CORRELATION BETWEEN DIFFERRENT PERIOPERATIVE PARAMETERS AND INCIDENCE OF COMPLICATIONS AFTER CLOSURE OF TEMPORARY STOMA

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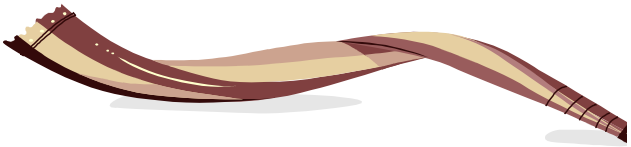

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BMI	**:**	Body mass index
CT	**:**	Computerized tomography
DM	**:**	Diabetes mellitus
DVT	**:**	Deep venous thrombosis
FAP	**:**	Familial adenomatous polyposis
HCV	**:**	Hepatitis C virus
HTN	**:**	Hypertension
IHD	**:**	Ischemic heart disease

INTRODUCTION

Temporary stoma formation is a common procedure in both elective and emergency colorectal surgeries being performed on patient with delayed presentation, having severe abdominal sepsis, profound shock and major multiple abdominal injuries in order to prevent complications like anastomotic leakage. [1, 2, 3] It is performed to relief obstruction in patients with colorectal cancer and diverticular disease, for defunctioning of bowel in patients with colonic or rectal trauma and patients with inflammatory bowel disease like ulcerative colitis and Crhon's disease, for resolution of sepsis in diverticular disease patients and for protection of ileal pouch anal anastomosis in familial adenomatous polyposis (FAP) patients. [4]

After formation of temporary stoma a high complication rate is detected [5]; these complications can be classified into early and late. Early complications include inappropriate location, skin excoriation, leakage, stoma retraction, dehydration and stoma necrosis. The late complications include parastomal hernia, stomal prolapse, stenosis, and peristomal dermatitis. [6]

Temporary stoma closure is accompanied by high incidence of complications that can be systemic problems such as cardiorespiratory complications, deep venous thrombosis, urinary tract infection and even death or specific complications such anastomotic leakage, hemorrhage (intraperitoneal or intraluminal), anastomotic stenosis, wound dehiscence, and incisional hernia.[7, 8]

Occurrence of complications after temporary stoma closure is affected by increasing age, gender, smoking, patient's comorbidities, primary disease, timing of surgery and experience of surgeon and assistant. [8, 9, 10]

Anatomy of anterior abdominal wall

The anterior abdominal wall can be considered to have two parts: anterolateral and middle or midline. The anterolateral portion is composed of the external oblique, the internal oblique, and the transversus abdominis muscles. The middle portion is composed of the rectus abdominis and pyramidal muscles. [11, 12]

The external and internal oblique muscles (Fig.1) and the transversus abdominis muscle are arranged so that their fibers are roughly parallel as they approach their insertion on the rectus sheath. More laterally, toward the flank, the fibers of the different muscles are more divergent. [11, 13]

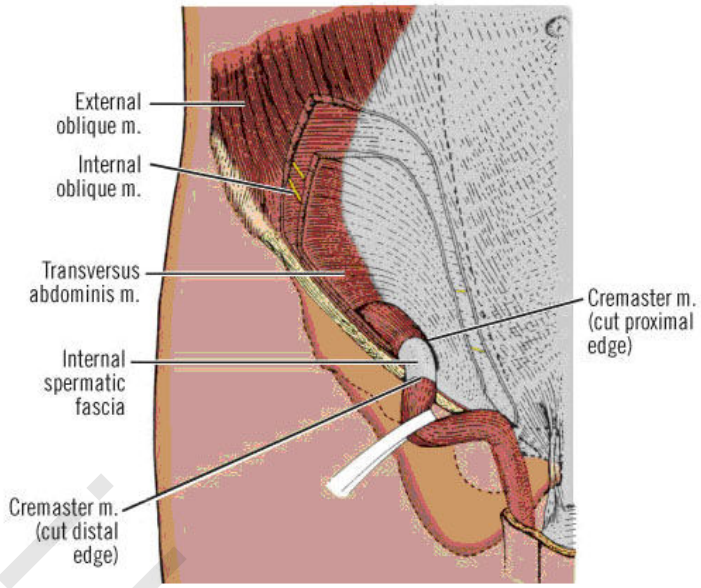


Figure (1): Muscles of anterior abdominal wall [11]

The superficial tissues of the lower anterolateral abdominal wall are supplied by three branches of the femoral artery. These branches, from lateral to medial, are the superficial circumflex iliac artery (Fig.2), the superficial epigastric artery, and the superficial external pudendal artery. Branches of these arteries travel toward the umbilicus in the subcutaneous connective tissues. [11, 13]

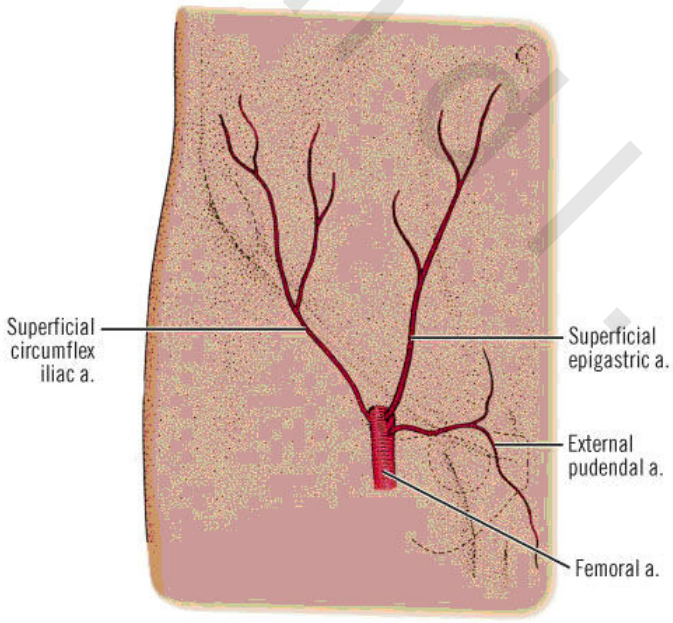


Figure (2): Branches of the femoral artery [11]

The superficial epigastric artery anastomoses with the contralateral artery. All three arteries have anastomoses with the deep arteries. The deep arteries lie between the transversus abdominis and the internal oblique muscles. They are the posterior intercostal

arteries 10 and 11, the anterior branch of the subcostal artery, the anterior branches of the four lumbar arteries, and the deep circumflex iliac artery. [11, 13]

The rectus sheath is supplied by two arteries. The superior epigastric artery arises from the internal thoracic artery. The inferior epigastric artery arises from the external iliac artery, just above the inguinal ligament. Generally, the inferior epigastric artery divides into two large branches below the level of the umbilicus. These vessels communicate with the superior epigastric artery above the level of the umbilicus. [11, 13]

The superior epigastric artery enters the upper end of the rectus sheath, deep to the rectus muscle. Musculocutaneous branches pierce the anterior rectus sheath to supply the overlying skin. The perforating arteries (Fig. 3) are closer to the lateral border of the rectus than to the linea alba. [11, 13]

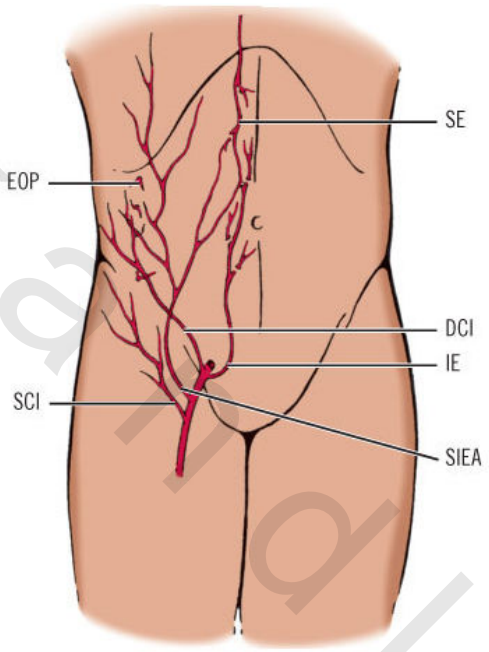


Figure (3): Vessels supplying anterior abdominal wall. EOP, External oblique perforators; SCI, superficial circumflex iliac artery; SE, superior epigastric artery; DCI, deep circumflex iliac artery; IE, deep inferior epigastric artery; SIEA, superficial inferior epigastric artery. [11]

Both the anterolateral portion of the abdominal wall and the rectus abdominis muscle are supplied by anterior rami of the 7th to 12th thoracic nerves and the 1st lumbar nerve. A branch (the lateral cutaneous ramus) arises from each anterior ramus and pierces the outer two flat muscles. It innervates the external oblique muscle and forms the lateral cutaneous nerve. [11, 13]

The anterior rami of the last six thoracic nerves enter the posterior layer of the rectus sheath, innervating the rectus muscle. They send perforating branches through the anterior layer of the sheath to form the anterior cutaneous nerves. The first lumbar nerve forms an anterior cutaneous nerve without passing through the rectus sheath. [11, 13]

Blood supply of small intestine

Jejunum is supplied by five to ten jejunal branches which arise from the left side of the upper portion of the superior mesenteric artery (Fig.4). They are distributed to the jejunum as a series of short arcades which form a single (occasionally double) tier of anastomotic arcs before giving rise to multiple vasa recta. These vessels run almost parallel in the mesentery and are distributed alternately to opposite aspects of its wall where the two series of vessels form distinct 'leaves' within the mesentery. [12, 14]

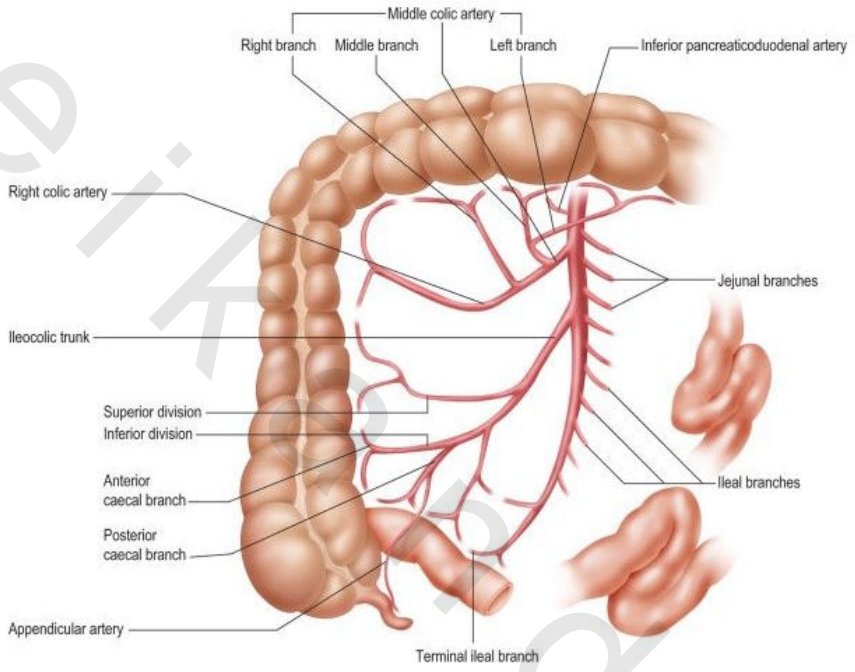


Figure (4): Jejunal and ileal branches of superior mesenteric artery [12]

Ileum is supplied by more numerous branches than the jejunal ones but smaller in calibre. They arise from the left and anterior aspects of the superior mesenteric artery. The length of the mesentery is greater in the ileum and the branches form three, four or sometimes five tiers of arcs within the mesentery before giving rise to multiple vasa recta that run directly towards the ileal wall. The ileal branches run parallel in the mesentery and are distributed to alternate aspects of the ileum. They are longer and smaller than similar jejunal vessels, particularly in the distal ileum, and do not form such definite parallel 'leaves' of vessels. The vascular supply in the last loop of the terminal ileum is limited. There are usually only two separate arcades, peri-serosal and in the mid-zone of the mesentery. [12, 14]

Venous drainage is through the superior mesenteric vein receives jejunal, ileal, ileocolic, right colic (when present), middle colic, right gastroepiploic and pancreaticoduodenal veins in a similar distribution to the corresponding arteries. [12, 14]

Blood supply of large intestine

The arterial supply of the large intestine is derived from both the superior and inferior mesenteric arteries (Fig.5). The caecum, appendix, ascending colon and right two-thirds of the transverse colon (derived from the midgut) are supplied from ileocolic, right colic and middle colic branches of the superior mesenteric artery. The left part of the transverse, descending and sigmoid colon, rectum and upper anal canal (hindgut derivatives) are supplied predominantly from the inferior mesenteric artery via the left colic, sigmoid and superior rectal arteries, with small contributions from branches of the internal iliac artery (the middle and inferior rectal arteries). [12, 15]

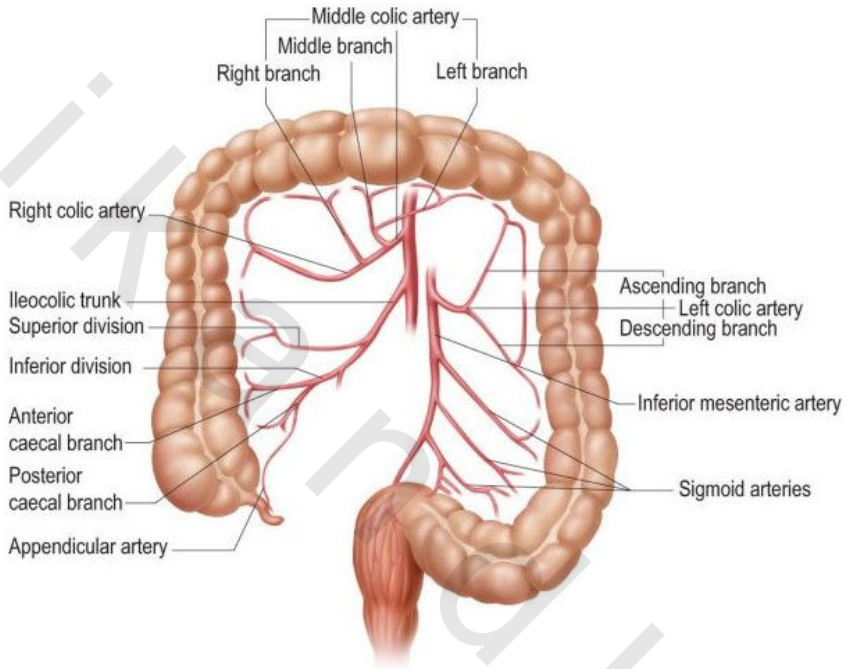


Figure (5): The main branches of the superior and inferior mesenteric arteries [12]

The larger unnamed branches of these vessels ramify between the muscular layers of the colon which they supply. They subdivide into smaller submucosal rami and enter the mucosa. The terminal branches divide into vasa brevia and vasa longa which either enter the colonic wall directly or run through the subserosa for a short distance before crossing the circular smooth muscle to give off branches to the appendices epiploicae (Fig. 6). [12, 15]

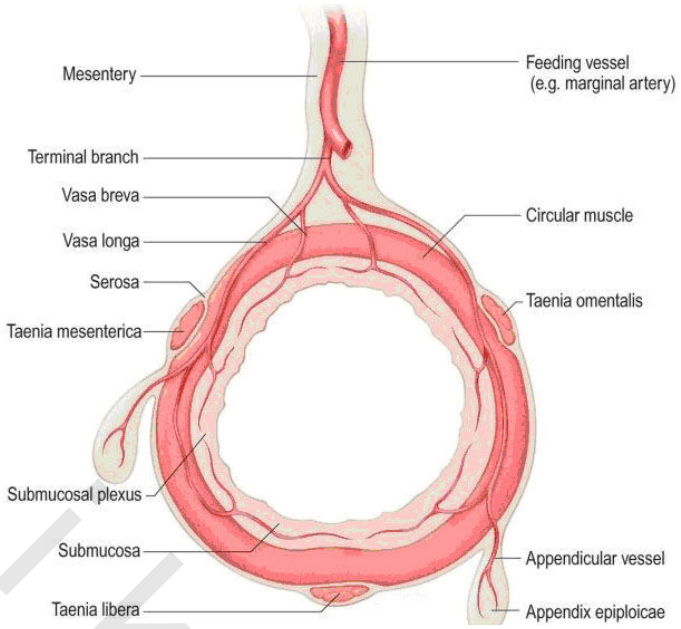


Figure (6): Typical pericolic arrangement of arterial vasculature [12]

Stoma creation

An intestinal stoma is an opening of the intestinal tract onto the anterior abdominal wall created to provide fecal diversion for both emergent and elective procedures; it may be either colostomy or ileostomy. It may be temporary or permanent, depending on the reason for the operation. It is considered a treatment that eliminates disease, relieves pain and improves health. [16, 17, 18]

Colostomy may be classified according to anatomic location; the most common type has been called an end-sigmoid colostomy (Fig 7). However, if the inferior mesenteric artery is transected during an operation for cancer of the rectum, the blood supply to the sigmoid colon is no longer dependable, and it should not be used for stoma construction. Therefore, an end-descending colostomy is usually preferable to an end-sigmoid colostomy. Other types of colonic stomas include the transverse colostomy (Fig 8) and cecostomy. Proximal colostomies should be avoided, as they will have the worst features of both a colostomy and an ileostomy: liquid, high volume, foul smelling effluent. [16]

It can also be classified according to function into decompressing and diversion colostomy. Decompressing colostomy does not necessarily provide fecal diversion but it mainly for relief of acute obstruction of distal bowel, it can be divided into 3 types blow hole decompressing stoma constructed in the cecum or transverse colon, a tube type of cecostomy and a loop transverse colostomy. Diverting colostomy provides diversion of intestinal content when the distal bowel segment is completely resected due to perforating or obstructing lesion (e.g., obstructing carcinoma, diverticulitis, leaking anastomosis, or trauma) or because of destruction or infection of the distal colon, rectum, or anus (e.g., Crohn's disease or failed anal sphincter reconstruction). [16, 19]

Other types of colostomies include Hartmann's procedure and double barrel colostomy; Hartmann's procedure is performed when colon or rectal resection is done

without an anastomosis in which a colostomy is created and the distal colon or rectum is left as a blind pouch. The term typically is used when the left or sigmoid colon is resected and the closed off rectum is left in the pelvis. If the distal colon is long enough to reach the abdominal wall, a mucus fistula can be created by opening the defunctioned bowel and suturing it to the skin. [20]

Double barrel colostomy is an old procedure rarely used now but still has a place in the management of colorectal trauma, after resection of a damaged segment of the colon; the proximal and distal ends of the colon are tacked together along the antimesenteric surfaces with interrupted absorbable sutures. The resulting double end is then brought out through the incision at the relevant site. [4]

There are various types of ileostomies that may be constructed like end ileostomy, loop ileostomy, loop end ileostomy and continent ileostomy. End ileostomy (Fig 9) is formed from the end of terminal ileum after proctocolectomy for inflammatory bowel disease or familial polyposis, while loop ileostomy (Fig 10) is used temporarily to protect a distal anastomosis such as an ileal pouch anal anastomosis or a low colorectal anastomosis, or for fecal diversion from the distal anorectum such as for perianal Crohn's disease, anorectal cancer, severe perineal trauma or sepsis and fecal incontinence. The loop end ileostomy is formed when the loop of ileum cannot be delivered beyond the stoma aperture without excessive tension; this ileostomy is matured as a conventional loop ileostomy. The continent ileostomy, or Kock pouch, is used as an alternative to a conventional ileostomy for certain patients with ulcerative colitis or familial polyposis. [16, 21]

Other less common type is split ileostomy which is created by bringing out the two cut bowel ends at different sites, this procedure forms a mucous fistula and its advantage is it completely defunctions the bowel without the risk of intra-abdominal leakage from a closed distal stump. [4]

The major indications for emergency colostomy creation are due to colonic obstruction with distal obstructing mass or in some of the pseudo-obstruction syndromes seen in elderly or immunocompromised patients, colonic perforation with peritonitis either traumatic or inflammatory and severe perineal trauma. While elective colostomy creation is commonly due to low rectal cancer which needs abdominoperineal resection or protection of a low colorectal or coloanal anastomosis, rectovaginal fistula, incontinence, radiation proctitis, and perianal sepsis. [16, 17]

Emergent ileostomy creation is due to conditions in which the integrity of a primary anastomosis would be compromised or due to hemorrhage, ischemia, perforation, or sepsis while elective ileostomy is commonly used for patients undergoing surgery for rectal cancer, inflammatory bowel disease, or familial polyposis. [17, 19]

Defunctioning of a distal anastomosis after rectal excision and anastomosis can be done with a loop ileostomy or a loop transverse colostomy. Both types of stoma are effectively the same; however temporary ileostomy has a minor effect on patients as regard complications related to its formation and closure. [4, 22]

Stoma placement is an important issue during its creation for improving patients' postoperative quality of life and reducing the rates of postoperative complications; it begins with identifying the "ostomy triangle" bounded by the anterior superior iliac spine,

the pubic tubercle, and the umbilicus. The stoma, ileostomy traditionally on the right and colostomy on the left, is placed in the center of this triangle, through the rectus muscle slightly below the umbilicus. The site should be 5 cm away from skin folds, previous scars or bony prominences, and the patient's belt line, it is chosen by evaluating the patient in the standing, sitting, and supine positions. In obese individuals, the stoma is better situated in the upper abdomen for good visualization and care. [16, 17, 23, 24]

Creation of stoma is left to the end of the procedure done; a circular incision 2.5 cm in diameter is made at the marked site and the skin is excised. The subcutaneous fat is parted with scissors and small retractors until the fascia of the abdominal wall is reached. A cruciate incision is made in the rectus sheath not more than 2 cm in each directon. The muscle fibers of the underlying rectus abdominis are split in the direction of their fibers then a small cruciate incision is made in the posterior rectus sheath (Fig.11). [4, 25]

During formation of loop ileostomy or loop colostomy, plastic rods have been used to support a loop stoma and to prevent the loop from falling back into the abdominal cavity but it can lead to skin maceration and local infection so using of a subcutaneously tunneled silicon drain as a stoma bridge results in less complications, less pain and higher satisfaction as compared to the conventional plastic rod while some studies revealed that the use of supporting bridges is not necessary. [26- 28]

Laparoscopic stoma creation is recently done; it is considered an effective treatment for several benign and malignant disorders including obstructing rectal adenocarcinoma, rectal obstruction from extrarectal malignancies, fecal incontinence, penetrating rectal trauma, sacral pressure ulceration, perineal Crohn's disease, pelvic fracture, and lumbosacral burns, this technique allows evaluation of the liver and peritoneum for the presence of metastases that may be undetected on preoperative imaging studies, and make fecal diversion without creating adhesions in the abdomen and pelvis. So it has the advantages of low morbidity and reoperation rates, and no procedure related mortality in comparison with open stoma creation. [16, 29- 31]

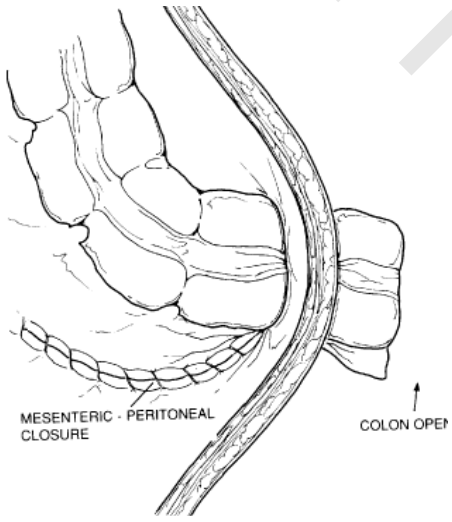
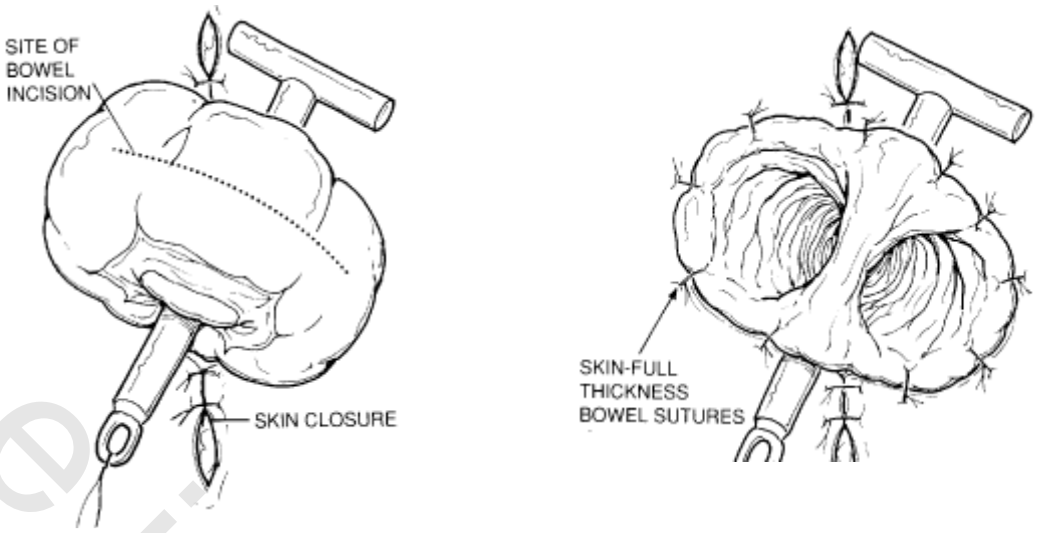


Figure (7): End sigmoid colostomy [16]



(A) **(B)**

Figure (8): Loop transverse colostomy [16]

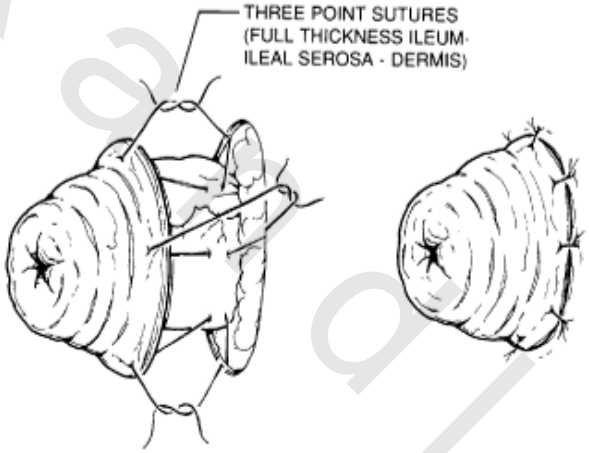


Figure (9): End ileostomy [16]

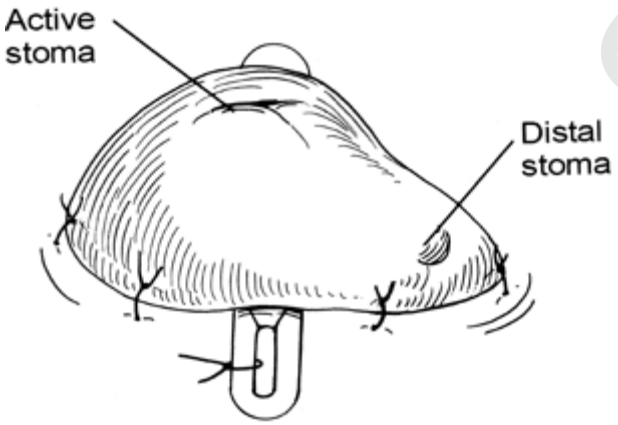
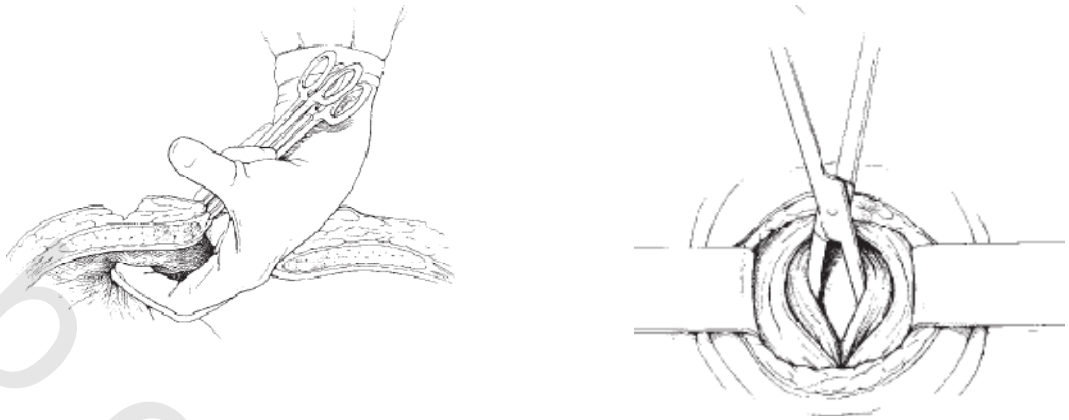


Figure (10): Loop ileostomy [19]



(A) **(B)**

Figure (11): Ostomy creation. (A)Circular skin is removed. (B)Fascia is divided [17]

Stoma complications

Stoma creation is associated with an overall complication rate between 21% and 70%. These complications can be early including metabolic derangements, skin irritation, ischemia and stoma retraction or late complications such as parastomal hernia, prolapse and stenosis. [32-34]

There are several risk factors for complications after stoma construction including body mass index, diabetes, emergency surgery, and technical aspects of stoma formation as stoma height and inappropriate stoma location. [5, 35, 36]

Peristomal skin irritation is the most common early complication, its incidence ranging from 3% to 42%. It is usually occurs due to ill-fitting appliances that results in leakage and chemical dermatitis and also due to frequent appliance changes. Peristomal skin irritation is more frequently seen with ileostomies than with colostomies because of the more liquid caustic effect of the bilious small bowel contents and colostomy output more formed so less skin contact and less irritation occurs. [37, 38]

Stoma retraction is an early complication resulting from tension on the bowel; several risk factors may play a role such as malnourishment, immunosuppression and obesity. It is managed by local revision or laparotomy is often required for repair. [37, 39]

Stoma stricture can occur at the level of the skin or the fascia, it occurs in 1% to 10% of stomas so it is considered a rare complication resulting from ischemia. It can be treated by local dilatation or even stoma revision after recurrent disease is excluded. [39, 40]

Parastomal hernia is a late complication its incidence ranging between 0 and 48.1% with higher rates for end than loop stomas and for colostomies as opposed to ileostomies. Appropriate fascial aperture size and stoma placement through the rectus muscle reduce its occurrence, also a prophylactic mesh implanted at the time of stoma construction plays a role (Fig. 13). [41- 44]

Stoma prolapse is uncommon complication, in which full thickness of bowel protrudes through the stoma; multiple surgical procedures are available including resection, revision, relocation and stoma closure (Fig. 14). [39]

High output stoma is defined as daily output more than 2 liters or amount that leads to dehydration or small bowel less than 200 cm . It results from extensive small bowel resection, bowel diseases as Crohn's disease and other less causes as partial small bowel obstruction, infectious enteritis, bacterial overgrowth and abrupt withdrawal of medications as steroids and opiods. It is treated by oral and intravenous fluid and electrolyte replacement. [39, 45, 46]

Stoma necrosis results from excessive resection of intestinal mesentery, excessive tension on the mesentery leading to the stoma, too small fascial opening or poor perfusion due to low flow states, it is corrected by stoma revision or if extended to peritoneal cavity it needs stoma recreation. Stoma perforation is a rare complication that may occur during careless irrigation with a catheter or during contrast x-ray studies; it is an emergency condition and needs laparotomy and reconstruction of stoma. [16]

Other general complications like electrolyte imbalance, irregularity of function; which most often is related to irritable bowel syndrome or irradiation of the intestine, patients experience episodes of diarrhea and constipation depending on their underlying disease, dietary habits, and episodic infections, gas and odor problems because there is no sphincter around the stoma and gas can be passed uncontrollably, minimal bleeding around a stoma is common because the mucosa is exposed to environmental trauma. [16]

Table (1): Differences between ileostomy and colostomy [47]

	Ileostomy	**Colostomy**
Site	Usually right iliac fossa	Usually left iliac fossa
Shape	High	Flat
Effluent	Liquid to semi liquid (small bowel content)	Solid to semi solid (fecal)
Complications:	Less risk of complications	High risk of complications
Output	High output (alkaline PH)	Low output
Retraction	Less	More
Prolapse	Less	More
Parastomal hernia	The same	The same
Obstruction of small bowel	Common	Rare
Surgical site infection	Less common	More common

Figure (12): Parastomal hernia [39]

Figure (13): Stoma prolapse [39]

Timing of stoma closure

Timing of safe temporary stoma closure has been a matter of debate; it may be very early as 10 days or may be late as 8- 12 weeks. Early closure of the temporary stoma might reduce both stoma-related morbidity and patient discomfort. [48, 49]

There is no significant difference in frequencies of complications between early and late closure of temporary stoma, but there is significant difference in types of complications where the early closure has more wound complications and not associated with increased morbidity and mortality while the late closure has significantly more small-bowel obstruction. [49, 50]

If early reversal of temporary stoma is chosen, it should better be done within 14 days from the creation of stoma because of the risk of formation of thick adhesions, so it can be done during the same hospital admission as the primary operation which will decrease the patient's physical and psychological discomfort. [51, 52]

Delayed closure of temporary stoma may be mandatory if there are signs of active infection, signs of anastomotic leakage, small bowel obstruction, organ failure in the postoperative period, pneumonia, cardiac arrhythmia or administration of either chemo or radiotherapy. [50, 53]

Temporary stoma closure

There are different underlying primary diseases leading to temporary stoma formation; colorectal cancer is a very common cause, diverticular disease, ulcerative colitis, Crohn's disease, colorectal trauma, familial adenomatous polyposis and infectious causes as typhoid and tuberculosis. [4, 54]

Before temporary stoma reversal a multitude of laboratory and radiological investigations should be done; routine laboratory investigations and histopathology of primary disease if present. Radiological investigations check the integrity of the intestinal tract; distal loopogram using barium and abdominal computed tomography with double contrast are commonly used. [54-56]

Preoperative mechanical bowel preparation is used routinely for the prophylaxis of post-operative complications related to fecal contamination. The most commonly used regimens include polyethylene glycol (PEG) solutions or sodium phosphate. PEG solutions make patients to drink a large volume and may cause bloating and nausea. Sodium phosphate solutions are better tolerated, but more likely to cause fluid and electrolyte abnormalities, both solutions are equally effective in bowel preparation. Recently, preparatory formulations introduced in the form of tablets, but they require ingestion large amount of them. In contrast several recent studies recommend that a mechanical bowel preparation does not decrease the risk of postoperative wound infection or anastomotic dehiscence. [57-61]

Preoperative antibiotic prophylaxis is recommended, it is administered orally, intravenous or combination of both, it reduces surgical site infection which ranges from stomal wound closure infection to organ space infection due to anastomotic leakage. Oral antibiotic prophylaxis as three doses of neomycin (1 gram) and erythromycin (1 gram) is commonly used or metronidazole (500 mg) instead of erythromycin to avoid gastrointestinal upsets, ciprofloxacin is also used. Intravenous antibiotic prophylaxis as cephalosporin (1^{st}, 2^{nd} or 3^{rd} generation) alone or combined with metronidazole or aminoglycoside.[59,62,63]

Temporary stoma closure technique; oval incision is made through the skin and subcutaneous tissue, this incision may include the original scar, the surgeon's index finger is inserted into the stoma to act as a guide to prevent incision through the intestinal wall or opening into the peritoneal cavity as the skin and subcutaneous tissue are divided by blunt and sharp dissection, the ring of scar tissue at the junction of mucous membrane and skin must be excised before proceeding with the closure then the mucous membrane is closed transversely to the long axis of the bowel and the previously developed seromuscular layer, which has been freed of any fat, is approximated with interrupted sutures, finally the peritoneum is closed with interrupted sutures, followed by a routine closure of the layers of the abdominal wall. [19]

Temporary stoma closure can be done also using laparoscope; as it provides well visualized lysis of adhesions and mobilization of the stoma and surrounding bowel, no wound infections and no reoperation for bowel obstruction but it has the disadvantage of being difficult procedure, time consuming. [64, 65]

Temporary stoma closure complications

Temporary stoma closure is an elective procedure; so the complication rate should be low but some previous studies reported high rate of serious complications and death. The overall complication rate for colostomy closure is ranging from 14% to 59.3% and for ileostomy closure is ranging from 4.7% to 33.3%. These complications can be classified into early and late; early complications like wound infection, anastomotic leakage, bleeding, reoperation and death; late complications like incisional hernia, intestinal obstruction and even new stoma formation. There are other systemic complications that may occur as cardiorespiratory problems, pneumonia, deep vein thrombosis and urinary tract infection. [7-10, 66-69]

Wound infection is a common early complication, it is ranging from 5.2% to 16% for colostomy closure and 1.7% to 18.3 for ileostomy closure, it leads to wound dehiscence and later incisional hernia, to reduce stomal wound closure infection rates, it is recommend to use closure techniques other than primary closure with or without a drain and preoperative prophylactic antibiotic therapy. The pursestring method resulted in the absence of infection after ostomy wound closure and leads to shorter healing time and improved patient satisfaction. [7-10, 66-72]

Anastomotic leakage is an early serious complication; it ranges between 0.6% and 8% for colostomy closure and between 0% and 4% for ileostomy closure, it can lead to intra-abdominal collection and formation of abscess or fistula either early or late. Old age, patient comorbidties, time of closure and technique of closure whether hand sewn or stapled anastomosis are considered risk factors affecting anastomotic leakage. [7-10, 66-71]

Reoperation rate is a good indicator for surgical quality; it varies between 0.6% and 20% for colostomy closure and between 0.4% and 8.6% for ileostomy closure. [7-10, 66-71, 73]

Incisional hernia is the most common late complication; risk of hernia is greater after colostomy closure than after ileostomy closure. It ranges between 9.3% and 14%, definitive imaging may provide an early marker for late clinically relevant hernias. [9, 74, 75]

Ileus is less common complication, it ranges between 3.7% and 4%, it resolves mostly with conservative treatment[9,76]. Intestinal obstruction is considered common complication after ileostomy reversal which usually ends with conservative treatment.[55,77,78]

Other rare complications may occur like bleeding either intraperitoneal or inraluminal and anastomotic stenosis, systemic complications; chest infection, cardiac complications, deep vein thrombosis, urinary retention and urinary tract infection. [8]

Risk factors for complications after temporary stoma closure

There are multiple risk factors that play a role in the occurrence of complications after temporary stoma closure; they can be categorized into patient related risk factors and surgery or operation technique risk factors. [56,79, 80]

Patient related risk factors are gender (male or female) where male gender increases the risk of wound infection due to smoking more common among males while female gender is considered risk factor for development of incisional hernia [81, 82]. Age when it

increases it raises the risk of postoperative morbidity and mortality as well as the presence of comorbid diseases is an important risk factor [83, 84]. Body mass index (kg/ m^2) when it is high it will increase the risk of complications especially incisional hernia [85]. Smoking affects healing at site of anastomosis and wound healing, type of stoma either ileostomy with least complications then colostomy and Hartmann's with highest rate of complications[9,54]. American society of anesthesiologists class (ASA class) as it reveals that patients with a high ASA class should be closely followed postoperatively for anastomotic leakage after colorectal operations. [79, 86]

Operation technique risk factors are timing of stoma closure as the early closure has more wound complications and not associated with increased morbidity and mortality while the late closure has significantly more small- bowel obstruction [49, 50]. Surgical approach whether laparotomy so it is considered major operation or closure at stoma site, anastomotic technique either stapled or hand sewn technique, surgeon's grade whether supervised trainee, specialist or consultant. [9]

AIM OF THE WORK

The present work is designed to evaluate the relation between different perioperative parameters and incidence of complications after closure of temporary stoma.

PATIENTS AND METHODS

This study included 100 patients that had been divided into prospective and retrospective groups. Forty patients with temporary diverting stoma who were prepared for closure of stoma had been studied prospectively and 60 patients with temporary diverting stoma that underwent closure of their temporary stomas had been studied retrospectively. Those patients had been admitted to the Colorectal Surgery Unit, Alexandria Main University Hospital and General Surgery Department, Karmouz hospital, General Authority for Health Insurance.

Patients in the prospective group subjected to closure of their stomas were observed as following:

Preoperative Data

Preoperative data were obtained as regard:

1. Patient data: age, gender, BMI (kg/m^2) and comorbid diseases.
2. Primary disease: ulcerative colitis, rectal cancer, diverticulitis, colon cancer, Crhon's disease, trauma, and FAP.
3. Type of stoma: ileostomy, colostomy or Hartmann.
4. Timing of stoma closure.
5. Preoperative investigations: routine laboratory, radiological and endoscopic investigations were registered.

Preoperative preparation

Preoperative preparation was done for all cases in the same manner where the patients 2 days before operation received oral fluids and (500 cc normal saline + 500 cc Ringer's solution) IV infusion. The day before operation; the patients became in off oral state and received (500 cc glucose 5% / 8 hours + 500 cc Ringer's solution / 12 hours + 500 cc normal saline once) IV infusion, per rectal and per stomal enema / 8 hours for intestinal irrigation, 250 cc manitol 20 % / 12 hours orally.

Prophylactic preoperative antibiotic was received, (ciprofloxacin + metronidazole) IV infusion before operation and continued for 5 days after operation and one patient was received (amoxicillin clavunlate IV + metronidazole IV infusion) in Colorectal Surgery Unit, Alexandria Main University Hospital while (cefotaxime IV + metronidazole IV infusion) were used in Karmouz hospital, General Authority for Health Insurance 2 days before operation and continued 5 days after operation.

Operative technique [16, 19]

1. Under general or spinal anesthesia.
2. The patient was placed in a comfortable supine position**.**

3. In addition to the routine skin preparation, the skin surrounds the stoma opening was shaved carefully and sterile gauze sponge was inserted.
4. A circumstomal incision was made through the skin and subcutaneous tissue; this incision might include the original scar.
5. Midline exploratory incision was made in case of reversal of Hartmann procedure.
6. The surgeon's index finger was inserted into the stoma to act as a guide to prevent iatrogenic perforation of the intestinal wall during freeing the intestine from surrounding tissues.
7. The ring of scar tissue at the junction of mucous membrane and skin was excised before continuing the closure.
8. The bowel was closed transversely to the long axis of the intestine to prevent stenosis.
9. The bowel wall was held with either Babcock forceps above and below the angles of the new opening.
10. Closure was done with single layer absorbable interrupted 2/0 or 3/0 vicryl sutures.
11. Four cases of Hartmann procedure were closed using stapled closure technique.
12. The intestinal lumen patency was assured by palpation between the surgeon's thumb and index finger.
13. The peritoneum is closed with interrupted sutures, followed by a routine closure of the layers of the abdominal wall.
14. Intra-abdominal or subcutaneous drain was inserted according to each case.
15. Skin was closed with single layer vertical mattress sutures.

Figure (14): Preoperative ileostomy prolapse with parastomal hernia

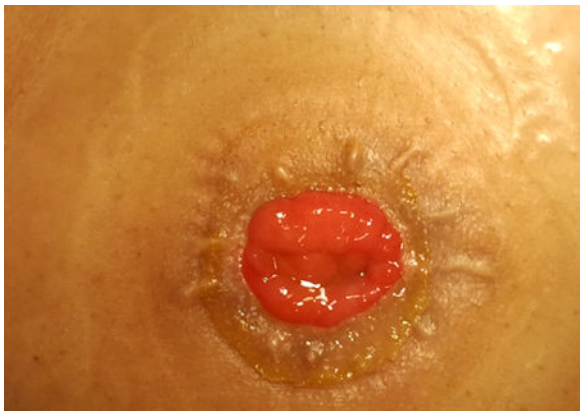


Figure (15): Non complicated transverse loop colostomy

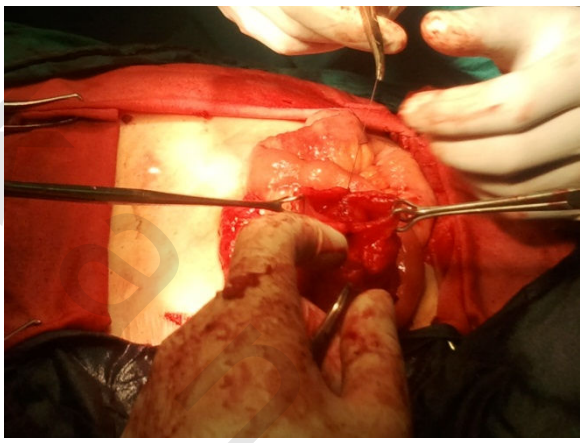


Figure (16): Hand sewn closure of loop ileostomy

Figure (17): Single layer interrupted sutures during ileostomy closure

Figure (18): Skin closure with vertical mattress sutures and subcutaneous drain

Intraoperative data

Registration of intraoperative data was done including operative technique (hand sewn or stapled), operative time, blood loss and experience of surgeon and assistant.

Patients were observed until regain of bowel movement and start of soft diet with registration of early complications that might occur, and then discharge with follow-up at outpatient clinic weekly for one month and monthly visit or phone call for 6 months.

Available data of the patients in the retrospective group were obtained as regard preoperative, intraoperative and postoperative parameters.

All collected data were subjected to statistical analysis by using the computer programs Microsoft Excel® 2013, the Statistical Package for the Social Science (IBM

SPSS version 20.0. Armonk, NY: IBM Corp) and MedCalc® software version 12 (MedCalc Software bvba, Mariakerke, Belgium).

Continuous variables were analyzed by Student t-test. The chi-square (χ_2) test and Fisher Exact test were used to evaluate the relationship between categorical variables as appropriate. The analysis of the quantitative variables in relation to the qualitative ones was carried out with the help of the Mann-Whitney test. Monte Carlo test applied to models estimated by indirect inference. Significance level (**p** value): $\mathbf{p} > 0.05$ Insignificant, $p \leq 0.05$ Significant. [87]

RESULTS

The aim of this study is to evaluate the relation between different perioperative parameters and incidence of complications after closure of temporary stoma.

Forty patients with temporary diverting stoma subjected for closure of stoma had been studied prospectively and sixty patients with temporary diverting stoma that underwent closure of their temporary stomas had been studied retrospectively.

There were 22 males (55.0%) and 18 females (45.0%) in the prospective group, while in the retrospective group there were 35 males (58.3%) and 25 females (41.7%) so the total in both groups was 57 males (57.0%) and 43 females (43.0%).

The mean age was 48.25 ± 14.40 years, (range 12-71 years) for the prospective group and it was 48.72 ± 17.21 years, (range 15-74 years) for the retrospective group so the mean age in both groups was 48.53 ± 16.07 years, (range 12-74 years).

The mean body mass index (BMI) was 25.27 ± 2.32, (range 21.70-31.50) for the prospective group and it was 25.33 ± 2.15, (range 21.40-31.10) for the retrospective group so the mean BMI for both groups was 25.31 ± 2.21, (range 21.40-31.50).Table (2).

Table (2): Distribution of Prospective and Retrospective group according to demographic data

	Prospective (n = 40)		**Retrospective (n = 60)**		**Total (n = 100)**	
	No	**%**	**No**	**%**	**No**	**%**
Gender						
Male	22	55.0	35	58.3	57	57.0
Female	18	45.0	25	41.7	43	43.0
Age						
Min. - Max.	12.0 - 71.0		15.0 - 74.0		12.0 - 74.0	
Mean ± SD	48.25 ± 14.40		48.72 ± 17.21		48.53 ± 16.07	
Median	51.0		53.50		53.0	
BMI						
Min. - Max.	21.70 - 31.50		21.40 - 30.10		21.40 - 31.50	
Mean ± SD	25.27 ± 2.32		25.33 ± 2.15		25.31 ± 2.21	
Median	25.30		25.35		25.35	

There were 11 patients (27.5%) are smokers and 29 patients (72.5%) are non-smokers in the prospective group, while the retrospective group there were 21 patients (35.0%) are smokers and 39 patients (65.0%) are non-smokers so the total in both groups was 32 patients (32.0%) are smokers and 68 patients (68.0%) are non-smokers.

There were 18 patients (45.0%) having co morbid disease in the prospective group while in the retrospective group there were 20 patients (33.3%) having co morbid disease so the total in both groups was 38 patients (38.0%) having co morbid disease.

Hypertension was the most common co morbid disease as it was found in 8 patients (44.4%) in the prospective group while 10 patients (50.0%) in the retrospective group and in both groups it was presented in 18 patients (47.4%), the second most common co morbid disease was diabetes mellitus (DM); in the prospective group 7 patients (38.9%) and 10 patients (50.0%) in the retrospective group so there were 17 patients (44.7%) in both groups had DM.

The third most common co morbid disease was ischemic heart disease (IHD); 6 patients (33.3%) in the prospective group while 7 patients (35.0%) in the retrospective group and there were 13 patients (34.2%) in both groups had IHD. Other less common co morbid diseases are listed in table (3).

Table (3): Distribution of Prospective and Retrospective group according to smoking and Co morbid disease

	Prospective (n = 40)		**Retrospective (n = 60)**		**Total (n = 100)**	
	No	**%**	**No**	**%**	**No**	**%**
Smoking						
No	29	72.5	39	65.0	68	68.0
Yes	11	27.5	21	35.0	32	32.0
Co morbid disease						
No	22	55.0	40	66.7	62	62.0
Yes	18	45.0	20	33.3	38	38.0
DM	7	38.9	10	50.0	17	44.7
IHD	6	33.3	7	35.0	13	34.2
HCV	1	5.6	1	5.0	2	5.3
HTN	8	44.4	10	50.0	18	47.4
renal impairment	1	5.6	0	0.0	1	2.6
Bronchial asthma	1	5.6	0	0.0	1	2.6
Total thyriodectomy on eltroxin therapy	1	5.6	0	0.0	1	2.6
DVT	0	0.0	1	5.0	1	2.6

Colorectal malignancy was the most common primary disease; there were 21 patients (52.25%) with colorectal malignancy in the prospective group while 29 patients (48.3%) in the retrospective group so the total in both groups was 50 patients (50.0%).

Trauma was the second most common primary disease; it includes stab abdomen, bullet injury, perineal trauma and iatrogenic injury; there were 5 patients (12.5%) in the prospective group and 11 patients (18.3%) in the retrospective group so the total in both groups was 16 patients (16.0%). Other primary diseases are shown in table (4).

Table (4): Distribution of Prospective and Retrospective group according to primary disease

	Prospective (n = 40)		Retrospective (n = 60)		Total (n = 100)	
	No	%	No	%	No	%
Primary disease						
Colorectal Carcinoma	21	52.5	29	48.3	50	50.0
FAP	1	2.5	1	1.7	2	2.0
Volvulus	3	7.5	4	6.7	7	7.0
Crhon's disease	3	7.5	3	5.0	6	6.0
Diverticulosis	2	5.0	6	10.0	8	8.0
Trauma	5	12.5	11	18.3	16	16.0
Leakage & Infection	3	7.5	2	3.3	5	5.0
Miscellaneous	2	5.0	4	6.7	6	6.0

Distal loopogram is the most common radiological study was used as it was done in 34 patients (85.0%) in the prospective group and 56 patients (93.4%) in the retrospective group so the total was 90 patients (90.0%) had been performed distal loopogram.

CT or Multislice (CT) had been used in 6 patients (15.0%) in the prospective group while 4 patients (6.6%) had used it in the retrospective group so the total in both groups was 10 patients (10.0%).

Preoperative endoscopic study was used and combined with radiological studies; it was used in 2 patients (5.0%) in the prospective group while it was used in 1 patient (1.7%) in the retrospective group so it was used in 3 patients (3.0%) in both groups. Table (5).

Table (5): Distribution of Prospective and Retrospective group according to Preoperative Radiological and Endoscopic studies

	Prospective (n = 40)		**Retrospective (n = 60)**		**Total (n = 100)**	
	No	**%**	**No**	**%**	**No**	**%**
Preoperative Radiological Studies						
Distal loopogram	34	85.0	56	93.4	90	90.0
CT or Multislice CT	6	15.0	4	6.6	10	10.0
Preoperative Endoscopic Study						
None	38	95.0	59	98.3	97	97.0
Endoscopy	2	5.0	1	1.7	3	3.0

In the prospective group there were 10 patients (25.0%) had given cefotaxime and metronidazole, 29 patients (75.5%) were given ciprofloxacin and metronidazole, 1 patient (2.5%) was given amoxicillin clavulnate and metronidazole; this patient was 12 years old.

In the retrospective group 17 patients (28.3%) were given cefotaxime and metronidazole, 43 patients (71.7%) were given ciprofloxacin and metronidazole so in both groups 27 patients (27.0%) were given cefotaxime and metronidazole, 72 patients (72.0%) were given ciprofloxacin and metronidazole, 1 patient (1.0%) was given amoxicillin clavulnate and metronidazole. Table (6).

Table (6): Distribution of Prospective and Retrospective group according to preoperative antibiotic prophylaxis

	Prospective (n = 40)		**Retrospective (n = 60)**		**Total (n = 100)**	
	No	**%**	**No**	**%**	**No**	**%**
Preoperative antibiotic prophylaxis						
Cefotaxime + metronidazole	10	25.0	17	28.3	27	27.0
Ciprofloxacin + metronidazole	29	75.5	43	71.7	72	72.0
Amoxycillin clavulnate+metronidazole	1	2.5	0	0.0	1	1.0

Ileostomy was the most common stoma performed in both groups; it was done in 28 patients (70.0%) in the prospective group while in the retrospective group it was done in 43 patients (71.7%) and in both groups it was done in 71 patients (71.0%).

Colostomy was done in 7 patients (17.5%) in the prospective group while in the retrospective group it was done in 13 patients (21.7%) and in both groups it was done in 20 patients (20.0%).

Hartmann procedure was done in 5 patients (12.5%) in the prospective group while it was done in 4 patients (6.7%) in the retrospective group and it was done in 9 patients (9.0%) in both groups. Table (7).

Table (7): Distribution of Prospective and Retrospective group according to Type of Stoma

	Prospective (n = 40)		Retrospective (n = 60)		Total (n = 100)	
	No	%	No	%	No	%
Type of Stoma						
Ileostomy	28	70.0	43	71.7	71	71.0
Colostomy	7	17.5	13	21.7	20	20.0
Hartmann	5	12.5	4	6.7	9	9.0

Hand sewn technique was the predominant technique of closure; in the prospective group 37 patients (92.5%) were subjected to hand sewn closure of their stomas while only 3 patients (7.5%) were closed with stapled technique, in the retrospective group 59 patients (98.3%) were closed with hand sewn technique while only 1 patient (1.7%) were closed with stapled technique. In both groups 96 patients (96.0%) were subjected to hand sewn closure while 4 patients (4.0%) were closed with stapled technique; these 4 patients were Hartmann procedure. The limited use of staplers was due to its high cost.

Operations were performed by surgeons of different degrees; mid-senior resident, senior resident, assistant lecturer, lecturer, specialist, consultant and professor. Residents had performed these operations under supervision of more experienced surgeons; 12 patients (30.0%) in the prospective group and 11 patients (18.3%) in the retrospective group so 23 patients (23.0%) in both groups their operations were performed by mid-senior residents, 12 patients (30.0%) in the prospective group and 24 patients (40.0%) in the retrospective group so 36 patients (36.0%) in both group their operations were performed by senior residents. Table (8).

Table (8): Distribution of Prospective and Retrospective group according to Operative Technique and Experience of Surgeon and Assistant

	Prospective (n = 40)		**Retrospective (n = 60)**		**Total (n = 100)**	
	No	**%**	**No**	**%**	**No**	**%**
Operative Technique						
Hand sewn	37	92.5	59	98.3	96	96.0
Stapled	3	7.5	1	1.7	4	4.0
Experience of Surgeon and Assistant						
Mid-senior resident	12	30.0	11	18.3	23	23.0
Senior resident	12	30.0	24	40.0	36	36.0
Assistant lecturer+Specialist	7	17.5	11	18.3	18	18.0
Lecturer+Consultant	7	17.5	10	16.7	17	17.0
Professor	2	5.0	4	6.7	6	6.0

Interval between formation of stoma and its closure; its mean time was 7.91 ± 9.03 months, (range 2.50-48.0 months) for the prospective group while in the retrospective group the mean interval was 6.14 ± 3.05 months, (range 2.50-18.0) and the mean interval for both groups was 6.85 ± 6.20 months, (range 2.50-48.0) (Fig.19).

The mean operative time was 89.50 ± 21.42 minutes, (range 55.0-150.0 minutes) and the mean blood loss during operations was 138.75 ± 52.49 cc, (range 50.0-250.0 cc) for the prospective group while in the retrospective group these data were not available.

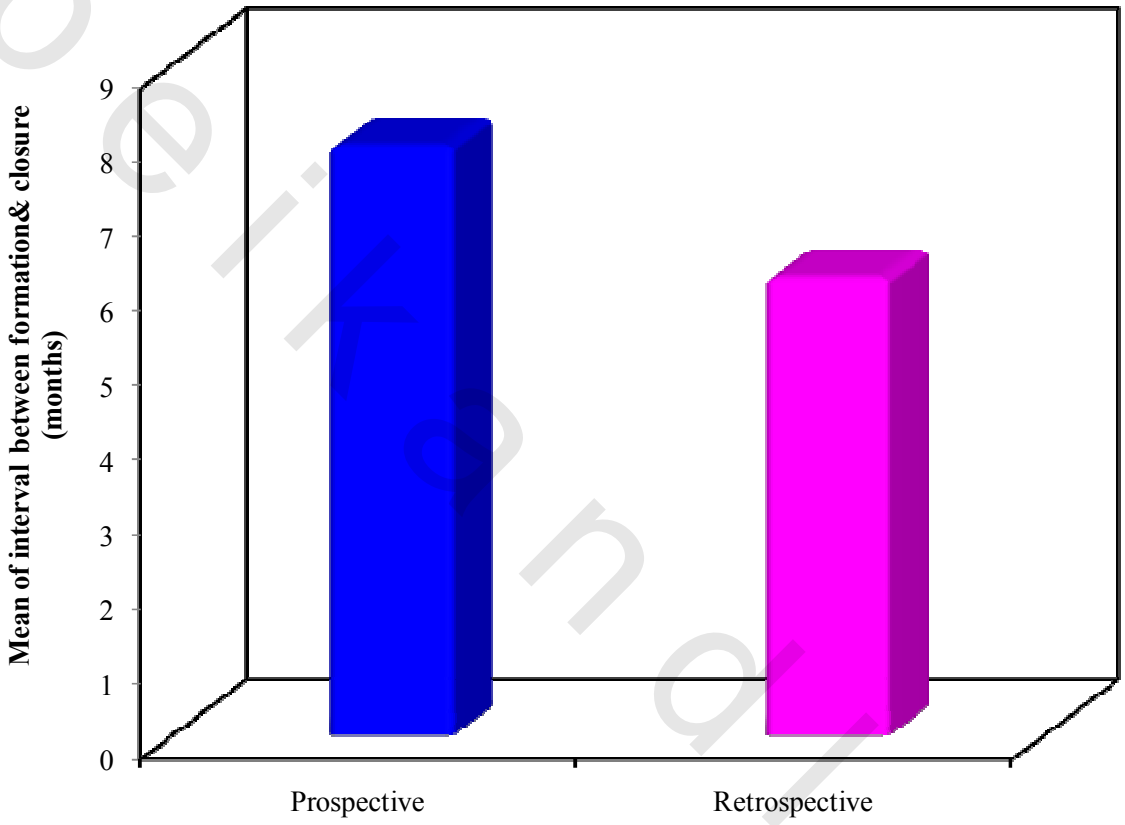


Figure (19): Mean of interval between formation and closure of temporary stoma in both prospective and retrospective groups

There were 10 patients (25.0%) had complications in the prospective group while 21 patients (35.0%) had complications in the retrospective group so the overall complication in both groups was 31 patients (31.0%).

The most common postoperative complication was wound infection that is occurred in 6 patients (15.0%) in the prospective group and 10 patients (16.7%) in the retrospective group so it was present in 16 patients (16.0%) in both groups, the second most common complication was incisional hernia that is occurred 4 patients (10.0%) in the prospective group and in 10 patients (16.7%) in the retrospective group so it was in 14 patients (14.0%) in both groups, the third most common complication was ileus that is occurred in 1 patient (2.5%) in the prospective group and in 4 patients (6.7%) in the retrospective group so it was present in 5 patients (5.0%) in both groups. Other less common complications are listed in table (9).

Table (9): Distribution of Prospective and Retrospective group according to complications

	Prospective (n = 40)		**Retrospective (n = 60)**		**Total (n = 100)**	
	No	**%**	**No**	**%**	**No**	**%**
Overall complication	**10**	**25.0**	**21**	**35.0**	**31**	**31.0**
Wound Infection	6	15.0	10	16.7	16	16.0
Ileus	1	2.5	4	6.7	5	5.0
Leakage	1	2.5	0	0.0	1	1.0
Reoperation	1	2.5	0	0.0	1	1.0
Incisional hernia	4	10.0	10	16.7	14	14.0
Neo-stoma	1	2.5	0	0.0	1	1.0
Mortality	1	2.5	0	0.0	1	1.0

The mean interval was 4.0 ± 1.03 days (range 1.0 - 5.0 days) for the prospective group while it was 4.20 ± 0.82 days (range 1.0 - 6.0 days) for the retrospective group and the mean interval for both groups was 4.12 ± 0.92 days (range 1.0 - 6.0 days).

There were 11 patients (28.2%) had started oral fluids <4 days and 28 patients (71.8%) had started oral fluids ≥4days in the prospective group while 9 patients (15.0%) had started oral fluids <4 days and 51 patients (85%) had started oral fluids ≥4days in the retrospective group so there were 20 patients (20.2%) had started oral fluids <4 days and 79 patients (79.8%) had started oral fluids ≥4days in both groups. One patient was died. Table (10).

Table (10): Distribution of Prospective and Retrospective group according to time of start of oral fluids

	Prospective (n = 39)		**Retrospective (n = 60)**		**Total (n = 99)**	
	No	**%**	**No**	**%**	**No**	**%**
Time of start of oral fluids						
<4	11	28.2	9	15.0	20	20.2
≥4	28	71.8	51	85.0	79	79.8
Min. - Max.	1.0 - 5.0		1.0 - 6.0		1.0 - 6.0	
Mean ± SD	4.0 ± 1.03		4.20 ± 0.82		4.12 ± 0.92	
Median	4.0		4.0		4.0	

There is no statistical significance between the type of stoma and the primary disease as the most common primary disease prior to temporary ileostomy formation was colorectal carcinoma which was present in 37 patients (52.1%) and also prior to temporary colostomy and Hartmann formation which was present in 13 patients (44.8%) and (p=0.660). Colorectal trauma was present in 10 patients (14.1%) in ileostomy group and 6 patients (20.7%) in colostomy and Hartmann group (p=0.548). Table (11).

Table (11): Relation between Type of Stoma and primary disease

	Type of Stoma				p
	Ileostomy (n = 71)		Colostomy & Hartmann (n = 29)		
	No	%	No	%	
Primary disease					
Colorectal Carcinoma	37	52.1	13	44.8	$^{\chi^2}p = 0.660$
FAP	2	2.8	0	0.0	$^{FE}p = 1.000$
Volvulus	3	4.2	4	13.8	$^{FE}p = 0.189$
Crhon's disease	4	5.6	2	6.9	$^{FE}p = 1.000$
Diverticulosis	7	9.9	1	3.4	$^{FE}p = 0.432$
Trauma	10	14.1	6	20.7	$^{FE}p = 0.548$
Leakage & Infection	5	7.0	0	0.0	$^{FE}p = 0.318$
Miscellaneous	3	4.2	3	10.3	$^{FE}p = 0.352$

p: p value for comparing between type of stoma
χ^2: Chi square test
FE: Fisher Exact test

The interval between formation of stoma and its closure; in cases of temporary ileostomy closure, its mean time was 6.95 ± 7.0 months, (range 2.50 - 48.0 months) while for temporary colostomy and Hartmann, its mean time was 6.59 ± 3.63 months, (range 2.50 - 18.0 months) with no statistical significance (p=0.520) (Fig.20).

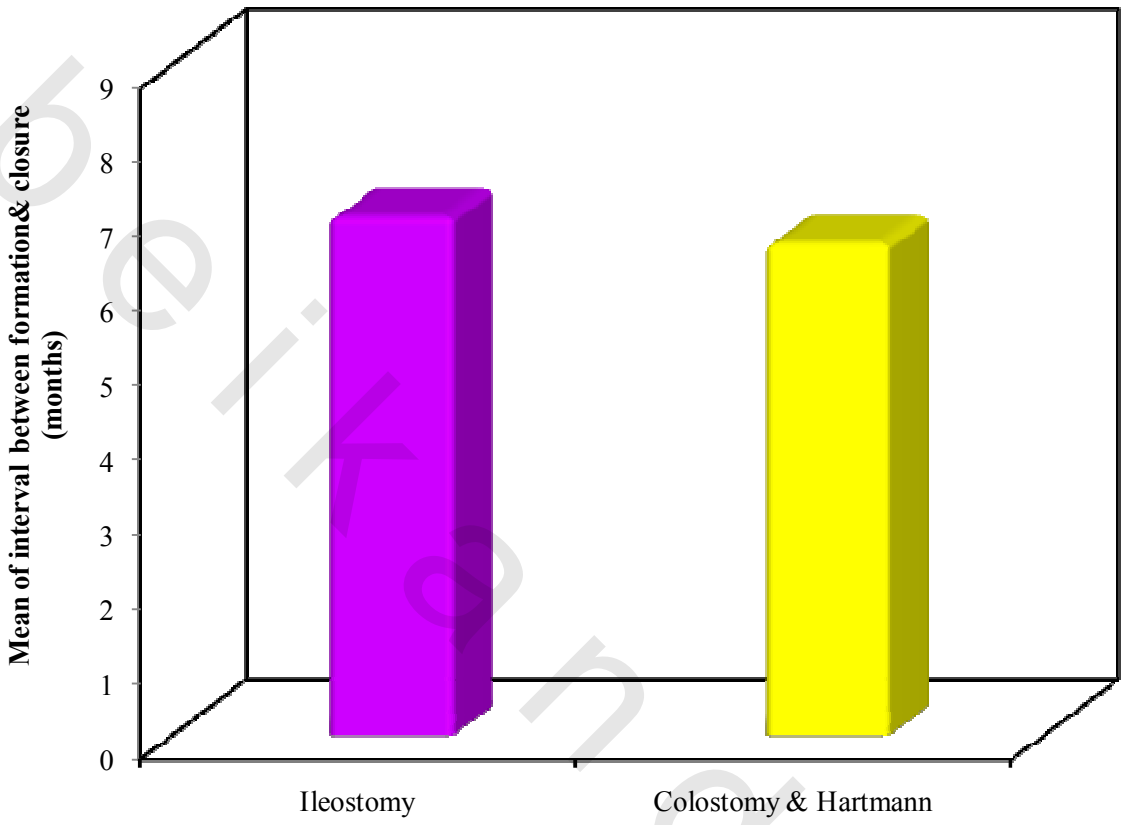


Figure (20): Relation between Type of Stoma and Interval between formation& closure

There is no statistical significance between the type of stoma and postoperative complications (p=0.338); as after temporary ileostomy closure 20 patients (28.2%) had complications while after temporary colostomy and Hartmann closure 11 patients (37.9%) had complications. Wound infection was present in 9 patients (12.7%) in ileostomy group and in 7 patients (24.1%) in colostomy and Hartmann group with no statistical significance (p=0.227). Incisional hernia was present in 10 patients (14.1%) in ileostomy group and 4 patients (13.8%) in colostomy and Hartmann group where (p=1.000). Table (12).

Table (12): Relation between Type of Stoma and complication

	Type of Stoma				**p**
	Ileostomy (n = 71)		**Colostomy & Hartmann (n = 29)**		
	No	**%**	**No**	**%**	
Overall complication	**20**	**28.2**	**11**	**37.9**	**χ^2p = 0.338**
Wound Infection	9	12.7	7	24.1	^{FE}p = 0.227
Ileus	3	4.2	2	6.9	^{FE}p = 0.626
Leakage	1	1.4	0	0.0	^{FE}p = 1.000
Reoperation	1	1.4	0	0.0	^{FE}p = 1.000
Incisional hernia	10	14.1	4	13.8	^{FE}p = 1.000
Neo-stoma	1	1.4	0	0.0	^{FE}p = 1.000
Mortality	1	1.4	0	0.0	^{FE}p = 1.000

p: p value for comparing between types of stoma
χ^2: Chi square test
FE: Fisher Exact test

Study of risk factors and detection which of them is significant was done, patients were categorized into patients with no postoperative complications (Group I) and patients with postoperative complications (Group II). According to gender, patients in (Group I) are classified into 43 males (62.3%) and 26 females (37.7%) while patients in (Group II) are classified into 14 males (45.2%) and 17 females (54.8%); female patients were more susceptible for complications but this difference in gender is not of statistical significance ($p = 0.109$).

According to age; the mean age in Group I patients 47.28 ± 16.48 years, (range 12.0 - 74.0 years) while in Group II patients there was slight increase in the mean age, it was 51.32 ± 14.99 years, (range 23.0 - 73.0 years). This difference in age is of no statistical significance ($p= 0.246$).

The mean BMI in Group I patients was 25.35 ± 2.15, (range 21.40 - 31.50) while in Group II patients was 25.22 ± 2.37, (range 21.80 - 30.10); this difference in BMI is not statistically significant ($p=0.786$). There were 24 patients (34.8%) smokers and 45 patients (65.2%) were non-smokers in Group I while n Group II there were 8 patients (25.8%) smokers and 23 patients (74.2%) were non-smokers, also no statistical significance is present ($p=0.373$).

According to the presence or absence of comorbid disease; in Group I, 24 patients (34.8%) were had comorbid disease and 45 patients (65.2%) with no comorbid disease while in Group II, 14 patients (45.2%) were had comorbid disease and 17 patients (54.8%) with no comorbid disease, in spite of difference in percentage there is no statistical significance ($p=0.323$).

According to the underlying primary disease; in Group I, 34 patients (49.3%) had colorectal carcinoma, 15 patients (21.7%) had trauma while in Group II, 16 patients (51.6%) had colorectal carcinoma, this factor is statistically significant ($p=0.003$).

Regarding to preoperative antibiotic prophylaxis; (ciprofloxacin + metronidazole) regimen was better than (cefotaxime + metronidazole) regimen where 19 patients (26.3%) had complications with the first regimen and 12 patients (44%) had complications with the second regimen. Table (13).

Table (13): Relation between Overall complications with Demographic and Preoperative data

	Overall complications				Test of sig.
	Group(I) -ve (n = 69)		Group(II) +ve (n = 31)		
	No	%	No	%	
Gender					
Male	43	62.3	14	45.2	$\chi^2 p = 0.109$
Female	26	37.7	17	54.8	
Age					
Min. - Max.	12.0 - 74.0		23.0 - 73.0		
Mean ± SD	47.28 ± 16.48		51.32 ± 14.99		$^t p = 0.246$
Median	49.0		57.0		
BMI					
Min. - Max.	21.40 - 31.50		21.80 - 30.10		
Mean ± SD	25.35 ± 2.15		25.22 ± 2.37		$^t p = 0.786$
Median	23.30		25.40		
Smoking					
No	45	65.2	23	74.2	$\chi^2 p = 0.373$
Yes	24	34.8	8	25.8	
Co morbid disease					
No	45	65.2	17	54.8	$\chi^2 p = 0.323$
Yes	24	34.8	14	45.2	
Primary disease					
Colorectal Carcinoma	34	49.3	16	51.6	$^{MC} p = 0.003^*$
FAP	1	1.4	1	3.2	
Volvolous	6	8.7	1	3.2	
Crhon's disease	4	5.8	2	6.5	
Diverticulosis	6	8.7	2	6.5	
Trauma	15	21.7	1	3.2	
Leakage & Infection	3	4.3	2	6.5	
Miscellneous	0	0.0	6	19.4	
Preoperative antibiotic prophylaxis					
Cefotaxime + metronidazole	15	21.7	12	38.7	$^{MC} p = 0.128$
Ciprofloxacin + metronidazole	53	76.8	19	61.3	
Amoxycillin clavulnate+metronidazole	1	1.4	0	0.0	

p: p value for comparing between -ve and +ve complications
χ^2: Chi square test
MC: Monte Carlo test
t: Student t-test
*: Statistically significant at $p \leq 0.05$

According to operative technique in Group I hand sewn closure was done for 66 patients (95.7%) and stapled closure was done for 3 patients (4.3%) while in Group II, 30 patients (96.8%) were subjected to hand sewn closure and stapled closure was done for 1 patient (3.2%), this difference of no statistical significance (p=1.000).

Interval between formation of temporary stoma and its closure didn't increase the rate of complications; the mean interval in Group I was 7.24 ± 7.17 months, (range, 2.50 - 48.0 months) while in Group II it was 5.96 ± 3.01 months, (range, 2.50 - 16.0 months), this difference is statistically insignificant (p=0.826).

Experience of surgeon and assistant correlated significantly (p=0.033) where the more experience are the surgeon and assistant after stoma closure the least the occurrence of complications.

Time of start of oral fluids correlated significantly (p=0.014) where the mean time in the non-complicated group was (1.97 ± 0.88) and the mean time in the complicated group was (4.9 ± 0.89). Table (14).

Table (14): Relation between Overall complications with Operative and Postoperative data

	Overall complications				Test of sig.
	Group(I) -ve (n = 69)		Group(II) +ve (n = 31)		
	No	%	No	%	
Operative Technique					
Hand sewn	66	95.7	30	96.8	$^{FE}p = 1.000$
Stapled	3	4.3	1	3.2	
Interval between formation& closure (months)					
Min. - Max.	2.50 - 48.0		2.50 - 16.0		
Mean ± SD	7.24 ± 7.17		5.96 ± 3.01		$^{MW}p=0.826$
Median	5.50		5.50		
Experience of Surgeon and Assistant					
Midsenior resident	13	18.8	10	32.2	
Senior resident	26	37.6	10	32.2	
Assistant lecturer + Specialist	12	17.3	6	19.3	$^{MC}p = 0.033^{*}$
Lecturer + Consultant	13	18.8	4	12.9	
Professor	5	7.2	1	3.2	
Time of start of oral fluids					
Min. - Max.	1.0 - 3.0		3.0 - 6.0		
Mean ± SD	1.97 ± 0.88		4.9 ± 0.89		$^{t}p = 0.014^{*}$
Median	2.0		4.5		

p: p value for comparing between -ve and +ve complications
MC: Monte Carlo test
FE: Fisher Exact test
t: Student t-test
MW: Mann Whitney test
*: Statistically significant at $p \leq 0.05$

DISCUSSION

Temporary stoma closure is not considered a minor procedure; it has several factors influencing the occurrence of postoperative complications. These factors may include patient's demographic data like age, gender and BMI, associated comorbid diseases and underlying primary disease. It also includes preoperative factors as timing of closure of temporary stoma or operative factors like operative technique either stapled or hand sewn, operative time and experience of surgeon and assistant. [8, 9, 78-80]

It is sometimes not a complication free procedure as it has considerable morbidity and mortality. Wound infection, anastomotic leakage, postoperative ileus and incisional hernia are common complications while reoperation, neo-stoma formation, intestinal obstruction, hemorrhage and death are less common complications. [7, 54, 81]

The current study included 100 patients who were subjected to temporary stoma closure, comparison was held between ileostomy group and colostomy, Hartmann group for the purpose of determining the difference of incidence of complications and possible risk factors in each group. Another comparison was held between complicated cases and non- complicated cases as regard preoperative, operative and postoperative parameters in order to identify risk factors for the occurrence of complications and possible recommendations to avoid them.

Analysis of data in our study revealed that overall complication was present in 31 patients (31.0%); 20 patients (28.2%) after ileostomy closure and 11 patients (37.9%) after colostomy and Hartmann closure, this difference was of no statistical significance. Mortality was (1.0%); this patient was diabetic, hepatitis C (+ve) with low serum albumin level, she was reoperated 2 days after closure and new ileostomy formation was done. Pokorny et al [76] reported that morbidity rate after stoma closure was 20% and mortality rate was 3% in their study which applied on 533 patients. Other studies [7, 9, 67-69, 71, 88] reported that morbidity rate after colostomy closure was ranging from 14% to 59.3% and mortality rate was ranging from 0% to 5.3% while morbidity rate after ileostomy closure was ranging from 4.7% to 33.3% and mortality rate was ranging from 0% to 3.3%. [8-10, 66. 69, 70, 89, 90]

In this study, wound infection was the most common complication where skin in all cases was closed with primary linear closure, Klink et al [91] reported that the risk for surgical site infection is lower in patients with purse string approximation in comparison to patients with primary linear closure in their study which performed on 140 patients (5% vs. 17%; p = 0.047), Mirbagheri et al [62] and McCartan et al [92] confirmed the same result. In contrast Harold et al [93] found that primary closure does not increase the rate of infection. Khan et al [94] observed that the frequency of wound infection was higher with early stoma closure.

Incisional hernia was the second most common complication according to our results (14.0%), Bhangu et al [74] in their review of 34 studies for 2,729 closed stomas reported that one in three patients may develop a hernia after stoma closure, and around half of hernias that are detected require repair, risk of hernia is greater after colostomy closure than after ileostomy closure. Bhangu et al [75] found that definitive imaging may provide an early

marker for late clinically relevant hernias. Song et al [82] reported that wound infection is a significant risk factor for the development of incisional hernia (P = 0.041).

Postoperative ileus was the third common complication (5.0%) in our study, and it is defined as temporary impairment in gastrointestinal motility following surgery, this physiological state usually manifests with nausea, vomiting, abdominal pain, abdominal distention, and or a delay in the passage of flatus and stool [95]. D'Haeninck et al [96] reported prolonged ileus (11.2%) and it was more frequent when the interval to stoma reversal exceeded 12 weeks (14.3% versus 3.5% ; p = 0.02). Hiranyakas et al [97] found that laparoscopic stoma closure is associated with lower rate of postoperative ileus than conventional method.

In the current study, postoperative anastomotic leakage was (1.0%) while Fauno et al[9] in the study that was performed on 997 patients, Pokorny et al [76] and Pokorny et al [98] found it ranges between (1.0% and 5.0%) and it was for colostomy closure [7, 9, 67-69, 71, 88] ranging between (0.6% and 6.1%) and for ileostomy closure [8-10, 66, 69, 70, 90] ranging between (0.0% and 4.0%). Saha et al [66] in their study that was applied on 325 patients found that the leakage rate was lower after a stapled anastomosis than a hand-sutured anastomosis while Garcia-Botello et al [70] reported no difference in the leakage rate between closure techniques.

Other less common complications in the present study; reoperation was present in 1 patient (1.0%) while in other studies [9, 55, 56, 79, 99] it ranges between (0.7% and 8.0%). New stoma formation was performed in 1 patient (1.0%) while in other studies [9, 79] it was (1.3%) and (5.8%) respectively. Mengual-Ballester et al [55] observed that intestinal obstruction was the most common complication (32.6%) which was resolved in all patients with conservative treatment while Fauno et al [9] reported (3.4%) only with intestinal obstruction.

Analysis of demographic and preoperative data revealed that female gender was slightly more susceptible to postoperative complications (54.8%) but this difference not of statistical significance (p=0.109); because female gender had weak abdominal wall due to repeated pregnancy. El-Hussuna et al [80] in their study which applied on 159 patients found that female gender was associated with increased risk of postoperative morbidity and it was statistically significant (p=0.032), Song et al [82] found that female gender was a significant risk factor for the development of incisional hernia (p=0.009) while Akiyoshi et al [81] found that male gender was statistical significant risk factor for the development of wound infections (p=0.0339) and D'Haeninck et al [96] found that surgical complications were more frequent in male patients (p = 0.005).

In the present study, increasing age is also slightly more associated with the occurrence of postoperative complications where the mean age in the complicated group was higher than non-complicated group but this difference was not statistically significant (p=0.246). This goes with the literature; Jan et al [56] in their study which applied on 46 patients and other studies [76, 80, 98] observed that age is not statistically significant but Van Westreenen et al [79] who studied 138 patients reported that increasing age is a significant risk factor for the development of postoperative complications (p=0.025) and Mansfield et al [8] reported that increasing age was associated with postoperative death as its range was (74-82 years) and it is statistically significant (p=0.0006). Dodgion et al [100] in their retrospective study which performed on 1179 patients found that old age is a definitive risk

factor that may prevent stoma reversal in rectal cancer patients who undergone low anterior resection with temporary stoma.

According to the current study, no association had been revealed between BMI and postoperative stoma closure morbidity as it does not show statistical significance (p=0.786); this goes with the results of El-Hussuna et al [80], Tan et al [86] and Guzman-Valdivia [101] that did not found significant association although Fauno et al [9] and Schreinemacher et al [85] reported weak association between high BMI and the development of hernia. Mirbagheri et al [62] in their study which applied on 142 patients found that obesity is a significant risk factor for wound infection (p=0.024).

Smoking increases the risk of complications after all types of major colorectal surgery, Sharma et al [102] reported significant increased risk of postoperative morbidity in current smoker patients. In this study, smoking also increases the risk of postoperative morbidity but it does not show statistical significant association (p=0.373), El-Hussuna et al [80] also did not find any statistical significance (p=0.911).

Comorbid diseases increases the risk of postoperative morbidity and mortality; this goes with the results of the present study but it does not show statistical significance (p=0.323), El-Hussuna et al [80] also reported the same results (p=0.351) but Mansfield et al[8] found that complications were significantly more common in patients with more comorbidity (p=0.0007). Dodgion et al [100] observed that the presence of comorbidities would delay reversal of temporary stoma and this was statistically significant (P = 0.014).

According to current study, underlying primary disease shows statistical significant association with postoperative morbidity (p=0.003), Luglio et al [99] also reported statistical significance between primary disease and postoperative morbidity (p=0.02) but this does not go with the literature [56, 76, 79] that showed no statistical significance.

Use of preoperative antibiotic prophylaxis decreases the risk of postoperative complications but in our study it does not show statistical significance (p=0.128). We used (cefotaxime and metronidazole) and (ciprofloxacin and metronidazole), better results were given with the latter regimen. Fauno et al [9] used cefuroxime and metronidazole 30-60 minutes before surgery and wound infection rate was (3.1%). Jan et al [56] used ceftriaxone and metronidazole at the time of induction which was continued for 5 days and wound infection rate was (4.35%). Memon et al [77] used amoxicillin clavulnate and metronidazole during anesthesia induction and wound infection rate was (41.6%). Mirbagheri et al [62] used a combination of amoxicillin (or cefazolin), gentamicin and metronidazole (triple antibiotic) and also used cefazolin/ceftriaxone and metronidazole (dual agent) and wound infection rate was (10.7%).

Review of operative and postoperative data revealed that most of our cases were closed by hand sewn technique (96.0%) and (4.0%) were closed by stapled technique. Shelygin et al [103] reported that stapled closure technique reduces operative time and this was statistically significant (p=0.01), also it reduces overall morbidity rate (p=0.04), postoperative ileus (p=0.009) and hospital stay. Luglio et al [99] in their study that performed on 944 patients reported higher postoperative complication rate with hand sewn closure technique and this was statistically significant (p=0.01) and the same result was found by Pokorny et al [98]. Gong et al [104] observed that stapled closure technique was associated with lower rate of small bowel obstruction ($p < 0.00001$) and shorter operation

time (p=0.01) but no significant difference on anastomotic leakage, wound infection and overall complications.

According to the current study; the interval between formation of temporary stoma and its closure has no statistical significance on postoperative morbidity (p=0.826), this is also reported by van Westreenen et al [79] (p=0.611) and Pokorny et al [76] (p=0.81). But El-hussuna et al [80] found that long interval between construction and closure of temporary stoma is associated with increased risk of complications and it is statistically significant (p=0.029) and this is also reported by Akesson et al [105] (p < 0.01). Khan et al [93] reported that anastomotic leak rate and wound dehiscence was lower with early stoma closure but it is statistically insignificant (p= 0.368, p= 0.298). Alves et al [50] observed that overall morbidity rates were similar in the early and late closure (p=0.254) while wound complications were more frequent after early closure (p= 0·007) but small bowel obstruction (p=0·002) and medical complications (p= 0·021) were more common with late closure.

In the present study, the mean operative time was 89.50 ± 21.42 minutes for the prospective group while this data was not available in the retrospective group. Keller et al[106] in their study that was performed on 351 patients reported that readmitted patients with postoperative complications had longer operative time than non-readmitted patients and this was statistically significant (p= 0.002).

The present study shows significant association between experience of surgeon and assistant and postoperative morbidity (p=0.033) Fauno et al [9] reported the same association as consultants attended 90% of the operations which leads to reduce postoperative morbidity and also by Pokorny et al [98] (p=0.04). Other studies [8, 76, 79, 80] show the same results but of no statistical significance.

Time of start of oral feeding increases with complicated patients than non-complicated patients and it shows statistical significance (p=0.014) in this study. Shelygin et al [103] reported that start of oral feeding is influenced by the closure technique as stapled closure reduces postoperative ileus and it is statistically significant (p=0.009). Luglio et al[99] also found that time to bowel movement and time to oral feeding is affected by technique of closure where stapled technique is more earlier than hand sewn one and it is statistically significant (p=<0.001).

SUMMARY

Temporary stoma closure is a common procedure that may be accompanied by serious complications which are affected by multiple factors. These factors include patient's factors as age, gender, BMI, comorbid diseases and underlying primary disease, preoperative factors like timing of closure or operative factors as operative technique operative time and surgeon's experience.

Complications after temporary stoma closure can be categorized into systemic complications which include cardiorespiratory complications, deep venous thrombosis, urinary tract infection and death or specific complications like wound infection, anastomotic leakage, incisional hernia and anastomotic stenosis.

The aim of this study is to evaluate the relation between different perioperative parameters and incidence of complications after closure of temporary stoma.

The study included 100 patients who were subjected to temporary stoma closure, 40 patients were studied prospectively and completed the follow up period while 60 patients who underwent closure of their temporary stomas were studied retrospectively with the available collected data.

Patients in the prospective group were assessed according to the following parameters:

A) Preoperative data: Patient data (age, gender, BMI and comorbid diseases), primary disease, type of stoma (ileostomy, colostomy, Hartmann), timing of stoma closure and preoperative investigations (laboratory, radiological, endoscopic).
B) Preoperative preparation: Mechanical bowel preparation and preoperative antibiotic prophylaxis.
C) Operative data: operative technique, operation time, blood loss and experience of surgeon and assistant.
D) Postoperative data: registration of early and late complications.

Patients in the retrospective group were assessed according to the available preoperative, intraoperative and postoperative parameters.

The study included 100 patients; 57 males (57.0%) and 43 females (43.0%), the mean age was 48.53 ± 16.07 years, (range 12-74 years), the mean BMI was 25.31 ± 2.21, (range 21.40-31.50), 71 patients (71.0%) with previous ileostomy, 20 patients (20.0%) with previous colostomy and 9 patients (9.0%) with previous Hartmann, the mean interval between formation and closure of stoma was 6.85 ± 6.20 months, (range 2.50-48.0). 32 patients (32.0%) are smokers and 68 patients (68.0%) are non-smokers, 62 patients (62.0%) had not comorbid diseases and 38 patients (38.0%) had comorbid diseases where HTN and DM were the most common diseases.

Colorectal malignancy was the most common primary disease (50.0%) followed by trauma (16.0%), distal loopogram was done in 90 patients (90.0%) and CT or multislice CT was done in 10 patients (10.0%) while preoperative endoscopy was performed in 3 patients (3.0%), 96 patients (96.0%) were closed with hand sewn technique and 4 patients (4.0%) were closed with stapled technique, 23 patients (23.0%) their operations were

performed by mid-senior residents and 36 patients (36.0%) were performed by senior residents.

Postoperative morbidity was (31.0%); wound infection was the most common complication (16.0%) followed by incisional hernia (14.0%), other complications were detected like anastomotic leakage postoperative ileus, reoperation and new stoma formation. Mortality rate was (1.0%).

Study of risk factors and detection which of them is significant was done; correlation between incidence of complications with demographic and preoperative data as regard age, gender, BMI, smoking, comorbid disease, preoperative antibiotic prophylaxis revealed no significant association while underlying primary disease correlated significantly (p= 0.003).

Correlation between incidence of complications with operative and postoperative data as regard operative technique and interval between formation of stoma and its closure revealed no significant association while according to experience of surgeon and assistant and time of start of oral fluids revealed significant association where (p=0.033) and (p=0.014) respectively.

CONCLUSION

1- Temporary stoma closure is a common procedure and it is not a complication free procedure.

2- Most common underlying primary disease was colorectal malignancy followed by colorectal trauma.

3- Ileostomy was the most common temporary stoma performed (71.0%), colostomy (20.0%) and Hartmann procedure (9.0%).

4- Overall complication rate was (31.0%), wound infection was the most common postoperative complication (16.0%) followed by incisional hernia (14.0%).

5- Other less common complications detected like postoperative ileus, anastomotic leakage, neo-stoma formation, reoperation and death.

6- Study of risk factors revealed that underlying primary disease, experience of surgeon and assistant and time of start of oral fluids were statistically significant risk factors.

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الملخص العربى

ان اغلاق فتحة التبرز الجانبية المؤقتة لهو اجراء شائع الذى قد يكون مصحوبا بمضاعفات خطيرة و التى تتأثر بعوامل متعددة. و تشمل هذه العوامل عوامل خاصة بالمريض مثل العمر ، الجنس ، مؤشر كتلة الجسم ، الأمراض المزمنة المصاحبة للمريض و المرض الأولى المسبب لعمل فتحة التبرز الجانبية المؤقتة وهناك ايضا عوامل ما قبل الجراحة مثل توقيت الاغلاق أو عوامل خاصة بالجراحة مثل تقنية الجراحة ، مدة الجراحة و خبرة الجراح و المساعد.

يمكن تصنيف المضاعفات بعد اغلاق فتحة التبرز الجانبية المؤقتة الى مضاعفات عامة و التى تشمل مضاعفات بأجهزة القلب و التنفس، الخثار الوريدى العميق، التهاب البمسالك البولية و الوفاة أو مضاعفات خاصة بالعملية مثل عدوى الجرح، التسرب و الضيق التوصيلى و الفتق الجراحى.

الهدف من الدراسة هو تقييم العلاقة بين العوامل المختلفة المحيطة بالجراحة و حدوث مضاعفات بعد اغلاق فتحة التبرز الجانبية المؤقتة.

وقد شملت الدراسة ١٠٠ مريض أجريت لهم عملية اغلاق فتحة تبرز جانبية مؤقتة، حيث تمت دراسة ٤٠ مريض مستقبليا و أكملوا فترة المتابعة فى حين تمت دراسة ٦٠ مريض بأثر رجعى خضعوا من قبل لاغلاق فتحة التبرز الجانبية المؤقتة من خلال البيانات المتاحة التى تم جمعها.

وقد جرى تقييم المرضى في المجموعة المستقبلية وفقا للمعايير التالية:

أ) بيانات قبل الجراحة : و تشمل بيانات المريض (العمر والجنس و مؤشر كتلة الجسم و الأمراض المزمنة) ، المرض الأولى المسبب لعمل فتحة التبرز الجانبية المؤقتة ، ونوع فتحة التبرز (فغر اللفائفي ، فغر القولون ، هارتمان) ، وتوقيت إغلاق فتحة التبرز الجانبية والأختبارات قبل الجراحة (المعملية، الإشعاعية و بالمنظار).

ب) إعداد ما قبل الجراحة : إعداد الأمعاء ميكانيكيا و الوقاية باستخدام المضادات الحيوية قبل الجراحة

ج) بيانات الجراحة : تقنية العملية، وقت العملية ، وفقدان الدم وخبرة الجراح ومساعده.

د) بيانات ما بعد الجراحة : تسجيل المضاعفات المبكرة والمتأخرة.

ولقد جرى تقييم المرضى في المجموعة اللتى تم دراستها بأثر رجعي وفقا للبيانات المتاحة قبل اجراء الجراحة، و أثناء العملية و بعد العملية الجراحية .

ولقد شملت الدراسة ١٠٠ مريض؛ ٥٧ من الذكور (٥٧,٠٪) و ٤٣ من الإناث (٤٣.٠ ٪)، وكان متوسط العمر ١٦,٠٧ ± ٤٨,٥٣ سنة، وكان متوسط مؤشر كتلة الجسم ٢.٢١ ±٢٥.٣١، وكان هناك ٧١ مريضا (٧١,٠ ٪) لديهم فغر اللفائفي، ٢٠ مريضا (٢٠,٠ ٪) لديهم فغر القولون و ٩ مرضى (٩,٠ ٪) لديهم تقنية هارتمان، والفاصل الزمني بين عمل فتحة التبرز المؤقتة و إغلاقها ٦.٢٠ ± ٦.٨٥ شهرا. ٣٢ مريضا (٣٢,٠ ٪) هم من المدخنين و ٦٨ مريضا (٦٨,٠ ٪) هم من غير المدخنين، و ٦٢ مريضا (٦٢,٠ ٪) ليس لديهم أمراض مزمنة و ٣٨ مريضا (٣٢,٠ ٪) لديهم أمراض مزمنة حيث كان مرض ارتفاع ضغط الدم و مرض السكرى هما الأكثر شيوعا.

الورم الخبيث بالقولون و المستقيم كان المرض الأولى الأكثر شيوعا (٥٠,٠٪) تليها الحوادث و الأصابات (١٦,٠٪) و قد تم عمل اشعة عادية بالصبغة لنحو ٩٠ مريضا (٩٠,٠٪) و اشعة مقطعية أو أشعة مقطعية متعددة الشرائح لنحو ١٠مرضى (١٠,٠٪) فى حين تم اجراء فحص بالمنظار لثلاثة مرضى فقط (٣,٠٪).

أما بالنسبة للتقنية الجراحية فلقد استخدمت تقنية التقطيب اليدوى فى ٩٦ مريضا (٩٦,٠٪) و التقطيب باستخدام الدباسات لأربعة مرضى فقط (٤,٠٪)، أما فيما يتعلق بخبرة الجراح فلقد تم عمل نحو ٣٦ عملية (٣٦,٠٪) بواسطة كبار الأطباء المقيمين و ٢٣ عملية (٢٣,٠٪) بو اسطة الأطباء المقيمين متوسطى الخبرة و لكن تحت اشراف استشارى الجراحة.

و قد وصل معدل الاصابة بالمضاعفات بعد اجراء العملية الجراحية الى (٣١,٠٪) حيث كانت الاصابة بعدوى الجروح أكثر المضاعفات شيوعا يليه فى ذلك الفتق الجراحى (١٦,٠٪)، و هناك مضاعفات أخرى تم رصدها مثل

التسرب التوصيلى، الشلل اللفائفى بعد الجراحة بالاضافة الى اعادة اجراء العملية و اعادة عمل فتحة تبرز جانبية أخرى، أما بالنسبة لمعدل الوفيات فكانت (١,٠٪).

و لقد تمت دراسة عوامل الخطورة و الكشف عن أى منها هام من خلال دراسة العلاقة بين حدوث المضاعفات مع البيانات الديموغرافية و بيانات ما قبل الجراحة فيما يتعلق بالسن، الجنس، مؤشر كتلة الجسم ،التدخين، الأمراض المزمنة و المضادات الحيوية للوقاية قبل الجراحة تبين عدم وجود علاقة هامة أما بالنسبة للمرض الأولى المسبب لعمل فتحة التبرز المؤقتة فتبين وجود ارتبا كبير بشكل ملحوظ.

أما علاقة حدوث مضاعفات مع بيانات اجراء الجراحة و ما بعدها فيما يتعلق بالتقنية الجراحية و الفاصل الزمنى ما بين عمل فتحة التبرز و اغلاقها فقد تبين عدم وجود اى علاقة هامة أما فيما يتعلق بخبرة الجراح و مساعده و توقيت بدء السوائل عن طريق الفم كشفت وجود ارتباط كبير.

الإرتباط بين العوامل المختلفة المحيطة بالجراحة و حدوث مضاعفات بعد غلق فتحة التبرز المؤقتة

رسالة علمية

مقدمة لكلية الطب – جامعة الإسكندرية
إيفاءاً جزئياً لشروط للحصول على درجة

الماجستير فى الجراحة

مقدمة من

حسن على حسن على الخانكى

بكالوريوس الطب والجراحة – جامعة الإسكندرية

كلية الطب
جامعة الإسكندرية
٢٠١٥

الإرتباط بين العوامل المختلفة المحيطة بالجراحة و حدوث مضاعفات بعد غلق فتحة التبرز المؤقتة

مقدمة من

حسن على حسن على الخانكى

بكالوريوس الطب والجراحة- الإسكندرية

للحصول على درجة

الماجستير فى الجراحة

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