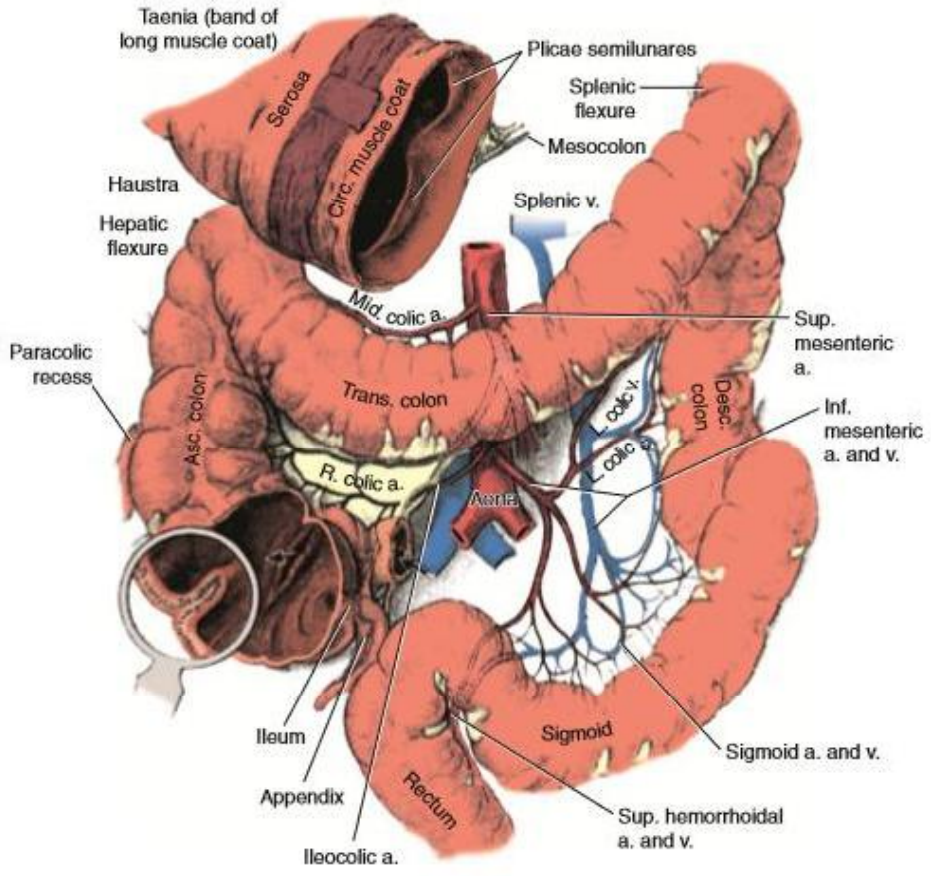
They are due to mechanical obstruction of the limbs by kinking, anastomotic narrowing, or adhesions. Symptoms are postprandial epigastric pain and nonbilious vomiting that is then relieved by projectile bilious vomiting.

ANATOMY OF THE COLON



The colon extends from the terminal ileum to the sigmoid colon. It contains cecum, ascending colon, transverse colon, descending colon, and sigmoid colon. Colon along with the rectum and anus called as large intestine. The colon situated in the peritoneal cavity .The splenic flexure generally lies higher than the hepatic flexure, this is appreciated in barium enema. The ascending and descending colons are situated retroperitoneally but the transverse and sigmoid colons have mesentries. The colonic length is 150 cm, but it varies from 120 and 200 cm . The maximum diameter of the colon is at caecum the range of 7.5 with minimum diameter is at the level of rectosigmoid region of around 2.5cm.In general women's colon has a longer than

men and have a longer transverse colon. Colonoscopy is more difficult to perform in female than in male and also difficult to perform in western than asian peoples. The transverse colon lies below the umbilicus in 10% of women. Distinctive features of the colon help to differentiate it from the small bowel:1.The presence of taeniae coli, 2.The presence of haustra coli, 3. The fatty appendices epiploicae.



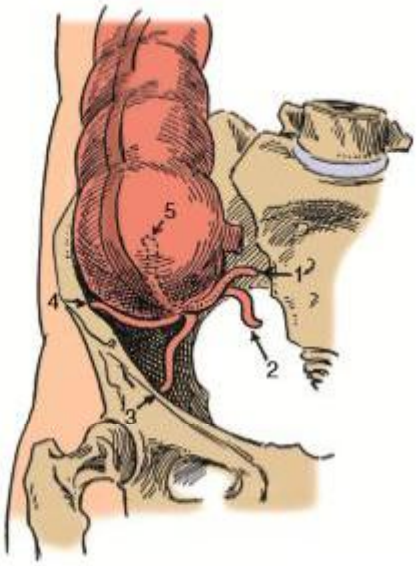
The taeniae coli is the three bundles formed by condensations of the longitudinal muscular layer of the large bowel . The taeniae has 6 cm breath which extends from the tip of the cecum to the rectosigmoid junction. The taeniae are shorter than the length of the bowel wall, thereby causing the circular muscle layer become puckered, leads to

formation of the haustra , which gives saccular appearance of the colon. Except the appendix and cecum, most of the colon contains, the peritoneum covered adipose tissue known as appendices epiploicae. They are elongated, pedunculated, and they are absent in the rectum.

SURFACE ANATOMY

The surface projection of the cecum is bounded by the right lateral plane, the transtubercular plane, and the inguinal ligament. From the caecum , the ascending colon ascends up to the right of the lateral plane until the hepatic flexure, it is the point which lies between the subcostal and transpyloric planes. At hepatic flexure , the ascending colon meets the transverse colon, which down towards the umbilicus then ascends upwards and to the left at splenic flexure . The transverse colon may show difference in length within the individual according to posture change. The descending colon then passes downwards up to the inguinal ligament in the lateral plane, then it continues as the sigmoid colon. Surface projections of the sigmoid colon are variable due to its length, distention and movement on its mesocolon.

ANATOMY OF CAECUM



The cecum is the starting portion of the large intestine and it is located below a transverse line which is passing above the level of ileocecal valve. Vermiform appendix, ileum and ascending colon all are continuous with the cecum. Iliacus and psoas major muscles lie posterior to caecum and cutaneous nerve of the thigh lies laterally. The small bowel and greater omentum lie between the anterior abdominal wall and caecum. Caecum is covered by peritonium all around except in its superior part of posterior surface. Caecum is mobile and it has short mesocaecum mobility of which leads to twisting of caecum along with the mesentric axis of mesocecum and thereby causing cecal valvulus or hernia through the right inguinal canal . The tenderness due to acute appendicitis may be felt over caecum if it has a long mesocecum. The ileocaecal junction has many peritoneal folds and recesses. Anterior

cecal artery lies near to the superior ileocecal fold where caecum extends as a mesenteric appendage anteriorly and covers the superior ileocecal recess. The inferior ileocecal fold called as bloodless fold of treves because it does not contain blood vessels. Endoscopically viewed lowest haustrum of the caecum is called fundus of caecum ,it contains appendiceal orifice. Visualisation of the appendiceal orifice is the indicator of complete colonoscopic exploration by colonoscopy. Appendiceal orifice is covered by a mucosal fold is called gerlach's valve. Ileocecal valve is endoscopically viewed another part and it has two lips 1. the ileocolic, or superior lip,2. the ileocecal, or inferior lip.

ILEOCECAL VALVE

The ileocecal valve is formed by continuation of circular and longitudinal muscle fibers of the terminal ileum and it lies posteromedially at the junction of caecum and ascending colon. This valve acts as a terminal ileal sphincter and prevents reflux of cecal contents into the ileum and and also prevents small intestinal contents passing rapidly into the cecum. An competent ileocecal valve with a colonic obstruction will leads to a closed loop obstruction, which results in perforation of the colon if surgically not intervened. Barium enema studies have shown that the ileocecal valve is frequently incompetent in persons without any disease.

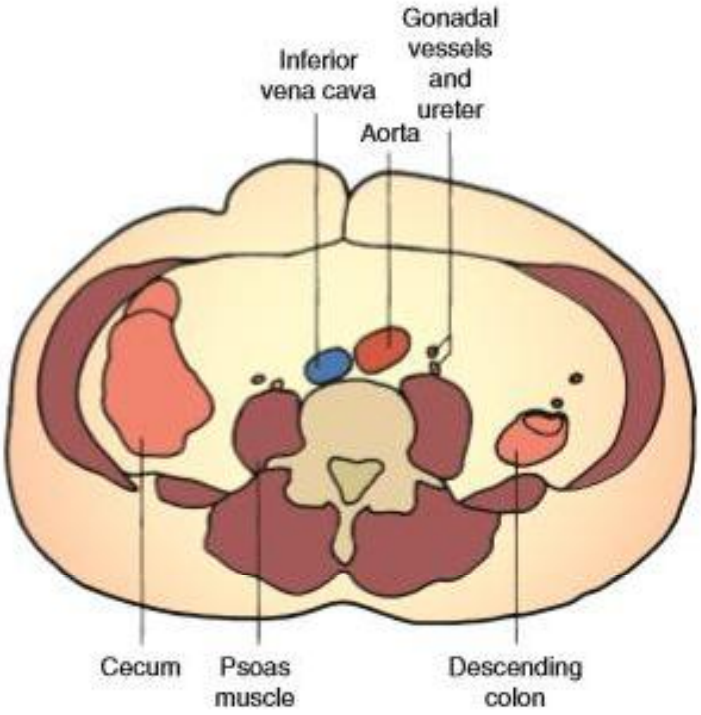
VERMIFORM APPENDIX

The vermiform appendix is a blind ending tube opening into cecum through the appendiceal orifice , below and behind the ileocecal valve. The appendix base is formed by the union of three taenia coli formed by longitudinal muscular layer. Appendix length is varies from 2 to 20 cm. The appendix lumen is wide in infants, it gradually narrows throughout life. The appendix usually origin from the posteromedial wall of the cecum 2 cm below the end of the ileum. The position of the appendix base is constant, but the appendix may occupy one of the following positions:1. Anterior to the terminal ileum(preileal), 2. Posterior to the terminal ileum (postileal), 3. Descending in the pelvis (pelvic/descending) 4. Below the cecum (subcecal)5.Retrocecum behind the cecum. Most common site of appendicitis is retrocecal or retrocolic around 65% .McBurney's point is the landmark for the appendix base, it is located at medial two third and lateral one third junction of the spinoumbilical line. The appendix supplied by appendicular artery a branch of ileo colic artery, which passes through the meso appendix.

ASCENDING COLON

The ascending colon lies over quadratus lumborum and transversus abdominis muscle and lies over right side of the abdominal cavity. Its length around 12 to 20 cms, it is continuation of the cecum extends upto the hepatic flexure. The ascending colon ascends upto the inferior surface of the right lobe of the liver. It then courses downwards,

forwards, and to the left side, then it forms the hepatic flexure. The muscles lie posterior to ascending colon are iliacus, iliolumbar ligament, quadratus lumborum, the origin of the transversus abdominis, the perirenal fat, and Gerota fascia anterior to the inferolateral part of the right kidney, and the ilioinguinal and iliohypogastric nerves.The right ureter and gonadal vessels, were lies posterior to the ascending colon.



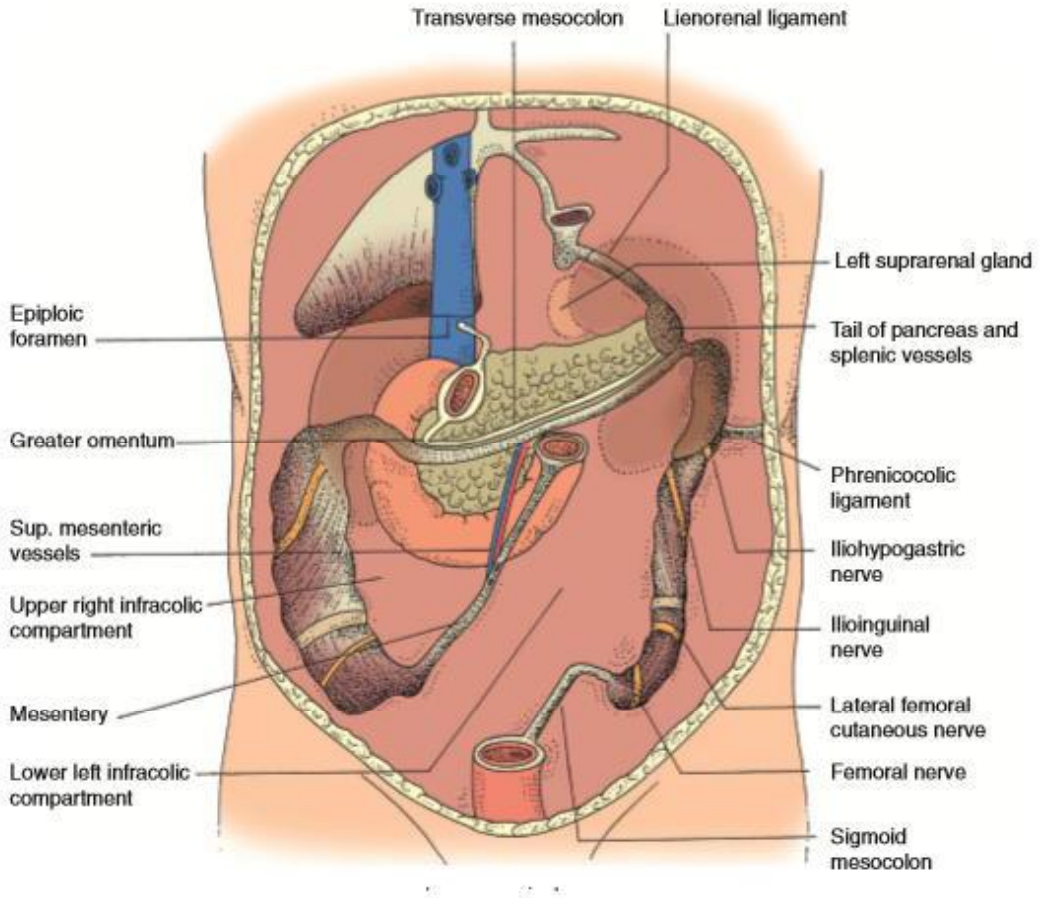
POSTERIOR RELATIONS OF ASCENDING COLON

The small intestine and the right edge of the greater omentum are lying anterior to ascending colon. The ascending colon is covered posteriorly by aereolar tissue to the posterior abdominal wall. The ascending colon adherent to the gallbladder, and lies over inferior border of the liver, it turns left at the hepatic flexure . The hepatic flexure lies just above the second part of the duodenum, and it is sometimes attached with

duodenum by a peritoneal fold called as duodenocolic ligament. The hepatic flexure is in direct contact with the inferolateral part of the right kidney posteriorly. The hepatic flexure is vertical and moves with respiration around 2.5 to 7.5cms.

TRANSVERSE COLON

This is about 50 cm long, origin at the hepatic flexure and passes over the left upper quadrant, and it curves acutely more than hepatic flexure, course downwards and backwards, and continues as the splenic flexure.



POSTERIOR RELATIONS OF TRANSVERSE COLON

The transverse colon is flexible more because have a long mesentry attachment with posterior abdominal wall, and is completely covered with peritoneum between the head of the pancreas and splenic flexure.

The transverse mesocolon (root)lies anteriorly up to the lower pole of the right kidney and it extends over the second part of the duodenum, and pancreas; and, over the hilum of the left kidney. Supramesocolic compartment seperated from inframesocolic compartments by transverse colon, and it is the important surgically. This part of the abdominal cavity acts as a natural barrier to prevent the infections between these two regions. The duodenojejunal junction located at the level of ligament of Treitz , and it is just inferior to the root of the transverse mesocolon. The greater omentum covers the transverse colon full length and also contains the gastrocolic ligament, which connect the greater curvature of the stomach and the transverse colon. Usually this part is dissected in cases of transverse colectomy and to access the lesser sac. The transverse colon is on right side posteriorly descends in front of the descending part of the duodenum and pancreatic head , it is separated by aereolar tissue. Superiorly, it is related to the liver and gallbladder, and the greater curvature of the stomach, and the lateral part of the spleen. It is covered on its anterior surface with the posterior layers of the greater omentum to which it is attached. The transverse colon continues as the descending colon at the level of splenic flexure. Superior to the splenic flexure is the lower part

of the spleen and the tail of the pancreas, whereas the anterior aspect of the left kidney lies medially. The splenic flexure is join to the diaphragm by the phrenicocolic ligament, at 10th and 11th ribs, and splenic flexure lies higher than the hepatic flexure. Due to flimsy adhesions to the lower pole of the spleen, splenic flexure becomes a fixed bowel segment . So spleen is the risk of damage when splenic flexure seperated during surgery.

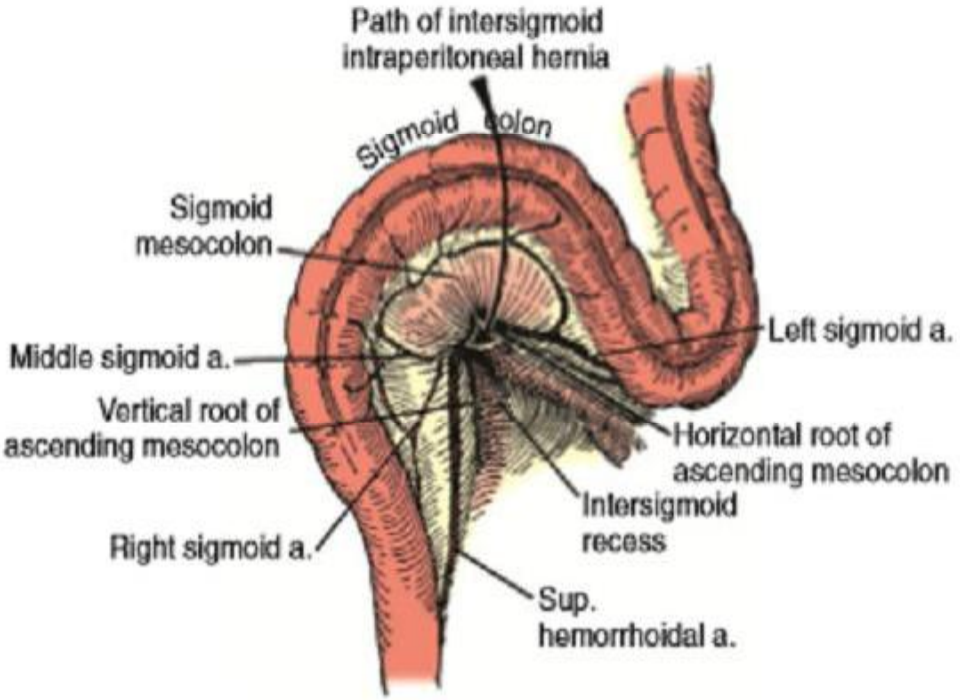
DESCENDING COLON

The descending colon length is around 25 cm and it extends from the splenic flexure, descends downwards to the pelvic brim. From the lateral border of the left kidney, it descends vertically between the psoas and the quadratus lumborum to the iliac crest. Then it turns medially over the iliacus and psoas major muscle and continues as the sigmoid colon. It is covered by peritoneum over its anterior surface and sides, and it is fixed on the posterior peritoneum by the white line of Toldt fascia. This line is important surgical plane for a bloodless dissection of the descending colon. The following structures located posterior to descending colon are the lower part of the left kidney, the transversus abdominis muscle origin, the quadratus lumborum, the iliacus and psoas major, the subcostal neurovascular structures, the iliohypogastric and ilioinguinal nerves, the 4th lumbar artery, cutaneous nerves, the gonadal vessels, and the external iliac artery.

Anteriorly it is related to small intestine, and the anterior abdominal wall at its lower part. The descending colon is both narrower and more deeper than the ascending colon, and it is located posterolaterally in young women.

SIGMOID COLON

The sigmoid colon is around 40 cm length and arises at the pelvic brim and forms a loop. The sigmoid colon varies in its course, and its length, position, and fixation . The border between the sigmoid colon and rectum is variable. Some consider at the level of the third sacral vertebra, some authors use the sacral promontory as the landmark.



The sigmoid loop contains the following parts: 1. Descending in

contact with the left pelvic wall 2. Sigmoid loop Crosses the pelvic cavity between rectum and bladder (or uterus), by that it reaches the right pelvic wall 3. Runs backwards and reach the median plane .The sigmoid colon is fully covered by the peritoneum, which leads to the formation of the sigmoid mesocolon . The sigmoid mesocolon is inverted V-shaped structure, extending from the left iliac fossa to the pelvic brim and then course across the left sacroiliac joint at the 2nd or 3rd sacral space, and the apex of the "V"lies at the bifurcation of the common iliac vessels over the sacroiliac joint . The left ureter situated between the peritoneum and common iliac artery at this point and it is an important landmark for the identification of V structure. The mesocolon is greatest in length at its center and decreases in length towards the end of the loop, so that the sigmoid colon is relatively fixed at its junctions with the descending colon and rectum. Sigmoid volvulus is common in patients with long mesocolon and short base , and a long convoluted sigmoid colon is the reason for constipation . The lateral limb of the mesocolon passes forward over the pelvic brim through the midway to the inguinal ligament. The medial limb runs downwards into the sacrum, where it lies over the median plane at the level of the 3rd sacral vertebra. Sigmoid colon posteriorly related to the left internal iliac vessels, the ureter, the piriformis muscle , and the sacral plexus. Laterally, related to the following structures: 1. left external iliac vessels,2. the obturator nerve,3. the ovary in females and ductus

deferens in males, 4. the lateral pelvic wall. The inferior relationship formed by bladder in male and uterus in females. Small intestine lies superior and medial to the sigmoid colon. The junction between the sigmoid colon and rectum is called rectosigmoid junction, and it has the following important features: 1. The large intestine diameter becomes shrunken. 2.lack of full peritoneal covering. 3. True mesentery is absent. 4. The three taeniae coli of the sigmoid become continuous as longitudinal muscle coat of the rectum. 5. The appendices epiploicae is absent. 6. Endoscopically, an acute angle is formed at the level of the rectosigmoid junction and the rectal mucosa, which is flat and smooth, but the mucosa of the sigmoid colon forms prominent rugal folds. The sigmoid colon is usually presents with the adhesion to the lateral wall of the iliac fossa ,so it important to free the adhesions to allow mobilization of the left colon. After releasing this structure ,white line of toldt fascia can be visualised. There is a recess in mesosigmoid otherwise called as intersigmoid fossa, this recess useful for identification of the ureter. Here the ureter runs , along the psoas muscle surface and it runs parallel to the gonadal vessels, and it descends into pelvis above the level of the common iliac artery bifurcation. The intersigmoid fossa is the site for development of internal hernias, the small bowel loop usually entrapped into this blind pouch.

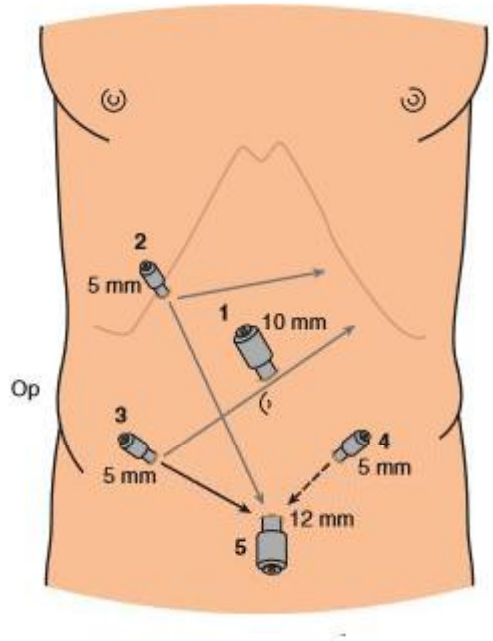
ANATOMY OF RECTUM

The rectum extends from the sacral promontory to the anorectal ring . The anorectal ring is the part at which the pubococcygeus, ileococcygeus, and puborectalis muscles of levator ani merge with the cranial part of the anal sphincter mechanism. Here the taeniae coli become to a diffuse longitudinal layer and this has been considered as the upper margin of the rectum. Rectum extends upto 12 cm from anal verge. Measurements should be done by rigid proctoscopy. Rectum is only upto distal 10cm from anal verge, rectum is biologically similar to sigmoid colon. The rectum has covered by peritoneum antrolaterally in its top third, only anteriorly in its middle third. Distal third has no peritoneal covering . The high anterior resection is above the level of peritoneal reflection. Low anterior resection is below the level of peritoneal reflection. Ultralow anterior resection, is defined as anastomosis done at the level of the puborectalis or pelvic floor. The coloanal anastomosis are done at the level of the dentate line. The rectum surrounded by a fibrofatty tissue called mesorectum which contains the vessels, nerves, and lymph nodes of the rectum. Rectum have three curvatures, among them two are with convexity on the right and one having the convexity on the left side, corresponds to three intraluminal mucosal folds known as the valves of houston. The rectal wall is contains of four layers: mucosa, submucosa, and circular and longitudinal muscles.

OPERATIVE TECHNIQUE

PREPARATION FOR COLOANAL ANASTOMOSIS

Preoperative Preparation one day before the surgery a mechanical bowel preparation done, and systemic intravenous antibiotics are given 1 hour before making incision. Deep vein thrombosis prophylaxis should be given . The position of the patient is for both abdominal and perineal approach. The position of the legs are placed in LloydDavis stirrups, and the position of the hips are 30 degrees flexion. A Foley catheter should be kept in the bladder. The position for laparoscopic surgery, is the extension of right thigh by 10 to 20 degrees, this position is for the purpose to utilize the lower right operative trocar. . Incision made for Laparotomy. Through a midline laparotomy incision the abdomen opened, and incision extends upto the level of pubic symphysis. For a Laparoscopy technique, Incision and Trocar Placement by 1-cm vertical incision at 2 to 3 cm above the level of umbilicus. A 10-mm size trocar is introduced and insufflation done. Two in number 5-mm trocars are then introduced one on the right midclavicular vertical line, trocar at McBurney's point and one 10 cm above.



LAPAROSCOPIC PORT SITES FOR COLOANAL ANASTOMOSIS

If needed, a 5-mm trocar can be placed at the level of left midclavicular vertical line 5 cm under the ribs. Above the pubis a 12-mm trocar is introduced in the midline, and a 5-cm incision will be done to extract the rectum .

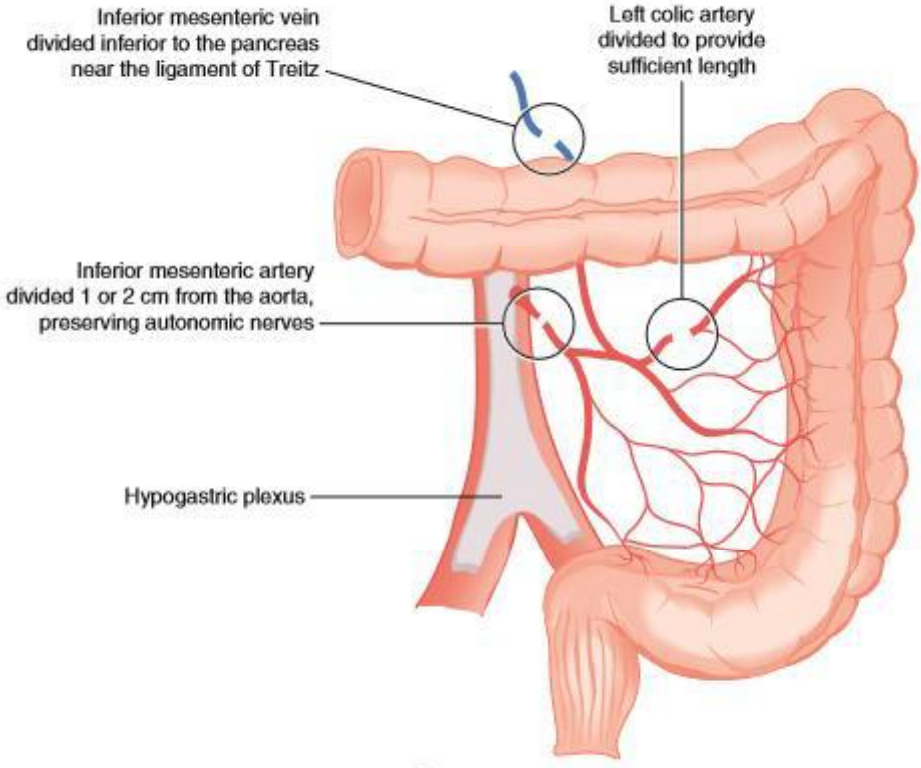
ABDOMINAL EXPLORATION

The abdominal cavity is exploration done to assess for ascitic fluid, invasion of mesenteric or paraaortic lymph nodes, peritoneal carcinomatous deposits, and resectability of the tumor, and to rule out liver metastasis.

DIVISION OF THE INFERIOR MESENTRIC VESSELS AND COLON MOBILIZATION

The inferior mesenteric artery (IMA) is ligated and divided at the level of 2 cm from the aorta for the purpose to preserve the autonomic

nerves. If APR is planned during intraoperatively, the first step is rectal dissection and second step is mobilization of the left colon . If Coloanal anastomosis is planned, the inferior mesenteric vein ligation done at its terminal end at the level just below the body of the pancreas and near the Treitz ligament , By doing this procedure we can get easier mobilization of the splenic flexure. The surgeon should stand between the patient's legs to mobilize down the splenic flexure. The left colon is completely mobilized for creating adequate length of the viable bowel for anastomosis. The transverse colon, the splenic flexure and the descending colon are mobilized, and the superior branch of the left colic artery also ligated for providing adequate length for



anastomosis. The left ureter is located at intersigmoid fossa by identifying inverted 'v' of sigmoid mesocolon, the left ureter is

seperated laterally away from the IMA origin. By laparoscopically the dissection is begins by the division of the inferior mesenteric vein at the level inferior surface of the pancreas . The mobilization of the left colon from the middle portion the vein ligated and divided from the attachments to the splenic flexure. The accessibility of the lesser sac is by division of the transverse colon mesentery. So complete mobilization of the left transverse colon is done by freeing the transverse colon mesentery inserting from the pancreas and free from the midline to the splenic flexure. The omentum is divided from the transverse colon from the midline to the left. Then, the IMA is divided at its origin level at the upper part of the mesorectum from the promontory . The left ureter is identified and preserved while mobilizing the sigmoid mesentry. The Inferior mesentric artery is ligated and cut, the colon's lateral attachments are then divided.

TOTAL MESORECTAL EXCISION

The inferior mesentric artery is exposed by lifting up the sigmoid colon and this artery becomes continues as superior hemorrhoidal artery. During the sigmoid colon separation the sharp dissection will prevent the damage to hypogastric nerves and to enter the perfect presacral plane for total mesorectal excision. The Sharp dissection is also done around the curve of the sacrum in the midline by downward direction, past the coccyx, and dissection over the anococcygeal raphe

by forward direction. By extending the plane of dissection in forward direction we can dissect the lateral attachments over the posterior midline around the side walls of the pelvis. The inferior hypogastric plexuses should be preserved during the dissection and it is tangenitally present nearby the mesorectum. The nervi erigentes should be preserved during dissection which lies in the same plane as the presacral nerves and posteriorly, and then curves forward direction from the sacral foramina and they join with the presacral nerves and forms the neurovascular bundles at the external border of the Denonvilliers fascia. and this nerve bundle lies in anterolateral position which is posterior to the seminal vesicles, where they are more prone for injury. Further deeper dissection into pelvis , few branches of the middle rectal vessels may be cut by using the diathermy coagulation. In men, anterior dissection starts with a transverse incision over the peritoneum anterior to the peritoneal reflection and extend downwards upto the upper parts of the seminal vesicles. The dissection extend anterior to the Denonvilliers fascia and is extended laterally to meet the lateral dissection. The division of the Denonvilliers fascia done at its lower part, where it join with the posterior prostatic fascia and contact with the terminal rectal anterior wall before it enters the levator ani muscle. In females, anterior dissection starts with a transverse incision at the lower peritoneal reflection and dissection along the cervix posterior part and vagina upto the levator ani. When the laparoscopic surgery is

done, the dissection of the mesorectum is done either by laparoscopy through the small midline incision or Pfannenstiel incision depends upon the difficulty of the case. Whenever laparoscopic dissection performed the dissection starts by the posterior dissection , as done by laparotomy. The lateral dissections are done with a carefully to avoid the damage to urogenital innervations, because some previous reports showing worse sexual function after laparoscopic dissection. The dissection is completed by doing anterior dissection at last.

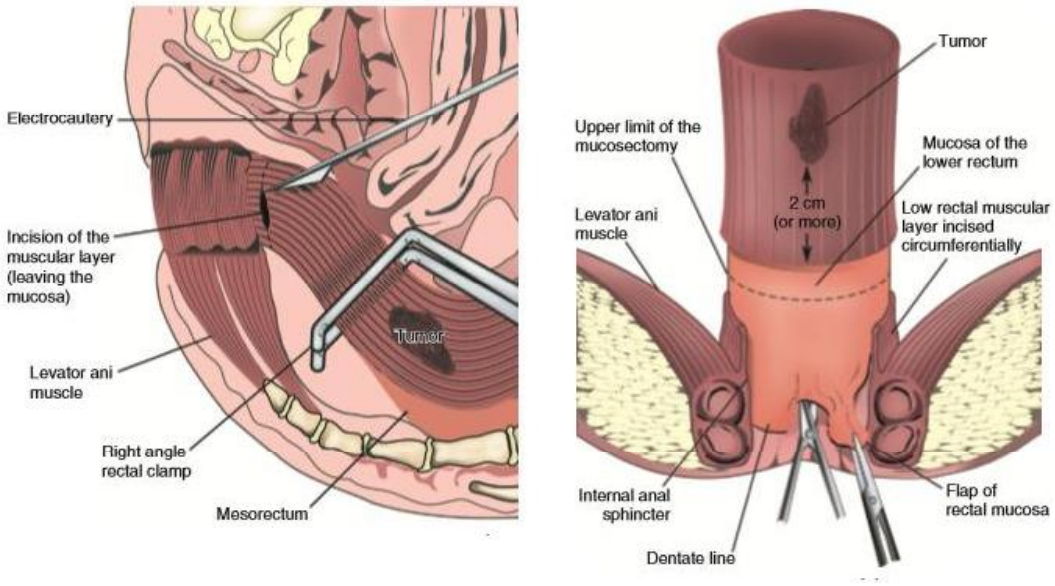
CHOOSING THE TYPE OF ANASTOMOSIS

After full mobilization of the mesorectum ,the type of the anastomosis depends upon tumor extension, If the growth is through the bowel wall into the levator ani, abdominoperineal resection is done and, the right-angled rectal clamp can be applied below the lower border of the malignant growth, a sphincter-saving surgery can be done. If transection of the rectum 2 cm below the edge of the malignant growth leaves 1 cm or more of rectum above the levator ani, a stapler anastomosis either colorectal or coloanal anastomosis can be done. A hand sewn Coloanal anastomosis will need to be used if the distance between the level of resection and the upper border of the anal sphincter does not allow the use of a stapling device. This is the case for very low rectal tumors when the remaining anal canal is too short after rectal resection to admit the circular stapler, or when a TA stapler

cannot be safely applied 2 cm below the tumor. This problem is solved by using the perineal first approach for sphincter preservation for very distal lesions. By perineal first technique there is a possibility for total mobilization of distal perirectal tissues. Thereby we can prevent the 'cone-down effect' that can happen when surgery in the distal pelvis through the abdomen in nonmucosectomy technique . If the sufficient margin clearance cannot be obtained between the distal edge of the tumor and the upper part of the sphincter, the technique called an intersphinctric resection, by which we can achieve the sufficient margin clearance between the distal edge of the tumor and the dentate line. In these cases, it is impossible to apply a right-angled clamp below the lower border of the tumor, but by doing per rectal examination it can be perceived that a resection of part of the internal sphincter will allow a distal margin clearance of 1 cm. The dissection can then be started in the abdomen by dividing the upper part of the internal sphincter from the levator ani. However, the main part of the dissection is performed during the perineal dissection.

HAND SEWN COLONIC POUCH ANAL ANASTOMOSIS

After full mobilization of the rectum and mesorectum , If technically feasible, Mucosectomy of the Rectal Stump is done at the level of the anorectal ring ,the muscular wall of the rectum is transected circumferentially.



The mucosa should not be incised but will be visible after cutting the muscle. If this technique is difficult, this will be done through the perineal approach. Transanal exposure is done by using two Gelpi retractors or Lone Star retractor ,which are applied perpendicular to each other over the external sphincter. A saline with epinephrine solution (1 : 1,000,000) is injected into the submucosa to balloon it and make the mucosa to float away from the muscle. A mucosectomy is done circumferentially from the dentate line up to the stapled over end of the rectum. The specimen is then removed. Hemostasis of the muscular stump and the lower portion of the pelvis is better achieved irrigation with warm saline, after removal of the specimen.

NONMUCOSECTOMY TECHNIQUE

The patient is put in the prone jackknife position and a Lone Star retractor is placed. The tumor or residual ulceration after

chemoradiotherapy is palpated and 2 cm distal to this point is marked with the cautery circumferentially. The dentate line is used as most distal position. A full-thickness incision made circumferentially through the intersphincteric plane by use a cautery through the internal sphincter. The rectum of specimen side are grasped with Allis clamps. The dissection is done in the distal part through the intersphincteric plane with blunt and sharp dissection to the distal part of the rectum and dissection continued proximally. Once the maximum length is achieved, the specimen side of the rectum is oversewn to prevent spillage of the tumor and stool. For the abdominal approach patient is placed in the lithotomy position, and a sponge is inserted in the anal. The transanal exposure is achieved with two Gelpi retractors or Lone Star retractor applied on the external sphincter. A circumferential division of the mucosa and internal sphincter is done with 1cm tumor margin clearance. The anterior part of the dissection done carefully to avoid injury to the urethra in males. Once the abdominal dissection plan is found, the specimen can be mobilized through the abdomen.

PREPARATION AND DIVISION OF THE COLON

A suitable site of the colon is selected for division with good blood supply and a site for a tension-free anastomosis. The apex of the planned pouch should be reached upto the level of the pubic

symphysis. The commonly used site for the division is the descending colon just proximal to the sigmoid. If sigmoid colon pouch is used, there is high chance of evacuatory problems such as severe motility dysfunction in comparison to a descending colonic pouch. Always use the non irradiated descending colon. The colon division done after the application of a TA 55 stapling device, and the stapled end is oversewn with continuous 4-0 suture. The specimen is removed from the operative field, and the distance between the lower border of the tumor and the level of the distal muscular division is assessed and measured.

CONSTRUCTION OF THE COLONIC POUCH

The colonic pouch for Coloanal anastomosis is J shaped, principally because it is easier to perform. The reservoirs should be small, with each limb of the pouch being no more than 9 cm in length. In a prospective randomized study, similar clinical results were obtained at 1 year with a small (5 cm) or a large (10 cm) pouch, but with long-term followup, constipation and evacuation problems were more likely in the group with a large reservoir. J shaped pouch is created for coloanal anastomosis by using the distal 15 centimeter of the colon. Each limb length is usually around 6 to 8 cm. The efferent limb is positioned on the right side and the descending limb is placed on the left side and, with the mesentery placed posteriorly. A pair of the Allis forceps is applied on the antimesenteric border of the colon at the apex of the

future pouch, and two additional Allis forceps are placed at the base of the pouch: one on the stapled end of the colon and the other on the descending limb of the pouch. Two adjacent holes are made by stab puncture on the antimesenteric border of each limb of the pouch at an equal distance from the top, close to the Allis forceps. The two forks of a GIA stapler (50 or 90) are inserted into the lumen of the colon, each through one hole, toward the apex of the pouch. Before firing, it is necessary to check that the mesocolon of the pouch is away from the stapler. The bowel is then everted to expose the remaining bridge, which is divided by the application of a GIA 50 stapler. The pouch is inverted, the Allis forceps are removed, and the hole is closed with continuous 4-0 polyglycolic acid suture. In this technique , the pouch is totally closed with no risk for septic contamination of the pelvis during its descent to the anal canal. Moreover, the size of the hole that will be made at the apex of the pouch for the anastomosis will be chosen to exactly fit the diameter of the anal canal.

COLOANAL ANASTOMOSIS

The apex of the pouch is brought to the anus with a Babcock forceps introduced through the anal stump. During this procedure, should not twist the colon around its mesentery. To improve the descent of the pouch, the genitourinary organs should be lifted with a hand or retractor, and the pouch should be gently pushed from above. The pouch

is then anchored to the anal sphincter by using four stitches of absorbable suture, each at one cardinal point just above the mucosal section. The apex of the pouch is opened, and the mucosa of the anal canal is anastomosed to the full thickness of the colon with the use of interrupted 4-0 polyglycolic acid suture . Four stitches are initially placed at 3, 6, 9, and 12 o'clock, and then an additional one or two stitches are added to each of the quadrants thus formed. The perianal retractors are removed, and a small drain is introduced through the anastomosis into the reservoir and will be left in place for 24 to 48 hours to drain any bleeding in the pouch, and obviate the risk for pouch distention by blood clots, and also treat the hemorrhage by saline irrigation.

DRAINAGE, LOOP STOMA, AND POSTOPERATIVE CARE

Two closed-suction drains are usually kept in the pelvis posterior and anterior to the pouch. We strongly advice routine construction of a diverting stoma simply because anastomotic leakage after total mesorectal excision and an ultralow anastomosis causes dramatic complications. We usually prefer a loop ileostomy over a colostomy because there is no risk of traction on the anastomosis and the blood supply to the descending colon is not compromised. The distal ileum may have been exposed to radiation during preoperative radiotherapy, because of this reason some surgeons prefer a loop proximal transverse

colostomy than loop ileostomy. Additionally, prior to abdomen closure, if the mobilized colon and mesocolon compress the duodenojejunal junction, the ligament of Treitz should be divided in order to prevent the postoperative small bowel obstruction. The nasogastric tube is removed at the end of the procedure or the next day morning, depending on how much dissection was performed near the stomach. Appropriate deep venous thrombosis prophylaxis should be maintained until the patient is fully ambulatory. The urinary catheter is generally removed on the third postoperative day. The pelvic suction drains are removed 24 to 48 hours after surgery. The stoma closure is done after a watersoluble contrast study done through the efferent limb of the stoma has shown satisfactory healing of the pouch and the anastomosis, stoma closure done after 6to 8 weeks. If a leak is observed, the stoma should be left in place for an additional few weeks and the contrast study repeated.

STAPLED COLONIC POUCH–ANAL ANASTOMOSIS

After total mesorectal excision, if a TA stapler can be applied between a rectal clamp positioned 1 or 2 cm below the lower edge of the tumor and the levator ani, a double-stapled anastomosis is possible. On the other hand, if the length of the rectal stump is more than 3 cm above the anal sphincter, the functional outcome after low colorectal anastomosis will be acceptable, but the incidence of anastomotic leakage reaches

10% to 15% in most series, probably because the anastomosis is done on a devascularized rectum. For this reason, fecal diversion is usually warranted in such cases.

DIVISION OF THE RECTUM

A right-angled rectal clamp is applied below the lower edge of the tumor . The lower portion of the rectum is washed with a povidone-iodine solution, this may be helpful in decreasing the risk for anastomotic recurrence as a result of viable tumor cells being trapped within the stapled line. The rectal clamp is used to horizontally align the rectum and facilitate positioning of a terminal anastomosis stapling device (TA 30 or 55, Roticulator 55 or 30) or linear stapler on the lower part of the rectum at the level of the levator ani. On closing the instrument before firing, care must be taken to include only the rectum (and nothing else) within the stapler. After firing, the rectum is divided, the specimen is removed from the pelvis, and the distal margin on the specimen is assessed.

CONSTRUCTION OF THE POUCH

The colon is divided at the junction of the descending and sigmoid colon after the application of a TA 55 stapling device, and the stapled end is oversewn with continuous 4-0 suture. Six to nine cm proximal to the colonic end, a 1-cm opening is created on the anti-mesenteric border of the colon. The forks of a GIA 50 or 90 stapler are introduced into

each limb, and a stapled side-to-side anastomosis is done between the two limbs to create the pouch . A simple over and over continuous purse-string suture of 0 or 2-0 nylon or polypropylene (Prolene) is placed around the hole where the GIA stapler was introduced. The anvil of a circular stapler (EEA 28/31 or ILS 29/33) is disconnected from the stapler and inserted into the hole, and the purse-string suture is tightened.

COLOANAL ANASTOMOSIS

The body of the circular stapler is introduced into the anus, aided by lubricant and the assistant's fingers. The spindle is slowly advanced and should perforate the rectal wall just posterior to the linear TA stapled line. The two half of the stapler (anvil and body) are approximated and the instrument is closed, with great care to avoid accidental catchhold of the posterior wall of the vagina or the seminal vesicles. The gun is fired when the gap is within the recommendations. The stapler is carefully removed and the rings are checked. They should be identified from both the rectal and the colonic sides. The distal ring or anorectal ring should be sent for histopathologic examination. If both anastomotic rings are intact, it is not necessary to test the anastomosis because the fecal stream will be diverted regardless. If both the rings are incomplete, proctoscopy should be

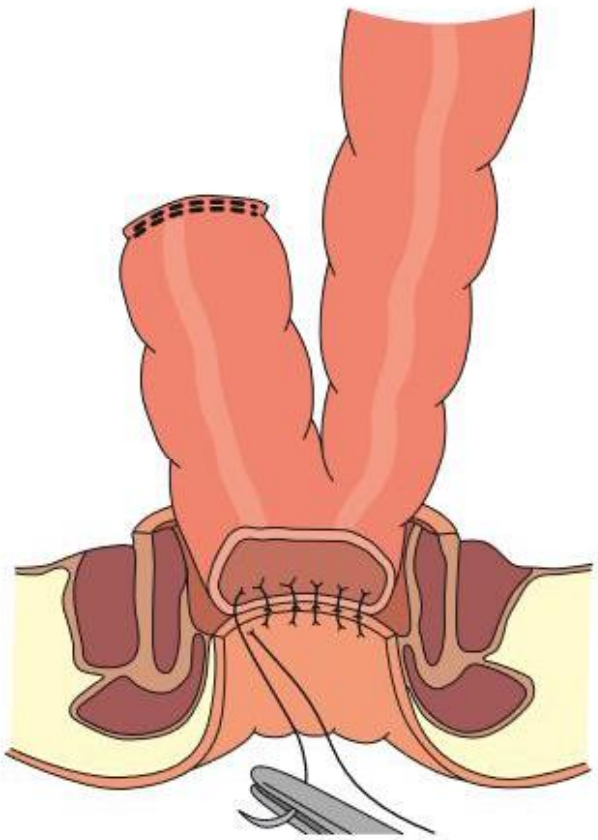
performed to determine whether sutures are required to close a significant defect.

Drainage, stoma, and postoperative care are same as followed in hand-sewn anastomosis. A randomized study has compared 20 patients with stapled J-pouch anastomoses to 17 patients with hand-sewn J-pouch anastomoses and demonstrated that the stapled coloanal anastomosis was significantly faster than hand-sewn anastomosis and has similar functional results.

TRANSVERSE COLOPLASTY

There are many situations where a colonic pouch cannot be constructed, including a narrow pelvis, severe diverticulosis, inadequate colonic length, and sometimes metastatic disease or other technical problems. An alternative method was devised by Fazio et al in which a reservoir is created just proximal to the anastomosis by adapting the Heineke-Mikulicz stricturoplasty technique used for the small bowel. The colostomy can be closed with either sutures or a stapler. Functional results have been similar to those of the colonic J pouch. Technically, the reservoir is easier to construct and is less bulky than the colonic J pouch.

SIDE-TO-END ANASTOMOSIS



HANDSEWN SIDE-TO-END ANASTOMOSIS

An alternative to the J pouch is the side-to-end coloanal anastomosis.This technique is easier than the J pouch and can be done with a circular stapling device or manually. After total mesorectal excision , the anvil of the circular stapler is placed 3 to 4 cm from the end of the divided bowel. A circular stapler is inserted through the anus and fired to create the anastomosis. In case of mucosectomy and transanal approach, the colon is pulled through the anus and a stitch is placed 4 cm from the end of the colon with a long remaining thread. The colon is then pushed upwards into the abdominal cavity and by

pulling on the string, the colon is positioned correctly to do a side-to end anastomosis manually as previously described .

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MATERIALS AND METHODS

STUDY DESIGN:

Prospective study

METHODOLOGY:

Sample size – 50.

Inclusion criteria

Patients undergoing gastrointestinal anastomosis.

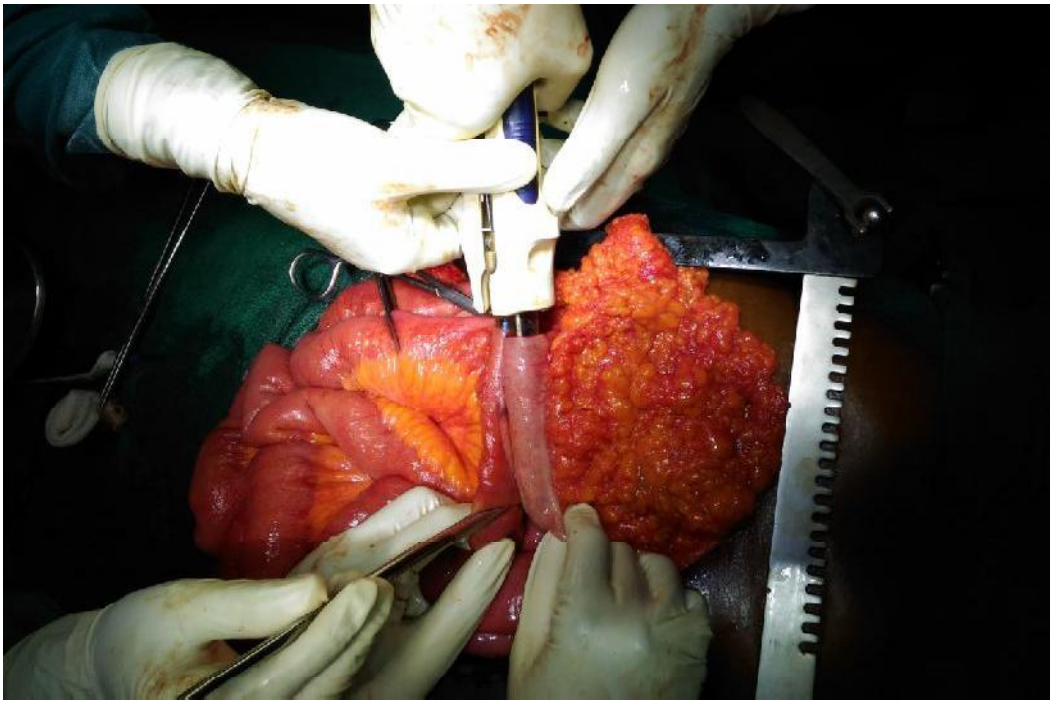
Exclusion criteria

Pediatric age group <13 years, anastomosis done in pancreatico-duodectomies with triple bypass, hepato-enteric anastomosis, patients with previous chemoradiation.

METHODS

Patients admitted in our ward and emergency department of surgery, Coimbatore medical college hospital will be allocated into two groups according to the type of anastomosis, handsewn and stapler. The handsewn anastomosis done by double layer, continuous suturing technique. Staplers used in anastamosis were linear cutting staplers. The parameters considered are time duration of surgery, hospital stay ,post operative leak, restoration of gastrointestinal function, post operative morbidity. The anastomosis commonly done are gastro-jejunostomy anterior and posterior, jejuno-jejuostomy, ileo-colic, and colo-rectal anastomosis.

HAND SEWN JEJUNOJEJUNAL ANASTOMOSIS



STAPLER ILEOTRANSVERSE ANASTOMOSIS

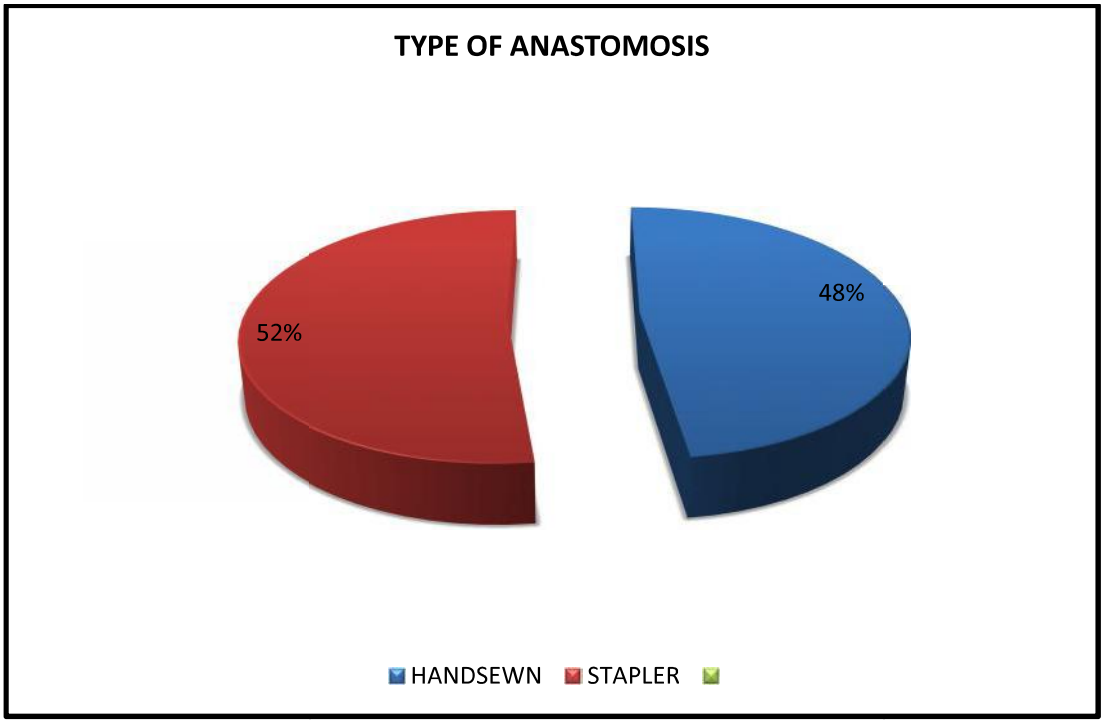
RESULTS

TYPES OF ANASTOMOSIS

TABLE - 1

GROUPS					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	HANDSEWN	24	48.0	48.0	48.0
	STAPLER	26	52.0	52.0	100.0
	Total	50	100.0	100.0	

CHART - 1

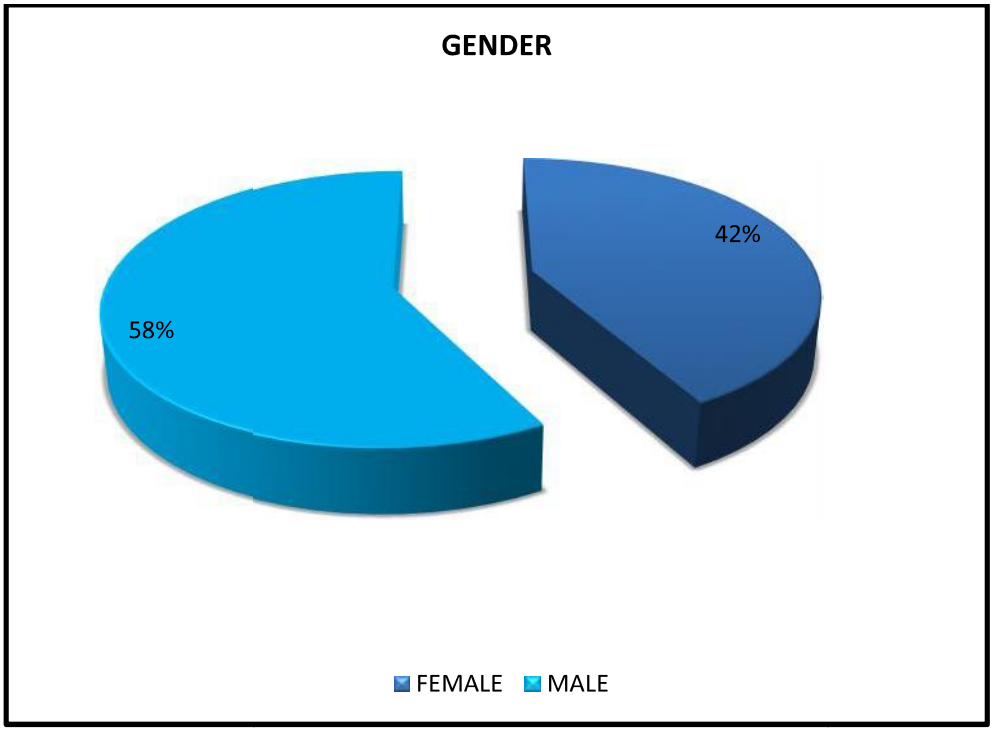


DISTRIBUTION OF SEX

TABLE -2

SEX					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	FEMALE	21	42.0	42.0	42.0
	MALE	29	58.0	58.0	100.0
	Total	50	100.0	100.0	

CHART - 2



CROSSTABS

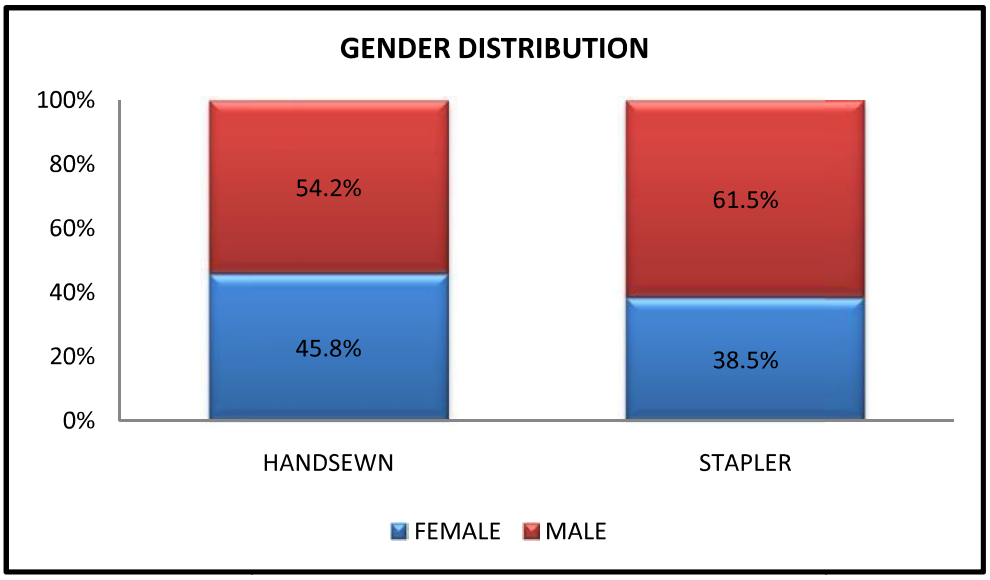
TABLE-3

SEX * GROUPS					
Crosstab					
			GROUPS		Total
			HANDSEWN	STAPLER	
SEX	FEMALE	Count	11	10	21
		% within GROUPS	45.8%	38.5%	42.0%
	MALE	Count	13	16	29
		% within GROUPS	54.2%	61.5%	58.0%
Total		Count	24	26	50
		% within GROUPS	100.0%	100.0%	100.0%

TABLE-4

	HANDSEWN	STAPLER
FEMALE	45.8%	38.5%
MALE	54.2%	61.5%

CHART-3

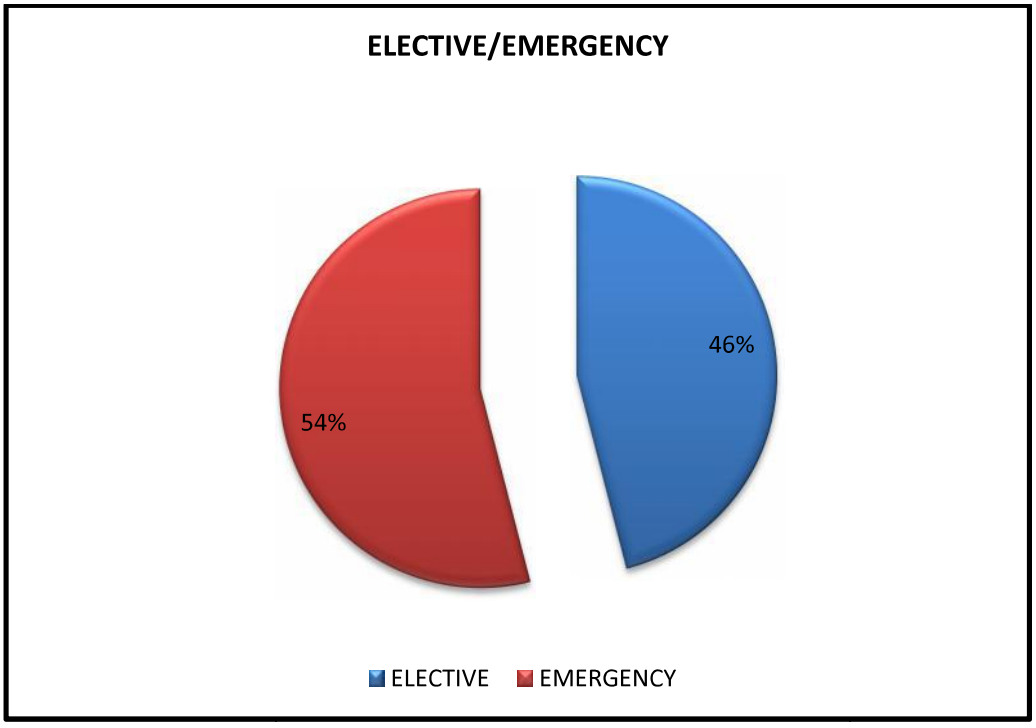


ELECTIVE VERSUS EMERGENCY

TABLE- 5

ELECTIVE / EMERGENCY					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	ELECTIVE	23	46.0	46.0	46.0
	EMERGENCY	27	54.0	54.0	100.0
	Total	50	100.0	100.0	

CHART-4



ELECTIVE / EMERGENCY GROUPS

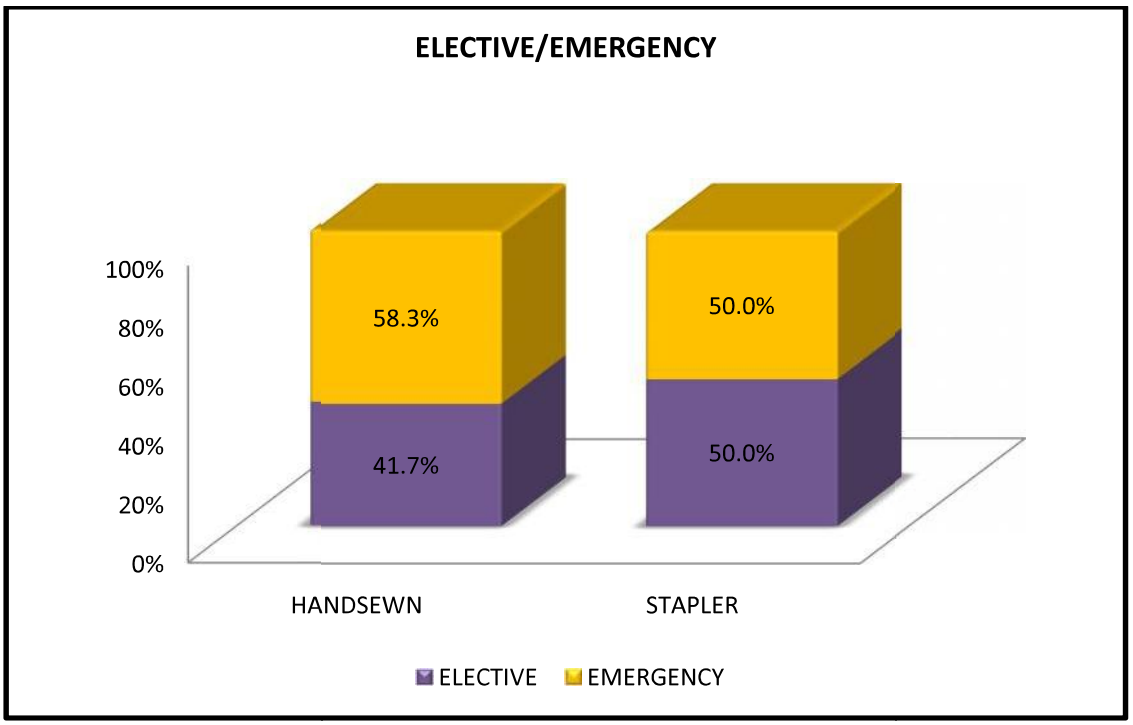
TABLE-6

CROSSTABS					
			GROUPS		Total
			HANDSEWN	STAPLER	
EE	ELECTIVE	Count	10	13	23
		% within GROUPS	41.7%	50.0%	46.0%
	EMERGENCY	Count	14	13	27
		% within GROUPS	58.3%	50.0%	54.0%
Total		Count	24	26	50
		% within GROUPS	100.0%	100.0%	100.0%

TABLE-7

	HANDSEWN	STAPLER
ELECTIVE	41.7%	50.0%
EMERGENCY	58.3%	50.0%

CHART-5



AGE GROUP COMPARISON

TABLE-8

AGE					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Upto 30 yrs	5	10.0	10.0	10.0
	31 - 40 yrs	7	14.0	14.0	24.0
	41 - 50 yrs	14	28.0	28.0	52.0
	51 - 60 yrs	13	26.0	26.0	78.0
	Above 60 yrs	11	22.0	22.0	100.0
	Total	50	100.0	100.0	

CHART-6

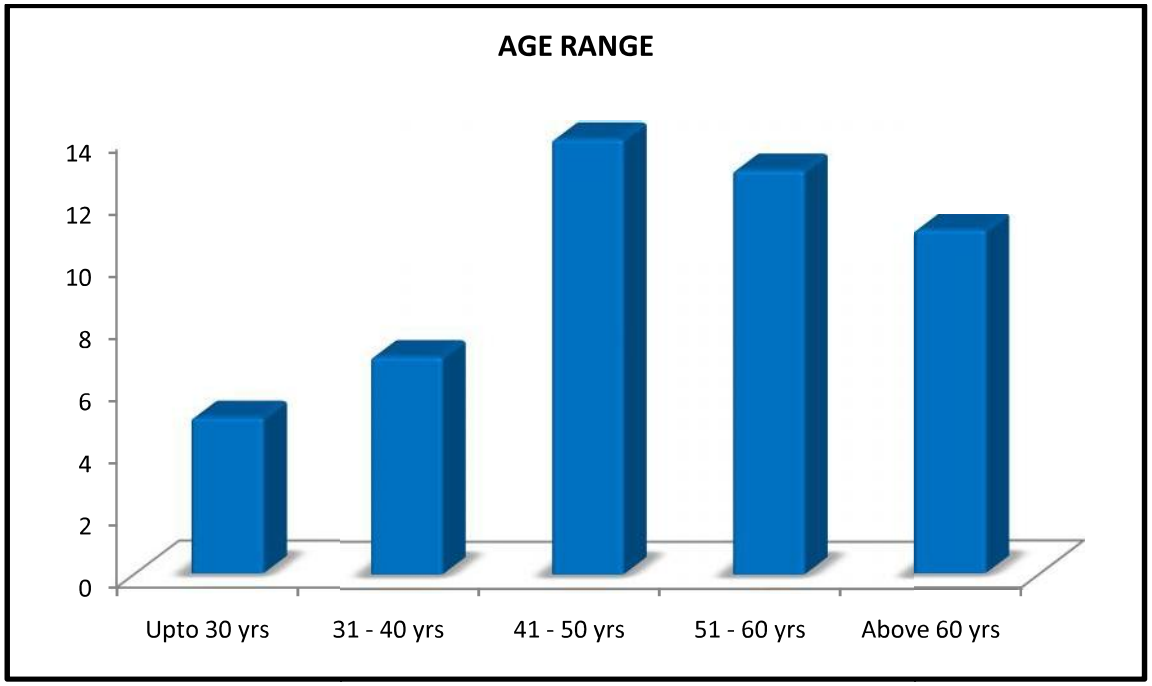


TABLE-9

CROSSTABS					
AGE * GROUPS Crosstabulation					
			GROUPS		Total
			HANDSEWN	STAPLER	
AGE	Upto 30 yrs	Count	3	2	5
		% within GROUPS	12.5%	7.7%	10.0%
	31 - 40 yrs	Count	2	5	7
		% within GROUPS	8.3%	19.2%	14.0%
	41 - 50 yrs	Count	7	7	14
		% within GROUPS	29.2%	26.9%	28.0%
	51 - 60 yrs	Count	6	7	13
		% within GROUPS	25.0%	26.9%	26.0%
	Above 60 yrs	Count	6	5	11
		% within GROUPS	25.0%	19.2%	22.0%
Total		Count	24	26	50
		% within GROUPS	100.0%	100.0%	100.0%

TABLE-10

	HANDSEWN	**STAPLER**
Upto 30 yrs	12.5%	7.7%
31 - 40 yrs	8.3%	19.2%
41 - 50 yrs	29.2%	26.9%
51 - 60 yrs	25.0%	26.9%
Above 60 yrs	25.0%	19.2%

CHART-7

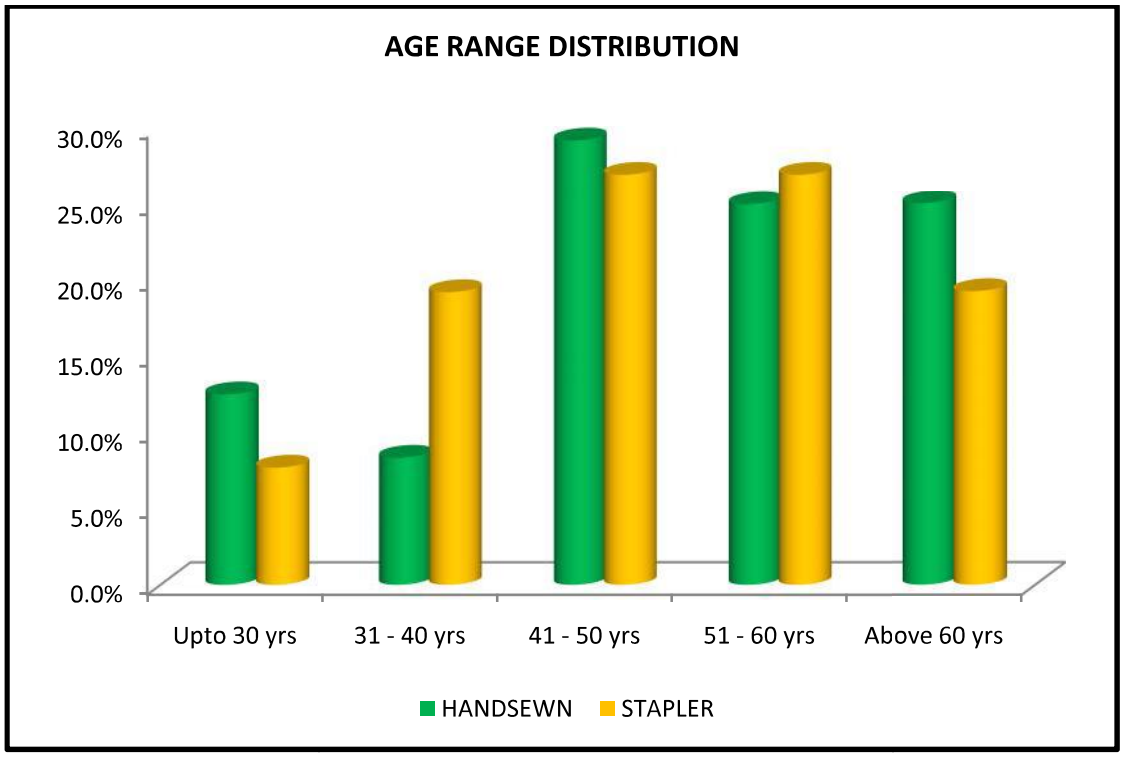


TABLE-11

Chi-Square Tests			
	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	1.576[a]	4	.813
Likelihood Ratio	1.618	4	.806
Linear-by-Linear Association	.094	1	.760
N of Valid Cases	50		

a. 4 cells (40.0%) have expected count less than 5. The minimum expected count is 2.40.

TABLE-12

	DURATION OF SURGERY (hrs.mins)
HANDSEWN	2.8
STAPLER	2.28

CHART-8

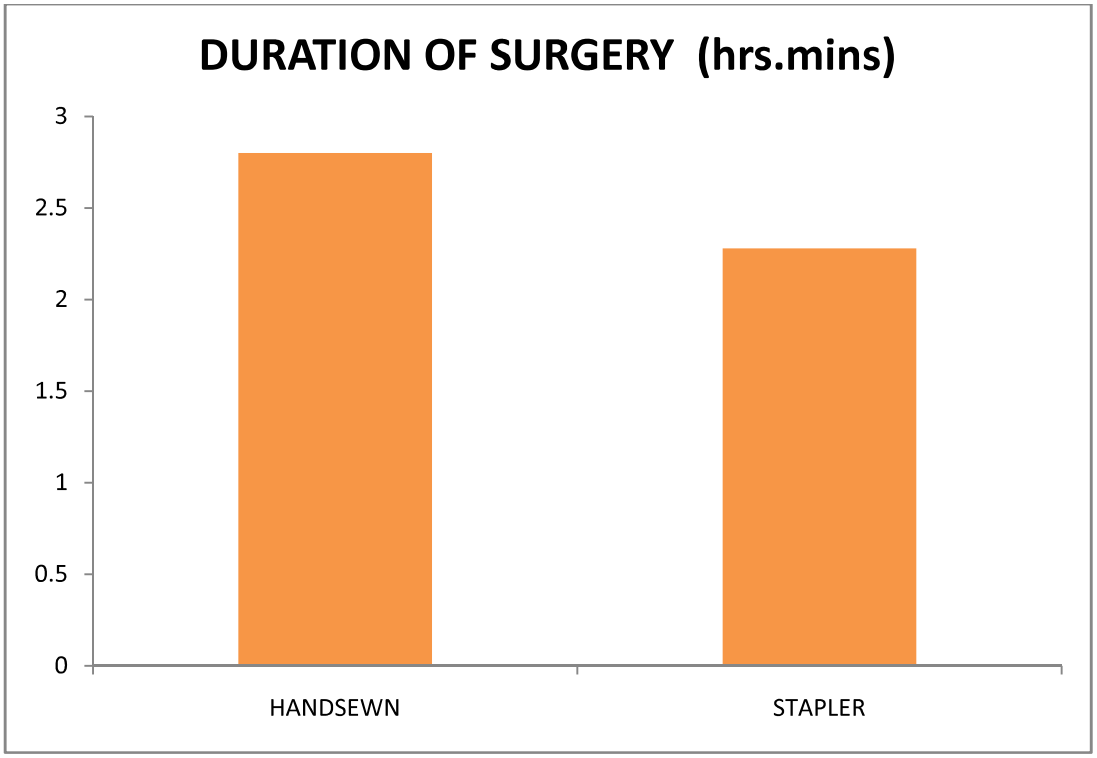


TABLE-13

	POST OPERATIVE GIT MOTILITY IN DAYS
HANDSEWN	6
STAPLER	4

CHART-9

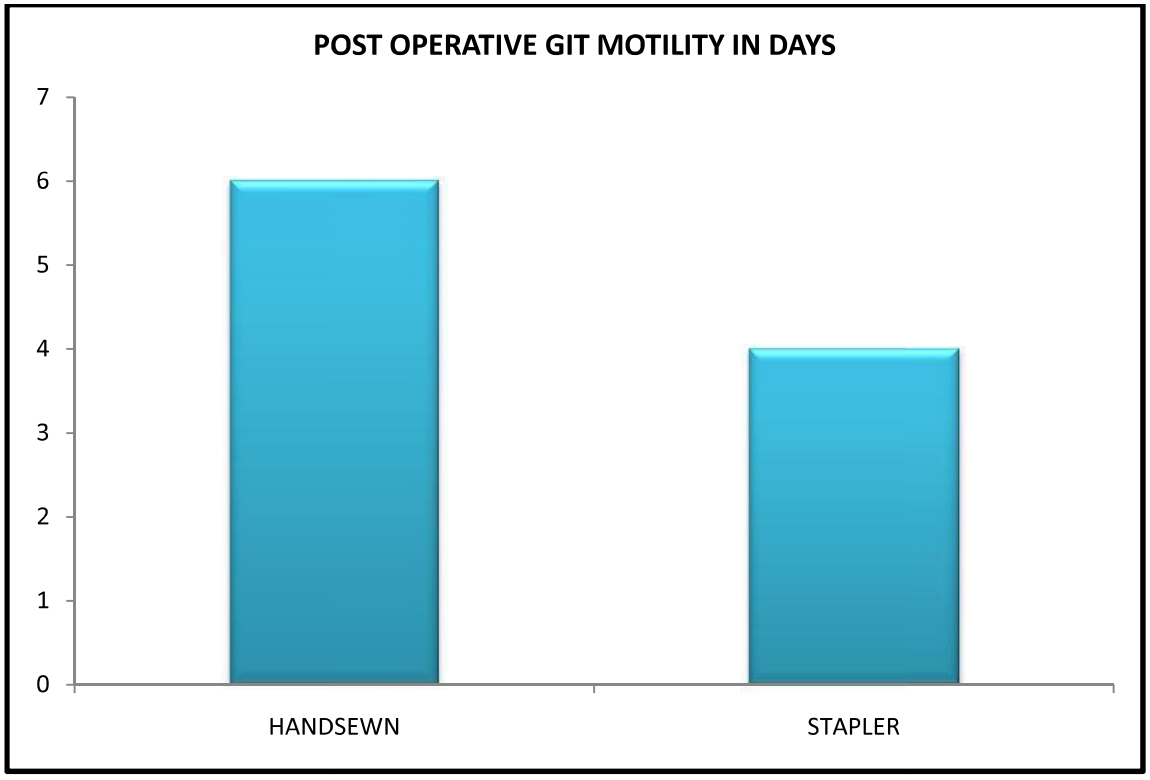
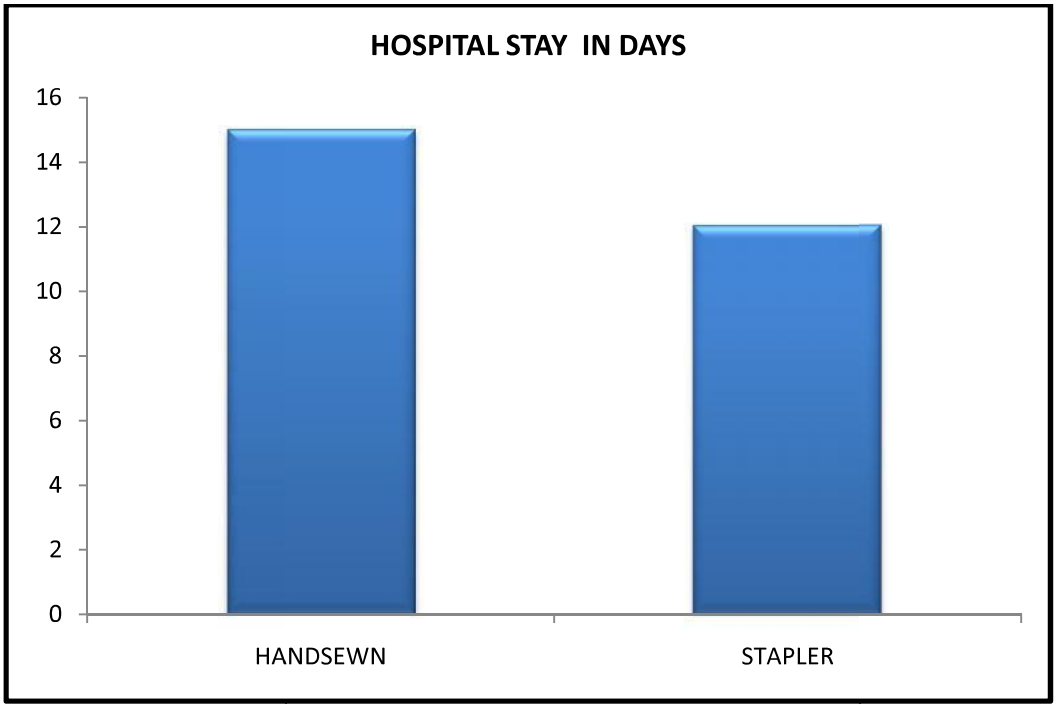


TABLE-14

	HOSPITAL STAY IN DAYS
HANDSEWN	15
STAPLER	12

CHART-10



COMPLICATIONS GROUPS

TABLE-15

COMPLICATIONS GROUPS					
Crosstab					
			GROUPS		Total
			HANDSEWN	STAPLER	
COMPLICATIONS	FISTULA	Count	3	0	3
		% within GROUPS	12.5%	0.0%	6.0%
	FISTULA,UTI	Count	1	0	1
		% within GROUPS	4.2%	0.0%	2.0%
	FISTULA,WOUND GAPPING	Count	1	0	1
		% within GROUPS	4.2%	0.0%	2.0%
	FISTULA,WOUND GAPPING,LRI	Count	0	1	1
		% within GROUPS	0.0%	3.8%	2.0%
	LRI	Count	1	1	2
		% within GROUPS	4.2%	3.8%	4.0%
	LRI,UTI	Count	1	0	1
		% within GROUPS	4.2%	0.0%	2.0%
	NIL	Count	7	16	23
		% within	29.2%	61.5%	46.0%

		GROUPS			
	UTI	Count	1	0	1
		% within GROUPS	4.2%	0.0%	2.0%
	WOUND GAPPING	Count	2	1	3
		% within GROUPS	8.3%	3.8%	6.0%
	WOUND GAPPING,LRI	Count	2	0	2
		% within GROUPS	8.3%	0.0%	4.0%
	WOUND INFECTION	Count	2	6	8
		% within GROUPS	8.3%	23.1%	16.0%
	WOUND INFECTION ,LRI	Count	3	1	4
		% within GROUPS	12.5%	3.8%	8.0%
Total		Count	24	26	50
		% within GROUPS	100.0%	100.0%	100.0%

TABLE-16

	HANDSEWN	STAPLER
FISTULA	12.5%	0.0%
FISTULA,UTI	4.2%	0.0%
FISTULA,WOUND GAPPING	4.2%	0.0%
FISTULA,WOUND GAPPING,LRI	0.0%	3.8%
LRI	4.2%	3.8%
LRI,UTI	4.2%	0.0%
UTI	4.2%	0.0%
WOUND GAPPING	8.3%	3.8%
WOUND GAPPING,LRI	8.3%	0.0%
WOUND INFECTION	8.3%	23.1%
WOUND INFECTION ,LRI	12.5%	3.8%
NIL	29.2%	61.5%

CHART-11

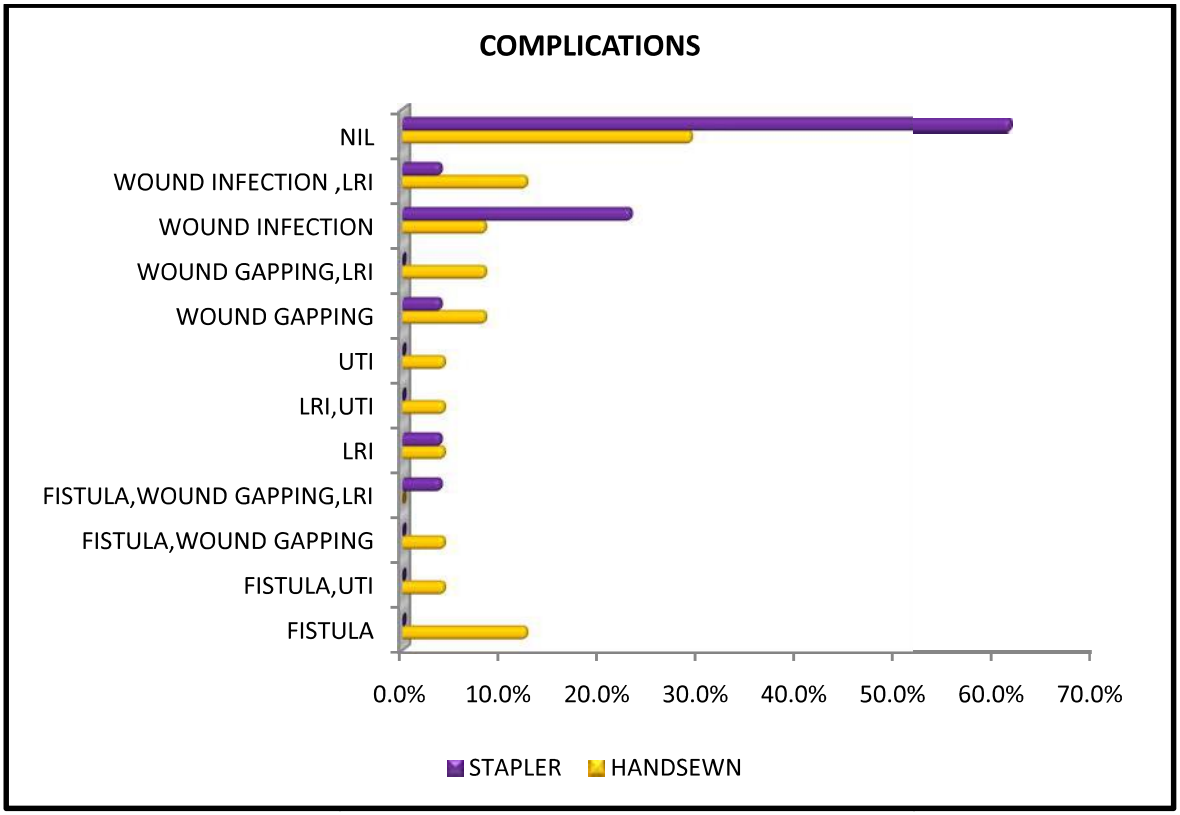


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TABLE-17

CHI-SQUARE TESTS			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.802[a]	11	.114
Likelihood Ratio	20.880	11	.035
N of Valid Cases	50		

DESCRIPTIVES

TABLE-18

DESCRIPTIVE STATISTICS					
		Minimum	**Maximum**	**Mean**	**Std. Deviation**
Age in years		18	84	51.10	15.165
Duration of Surgery in minutes		60	195	142.52	28.767
Post-operative Git motility in Days		4	6	4.88	.849
Hospital stay in Days		10	19	13.48	2.178

TABLE-19

T-TEST					
GROUP STATISTICS					
GROUPS		**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
AGE	HANDSEWN	24	52.04	15.763	3.218
	STAPLER	26	50.23	14.849	2.912
DURATION OF SURGERY	HANDSEWN	24	158.38	26.857	5.482
	STAPLER	26	127.88	22.234	4.360
POST OPERATIVE GIT MOTILITY IN DAYS	HANDSEWN	24	5.58	.584	.119
	STAPLER	26	4.23	.430	.084
HOSPITAL STAY IN DAYS	HANDSEWN	24	14.79	1.414	.289
	STAPLER	26	12.27	2.070	.406

MEAN AGE-51.4

MEAN DURATION OF SURGERY FOR HANDSEWN-158.38MINS

MEAN DURATION OF SURGERY FOR STAPLER-127.88MINS

MEAN POST OPERATIVE GIT MOTILITY FOR HAND SEWN- 5.58 DAYS

MEAN POST OPERATIVE GIT MOTILITY FOR STAPLER-4.23 DAYS

MEAN HOSPITAL STAY FOR HANDSEWN-14.79DAYS

MEAN HOSPITAL STAY FOR STAPLER-12.27DAYS

TABLE - 20

INDEPENDENT SAMPLES TEST										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Age	Equal variances assumed	.094	.761	.418	48	.678	1.811	4.329	-6.894	10.515
	Equal variances not assumed			.417	47.062	.678	1.811	4.340	-6.919	10.541
Duration Of Surgery	Equal variances assumed	.431	.515	4.386	48	.000	30.490	6.952	16.513	44.467
	Equal variances not assumed			4.353	44.808	.000	30.490	7.005	16.380	44.600
Post Operative Git Motility in Days	Equal variances assumed	6.188	.016	9.383	48	.000	1.353	.144	1.063	1.642
	Equal variances not assumed			9.269	42.082	.000	1.353	.146	1.058	1.647
Hospital Stay in Days	Equal variances assumed	1.780	.188	4.990	48	.000	2.522	.506	1.506	3.539
	Equal variances not assumed			5.065	44.340	.000	2.522	.498	1.519	3.526

DISCUSSION

A comparative study between hand sewn anastomosis and stapler anastomosis was done in 50 patients and the results were analyzed. The results vary for both hand sewn and stapler anastomosis groups regarding duration of surgery, resumption of oral feeds, Return of Gastro intestinal tract motility, Post operative hospital stay and complications.

Regarding the total duration of the anastomosis time, it is shorter in stapler group when compared to handsewn group. Mean value of duration of stapler anastomosis was 127.88 minutes when compared with handsewn anastomosis which was 158.38 minutes with significant predictive value.

Appearance of bowel sounds and starting of oral feeds were earlier in stapler group and its mean value of stapler anastomosis was 4.23days when compared with handsewn which was 5.58days with significant predictive value.

Total duration of the hospital stay was less in stapler group when compare with handsewn group. Mean value of total duration of the hospital stay in stapler anastomosis was12.27 when compared to handsewn group which was 14.79 with statistically significant predictive value.

Regarding complications stapler group had lesser complications when compared to hand sewn group. Postoperative fistula was observed in only one case in Stapler anastomosis whereas in handsewn anastomosis there were 4 cases. Regarding wound infection with lower respiratory tract infection, stapler anastomosis group had only one case whereas handsewn group had three cases. Most of the complications occurred in emergency surgeries than elective in both stapler and handsewn anastomosis. Wound gapping was there in 5 cases in handsewn and in stapler technique there were only 2 cases.

Both the groups did not have any mortality.

In our series anastomotic leak in emergency surgeries leads to fistula was 3.8%(one case) in stapler and 16.7 %(four cases) in hand sewn anastomosis. Among the five cases of anastomotic leak, three cases were operated as emergency and two cases were operated as elective surgery. In stapler anastomosis one case developed anastomotic leak, that was operated as emergency procedure for small bowel and caecal gangrene in which resection of small bowel ,caecum followed by jejunocolic anastomosis was done. In handsewn anastomosis four cases were developed anastomotic leak. Among them two cases were operated as emergency and two cases were operated as elective procedure.

In Handsewn technique,

Emergency procedures are

1.small bowel gangrene for which segmental resection and jejunoileal anastomosis was done.

2.Acute intestinal obstruction with growth in ileocaecal region for which right hemicolectomy with ileotransverse anastomosis was done.

Elective procedures are

Two cases of carcinoma rectum for which low anterior resection with colorectal anastomosis was done.

Wound infection rate was high in emergency surgeries compared to elective surgeries. Wound infection rate was equal in both handsewn and stapler anastomosis.

In a study from the West of Scotland and Highland Anastomosis Study Group, there was no difference in the clinical leaks. As per the 1998 meta-analysis which addressed 13 trials published during 1980 to 1998 showed no difference in leak in colorectal anastomosis and significant reduction in leak in stapled group for ileocolic anastomosis. The high rate of anastomotic leak in oesophagealgastric group in this study is due to absence of adventitious layer. As for mortality is concerned amounting to 7.5% and is

the same for both the groups of hands sewn and stapler group. This is observed in both the studies of West of Scotland and Highland groups and the metaanalysis of 1998, that there was no difference in mortality. The mean of total operating time for hand sewn group was 269.14 mins whereas for the stapler group it was 253.43 mins with a p value of 0.500 which was statistically not significant. The total mean operating time were significantly shorter in stapler group. These results are similar to the study done by HimabinduBangaruet al5 and similar to the study done by Dameshaet al6, George et al7 and Hollender et al8.

A systematic review and meta-analysis of 17 studies comparing hand sewing and stapling in ileocolonic, colocolonic and colorectal anastomosis was done by MacRae& McLeod9 in 1998. They concluded that although intraoperative technical problems were more common in those that were stapled, no evidence of differences between the two groups was found in the other variables, and they considered the two techniques to be equally effective. The increased mean operating time in both the groups can be explained by cases of Carcinoma Pancreas, Periampullary Carcinoma and Carcinoma GE junction which require significantly longer operating time when compared to other malignancies. The mean anastomosis time in hand sewn group was 33.9 mins and in the stapler group it was 12.92 mins. In the stapler group 88 % of anastomosis was done within 10-15 mins which

included loading the stapler gun, alignment of the tissues and firing of the gun. In 11 % of the patients in stapler group the anastomosis time was slightly longer (between 20 – 30 mins) due to the added time required to set up the circular stapler. In the hand sewn group, for 51% of patients the anatomosis time was between 20-30 mins and in the remaining 35 % of patients the anastomosis time was between 30-40 mins. This was mainly due to different surgeons and different suturing techniques employed by the surgeon. Whereas in the stapler group, alignment and firing of the stapler was uniform with different surgeons. In this study using staplers reduces the anastomosis time and in turn the total operating time, which is in conjunction with other studies.

In their study, they had a total of 18 benign cases (15 in the hand sewn group and 3 in the stapler group). Rest of the cases were malignant (52 cases). Most of the benign cases underwent hand sewn anstomosis. Most of the other studies have taken only malignant cases. In their study they took all the cases which underwent elective GI anastomosis irrespective of the type of pathology (Benign or Malignant). With respect to return of bowel sounds, it was 3.89 in the hand sewn group and 3.26 in the stapler group with a p value of 0.0011. It was statistically significant but clinically the difference was negligible. For resumption of oral feeds the mean was 5.37 days for hand

sewn group and 4.89 days for stapler group with a p value of 0.117, which was statistically not significant.

Similar findings were found in HimabinduBangaru et al5 and Damesha et al6. In this study there was one anastomotic leak in the hand sewn group post Whipples procedure. It was managed conservatively. There was no statistical difference in anastomosis leak in hand sewn and stapler group. In other studies of Quan Wand et al10 also found no significant difference in both hand sewn and stapler group. J.D Uschal et al in their meta-analysis of 50 articles found no significant difference in the leak in hand sewn and stapler anastomosis. This result does not correlate with other studies by Docherty et al14, Lustosa et al15 and Nasir Khan et al16 and HimabinduBangaru et al5 and Frances Goulder et al17 in which there were anastomotic leaks in colorectal anastomosis, but similar in both hands sewn and stapler anastomosis. Frances et al in their review article quoted to have 8.3% of hand sewn and 2.8% of stapler anastomosis leaks. Their study was in accordance with study done by SuzanaAngélicaet al18 in 2008 which showed no difference in incidence of anastomotic leak between the two groups. There was no bleeding from the anastomotic site which is similar to Himabinduet al5 study.

CONCLUSION

Stapler anastomsis reduced the duration of surgery than the conventional handsewn anastomosis. Hence can be used in patients with poor general condition and in emergency surgeries.

The duration for postoperative recovery of bowel functions and postoperative hospital stay was lesser in stapler anastomosis when compared to handsewn anastomosis.

Incidence of anastomotic leak leads to fistula was higher in handsewn anastomosis than stapler anastomosis .

In view of our study, stapler anastomosis has better outcome than conventional handsewn anastomosis.

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PROFORMA

Name: D.O.A

Age/ Sex: D.O.S

Occupation: D.O.D

Address: I.P No:

CHIEF COMPLAINTS:

1.Abdominal pain

2.Vomiting

3.Abdominal distension

H/O PRESENT ILLNESS:

Abdominal pain - onset

duration of pain

site of pain

Aggravating and relieving factors

Nature of the pain

Radiation of the pain

Vomiting- onset &duration

bilious /non bilious

blood stained or not

Abdominal distension-Onset& duration

Progression

Other symptoms-Malena, Bleeding PR,

Altered bowel habits, Absolute constipation

loss of appetite&loss of weight

Fever, trauma, yellowish discolouration of urine.

PAST HISTORY:

H/O Similar episodes before

H/O any Chronic drug use

H/O DM / SHT / BA / TB /Seizure disorder

H/O previous surgery

PERSONAL HISTORY:

Smoker/Alcoholic & Diet

FAMILY HISTORY:

H/O similar episodes in other family members.

GENERAL PHYSICAL EXAMINATION:

Conscious

Orientation

Hydration

Nutritional status

Pallor, Icterus

Cyanosis/ clubbing/ edema

Generalized/ regional lymphadenopathy

Pulse rate

Respiratory rate

Blood pressure.

SYSTEMIC EXAMINATION

PER ABDOMEN

INSPECTIOIN - Abdominal distension,

Old scars

Position of umblicus

Flanks,VGP,VIP,Dilated veins.

Hernial orifices.

PALAPTION-Warmth,

Tenderness,

Guarding,Rigidity

Palpable Mass

Organomegaly

PERCUSSION-Liver dullness normal or Obliterated

AUSCULTAION-Bowel sounds

PER RECTAL EXAMINATION-Sphincter tone,Growth,Fecal staining,

Roomy or collapsed rectum.

EXTERNAL GENITALIA EXAMINATION

CARDIO VASCULAR SYSTEM

RESPIRATORY SYSTEM

CENTRAL NERVOUS SYSTEM

INVESTIGATIONS:

- Complete hemogram, random blood sugar, blood urea, serum creatinine, serum electrolytes,LFT,Coagulation profile.

-Blood grouping&Typing,HIV,HBsAg.

- Electrocardiogram.

- Chest radiograph.

-X-Ray abdomen erect

- Ultrasound abdomen

-CECT Abdomen&Pelvis

-OGD Scopy& Biopsy,Colonoscopy&Biopsy

TYPE OF ANAESTHESIA : spinal /general

MANAGEMENT:

Carcinoma Stomach-Subtotal / Total Gastrectomy,with GJ &JJ

Carcinoma Caecum&Ascending colon-Rt hemicolectomy with Ileo transverse anastomosis

Carcinoma Rectum-1.APR with End colostomy

2.Low anal resection with colo anal anastomosis

3.Anterior resection with colorectal anastomosis

Acute Intestinal Obstruction due to TB Abdomen-Ileo transverse anastomosis

Carcinoma Descending Colon-Lt Radical Hemocolectomy with coloanal anasatomosis.

Carcinoma Transvrese Colon-Extended Rt hemicolectomy with Ileocolic anastomosis.

DURATION OF SURGERY

POST OPERATIVE GIT MOTILITY &STARTING OF ENTERAL FEEDS

POST OPERATIVE DURATION OF HOSPITAL STAY

COMPLICATIONS-Local&Systamic.

STATEMENT OF CONSENT

I, ……. do hereby volunteer and consent to participate in this study being conducted by **Dr.B.Mageshwaran** have been read and understood the consent form/ or it has been read and explained to me in my own language. The study has been fully explained to me, and I may ask questions at any time.

Study Name

"A COMPARATIVE STUDY BETWEEN STAPLER AND HANDSEWN ANASTOMOSIS IN GASTROINTESTINAL SURGERIES IN COIMBATORE MEDICAL COLLEGE HOSPITAL, COIMBATORE"

Signature / Left thumb Impression of the Volunteer Date :

Place :

Signature and Name of witness Date :

Place :

Signature of the Investigator :

Name of the Investigator :

ஒப்புதல் படிவம்

பெயர் :

பாலினம் :

முகவரி : வயது :

அரசு கோவை மருத்துவக் கல்லூரியில் பொது அறுவை சிகிச்சை துறையில் முதுகலை மருத்துவம் பயிலும் மாணவர் மரு. பூ.மகேஸ்வரன் அவர்கள் மேற்கொள்ளும் **"A COMPARATIVE STUDY BETWEEN STAPLER AND HANDSEWN ANASTOMOSIS IN GASTROINTESTINAL SURGERIES IN COIMBATORE MEDICAL COLLEGE HOSPITAL, COIMBATORE"** என்ற சோதனையின் செய்முறை மற்றும் அனைத்து விபரங்களையும் கேட்டுக் கொண்டதுடன், எனது அனைத்து சந்தேகங்களையும் தெளிவுபடுத்திக் கொண்டேன் என்பதை தெரிவித்துக் கொள்கிறேன்.

நான் இந்த ஆய்வில் முழு சம்மதத்துடனும், சுய சிந்தனையுடனும் கலந்து கொள்ள சம்மதிக்கிறேன்.

இந்த ஆய்வில் என்னுடைய அனைத்து விபரங்களும் பாதுகாக்கப்படுவதுடன், இந்த முடிவுகள் ஆய்விதழில் வெளியிடப்படுவதில் எனக்கு எந்த ஆட்சேபனையும் இல்லை என்பதை தெரிவித்துக் கொள்கிறேன். எந்த நேரத்திலும் இந்த ஆய்வில் இருந்து விலகிக் கொள்ள எனக்கு உரிமை உண்டு என்பதையும் அறிவேன்.

இடம்

தேதி கையொப்பம் / கைரேகை

MASTER CHART

S.NO	NAME	AGE	SEX	IP.NO	DIAGNOSIS	SURGERY	ELECTIVE/ EMERGENCY	TYPE OF ANASTOMOSIS	DURATION OF SURGERY	POST OPERATIVE GIT MOTILITY IN DAYS	HOSPITAL STAY IN DAYS	COMPLICATIONS
1	SAMEERA BANU	45	FEMALE	72014	CARCINOMA RECTUM	COLOANAL ANASTOMOSIS	ELECTIVE	STAPLER	2HRS 10 MIN	4.5	11	NIL
2	ARUMUGAM	50	MALE	76401	CARCINOMA STOMACH	SUBTOTAL GASTRECTOMY WITH POSTERIOR GJ AND JJ	ELECTIVE	HAND SEWN	1HR50MIN	5	14	NIL
3	KAMALA	37	FEMALE	67302	ILEOCAECAL TUBERCULOSIS	ILEOTRANSVERSE ANASTOMOSIS	EMERGENCY	STAPLER	1HR	5	10.5	WOUND INFECTION
4	GAYATHRI	21	FEMALE	43580	STAB INJURY MULTIPLE JEJUNAL PERFORATTION	SEGMENTAL RESECTION ANASTOMOSIS	EMERGENCY	HANDSEWN	1HR15 MIN	5.5	13	WOUND INFECTION
5	JOTHI	55	FEMALE	77564	CAECAL CARCINOMA	RIGHT HEMICOLECTOMY AND ILEOTRANSVERSE ANASTOMOSIS	ELECTIVE	STAPLER	2HRS	3.5	10.5	NIL

6	NAVEEN	34	MALE	76430	CARCINOMA RECTUM	LOW ANTERIOR RESECTION AND COLORECTAL ANASTOMOSIS	ELECTIVE	STAPLER	2HRS 5MIN	3.5	10	NIL
7	ROJA	42	FEMALE	74509	CARCINOMA STOMACH	SUBTOTAL GASTRECTOMY WITH GASTROJEJUNOSTOMY	ELECTIVE	HANDSEWN	2HRS40MIN	5.5	14	LRI
8	MARIMUTHU	35	MALE	32705	SMALL BOWEL GANGRENE	SEGMENTAL RESECTION WITH JEJUNOILEAL ANASTOMOSIS	EMERGENCY	HANDSEWN	2HRS 35MIN	5	14.5	FISTULA
9	GANESAN	41	MALE	56329	ILEAL STRICTURE WITH INTESTINAL OBSTRUCTION	SEGMENTAL ILEAL RESECTION END TO END ILEO ILEAL ANASTOMOSIS	EMERGENCY	STAPLER	1HR55MIN	4	11	WOUND INFECTION
10	CHIDAMBARAM	70	MALE	49998	INTESTINAL OBSTRUCTION WITH ILEOCAECAL TB	RIGHT HEMICOLECTOMY WITH ILEOTRNSVERSE ANASTOMOSIS	EMERGENCY	STPLER	2HRS	4.5	14	WOUND INFECTION ,LRI
11	AMBIKA	50	FEMALE	65390	CARCINOMA TRANSVERSE COLON	EXTENDED RIGHT EMICOLECTOMY	ELECTIVE	HANDSEWN	2HRS 39MIN	6	15	UTI
12	SANKAR	35	MALE	54565	SMALL BOWEL AND CAECAL GANGRENE	SMALL BOWEL AND CEACAL RESECTION AND JEJUNOCOLIC END TO END ANASTOMOSIS	EMERGENCY	STAPLER	2HRS 10MIN	4.2	19	FISTULA,WOUND GAPPING,LRI

13	VIJAYA	46	FEMALE	63185	SMALL BOWEL OBSTRUCTION ,ILEAL PERFORATION	SEGMENTAL RESECTION TERMINAL ILEUM,CAECUM,APPENDIX,ASCENDING COLON WITH ILEOCOLIC ANASTOMOSIS	EMERGENCY	HANDSEWN	2HRS 55MIN	6SSS	15	WOUND GAPPING
14	KARUPPASAMY	60	MALE	66229	SIGMOID VOLVULUS	SIGMOID COLECTOMY WITH COLORECTAL ANASTOMOSIS	EMERGENCY	STAPLER	1HR 30MIN	4	11	NIL
15	SUBASH	30	MALE	67705	INTESTINAL OBSTRUCTION TB ABDOMEN	ADHESIOLYSIS WITH ILEOTRANSVERSE ANASTOMOSIS	EMERGENCY	HANDSEWN	2HRS 12MIN	4	12	NIL
16	SRINIVASAN	80	MALE	69529	FEMORAL HERNIA INTSTINAL OBSTRUCTION	SEGMENTAL RESECTION ILEOILEAL END TO END ANASTOMOSIS	EMERGENCY	STAPLER	2HRS 40MIN	5	15	NIL
17	SAHISHA	29	FEMALE	65809	BLUNT INJURY ABDOMEN WITH JEJUNAL PERFORATION	SEGMENTAL JEJUNAL RESECTION AND ANASTOMOSIS	EMERGENCY	HANDSEWN	2HRS 47MIN	5.5	15	WOUND INFECTION,LRI
18	JOTHIMANI	65	FEMALE	19170	SIGMOID COLON GROWTH	RESECTION OF SIGMOID COLON WITH COLORECTAL ANASTOMOSIS	ELECTIVE	HANDSEWN	2HRS 28MIN	5	15	FISTULA
19	MUTHRA	75	FEMALE	21091	STRANGULATED INGUINAL HERNIA WITH ILEAL PERFORATION	SEGMENTAL ILEAL RESECTION WITH ANASTOMOSIS AND ANATOMICAL HERNIAL REPAIR DONE	EMERGENCY	STAPLER	2HRS 10MIN	4.5	12	NIL

20	SHANMUGAM	60	MALE	39885	ILEOCOLIC INTUSSUSEPTION	RT HEMI COLECTOMY WITH ILEO TRANSVERSE ANASTOMOSIS	EMERGENCY	HAND SEWN	2HRS 50 MIN	6	15	WOUND INFECTION
21	JANAKI	45	FEMALE	49377	SIGMOID V0LVULUS	SIGMOID COLECTOMY WITH COLORECTAL ANASTOMOSIS	EMERGENCY	HAND SEWN	2HRS 40MIN	5.5	14	NIL
22	SUBRAMANI	50	MALE	79442	IRREDUCIBLE RT INGUINAL HERNIA WITH ILEAL PERFORATION	SEGMENTAL RESECTION WITH ILEOILEAL ANASTOMOSIS	EMERGENCY	STAPLER	2HRS 10MIN	4	12	NIL
23	KALIYAPPAN	70	MALE	83064	CARCINOMA RECTUM	APR(SPHINCTER SAVING)COLOANAL ANASTOMOSIS	ELECTIVE	HANDSEWN	3HRS	5	13	NIL
24	KUNJAPPAN	68	MALE	84563	ILEOILEAL INTUSSUEPTION	RT HEMICOLECTOMY WITH ILEO TRANSVERSE ANASTOMOSIS	EMERGENCY	HANDSEWN	2HRS40 MIN	5.5	14	LRI,WOUND INFECTION
25	KANNAMMAL	45	FEMALE	76852	CARCINOMA STOMACH	SUB TOTAL GASTERECTOMY WITH POSTERIOR GJ AND JJ ANASTOMOSIS	ELECTIVE	STAPLER	2HRS50 MIN	4	13	LRI
26	KAVITHA	35	FEMALE	31605	INTESTINAL OBSTRUCTION DUE TO ILEOCAECAL TB	ILEOTRANSVERSE SIDE TO SIDE ANASTOMOSIS	EMERGENCY	HAND SEWN	1HR55MIN	5	14.5	NIL
27	KANDASAMY	46	MALE	78654	CARCINOMA TRANSVERSE COLON	EXTENDED RT HEMICOLECTOMY WITH END TO END ILEOCOLIC ANASTOMOSIS	ELECTIVE	STAPLER	1HR 40MIN	3.5	11	NIL

28	RAJAMMAL	84	FEMALE	4191	CARCINOMA RECTUM	ANTERIOR RESECTION WITH COLORECTAL ANASTOMOSIS	ELECTIVE	HANDSEWN	2HRS 50MIN	5	15	LRI,WOUND INFECTION
29	THANGARAJ	51	MALE	18218	ACUTE INTESTINAL OBTRUCTION DUE TO ILEOCAECAL GROWTH	RIGHT HEMICOLECTOMY WITH ILEOTRANSVERSE ANASTOMOSIS	EMERGENCY	HANDSEWN	3HRS	5.5	17	FISTULA
30	GANESAMOORTHY	18	MALE	25039	STAB INJURY WITH MULTIPLE JEJUNAL PERFORATION	SEGMENTAL RESECTION WITH JEJUNO JEUNAL ANASTOMOSIS	EMERGENCY	STAPLER	1HR 55MIN	4	11	NIL
31	MUNUSAMY	73	MALE	25722	CARCINOMA ASCENDING COLON	RT HEMICOLECTOMY WITH ILEO TRANSVERSE ANASTOMOSIS	ELECTIVE	HANDSEWN	2HRS45 MIN	6	16	LRI,UTI
32	PREMCHAND	49	MALE	32015	CARCINOMA STOMACH	SUB TOTAL GASTERECTOMY WITH GJ AND JJ ANASTOMOSIS	ELECTIVE	HAND SEWN	3HRS 5MIN	6	14	NIL
33	SABRIVASAN	53	MALE	85632	CARCINOMA DESCENDING COLON	LT RADICAL HEMI COLECTOMY WITH COLOANAL ANASTOMOSIS	ELECTIVE	STAPLER	2HRS	3.5	12	WOUND GAPPING
34	RAJAMMAL	57	FEMALE	40039	STRANGULATED INCISIONAL HERNIA	SEGMENTAL JEJUNAL RESECTION WITH JEJUNO ILEAL ANASTOMOSIS WITH ANATOMICAL REPAIR	EMERGENCY	HAND SEWN	2HRS35 MIN	5	15	WOUND GAPPING

35	JAGADEESH	39	MALE	62354	CARCINOMA STOMACH	TOTAL GASTERECTOMY WITH ESOPHAGO JEJUNAL ANASTOMOSIS	ELECTIVE	STAPLER	2HRS	4	12	NIL
36	MURUGESAN	56	MALE	56342	CARCINOMA RECTUM	LOW ANTERIOR RESECTION WITH COLORECTAL ANASTOMOSIS	ELECTIVE	HAND SEWN	3HRS 15MIN	6	17	FISTULA,WOUND GAPPING
37	MAHALI	58	FEMALE	43370	INTESTINAL OBSTRUCTION DUE TO CAECAL CARCINOMA	RT HEMICOLECTOMY WITH ILEO TRANSVERSE ANASTOMOSIS	EMERGENCY	HANDSEWN	2HRS 45MIN	5.5	14	NIL
38	SUBASH CHANDRABOSE	29	MALE	44453	BLUNT INJURY ABDOMEN WITH PERFORATION AND GANGRENE OF THE CAECUM	RESECTION OF THE CAECAL GANGRENE WITH APPENDICECTOMY AND STUMP CLOSURE WITH ILEO TRANSVERSE ANASTOMOSIS	EMERGENCY	STAPLER	2HRS 25MIN	4	16	WOUND INFECTION
39	PUSHPA	60	FEMALE	68931	CARCINOMA RECTUM	ABDOMINO PERINEAL RESECTION (SPINCHTER SAVING)WITH COLO ANAL ANASTOMOSIS	ELECTIVE	STAPLER	2HRS 35MIN	4	12	NIL
40	NEELAMEGAM	73	MALE	93605	CARCINOMA STOMACH WITH PERFORATIVE PERITONITIS	GRAHAM'S OMENTAL PATCH CLOSURE WITH GASTRO JEJUNOSTOMY	EMERGENCY	HANDSEWN	2HRS 50MIN	6	18	WOUND GAPPING,LRI

41	SWAMINATHAN	60	MALE	68954	CARCINOMA RECTUM	LOW ANTERIOR RESECTION WITH COLORECTAL ANASTOMOSIS	ELECTIVE	HANDSEWN	3 HRS 5 MIN	5	17	FISTULA,UTI
42	RANI	58	FEMALE	94652	CARCINOMA STOMACH	SUB TOTAL GASTERECTOMY WITH GASTROJEJUNOSTOMY WITH JEJUNOJENOSTOMY	ELECTIVE	STAPLER	2HRS 15MIN	5	14	NIL
43	SASIKUMAR	45	MALE	75684	CARCINOMA STOMACH	SUBTOTAL GASTERECTOMY WITH DUODENAL STUMP CLOSURE WITH GJ &JJ	ELECTIVE	STAPLER	2HRS 30MIN	4.5	11	NIL
44	INDHUMATHI	50	FEMALE	65783	INTESTINAL OBSTRUCTION DUE TO ILEOCAECAL GROWTH	RT HEMICOLECTOMY WITH ILEOTRANSVERSE ANASTOMOSIS	EMERGENCY	STAPLER	2HRS 10 MIN	4	12	WOUND INFECTION
45	SUBRAMANI	68	MALE	70021	CARCINOMA RECTUM	ANTERIOR RESECTION WITH COLORECTAL ANASTOMOSIS	ELECTIVE	STAPLER	2HRS 30MIN	5	13	NIL
46	RUCKMANI	35	FEMALE	94584	ACUTE INTESTINAL OBSTRUCTION DUE TO ILEOCAECAL TUBERCULOSIS	ILEOTRANSVERSE ANASTOMOSIS	EMERGENCY	STAPLER	2HRS 10MIN	4.5	13	WOUND INFECTION
47	SAMANULLAH	42	MALE	65333	BLUNT INJURY ABDOMEN WITH JEJUNAL TRANSECTION	SEGMENTAL JEJUNAL RESECTION AND ANASTOMOSIS	EMERGENCY	HANDSEWN	2 HRS 45MIN	6	15	WOUND GAPPING,LRI

48	KANNIYAMMAL	53	MALE	76651	ILEOILEAL INTUSSUSEPTION	SEGMENTAL ILEAL RESECTION WITH ILEO ILEAL ANASTOMOSIS	EMERGENCY	STAPLER	2HRS 10MIN	5	10	NIL
49	NANJAPPAN	60	MALE	45621	CARCINOMA RECTO SIGMOID	ANTERIOR RESECTION WITH COLORECTAL ANASTOMOSIS	ELECTIVE	STAPLER	2HRS15 MIN	5	13	WOUND INFECTION
50	PATTAMMAL	65	FEMALE	89000	CARCINOMA STOMACH	TOTAL GASTRECTOMY WITH DUODENAL STUMP CLOSURE AND GJ&JJ	ELECTIVE	STAPLER	2HRS 10MIN	4	11	NIL