COLOSTOMY CLOSURE AS SEEN AT KENYATTA NATIONAL HOSPITAL BOTH RETROSPECTIVE AND PROSPECTIVE STUDY

A DISSERTATION SUBMITTED IN PART FULFILMENT FOR THE DEGREE OF MASTER OF MEDICINE (SURGERY) OF THE UNIVERSITY OF NAIROBI

BY

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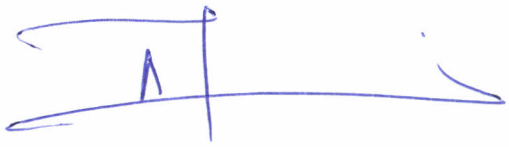
DECLARATION

This dissertation is my original work and has not been presented for a degree in any other university.



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DEDICATION

This work is dedicated to my sons Abdullahi and Jabbir and my wife Saadia.

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ABBREVIATIONS

ECF	-	Enterocutaneous fistula
D COLON	-	Descending colon
SHO	-	Senior House Officer
WBC	-	White Blood Cells
HB	-	Haemoglobin
U/E	-	Urea and Electrolyte
PEG – ELS	-	Polyethylene Glycol – Electrolyte lavage solution
PDS	-	Polydioxanone sulfate

SUMMARY

This is both a prospective study of thirty patients from March 2002 to February 2003 and a retrospective study of eighty-five patients from January 1999 to February 2002 who underwent colostomy closure at the Kenyatta National Hospital. There was no significant difference in the results of the two groups.

The main objective of the study was to analyse variables that determine outcome of colostomy closure. All patients who met the inclusion criteria were recruited into the study.

The average age of patients in the prospective group was 34 (range, 15-85) years and 35 (range 16-87) years in the retrospective group. There were more males than females in the study with a male to female ratio of 5:1 and 4.3:1 in the prospective and retrospective groups respectively. The common indications for colostomy were colon injury and colon obstruction accounting for more than eighty five percent (85%) of the patients.

Hartman's colostomy was the commonest type of colostomy fashioned accounting for fifty percent (50%) and 44.7% of the colostomies in the prospective and retrospective studies respectively. Seventy percent (70%) of the colostomies in the prospective group and 58.8% of those in the retrospective group were sited at the sigmoid colon. Mean time until colostomy closure was 7.6 (range, 0.82 to 91) months in the prospective group and 5.3 (range, 0.79 to 29) months in the retrospective group.

All the patients had mechanical bowel preparation. Seventy three percent (73%) in the prospective group and 63.3% in the retrospective group had prophylactic systemic antibiotics. All the patients had intraperitoneal closure of the colostomy. About ninety percent (90%) of the patients in the study had two-layer anastomosis of the colon. About sixty percent (60%) of the patients in the study had their colostomies closed in less than two hours. The average hospital stay for patients in the prospective group was 7.1 (range, 2 to 18) days and 9.8 (range, 4 to 61) days in the retrospective group.

The rate of developing early complications was 16.7% in the prospective group of which 13.4% had wound infection and 15.3% in the retrospective group of which 11.8% had wound infection. There was no death. There was a trend of increasing morbidity in patients who had colon

obstruction, colostomies sited at the sigmoid colon, Hartman's colostomy, operations lasting more than two hours and those operated by Registrars.

INTRODUCTION

Colostomy is the surgical creation of an artificial opening between the colon and the surface of the body. It could be temporary or permanent. Temporary colostomy is constructed with the expectation of re-establishing colonic continuity in the future. Colostomy closure is applicable where a temporary colostomy has been formed for the relief of obstruction, protection of anastomosis, in order to rest or defunction the colon (1).

The types of temporary colostomies commonly fashioned are; loop colostomy, double barrelled colostomy and Hartman's colostomy. Optimal timing for the repair of the colostomy is from six weeks to three months of the initial operation. If the repair is done earlier than four weeks the risk of anastomotic breakdown is high due to oedema, inflammation and collagenase activity at the site. After three months the stoma gets firmly adherent to the site due to fibrosis (2).

The use of preoperative bowel preparation with mechanical cleansing and antibiotics to reduce faecal mass and intraluminal colonic bacteria is desirable for elective colon and rectal surgery to minimize infectious complications, morbidity and mortality (3).

Intraperitoneal closure of colostomy is more commonly performed and allows proper identification of the anastomosis under vision. Extraperitoneal closure of colostomy used to be practised in the past with the hope to contain the leak outside the peritoneal cavity should there be anastomotic breakdown.

Interrupted single-layer serosubmucosal suture is the 'gold standard' for intestinal anastomosis. There are three different methods of wound closure; primary closure, primary closure with subcutaneous drains and delayed primary closure. Colostomy closure is associated with morbidity and mortality. Wound infection and anastomotic leaks are the common early complications. Some of the late complications include incisional hernias and intestinal obstruction.

Many factors have been implicated in complications of intestinal anastomosis, for example, poor surgical technique, and various local and systemic abnormalities in the patient (4). Fielding et al; has suggested that surgeon-related variables are of much greater importance than local or systemic patient related variables in the pathogenesis of complications (4). Experimental studies have shown that infection causes a reduction in collagen synthesis and increased lysis of collagen in colonic anastomosis (5). Severe malnutrition results in reduced collagen synthesis and impaired healing of colonic anastomosis (6).

LITERATURE REVIEW

ANATOMY AND PHYSIOLOGY

The large intestine is a hollow muscular organ that extends from the ileocaecal junction to the anus and is about 1.5m (4.5ft) long (7). The large intestine consists of the following:

- Caecum with vermiform appendix
- Ascending; transverse; descending and sigmoid parts of the colon
- Rectum
- Anal canal (8).

The colon consists of 4 parts,

- Ascending colon
- Transverse colon
- Descending colon
- Sigmoid colon

Of the four parts of the colon, the transverse and sigmoid parts are suspended in mesenteries – the transverse mesocolon and sigmoid mesocolon respectively.

The ascending and descending colon are plastered onto the posterior abdominal wall and hence have posterior 'bare areas' devoid of peritoneum. The ascending colon, about 15cm (6in) in length extends upwards from the Caecum to the right colic (hepatic) flexure, on the lateral surface of the inferior pole of the right kidney, in contact with the inferior surface of the liver. Usually it is retroperitoneal.

The transverse colon, about 45cm (185in) long extends from the hepatic to the splenic flexure in a loop that hangs down to a variable degree between the two fixed points. The transverse colon is completely invested in peritoneum; it hangs free on the transverse mesocolon.

The descending colon, less than 30cm (12in) long extends from the splenic flexure to the pelvic brim. It is usually retroperitoneal.

The sigmoid colon formerly known as the pelvic colon, about 45cm (18in) long extends from the descending colon at the pelvic brim to the commencement of the rectum in front of the third

piece of the sacrum. It is completely invested in peritoneum and hangs freely on a mesentery, the sigmoid mesocolon.

The calibre of the colon decreases as it progresses distally such that the terminal diameter of the sigmoid colon is considerably less than that of the Caecum. There is an increase in calibre in rectum (9).

The structure of the large intestine is adapted for storage of matter reaching it from the small intestines and for absorption of fluid and solutes from it. There is adequate lubrication for passage of its contents by mucus. The presence of numerous solitary lymphoid follicles provides protection against bacteria present in the lumen of the intestine by mucous secretion rich in IgA.

BLOOD SUPPLY

The Caecum, ascending colon and the proximal (right) two-thirds of the transverse colon are supplied by the:

- Iliocolic
- Right colic
- Middle colic

Branches of the superior mesenteric artery.

The remainder of the colon by:

- Left colic
- Sigmoid

Branches of the inferior mesenteric artery

The anastomotic branches near the medial margin of the whole colon form the marginal artery and it is from this that the long and short vessels run into the gut wall.

The weakest link in this marginal chain of vessels is near the left colic flexure, between the middle and left colic branches i.e. between the midgut and hindgut vessels.

The veins correspond to the arteries, and thus reach the portal vein via the superior or inferior mesenteric veins. The inferior mesenteric vein opens into the splenic vein. The Splenic vein then joins the superior mesenteric vein to form the portal vein.

Billings and colleagues suggest that the high rate of morbidity associated with colostomy closure may be attributed to inadequate blood supply. They recommended that consideration be given to performing weekly Laser Doppler Flommetry of the stoma until optimal blood flow is achieved (10).

LYMPHATIC DRAINAGE

There is a rich network of intramural lymphatics in the submucosal and subserosal layers that drain into external lymphatics.

Four groups of lymph nodes drain the large intestine:

- Epicolic lymph nodes – lie on the wall of the large intestine
- Paracolic nodes – located along the marginal artery
- Intermediate nodes – located along the main colic vessels and branches
- Principle (terminal) nodes – along the superior and inferior mesenteric arteries

NERVE SUPPLY

The nerve supply of the colon is both sympathetic and parasympathetic. The midgut territory receives its sympathetic supply from the coeliac and superior mesenteric ganglia (T10-L1) and its parasympathetic supply from the vagus. Both types of nerves are distributed to the gut through the superior mesenteric plexus. The hindgut territory receives its sympathetic supply from the lumbar sympathetic chain (L1-L2) and its parasympathetic supply from the pelvic splanchnic nerves, both via the superior hypogastric and inferior mesenteric plexus.

The parasympathetic nerves are motor to the large intestine and inhibitory to internal anal sphincter. The sympathetic nerves are largely vasomotor. The pain fibres that accompany the vasomotor nerves give rise to periumbilical pain if from the midgut (e.g. the appendix) but to hypogastric pain if from the hindgut.

NORMAL BACTERIAL FLORA OF COLON

The largest amount of normal flora in the body is found in the colon. The bulk of faeces are made of bacteria of normal flora. There are around 10^{12} bacteria in a gram of wet faecal material. The large intestinal contents have a vast flora that is predominantly anaerobic (11).

The major component genera are:

- Bacteroides
- Fusobacterium, both anaerobic and gram positive bacilli
- Enterobacteriacae e.g. E. coli, Klebsiella, Pseudomonas, Proteus etc
- Clostridium (welchi, tetani etc)
- Streptococcus e.g. S. faecalis, Peptostreptococcus (anaerobic variety of streptococcus), enterococci
- Peptococci, anaerobic variety of staphylococcus

Disturbances of the normal bacterial flora may lead to serious opportunistic infections. Antibacterial drugs have two major effects on the normal flora; reduces all or parts of the normal flora or allows overgrowth or superinfection with clostridia defficile causing pseudomembranous colitis in the large intestine.

COLOSTOMY

1. DEFINITION

It is the surgical creation of an artificial opening between the colon and the surface of the body. Its purpose is to divert the faecal flow because of removal of the distal colon or to decompress or rest the segment of colon distal to the colostomy (12,13).

2. INDICATIONS

Colostomies are made for the following purpose (12):

- To decompress an obstructed colon
- To divert faecal stream in preparation for resection of an inflammatory, obstructive, or perforated lesion, or following traumatic injury
- To serve as the point of evacuation of stool when the distal colon or rectum is removed
- To protect a distal anastomosis following resection

Indications for Colostomies can also be categorized into five groups:

I. Colon obstruction which can be caused by:
   - Congenital malformations e.g. anal atresia and Hirschsprung's disease
   - Neoplasm of the colon, both intrinsic and extrinsic e.g. colorectal carcinoma
   - Volvulus of the sigmoid colon or caecum.
   - Inflammatory bowel disease with obstruction

- Endometriosis of the colon or the rectum
- Colonic ischaemia with necrosis of the mucosal and muscular layers that may result in stenosis of the colon
- Radiation injury to the colon

II. Complications of an inflammatory process of the colon that lead to perforation or impending perforation of the colon wall require a colostomy. The complications occur in:

- Acute/chronic ulcerative colitis
- Crohn's disease of the colon
- Diverticular disease of the colon
- Advanced ischaemic colitis with necrosis of the colonic wall

Sometimes these inflammatory processes result in fistulous communications of the colorectum in the form of colocuteneous, perirectal, and rectovaginal or vesicocolic fistulas.

III. Colonic injuries are sometimes an indication for colostomy. Small injuries to the colorectum with minimal damage to the colonic wall and with minimal peritoneal contamination can be closed primarily. Larger injuries can be treated by exteriorization of the primarily repaired segment of the colon, which is returned to the abdomen a few days later (Precolostomy). However injuries that produce considerable destruction of the colonic wall, those associated with injuries to other abdominal organs, or injuries causing massive faecal contamination of the peritoneal cavity are best treated by proximal colostomy.

IV. Operations e.g. excision of the rectum may also necessitate a colostomy. A colostomy may also be required to protect a tenuous anastomosis that is at high risk of leakage.

V. Miscellaneous and uncommon indications for colostomy are:

- Severe and persistent colonic hypomotility
- Anal incontinence resulting from; repeated operation from inflammatory perianal disease, paraplegia, extensive decubitus ulcers and severe burns or infection of the perineum.

CLASSIFICATION

There are a variety of colonic stomas. In fact, the word colostomy should be complemented by a second term that is descriptive of some of its anatomic or functional characteristics.

Colostomies may be classified in accordance with the degree of longevity, anatomic location or surgical technique as follows (14):

I. Longevity

- Temporary colostomy
  - Is a colostomy constructed with the expectation of re-establishing colonic continuity in the future (15).
- Permanent colostomy
  - Is a colostomy constructed with no anticipation of re-establishing colonic continuity

II anatomical location;

- Transverse colostomy
- Sigmoid colostomy
- Caecostomy
- Descending colon

III Surgical technique

(a) Loop colostomy:

A loop of colon is brought out through the abdominal wall (transverse or descending colon) over a rod or other devices (plastic hollister bridge) to prevent its retraction into the abdomen. The anterior wall of the exteriorized segment is incised and sutured to the anterior abdominal wall. The supportive device is removed after five days. Since the continuity of the colonic wall remains, usually on the posterior aspect, some of the colonic contents may not be diverted into the colostomy appliance and may pass into the distal loop; therefore such a colostomy is classified as partially defunctionalizing.

(b) Divided colostomy:

Less commonly performed. A skin bridge of varying size separates the two ends of the colon. This is usually a temporary stoma, but is more difficult to close than a loop colostomy.

(c) *Double-barrelled colostomy:*

Is constructed as part of the rarely used Paul-Mikulicz operation. A spur is fashioned between the two limbs of the colostomy that can subsequently be necrosed by the application of a crushing enterotome. Theoretically this kind of colostomy should close spontaneously after the spur is crushed, but usually a formal closure is required. Whilst

this operation was originally described for treating patients with complicated Diverticular disease or carcinoma of the colon, its use now is almost confined to the treatment of patients with acute sigmoid volvulus (16).

(d) End colostomy:

It is also referred to as a terminal colostomy, completely defunctionalizing colostomy or single-barrelled colostomy.

The transected proximal end of the colon is brought out through the abdominal wall to the skin thus completely diverting the faecal flow. When an end colostomy is constructed, something must be done with the transacted distal colonic end. It can be completely removed as in abdomino-perineal resection of the rectum, it can be closed as a blind pouch (Hartman's operation), and it can be brought out through the abdominal wall as a mucus fistula.

(e) Protruding colostomy:

Is one that extends > 1cm above the skin surface. In most instances the transected edge is left intact and only 2-4 sutures are used to fix the serosa to the skin.

(f) Skin level colostomy:

The edges are sutured to the skin edge to produce a flat or skin-level colonic stoma. This process is referred to as immediate maturation of the colostomy.

(g) A venting (decompressing) colostomy:

It is performed to decompress a greatly distended colon such as occurs in toxic megacolon. The colostomy is usually constructed in the transverse or sigmoid segment and is always made in conjunction with a proximal loop ileostomy. Advantages of a venting colostomy are that it immediately decompresses the colon and the stoma closes spontaneously in 2-3 months.

(h) Extraperitonial colostomy:

The end colostomy usually in the left lower abdomen is brought out to the skin surface through a short tunnel between the peritoneum and the skin of the abdominal wall. The advocates of this technique claim a decreased incidence of paracolostomy hernias.

(i) Colonic mucus fistula:

It is not a true colostomy. It is a venting of the transected distal end of the defunctionalized segment of the distal colon.

TIMING OF COLOSTOMY CLOSURE

A temporary loop colostomy is closed when there is no longer a need to defunction the distal bowel. If a colostomy has been constructed to cover a healing anastomosis then it is essential that total healing of the anastomosis has occurred before undertaking the colostomy closure. This may be assessed either endoscopically or radiologically using a water-soluble contrast enema (e.g. gastrografin). The colostomy itself must be suitable for closure in that it should be pink in colour, not cyanosed, nor oedematous (17).

It is unlikely that the local conditions for closure will be suitable until 3-4 weeks after colostomy construction. It is desirable to wait at least three months after the construction of the colostomy particularly in perforating diverticulitis, before closure, as the inflammation takes that long to subside. The following criteria should be fulfilled before a colostomy is closed (18).

- At least 90 days should have elapsed from the time of the initial operation
- The patient should be ambulatory
- The patient should be eating sufficient regular food to be in positive nitrogen balance
- There must not be a major infection
- In instances of trauma other associated injuries should be healed or stable

Colostomy for trauma to the colon alone may often be closed earlier. Velmahos and colleagues found that the current trend is to reverse the colostomy early rather than wait the traditional three months before closure. They also found that technically early closure was far easier than late closure and required significantly less operating time and less intra- operative blood loss (19). Aston and Everett also felt that early closure of a loop colostomy could be undertaken relatively safely (20).

In the Lahey Clinic experience, Mirelman and colleagues in the analysis of the intervals between creation and closure of the colostomies demonstrated that individuals whose stomas were closed within three months after resection had a morbidity rate of 50%. This rate decreases to about 34% for closure after four months interval (21).

TABLE: Interval between colostomy creation and closure

Interval (Months)	No. of patients	No. of complications	% with complications
0-3	41	21	51.2
4-6	35	12	34.2
7-12	26	9	34.6
>12	16	3	18.6
	118	45	

Freund and colleagues found that the two major factors determining subsequent complications were: timing and method of closure. Colostomies closed sooner than 12 weeks after their construction had twice the incidence of complications than those that were closed after that time (22). Oluwole and associates also advocate that colostomy closure three months following construction is preferred (23). Smit and Walt felt that the optimal period for closure was from 2-3 months after colostomy construction (24). Khan and colleagues found that morbidity was highest in those patients whose colostomy closure was carried out within 3 months of colostomy formation (25). Sola and colleagues also felt that waiting longer than 3 months to perform colostomy closure did not improve results further (26).

Pittmann and Smith observed that complications were not related to the time interval between creation and closure (27). Todd and colleagues found that, there was no evidence that the timing of the colostomy closure was a critical factor for the subsequent development of anastomotic complications (28). Vernel and Pemberton found that the time interval between colostomy creation and closure did not affect morbidity (29).

Otelle in his study at Kenyatta National Hospital from 1990 to 1995 observed that, out of the 158 patients, reversal of 71% of stomas occurred after six months, 17% between three to six months and 12% before three months. The complication rate was lowest (41%) for stomas closed between three to six months; those closed before (63%) or after (60%) this period had higher complication rates (30).

BOWEL PREPARATION

Complications of colonic surgery e.g. wound infection and anastomotic dehiscence are partially related to the high bacteria content of the large bowel (12). It is advisable to eliminate the faecal mass and reduce the number of bacteria as much as possible prior to operation. Measures taken to achieve this purpose are known as 'bowel preparation'. The bowel preparation regimen consists of appropriate dietary restriction, mechanical cleansing, non-absorbable oral antibiotics and intravenous systemic antibiotics (18). The most important preoperative measure is to empty the large bowel completely. This is achieved by admitting the patient to hospital three days earlier before the operation.

Day 1 - Low residue diet

- Laxatives- the choice of laxative is a matter of the surgeon's personal experience e.g. castor oil, magnesium citrate, dulcolax etc.

Day 2 - Nourishing fluids only given by mouth.

- Laxative
- Enema

Day 3 - Clear fluids only given by mouth

- Enema given until clear
- *Oral neomycin1.0g and erythromycin* 1.0g at 1.00pm, 2.00pm and 11.00pm

Preoperative washout of the distal segment with physiological saline should be carried out twice during the 24 hours before the operation or until clear. Non-absorbable oral antibiotic regimen has been extremely successful in reducing the incidence of infectious complication (31). Intravenous broad-spectrum antibiotics are given on induction of anaesthesia, second and third dose at eight hourly intervals. Intravenous cifoxilin or cefilaxine with metronidazole can be given as well. Intravenous ampicillin, gentamycin and metronidazole are commonly used at Kenyatta National Hospital.

Preoperative bowel preparation involving mechanical cleansing and administration of antibiotics before colon and rectal operation is the standard practice (32). Two recent surveys of

preoperative bowel preparation indicate that the use of polyethylene glycol-electrolyte lavage solution (PEG-ELS) is the most popular agent for mechanical bowel preparation (33, 34). The patients are admitted one day before surgery for inpatient bowel preparation. Gut lavage with PEG – ELS has been shown to produce colonic cleansing for diagnostic and surgical procedures and is safe, well tolerated, and adaptable to outpatient use (35). Patients are limited to a clear liquid diet one day before the operation and given PEG-ELS the night before the operation; 25mg/kg/hr x 5hrs or till gut clears or 4 litres of PEG-ELS in 4hrs.

PEG-ELS technique developed by Davis et al in 1980 produces antigrade colonic cleansing with little disturbances of fluids and electrolytes. Commercially available as; golytely (Braintree laboratories Inc), colyte (Reed and Carnrick pharmaceuticals). Newer preparations include; sulfate-free electrolyte lavage solution (SF-ELS)– Nulytely, cherry-flavored Nulytely, and pineapple flavored colyte. Outpatient preparation with PEG-ELS and oral antibiotics before elective colonic surgery can be done with equivalent safety and at a substantial cost saving compared to inpatient preparation (36).

Smit and colleagues noted that there was a higher incidence of complications in patients who did not undergo a full bowel preparation or who were not on antibiotics (24). Vernel and Pemberton found that the use of systemic antibiotics alone did not affect morbidity (29). Oluwole and associates found that mechanical and an antibiotic bowel preparation is one of the factors associated with a lower incidence of complications after colostomy closure (23).

Rosen and Friedman however noted that the incidence of wound infection was not significantly improved by the use of systemic or non-absorbable oral antibiotics (37).

Broad spectrum intravenous antibiotics should be continued post operatively in cases of (18):

- Poorly prepared bowel
- Perforation
- Obstruction
- Abscess
- Faecal contamination
- Prolonged operating time
- Considerable blood loss
- Valvular heart disease

ANASTOMOTIC TECHNIQUE

A number of anastomotic techniques are available but, because all compromise healing, none can be considered perfect. Techniques for intestinal anastomosis (38):

CONVENTIONAL METHODS	UNCONVENTIONAL METHODS
Hand-sewn	Compression rings
Stapled	Tissue glue
	Laser welding

The optimal method of intestinal anastomosis would:

- Promote primary healing by achieving accurate alignment of the divided bowel
- Cause minimal disruption of local vasculature
- Incorporate the minimum amount of foreign material
- Not implant malignant cells at the anastomosis
- Not enhance the risk of metachronous cancers

Todd and colleagues reviewed their experience in a retrospective fashion of 206 colostomy closures and found that the method employed did not significantly influence the postoperative morbidity or mortality (28). Pittman and Smith observed that no significant difference was found in the anastomotic leak rates between sutured and stapled technique (27).

Rickwood and colleagues reported a study of 100 consecutive colostomy closures in infants and children, and used a resection technique with intraperitonial closure; their overall morbidity rate was in excess of 50% (39).

HAND-SEWN ANASTOMOSIS

Traditionally anastomoses were hand sewn, with two layers of sutures to achieve mucosal inversion and serosal opposition. A continuous absorbable suture incorporated all layers of the bowel. An outer layer of interrupted seromuscular suture that inverted the inner layer achieved serosal opposition. The 'sense of security' generated by the two layer technique does not withstand critical scrutiny, however single-layer anastomoses are now preferred (38).

SINGLE-LAYER ANASTOMOSIS

Single-layer anastomoses heal faster because they achieve more accurate realignment of muscle and mucosa, and cause less reduction in lumen size and less tissue strangulation. The first step is to achieve meticulous hemostasis of the debrided open ends of the intestine. If hemostasis is not perfect, a two-layer anastomosis should be made. Care must be taken that the two ends are correctly aligned without any twists or kinks (18).

INTERRUPTED SINGLE-LAYER SEROSUBMUCOSAL (OR EXTRAMUCOSAL) SUTURE

This technique is widely considered to be the 'gold standard' for intestinal anastomosis and is the preferred hand sewn technique. Interrupted serosubmucosal sutures (38);

- Allow accurate tissue apposition
- Incorporate the strongest layer of the gut (the submucosal)
- Cause minimal damage to the submucosal vascular plexus
- Minimize the risk of malignant cell implantation

Matheson and colleagues in an eight-year prospective study used appositional anastomosis rather than inverting made using a single-layer of interrupted seromuscular sutures, avoiding incorporation of the mucosa and using 3/0 braided polyamide (ethicon). The authors now believe an open appositional technique without clamps and without inversion is theoretically and practically sounder. The main attraction of this technique is its simplicity; minimizes ischaemia; shows a low incidence of anastomotic leakage and a notable avoidance of septic complication (40).

Corner stitches are placed at opposite sides of the intestine to maintain alignment. The back row is sewn using interrupted, non-absorbable sutures placed 6mm from the end between 1-1.5mm bites and brought out just beneath the mucosa. The stitches of the backrow are then tied in knots placed externally. The front row is placed in an identical manner. The end result is a 'butt-end' extramucosal apposition (1). Carty and colleagues advocated a single layer extramucosal approach (41).

CONTINOUS SEROSUBMUCOSAL SUTURE

When access is good and the anastomosis is technically straight forward, a continuous serosubmucosal suture method is equally effective. This is particularly useful in the upper GIT (e.g. gastroenterostomy and biliary-enteric anastomosis) and is quicker than the interrupted single-layer technique (38).

OPEN END-TO-END ANASTOMOSIS

The first sutures are inserted at the mesenteric and antimensenteric borders, entering about 5-6mm from the cut edge of the bowel and exiting in the sub-mucosal plane. The suture then enters the opposing bowel en face in the same plane. The second suture is placed in similar fashion diagonally opposite the first. These sutures are knotted and held while the anterior sutures are inserted segmentally (38).

A mid-point marking suture aids accurate tissue opposition. Once the anterior sutures are tied and cut, the anastomosis is turned through 180 and the mesentery rotated to achieve a satisfactory lie before the posterior sutures are inserted. All remaining sutures are tied and cut and the mesenteric defect is closed.

A modified technique is required when access is limited e.g. in oesophagojejunal or colorectal anastomosis. It is important to avoid inserting an excessive number of sutures because this will compromise the blood supply at the anastomosis. Individual sutures should be inserted at least 5mm apart.

TWO-LAYER ANASTOMOSIS

The back row of interrupted stitches is placed before the cut ends are open. A fine nonabsorbable material is used. An inner layer of stitches is placed using a fine absorbable suture material. The function of the inner row is only to provide hemostasis and prevent suture line hemorrhage or an obstructing hematoma.

A running, continuous, locked back row continued anteriorly using an inverting connel stitch is the most effective hemostatic stitch. Though an interrupted inner row causes less narrowing of the lumen. The amount of tissue included in each bite should only be enough to provide hemostasis.

The front row of seromuscular, submucosal, interrupted, nonabsorbable sutures is then placed, inverting the inner suture line. Halsted preferred narrow Lembert mattress sutures, although vertical Lembert sutures cause less suture line ischaemia. At the completion of the anastomosis, the corner stitches are tied and all sutures are cut (18).

STAPLED ANASTOMOSIS

The anatomy of the stapled intestinal anastomosis resembles that of the traditional two-layer hand-sewn anastomosis. The bowel ends are inverted and the serosal surfaces are held in apposition by staples while healing occurs. This precludes primary union. Contraction of granulation tissue, which is an inevitable consequence of healing by secondary intention, probably partly accounts for the increased incidence of anastomotic strictures seen within stapled anastomosis.

Anastomosis can be made with linear or circular stapling devices, used alone or in combination.

- Linear stapling devices are used for side-to-side and 'functional' end-to-end anastomosis
- Circular stapling devices are required for end-to-end anastomosis

Extra care is required when the bowel wall is thickened (e.g. in inflammatory condition, chronic obstruction). In these patients, it is often safer to suture the anastomosis than risk tissue necrosis at a staple line. Intestinal staples are not hemostatic, and bleeding points should be secured with fine diathermy before stapling, or with a suture after stapling. Diathermy must not be applied directly to staple lines; this is likely to result in tissue necrosis because of the electroconductive properties of metal staples (38).

'SUTURELESS' ANASTOMOSIS

Sutureless anastomosis was abandoned at the beginning of the 20th century, but technological advances have rekindled interest in this technique. Its use could overcome deficiencies of sutured and stapled anastomosis such as incorporation of foreign material and implantation of exfoliated tumor cells. 'sutureless' intestinal anastomosis can be achieved by:

- Compression (two inverted rings of bowel are compressed by a hollow circular device which subsequently sloughs)
- Tissue glue
- Laser welding

These techniques are under development. Trials of a biological fragmentable compression ring and of laser welding have produced results comparable to conventional anastomotic methods (38)

CHOICE OF TECHNIQUE:

'Sutureless' anastomoses are, for all practical purposes experimental, the choice of anastomotic technique is between sutures and staples. Objective evidence has failed to demonstrate an outstanding benefit that would favor the universal use of staples over sutures. Prospective randomized trials comparing various suture techniques with staples demonstrate that; stapled anastomosis can be constructed faster than sutured anastomosis, and this can result in a reduction in total operating time.

Variable results have been reported in trials of colorectal anastomosis. In the most recent trials, radiological leaks occurred more often after sutured anastomoses, but strictures were more common following stapling. Stapling does not appear to facilitate lower colorectal anastomosis than can be achieved by hand, but many surgeons find stapling easier. In one long-term follow-up study of patients with colorectal cancer, however, tumor recurrence and cancer specific mortality at 24 months were higher after sutured than stapled anastomoses, and the higher radiological leak rate in the former group was implicated as the cause of this. These findings require verification before recommendation in favor of stapling can be made. It should be noted that the leak and the local recurrence rates following sutured anastomosis in this study were higher than have been reported in prospective but uncontrolled studies of the serosubmucosal technique. The propensity of stapled anastomosis to stenosis is well documented. Only a few strictures require treatment, by dilatation or endoluminal incision/resection.

Surgeons in Training should adopt a standard anastomotic method that is suitable (with minor modifications) for all situations in the gut; this allows them to develop familiarity, sensitivity and selectivity in fashioning anastomoses. In addition hand-sutured anastomosis should be mastered before relying on stapling devices, allowing the surgeon to take remedial action when technical problems occur with stapling (38).

CLOSURE OF LOOP COLOSTOMY

(a) Mobilization of the colostomy:

- To minimize bleeding infiltrate the skin and subcutaneous tissues around the colostomy with local anaesthetic solution containing adrenaline 1:200,000. Wait for the anaesthetic to act.
- Eight strong silk sutures are placed around the mucocutaneous junction of the colostomy. This allows good control of the colon during mobilization. Or four Kocher clamps are placed on the skin around the colostomy and four triple hooks (Lahey) are placed on the surrounding skin to act as retractors
- The incision is made around the edge of the colostomy taking a small fringe of skin about 2mm wide
- If necessary the incision may be enlarged at either end of the colostomy in the transverse plane

(b) Separation from the anterior abdominal wall

- With traction applied to the colostomy using the stay sutures, the tissue of the anterior abdominal wall is freed from the colon
- Great care must be exercised to remain in the correct plane and avoid damage to the colon
- There is usually little blood loss during this procedure
- If there is hemorrhage this suggests that the surgeon is in an incorrect plane

(c) Removal of the skin edge and unrolling of the colostomy edge

- The rim of skin is removed and the edge of the colostomy unrolled
- When all the scar tissue has been removed the colon is then ready for closure
- In both these instances the operation is conducted so that the colon is returned to within the peritoneal cavity
- So-called extraperitonial closure of the colostomy is seldom performed and is unsatisfactory because there is inadequate colonic mobilization. This may result in anastomotic dysfunction or breakdown.

(d) Simple closure of the colon

- This is usually done in two layers. A layer of Vicryl suture is inserted first, often using the connel stitch, and taking all layers. Then an outer layer of interrupted Vicryl seromuscular Lambert sutures is inserted.

- If the colostomy has been excised an end-to-end anastomosis is performed in the same way as it would be during a transverse colostomy.
- Some surgeons advocate using a single layer of sutures for this closure.
- Closure of the mesentery is by either an interrupted or continuous approach.
- Polydioxanone sulfate (PDS), polymers of glycolide and lactide (Dexon, Vicryl) are the ideal sutures for gastrointestinal anastomosis. Catgut alone is inappropriate because of its rapid loss of tensile strength. Silk and linen produce too brisk a tissue reaction to be recommended. It is best to avoid braided material in sites where infection is a high-risk (42).

(e) Closure of the abdominal wall.

- A single layer of monofilament nylon sutures is inserted into all layers taking large bites of tissue on either side of the wound
- After all the sutures have been placed they are tied so that the edges of the abdominal wall are closely but not tightly apposed
- The skin wound is closed over a corrugated drain that is placed from one end of the wound to the other. This technique will allow any hematoma to drain and this prevents wound infection.
- The skin edges are left open for delayed primary closure. Berne and colleagues performed a prospective randomized study of three different methods of wound closure; primary closure, primary closure with subcutaneous drainage and delayed primary closure found no statistically significant difference in frequency of wound infection. Overall wound infection rate was 4.8% (43).

RESTORATION OF INTESTINAL CONTINUITY OF THE BOWEL FOLLOWING A HARTMAN'S PROCEDURE

Continuity of the bowel can be restored by, hand-sewn anastomosis and stapling. The colostomy is dissected from the abdominal wall and mobilized from the skin surface down to the peritoneal cavity. A sterile glove is placed over the mobilized colostomy and secured with a tape tie. The colostomy is then returned into the abdomen, the resulting abdominal wound being left open. The previous left paramedian/midline incision is reopened. Intraperitoneal adhesions are divided and the small intestine packed away from the operation site. A difficulty often

experienced in this operation is the localizing of the rectal stamp caused by inflammatory and fibrous reactions, and the rectum may be contracted.

To facilitate dissection of the rectal stump, an assistant passes an obturator of a small sigmoidoscope through the anus. This enables the abdominal operator to identify the rectal stump and to mobilize it sufficiently so that anastomosis may be performed by either, hand-sewn technique or use of stapling instrument.

Drains are placed in the pelvis, the wound of the previous colostomy and the abdominal wound secured. The anus may be mildly stenotic owing to the lack of function of the anal canal and in such cases it should be stretched before the termination of the anaesthetic.

HEALING OF INTESTINAL ANASTOMOSIS

Intestinal anastomosis heals in a series of overlapping stages; lag phase (day 0-4)- the acute inflammatory response that clears the wound of debris. Phase of fibroplasia (day 3-14)- Fibroblasts proliferate and immature collagen is laid down. Maturation phase (day 10 onwards)- Collagen remodels (38).

Intestinal anastomosis is extremely weak until collagen deposition is established, and therefore extrinsic support is required during the lag phase to maintain tissue apposition. The surgeon's role is to provide such support (usually by inserting sutures or staples) and also to ensure optimal conditions for subsequent healing. Although anastomotic technique is the single most important determinant of the outcome, a number of other factors affect healing. If these combine to make the risk of anastomotic failure high, the wisdom of performing an anastomosis should be questioned.

Factors in Intestinal Anastomotic Healing:

POSITIVE	NEGATIVE
Vigorous blood supply	Distal obstruction
Maintenance of apposition	Peri-anastomotic sepsis
Appropriate alignment	Peri-anastomotic hematoma
Lack of tension	Hypotension
	Hypoxia
	Malnutrition
	Corticosteroids
	Uraemia
	Jaundice

POST OPERATIVE CARE

Intravenous fluids should be maintained until good bowel sounds are established and the patient has passed flatus. Nasogastric tube should be retained until flatus or fecal evacuation is evident. Oral fluids are then started and gradually increased (19)

COMPLICATIONS OF COLOSTOMY CLOSURE

Colostomy closure is associated with morbidity reported to be between 10 and 50% and a mortality of 0 to 4%. Wound infection and anastomotic leak head the list of surgical complications, whereas urinary tract infection, congestive cardiac failure, pulmonary embolism and pneumonia account for most of the less frequently noted systemic complications.

Wound infections necessitate adequate drainage and aggressive local care. Small-localized anastomotic leaks may be treated conservatively with a low-residue diet high in protein and calories. If the patient begins to show signs of systemic sepsis or if complete anastomotic disruption is recognized, proximal diversion and drainage or exteriorization of the anastomosis are indicated (44).

Both clinical leaks with either general peritonitis or a faecal fistula occur in the upward of 8-10% of most series. Subclinical leaks detected by radiological contrast examination in anything from an extra 10-15% depending on the site of the anastomosis and the skills of the operation.

Yajko and colleagues reported 28% incidence of complications associated with colostomy closure in 100 patients; wound infection in 10% and faecal fistula in 4%. These authors advocated; an open, two-layer anastomosis with delayed wound closure (45).

Beck and Conklin analysed the records of 77 Vietnam War casualties who underwent loop colostomy closure. The post-operative complication rate was 9% with simple loop closure compared with 24% with resection and anastomosis. These authors felt that closure without resection was technically easier and associated with a lower morbidity than resection of the stoma with reanastomosis (46).

Wara and associates noted a morbidity rate of 57% with a leakage rate of 10% and a mortality rate of 1.7% in 105 patients (47). Smit and Walt reported a complication rate of 30% in 167 patients who underwent colostomy closure with wound infections seen in >17% of patients (24). Eleven selected reports (48-58) from the literature on the results of colostomy closure revealed a mean morbidity rate of 24% (range 14% -38%). In the Lahey clinic experience (1963-1974) with colostomy closure, the combined early and late morbidity was 49% with wound infection in 25%, faecal fistula in 9.3%.

Table: Late Complications of Colostomy Closure

COMPLICATION	NO. OF PATIENTS	PERCENTAGE OF SERIES
Incisional hernia	19	16.4
Suture sinus	3	2.6
Intestinal obstruction	2	1.7
>1 of the above	4	3.7
	28	24.4

Results were most unsatisfactory because much of the period covered during the study antedated contemporary techniques (22). Most surgeons have noted a decreased incidence of complications in all aspects of colostomy closure.

Two reports demonstrated a remarkably low incidence of problems associated with colostomy closure. Salley and colleagues reported a complication rate of 7.8% in 166 patients operated

from 1971-1981. The infection rate was extremely low, 2-3%(59). Garnjobst and colleagues reviewed their experience of 125 consecutive colostomy closures, noting a complication rate of 5.6% in the early phase and late complication rate of 4% primarily due to incisional hernia (60).

Incision hernia that is a late complication of colostomy closure present with pain and obstruction. Incision hernia should be treated by early repair. Conservative management may be done if the patient is unwilling to undergo surgery or the patient is a poor surgical risk, an elastic corset may control symptoms. Defects that are too large to close may be left without surgical repair if they are assymptomatic since they are unlikely to incarcerate. Small hernias usually require a direct fascia-to-fascia repair with interrupted or continuous non-absorbable sutures. Large hernias are those where the fascial edges cannot be approximated without tension. After removal of the sack, repair of the large defect is performed using non-absorbable mesh.

RATIONALE AND JUSTIFICATION OF THE STUDY

Both colostomy creation and closure are commonly performed procedures at the Kenyatta National Hospital. Due to an ever increasing number of road traffic accidents and violent robberies in Kenya, there is an increase in the number of colonic injuries and hence the need for colostomies.

In a six-year retrospective study by Otele at Kenyatta National Hospital from 1990 to1995 involving 282 cases of faecal diversion, 97% were colostomies (30). In this period a total of 158 diversion stomas were reversed (56%), 80% by consultant surgeons and the remaining 20% by SHOs. Colostomies closed by consultant surgeons were associated with fewer complications compared with those closed by SHOs (18% Vs 63%).

There is lack of uniformity in terms of timing of colostomy closure, bowel preparation and method for colostomy closure in the three general surgical wards. The findings from this study will be used to offer suggestions on ways in which colostomy closure can be improved at Kenyatta National Hospital.

OBJECTIVES OF THE STUDY

BROAD OBJECTIVE:

To analyse variables that determine the outcome of colostomy closure.

SPECIFIC OBJECTIVES:

1. To stratify patients for colostomy closure into risk categories according to the following preoperative variables e.g.
   - Indication for colostomy fashioning
   - Age
   - Gender
2. To determine whether type or site of colostomy will influence the outcome of colostomy closure
3. To determine the ideal time interval between colostomy creation and closure
4. To determine the optimal method of bowel preparation before colostomy closure
5. To determine the optimal method of re-establishing intestinal continuity
   - Experience of the surgeon
   - Single Vs two-layer anastomosis
   - Operating time
6. To determine the frequency of early complications of colostomy closure
7. To determine the overall hospital stay of patients who had colostomy closure

MATERIAL AND METHODS

Study design

This is both a one-year descriptive prospective study from March 2002 to February 2003, and a three-year retrospective study from January 1999-February 2002. The study included all patients with colostomy undergoing colostomy closure by the general surgeons at the Kenyatta National Hospital.

In the prospective group all patients with the above diagnosis were recruited in the one-year study period and followed while in the ward. The patients were admitted three days before the surgery. Patients in the two groups were selected randomly. Bowel preparation (mechanical) was commenced from the day of admission.

Day 1 – light diet + enema + laxative

Day 2 – liquid diet + enema + laxative

Day 3 – clear fluids + enema

The morning of the surgery, the colostomy was draining clear fluid. The patients were given prophylactic systemic antibiotics at induction of anaesthesia.

For the Retrospective group information was retrieved from files in the records department of Kenyatta National Hospital (KNH). Information retrieved included personal data of the patients, dates of colostomy creation and closure, indication for the colostomy, type and site of colostomy, method of bowel preparation and operative and postoperative follow-up notes and complications, and method of management of complications.

Study Area

The study was conducted at the Kenyatta National Hospital.

Sample Size

In the prospective group all patients who had colostomy closure within the one-year recruitment period were included. The retrospective study covered all colostomy closures done in the last three years prior to start of prospective study. An estimate from theatre records has shown thirty colostomies were closed per year giving a sample size of 30 for prospective group and 90 for retrospective group.

Inclusion Criteria

All patients with colostomies undergoing colostomy closure in the general surgical wards

Exclusion Criteria

All patients who had colostomy closure in the paediatric surgical unit. Patients who had prior radiotherapy and those with additional procedure done at the same sitting.

Data Collection

In the prospective group data collection was done by the researcher on the pre-designed data collection form (Appendix 1) after getting informed consent from the patients. All pre-operative data was filled. Intraoperative data was collected in the operating room. Postoperatively each patient was seen twice a day until discharge.

In the retrospective study data from patients' records was recovered using a predesigned data collection form.

Data Management and Presentation

All the data obtained was transferred from the data collection form onto a coded sheet for computer analysis. Data validation was done before the analysis. This was done using the SPSS version 10.0 (SPSS Inc. Chicago, USA). Continuous data was analysed using means, medians and frequency distribution. The results were presented in graphical, tabular and chart forms. Statistical significance was determined using the Chi-square test and a P value of <0.05 was considered significant. The prospective and retrospective results were compared.

Ethical considerations and Patient consent

The research proposal was submitted to the hospital ethical and research committee for approval before embarking on the study. All patients were recruited on informed consent basis (prospective) provided to them and signed the consent forms. All information has been treated in confidence and has not been made public in any form.

RESULTS

PROSPECTIVE STUDY

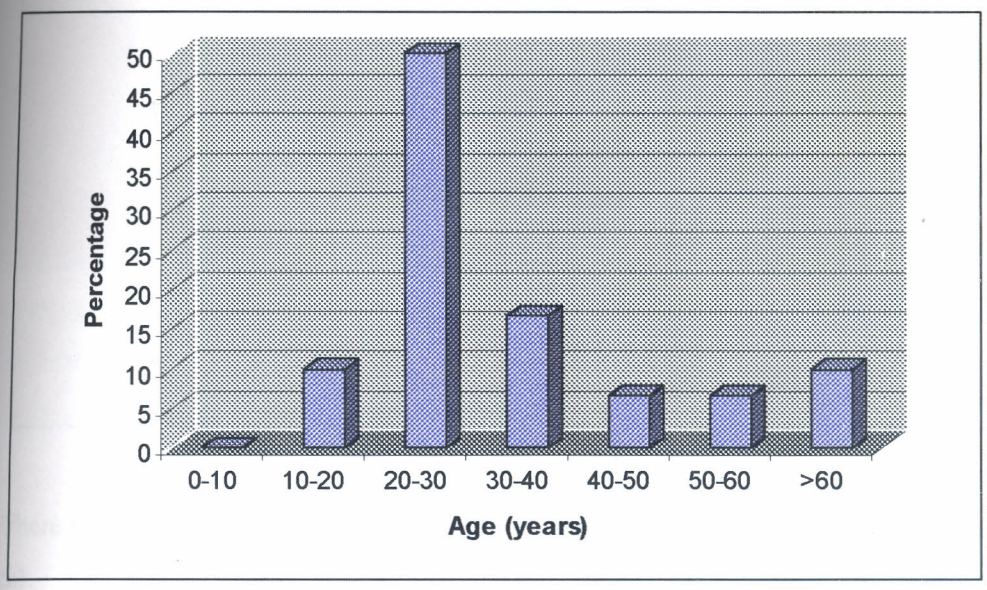
A total of thirty patients underwent colostomy closure from March 2002 to February 2003. The average hospital stay was 7.1 days (range, 2-18).

1. Age Distribution

Table 1: Age Distribution in patients who had colostomy closure

Age Category	No. of Patients	Percentage
0-10	0	0
10-20	3	10
20-30	15	50
30-40	5	16.7
40-50	2	6.7
50-60	2	6.7
>60	3	10
Total	30	100

Figure 1- Age distribution in patients who had colostomy closure



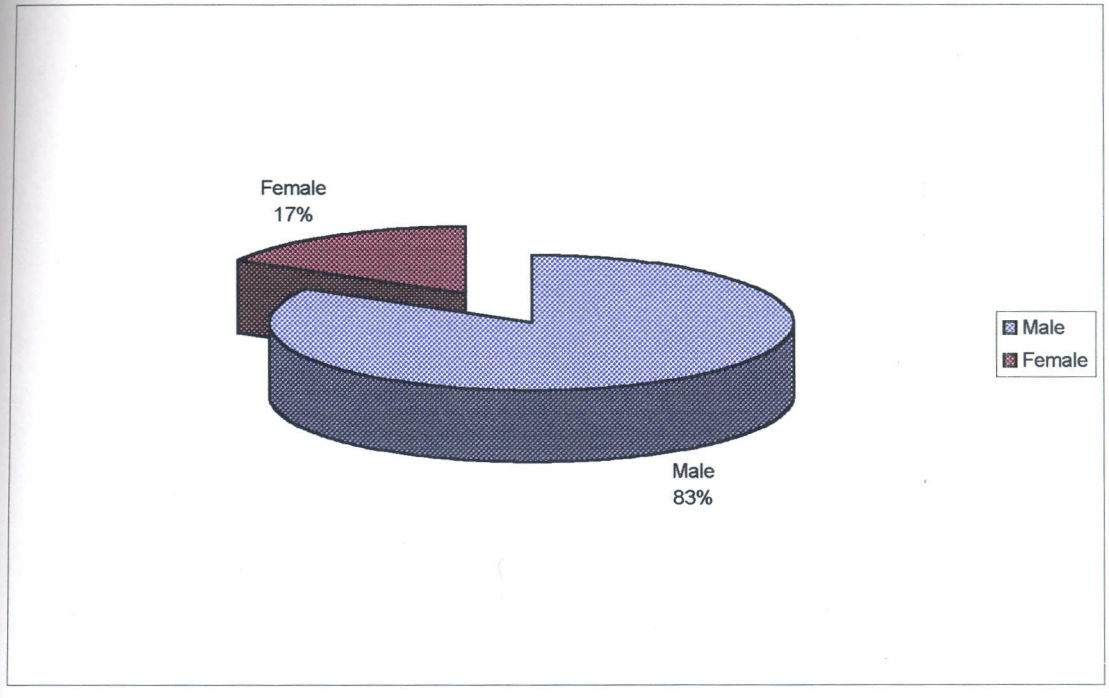
The ages of patients who underwent colostomy closure ranged from 15 years to 85 years (mean = 34 years). There is a peak at the 20-30 year age category with fifty percent of the patients in this age category.

2. Sex Distribution

Table 2: Sex distribution in patients who had colostomy closure

Sex	No. of Patients	Percentage
Male	25	83.3
Female	5	16.7
Total	30	100

Figure 2 – Sex distribution in patients who had colostomy closure



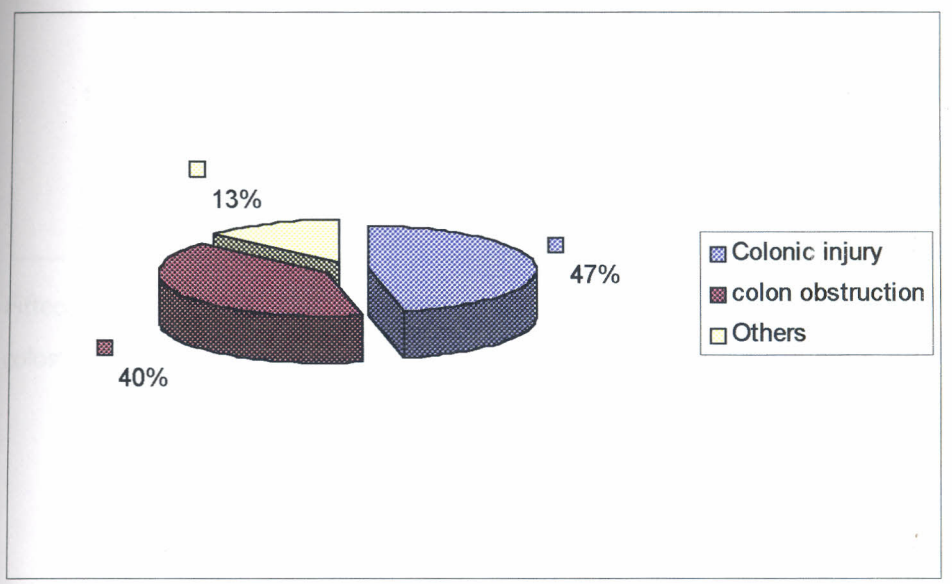
There were twenty-five males (83%) and five females (16.7) with a male to female ratio of 5:1.

3. **Indications for colostomy**

Table 3 – Indications for colostomy

Indication	Percentage	No. of patients
Colon injury	46.7	14
Colon obstruction	39.9	12
▪ Neoplasms	3.3	1
▪ Sigmoid volvulus	33.3	10
▪ Others	3.3	1
Others	13.4	4
Total	100	30

Figure 3 – Indications for colostomy



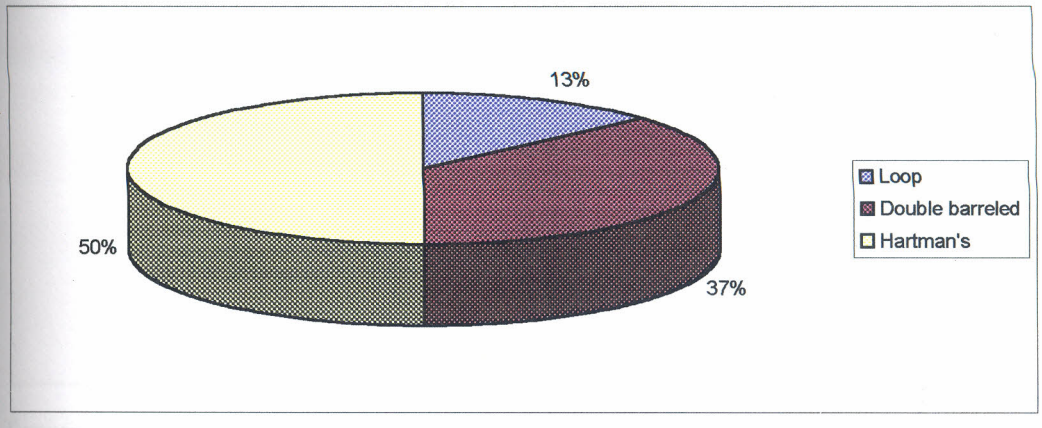
Fourteen patients had colon injury as the indication for colostomy, 12 patients had colon obstruction of which 10 patients had sigmoid volvulus one patient had neoplasm and another one patient had adhesions. Four patients had perineal injury.

4. **Type of colostomy**

Table 4- Type of colostomy

Type	No. of Patients	Percentage
Loop colostomy	4	13.3
Double barrelled colostomy	11	36.7
Hartman's colostomy	15	50
Total	30	100

Figure 4 – Type of colostomy



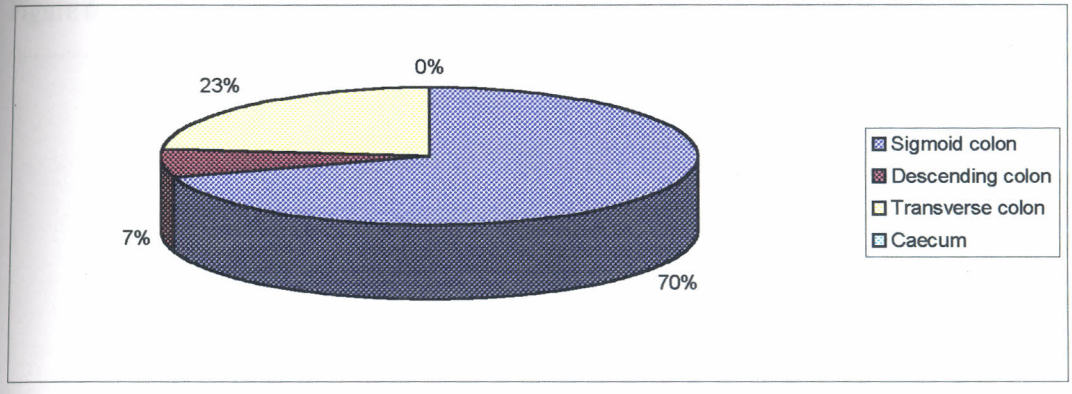
Fifteen patients (50%) had Hartman's colostomy, 11 patients (36.7%) had double-barrelled colostomy and 4 patients (13.3%) had loop colostomy.

5. **Site of colostomy**

Table 5: Site of colostomy

Site	No. of Patients	Percentage
Sigmoid colon	21	70
Descending colon	2	6.7
Transverse colon	7	23.3
Total	30	100

Figure 5 – Site of colostomy



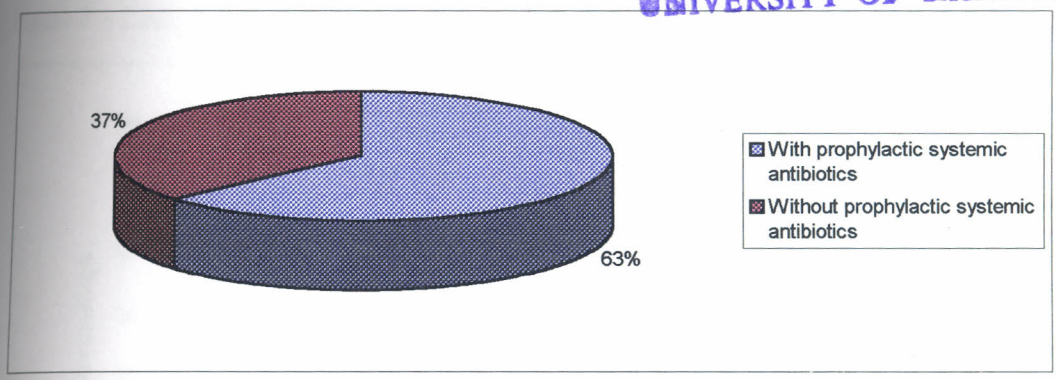
Twenty-one patients (70%) had their colostomies sited in the sigmoid colon. Seven patients (23.3%) had their colostomies sited in the transverse colon. Two patients (6.7%) had their colostomies sited in the descending colon.

6. **Method of bowel preparation**

Table 6 - **Method of Bowel preparation**

Method	No. of Patients	Percentage
With prophylactic systemic antibiotics	19	63.3
Without prophylactic systemic antibiotics	11	36.7
Total	30	100

Figure 6 – **Method of bowel preparation**



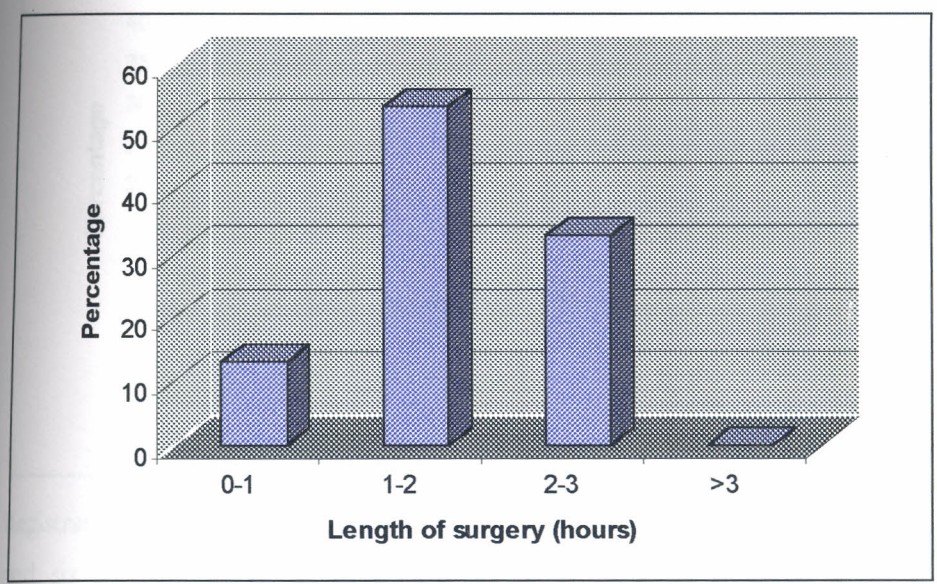
Nineteen patients (63.3%) had mechanical bowel preparation with prophylactic systemic antibiotics. Eleven patients (36.7%) had no prophylactic systemic antibiotics of which 8 patients (26.7%) had mechanical bowel preparation only and 3 patients (10%) had mechanical bowel preparation and oral non-absorbable antibiotics.

7. Length of surgery for colostomy closure

Table 7 – Length of surgery for colostomy closure

Time (Hours)	No. of Patients	Percentage
0-1	4	13.3
1-2	16	53.3
2-3	10	33.3
>3	0	0
Total	30	100

Figure 7 – Length of surgery for colostomy closure



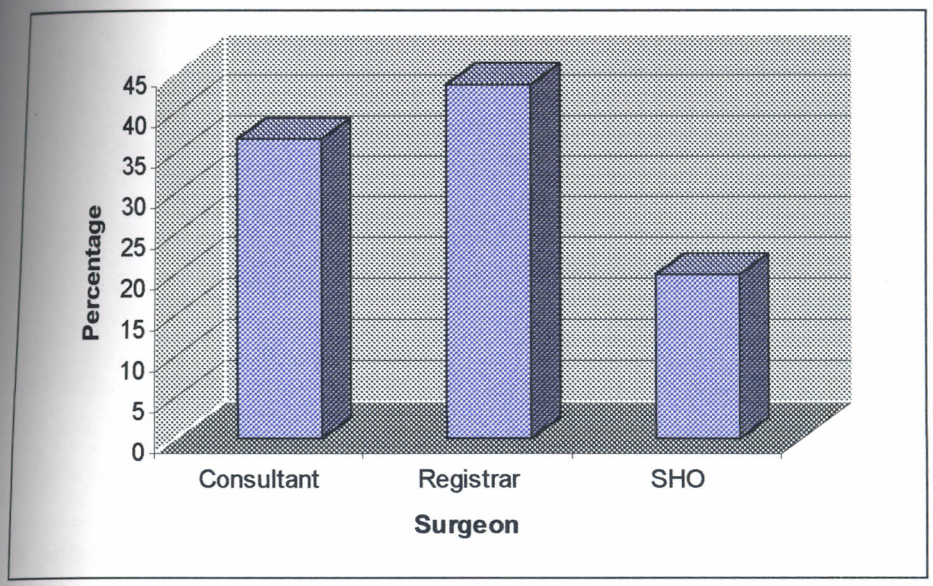
Length of surgery was estimated as time taken from making the first incision to applying the last suture. Twenty patients (66.7%) had their colostomies closed in less than two hours. Ten patients (33.3%) had their colostomies closed in more than two hours.

8. **Qualification of surgeon**

Table 8 - **Qualification of surgeon**

Surgeon	No. of Patients	Percentage
Consultant	11	36.7
Registrar	13	43.3
SHO	6	20
Total	30	100

Figure 8 – **Qualification of surgeon**



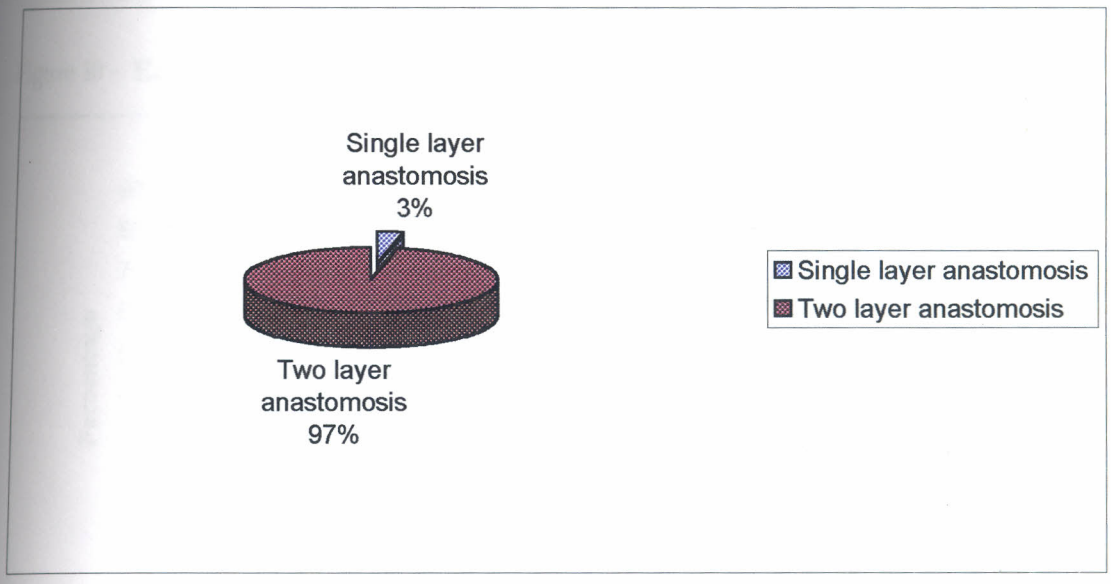
Registrars operated thirteen patients (43.3), eleven patients (36.7%) operated by consultants and six patients (20%) operated by SHOs. The SHO (Senior House Officer) is the postgraduate resident in general surgery at the Kenyatta National Hospital. A registrar is a qualified surgeon who is doing his residency in general surgery.

9. **Method of establishing intestinal continuity**

Table 9: **Method of re-establishing intestinal continuity**

Method	No. of Patients	Percentage
Single-layer anastomosis	1	3.3
Two-layer anastomosis	29	96.7
Total	30	100

Figure 9 – **Method of re-establishing intestinal continuity**



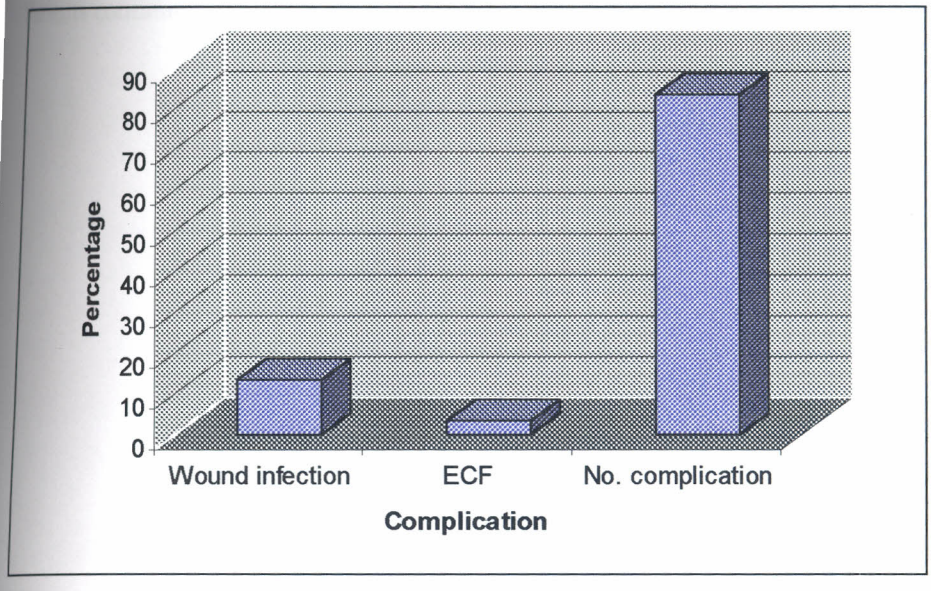
All patients had intraperitoneal closure of the colostomy. Twenty-nine patients (96.7) had two-layer anastomosis, one patient (3.3%) had single layer anastomosis. In all the patients vicryl was the suture material used for intestinal anastomosis. All wounds were closed primarily.

10. Early complication of colostomy closure

Table 10: Early complication of colostomy closure

Complication	No. of Patients	Percentage
Wound infection	4	13.4
Enterocutaneous fistulae (ECF)	1	3.3
No complication	25	83.3
Total	30	100

Figure 10 – Early complications of colostomy closure



The rate of developing early complications was 16.7% (n=5) of which wound infection accounted for 13.4% (n=4) and enterocutaneous fistula accounted for 3.3% (n=1).

11. Management of early complications

Table 11 – Management of early complications

Management	No. of Patients	Percentage
Conservative	5	16.7
Surgical	0	0
None	25	83.3
Total	30	100

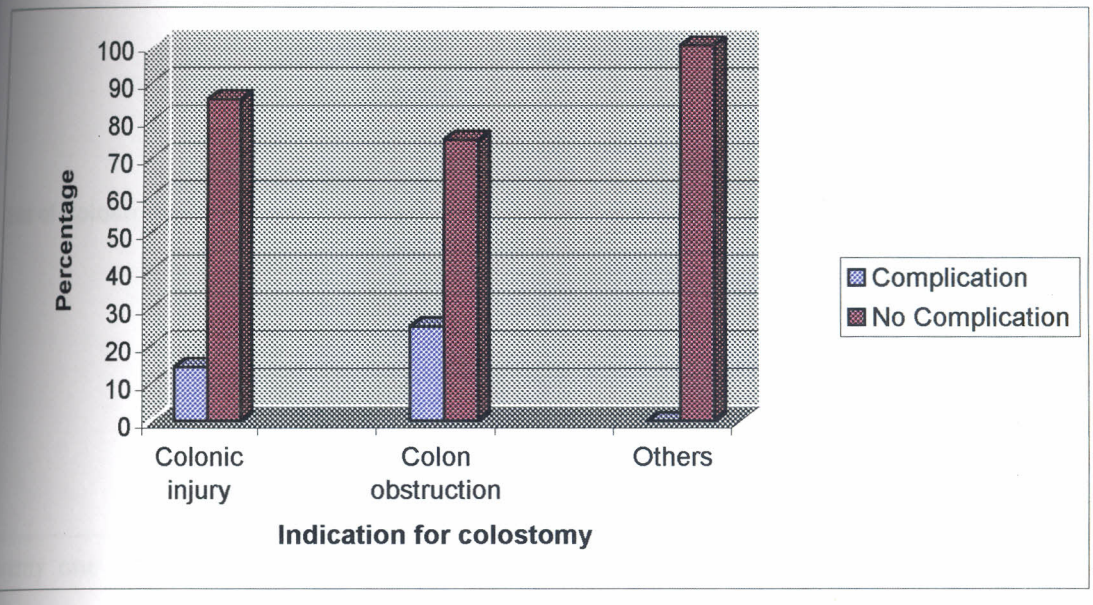
All patients who developed early complications were managed conservatively by adequate drainage of the wound, aggressive local care and systemic antibiotics. All patients improved. Patients continued feeding during the period of treatment.

12. Association between Indication for Colostomy and Development of Early Complications

Table 12 – Indications for colostomy and early complications

Indication	Complication	No Complication	Total
Colon Injury	2 (14.3%)	12 (85.7%)	14
Colon obstruction	3 (25%)	9 (75%)	12
Others	0	4 (100%)	4
Total	5 (16.7%)	25 (83.3%)	30

Figure 11 – Indication for colostomy and early complications



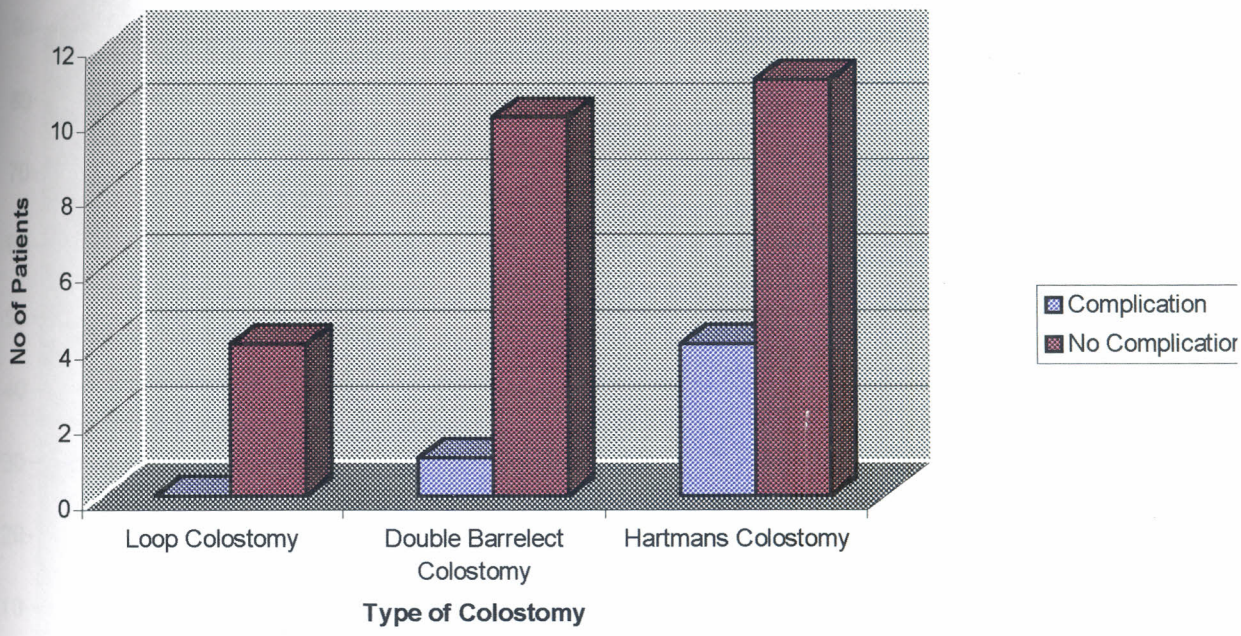
Twelve patients had colon obstruction of which 3 (25%) developed early complications, 14 patients had colon injury of which 2 (14.3%) developed early complications and none of the patients with other indications for colostomy developed early complications. This was not statistically significant. (P>0.05)

14. Association between Type of Colostomy and Development of Early Complications

Table 14 – Type of colostomy and early complications

Type	Complications	No complications	Total
Loop colostomy	0	4 (100%)	4
Double barrelled colostomy	1 (9.1%)	10 90.9%)	11
Hartman's colostomy	4 (26.7%)	11 73.3%)	15
Total	5 (16.7%)	25 (83.3%)	30

Figure 13 – Type of colostomy and early complications



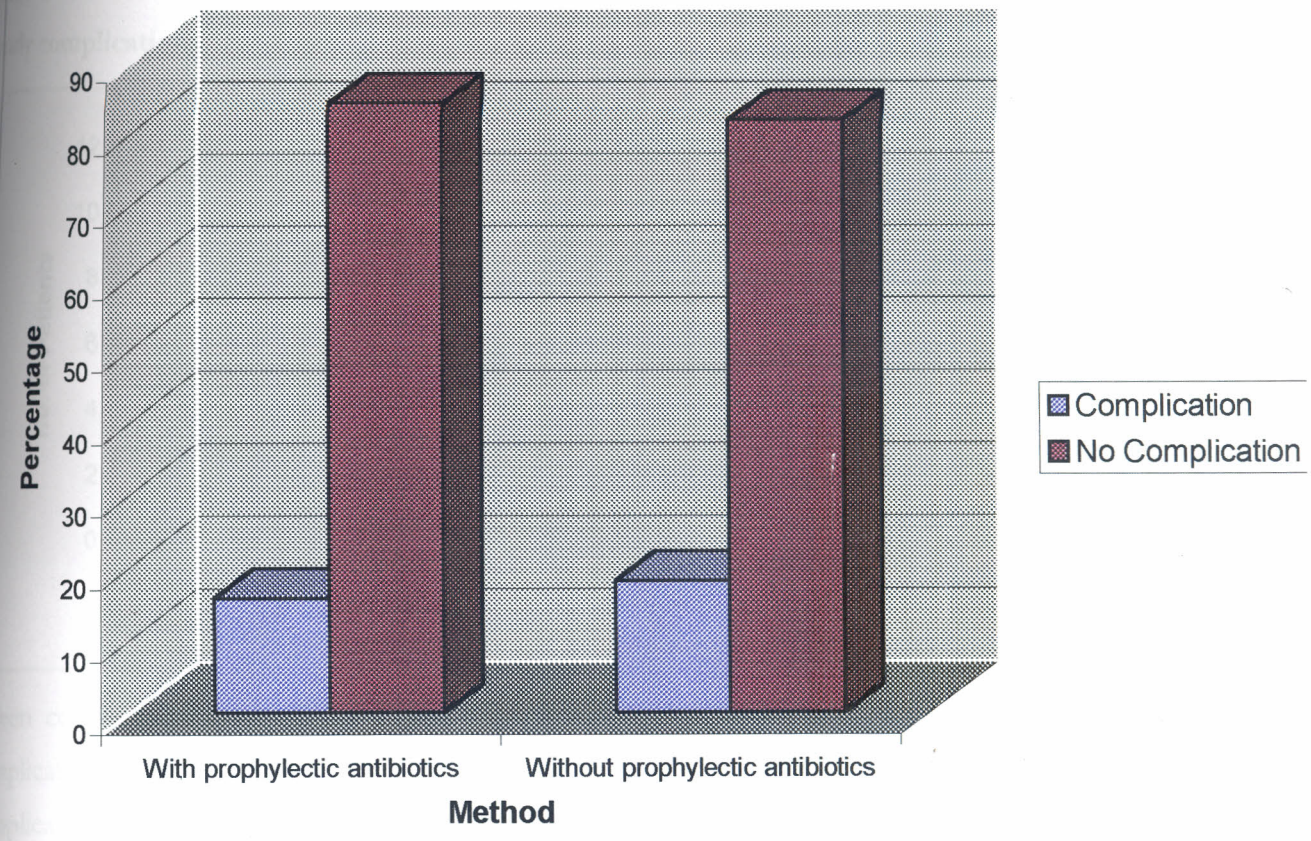
Fifteen patients had Hartman's colostomy of which 4 (26.7%) developed early complications, 11 patients had double barrelled colostomy of which one (9.1%) developed early complications and 4 patients who had loop colostomy did not develop complications. This was not statistically significant. (P>0.05).

15. Association between method of bowel preparation and the development of early complications

Table 15 - **Method of bowel preparation and early complication**

Method	Complications	No complications	Total
With prophylactic antibiotics	3 (15.8%)	16 (84.2%)	19
Without prophylactic antibiotics	2 (18.2%)	9 (81.8%)	11
Total	5 (16.7%)	25 (83.3%)	30

Figure 14 – ***Method of bowel preparation and early complications***



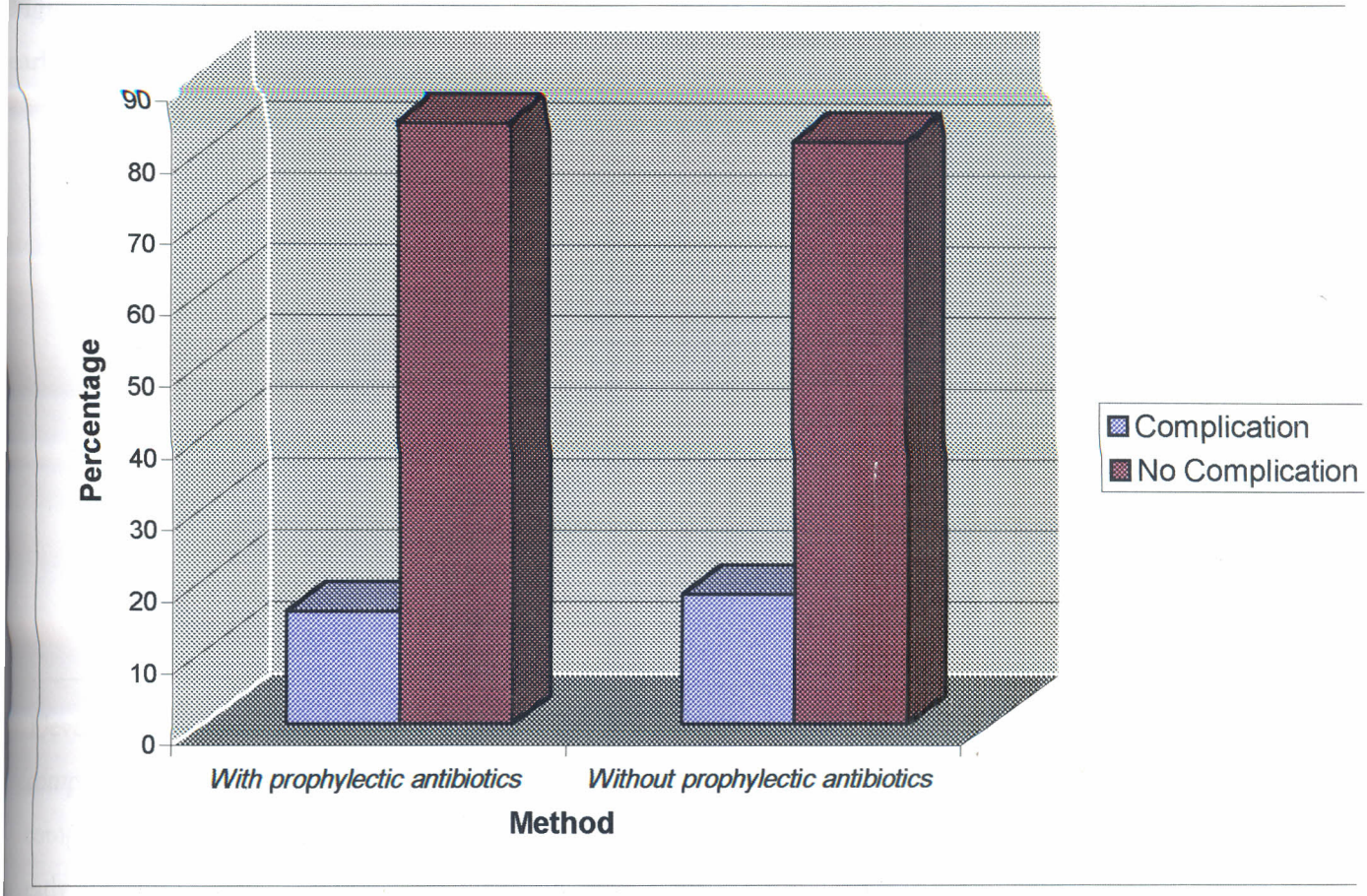
Nineteen patients had mechanical bowel preparation with prophylactic systemic antibiotics of which 3 (15.8%) developed early complications and 11 patients had mechanical bowel preparation without prophylactic systemic antibiotics of which 2 (18.2%) developed early complications. This was not statistically significant. (P>0.05).

15. Association between method of bowel preparation and the development of early complications

Table 15 - Method of bowel preparation and early complication

Method	Complications	No complications	Total
With prophylactic antibiotics	3 (15.8%)	16 (84.2%)	19
Without prophylactic antibiotics	2 (18.2%)	9 (81.8%)	11
Total	5 (16.7%)	25 (83.3%)	30

Figure 14 – Method of bowel preparation and early complications



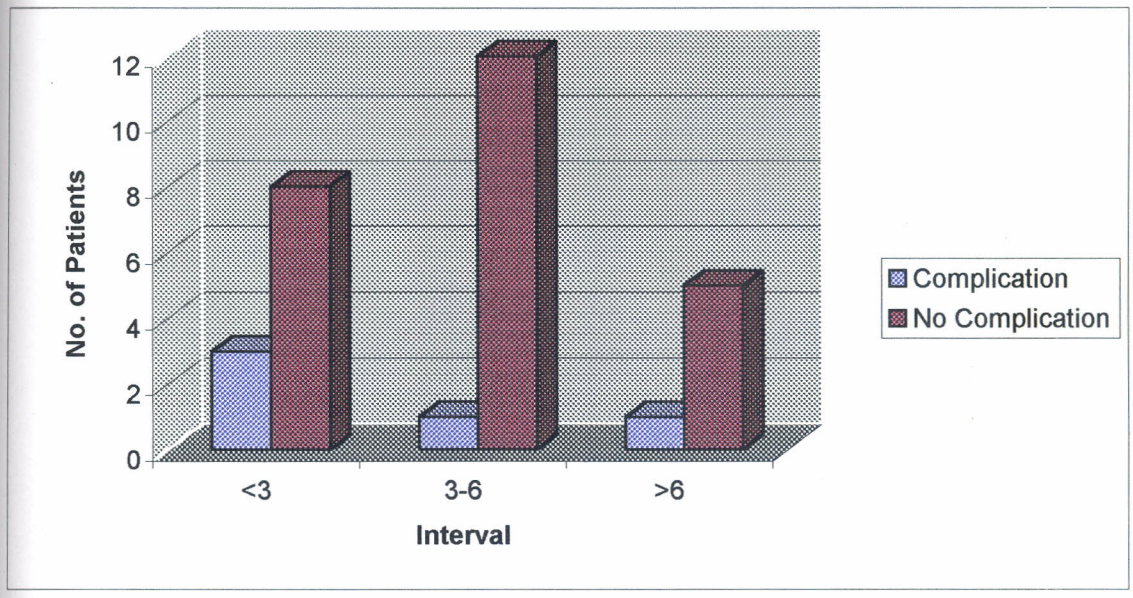
Nineteen patients had mechanical bowel preparation with prophylactic systemic antibiotics of which 3 (15.8%) developed early complications and 11 patients had mechanical bowel preparation without prophylactic systemic antibiotics of which 2 (18.2%) developed early complications. This was not statistically significant. (P>0.05).

16. Association between interval of creation and closure of colostomy and development of early complications

Table 16 – Interval between creation and closure and early complications

Interval (months)	Complications	No complications	Total
<3	3 (27.3%)	8 (72.7%)	11 (36.7%)
3-6	1 (7.7%)	12 (92.3%)	13 (43.3%)
>6	1 (16.7%)	5 (83.3%)	6 (20%)
Total	5	25	30

Figure 15 – interval between creation and closure of colostomy and the development of early complications



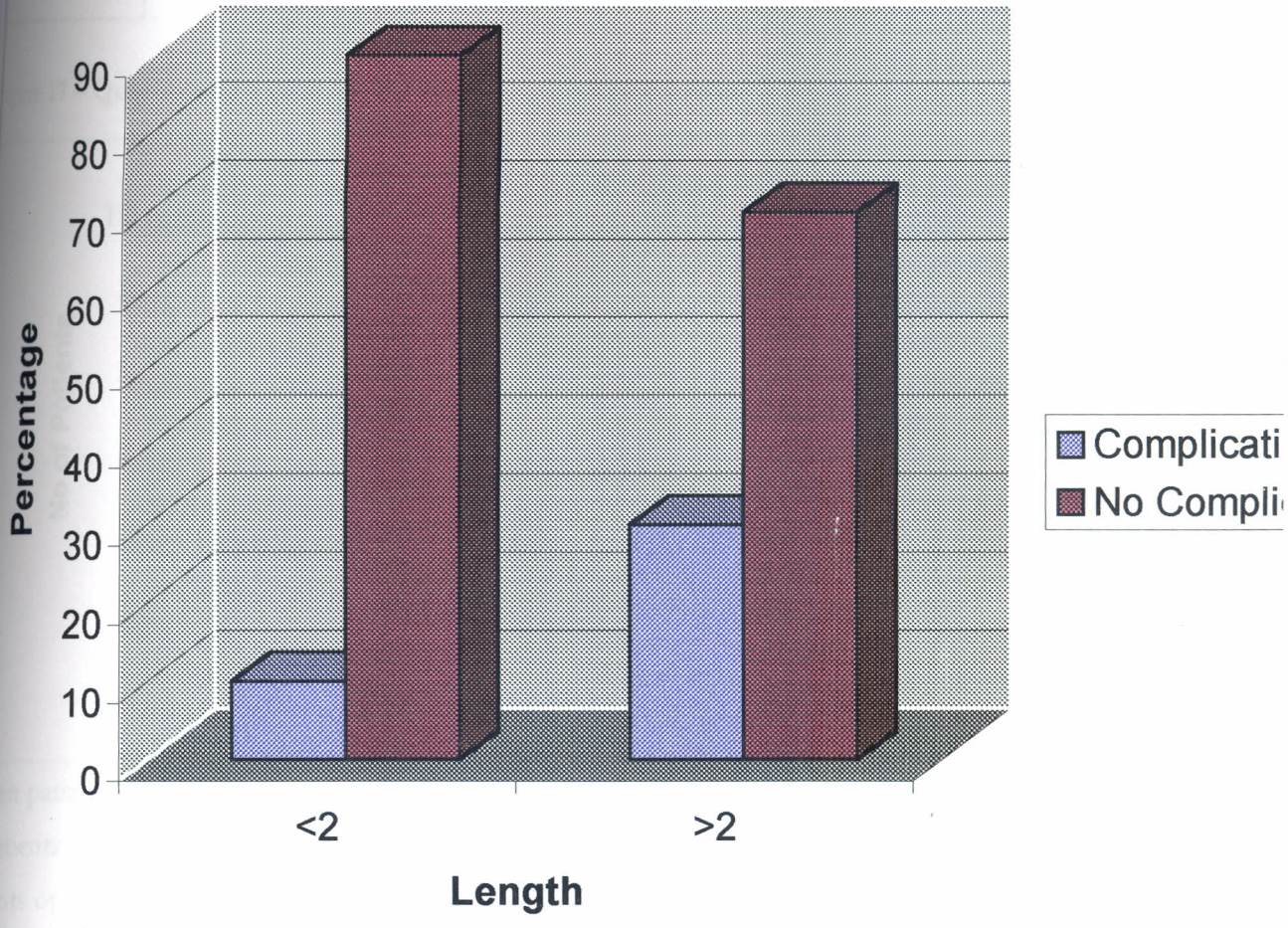
Eleven colostomies were closed in less than 3 months of which 3 (27.3%) developed early complications, 13 colostomies were closed in 3-6 months of which one (7.7%) developed early complications and 6 colostomies were closed after 6 months of which one (16.7%) developed early complications. This was not statistically significant. (P>0.05).

17. Association between length of surgery and development of early complications

Table 17 – Length of surgery and early complication

Length (hours)	Complications	No complications	Total
<2	2 (10%)	18 (90%)	20
>2	3 (30%)	7 (70%)	10
Total	5 (16.7%)	25 (83.3%)	30

Figure 16 – Length of surgery and early complications



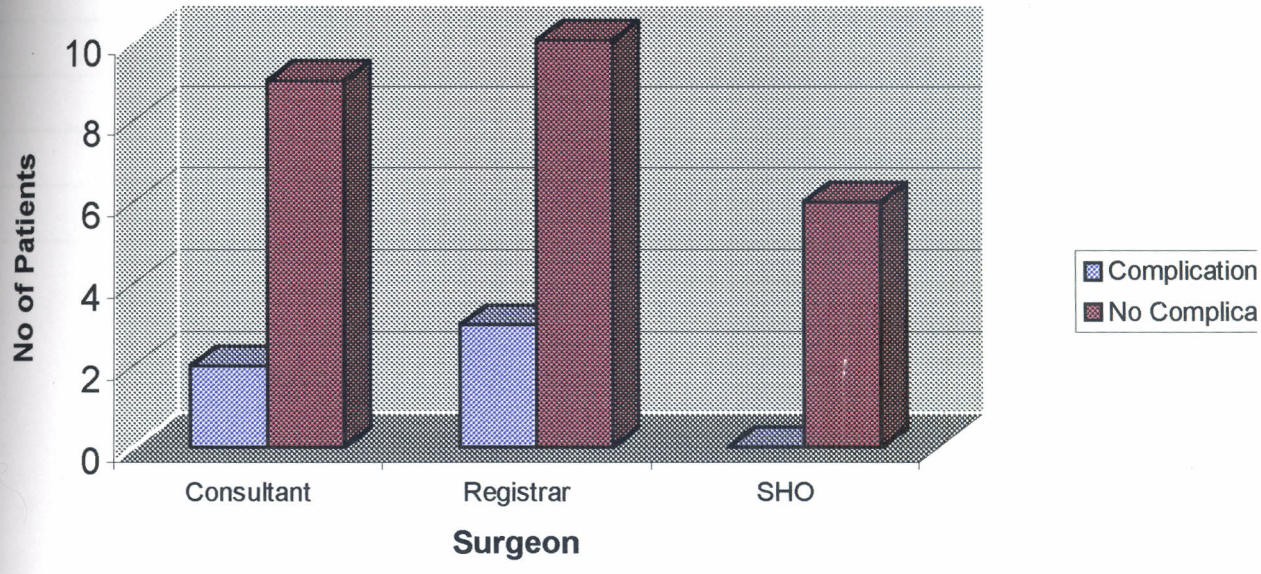
Twenty patients had their colostomies closed in less than two hours of which 2 (10%) developed early complications and 10 patients had their colostomies closed in more than two hours of which 3 (30%) developed early complications. This was not statistically significant (P>0.05).

18. Association between qualification of surgeon and development of early complications

Table 18 – Qualification of surgeon and early complications

geon	Complications	No complication	Total
nsultant	2 (18.2%)	9 (81.9%)	11
gistrar	3 (23.1%)	10 (79.9%)	13
HO	0	6 (100%)	6
tal	5 (16.7%)	25 (83.3%)	30

Figure 17 – Qualification of surgeon and early complications



Eleven patients were operated by consultants of which 2 (18.2%) developed early complications, 13 patients were operated by Registrars of which 3 (23.1%) developed early complications and 6 patients operated by SHOs did not develop complications. This was not statistically significant. (P>0.05).

RETROSPECTIVE STUDY

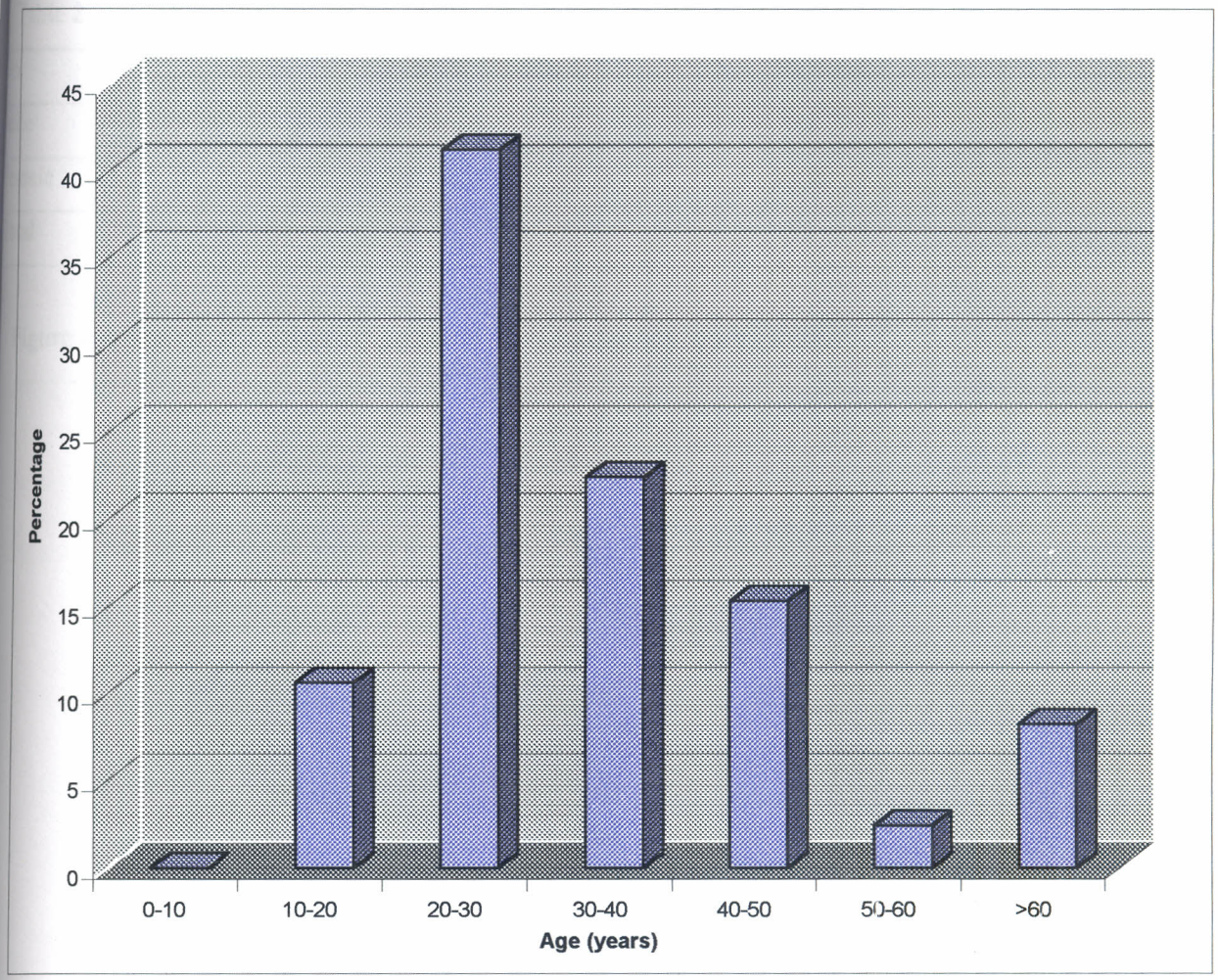
A total of eighty-five patients underwent colostomy closure from January 1999 to February 2002. The average hospital stay was 9.8 days (range, 4-61).

1. Age distribution

Table 1 – Age distribution in patients who had colostomy closure

Age Category	No. of Patients	Percentage
-10	0	0
0-20	9	10.6
0-30	35	41.2
0-40	19	22.4
0-50	13	15.3
0-60	2	2.4
>60	7	8.2
Total	85	100

Figure 1 – Age distribution in patients who had colostomy closure



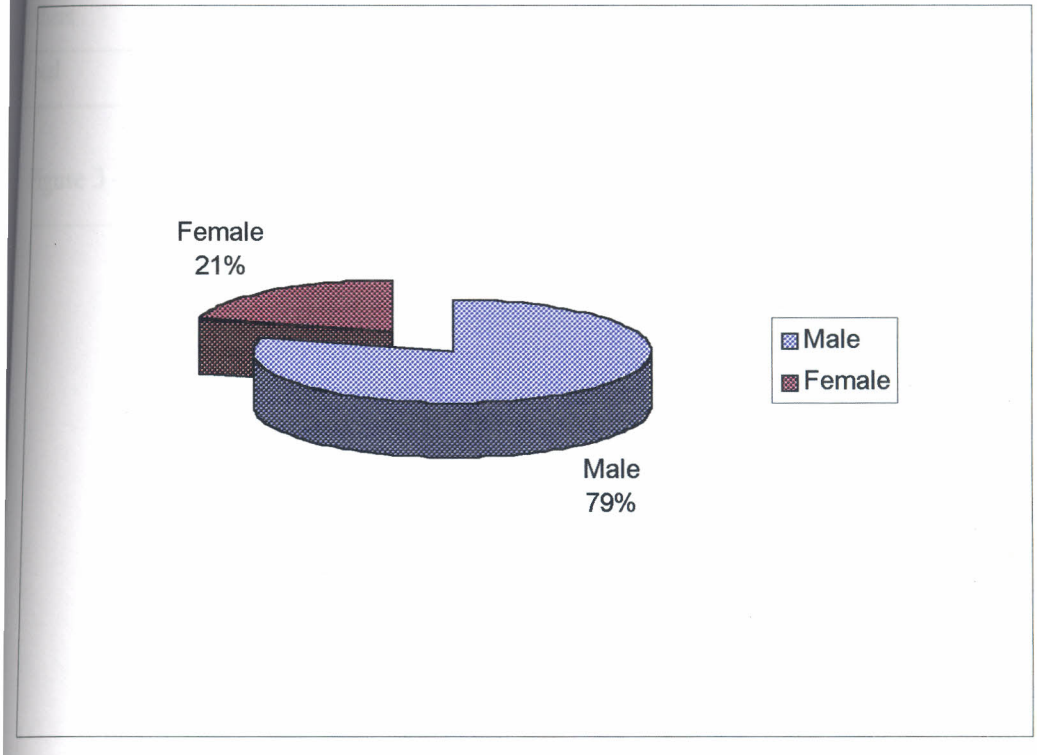
The ages of patients who underwent colostomy closure ranged from 16 years to 87 years (mean age = 35 years). There is a peak at the 20-30 year age category with 41.2% of the patients in this age group.

2. **Sex distribution**

Table 2 – Sex distribution in patients who had colostomy closure

	No. of Patients	Percentage
ale	67	78.8
emale	18	21.2
otal	85	100

Figure 2 – Sex distribution in patients who had colostomy closure



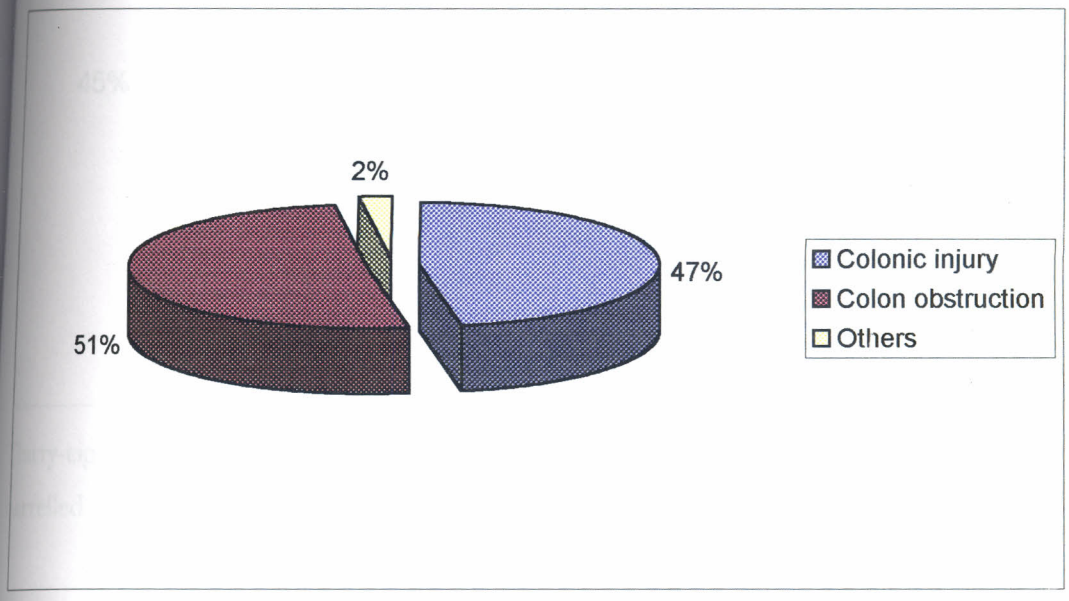
There were sixty-seven males (78.8%) and eighteen females (21.2%) with a male to female ratio of 4.3:1.

3. Indication for colostomy

Table 3 – Indication for colostomy

Indication	No. of Patients	Percentage
Colon Injury	40	47.1
Colon Obstruction	43	50.6
• Neoplasm	5	5.9
• Sigmoid volvulus	33	38.8
• Others	5	5.9
Others	2	2.4
Total	85	100

Figure 3 – Indication for colostomy



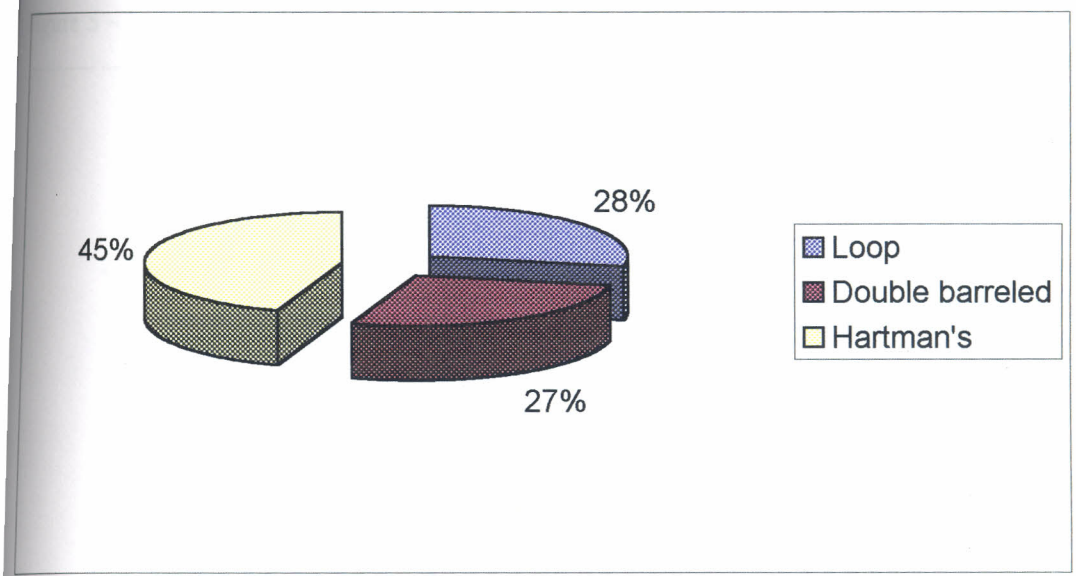
Forty patients had colon injury as the indication for colostomy, 43 patients had colon obstruction of which 33 patients had sigmoid volvulus, 5 patients had neoplasm and 5 patients had other causes of colon obstruction. Of the 5 patients who had other causes of colon obstruction, 3 had adhesions, 1 had postanastomotic stricture and 1 had stricture at the rectosigmoid junction secondary to ulcerative colitis. Two patients had perineal injury.

4. **Type of colostomy**

Table 4 – Type of colostomy

pe	No. of Patients	Percentage
op colostomy	24	28.2
uble barrelled colostomy	23	27.1
rtman's colostomy	38	44.7
tal	85	100

Figure 4 – Type of colostomy



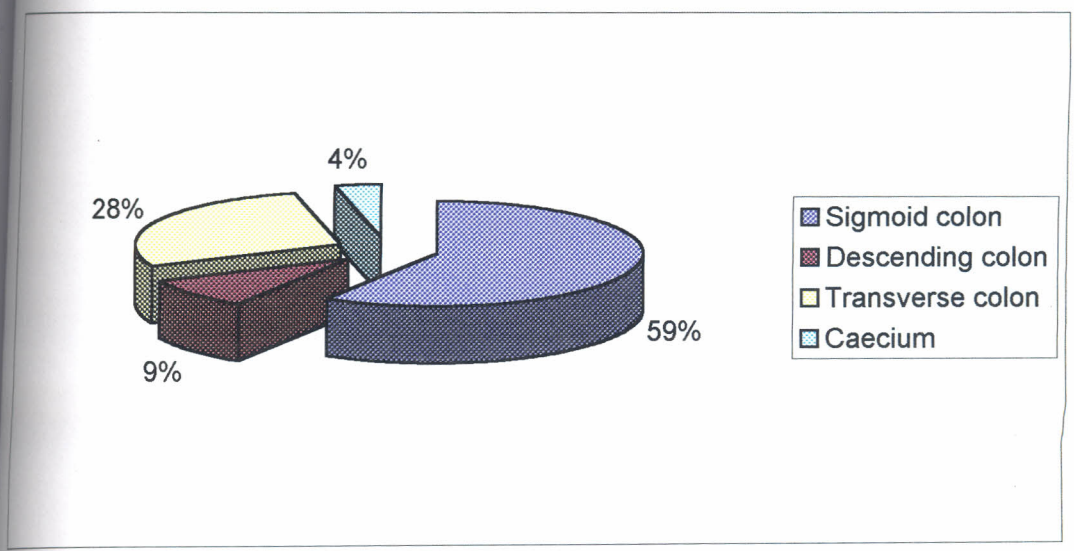
Thirty-eight patients (44.7%) had Hartman's colostomy, 23 patients (27.1%) had double-barrelled colostomy and 24 patients (28.2%) had loop colostomy.

5. **Site of colostomy**

Table 5 –Site of colostomy

Site	No. of Patients	Percentage
Sigmoid colon	50	58.8
Descending colon	8	9.4
Transverse colon	24	28.2
Caecum	3	3.5
Total	85	100

Figure 5 – Site of colostomy



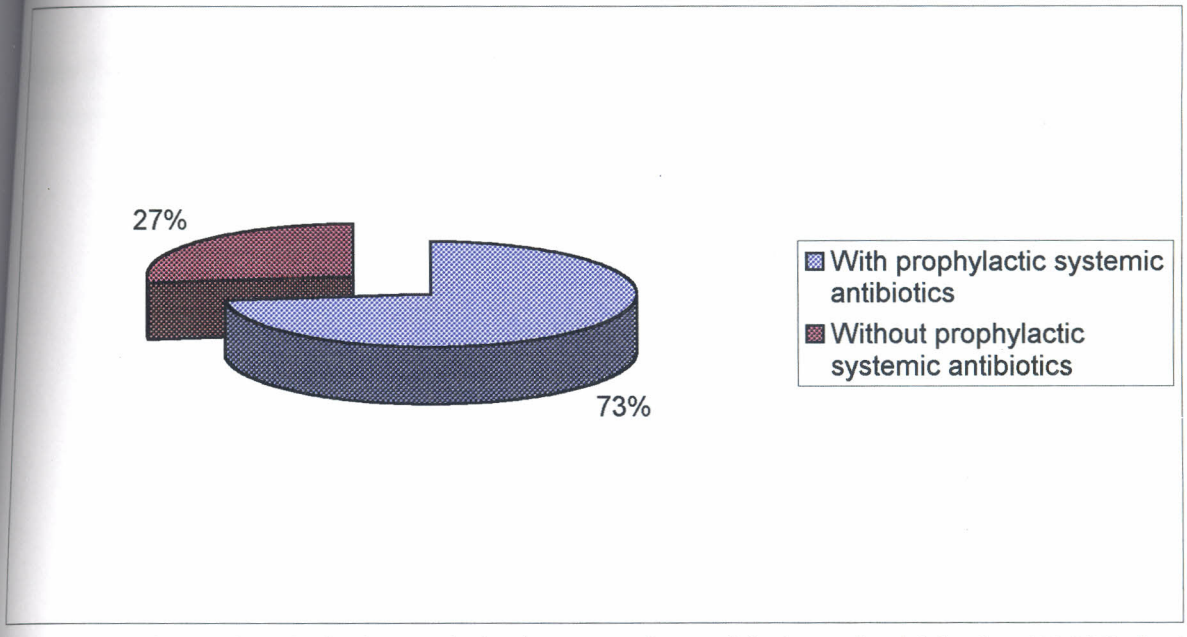
Fifty patients (58.8%) had their colostomies sited at the sigmoid colon. Twenty-four patients (28.2%) had their colostomies sited at the transverse colon. Eight patients (9.4%) had their colostomies sited at the descending colon. Three patients (3.5%) had caecostomy.

6. Method of bowel preparation

Table 6 – Method of bowel preparation

Method	No. of Patients	Percentage
With prophylactic systemic antibiotics	62	73
Without prophylactic systemic antibiotics	23	27
Total	85	100

Figure 6 – Method of bowel preparation



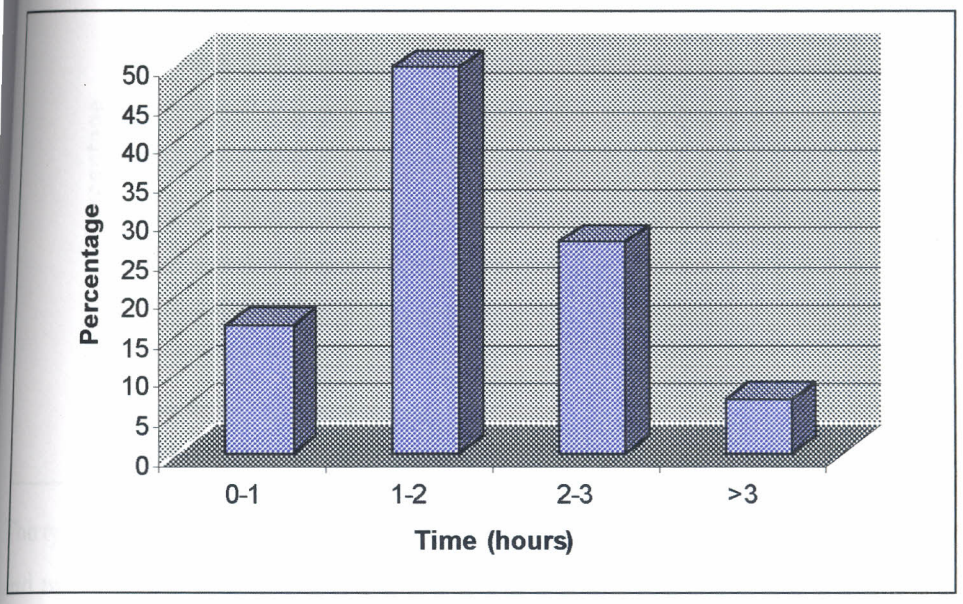
Sixty-two patients (73%) had prophylactic systemic antibiotics of which 56 (65.9%) had mechanical bowel preparation only and 6 (7.1%) had mechanical bowel preparation and non-absorbable oral antibiotics. Twenty-three patients (27%) had no prophylactic systemic antibiotics of which seventeen (20%) had mechanical bowel preparation only and six patients (7%) had mechanical bowel preparation and oral non-absorbable antibiotics.

7. *Length of surgery*

Table 7 – *Length of surgery in colostomy closure*

me (hours)	No. of Patients	Percentage
	14	16.5
	42	49.5
	23	*27.1*
	6	7.1
tal	85	100

Figure 7 – Length of surgery in colostomy closure



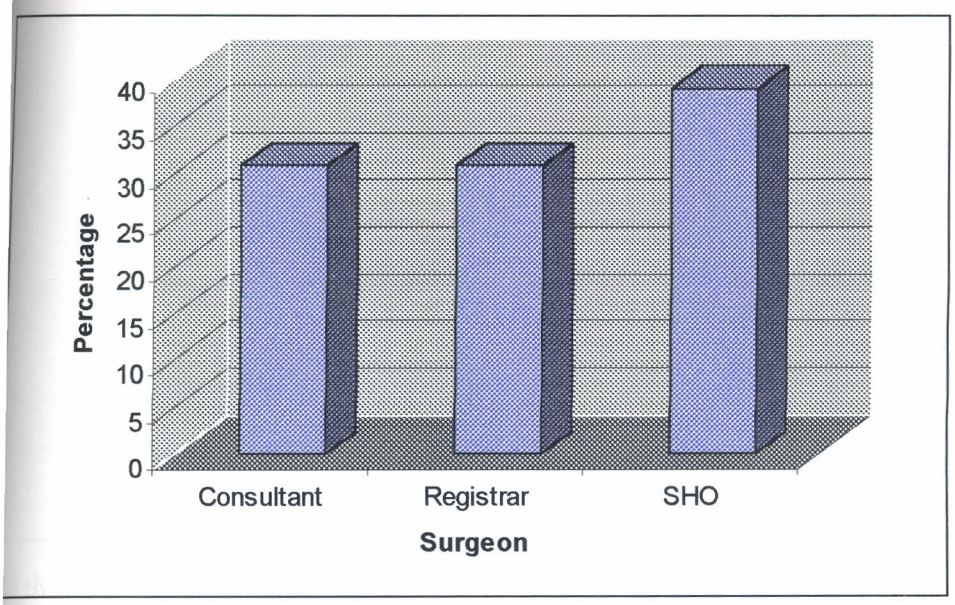
Fifty-six patients (66%) had their colostomies closed in two hours, and twenty-nine patients (34%) had their colostomies closed in more than two hours.

8. Qualification of surgeon

Table 8 – Qualification of surgeon

Surgeon	No. of Patients	Percentage
Consultant	26	30.6
Registrar	26	30.6
SHO	33	38.8
TOTAL	85	100

Figure 8 – Qualification of surgeon



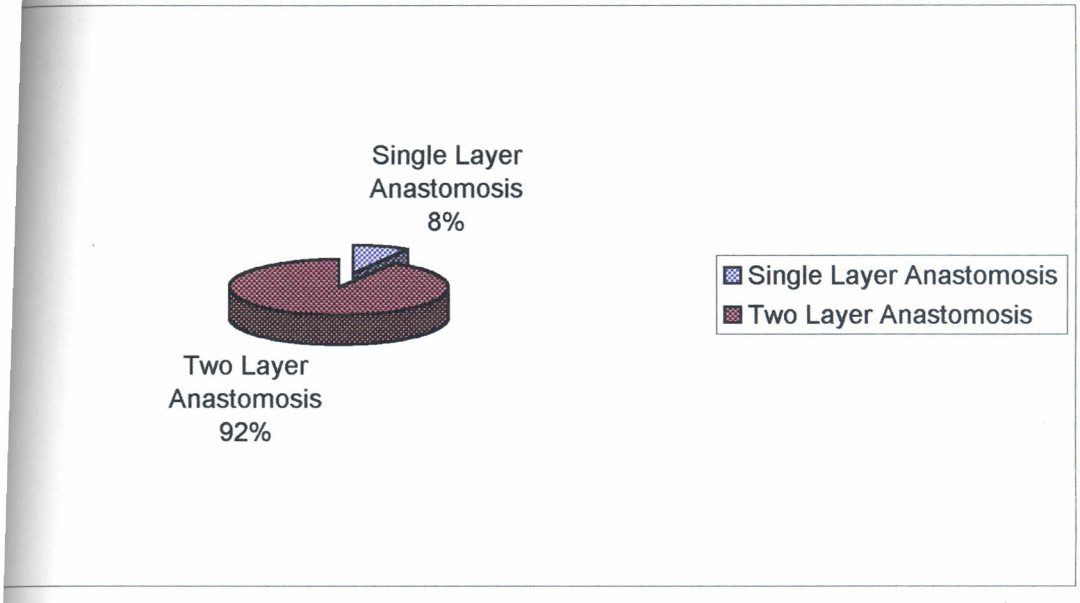
Thirty-three patients (38.8%) were operated by SHOs, twenty-six patients (30.6%) by consultants and twenty-six patients (30.6%) by Registrars.

9. Method of re-establishing intestinal continuity

Table 9 – Method of re-establishing intestinal continuity

thod	No. of Patients	Percentage
gle-layer anastomosis	7	8.2
o-layer anastomosis	78	91.8
al	85	100

igure 9 – Method of re-establishing intestinal continuity



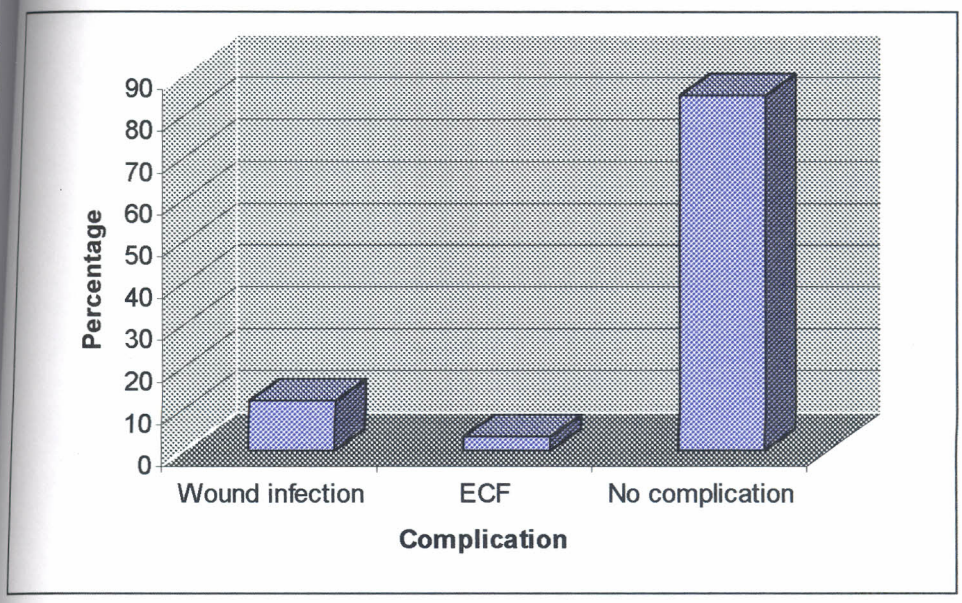
ll the patients had intraperitoneal closure of the colostomy. Seventy-eight patients (91.8%) had wo-layer anastomosis and seven patients (8.2%) had single layer anastomosis of the colon. In all he patients vicryl was the suture material used in intestinal anastomosis. All wounds were closed rimarily.

10. Early complication of colostomy closure

Table 10 – Early complications of colostomy closure

Complication	No. of Patients	Percentage
Wound infection	10	11.8
Enterocutaneous fistula	3	3.5
No complication	72	84.7
Total	85	100

Figure 10 – Early complications of colostomy closure



The rate of developing early complications was 15.3% (n=13) of which wound infection accounted for 11.8% (n=10) and enterocutaneous fistula accounted for 3.5% (n=3).

11. Management of early complication

Table 11 – Management of early complication

Management	No. of Patients	Percentage
Conservative	12	14.1
Surgical	1	1.2
None	72	84.7
Total	85	100

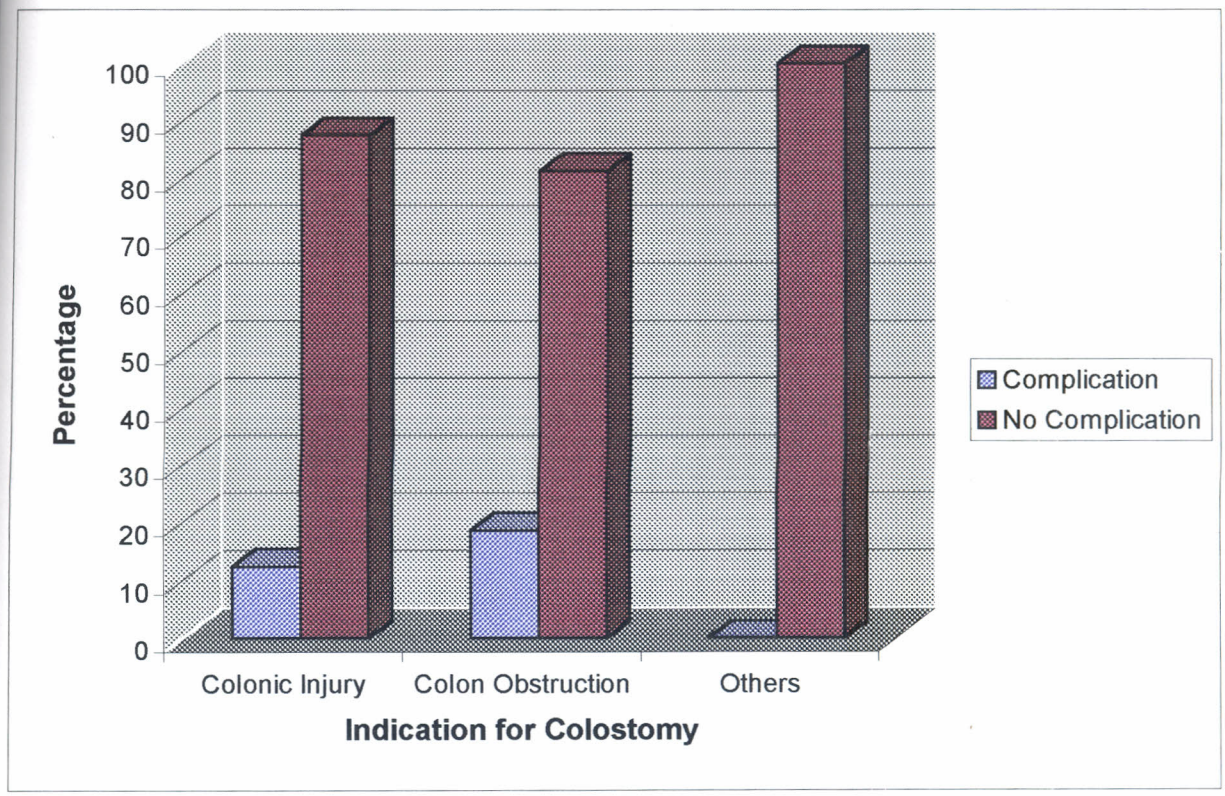
Out of the thirteen patients who developed early complications, twelve were treated conservatively. One patient who had enterocutaneous fistula had a laparatomy done a colostomy fashioned.

12. Association between indication for colostomy and development of Early Complication

Table 12 – Indication for colostomy and early complication

Indication	Complication	No Complication	Total
Colon Injury	5 (12.5%)	35 (87.5%)	40
Colon obstruction	8 (18.6%)	35 (81.4%)	43
Others	0	2 (100%)	2
Total	13 (15.3%)	72 (84.7%)	85

Figure 11 – Indication for colostomy and early complications



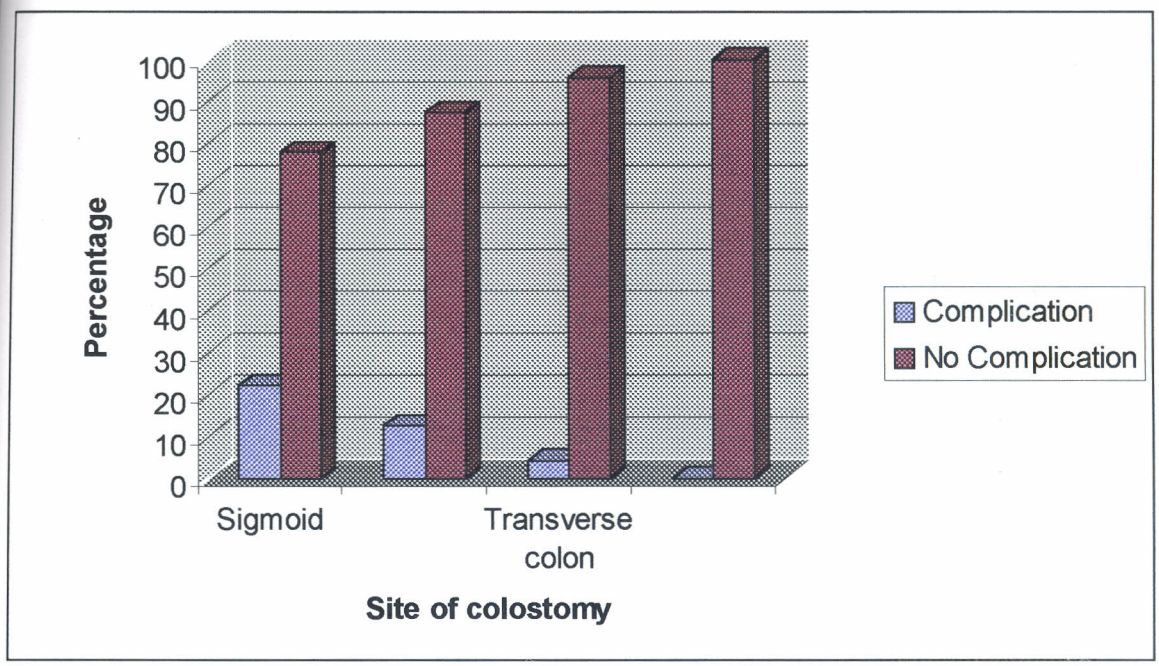
Forty patients had colon injury of which 5 (12.5%) developed early complications, 43 patients had colon obstruction of which 8 (18.6%) developed early complications and 2 patients who had other indications for colostomy developed no complications. This was not statistically significant. (P>0.05).

13. Association between site of Colostomy and Development of Early Complications

Table 13 – Site of colostomy and early complications

Site	Complication	No complication	Total
Sigmoid	11 (22%)	39 (78%)	50
Descending colon	1 (12.5%)	7 (87.5%)	8
Transverse colon	1 (4.2%)	23 (95.8%)	24
Caecum	0	3 (100%)	3
Total	13	72	85

Figure 12 – Site of colostomy and early complications



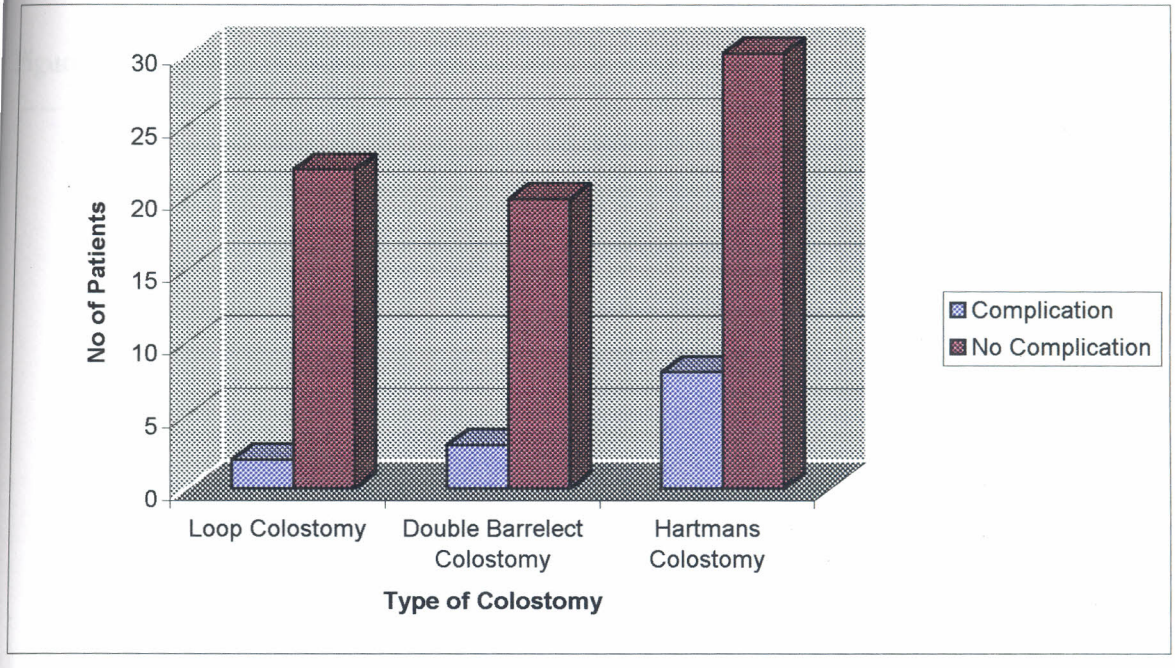
Fifty patients had their colostomies sited at the sigmoid colon of which 11 (22%) developed early complications, 8 patients had their colostomy at the descending colon of which one (12.5%) developed early complications and 24 patients had their colostomies at the transverse colon of which one (4.2%) developed early complications. None of the 3 patients who had caecostomies developed early complications. This was not statistically significant. ($P>0.05$).

14. Association between type of Colostomy and Development of Early Complications

Table 14 – Type of colostomy and early complications

Type	Complications	No complications	Total
Loop colostomy	2 (8.3%)	22 (91.7%)	24
Double barrelled colostomy	3 (13%)	20 (87%)	23
Hartman's colostomy	8 (21.1%)	30 (78.9%)	38
Total	13 (15.3%)	72 (84.7%)	85

Figure 13 – Type of colostomy and early complications



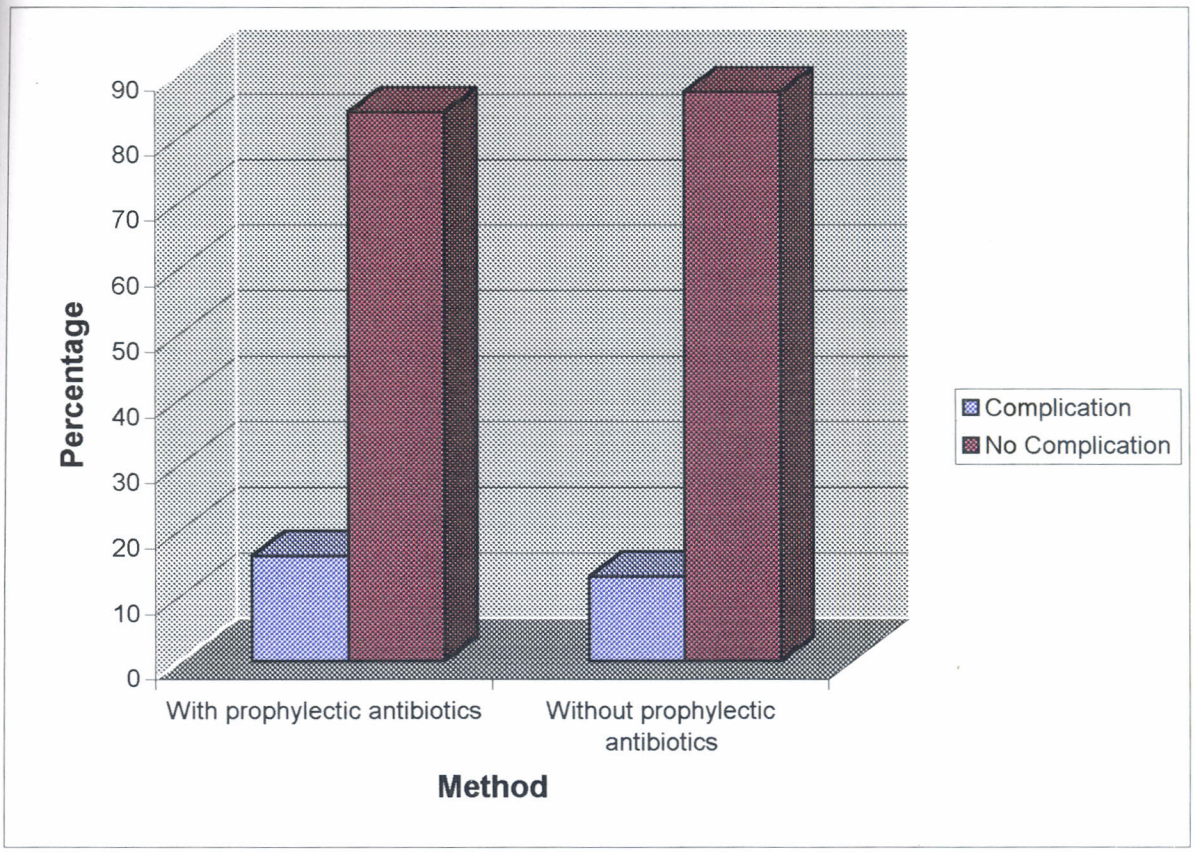
Thirty eight patients had Hartman's colostomy of which 8 (21.1%) developed early complications, 23 patients had double barrelled colostomy of which 3 (13%) developed early complications and 24 patients had loop colostomy of which 2 (8.3%) developed early complications. This was not satisfactorily significant. (P>0.05).

15. Association between Method of Bowel Preparation and the Development of Early Complications

Table 15 – Method of bowel preparation and early complications

Method	Complications	No complications	Total
With prophylactic systemic antibiotics	10 (16.1%)	52 (83.9%)	62
Without prophylactic systemic antibiotics	3 (13%)	20 (87%)	23
Total	13 (15.3%)	72 (84.7%)	85

Figure 14 – Method of bowel preparation and early complications



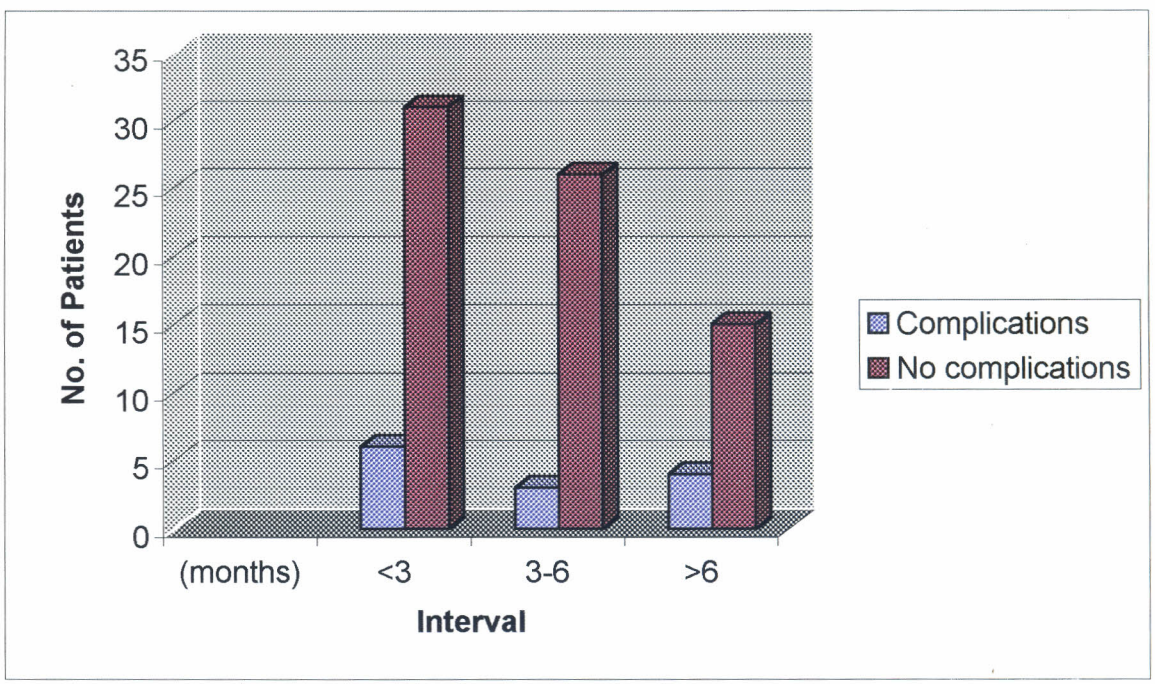
Sixty-two patients had mechanical bowel preparation with prophylactic systemic antibiotics of which 10 (16.1%) developed early complications and 23 patients had mechanical bowel preparation without prophylactic systemic antibiotics of which 3 (13%) developed early complications. This was not statistically significant. (P>0.05).

16. Association between Interval of creation and closure of colostomy and development of early complications

Table 16 – Interval between creation and closure of colostomy and early complications

Interval	Complications	No complications	Total
Months			
<3	6 (16.2%)	31 (83.8%)	37 (43.5%)
3 - 6	0	26 (89.7%)	29 (34.1%)
>6	4 (21.1%)	15 (78.9%)	19 (22.4%)
Total	13	72	85

Figure 15 – Interval between creation and closure of colostomy and early complications



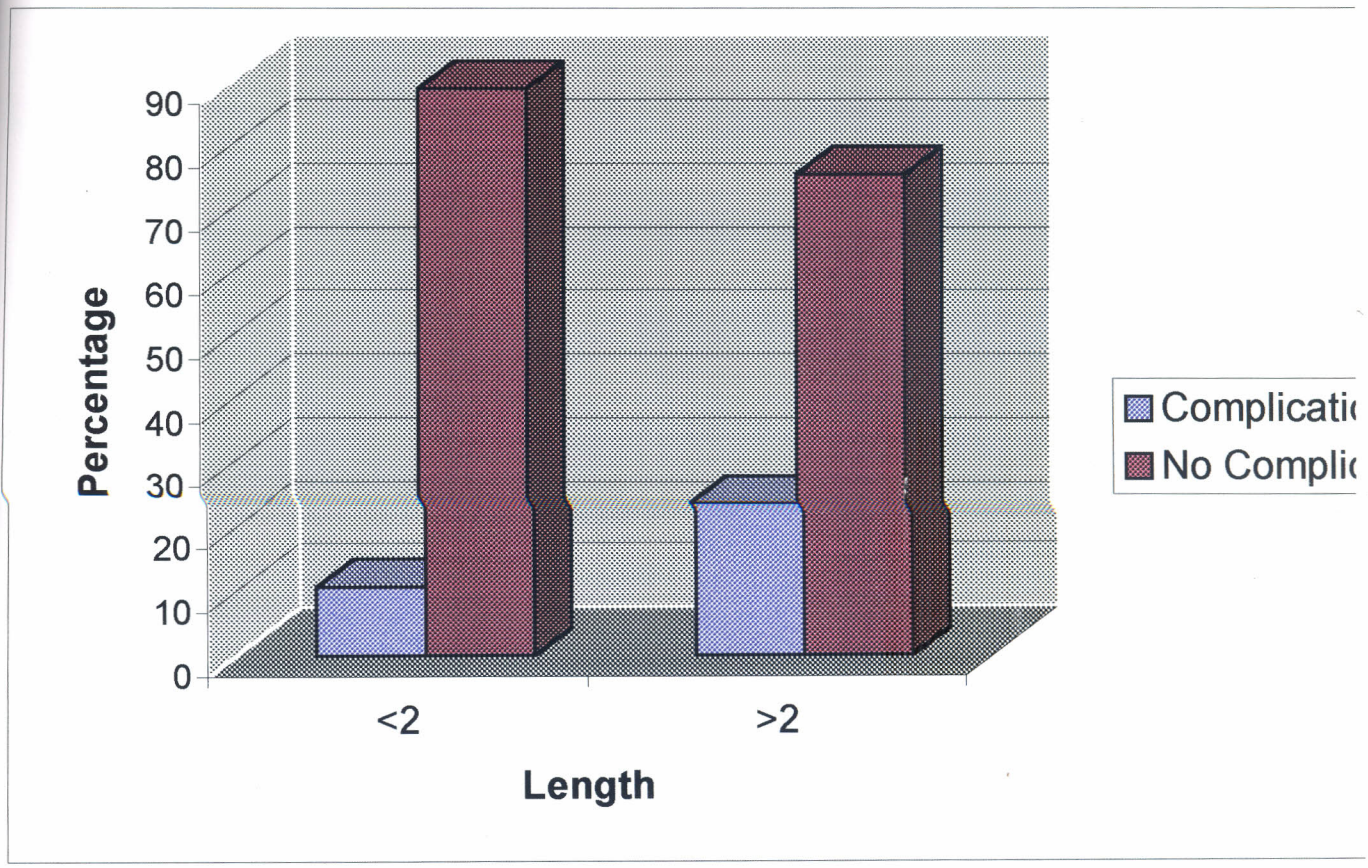
Thirty seven patients had their colostomies closed in less than three months of which 6 (16.2%) developed early complications, 29 colostomies were closed in 3-6 months of which 3 (10.3%) developed early complications and 19 colostomies were closed more than six months of which 4 (21.1%) developed early complications. This was not statistically significant. (P>0.05).

17. Association between Length of Surgery and Development of Early Complications

Table 17 – Length of surgery and early complications

Length (hours)	Complications	No complications	Total
<2	6 (10.7%)	50 (89.3%)	56
>2	7 (24.15%)	22 (76%)	29
Total	13 (15.3%)	72 (84.7%)	85

Figure 16 – Length of surgery and early complications



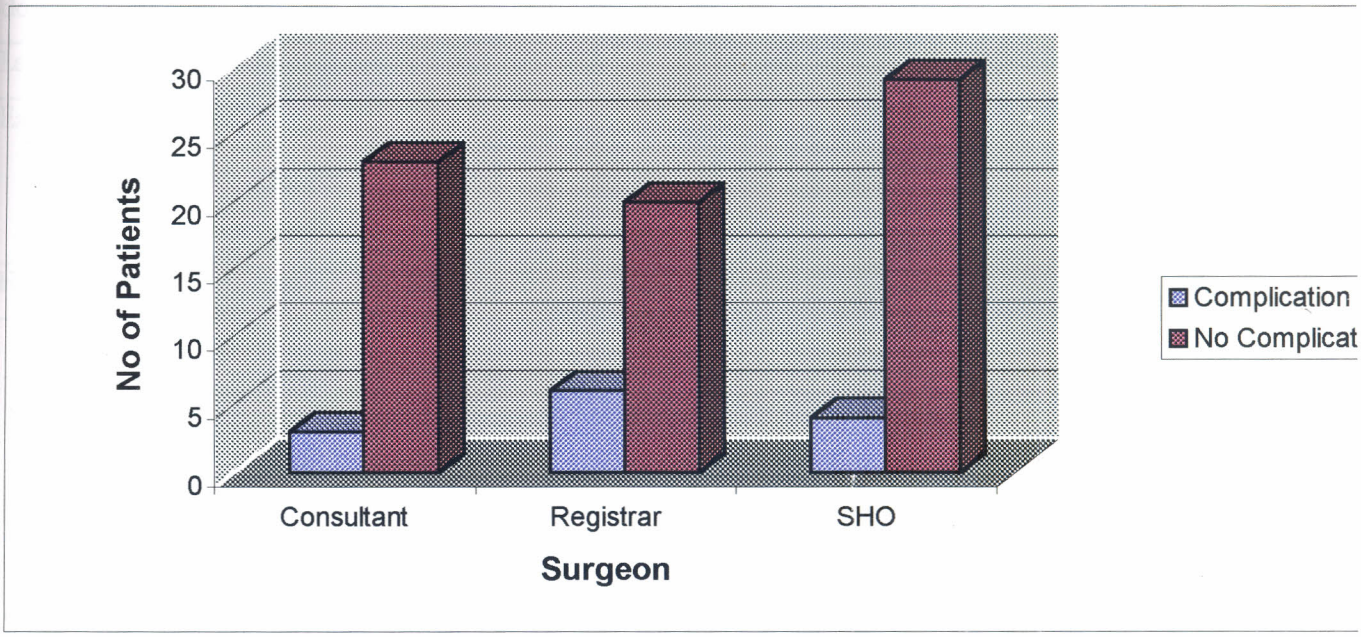
Fifty-six patients had their colostomies closed in less than two hours of which 6 (10.7%) developed early complications and 29 patients had their colostomies closed in more than two hours of which 7 (24%) developed early complications. This was not statistically significant. (P>0.05)

18. Association between Qualification of Surgeon and Early Complications

Table 18 – Qualification of surgeon and early complications

rgeon	Complications	No complication	Total
nsultant	3 (11.5%)	23 (88.5%)	26
egistrar	6 (23.1%)	20 (76.9%)	26
HO	4 (12.1%)	29 (87.9%)	33
otal	13 (15.3%)	72 (84.7%)	85

Figure 17 – Qualification of surgeon and early complication



Twenty six patients were operated by consultants of which 3 (11.5%) developed early complications, 26 patients were operated by Registrars of which 6 (23.11%) developed early complications and 33 patients were operated by SHOs of which 4 (12.1%) developed early complications. This was not statistically significant. (P>0.05).

9. Summary of the results of colostomy closure

There is no significant difference in the pattern of results in the two groups

Table 19 a – Demographic pattern of patients in the study

VARIABLES	PROSPECTIVE GROUP	RETROSPECTIVE GROUP	P VALUE
Age (Years)	34 (15 – 85)	35 (16 – 87)	>0.05
Sex (M: F)	5:1	4.3:1	>0.05
Interval between creation and closure (months)	7.6 (0.82-91)	5.3 (0.79-29)	>0.05
Length of surgery (minutes)	106.1 (55-180)	114.9(40-260)	>0.05
Early complications ➢ Wound infection ➢ Enterocutaneous fistula	16.7% 13.4% 3.3%	15.3% 11.8% 3.5%	>0.05
Hospital stay (days)	7.1 (2-18)	9.8 (4-61)	>0.05

Table 19b – Association between risk factors and development of early complications

VARIABLE	PROSPECTIVE % COMPLICATION	RETROSPECTIVE % COMPLICATION	P VALUE
Indication for colostomy			>0.05
➢ Colon injury	14.2	12.5	
➢ Colon obstruction	25	18.6	
➢ Others	0	0	
Type of colostomy			>0.05
➢ Loop	0	8.3	
➢ Double barrelled	9.1	13	
➢ Hartman's	26.7	21.1	
Site of colostomy			>0.05
➢ Sigmoid colon	19	22	
➢ Transverse colon	0	12.5	
➢ Ascending colon	14.3	4.2	
Method of Bowel preparation			>0.05
➢ With prophylactic antibiotics	15.3	16.1	
➢ Without prophylactic antibiotics	18.2	13.0	
Interval of creation and closure (months)			>0.05
➢ <3	27.3	16.2	
➢ 3-6	7.7	10.3	
➢ >6	16.7	21.1	
Length of surgery (Hours)			>0.05
➢ < 2 hours	10	10.7	
➢ > 2 hours	30	24.0	
Qualification of Surgeon			>0.05
➢ Consultant	18.2	11.5	
➢ Registrar	23.1	23.1	
➢ SHO	0	12.1	

DISCUSSION

The average hospital stay for the patients in the prospective group was 7.1 days (range, 2-18 days) and 9.8 days (range, 4-61 days) in the retrospective group. This was similar to study done by Sola and colleagues (61) where average length of hospital stay was 10.4 days.

The patients who underwent colostomy closure ranged in age from 15 to 85 (mean, 34) years and 16 to 87 (mean, 35) years in the prospective and retrospective groups respectively. The peak age of colostomy closure in both groups was 20 to 30 years. A similar pattern was reported by Otele (30), Khoury et at (63) and Sola et al (61). There were more males than females in the study with a male to female ratio of 5:1 in the prospective group and 4.3.1 in the retrospective group.

The rate of developing early complications was 16.7% (n=5) and 15.3% (n=13) in the prospective and retrospective groups respectively. There was no death during the study period. The pattern of early complications was similar in both groups. Wound infection accounted for 13.4% (n=4) and 11.8% (n=10) and enterocutaneous fistula accounted for 3.3 (n=1) and 3.5% (n=2) in the prospective and retrospective groups respectively. A number of studies have shown a similar pattern of early complications (30,44,48-58). Due to the high rate of wound infection in this study, other methods of wound management i.e. primary closure with subcutaneous drains and delayed primary closure may be attempted. Some studies (45, 61) have shown that delayed primary closure of wounds was associated with fewer complications. While other studies (44,62) have shown that there was no difference in wound infection in patients who had primary closure, primary closure with subcutaneous drains and delayed primary closure.

The common indications for colostomy closure in this study were colon injury and colon obstruction accounting for more than 85% of the patients. In the prospective group fourteen patients (46.7%) had colon injury, out of which 2 (14.3%) developed early complications. Twelve patients (39.9%) had colon obstruction of which 3 (25%) had early complications. In the retrospective group 43 patients (50.6%) had colon obstruction out of which 8 (18.6%) developed early complications. Forty patients (47.1%) had colon injury of which 5 (12.5%) developed early complications. Eighty percent of the patients with colon obstruction had sigmoid volvulus. Sixty percent of the patients with early complications had colon obstruction. This was not statistically significant. Similar results were observed by Foster and colleagues (64). Colon injury has surpassed colon obstruction as the commonest indication of colostomy in the prospective

group. This could be due to an increase in crime and violence in society. Colostomy closure after trauma is associated with significant morbidity. The high morbidity necessitates the use of primary repair of colon injury for selected patients. Majority of the patients with sigmoid volvulus had Hartman's colostomy that was associated with higher morbidity. This brings into perspective the role of other types of colostomies e.g. double-barrelled colostomy or resection of the redundant loop and primary anastomosis.

The commonest type of colostomy fashioned was Hartman's colostomy. Fifty percent and 44.7% of the patients in the prospective and retrospective groups respectively had Hartman's colostomy. Four out of five patients in the prospective group and 8 out of 13 patients in the retrospective group who developed early complications had Hartman's colostomy. One out of five patients in the prospective group and 3 out of 13 in the retrospective group who developed early complications had double barrelled colostomy. Two out of 13 patients in the retrospective group and none in the prospective group who developed early complications had loop colostomy. Therefore Hartman's colostomy was associated with a higher complication rate followed by double-barrelled colostomy. Loop colostomy was associated with lower complication rate. This was not statistically significant. A number of studies concur with these findings (65,66). Majority of the loop and double-barrelled colostomies were closed in less than 2 hours. Most of the Hartman's colostomies were closed in more than 2 hours. Reversal of Hartman's colostomy is technically difficult due to extensive local adhesions. Both a stomal and midline/paramedian wounds were created leading to a longer operating time and increased blood loss. Most colostomies at the Kenyatta National Hospital are fashioned by SHOs.

Majority of the patients had their colostomies sited at the sigmoid colon, followed by the transverse colon. Few patients had their colostomies sited at the descending colon. Three patients had caecostomies in the retrospective group. Eighty percent or more of the patients with early complications had their colostomies sited at the sigmoid colon. The patients who had caecostomies developed no complications. The trend noticed is that the rate of early complications was lower in colostomies sited at the proximal colon and higher in those sited at the distal colon. This was not statistically significant. Similar results were observed by Berne et al (66)

The mean time interval from creation to closure of colostomy was 7.6 (range, 0.82 to 91) months in the prospective group and 5.3 (0.79 to 29) months in the retrospective group. In the

prospective group, 1 of 13 colostomies (7.7%) closed in 3 – 6 months, 3 of 11 colostomies (27.3%) closed in less than 3 months and 1 of 6 colostomies (16.7%) closed in more than 6 months developed early complications. In the retrospective group, 6 of 37 colostomies (16.2%) closed in less than 3 months, 3 of 29 colostomies (10.3%) closed in 3 – 6 months and 4 of 19 colostomies (21.1%) closed in more than 6 months developed early complications. There is a delay in the interval of time between creation and closure of colostomy in the prospective group. This is in contrast with findings by Otele (30) where reversal of 71% of the stomas occurred after 6 months. Colostomy closed in less than 3 months after creation had a higher rate of complication followed closely by those closed in more than 6 months. Colostomies closed in 3 – 6 months after creation had a lower complication rate. This was not statistically significant ($P>0.05$). A number of studies have shown that colostomies closed in 3 – 6 months had lower complication ratio (30,65,66). The optimal timing for colostomy closure in this study was 3-6 months. Colostomies fashioned for trauma to the colon may be reversed after four weeks. If reversal of colostomy was done earlier than four weeks the risk of anastomotic breakdown is high due to oedema and inflammation at the site. Those reversed after six months, the stoma gets firmly adherent to the site due to fibrosis.

There has been no standard protocol at the Kenyatta National Hospital on the use of prophylactic systemic antibiotics. Intravenous crystalline penicillin, gentamycin and metronidazole were given at induction of anaesthesia as prophylactic antibiotics. All patients in the study had mechanical bowel preparation. Sixty three point three percent of patients in the prospective group and 73% in the retrospective group received prophylactic systemic antibiotics. There was no significant difference in the rate of complication in patients who had prophylactic systemic antibiotics and those who did not. A number of studies have shown similar results (29,37). Oluwole and associates (22) and Smit and colleagues (23) found that patients who had mechanical bowel preparation with prophylactic systemic antibiotics had lower complication rates.

Majority of the patients (66%) had their colostomies closed in less than 2 hours. In the prospective group, 2 of 20 patients (10%) whose operation lasted less than 2 hours and 3 of 10 patients (30%) whose operation lasted more than 2 hours developed early complications. In the retrospective group, 6 of 56 patients (10.7%) whose operation lasted less than 2 hours and 7 of 29 (24%) patients whose operation lasted more than 2 hours developed early complications. Therefore operative time more than 2 hours was associated with higher rate of early

complication. This was not statistically significant (P>0.05). Berne et al (66) concur with this finding.

Qualification of the surgeon was also looked at. In the prospective group, three of thirteen patients (23.1%) operated by Registrars and 2 of 11 of patients (18.2%) operated by consultants developed early complications. Six patients operated by SHOs did not develop complications. In the retrospective group, 4 of 33 patients (12.1%) operated by SHOs, 3 of 26 patients (11.5%) operated by consultants and 6 of 26 patients (23.1%) operated by Registrars developed early complications. Registrars operated majority of the patients who developed early complications. This was not statistically significant (P>0.05). It is surprising that the colostomies closed by SHOs were associated with fewer complications than those closed by Registrars, as one would expect the opposite. This could be due to the fact that Registrars and Consultants closed the technically more difficult Hartman's colostomies and SHOs closed loop or double-barrelled colostomies.

All patients had intraperitoneal closure of the colostomy. Ninety six point seven percent in the prospective group and 91.8% in the retrospective group had two-layer anastomosis of the colon. In all the patients vicryl was the suture material used in anastomosis of this colon. All patients had primary wound closure. Single layer anastomosis of the colon is not commonly done at the Kenyatta National Hospital.

Conclusion

Majority of the patients who underwent colostomy closure were less than forty years with a male preponderance. The rates of early complications were high with wound infection as the commonest complication. The study also shows that the common indications for colostomy were colon injury and colon obstruction. The commonest type of colostomy was of the Hartman's type. Most of the patients had their colostomies sited at the sigmoid colon.

Mean time from creation to closure was six and a half months. Colostomies closed in 3-6 months had lower rates of complications. Majority of the patients had mechanical bowel preparation and prophylactic systemic antibiotics. Majority of the patients had their colostomies closed in less than two hours.

There was an increase in rate of early complications in patients who had colon obstruction; Hartman's colostomy, those who had their colostomies sited at the sigmoid colon, patients whose operation lasted more than two hours and patients operated by the Registrars. However, this was not found to be statistically significant.

RECOMMENDATION

1) The optimum time for colostomy closure is between 3-6 months after creation
2) Hartman's colostomies should be created if indicated, but when a choice exists, loop colostomies and double barrelled colostomies are preferable
3) A larger prospective study over a longer period is recommended

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APPENDIX I

Data Collection for:

Early complications of colostomy closure

PROFORMA QUESTIONNAIRE

COLOSTOMY CLOSURE

1. PATIENT PROFILE

NAME: _____

AGE: _____

SEX: MALE_____ FEMALE_____

IP. NO: _____

DATE OF BIRTH_____

DATE OF COLOSTOMY CREATION: _____

DATE OF COLOSTOMY CLOSURE: _____

DATE OF DISCHARGE: _____

2. INDICATION FOR COLOSTOMY

a) Colonic injury_____

b) Colon obstruction

- Neoplasm_____
- Sigmoid volvulus_____
- Intussuception_____
- Others (specify)_____

c) Inflammatory bowel disease_____

d) Others (specify)_____

3. TYPE AND SITE OF COLOSTOMY

- Loop colostomy_____
- End colostomy_____

  (Hartman's operation)
- Double – barrelled colostomy_____
- Site of colostomy

- Sigmoid colon_____
- Descending colon_____
- Transverse colon_____
- Ascending colon_____

4. BOWEL PREPARATION

- Mechanical

  -Dietary restriction_____

  --Lavage_____

- Oral non absorbable antibiotics

  -Neomycin_____

  -Erythromycin_____

  -Metronidazole_____

- Prophylactic systemic antibiotics_____

5. INVESTIGATIONS

PRE-OPERATIVE

HB_____

WBC count_____

U/E + creatinine_____

Ba Enema_____

Sigmoidoscopy_____

6. METHOD OF INTESTINAL CONTINUITY

a) Length of surgery in minutes_____

b) Qualification of the surgeon

- Consultant_____
- Registrar_____
- SHO_____

c) Type of closure

- Single layer anastomosis_____
- Two-layer anastomosis_____
- Extraperitonial_____
- Intraperitoneal_____

- Type of suture

d) Wound management
   - Primary wound closure
   - Delayed wound closure

7. Outcome of colostomy closure (Early Complications)

- Pnuemonia_____
- Peritonitis_____
- Enterocutaneous Fistulae_____
- Death_____
- Others_____

8. Management of complications

- Conservation_____
- Surgical_____
- Others (Specify)_____

APPENDIX 2

Consent Form

This is to certify that my participation in this study of colostomy closure is entirely voluntary. I understand that participation or otherwise in this study will not adversely affect my medical care, and that I can withdraw from the study at anytime, again without adverse consequences. The information obtained in this study will be confidential and used for research purpose. My identity will be kept confidential in so far as the law allows. If I agree to participate the following things will happen:

- I will answer some questions about my medical history
- I will have an ordinary physical examination
- I will have bowel preparation for the operation and I understand that the operation may be associated with complications.

Patient Signature_____

Date_____

Investigator's Signature_____

Date_____

Contact number_____

Tel: 726300 - 19
726550 - 9
726562 - 6
726450 - 9
726581 - 2
Fax: 725272

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Ref: KNH-ERC/01/1380

13 June 2002

Dr. Mohamed A. Sheikh
Dept. of Surgery
Faculty of Medicine
University of Nairobi

Dear Dr. Mohamed,

RESEARCH PROPOSAL "COLOSTOMY CLOSURE AS SEEN AT KENYATTA NATIONAL HOSPITAL: BOTH RETROSPECTIVE AND PROSPECTIVE STUDY" (P122/11/2001)

This is to inform you that the Kenyatta National Hospital Ethical and Research Committee has reviewed and **approved** the revised version of your above cited research proposal.

On behalf of the Committee I wish you fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of data base that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Thank you.

Yours faithfully,

PROF. A.N. GUANTAI
SECRETARY, KNH-ERC

c.c. Prof. K.M. Bhatt,
Chairman, KNH-ERC,
Dept. of Medicine, UON.

Deputy Director (CS),
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