"COMPARATIVE STUDY OF SINGLE LAYER VERSUS DOUBLE LAYER ANASTOMOSIS OF SMALL INTESTINE"

By

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In partial fulfillment of the requirements for the degree of

MASTER OF SURGERY

IN

GENERAL SURGERY

Under the Guidance of

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LIST OF ABBREVATION

SLA	:	Single Layer Anastomosis
DLA	:	Double Layer Anastomosis
SMA	:	Superior Mesenteric Artery
SMV	:	Superior Mesenteric Vein
GI	:	Gastrointestinal
RCT	:	Randomized Control Trial
RIF	:	Right Iliac Fossa
DJ	:	Duodeno-jejunal
IVC	:	Inferior Venecava
GB	:	Gall bladder
ICV	:	Ileocecal valve
EC	:	Extracellular
Hb	:	Haemoglobin
ATP	:	Adenosine triphosphate
MgCL2	:	Magnesium chloride
SSI	:	Surgical site infection
MODS	:	Multiorgan dysfunction syndrome

ABSTRACT

Background: Intestinal anastomosis is an operative procedure that is of importance in the practice of surgery. Intestinal anastomosis is a very commonly performed technique in today's surgical era. Gastrointestinal anastomosis is the most interesting surgical procedure to be performed by a budding surgeon in our surgical practice.

Objectives To study the post-operative complications like anastomotic leak and abscess formation and duration of hospital stay in single layers and double layer anastomosis and to compare the above

Methods: In our prospective observational study, 40 patients were reviewed and were divided into 2 groups. Cases were allotted to either groups based on the odd even method requiring single layer anastomosis and double layer anastomosis, odd being single layer and even being double layer anastomosis. Intestinal anastomosis will be carried out in single layer technique with delayed absorbable suture material and double layer technique with inner transmural layer with delayed absorbable suture material and seromuscular layer with non-absorbable suture material.

Results: Each group has 20 patients, there was significant difference in the time taken for anastomosis, duration of hospital stay and anastomotic leaks between the single and double layer anastomosis.

Conclusion: single layer anastomosis was better in terms of duration of hospital stay, post-operative anastomotic leaks and time taken for anastomosis.

Keywords: single layer, double layer, small bowel, duration of hospital stay, anastomotic leaks

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INTRODUCTION

INTRODUCTION

Intestinal anastomosis is an operative procedure that is of importance in the practice of surgery[1]. Intestinal anastomosis is a very commonly performed technique in today's surgical era. Gastrointestinal anastomosis is the most interesting surgical procedure to be performed by a budding surgeon in our surgical practice. The aim of anastomosis is to make a good approximation of bowel edges so that the contents pass through it easily & as early as possible.

End to end anastomoses, side to end / side to side, are the various methods of Gut anastomosis used depending on the surgery, & the operating surgeon. Different methods of anastomosis such as, SLA, DLA, staplers, glues, & laser welding have been tried. Various techniques were devised at various times, yet there is no single technique which has been accepted internationally.

For over 150 years, to perform intestinal anastomosis a wide range of techniques and suture materials are used. In today's cost conscious environment the use of staples for intestinal anastomosis does not suit common man as these staples are very expensive and should be used with caution. But hand-sewn anastomosis can be done, in an appropriate time and can be performed at a lesser cost to suit the economy of common man. Hand sewn suturing technique remains the main stay for bowel anastomosis in developing countries like India and has been proven successful in most bowel surgery The method that has with stood the test of time in most situations, & in the hands of most surgeons has been the double-layered anastomosis, using non-absorbable sutures for, an outer seromuscular layer &absorbable sutures for inner layer.

Single-layered anastomosis, using absorbable suture requires lesser time. It costs lesser than the double-layered method and has no increased risk of leakage or stricture formation[2]

In double layered anastomosis, though hemostatic, there is chance of strangulation of mucosa, due to damage of sub mucosal vascular plexus, there by increasing the chance of anastomotic leaks. In SLA, only seromuscular layer of gut wall is approximated. This includes the strongest layer (sub mucosa) & causes minimal damage to sub mucosal vascular plexus. This reduces chances of necrosis and anastomotic leaks.

Various complications that are seen post operatively are anastomotic leak which result in peritonitis/ abscess formation, fistula formation, necrosis, and stricture formation. Factors contributing to these complications- suturing technique, suture material, presence of concurrent sepsis, vascular compromise etc. Anastomotic leak in the GI tract is a major complication & accounts for about 1.3 to 7.7%, & associated with, increased morbidity & mortality and prolonged stay.[1]

OBJECTIVES

OBJECTVES OF THE STUDY

- To study post-operative complications -anastomotic leak & abscess formation & duration of hospital stay in double layer anastomosis.
- To study post-operative complications - anastomotic leak & abscess formation & duration of hospital stay in single layer anastomosis.
- To compare above in single v/s double layer anastomosis.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

The word anastomosis is derived from a Greek word *Anastomoo* which means "to furnish with a mouth". Anastomosis -surgical connection between the two hollow viscus or viscera.Historically Travers, Lembert and Lambert laid down the principles of gut anastomosis more than 100 years ago.[2]

A meta-analysis of RCT's at Kyoto prefectural university of medicine, Japan in 2006 clarified that, considering the duration taken to perform the anastomosis & hospital expenses, single layered intestinal anastomosis may prove to be the better choice in such surgical situations[3]

A prospective study, conducted at Dow University of Health Sciences & Civil Hospital, Karachi in 2009, single layered interrupted extra-mucosal bowel anastomosis can be constructed in less time with minimal complications compared with two-layered technique.[4]

According to study conducted by Department of General Surgery, Sri Guru Ram Das Institute of Medical Sciences & Research, Vallah, Sri Amritsar, Punjab, double layered anastomosis of intestine ,offers no definite advantage over single layered anastomosis as far as postoperative complications like leakage, intra-abdominal abscesses are concerned. Single layered anastomosis is as safe as double layered method, & it is easy to perform.[5]

A comparative study done in the P.D.U Medical college, Rajkot, Gujarat, single layered interrupted extra mucosal technique required significantly less duration for anastomosis, was highly cost effective, with no significant difference in anastomotic leak rates, & was as safe as conventional double layered technique.[1]

A comparative Study of Different Anastomotic Technique-Single Layer Extra Mucosal Versus Conventional Double Layer Anastomosis in Elective and Emergency

Laparotomy, there was lower incidence of anastomotic failure and septic complications in single layer closure as compared to the conventional double layer closure of intestinal anastomosis.[6]

A comparative study conducted on single layered continuous extra-mucosal technique versus interrupted technique for sutures of anastomoses in gut, the study concluded that: Single layer continuous extra mucosal technique for suturing of gut anastomosis proved to be safer, less time consuming, compared to single layered interrupted technique [7].

A conducted in Madurai Meenakshi college by Dr.K.S.Gokulnath Premchand et al, the study showed that There was not much of a difference noted in the development of complication in single / double layer anastomosis in small bowel, & the rate of complications was the same in case of emergencies in both. Time required to construct, SLA was comparatively lesser than DLA. Narrowing of lumen of bowel was lesser in single layered anastomosis along with early recovery of the bowel movements in single layered anastomosis, when compared to double layered [8].

Study conducted by Pathak et al: "Single-Layer Versus Double Layer Intestinal Anastomosis of Small Bowel" at Nepalgunj Teaching Hospital showed that single layered anastomosis was better in terms of time taken for anastomosis & cost effectives in terms of use of suture materials [9].

Lady Reading Hospital Peshawar, conducted a study : "Single-Layer Continuous Versus Single-Layer Interrupted Extra Mucosal Techniques in Small Intestine Anastomosis" which showed that single layered continuous extramucosal technique was as safe as interrupted extramucosal anastomosis & could be performed in shorter

duration of time & can be a cost effective alternative for construction of gut anastomosis [10].

Similar study conducted by Nemma SK et al in Department of Surgery, GGS Medical College, Faridkot, Punjab, India, showed that in small bowel anastomosis single layered anastomosis was better, in terms of time taken for anastomosis & effectiveness.[11]

Study conducted by Akthar Mahboob et al at the DHQ Hospital, Sahiwal showed that the single layered continuous extramucosal technique that was done, for the suturing of gut anastomosis proved to be safe, time conserving & efficacious as compared to single layer interrupted technique.[12]

According to study conducted in March 2019 in Katuri Medical College showed that single layered continuous technique for small bowel was the preferred techniques for the prevention of anastomotic leak [13].

Study by Yasir Mehmood et al. in the year 2012 concluded that statistically there was no difference in the risk of leakage & post-operative hospital stay between single & double layer anastomosis but the time taken for anastomosis was significant between the two study groups. Single layer extramucosal intestinal anastomosis was safer and could be performed in shorter time than double layer anastomosis.[7]

Liaquat Ali Zia et al. conducted a study," Extramucosal Single Layer Versus Double Layer Continuous Intestinal Anastomosis - A Comparative Study" which showed that single layered anastomosis is better than double layer and is the preferred choice of anastomosis by most surgeons.[14]

SMALL INTESTINE

HISTORY

Sushruta in the sixth century B.C, wrote about the oldest known descriptions of bowel surgeries in history . Galen was to first to observe and describe anatomy of intestine.[17]

EMBRYOGENESIS

The distal end of foregut and proximal end of the midgut are responsible for the formation of small bowel i.e duodenum, jejunum, and the ileum.[17,18]

"Early in the 2nd month of gestation, the intestines, which elongate faster than the abdominal cavity expands, push a loop out into the umbilical cord. This is the "midgut" of the embryologist, not the "midgut" of the surgeon." [17,18]

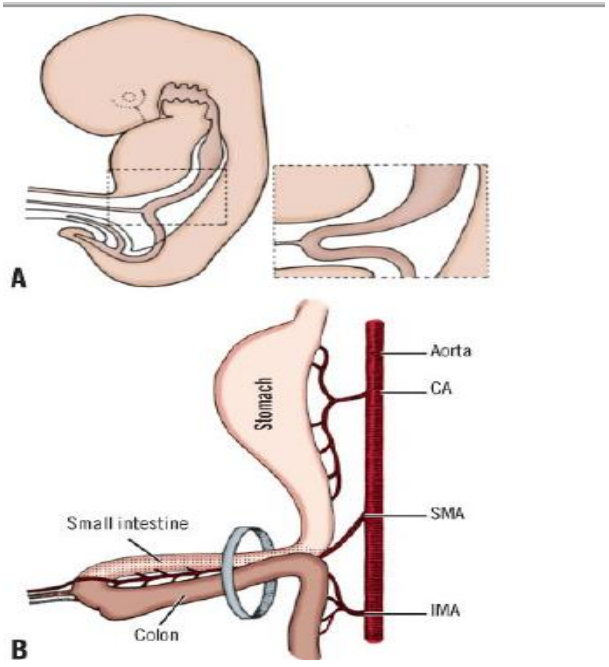


FIG 1: DEVELOPMENT OF THE SMALL BOWEL

The herniated segment contains the distal 1/3rd of duodenum, the jejunum , ileum and the proximal 1/3rd of transverse colon. It is supplied by SMA branches. This SMA forms the axis for the rotation of the gut[17,18].

Rotation of gut occurs ,in counterclockwise direction (90°) and there by brings the future duodenum and proximal small gut to the right side of colon. In the tenth week of intrauterine life, they suddenly return into the abdomen. The cranial part ,returns first, followed by duodenum which passes behind the SMA. The caudal limb, i.e the distal ileum and the entire large bowel, returns later. Transverse colon comes to lie, in front of the artery & the duodenum.[17,18]

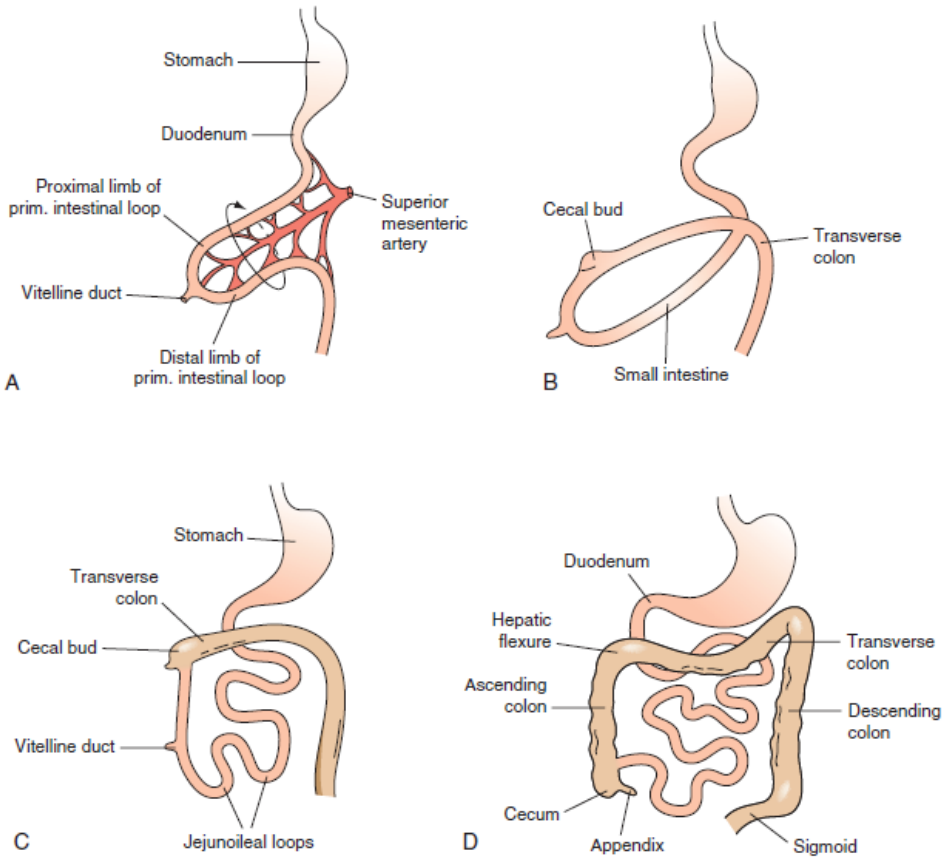


FIG 2 : ROTATION OF THE GUT

GROSS ANATOMY

The small intestine, a complex organ that, is not only, a site of nutrient digestion and absorption but also contains the largest reservoir of immunologically active and hormone-producing cells. It is 1 of the largest organ, of the immune and endocrine systems. [19]

"The small intestine is, a tubular structure that ranges from the pylorus to the cecum. The estimated length varies depending on whether radiologic, surgical, or autopsy measurements are made. In the living, it is thought to measure 4 to 6 meters. Small intestine consists of three segments lying in series: the duodenum, the jejunum, and the ileum. The duodenum, the most proximal segment, lies in the retroperitoneum immediately adjacent to the head and inferior border of the body of pancreas. Duodenum is delineated from the stomach by the pylorus & from the jejunum, by the ligament of Treitz. The jejunum & ileum lie within the peritoneal cavity & are tethered to the retroperitoneum by a broad-based mesentery." [19]

"Lumen of small intestine is a complex arrangement of structures that aid in nutrient absorption. Each structure is responsible for increasing the surface area of intestine to enhance digestion & absorption of nutrients. The net result is a 600- to 1000-fold increase in surface area. Epithelium of small intestine is replaced every 3 to 6 days & can be influenced by a variety of factors." [20]

Small intestine is divided, into duodenum (fixed part), which is divided further into four segments: the duodenal bulb or cap; the second vertical or descending portion; the third horizontal or transverse portion; and the fourth oblique or ascending portion.[18] The mobile part is divided into ,upper two fifth known as jejunum and lower three fifth , known as ileum [20].

The small gut is suspended ,by the mesentery which extends from , the left side of the 2nd lumbar vertebra to the right iliac fossa, crossing the 3rd part of the duodenum, aorta, vena cava, & right ureter in its course. It measures 1.5 metres in length, along this line of attachment.. Its depth,15 cm, except in relation to the small bowel, where it dwell in the pelvis, and measures 20 cm.[20]

Parts of small intestine, lie in the pelvis i.e the terminal ileum (except the last 5 cm, which is fixed in the RIF), & about 1.5 metres of small bowel beginning at a point 1.8m from the DJ flexure to a point, 3.4 metres from the flexure.[20]

DUODENUM[20,21]

The duodenum is 25cm in length. It's a C shaped bend which lies in, close proximity to the head of the pancreas.

RELATIONS

First part

Anterior part: Quadrate lobe of liver

Posterior: Portal vein, gastroduodenal artery and the bile duct, IVC

Superior: epiploic foramen and the hepatic artery

Inferior: Head of the pancreas

Second part

Anterior : GB, Transverse colon

Posterior : Renal vessels, pelvis of the kidney

Right : Hepatic flexure of the colon

Left : Head of the pancreas

Third part:

Anterior part: SMA, root of the mesentry , transverse colon, mesocolon

Posterior: IVC, aorta, spermatic vessels, left sympathetic trunk and left psoas

Superior: head of the pancreas

Inferior: small intestine.

ARTERIAL SUPPLY

The main vessels , that supply the duodenum are superior and inferior pancreatic duodenal arteries, which are SMA branches.

LYMPHATIC DRAINAGE

The lymphatics from the duodenum, drain into the anterior & posterior pancreatic nodes which are situated in the anterior & posterior groove between the pancreatic head & duodenum.

VENOUS DRAINAGE

The veins of duodenum drain into splenic, superior mesenteric and portal vein.

NERVE SUPPLY

Thoracic 9^{th} &10^{th} spinal segments, parasympathetic nerves which arise from vagus nerve.

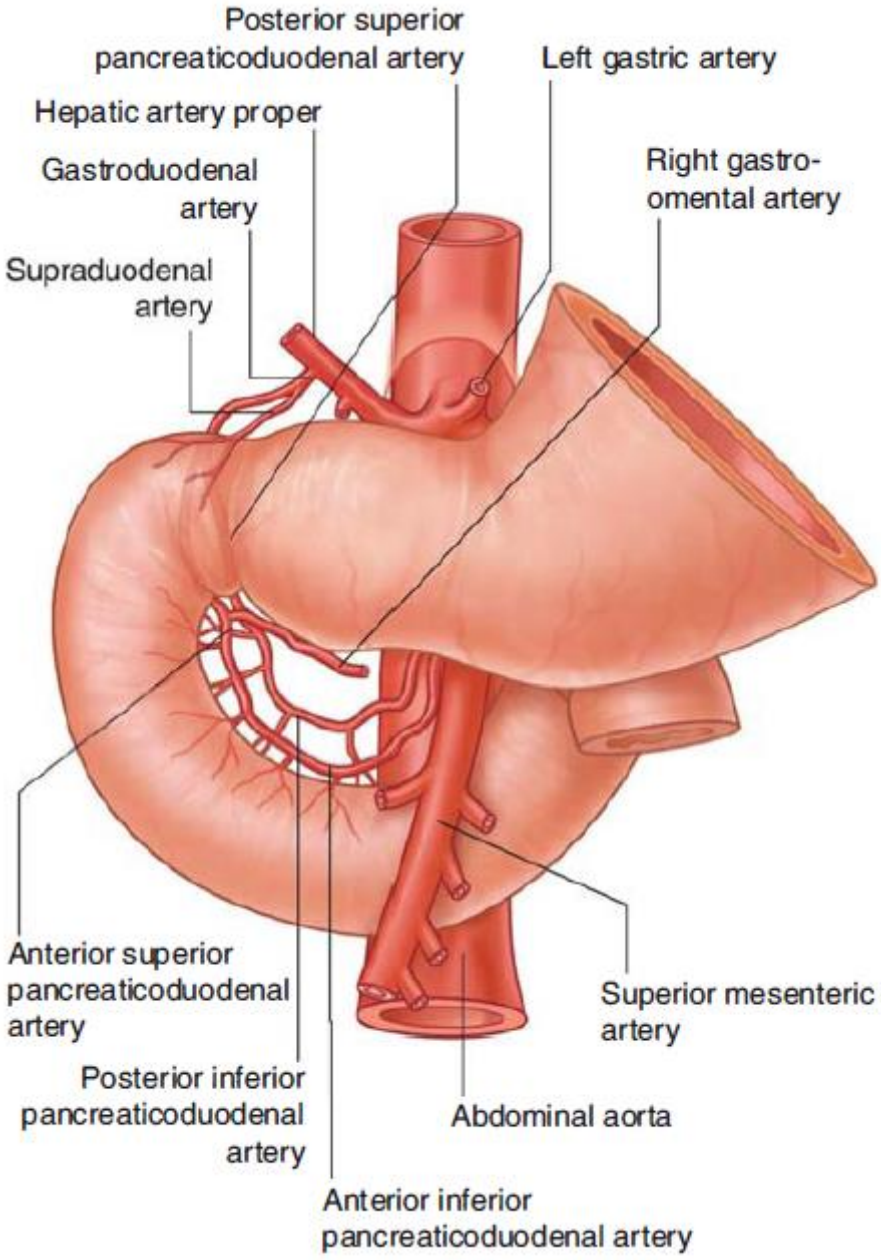


FIG 3: ARTERIAL SUPPLY OF THE DUODENUM

JEJUNUM AND ILEUM [22]

These two are, the most mobile part of the small intestine. They are suspended from posterior abdominal wall by the mesentery and hence the mobility. The jejunum constitutes ,of the upper two- fifths of small intestine, while the ileum constitutes the lower 3/5th . The jejunum begins at DJ flexure. The ileum terminates, at Ileocoecal region [20,21].

Jejunum starts at , ligament of Treitz & the ileum terminates at the ICV.The jejunum is more centrally placed in the abdomen, whereas the ileum lies mostly in the hypogastric region and pelvic cavity.[18]

ARTERIAL SUPPLY [23]

The arterial supply to jejunum & ileum arise from SMA . Jejunal branches arise from left side,upper portion of SMA. Ileal branches arise from left & anterior aspect of SMA. Jejunum has one / two arterial arcades in the mesentery, with parallel vessels 3.7 cm long going into the gut. Ileum has two/three arterial arcade in the mesentery, with parallel vessels 1.2 cm long going to gut. There is no collateral circulation beyond the terminal arcades in small gut.

LYMPHATICS [23,24]

Lymphatic vessels, called lacteals are arranged at two levels, within wall of small gut. First one, in mucosa & second, the muscular coat and which further drains into plexus into wall of gut. From there, it passes into lymphatic vessels in the mesentery and passing through numerous lymph nodes, present in mesentery & along the SMA

VENOUS DRAINAGE[23,24]

The veins, drain into SMV.

NERVE SUPPLY [23,24]

Sympathetic & parasympathetic nerves arise from superior mesenteric plexus & supply the jejunum & ileum.

DIFFERENCE BETWEEN JEJUNUM AND ILEUM [18]

JEJUNUM	ILEUM
About 8 feet long	11 feet long
Walls are thicker	Walls are thinner
Lumen is larger	Lumen is smaller
Prominent plicae circulates	Less prominent plicae
One arterial arcade	Two-three arterial arcades
Peyers patches are sparse	Peyers patches are more in number

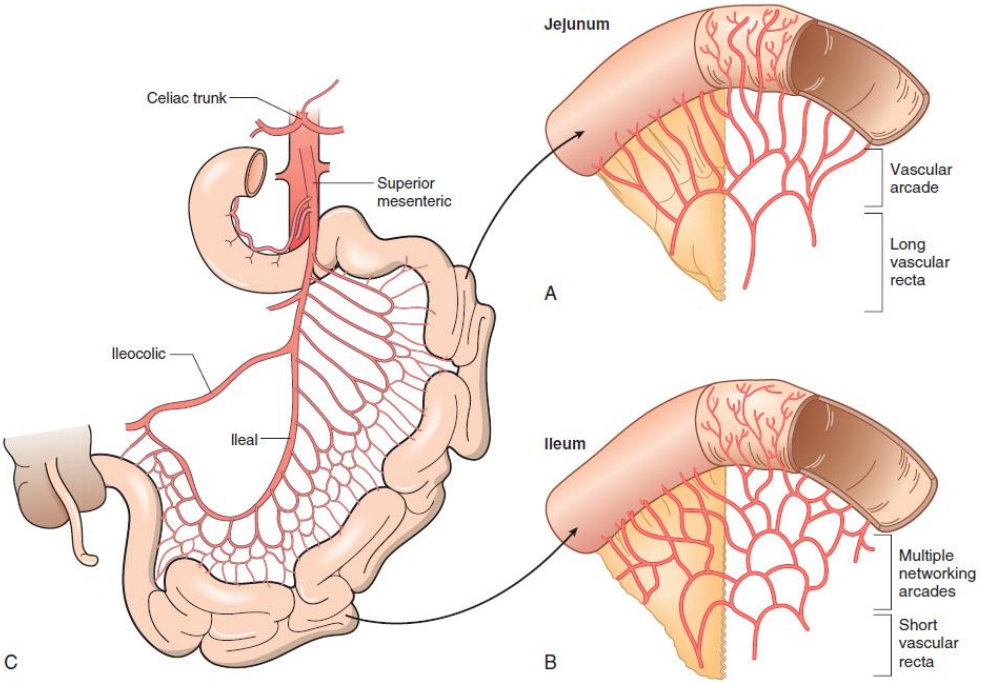


FIG 4: JEJUNUM AND ILEUM

HEALING OF GI ANASTOMOSIS [28]

Effective wound healing is of utmost importance to the surgeon & the patient in case of intestinal anastomosis. Failure of wound-healing causes life threatening complications like, additional surgeries , longer hospital stay, financial burden on the family & in the long run disability to the patient.

The GI tract has 4 layers : the mucosa, submucosa, muscularis propria & serosa.

In 1887, Halsted showed that submucosa - strongest layer of the GI tract. The submucosa has the highest concentration of collagen, followed by blood vessels, lymph and nerves. The muscularis propria also has a mix of the collagen. There is increase in collagen content as a response to chronic obstruction. Serosa-a very thin layer of connective tissue, covers muscularis propria. When creating anastomosis, approximation of serosa minimizes the risk of leak.

The process of healing of the intestine, is similar to wound healing. It is divided into an acute inflammatory -lag phase, proliferating phase, & finally, a re-modelling phase / maturation phase.

The most important factor determining the strength of the wall of the intestine is Collagen. [24]In proliferative stage, the fibroblasts become predominant & play, crucial role in laying down of collagen in the EC space. There is division of the crypts at epithelial level, which in turn cover the defects that occur, at the luminal surface of

the gut. After an insult, to GI tract i.e in form of surgery, the mature collagen degrades & this occurs at the twenty fifth hour and lasting up-to-the first 4 days. It made up of twenty zinc-dependent endopeptidases. The usage of matallo-proteas inhibitors, has shown to decrease anastomotic leaks by 48% on third post-op day, there by confirming the importance of the above in GI anastomosis. By post-op day seven, collagen synthesis increases especially in the caudal part of the anastomosis. After five-six weeks,amount of collagen synthesized is not affected in wound healing /anastomosis. The strength of the scar continues to increase as months progress. The workable strength is increased by cross-linking of collagen fibres. The submucosa contains the highest amount of the collage, and is strongest layer of the gut.. Hence,during gut anastomosis, its very important that this layer's included. Capacity to synthesize Collagen is better in large bowel than the small-gut; production being much higher in the proximal & distal small intestine. The strength of ileal anastomoses and larger bowel anastomoses at the end of four days is the same.

PHYSIOLOGY OF HEALING OF GASTRO-INTESTINAL ANASTOMOSIS

The lag phase ,is the first phase that's seen in intestinal anastomosis . It is also called, phase of inflammation. First step being the vasoconstriction followed-by increased permeability.[29] This causes the entry of neutrophils into the wound,followed by the macrophages ,on-to the anastomotic site, where synthesis & release of tissue growth- factors occurs.

This is followed by, proliferative phase which, is identified by the granulation tissue at the site of anastomosis. The collagen undergoes, both breakdown and production, which is, the strongest element & is found in with-in the submucosal layer.

The anastomotic strength during the first post-op days is comparatively less, as collagen is broken down by the collagenase at the injury site. Hence early anastomotic strength, is dependent on suture / staple holding capacity of existing collagen, until a huge amount of new collagen can be synthesized. This synthesis is by both, the fibroblasts and the smooth muscle cells. The final phase - the maturation phase, has a lesser number of macrophages & fibroblasts at the site of anastomosis[30].

FACTORS INFLUENCING THE HEALING OF GUT ANASTOMOSIS [31,32,33]

Wound-healing, a compound process involving, interaction of various predictable, and variety of time-dependent components. Wound healing trajectory is used to measure it. The curve begins with a "lag phase". Risk of breakdown of anastomosis is highest, at this time, as activity of collagenase is at its peak. After a period of forty-eight hours, the strength of the anastomoses is only 30% of its initial strength. The next is the Proliferation phase which is demonstrated with a steep slope on the graph [24].

Failure of wound healing occurs when, theres an abnormality in either the degree / the duration of components of tissue repair. Various factors are involved in wound healing and they have been divided into local and systemic factors.

GENERAL FACTORS[34]

AGE AND GENDER

In study, by Irvin & Goligher,[37,38] >50% of the patients , were above 60 years of age & had higher chances of intestinal leak than patients who were < 60 years of age. The study of Goligher et al ,showed that there was a higher chance of breaking down of the anastomosis in female population, than the male population, and was higher in the age of greater than 60 years compared to those who were <27 years of age. [23]

EMERGENCY / ELECTIVE PROCEDURE

In surgeries performed on emergency basis / obstructed bowel/ un-prepared bowel or in case of poor condition of patients ,higher chances of leaks were seen. Despite what might be expected in elective medical procedures, where there was sufficient opportunity to improve the condition of patient & gut would be solid and steady, the odds of anastomotic break down was less [24].

ON-GOING SEPSIS

There are evidences from clinical and experimental studies that sepsis in the peritoneal cavity have some adverse effect on the anastomoses. The chances of anastomotic leaks were more common when surgeries were performed on perforated diverticulitis/ carcinoma/ injuries to left side of colon. One of the causes of this may be due to defective collagen synthesis at the anastomosis.The surgeon should go for either a colostomy / ileostomy in such cases, to avoid break down of the anastomosis.

DRUGS (CORTICOSTEROIDS AND IMMUNOSUPPRESSIVE)

Corticoteroids interfere with wound-healing. The higher the portion, the higher the possibility of break of the anastomosis. Steroids are known for the mitigating impact that add to lysosome membrene stabilization and this causes disturbance of the anastomosis which thusly prompts breakdown of the anastomosis .[24,25]

SYSTEMIC ILLNESS

DISEASE	Effects
Jaundice [25]	Counteracts movement of the fibroblast & combination of collagen[25]
Uraemia	Reduces formation of granulation and prevents growth of fibroblast[26]
Malignancy	Exposure to radiation and chemotherapy agents causes breakdown of anastomosis
Diabetes Mellitus	Reduces phagocytosis, lowers the synthesis of collagen.[26]

SPECIFIC FACTORS [35,36]

MALNUTRITION

The protein content in the body is required for the creation of the collagen which thusly is the most significant factor for recuperating of anastomosis. Diminished sums in the body can be one of the reasons for leaks. The protein in the body are increasingly significant for the mending of the abdominal wounds. Subsequently the pre and post-op protein levels should be kept up for good healing.[26]

HAEMOGLOBIN <11G%

Low degrees of Hb prompts diminished O2 to the tissues which inturn can prompt tissue ischemia and separation of the anastomosis.[26]

EXCESSIVE LOSS OF BLOOD

Blood loss leads to lowers Hb & there by reduces the Oxygen carrying capacity of the blood to the tissues.[22]

RADIOTHERAPY

Radiotherapy given within 3 weeks of medical procedure, damages the epithelial cells.

Diminishes the pace of mitosis, decreases the stature of villi and causes submucosal & muscular edema. The absolute time taken for this to rectify, is twenty two days.

Henceforth it is prescribed to sit tight for a period of 3 weeks after medical procedure to begin radiotherapy.[25]ATP-MgCL2 appears to protect the anastomosis after radiotherapy. Vit A is also shown to have protective effects.[25]

USAGE OF ANTIBIOTICS

Bowel preparation is said to be advantageous in averting intestinal leaks. This along with prophylactic antibiotic preoperatively reduces the anatomotic breakdown and also reduced the SSI rates.[27]

LOCAL FACTORS

SITE OF ANASTOMOSIS

Serosa is the most important layer in healing of anastomosis. Sites that lack this serosa i.e oesophagus & lower rectum have higher rates of leaks.[27]

Tension at the anastomosis

Blood flow to the anastomotic sites are most important and anything that hampers this can lead to break-down of the anastomosis. Proper & complete mobilization of the bowel will reduce the rate of anastomosis breakdown.[27]

Distraction of the anastomoses

In intestinal obstruction dilatation of the proximal bowel occurs & proximal end is loaded with fecal matter. Adequate decompression, followed by cleansing of the

proximal bowel is required.Early post-operative feeding, contrasts x-ray post-operatively are dangerous.[27]

PLACEMENTS OF DRAINS

There have been numerous examinations that have demonstrated that the utilization of drains is both helpful and hurtful. They can be a potential sites of infection. Drains that are placed close to anastomotic sites, produce an inflammatory reaction and disrupt the suture lines.[27]

TECHNIQUE OF SUTURING

Inversion of the mucosa has demonstrated prevalence over the eversion of mucosa in numerous examinations - trial & clinical investigations . There has been no huge contrast in after-effects of single layer and double layer suture methods in much clinical trials. Single layered methods demonstrated to be prevalent & favored by numerous specialists in anastomosis including extra peritoneal portion of the rectum & esophagus , as this preserves the blood supply which is superior to a double layer procedure.[28,29]

SUTURING METHODS [40,]

Suturing can either be simple / interrupted /continuous / running manner. The advantage of a continuous suture-is water-tight suture lines, while the disadvantage being; the integrity of the entire suture line will be based on one single stitch. Although haemostasis is achieved with continuous suture, it may constrict blood flow to the anastomosis more than interrupted sutures. Certain principles are to be followed in anastomosis & they are:

- The anastomoosis must be watertight & mucosael apposition should be present.
- The submucosae that provides strength to a gut anastomosis, must be incorporated.
- Edges of the small gut are carefully sutured ,to avoid strangulation during closure in order to avoid stricture/necrosis & subsequent anastomotic leakage.

LEMBERT SUTURE

Lembert suture a commonly used suture in GI surgeries. Its used as outer layer of a 2/3rd gut anastomosis & is also used to repair sero-muscular tear in the gut wall. The stitch is started, approx. 3 to 4 mm lateral to the incision & placed at 90 degrees ,to the long axis of the incision. It incorporates the sero-muscular layer. Full thickness of gut is not taken. The needle tip, is brought out, close to the edge of the incision & is

then re-inserted in the opposing wound edge & brought out, about 3 to 4 mm lateral to the wound edge.Suture is then tied to approximate the tissue, not very tight to prevent tearing of the tissue. The most commonly used material for a lembert suture is either silk/ poly-dioxanone suture. This is either performed in interrupted / continuous manner.

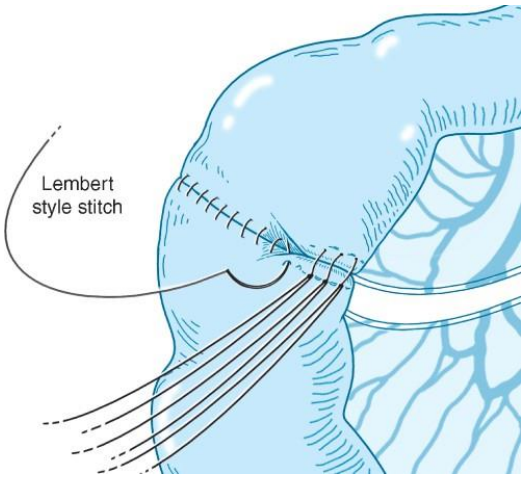


FIG 5: LEMBERT SUTURE.

HORIZONTAL MATTRESS SUTURE /HALSTED SUTURE

The horizontal mattress suture/ Halsted suture, is used for sero-muscular apposition in multi-layer anastomoses.

Sutures are passed through the seromuscular layer two to 3 mm lateral to the wound edge & brought out at the wound edge.Needle is then passed through the opposing edge of the wound & brought out two to 3 mm lateral end. On same side of wound approx. 2 milimeter distally, the suture is passed, through both edges of the wound to

create two free ends of the suture on 1 side of wound edge with loop of the suture on the other side. This stitch is used in damaged, inflamed tissue where a lembert suture pulls through the tissue, because the horizontal mattress stitch distributes tension in a plane 90 degrees to that of a lambret suture & it allows for approximation of tissues with less crushing effect.

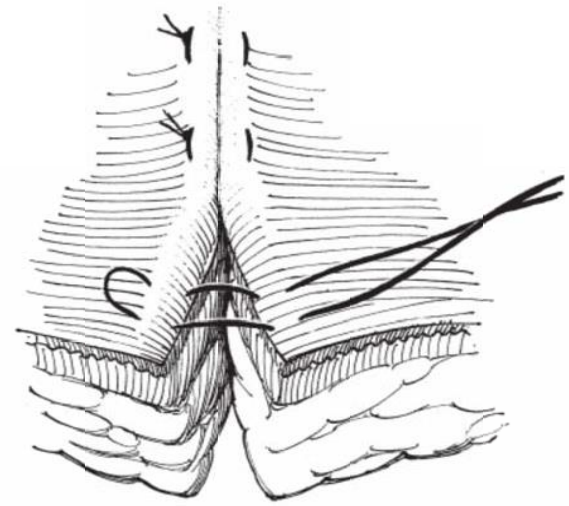


FIG 6:HORIZONTAL MATTRESS SUTURE

PURSE STRING SUTURE

A purse string suture is used to invert appendiceal stumps / to secure feeding tubes /drainage tubes in place. Its a circular continuous laembert stitch, around a fixed point / opening in the GI tract. Nonabsorbable suture material is most commonly used.

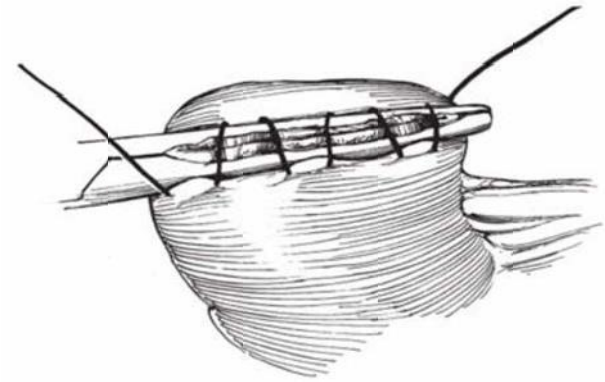


FIG 7:PURSE STRING SUTURE

CONNELL SUTURE

Connell suture is a continuous stitch that inverts the mucosa in-to lumen of the bowel.Suture is started at edge of the anastomosis & brought, full-thickness, from inside to-out on one side & then outside-to in on the opposite side. The knot lies within lumen of bowel. Suture is passed through the tissues from inside-to out, on one side-to begin the Conell stitch. On the other end , suture is taken through the full thickness of tissue, from outside-to in. On the inside of bowel lumen, stitch is advanced 2 to 3 mm along, wall & then through gut wall from inside to out on-to same side. With suture now on the outside, the next throw is performed, on the opposite side in an similar manner. This creates a U-shaped, full-thickness, running inverted suture. It acts as an inner layer of a two-layered anastomosis. Chromic catgut/vicryl are generally used. Most of anastomoses are performed in an inverting fashion in one / two layers. Gamine & associates, in the year 1956, published one hundred and fifty six patient series of various colonic anastomoses in which they used

a single-layered, full-thickness, interrupted,/inverting technique with silk suture. They reported 5 deaths as result of anastomotic leaks with mortality of 3% . Incidence of all anastomotic complications- eight point six %. In year 1966, Getzen published a Clinical series containing hundred and thirty six cases of exerted gastrointestinal anastomoses in which only 1 leak occurred. Inverting & everting bowel anastomosis were also compared in in dogs. Oedema at anastomotic site was more pronounced in even-ed group up-to twenty one days after surgery. Strength of the inverted anastomosis was $2/3^{rd}$ of everted group upto twenty one days after surgery. Anastomotic strength was comparable in the 2 groups after twenty one days. Zero deaths were noted , in cases where mucosa was everted .Sub-mucosa the important layer, contains the fibroblasts & produces collagen that helps in holding the anastomosis together. Inverting the mucosa brings it into the lumen, where it will be broken down further until 1 side is opposed on-to the submucosa of other side. It may also adhere to surrounding structures, leading to more adhesions and delayed healing. Hence surgeons prefer the inverting technique for the anastomosis.

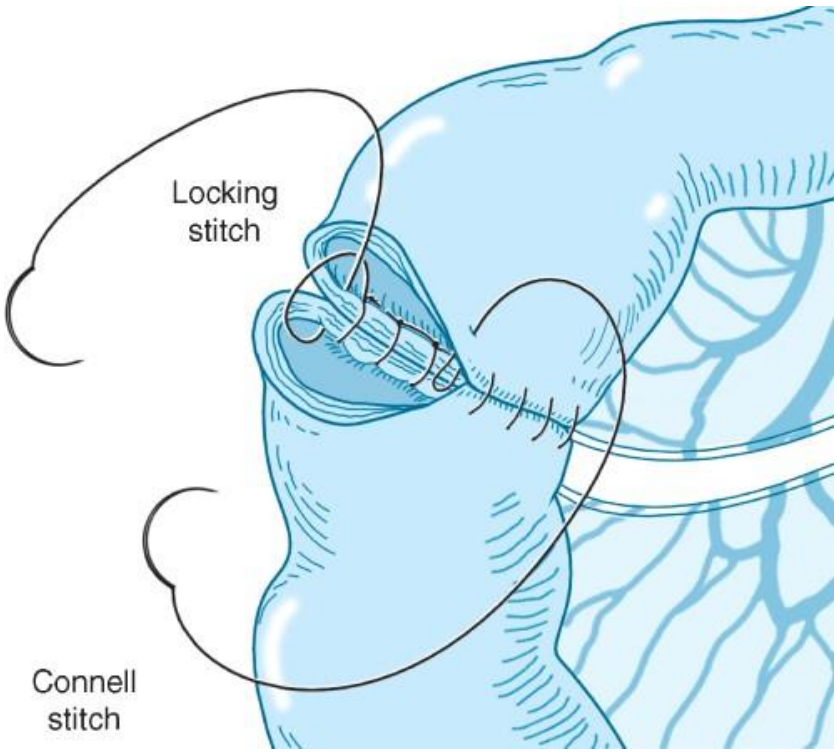


FIG 8: CONNELL SUTURE

PRINCIPLES OF INTESTINAL ANASTOMOSIS [40,41]

To restore the continuity of GI tract when a segment is resected for either benign/ malignant conditions anastomosis is required. Resected segment can be anywhere between pharynx to the anus. As a result of this, multiple anastomotic sites can be performed i.e between the esophagus & stomach ,small bowel & small bowel, small gut & large bowel, colon & colon, colon & rectum ,colon & anus (coloanal) & small gut & the anus (ileaoanal).

The anastomoses are usually between ends of intestinal segments & thus are called end- end anastomoses. The anastomoses can also be between , the end of one segment & the side of the other (end-side anastomosis)/ between the sides of 2

segments (side -side anastomosis). Intestinal anastomoses are performed in a variety of ways. [31]

Principles of successful intestinal anastomosis

WELL-NOURISHED PATIENT WITH NO SYSTEMIC ILLNESS

The assessment of nutritional status was done based on 2 bio-chemical parameters namely hemoglobin & sr albumin estimation. Both, prolonged & short term malnutrition have detrimental effects. Malnutrition affects anastomotic healing in the following mechanism i.e lack of essential amino acids that are required for collagen synthesis/ deterioration in patients immune competence. In well nourished patients do not require any special nutritional regimens. Enteral nutrition is the first choice. It has advantage of improving host defenses by sustaining the gut barrier & thereby diminishing the problem of bacterial translocation which is an important factor implicated in MODS. Total parental nutrition's considered only if the patient exhibits intolerance to various enteral nutrients. Vitamin C is an important factor in process of bowel healing. Inability to secrete pro-collagen into extracellular space is due to Vitamin C deficiency . Ketone bodies are better as a nutritional factor in gastrointestinal surgeries. Ketone bodies inhibit intestinal mucosal atrophy that is associated with glucose based nutrition. Growth hormone, increases the uptake of glutamine & several other amino-acids by the gut ,a process which explains anabolic effect & nitrogen retention that attributes to growth hormone.[32]

FECAL OR PURULENT CONTAMINATION, EITHER WITHIN THE LUMEN IF THE BOWEL / IN THE PERITONEAL CAVITY

One of the significant factors that affect anastomotic site & its healing is presence of bacterial contamination. An early, significant decrease in suture holding ability of anastomotic tissue occurs in esophagus, stomach & ileum & large bowel. Gastro-duodenostomies lose 64% of their strength & colonic anastomosis 72%. The first 3 days are the most crucial and the strength is lost as a reflection of an imbalance between collagen synthesis & degradation. The first 3 days , a crucial time for the anastomosis, because its integrity depends on it. Leucocytes, responsible for breakdown of collagen, increase in collageno-lytic activity leading to higher breakdown of anastomosis. Anastomotic healing is significantly affected by bacterial load present in the gut. Fibro-purulent exudates filling anastomotic space ,despite rigorous peritoneal lavage in peritoneal sepsis prevents fibroplasia & angiogenesis from bridging the gap. The local use of antibiotics helps in healing process via primary intension. The sepsis in turn increases collageno-lysis and there is decrease in the synthesis of collagen.[32]

ADEQUATE EXPOSURE & ACCESS

Access, which is a critical determinant ,& the incision that must be made in such a way as to allow adequate exposure of the operating field. A suitable retractor is used so that lateral aspects of the field can be controlled. This increases efficiency of

operating assistants & space. Its also important to compartmentalize the abdomen and can be achieved in various ways. Handling of small gut is usually difficult hence , is packed off using wet mop. Next stage is to bring the bowel to the surface. Small bowel being mobile can be easily brought out of abdomen in absence of any adhesions/tethering thats caused by disease. However, with the large bowel, the peritoneum needs to be divided along the lateral border & retroperitoneal structures need to be reflected posteriorly.[31]

HANDLING OF THE TISSUE & METICULOUS TECHNIQUE

In case of any surgeries , gentle tissue handling is of utmost important. While suturing the bowel, use of atraumatic graspers & picking up of the tissue only when necessary to prevent the crushing injury from the forceps. Pass the needle 90 degres to tissues, and take bites that include sub-mucosa. Minimize lateral movements to avoid any tissue shearing. An inverting technique is prefered, but everting anastomosis, which minimizes exposed mucosa, is safe . Follow "approximate, do not strangulate" principle to avoid bowel ischemia. [33]

VASCULARISED TISSUES & ADEQUATE HAEMOSTASIS

Healing of anastomosis is best when there's good blood supply & this depends on the vasculature . Adequacy of blood supply to anastomotic site is confirmed by the presence of bleeding from cut ends of bowel, the color of bowel & pulsations of

adjacent mesenteric vessels before the commencement of anastomosis. The tissues around bowel are divided using a scissors, & the mesentery is divided using clamps & then are tied with thread. Tissue planes are separated using the fingers/ swab. Bleeding points are cauterized & the disadvantages of this dissection technique is the oozing from raw surfaces. Newer methods being used are - ultrasonic scalpel / bipolar electrocautery to prevent problems of coagulation. This reduces the bleeding reduces the number of ties that are needed.[32]

ABSENCE OF TENSION & DISTAL OBSTRUCTION

One of the critical factors which determine perfusion to anastomotic site is the mobilization of intestine. Excessive / rough mobilization may cause damage to vessels. Another factor is absence of any sort of obstruction distally. In small bowel anastomoses tension is not an issue, but in large gut anastomoses, it is very essential that 2 ends of bowel be joined together without any tension. [31]

APPROXIMATION OF ENDS OF BOWEL & VASCULARIZATION

Inadequate mobilization causes tension at the anastomotic site and this leads to vascular compromise of anastomotic site. Before start of anastomosis the pulsations of the mesenteric vessels must be felt & bowel cut ends should have a good color and should have bleeding ends. [31]

TECHNIQUES OF GUT ANASTOMOSES [40]

The anastomotic techniques that are commonly used are

(1) Hand-sutured anastomosis

(2) Stapled anastomosis

SUTURE MATERIAL

Intestinal segments can be sewn together with various suture materials. The ideal suture material, one that causes minimal inflammation and tissue reaction, while providing maximum strength during lag phase of healing is yet to be discovered.

Popular choices include

Absorbable sutures(Polydioxanone, vicryl) v/s non-absorbable (silk)

Mono-filament (PDS, Maxon) v/s braided (vicryl)

CONTINUOUS SUTURES V/S INTERRUPTED SUTURES[42]

Continuous & interrupted sutures are used in performing gut anastomosis. There are no RCT's that show superiority of interrupted over continuous sutures.

Double layered anastomoses consist of inner layer of continuous / interrupted absorbable sutures & outer layer of interrupted absorbable / non-absorbable sutures.

The single layer anastomoses consist of 1 layer of interrupted / continuous absorbable sutures.

There are studies that show that single layer anastomosis is superior to the double layer anastomosis in theory , but in practicality they both are equally efficacious.

TECHNIQUE OF DOUBLE LAYER GUT ANASTOMOSES [40]

1. The 2 bowel ends to be anastomosed, are aligned next to each other by aligning the non-crushing bowel clamps.

2. Two corner sutures placed through serosa & underlying muscularis mucosa, each of it, then tied & tagged with straight intestinal clamp.

3. Posterior interrupted layer: 5 - 7 interrupted Lambert stitches , placed between the corner sutures. Sutures are tied (3 knots) so that knots will be outside the anastomosis. All but 2 corner sutures are cut, leaving the tied corner sutures tagged with straight clamps. The dictum- inside out, outside in is followed.

4. Inner posterior layer: Starting in the middle, 2 continuous sutures are started to form inner layer of the anastomosis. Each suture goes towards each of the corner, in an over & over manner incorporating the mucosal & submucosal layers of each lumen.

5. Inner anterior layer: The continuous suture is continued around the corners, 1 after the other, and come together in the middle & the two ends are ties, after cutting

the needles of each (four to five knots). The non crushing bowel clamps are removed after the inner layer of anastomosis has been completed.

6. Anterior interrupted layer : 5 - 7 anterior {seromuscular} Lambert sutures are placed. Sutures, tied at ends (three knots) and cut five mm, distal to the knots. Once anastomosis is completed the entire circumference of bowel is inspected. If divided ends of the anastomosis appear to be well apposed, the anastomosis is sound.

SINGLE-LAYER INVERTING SUTURE [41]

The anastomotic technique that involves single-layer inverting anastomosis includes placing sutures through serosa, submucosa & muscularis mucosae. The needles should enter from serosal side & should include muscular layer, the submucosa & muscularis mucosa layer.The needle is pulled out between muscularis & mucosae, & then placed back in opposite fashion on other side of gut anastomosis. Sutures are placed about 4 mm from anastomotic edge on serosal surface, 2 mm from edge in the submucosa & 1mm from edge of muscularis mucosa. The knots are placed on the serosal side. Mucosal impairment is minimal as the sutures are taken through mucosa.

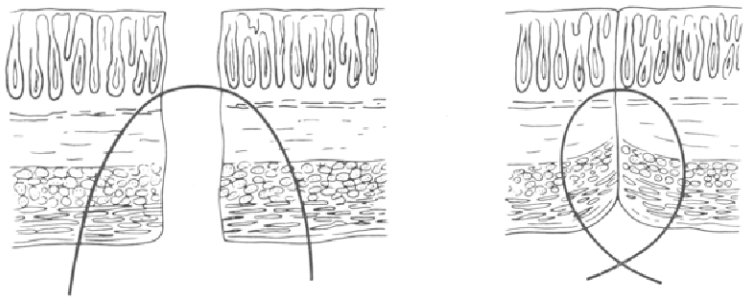


FIG 9:SINGLE LAYER INVERTING SUTURE

END - END DOUBLE LAYERED ANASTOMOSIS [42]

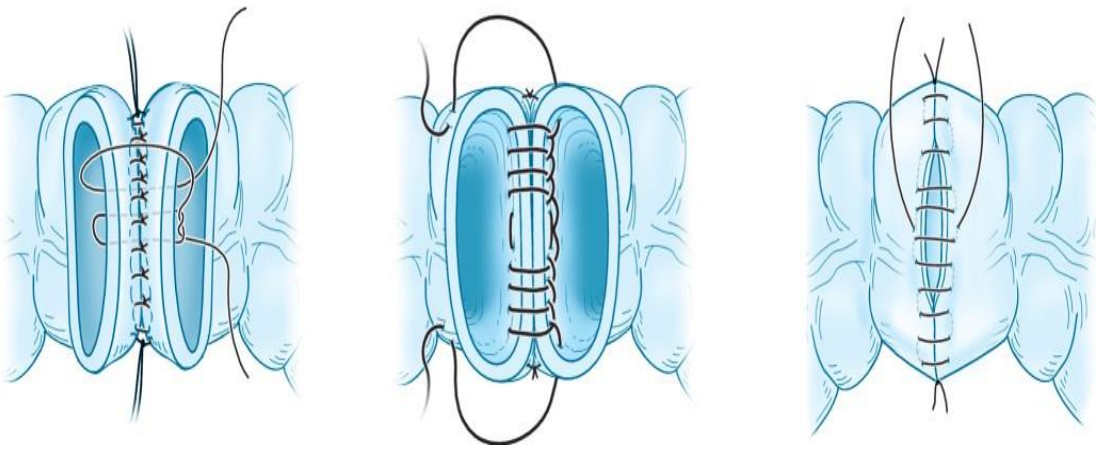
Ideal method is to bring both ends without any tension. Stay sutures are placed in order to avoid any need for tissue forceps, which inturn helps with placement of the continuous posterior layer & allows rotation of the anastomosis.

For inner continuous suture that contains all layers of bowel, a double-ended suture is taken, this keeps the anastomosis even. One / two Connel sutures are taken which help in inverting the mucosa. The double-ended suture is tied on the anti-mesenteric side of bowel and in middle. The inversion of anastomosis done inverted using seromuscular anterior &continuous Laembert suture. Bowel should be apposed in each layer as accurately as possible. The distance of sutures should be approx.five mm deep & five mm apart. Suture materials used are 2-0/3-0 size & are made of absorbable material, which is either braided / a monofilament material & has a round bodies needle. Braided & coated sutures are easier to handle & tie knots. Inner continuous suture which has all the layers is undertaken first.Second layer being the inverting sero- muscular, Lambert layer.

Bowel with similar diameters are brought together to form an end-end anastomosis. 'Parachuting' / 'purse-stringing' proximal part of dilated bowel lumen into narrower distal bowel risks a poor anastomosis & leads to anastomotic leaks. A side-side / end-side anastomosis is safer in such cases. The “Cheatle split” (a cut is made in the anti-

mesenteric border of bowel) helps to enlarge lumen of distal part of bowel which is collapsed. Any tear in mesentery has to be closed, to prevent internal herniation.

FIG 10: END TO END ANASTOMOSIS



COMPLICATION OF INTESTINAL ANASTOMOSIS [47,48]

Important complications seen following gut anastomosis are:

ANASTOMOTIC LEAK

Most feared complication of intestinal anastomosis-anastomotic leak .Its one of the early complication of gut anastomosis. Healing of intestinal anastomosis is based on the integrity of anastomosis which depends on strength that is provided by sutures. This is seen in inflammatory phase. Followed by the phase- fibroplasia which is seen at 5^{th} - seventh post-operative. There's formation of collagen & decrease in the degradation of collagen which gives strength to anastomosis. Systemic / local factors

that cause delay in the transition of inflammatory phase to the fibroplasia phase result in poor healing & leak.

Leaks presenting on post-operative day one /two invariably are due to technical reasons. Anastomotic leak secondary to mechanism that interfer with normal healing presents around 7 postoperative day. Anastomotic leak presents as peritonitis / as localized abdominal abscess .If leak is uncontrolled, there is diffuse peritonitis which can cause high morbidity & mortality & requires reexploration.

Thorough lavage of peritoneal cavity is carried out during re-laparotomy. In some of the cases,anastomosis is broken down and bowel's brought out as ileostomy or colostomy. In localized intra-abdominal abscess, it is managed conservatively with either drainage of abscess percutaneously or under image guidance followed by antibiotics.

BLEEDING

Patients with sepsis & deranged coagulopathy usually present with bleeding. Bleeding manifestation is either seen immediately in post-op period as, hemorrhagic aspirate in the ryles tube, / as hematemesis/ melena, / bleeding from the abdominal drains. Patients should be managed with correction of coagulopathy aggressively & blood transfusion. If bleeding results in significant fall in haemoglobin, immediate re-exploration should be done. Intra-operative anastomotic site bleeding is characterized

by appearance of blood in the intestinal lumen, distal to anastomosis. Anterior layer of sutures are opened & both layers examined for evidence of any bleeding. Once bleeding site is identified, it is controlled by placing sutures.

WOUND INFECTION

Spillage of intestinal contents during anastomosis causes wound infection. Its managed by removing a few skin sutures & proper drainage of collected pus. Superficial SSI does not require treatment with systemic antibiotics.

ANASTOMOTIC STRICTURE

Late complication of intestinal anastomosis is formation of a anastomotic stricture. The formation of anastomotic stricture is higher after end-end anastomosis, especially when staplers are used for anastomosis. The most important risk factor for anastomotic stricture is controlled anastomotic leak thats managed conservatively. This occurs more commonly in esophageal & large bowel anastomosis & is usually managed conservatively.

METHODOLOGY

MATERIALS AND METHODS

SOURCE OF DATA:

Data was collected from patients who came to Department of General Surgery R.L. Jalappa Hospital, Tamaka, Kolar.

DURATION : November 2017 to June 2019

Method of collection of data:(including sampling procedure if any)

SAMPLING PROCEDURE:

Patients selected for this study were admitted with small bowel gangrene, strangulated hernia with bowel loop as content, small tumors, intestinal ischemia requiring resection & anastomosis of bowel.

Detailed history, thorough examinations, pre-operative examinations radiological examinations will be done.

Cases were allotted to either groups based on odd even method requiring single layer anastomosis & double layer anastomosis, odd being single layer & even being double layer anastomosis. In single layer technique anastomosis was carried with delayed absorbable suture material & double layer technique with inner transmural layer with delayed absorbable suture material & seromuscular layer with non-absorbable suture material.

All cases were followed up to a period of 2 weeks post discharge. Each case was analyzed with respect to, post-operative complications- anastomotic leak, abscess formation & duration of hospital stay.

Inclusion criteria:

- Age criteria 19-60 years.
- Surgical procedure for clinical conditions like small bowel gangrene, strangulated hernia with bowel loop as content, small bowel tumours, intestinal ischemia, requiring resection & anastomosis of small bowel.

Exclusion criteria:

- Patients requiring multiple anastomosis.
- Post chemotherapy and radiotherapy.
- Patients with diseases like sepsis, known cardiovascular disease.

A pretested proforma was used to collect relevant information (patient data, clinical findings, lab investigations, follow up events etc.,) from all selected patients.

STATISTICAL ANALYSIS:

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of Frequencies and proportions. Chi-square test was used as test of significance for qualitative data. Continuous data was represented as mean and standard deviation. Independent t test or was used as test of significance to identify the mean difference between two quantitative variables.

Graphical representation of data: MS Excel and MS word was used to obtain various types of graphs such as bar diagram.

p value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

FIG 11A: ILEAL PERFORATION

FIG 11B:SINGLE LAYER ANASTOMOSIS

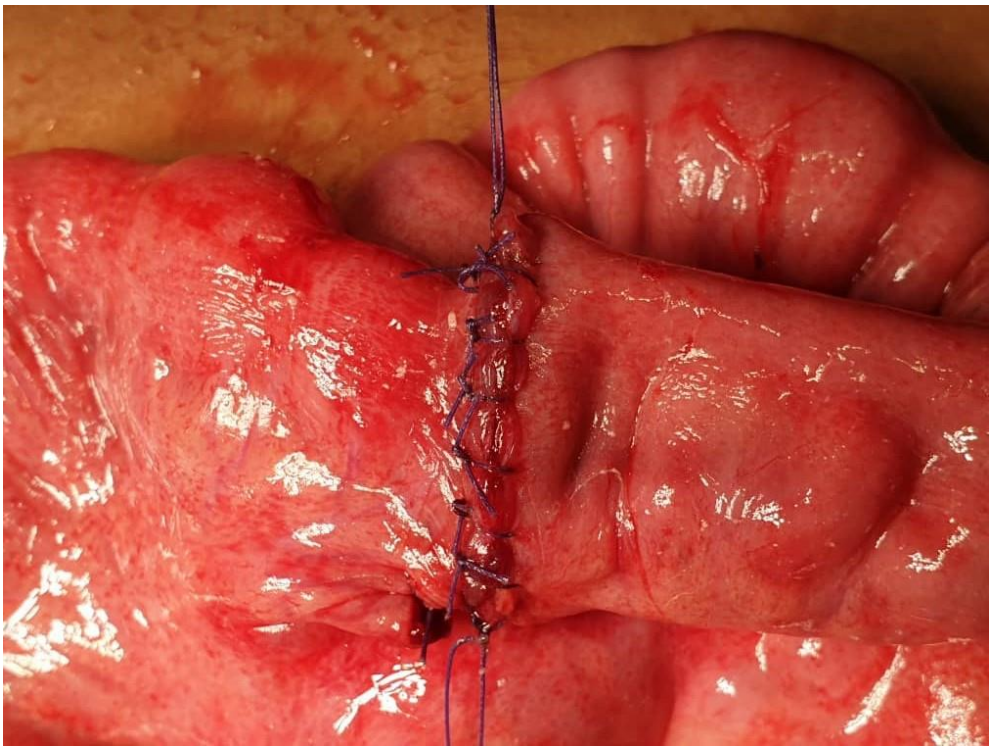


FIG 12A :DOUBLE LAYER ANASTOMOSIS (OUTER SEROMUSCULAR)

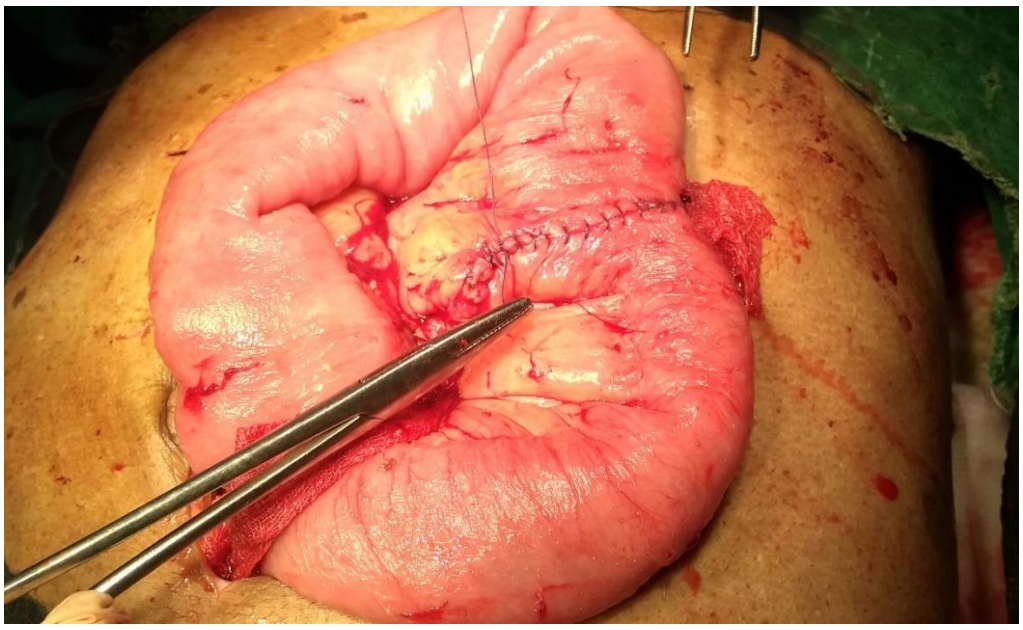


FIG12B:DOUBLE LAYER ANASTOMOSIS (INNER FULL THICKNESS)

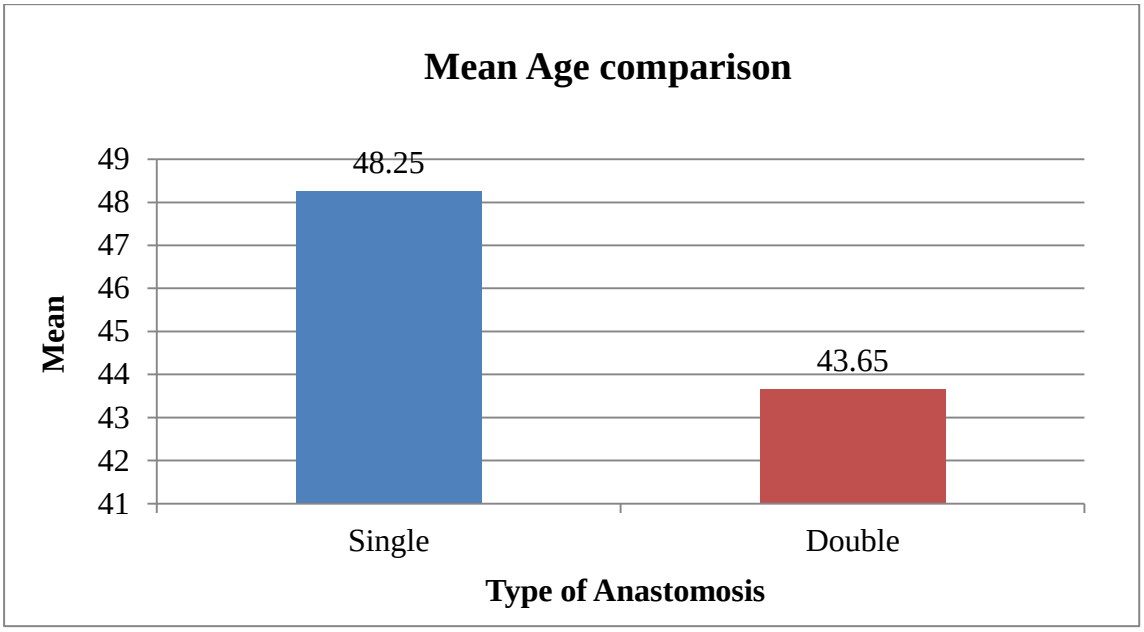
RESULTS

RESULTS

TABLE 1: MEAN AGE COMPARISON BETWEEN TYPE OF ANASTOMOSIS DONE

	Type of Anastomosis done				P Value
	Single		Double		
	Mean	SD	Mean	SD	
Age	48.25	13.83	43.65	15.15	0.322

In the above study, out of the subjects that were taken for the study: In Single Anastomosis group, the average age was 48.25 ± 13.83 years & in double layer group,average age was 43.65 ± 15.15 years. There was no significant difference in age distribution between two groups.



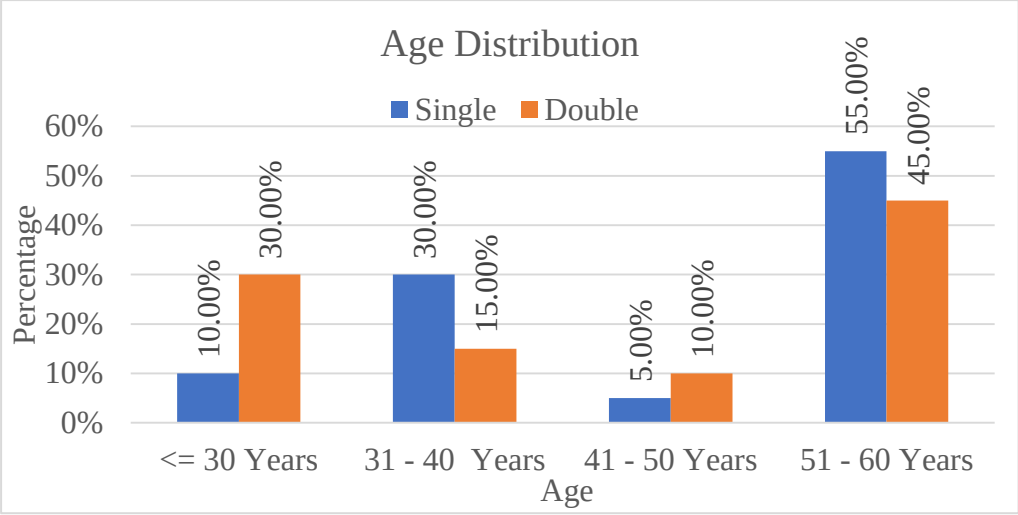
BAR 1 : BAR DIAGRAM SHOWING MEAN AGE COMPARISON BETWEEN TYPE OF ANASTOMOSIS DONE

TABLE 2: AGE DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

		Type of Anastomosis					
		Single		Double		Total	
		Count	%	Count	%	Count	%
Age	<= 30 Years	2	10.00%	6	30.00%	8	20.00%
	31 - 40 Years	6	30.00%	3	15.00%	9	22.50%
	41 - 50 Years	1	5.00%	2	10.00%	3	7.50%
	51 - 60 Years	11	55.00%	9	45.00%	20	50.00%
	Total	20	100.00%	20	100.00%	40	100.00%

$\chi 2 = 3.533$, df = 3, p = 0.316

In Single group, majority of subjects were in age group 51 - 60 years (55%) and in double group, majority of subjects were in the age group 51 - 60 years (45%). There was no significant difference in age distribution between 2 groups.



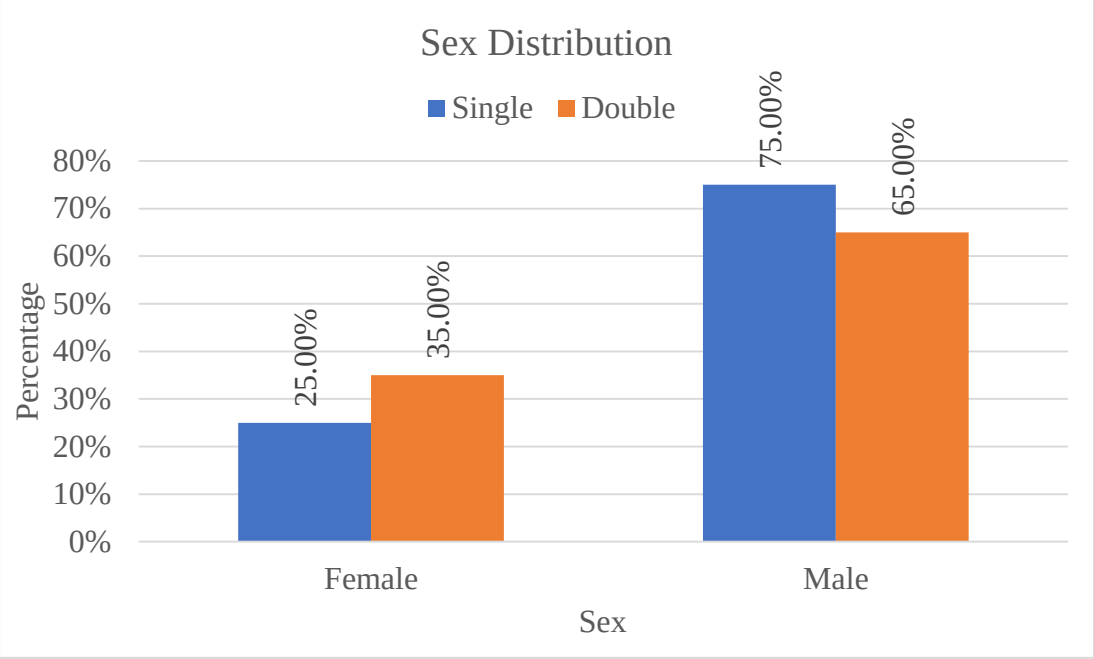
BAR 2 : BAR DIAGRAM SHOWING AGE DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

TABLE 3: SEX DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

		Type of Anastomosis done					
		Single		Double		Total	
		Count	%	Count	%	Count	%
Sex	Female	5	25.00%	7	35.00%	12	30.00%
	Male	15	75.00%	13	65.00%	28	70.00%
	Total	20	100.00%	20	100.00%	40	100.00%

$\chi 2 = 0.476$, df = 1, p = 0.490

In Single group, 75% were males and 25% were females and in double group, 65% were males and 35% females. No significant difference in sex distribution between 2 groups was noticed.



BAR 3 : BAR DIAGRAM SHOWING SEX DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

TABLE 4 : ANASTOMOTIC LEAK DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

		Type of Anastomosis done					
		Single		Double		Total	
		Count	%	Count	%	Count	%
Anastomotic Leak	No	19	95.00%	14	70.00%	33	50.00%
	Yes	1	5.00%	6	30.00%	7	17.50%
	Total	20	100.00%	20	100.00%	40	100.00%

χ 2 = 4.329, df = 1, p = 0.037*

In Single group, majority of subjects had no Anastomotic Leak (95%) and 5% had leak. In Double group 70% had no leak and 30% had leak. P value is statistically significant.

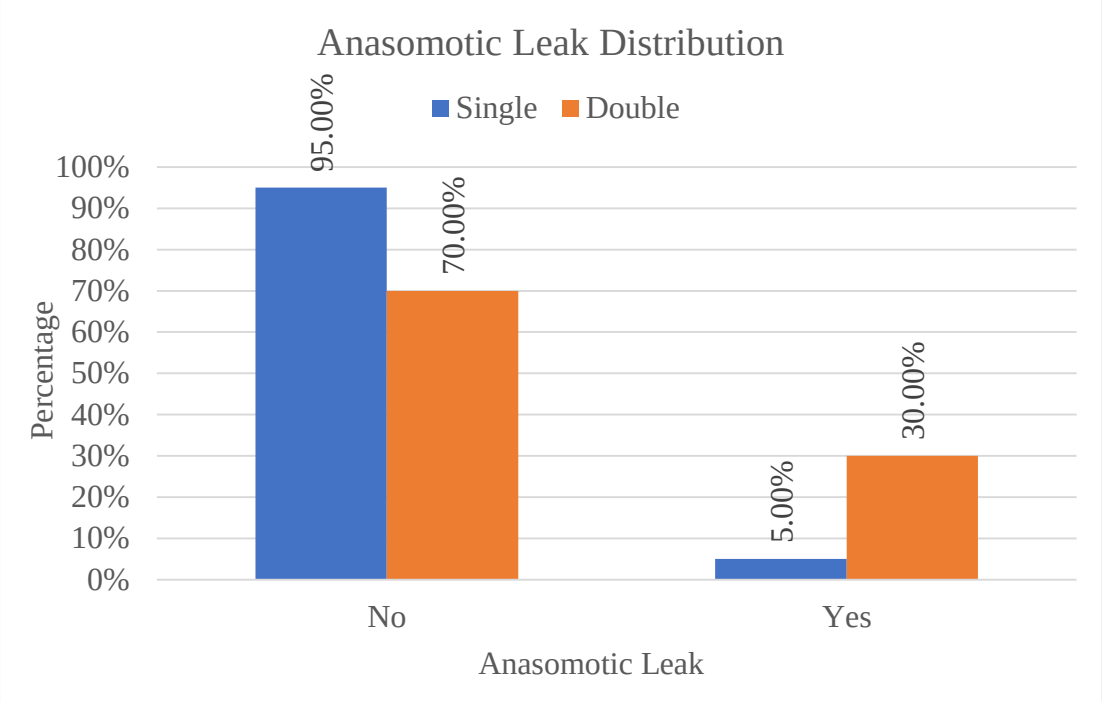


Figure 4 : Bar Diagram Showing Anasomotic Leak Distribution between Type of Anastomosis Done

TABLE 5 : DURATION OF STAY COMPARISON BETWEEN TYPE OF ANASTOMOSIS DONE

	Type of Anastomosis done						P Value
	Single		Double		Total		
	Mean	SD	Mean	SD	Mean	SD	
Duration of Stay	17.85	7.62	26.20	16.12	22.03	13.14	0.043*

Mean duration of hospital stay - single group was 17.85 ± 7.62 days and in double group was 26.20 ± 16.12 days. The duration of stay between two groups was statistically significant.

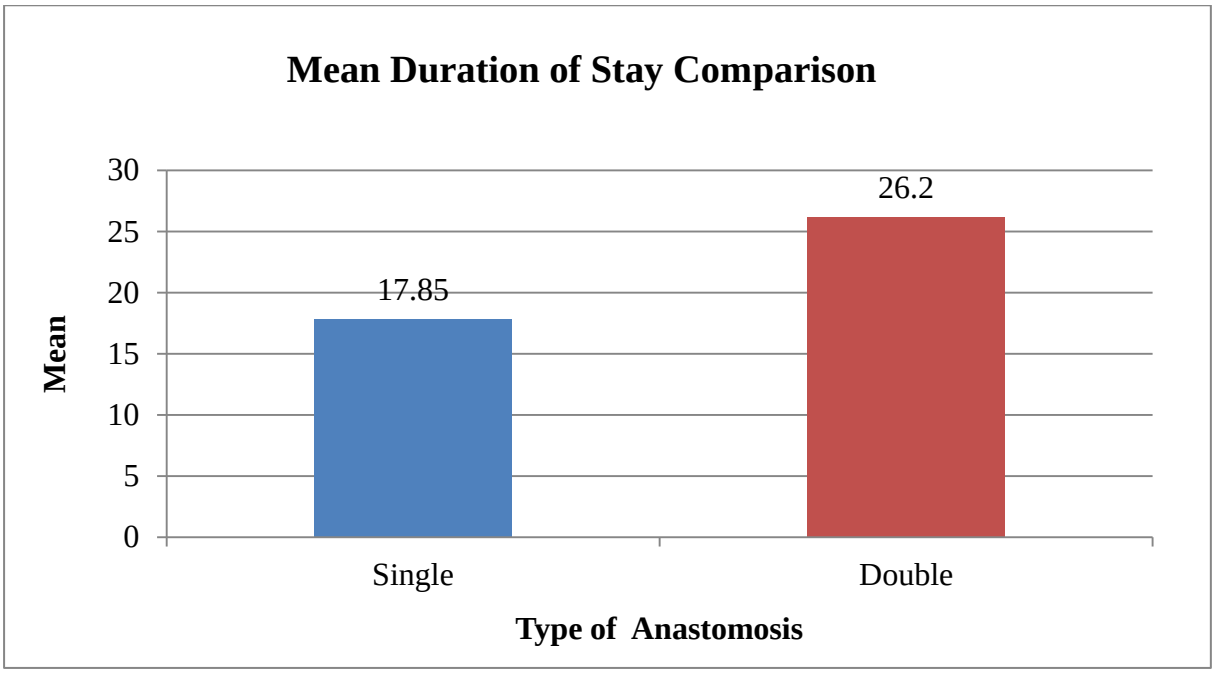


Figure 5 : Bar Diagram Showing Duration of Stay Comparison between Type of Anastomosis Done

TABLE 6 : ANASTOMOTIC SITE DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

		Type of Anastomosis done					
		Single		Double		Total	
		Count	%	Count	%	Count	%
Anastomotic Site	Ileo Ileal	10	50.00%	12	60.00%	22	55.00%
	Jejuno Ileal	5	25.00%	0	0.00%	5	12.50%
	Jejuno Jejunal	5	25.00%	8	40.00%	13	32.50%
	Total	20	100.00%	20	100.00%	40	100.00%

$\chi 2 = 5.874$, df = 2, p = 0.053

In Single group, site of Anastomosis was Ileo Ileal in 50%, Jejuno Ileal in 25% and Jejuno Jejunal in 25% and in double group, site of Anastomosis was Ileo Ileal in 60%, Jejuno Ileal in 0% and Jejuno Jejunal in 40%. There was no significant difference in anastomostic site beween two groups.

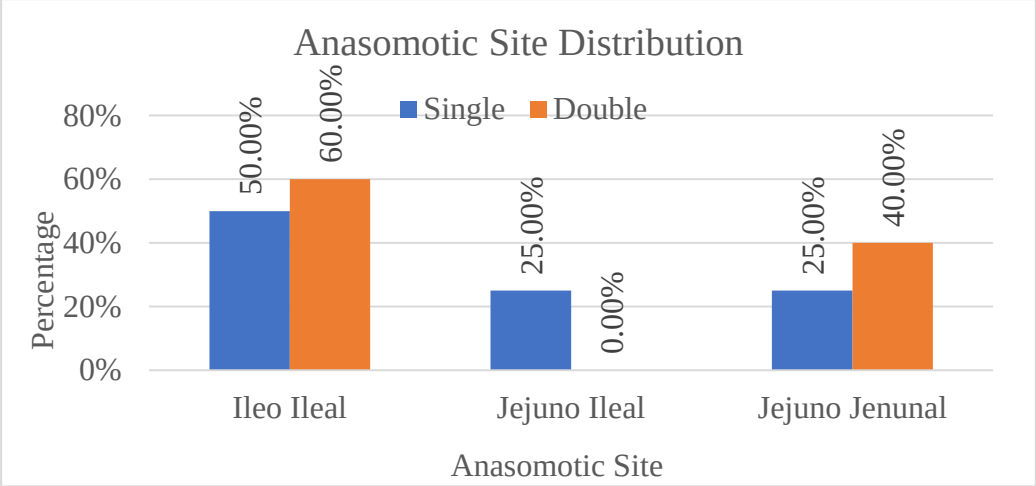


Figure 6 : Bar Diagram Showing Anastomotic Site Distribution between Type of Anastomosis Done

TABLE 7: RELAPROTOMY DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

		Type of Anastomosis done					
		Single		Double		Total	
		Count	%	Count	%	Count	%
Relaprotomy	No	20	100.00%	17	85.00%	47	92.50%
	Yes	0	0.00%	3	15.00%	3	7.50%
	Total	20	100.00%	20	100.00%	40	100.00%

$\chi 2 = 3.24$, df = 1, p = 0.071

In Single group, 0% had Relaprotomy and in double group, 15% required Relaprotomy. There was no significant difference in Relaprotomy between two groups.

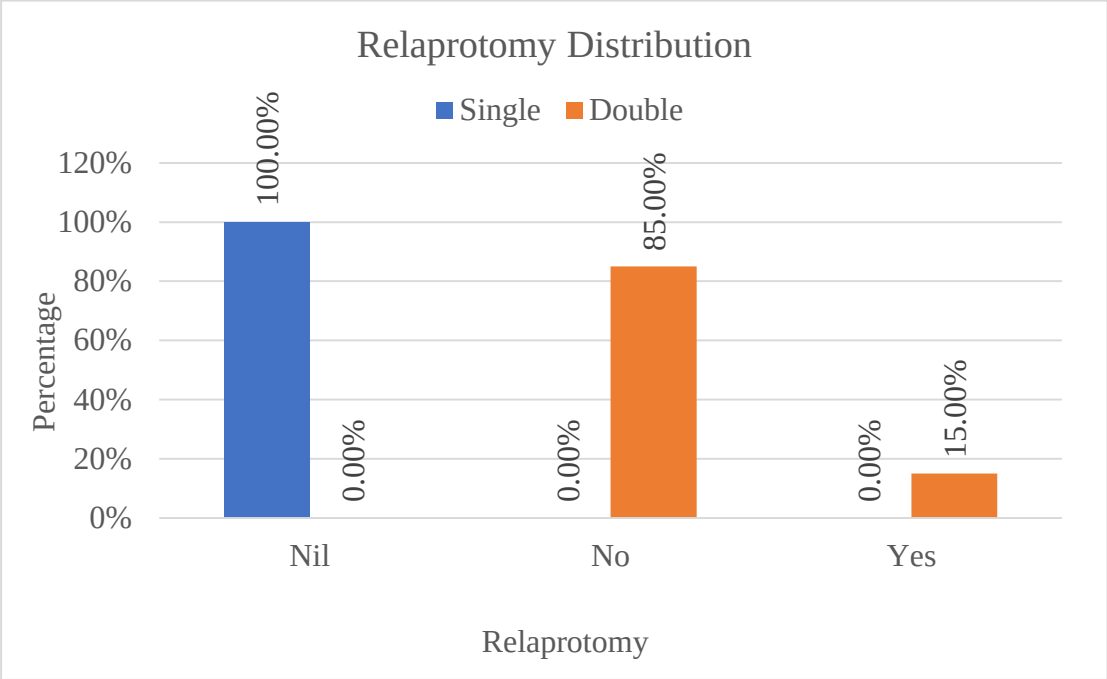


Figure 7 : Bar Diagram Showing Relaprotomy Distribution between Type of Anastomosis Done

TABLE 8 : MORTALITY DISTRIBUTION BETWEEN TYPE OF ANASTOMOSIS DONE

		Type of Anastomosis done					
		Single		Double		Total	
		Count	%	Count	%	Count	%
Death	No	19	95.00%	17	85.00%	36	90.00%
	Death	1	5.00%	3	15.00%	4	10.00%
	Total	20	100.00%	20	100.00%	40	100.00%

χ 2 = 1.111, df = 1, p = 0.292

In Single group, 5% had mortality and in double group, 15% had mortality. There was no significant difference in mortality between two groups.

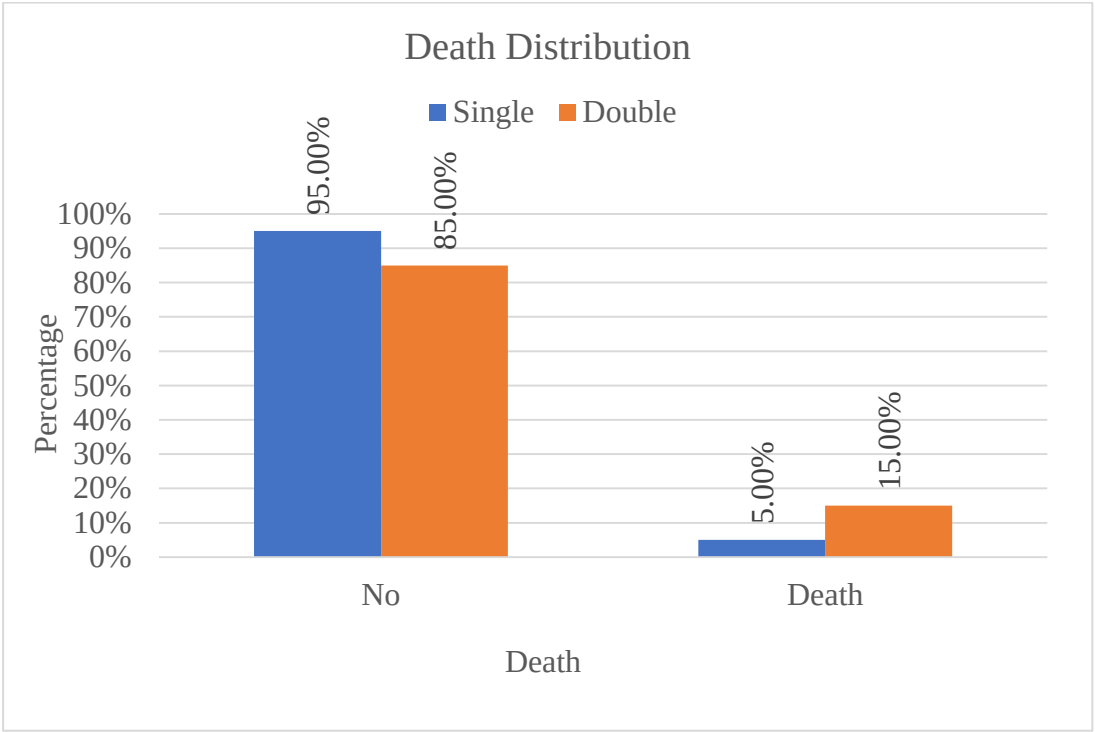


Figure 8 : Bar Diagram Showing Mortality Distribution between Type of Anastomosis Done

TABLE 9 : MEAN COMPARISON OF TIME TAKEN BETWEEN TYPE OF ANASTOMOSIS DONE

	Type of Anastomosis done						P Value
	Single		Double		Total		
	Mean	SD	Mean	SD	Mean	SD	
Time Taken	18.50	1.73	29.05	2.19	23.78	5.69	< 0.001*

In Single group, mean time taken was 18.50 ± 1.73 and in double group was 29.05 ± 2.19. There was significant difference in time taken between two groups.

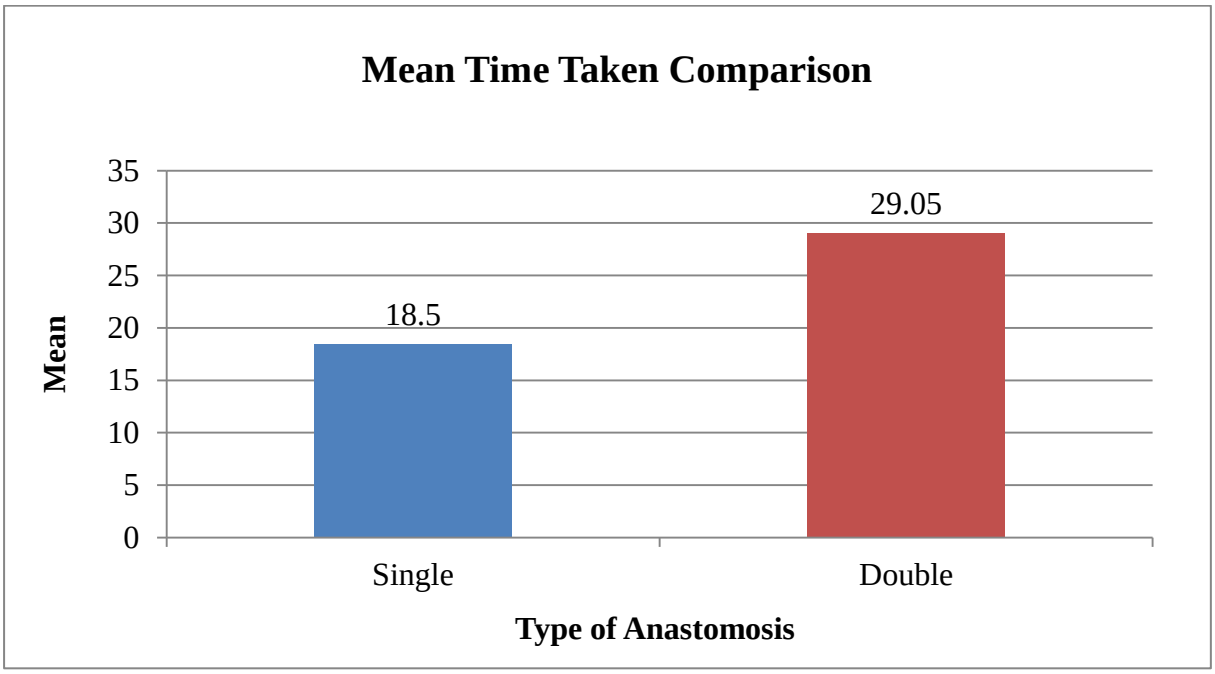


Figure 9 :Bar Diagram Showing Comparison of Time Taken between Type of Anastomosis Done

DISCUSSION

DISCUSSION

This present study,conducted in the department of RL Jalappa hospital & research centre. This study assessed , efficacy & safety of the SLA in comparison with DLA in small intestine. This study included 2 groups, single layer & double layer, each group had 20 cases, altogether 40 cases. Cases allotted to either groups ,based on the odd &even method, odd being single layer & even being double layer anastomosis. Intestinal anastomosis were performed in single layer with a delayed absorbable suture material & double layer with inner full thickness layer with delayed absorbable suture & outer seromuscular layer with non-absorbable suture material. Efficacy of both groups were compared in terms of duration required to perform intestinal anastomosis- single & double layer, post-operative complications & the duration of hospital stay in either of them.

COMPARISION OF MEAN AGE

A study that was conducted by Akthar Mehboob et al[7] in year June 2019 showed that more male patients underwent gut anastomosis: 40 and females were 20. This was similar to study conducted by Nemma[11] et al in 2019 which showed that the number of men under going anastomosis was 31 compare to only 9 women undergoing anastomosis. Hussain[10] et al conducted a study in the year 2015 which showed total of 29 men & 21 women undergoing anastomosis. Kanagale[13] et al showed that 26 men underwent anastomosis and 10 women underwent anastomosis. This was similar in the studies conducted by Saboo[15] et al in the year 2015 which showed more number of anastomosis in men , 41 than women i.e 19. Burch[16] et al in the year 1999 conducted a study which has 82 men and 50 women in the study where the average age was 44.3 in single layer and 44.7 in

the double layer anastomosis. In Patak[9] et 43 men and 19 women underwent gut anastomosis. Dandi[1] et al showed that large number of anastomosis was in males, SLA had 76% men & 66% in the DLA, 23% and 44% women in single & double layer.

In this study that was conducted: in SLA group, average was 48.25 ± 13.83 years & in double layer group, mean age was 43.65 ± 15.15 years.

COMPARISON OF GENDER

Study that was conducted by Akthar Mehboob[7] et al in the year June 2019 showed that mean age of patients undergoing gut anastomosis was 30.03±3.34years. This was similar to study conducted by Nemma[11] et al in 2019 which showed that mean was 33.55 years. Hussain[10] et al conducted a study in 2015 that showed an average age of 29.29 years in single layer & 28.96 in double layer anastomosis. Kanagale [13]et al showed that average age in which the anastomosis took place was between 20-40 years. This pattern was similar in studies that was conducted by Saboo[15] et al in the year 2015 which showed that the average age of the patient's undergoing SLA was 49.46±15.94 and 49.66±17.09 in DLA. This was also seen in study that was conducted by Burch[16] et al in the year 1999 where the average age in SLA -44.3 & 44.7 in DLA. In Patak [9]et al study, ages were 45.1 in single layer & 48.60 in double layer.

In the present study,Single layer group, 75% were males & 25% were females and double group, 65% were males & 35% females. There's no significant difference in sex distribution between 2 groups.

COMPARISION OF ANASTOMOTIC LEAK

Anastomotic leaks are generally seen during the post op day 5-7. This is time when the collagen synthesis is weakest hence leads to dehiscence. Study conducted by Akthar Mehboob [7]et al. showed, anastomotic leaks were seen in double layer anastomosis i.e 4 cases & 2 cases-anastomotic leak was seen in single layer.

Study conducted by Kanagale[13] et al. showed ,single layer interrupted anastomosis had leaks compared to single layer continuous anastomosis. Nemma[11] et al had higher number of leaks in double layer anastomosis (5 cases) than the single layer. Similar results were seen in studies conducted by Hussain[10] et al and Tawar[6] et al. where leaks were more in the double layer anastomosis.

In the above study conducted , Single layer group showed majority of subjects had no Anastomotic Leak (95%) and 5% had leak. In Double group 70% had no leak and 30% had leak. P value is statistically significant.

COMPARISON FOR TIME TAKEN FOR ANASTOMOSIS

The time taken for anastomosis was 12.15±1.4 in single layer & 20.98± 1.38 in double layer anastomosis in a study that was conducted by Akthar Mehboob [7] et al. In a study by Hussain [10]et al. the time was longer in double layer anastomosis i.e 19.2±1.93 & single layer was 10.04±1.37. Study conducted by Burch[16] et al & Dandi[1] et al showed time taken-single layer 20.8 and 19.6 and 30.7 & 29.5 minutes respectively. Patak[9] et al showed that for single layer anastomosis time was 17.59±1.16 & double layer was 30.16±1.28.

All these studies had significant p value in terms of time taken for anastomosis

In our study, time taken for single layer anastomosis was comparatively lesser than double layer anastomosis. The p value-significant.

COMPARISION FOR DURATION OF HOSPITAL STAY

Study conducted by Akthar Mehboob[7] showed that duration of hospital stay was almost comparable in both the single & double layer anastomosis i.e 6.40±1.32 and 6.36±0.66 in single & double layer. This was also seen in study that was conducted by Nemma[11] et al which showed 9.1 and 9.6 days -single & double layer anastomosis. The duration of hospital stay was comparable in studies that were conducted by Hussain[10] et al (5.87±2.22, 6.2±0.25), Burch[16] et al. (7.9,9.9) , Dandi [1]et al.(8.24, 8.48). In Saboo[28] et al the duration of hospital stay was similar (16.9±4.41 & 16±3.45) in single & double layer and was also seen in study conducted by Tawar[6] et al.(11.48±2.10, 13.45±4.90).

In the above study -Mean duration of hospital stay- single group was 17.85 ± 7.62 days and in double group was 26.20 ± 16.12 days. There was significant difference in duration of stay between 2 groups.

COMPARISION WITH RE-INTERVENTIONS

The reintervention rates in form of re-laprotomies was more in DLA in this study, while it was lesser in the DLA in the study conducted by Saboo[28] et al.

COMPARISION WITH SITE OF ANASTOMOSIS

In the study by Akthar Mehboob[7] et al. most common site of anastomosis was the ileum (48 of 60). This was seen in the study by Hussain [10]et al & Talwar [6]el al. in which ileal anastomosis was the most common.

The present study, in single layer group, site of Anastomosis was Ileo-Ileal in 50%, Jejuno Ileal in 25% and Jejuno Jejunal in 25% & double layer group, site of Anastomosis was Ileo Ileal in 60%, Jejuno Ileal in 0% and Jejuno Jejunal 40%. There was no significant difference in anastomostic site between 2 groups.

COMPARISION OF MORTALITY

Study conducted by Nemma[11] et al. study had 2 mortalities & this was seen in double layer group. Same was seen in study by Hussain[10] et al. where mortality was more in the double layer group (2 cases) than in single layer (1 case). Saboo[28] et al, & Patak[9] et al showed higher leaks in single layer than double layer anastomosis. The above study, in Single group, 5% had mortality & in double group, 15% had mortality. There was no significant difference in mortality between two groups.

STUDIES	GENDER	AGE	ANASTOMOTIC LEAK	TIME TAKEN FOR ANASTOMOSIS	DURATION OF HOSPITAL STAY	RELAPROTOMIES	SITE OF ANASTOMOSIS	MORTALITY
Akthar Mehboob et al.	M=40 F=20	30.03±3.34	S=2 D=4	S=12.15±1.4 D=20.98	S=6.40±1.32 D=6.36±0.66		I=48 J=12	
Nemma et al	M=31 F=9	33.55	S=2 D=5		S=9.1 D=9.6			S=0 D=2
Hussain et al	M=29 F=21	29.29	S=1 D=2	S=10.04±1.37 D=19.2±1.93	S=5.87±2.22 D=6.2±0.25		I=29 J=21	S=1 D=2
Kanagale et al	M=26 F=10	20-40	S=6 D=10					
Saboo et al	M=41 F=19	49	S=2 D=4		S=16.9±4.41 D=16±3.45	S=3 D=1		S=3 D=2
Burch et al.	M=82 F=50	44	S=2 D=4	S=20.8 D=30.7	S=7.9 D=9.9			
Patak et al	M=43 F=19	46	S=2 D=4	S=17.59±1.16 D=30.16±1.28				S=1 D=0
Tawar et al			S=3 D=5		S=11.48±2.10 D=13.45±4.90		I=36 J=12	
Dandi et al				S=19.6 D=29.5	S=8.24 D=8.48			
Present study	M=28 F=12	45	S=1 D=6	S=18.50±1.73 D=29.05±2.19	S=17.85±7.62 D=26.20±16.12	S=0 D=3	I=13 J=22	S=1 D=3

SUMMARY

SUMMARY

This prospective study that was conducted in Department of General surgery, in R L Jalappa Hospital included 40 cases of clinical conditions of small bowel that required resection & anastomosis. This was a comparative study. Study was conducted between December 2017 to June 2019.

The study had two groups, single layer & double layer comprising of 20 cases in each of the group. Each group was evaluated & compared with respect to duration required, anastomotic leak, outcome associated & duration of hospital stay in single v/s double layered bowel anastomosis.

Following conclusions were drawn at the end:

Duration required to perform SLA was significantly lesser when compared to double layer.(p=0.001)

There's a significant difference in anastomotic leak between 2 groups. (p=0.037).The anastomotic leaks was more in double layer group than single layer in the above study conducted and was more commonly seen in the ileal region as compared to the jejunal region.

There was a significant difference in terms of duration of hospital stay in single v/s double layered bowel anastomosis. (p=0.043) Longer hospital stays were noted in double layer anastomosis than in the single layer. This was due to interventions that seen in the double layer anastomosis such as relaprotomies for anastomotic leaks.

Mortality was higher in double layer anastomosis than single layer. Cause of death was due to sepsis & DIC secondary to the anastomotic leak.

CONCLUSION

CONCLUSION

In the above prospective study that was conducted in Department of General Surgery of R L Jalappa hospital, 40 cases which underwent single layer and double layer anastomosis divided as 2 groups. Various aspects were recorded & compared between 2 groups i.e duration of hospital stay, post operative complications like anastomotic leaks.

The above studied showed that single layer anastomosis in small bowel was better than double layer anastomosis in terms of duration of hospital stay and anastomotic leaks, single layer having lesser leaks and duration of hospital.

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ANNEXURES

ANNEXURE

PROFORMA

Particulars of the patients

Name

Age

Gender

Occupation

Date of admission

Date of surgery

Date of discharge

Complaints

1.Pain abdomen/ mass:

2. Vomiting:

3. Bowel habits

4. Distension

5. Fever

PREVIOUS HISTORY

PERSONAL HISTORY

Diet

Appetite

Smoking

Alcohol

Bowel habits

Menstrual history.

GENERAL PHYSICAL EXAMINATION

Appearance

Temperature

Pulse

Blood pressure

Respiration

LOCAL EXAMINATION [ABDOMEN]

Inspection

Palpation

Percussion

Auscultation

OTHER RELAVENT EXAMINATIONS

Per rectal

Per vaginal

SYSTEMIC EXAMINATION

Cardiovascular system

Central nervous system

Respiratory system

ROUTINE INVESTIGATIONS

PRE OPERATIVE TREATMENT

Complications

Anastomotic leakage

Abscess formation.

INFORMED CONSENT FORM

I Mr./Mrs. have been explained in my own understandable language, that I will be included in a study 'COMPARATIVE STUDY OF SINGLE LAYER VERSUS DOUBLE LAYER ANASTOMOSIS OF SMALL INTESTINE' which is being conducted in RL JALAPPA HOSPITAL.

I have been explained that my clinical findings, investigations, intraoperative findings, post-operative course, will be assessed and documented for study purpose.

I have been explained my participation in this study is entirely voluntary, and I can withdraw from the study any time and this will not affect my relation with my doctor or the treatment for my ailment.

I have been explained about the follow up details and possible benefits and adversities due to interventions, in my own understandable language.

I have understood that all my details taken during the study are kept confidential and while publishing or sharing of the findings, my identity will be masked.

I have principal investigator mobile no for enquiries.

I in my sound mind give full consent to be included in this study.

Signature of the patient:

Name:

Signature of the witness:

Name:

Relation to patient

Date:

Place:

PATIENT INFORMATION SHEET

Study title: "COMPARATIVE STUDY OF SINGLE LAYER VERSUS DOUBLE LAYER ANASTOMOSIS OF SMALL INTESTINE"

GUIDE: DR SHASHIREKHA C A
STUDY CONDUCTED BY DR TEJASWINI M PAWAR

Study location: R L Jalappa Hospital and Research Centre attached to Sri DevarajUrs Medical College, Tamaka, Kolar.

PROCEDURE: single layer vs double layer intestinal anastomosis.
NEED FOR THE STUDY: to compare the post operative complications and the duration of hospital stay in single vs double layer intestinal anastomosis.
SUBJECT SELECTION: Patients aged more than 19 years to 60 years undergoing resection and anastomoses of small bowel at our hospital for causes like small bowel gangrene, strangulated hernia with bowel loop as content, small bowel tumours, intestinal obstruction will be included in this study.
Patients undergoing multiple anastomosis, post chemotherapy and radiotherapy patients, and patients with co-morbid diseases like sepsis, known cardiovascular disease will be excluded from the study.

Patients in this study will have to undergo CBC, BT CT, Blood Grouping, Random blood sugar, blood urea, serum creatinine, serum electrolytes, HIV, HbsAG, Plain X Ray Abdomen, chest x-ray. ECG, USG Abdomen.
ADVANTAGES: single layer: lesser post operative complications, duration of hospital stay is less.
Double layer: post operative comlications are higher and longer duration of hospital stay.
Complications: wound infection, post-operative anastomotic leakage, abscess formation.
Please read the following information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study we will collect information (as per proforma) from you or a person responsible for you or both. Relevant history will be taken. This information collected will be used only for dissertation and publication.
All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. This study has been reviewed by the Institutional Ethics Committee and you are free to contact the member of the Institutional Ethics Committee. There is no compulsion to agree to this study. The care you will get will not change if you do not wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

For further information contact
Dr. Tejaswini M Pawar (Post graduate)
Phone No:
Department of General Surgery
SDUMC, Kolar

Signature of the patient:

ತಿಳಿವಳಿಕೆಯಸಮ್ಮತಿನಮೂನೆ

ನಾನುಶ್ರೀ / ²æÃªÀÄw.

.....ನನ್ನಸ್ವಂತಅರ್ಥವಾಗುವಂತಹಭಾಷೆಯಲ್ಲಿವಿವರಿಸಲಾಗಿದ್ದು, ನಾನುDgï. J¯ï. eÁ®¥Ààಆಸ್ಪತ್ರೆಯಲ್ಲಿನಡೆಸಿದ 'ಏಕೈಕ ಲೇಯರ್ಡ ಸ್ಥಬಲ್ಲೇಯರ್ಡಂಟಾಮೊಸಿಸ್ಆಫ್ಇಂಟೆಸ್ಟಿನ್ಹೋಲಿಕೆಯಅಧ್ಯಯನ' ಎಂಬಅಧ್ಯಯನದಲ್ಲಿಸೇರಿಸಲಾಗುವುದು.

ಅಧ್ಯಯನದಉದ್ದೇಶಕ್ಕಾಗಿನನ್ನವೈದ್ಯಕೀಯಸಂಶೋಧನೆಗಳು, ತನಿಖೆಗಳು, ಶಸ್ತ್ರಚಿಕಿತ್ಸೆಗೆಒಳಪಡುವಆವಿಷ್ಕಾರಗಳು, ಆಪರೇಟಿವ್ನೋರ್ಸ್, ಮೌಲ್ಯಮಾಪನಮತ್ತುದಾಖಲಿಸಲಾಗುವುದುಎಂದುನನಗೆವಿವರಿಸಲಾಗಿದೆ.

ಈಅಧ್ಯಯನದನನ್ನಪಾಲ್ಗೊಳ್ಳುವಿಕೆಯುಸಂಪೂರ್ಣವಾಗಿಸ್ವಯಂಪ್ರೇರಿತವಾಗಿರುವುದನ್ನುನಾನುವಿವರಿಸಿದ್ದೇನೆಮತ್ತುಯಾವುದೇ ಸಮಯದಲ್ಲಿನಾನುಈಅಧ್ಯಯನದಿಂದಹಿಂತೆಗೆದುಕೊಳ್ಳಬಹುದುಮತ್ತುಇದುನನ್ನವೈದ್ಯರೊಂದಿಗೆನನ್ನಸಂಬಂಧವನ್ನುಅಥವಾನನ್ನಕಾಯಿಲೆಯಚಿಕಿತ್ಸೆಗೆಪರಿಣಾಮಬೀರುವುದಿಲ್ಲ.

ನನ್ನಸ್ವಂತಅರ್ಥವಾಗುವಭಾಷೆಯಲ್ಲಿ,
ಮಧ್ಯಸ್ಥಿಕೆಗಳಕಾರಣದಿಂದಾಗಿಅನುಸರಣೆವಿವರಗಳುಮತ್ತುಸಂಭವನೀಯಪ್ರಯೋಜನಗಳುಮತ್ತುವಿಪತ್ತುಗಳಬಗ್ಗೆನನಗೆವಿವರಿಸಲಾಗಿದೆ.
ಅಧ್ಯಯನದಸಮಯದಲ್ಲಿತೆಗೆದುಕೊಳ್ಳಲಾದಎಲ್ಲಾವಿವರಗಳನ್ನುಗೌಪ್ಯವಾಗಿರಿಸಲಾಗುವುದುಮತ್ತುಪ್ರಕಟಣೆಮಾಡುವಾಗಅಥವಾಆವಿಷ್ಕಾರಗಳಹಂಚಿಕೆಯಸಂದರ್ಭದಲ್ಲಿನನ್ನಗುರುತನ್ನುಮರೆಮಾಚಲಾಗುವುದುಎಂದುನಾನುಅರ್ಥಮಾಡಿಕೊಂಡಿದ್ದೇನೆ.
ವಿಚಾರಣೆಗಾಗಿನಾನುಪ್ರಧಾನತನಿಖಾಧಿಕಾರಿಮೊಬೈಲ್ಸಂಖ್ಯೆಇಲ್ಲ.
ನನ್ನಅಧ್ಯಯನದಲ್ಲಿನಾನುಒಳಗೊಳ್ಳಲುಪೂರ್ಣಸಮ್ಮತಿಯನ್ನುನೀಡುತ್ತೇನೆ.

ರೋಗಿಯಸಹಿ:
ಹೆಸರು:

ಸಾಕ್ಷಿಸಹಿ:
ಹೆಸರು:
ರೋಗಿಗೆಸಂಬಂಧ

ದಿನಾಂಕ:
ಸ್ಥಳ:

ರೋಗಿಯ ಮಾಹಿತಿ ಪತ್ರ

ಅಧ್ಯಯನಶೀರ್ಷಿಕೆ:

"ಏಕೈಕಲೇಯರ್ವರ್ಸಸ್ಡಬಲ್ಲೇಬಲ್ಅನಾಟೊಮಾಸಿಸ್ಆಫ್ಟೋವೆಲ್ನಹೋಲಿಕೆಯಅಧ್ಯಯನ"

ಮಾರ್ಗದರ್ಶಿ: ಡಿ.ಆರ್. ಶಶಿರೇಖಾ ಸಿಎ

ಡಿ.ಆರ್. ತೇಜಸ್ವಿನಿ ಎಂ ಪವಾರ್ ಮೂಲಕಅಧ್ಯಯನನಡೆಸಲಾಗಿದೆ

ಅಧ್ಯಯನಸ್ಥಳ: ಆರ್ಎಲ್ಜಾಲಪ್ಪಆಸ್ಪತ್ರೆಮತ್ತುಸಂಶೋಧನಾಕೇಂದ್ರ,ಶ್ರೀದೇವರಾಜ್ಅರಸ್ ಮೆಡಿಕಲ್ಕಾಲೇಜು, ಟಮಕ, ಕೋಲಾರ.

ಪ್ರಕ್ರಿಯೆ: ಏಕಪದರದವಿರುದ್ಧಎರಡುಪದರಕರುಳಿನಅನಾಸ್ಟೊಮೊಸಿಸ್.

ಅಧ್ಯಯನದಅಗತ್ಯತೆ: ಪೋಸ್ಟ್ಆಪರೇಟಿವ್ತೊಡಕುಗಳನ್ನುಹೋಲಿಸಲುಮತ್ತುಆಸ್ಪತ್ರೆಯಅವಧಿಯುಏಕ ಥ ಡಬಲ್ಲೇಯರ್ಕರುಳಿನಅನಾಸ್ಟೊಮೊಸಿಸ್ನಲ್ಲಿಉಳಿಯುತ್ತದೆ.

ವಿಷಯಆಯ್ಕೆ:ಸಣ್ಣಕರುಳಿನಗ್ಯಾಂಗ್ರೀನ್, ಕರುಳಿನಲೂಪ್ನವಿಷಯ, ಸಣ್ಣಕರುಳಿನಗೆಡ್ಡೆಗಳು, ಕರುಳಿನಅಡಚಣೆಯನ್ನುಹೊಂದಿರುವಈಕಾಯಿಲೆಯಿಂದಾಗಿನಮ್ಮಆಸ್ಪತ್ರೆಯಲ್ಲಿ ೧೯ ವರ್ಷದಿಂದ ೬೦ ವರ್ಷಗಳಿಗಿಂತಲೂಹೆಚ್ಚುವಯಸ್ಸಿನರೋಗಿಗಳುನಮ್ಮಕಾಯಿಲೆಗೆಸಣ್ಣಕರುಳಿನಅಸ್ವಸ್ಥತೆಗೆಒಳಗಾಗುತ್ತಾರೆ ಮತ್ತುಈಅಧ್ಯಯನದಲ್ಲಿಸೇರಿಸಿಕೊಳ್ಳುತ್ತಾರೆ.

ಬಹುಅನಾಸ್ಟೊಮೊಸಿಸ್, ಪೋಸ್ಟ್ಕಿ ಮೊತೆರಪಿಮತ್ತುರೇಡಿಯೊಥೆರಪಿರೋಗಿಗಳು, ಮತ್ತುಸೆಪ್ಸಿಸ್ನಂತಹಸಹ-

ಅಸ್ವಸ್ಥರೋಗಗಳರೋಗಿಗಳಿಗೆತಿಳಿದಿರುವರೋಗಿಗಳುಅಧ್ಯಯನದಿಂದಹೊರಗಿಡಲಾಗುತ್ತದೆ.

ಈ ಅಧ್ಯಯನದರೋಗಿಗಳುಸಿಬಿಸಿ, ಬಿಟಿಸಿಟಿ, ಬ್ಲಡ್ಗುಂಪು ಒಳಗಾಗಬೇಕಾಗುತ್ತದೆ. ಯಾದೃಚ್ಛಿಕರಕ್ತದಸಕ್ಕರೆ, ರಕ್ತದಯೂರಿಯಾ, ಸೀರಮ್ಕ್ರಿಯಾಟೈನ್, ಸೀರಮ್ಎಲೆಕ್ಟ್ರೋಲೈಟ್, ಎಚ್ಐವಿ, ಎಚ್ಬಿಎಸ್ಎಗ್, ಪ್ಲೈನ್ಎಕ್ಸ್ರೇಹೊಟ್ಟೆ, ಎದೆಯ ಥಿಬಿಥಿ.ಇಅಉ, ಯುಎಸ್ಜಿಹೊಟ್ಟೆ.

ತೊಡಕುಗಳು: ಗಾಯದಸೋಂಕು, ಪೋಸ್ಟ್ಆಪರೇಟಿವ್ಅನಾಸ್ಟೊಮೊಟಿಕ್ಸೋರಿಕೆ, ಬಾವುರಚನೆ.

ಕೆಳಗಿನಮಾಹಿತಿಯನ್ನುಓದಿಮತ್ತುನಿಮ್ಮಕುಟುಂಬಸದಸ್ಯರೊಂದಿಗೆಚರ್ಚಿಸಿ.

ಅಧ್ಯಯನದಬಗ್ಗೆನೀವುಯಾವುದೇಪ್ರಶ್ನೆಯನ್ನುಕೇಳಬಹುದು.

ನೀವುಅಧ್ಯಯನದಲ್ಲಿಪಾಲ್ಗೊಳ್ಳಲುಒಪ್ಪಿಕೊಂಡರೆನಾವುನಿಮ್ಮಿಂದ (ಮಾಹಿತಿಪ್ರಕಾರ) ಮಾಹಿತಿಯನ್ನುಅಥವಾನಿಮ್ಮಅಥವಾಎರಡಕ್ಕೂಜವಾಬ್ದಾರರಾಗಿರುವವ್ಯಕ್ತಿಗಳನ್ನುಸಂಗ್ರಹಿಸುತ್ತೇವೆ.

ಸಂಬಂಧಿತಇತಿಹಾಸವನ್ನುತೆಗೆದುಕೊಳ್ಳಲಾಗುವುದು.

ಸಂಗ್ರಹಿಸಿದಈಮಾಹಿತಿಯನ್ನುಪ್ರೌಢಪ್ರಬಂಧಮತ್ತುಪ್ರಕಟಣೆಗಾಗಿಮಾತ್ರಬಳಸಲಾಗುತ್ತದೆ.

ನಿಮ್ಮಿಂದಸಂಗ್ರಹಿಸಿದಎಲ್ಲಾಮಾಹಿತಿಯನ್ನುಗೌಪ್ಯವಾಗಿರಿಸಲಾಗುವುದುಮತ್ತುಯಾವುದೇಹೊರಗಿನವರಿಗೆ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮಗುರುತನ್ನುಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ.

ಈಅಧ್ಯಯನವುಸಾಂಸ್ಥಿಕನೀತಿಶಾಸ್ತ್ರಸಮಿತಿಯಿಂದಪರಿಶೀಲಿಸಲ್ಪಟ್ಟಿದೆಮತ್ತುನೀವುಸಂಸ್ಥೆಯಎಥಿಕ್ಸ್ಸಮಿತಿಯಸದಸ್ಯರನ್ನುಸಂಪರ್ಕಿಸಲುಮುಕ್ತವಾಗಿರುತ್ತೀರಿ.

ಈಅಧ್ಯಯನಕ್ಕೆಒಪ್ಪಿಗೆನೀಡಲುಯಾವುದೇಕಡ್ಡಾಯವಿಲ್ಲ.

ನೀವುಭಾಗವಹಿಸಲುಬಯಸದಿದ್ದರೆನೀವುಪಡೆಯುವಕಾಳಜಿಬದಲಾಗುವುದಿಲ್ಲ.

ಈಅಧ್ಯಯನದಲ್ಲಿನೀವುಸ್ವಯಂಪ್ರೇರಣೆಯಿಂದಒಪ್ಪಿಕೊಳ್ಳುವುದಾದರೆಮಾತ್ರಹೆಬ್ಬೆರಳುಅನಿಸಿಕೆಗೆನೀವುಸಹಿ / ನೀಡಬೇಕಾಗಿದೆ.

ಹೆಚ್ಚಿನಮಾಹಿತಿಗಾಗಿ

ರೋಗಿಯಸಹಿ:

ಡಾ. ತೇಜಸ್ವಿನಿಎಂಪವಾರ್ (ಪದವಿಪದವಿ)

ದೂರವಾಣಿಸಂಖ್ಯೆ:ಸಾಮಾನ್ಯಸರ್ಜರಿಇಲಾಖೆಖಖಖಖಅ,ಕೋಲಾರ್

	UHID NO	AGE	SEX	TYPE OF AI	ANASTOMOTIC LEAKS	DURATION OF STAY(DAY	ANASTOMOTIC SITE	RELAPROTOMY	death	CAUSE OF DEATH	DIAGNOSIS	TIME TAKEN FOR ANASTOMOSIS(MINUTES)
1	660137	60	FEMALE	single	no	12	jejuno jejunal	nil	no		intestinal obstruction	18
2	692541	60	MALE	single	no	13	JEJUNO ILEAL	nil	no		intestinal obstruction	18
3	686341	18	MALE	single	no	16	ileoileal	nil	no		ileostomy closure	17
4	658472	60	MALE	single	no	25	jejuno jejunal	nil	no		jejunal perforation	16
5	582198	32	MALE	single	no	20	jejunojejunal	nil	no		jejunal perforation	20
6	663902	38	MALE	single	no	14	jejunojejunal	nil	no		intestinal obstruction	18
7	675757	60	MALE	single	no	2	ileoileal	nil	no		ileal perforation	19
8	535780	60	MALE	single	no	15	ileo ileal	nil	no		ileal gist	22
9	551069	60	MALE	single	no	26	ileo ileal	nil	no		ileal gist	18
10	592095	60	MALE	single	no	27	ileo ileal	nil	no		acute intestinal obstructio	18
11	600293	58	FEMALE	single	no	12	ileo ileal	nil	no		ventral hernia	20
12	62147	30	MALE	single	no	28	jejuno ileal	nil	no		intestinal obstruction	21
13	599755	39	MALE	single	yes	5	jejuno ileal	nil	death	DIC	jejunal perforation	19
14	753173	40	MALE	single	no	15	jejuno ileal	nil	no		jejunal perforation	18
15	746347	34	FEMALE	single	no	28	ileo ileal	nil	no		small bowel gist	20
16	506020	32	MALE	single	no	28	ileo ileal	nil	no		ileostomy closure	19
17	468676	60	FEMALE	single	no	22	ileo ileal	nil	no		ileal stricture	14
18	742846	48	FEMALE	single	no	20	ileo ileal	nil	no		intestinal obstruction	18
19	719246	60	MALE	single	no	14	jejuno jenunal	nil	no		intestinal obstruction	19
20	718394	56	MALE	single	no	15	jejuno ileal	nil	no		intestinal obstruction	18

	UHID NO	AGE	SEX	TYPE OF ANASTOMOSIS	ANASTOMOTIC LEAKS	DURATION OF STAY (DAYS)	ANASTOMOTIC SITE	RELAPROTOMY	DEATH	CAUSE OF DEATH	DIAGNOSIS	TIME TAKEN FOR ANASTOMOSIS(MINUTES)
1	615361	51	FEMALE	double	yes	41	ileo ileal	yes	no		ileostomy closure	29
2	633079	30	MALE	double	no	30	jejuno jejunal	no	no		intstinal obstruction	27
3	676473	60	FEMALE	double	yes	65	jejuno jejunal	yes	death	septicemia	intestinal obstruction	25
4	642288	60	MALE	double	no	20	jejuno jejunal	no	no		pyloric stricture	28
5	624847	39	MALE	double	yes	5	ileo ileal	no	no		intstinal obstruction	29
6	611996	45	FEMALE	double	no	18	ileo ileal	no	no		intstinal obstruction	28
7	655745	20	MALE	double	no	20	ileo ileal	no	no		paraduodenal hernia	28
8	547069	32	MALE	double	no	30	ileo ileal	no	no		ileal perforation	27
9	560566	60	FEMALE	double	no	24	jejuno jejunal	no	no		jejunal perforation	31
10	564424	33	FEMALE	double	no	28	ileo ileal	no	no		intstinal obstruction	29
	533931	24	MALE	double	no	14	ileo ileal	no	no		intstinal obstruction	31
12	586909	29	MALE	double	no	19	ileo ileal	no	no		ileal intusseption	32
13	598107	60	FEMALE	double	no	19	ileo ileal	no	no		ileal perforation	35
14	571105	27	MALE	double	no	44	ileo ileal	no	no		ileal perforation	31
15	568510	23	MALE	double	no	19	jejuno jejunal	no	no		ileostomy closure	29
16	607631	60	MALE	double	no	25	jejuno jejunal	no	no		jejunal perforation	30
17	646680	46	MALE	double	yes	60	ileo ileal	no	no		intestinal obstruction	28
18	678452	60	MALE	double	yes	3	jejuno jejunal	no	death	ARDS	intstinal obstruction	27
19	718306	54	FEMALE	double	yes	30	jejuno jejunal	yes	no		ca small bowel	28
20	726063	60	MALE	double	no	10	ileo ileal	no	death	pneumonia	ileal gangrene	29