

A Study of Complications Related With Colostomy Closure

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Objective: To determine the complications associated with colostomy closure following a suggested protocol and then compare the incidence with recent reported literature and to suggest measures for reduction of morbidity and mortality associated with colostomy closure. **Study design:** This study is based on a review of all the patients undergoing colostomy closure from August 1995 to September 1997 in East Surgical Ward, Mayo Hospital, Lahore. **Material and methods:** This prospective clinical study was carried out in the East Surgical Ward, Mayo Hospital, Lahore. A total of 32 patients belong to either sex who underwent colostomy closure following emergency colostomy were included in this study. Patients under 12 years of age were not included as these were managed in Paediatric Surgery Department of Mayo Hospital, Lahore. Time interval between construction and closure of colostomy was three months and all the patients were fit for anaesthesia. Pre-operative barium enema was done prior to admission to check any distal pathology like stricture or leakage. In only two cases strictures were found, and these patients were excluded from study. All patients were admitted through the outpatient department three days before operation, and a special proforma was filled for each patient. A detailed history was taken to find the time and indication for colostomy. A short note was made about the state of other injuries and site of colostomy. A thorough examination was performed to find the state of colostomy, type of colostomy and fitness of the patient. **Results:** A total of 32 patients were included in this study. Of these 26(81.2%) were male and 6 (18.7%) patients were female. 21(65.6%) were with loop colostomy, 7(21.8%) end colostomy with mucus fistula and 4(12.5%) were with end colostomy with Hartmann's pouch. Penetrating injury of the colons is the most common etiology for colostomy at the initial operation. 15(46.8%) were made in the transverse colon, 13(40.6%) were made in the left colon and 4(12.5%) were made in the right colon. **Conclusion:** It has been concluded in this study that the most common indication for colostomy construction in Pakistan is the penetrating injury of abdomen. Young males are more commonly suffered from firearm injuries of abdomen. Loopogram should be done before colostomy closure especially in non-traumatic cases.

Key words: Colostomy, complications

An intestinal stoma is a surgically created opening of the bowel onto the body surface¹. It may be necessitated by a variety of causes like carcinoma, iatrogenic perforations, diverticulitis, volvulus of sigmoid colon, and trauma to colon¹². Traditionally, it was considered to be the safest method of treatment of colon injuries, and was practiced as a routine in World War-II, Korean and Vietnam Wars^{2,3,4}.

Due to increased incidence of civilian violence, now most of the colonic injuries are due to high velocity missiles (gunshot) leading to extensive colonic damage, gross faecal contamination, multiple visceral injuries and hypovolaemic shock. In these conditions primary repair of colon is considered unsafe, and diverting colostomy is made to reduce the morbidity and mortality^{5,6,13}.

Subsequent closure of colostomy is however not free from complications. These include faecal fistula, wound infection, colonic stenosis, anastomotic leakage, anastomotic bleeding, intra-abdominal abscesses and diversion colitis^{7,8,13}.

According to various studies these complications are related to the age of the patient, timing of colostomy closure, preoperative barium studies and bowel preparation, technique of colostomy closure.

In the light of these various studies, a protocol for colostomy closure was devised to minimise the complications of colostomy closure.

This study was proposed to evaluate the safety and effectiveness of this suggested protocol.

Purpose of study

1. To determine the complications associated with colostomy closure following a suggested protocol and then compare the incidence with recent reported literature.
2. To suggest measures for reduction of morbidity and mortality associated with colostomy closure.

Study design:

This study is based on a review of all the patients undergoing colostomy closure from August 1995 to September 1997 in East Surgical Ward, Mayo Hospital, Lahore, a teaching hospital which is attached with King Edward Medical College, Lahore where facilities for postgraduate training are available.

Material and methods:

1. This prospective clinical study was carried out in the East Surgical ward, Mayo Hospital, Lahore.
2. A total of 32 patients belong to either sex who underwent colostomy closure following emergency colostomy were included in this study. Patients under 12 years of age were not included as these were managed in Paediatric Surgery Department of Mayo Hospital, Lahore.
3. Time interval between construction and closure of colostomy was three months and all the patients were fit for anaesthesia.

4. Pre-operative barium enema was done prior to admission to check any distal pathology like stricture or leakage. In only two cases strictures were found, and these patients were excluded from study.
5. All patients were admitted through the outpatient department three days before operation, and a special proforma was filled for each patient. A detailed history was taken to find the time and indication for colostomy. A short note was made about the state of other injuries and site of colostomy. A thorough examination was performed to find the state of colostomy, type of colostomy and fitness of the patient.
6. Following laboratory and radiological investigations were carried out urine C/e, blood sugar, urea, creatinine and serum electrolytes.
7. Pre-operative bowel preparation was done
8. Systemic antibiotics were started 12 hours before operation
9. Vicryl (poly-glactin) 2/0 on round body was used for both layers of anastomosis.
10. Nelton tube drain No.28 was placed in proximity to anastomosis and removed when it had served its purpose.
11. Musculoaponeurotic layer was closed with Prolene (poly propylene) No.1 on round body by continuous stitches.
12. Skin along with subcutaneous tissues of stoma wounds were left open and closed days later under local anaesthesia.
13. Patients were kept on intravenous fluids for 4-5 days postoperatively while oral intake was not allowed.
14. Daily progress including pulse, temperature, respiratory rate, blood pressure, bowel sounds, and any complication was noted.
15. Patients were discharged from the hospital, when they started oral intake, wound closed and there was no complication. The hospital stay was recorded.

Results:

A total of 32 patients were included in this study. Of these 26(81.2%) were male and 6 (18.7%) patients were female. Age of the patients ranged from 14 to 75 years with 26 patients below 40 and 6 patients above 40 years. Total patients of study were 32, out of which 21(65.6%) were with loop colostomy, 7(21.8%) end colostomy with mucus fistula and 4(12.5%) were with end colostomy with Hartmann's pouch. Total patients were 32; out of which the penetrating injury of the colons is the most common etiology for colostomy at the initial operation.

Total colostomies were 32; out of which 15(46.8%) were made in the transverse colon, 13(40.6%) were made in the left colon and 4(12.5%) were made in the right colon.

We have done barium enema in all cases, and in only two cases of old anorectal sepsis, stenosis of distal end was found and were not included in 32 colostomies.

One wound infection (3.1%), and one anastomotic leak (3.1%) were occurred, out of 32 cases.

In 32 patients study, these were 26 patients were below 40 years, with no complication, while 6 patients were above 40 years with two complication (33.3%). A total of 21 loop colostomies (65.5%) were closed, out of which 13(61%) were closed by simple transverse closure, and 8(38%) were closed by resection and anastomosis. There was no complication in both types of procedure. Traumatic cases were 25 with no complication, while non traumatic were 7 with 2 complications (28.5%)

Table: Colostomy Closure Morbidity Comparison With Other studies

References	No. of patients	Morbidity (%)
Mileski et al ¹⁶²	93	16.1
Garnjobst et al ¹³⁶	125	5.6
Knox et al ¹⁴⁹	179	33
Finch ¹³¹	213	35
Dolan et al ¹³⁸	118	22
Parks and Hastings ⁹¹	83	41
Demetriades et al ⁹⁸	110	14.5
Mahmood T et al ¹³	48	8.3
Present study	32	6.2

Discussion:

The incidence of colonic injuries is on the increase and is a clinical problem of paramount importance with regard to its management. The ability to safely repair colonic injuries, primarily stab wounds and low-velocity gunshot wounds is reported to vary between 20 and 66 percent^{14,15,16}.

This wide variance in the use of primary closure versus colostomy is undoubtedly due to several factors, which are following.

1. Pre operative shock (Blood pressure less than 80/60mmHg).
2. More than 1000ml of intraperitoneal haemorrhage.
3. More than two intra-abdominal organ system injured.
4. Significant faecal peritoneal contamination.
5. FDelays in treatment (more than 8 hours after injury).
6. Colon wound so destructive as to require resection.
7. Major loss of abdominal wall substance or the need of mesh for repair¹⁷.

Although each of them can be challenged for its credibility, but in our setup, these are valid reasons for creating a colostomy¹⁸.

Proponents of primary repair often quote the reported excessive morbidity associated with the creation and closure of a colostomy to justify their point of view. We have increasingly used primary repair but continue to believe that patients with complex colon injuries are more appropriately treated by colostomy¹⁹.

Subsequent closure of colostomy is however not free from morbidity and mortality according to Fiuch was 35%, Parks and Hastings 41%, a Knox et al was 33%. The overall morbidity of our study is 6.2%. This difference of morbidity is due to the difference of reasons for colostomy construction. In the West, most of the colostomies were constructed for non-traumatic causes, while in our country trauma is the most common cause. That is why, our morbidity rate of 6.2% is comparable to one local study (8.3%)¹³.

The records of two patients who had early postoperative complications were carefully analyzed in an attempt to delineate their cause. One patient whose skin was left open developed a fascial infection unassociated with a colon leak for which no obvious cause was identified. One old patient developed anastomotic leakage after closure of end colostomy with mucus fistula. The procedure was done by a resident medical officer and was probably due to some technical errors.

There was no anastomotic stenosis, anastomotic bleeding, intra-abdominal abscesses, or extra abdominal complications. The average hospital stay of the patients was 10 days. The mortality rate was zero percent. The mortality of colostomy closure ranges from 0 to 4% according to various studies^{20,21}. This is comparable to our study.

As the mortality and morbidity of colostomy closure is related with further our results in relation to these factors.

1. Age

Garber et al found 24% complications of the patients were less than 40 years and 45% if greater than 50 years. Demetriades et al²² in a study of 110 patients found a complication rate of 14.6% for patients under 50 years of age and 21.4% for those over 50 years of age. Wong et al²³ has described increased morbidity in patients 70 years or older as compared to below 70 years (15% versus 5%) in his study of three hundred seven cases. Mileski et al²⁴ also described increased morbidity in older patients which attributed to hypoalbuminaemia and diabetes mellitus in his 93 consecutive colostomy closures. In our prospective study of 32 cases, 26 patients were below 40 years while 6 patients were above 40 years. There was no complication in patients below 40 years, as compared to 33.3% in patients above 40 years. These results correlate with above mentioned results.

2. Timing of Colostomy Closure

A very important issue is the timing of colostomy closure. Demetriades et al²² found morbidity rate of 15% for closures within 1 to 2 months of the initial operation; 10% for those within 2 to 3 months, 16% for those after 3 months in his study of 110 patients. Machiedo et al²⁵ showed that patients whose colostomies were closed less than 6 weeks after their initial injury had increased morbidity and were judged to have a more difficult operation. Salley et al found a significantly increased

incidence of major morbidity and septic complications in colostomies closed at an interval of less than 8.5 weeks from formation. Sola et al²⁶, also described increased morbidity in patients who underwent closure earlier than 3 months after injury particularly those who had complications at their initial hospitalization. According to Parks and Hastings²⁷, the major factor affecting the complication rate was the time interval from creation of colostomy to its closure. They found that those patients who underwent closure after a 90 days interval had a lower overall complication rate than comparison groups with less than 30 days interval and 30 to 90 days interval. Garber et al¹¹ showed zero complication after two months interval from construction. Henry and Everett²⁸ advised waiting for 6 weeks. Livingstone et al²⁹ closed 121 colostomies. The time interval between colostomy creation and take down ranged from 18 to 582 days (mean 122 days). Although they could not demonstrate a difference in the complication rate respective to the timing of operation but they believed that if the first operation was complicated by severe intra-abdominal sepsis or major wound problem, 6 months probably should ensue before attempting closure of the colostomy. Freund et al¹², favoured three months waiting, while Pittman and Smith³⁰ advised two to three months.

Our decision to close the colostomy after three months was based on the results of above mentioned studies. The rationale behind closure after the months is based on several advantages quoted in these comparative studies, which are following:

- Dissection of the tissues is simple
- Blood loss and injury to adjacent structures minimized.
- Tissues for anastomosis are healthy and free of fibrosis or oedema with a diminished likelihood of anastomotic complication.
- Nutritional status of the patients can be improved.
- and the effects of complications at the initial operation will be minimized during that period.

3. Barium Enema Studies

Before closure healing of the distal gut is usually confirmed by barium studies. However, Sola et al²⁶ and Severson et al³¹, feel that barium enema prior to colostomy closure yields little useful information and does not affect morbidity rate. Mahmood et al¹³ did barium studies before colostomy closure in all cases and found no abnormality

We have done barium studies in all cases and found distal rectal stenosis in two cases of anorectal sepsis and were excluded from colostomy closure group. Our results regarding traumatic cases are similar to these studies, however our experience with non-traumatic cases was different where we found abnormalities (rectal stenosis) in two out of nine patients. Therefore in this study the

usefulness of precolostomy closure barium enema is supported especially in non-traumatic cases.

4. Pre-Operative Bowel Preparation

To achieve optimal results after colostomy closure a similar degree of care should be exercised regarding bowel preparation as carried out for colectomy and anastomosis. The objective of bowel preparation is to reduce the amount of faeces and hence the concentration of micro-organisms within the colon.

The number of micro-organisms present in the colon can be reduced by antibiotics. These micro-organisms are both aerobic and anaerobic and are responsible for postoperative sepsis. Systemic antibiotic therapy is more effective than oral antibiotic therapy in this regard.

We have used oral sodium picosulphate solution (picolax), saline enema and systemic antibiotics against aerobes and anaerobes. This regimen favoured by most of the international studies^{32,33,34}. This regimen was found to be quite tolerable in all the patients. There was no vomiting, abdominal fullness, cramps, fluid electrolyte imbalance or dehydration. It was also found to be less expensive. This is similar to international studies.

At the time of surgery the gut was found absolutely clean with no faecal content. Our wound infection rate was 3.1%, which differs from a local study by Mahmood et al¹³, in which the wound infection rate was 6.2%. They used 10% mannitol bowel preparation plus Cephaloridine, Gentamicin and Metronidazole. Out of their 48 patient 5 did not tolerate 10% mannitol while in our study no patient was intolerable. Further his regimen was expensive as compared to our regimen of preoperative bowel preparation. In the Western countries, the increased use of outpatient preoperative bowel preparation has significantly reduced the hospital stay^{35,36}. But in our set up this is not feasible most probably due to poor education.

5. Types of Colostomy

In our prospective study out of a total of 32 cases, we closed 21 loop colostomies, and 11 end colostomies with mucus fistula or Hartmann's pouch.

The morbidity rate of loop colostomy was zero percent while that of end colostomies was 18.1%. thus loop colostomies appear to have fewer complications than end colostomies. This is similar to international study.

Wong et al²³ found increased morbidity in end colostomy as compared to loop colostomy (10% versus 2%). Vpm-Flue et al²⁰, analyzed 43 patients who underwent colostomy closure after Hartmann's procedure and found 9% perioperative morbidity. Mileski et al²⁴, analyzed data from 93 consecutive colostomy closures of which 62 were loop and 31 were end colostomies. They found that closure of end colostomies took longer and was associated with more loss of blood than closure of loop colostomies. Furthermore, the identification of distal segment or short distal segment was associated with increased morbidity. Similar idea was shared by Yakimates³⁷ who found two anastomotic leak after closure of 71 loop colostomies and

Mahmood et al¹³ found one anastomotic stenosis after closure of 2 Hartmann's procedure. The only instance of anastomotic leak in the present study was encountered after closure of an end colostomy with mucus fistula. On this limited data was unable to draw any conclusion regarding the outcome related to the type of colostomy.

6. Site of Colostomy

In the present study 15 transverse 13 left colon, and 4 right colon colostomies were taken down with a percentage of 46.8%, 40.6% and 12.5% respectively.

The morbidity rate was 15% for left colon colostomies while that of right and transverse colostomies was zero percent.

Garber et al¹¹ in his study of 80 colostomy closures found that closure of left-sided colostomies was associated with a higher infectious complication rate as compared to transverse or right sided colostomies (26% versus 13%).

These results compare well with the results of our study. In contrast; Demetriades et al²² described that site of colostomy was not a significant risk factor. He found a morbidity rate of 17% for colostomies on the left side, 16.7% for transverse colostomies and 11.1% for colostomies on the right side.

7. Type of Initial Pathology

In our present study of 32 cases the reason for 25 colostomies (78%) was trauma, and rest of 7 colostomies were due to non-traumatic causes (21.8%). The incidence of complications was 0% for traumatic causes and 28.5% for non-traumatic causes. Thus closure of colostomy due to trauma has fewer complications as compared to non-traumatic colostomy closure. According to Demetriades et al²², the type of initial pathology did not influence the morbidity rate. He found 15% incidence of complications in trauma cases, and 16.6% in non-trauma cases. In contrast Miles and Greene³⁸, Pittman and Smith¹⁶⁵ found that patients with penetrating abdominal trauma and foreign body rectal perforations had fewer serious complications following colostomy closures than patients with diverticulitis, cancer, anorectal abscess or fistula because the complication due to initial disease will be added. Their idea favour our present prospective study.

8. Operative Technique

Adeyemo et al¹³⁵ describe 4.6% wound infection and 4.6% fecal fistula after closure of 43 colostomies by intraperitoneal methods, as compared to 10 to 21 percent by extraperitoneal method.

Yakimates³⁷ found minor complications after closure of 71 loop colostomies, while Livingstone et al²⁹ found a major morbidity of 4.9% after closure of 121 colostomies and Wong et al²³ described a morbidity rate of 9% after closure of 307 colostomies by intraperitoneal method of colostomy closure.

We have found a morbidity rate of 6.2% after closure of 32 colostomies, which is similar to above and other international studies^{9,12,42,43,10}.

9. Simple Closure of Loop Colostomy Vs Resection & end-to-end Anastomosis

In our consecutive prospective study of 32 cases, we have closed 13 loop colostomies (61%) by simple transverse closure technique, and 8 loop colostomies (38%) by resection and anastomosis with no morbidity difference. This is similar to a study done by Salley et al¹²⁸, but slightly against Beck and Conklin¹²⁷ study. They found a total postoperative complication rate of 9% with simple loop closure as compared to 24% for resection and anastomosis. In short, as far as the effect of surgical technique is concerned, we believe that it is less important when an experienced surgeon perform the procedure.

10. Drains

Freund et al¹², reported a 29% wound infection rate in drained wounds, and 18% in the undrained, while the Goldstein and Duff¹⁴⁴ found a complication rate of 23% when drains were used compared to 7% when they were not. Our results differ from these studies but are comparable to one local study¹³. We have used peri anastomotic drain and found no increased in morbidity due to drain.

11. Wound Closure

According to Garber et al¹¹, delayed primary closure or closure by secondary intention was associated with less wound morbidity than primary closure (10% Versus 17%), similar results were also obtained by Pittman and Smith⁴⁵.

Mahmood et al¹³ found 6.25% wound infection after delayed primary closure. Mileski et al¹⁶² found that primary closure of stoma wound had an infection rate of 9.1% and in delayed closure it was 5%. Our lower incidence of wound infection rate (3.1%) is attributed to delayed primary closure of wounds. This operation is shared by the results of one local and several international studies^{11,13,48,49}.

12. Hospital Stay:

Pittman and Smith⁴⁵ found average hospitalization 11.1 days for patients without complications, 15.5 days for those with wound infection, 18.5 days for patients with ileus, and 20.4 days for patient with anastomotic leaks.

Sola et al⁴² described an average hospital stay of 10.4 days in uncomplicated cases.

In the present study the average hospital stay was 10 days in uncomplicated cases, which is similar to these international studies. The hospital stay of one patient with wound infection was 13 days which is slightly less than Pittman and Smith study. The hospital stay of patient with anastomotic leakage was 23 days.

Conclusion:

1. It has been concluded in this study that the most common indication for colostomy construction in Pakistan is the penetrating injury of abdomen.
2. Loop colostomy is the most common type of colostomy.

3. Young males are more commonly suffered from firearm injuries of abdomen.
4. Loopogram should be done before colostomy closure especially in non-traumatic cases.
5. Preoperative bowel preparation by mechanical as well as by chemical method is mandatory for colostomy closure.
6. Picolax solution (Sodium Picosulphate) is cheap and highly tolerable. It produces no electrolyte abnormality or dehydration if Ringer's lactate is used along with oral Picolax Solution. It produces excellent mechanical preparation of the gut.
7. Intraperitoneal colostomy closure is safe for all types of colostomy.
8. There is no difference between simple transverse closure versus resection and anastomosis with regard to complications. Simple transverse closure, however is simple and rapid method for loop colostomies
9. All types of colostomy closures can safely be done after a period of three months from construction.
10. Complications are more after closure of end colostomies as compared to loop colostomies.
11. Complications are less in traumatic cases as compared to non-traumatic cases.
12. Delayed primary closure of colostomy wound is a safe method.
13. Although the trend toward the increased use of primary repair of colon injuries in selected patients is supported, our study indicates that the risk of colostomy closure has been exaggerated and should not be a major factor in the decision to create a colostomy after colon trauma if it appears indicated.

Recommendation:

In the light of our study, we recommend following measures for the reduction of morbidity/mortality of colostomy closure.

1. All types of colostomies can safely be closed after three months from construction.
2. Preoperative barium studies should be done, particularly in non-traumatic cases.
3. Preoperative bowel preparation is mandatory for all types of diverting colostomies to decrease the morbidity and mortality of colostomy closure.
4. Intra-peritoneal method of colostomy closure is safe for all types of colostomies.

References:

1. Irving MH, Hulame O: Intestinal Stomas. Br Med J 1992;304:1679-81.
2. OGilvie WH: Abdominal wounds in the Western Desert. Surg Gynecol Obstet 1944;78:225-38.
3. Zippermanh H: The management of large bowel wounds in the Korean Campaign. U.S. Armed Forced Med J. 1956;7:85-91.

4. Ganchrow M.I, Lavensen GS Jun and McNamara JJ: Surgical management of traumatic injuries of the colon and rectum. *Arch Surg* 1970;100:515-2.
5. Garfinkle SE, Cohen SE, Matolog NM: Civilian injuries. *Arch Surg* 1974, 109:402-4.
6. Parks TG: Surgical management of injuries of the large intestine. *Br J Surg* 1981; 68:725-8.
7. Doberneck CR: Revision and closure of colostomy. *Surg Clin North Am* 1991;71(1):193-201.
8. Ferguson CM, Siegel RJ: A prospective evaluation of diversion colitis. *Am J Surg* 1991, 57(1):46-9.
9. Namdu PT: Complications of colostomy closure in Zaria, Nigeria; a report of 70 cases. *Cent Afr J Med* 1990 Nov.36(11):287-91.
10. Wedell J, Meier, Stormer J, Meier, Eissea P: Morbidity and mortality following intraperitoneal closure of transverse loop colostomy. *Langenbecks Arch Chir* 1982;356(1):17.
11. Garber HT, Morris DM, Eisenstat TE, Coker DD, Annous MO: Factors influencing the morbidity of colostomy closure. *Dis Colon. Rectum* 1982 Jul-Aug.25(5):464-70.
12. Freund HR, Raniel J, Muggia Sulam M: Factors affecting the morbidity of colostomy closure; a retrospective study. *Dis Colon. Rectum* 1982 Oct.25(7):712-5.
13. Mahmood T, Manzar S: Colostomy closure. *PJS*, Jul-Sept. 1997. Vol.13, No.3:109-11.
14. Clarke JS, Coudon RE, Bartlett JG et al: Preoperative oral antibiotics reduce septic complications of colon operation: Results of a prospective, randomized, double-blind clinical study. *Ann Surg.* 1977. 186:251.
15. Stone HH, Haney BB, Kolb LD et al: Prophylactic and preventative antibiotic therapy. Timing, duration and economics. *Ann Surg* 1979;189:691.
16. Viiachki T, Tokoy P, Asnov A: Closure of the double barreled colostomy. *Khirurgiiia-Sofia* 1990;43(4):79:81.
17. Freund HR, Raniel J, Muggia Sulam M: Factors affecting the morbidity of colostomy closure; a retrospective study. *Dis Colon. Rectum* 1982 Oct.25(7):712-5.
18. Stone, HH: Antibiotics in colon Surgery. *Surg Clin. North Am.* 1983;63:3.
19. Goldring V, McNaught GO, Scott A et al: Prophylactic oral antibiotic agents in elective colonic surgery. 1975. *Lancet* ii:997.
20. Von-Flue M, Arigon M, Vogt B: Colostomy closure after Hartmann operation: Functional results. *Helv-Chir-Acta*, 1992 Mar.58(5):741-5.
21. Paredes JP, Cainzoos M, Garcia J, Parda P, Fernandez E, Paulos A et al: Colostomy closure: is it an intervention without risk? *Rev Exp Enferm Dig* 1994;86(4):733-7.
22. Demetriades D, Pezikis A, Melissas J, Parekh D, Pickles G: Factors influencing the morbidity of colostomy closure. *Am J Surg* 1988;155:594-6.
23. Wong RW, Rapaport WD, Witzke DB, Putnam CW, Hunter GC: Factors influencing the safety of colostomy closure in elderly. *J Surg Res.* 1994;57(2):289-92
24. Mileski WJ, Rege RV, Jochl JR, Nahrwold DL: Rates of morbidity and mortality after closure of loop and end colostomy. *Surg. Gynaecol. Obstet* 1990;171:17-21.
25. Machiedo GW, Casey KF, Blackwood JM: Colostomy closure following trauma. *Surg Gynecol Obst.* 1980;151:58.
26. Sola JE, Bender JS, Buchman TJ: Morbidity and timing of colostomy closure in trauma patients. *Injury* 1993 Aug.24(7):438-40.
27. Parks SE, Hastings PR: Complications of colostomy closure. *Am J Surgery.* 1985 May, 149(5):672-5.
28. Henry MM, Everett WG: Loop colostomy closure. *Br. J. Surg* 1979 Apr. 66(4):275-7.
29. Livingston DH, Miller FB, Richardson JD: Are the risk after colostomy closure exaggerated? *Am. J Surg* 1989 Jul.158(1):17-20.
30. Pittman DM, Smith LF: Complications of colostomy closure. *Dis. Colon Rect.* 1985 Nov. 28(11):836-43
31. Swenson K, Stamos M and Klein S: The role of barium enema in colostomy closure in trauma patients. *Am Surg* 1997 Oct. 63(10):893-895.
32. Hamilton D, Mulcahy D, Walsh D, Farrelly C, Tormey WP, Watson G: Sodium picosulphate compared with polyethylene glycol solution for large bowel lavage: a prospective randomised trial. *Br. J. Clin. Pract.* 1996 Mar. 50(2):73-5.
33. Lai AK, Kwok PC, Man SW, Lan RS, Chan SC: A blinded clinical trial comparing conventional cleansing enema, picolax and glytely for barium enema bowel preparation.
34. Lee EC, Roberts PL, Taranto R, Schoetz DJ, Marray JJ, Coller JA: Inpatient Vs outpatient bowel preparation for elective colorectal surgery. *Dis-Colon-Rectum.* 1996 Apr. 39(4):369-73.
35. Le TH, Timmcke AE, Gathright JB Jr, Hicks TC, Opelka FG, Beck DE: Outpatient bowel preparation for elective colon resection. *South Med J* 1997 May 90(5):526-530.
36. Yakimets WW: Complications of closure of loop colostomy. *Am. J. Surg.* 1975; 19:360-62.
37. Miles RM and Cireene RS: Review of colostomy in a community hospital. *Am. J. Surg* 1983. 49:182.
38. Miles RM and Cireene RS: Review of colostomy in a community hospital. *Am. J. Surg* 1983. 49:182.
39. Adeyemo A, Gaillard WE, Ali SD et al: Colostomy: intraperitoneal or extraperitoneal closure? *Am. J. Surg.* 1975 Sept. 130(3):273-4.
40. Namdu PT: Complications of colostomy closure in Zaria, Nigeria; a report of 70 cases. *Cent Afr J Med* 1990 Nov.36(11):287-91.
41. Freund HR, Raniel J, Muggia Sulam M: Factors affecting the morbidity of colostomy closure; a retrospective study. *Dis Colon. Rectum* 1982 Oct.25(7):712-5.
42. Sola JE, Bender JS, Buchman TJ: Morbidity and timing of colostomy closure in trauma patients. *Injury* 1993 Aug.24(7):438-40.
43. Boman Saundelin K, Fenyo G: Construction and closure of the transverse loop colostomy. *Dis. Colon Rect.* 1985 Nov.28(11):772-4.
44. Wedell J, Meier, Stormer J, Meier, Eissea P: Morbidity and mortality following intraperitoneal closure of transverse loop colostomy. *Langenbecks Arch Chir* 1982;356(1):17.
45. B Pittman DM, Smith LF: Complications of colostomy closure. *Dis. Colon Rect.* 1985 Nov. 28(11):836-43.
46. Thal ER and Yeary EC: Morbidity of colostomy closure following colon trauma. *J Trauma* 1980. 20:287-91.
47. Parks SE, Hastings PR: Complications of colostomy closure. *Am J Surgery.* 1985 May, 149(5):672-5.
48. Dolon P, Caldwell F, Thompson C, Westbrook K: Problems of colostomy closure. *Am. J. Surg.* 1979;137:188-91.
49. Pittman DM, Smith LF: Complications of colostomy closure. *Dis. Colon Rect.* 1985 Nov. 28(11):836-43.