

Original Article

# Comparison of Intraperitoneal and Extraperitoneal Colostomy Closure Methods

Hakan Baysal

*Istanbul Medeniyet University, Faculty of Medicine, Department of General Surgery, Goztepe Prof. Dr. Suleyman Yalcin City, Hospital, Istanbul, Turkey.*

*Corresponding Author : hakanbaysal\_tr@yahoo.com*

Received: 15 June 2023

Revised: 29 July 2023

Accepted: 12 August 2023

Published: 31 August 2023

**Abstract** - In this study, we compare intraperitoneal and extraperitoneal colostomy closure methods and review the subject from various aspects. Between 1992 and 1996, 65 cases of closed colostomy due to different indications in our clinic were included in the study. The patients' characteristics, colostomy closure techniques, complications, and management were evaluated retrospectively. The mean age of these 65 (F/M = 38.4%/61.6%) patients was 55 (17-83). Colostomy was opened due to malignancy in 34 patients, intra-abdominal injuries and traumas in 15 patients, non-malignant obstruction in 8 patients, inflammatory diseases in 6 patients, post-operative fistula in 1 patient, and rectovaginal fistula in 1 patient, the period from the application of the colostomy to its closure ranged from 1 month to 1 year. The intraperitoneal method was used in 29 (44.6%) patients, and the extraperitoneal method was used in 36 (55.4%) patients for colostomy closure. Complications were observed in 9 (13.8%) of the cases. Fecal fistula developed in 4 patients, surgical site infection in 3 patients, and lung infection in 2 patients. Of the 4 cases that developed fecal fistula, 1 was closed with the extraperitoneal technique and 3 with the intraperitoneal technique. In our study, it was concluded that the extraperitoneal colostomy closure method is a preferable method depending on the experience of the surgeon since complications are less than the intraperitoneal method.

**Keywords** - Colostomy, Peritoneum, Surgical procedures, Fistula, Infections.

## 1. Introduction

Colostomy is an integral part of surgeries performed for reasons such as maintaining the function of the anus permanently, temporarily diverting the flow of stool towards the occluded, injured or diseased colon, preserving an anastomosis on the distal surface of the colon, as in major malignant diseases[1]. Despite certain advantages, stomas can cause patients to face difficulties in adapting to daily life and the psychological problems that may arise as a result. Moreover, they can cause significant disorders such as prolapse, necrosis, stenosis and skin irritation. Therefore, stomas that have completed their function should be closed as soon as possible. Although it is a technically simple procedure, stoma closure has many complications, such as surgical site infection, bowel obstruction, incisional hernia and anastomotic leakage from the site of ileostomy or colostomy repair[2].

This rate has been reported between 2% and 33%. As a result of the increase in knowledge and experience in surgical technique and post-operative care, a decrease in stoma closure complications has been observed in recent years. However, despite these positive developments, there was no decrease in morbidity at the expected rate. This study aims to

compare the intraperitoneal and extraperitoneal colostomy closure methods and to review the subject from various aspects.

## 2. Materials and Methods

Between September 1992 and September 1996, colostomy closure was performed in 65 cases with various indications in the General Surgery Clinic of SSK Göztepe Training Hospital. The demographic characteristics of the patients, colostomy closure techniques, complications and their management were evaluated retrospectively by comparing them with the literature. The reasons for the colostomy opening of the patients included in the study were documented.

Colostomy closure times were reviewed from patient files. Intraperitoneal and extraperitoneal colostomy closure methods were used. In the intraperitoneal method, single-layer and double-layer closure techniques and stapler-assisted anastomosis were applied. In the extraperitoneal method, single-layer and double-layer closure techniques were applied—complications and length of hospital stay after both methods were compared with each other.



**3. Results**

Of the 65 cases whose colostomy was closed, 40 (61.6%) were male and 25 (38.4%) were female. Considering the age distribution of the cases, the youngest age was 17, and the oldest was 83, with a mean age of 55. Considering the colostomy indications, a colostomy was opened in 34

(52.3%) patients because of neoplastic diseases, in 15 (23.1%) due to blunt and sharp abdominal injuries, in 8 (12.4%) due to non-malignant obstructive diseases, in 6 (9.2%) due to inflammatory diseases, in 1 (1.5%) due to a post-operative fistula and in 1 (1.5%) because of a rectovaginal fistula (Table 1).

**Table 1. Indication for colostomy**

Indication for Colostomy	Number of Cases	% Percent
<b>Neoplastic diseases</b>		
Left colon tumor	1	1.5
Carcinomatosis peritonei	2	3
Right colon tumors	4	6.2
Sigmoid colon tumors	11	17
Rectal tumors	16	24.6
Total	34	52.3
<b>Injury</b>		
Gunshot wound	3	4.6
Blunt abdominal trauma	5	7.6
Penetrating injury	7	10.8
Total	15	23
<b>Obstructive diseases</b>		
Brid ileus	4	6.2
Sigmoid torsion	4	6.2
Total	8	12.4
<b>Inflammatory diseases</b>		
Perianal fistula and abcess	2	3.0
Diverticulosis	4	6.2
Total	6	9.2
<b>Rectovaginal fistula</b>	1	1.5
<b>Post-op fistula</b>	1	1.5

In our study, the time from applying the colostomy to its closure ranged from 1 month to 1 year. Of 65 cases whose colostomies were closed, 29 (44.6%) were closed using the intraperitoneal method, and 36 (55.4%) were closed using the extraperitoneal method (Table 2). Of 29 cases closed with the intraperitoneal approach, 6 (20.7%) were closed over a single

layer, 8 (27.6%) were closed with staples, and 15 (51.7%) were closed over a double layer (Table 2). Of the 36 cases that were closed extraperitoneally, 8 (22.2%) were closed over a single layer, and 28 (77.8%) were closed over a double layer (Table 2).

**Table 2. Colostomy closure techniques**

Intraperitoneal	Method	Number of Cases	% Percent
	Single layer	6	20.7
	Stapler	8	27.6
	Double layer	15	51.7
	Use of drain	18	62.1
	Not drain	11	37.9
<b>Total</b>		29	44.6
<b>Extraperitoneal</b>	Single layer	8	22.2
	Double layer	28	77.8
	Use of drain	25	69.4
	Not drain	11	30.6
<b>Total</b>		36	55.4

**Table 3. Colostomy closure complications**

Complication	Intraperitoneal	Extraperitoneal	Total
Enterocutaneous fistula	3	1	4
Surgical site infection	2	1	3
Pulmonary problems	2	-	2

Complications developed in 9 (13.8%) of 65 patients who underwent colostomy closure. Fecal fistula developed in 4 (50%) of these 9 patients, surgical site infection in 3 cases (37.5%), and pulmonary complications in 2 (25%) cases. While 1 (25%) of the 4 cases that developed fecal fistula was closed extraperitoneally, 3 (75%) developed it in cases that were closed intraperitoneally (Table 3).

The case that was closed extraperitoneally was closed over a double layer, and there was no fistula in those with a single layer. Of 3 cases closed intraperitoneally, 2 (66.7%) were closed over a double layer, and 1 (33.3%) over a single layer. A new surgical intervention was required in only 1 case that was closed over the double layer. In total, a new surgical intervention was required in 1 of 4 cases (25%), while the fistula closed spontaneously in 3 cases (75%) with a medical treatment approach. Fistula complication was not observed in the 8 cases closed with the stapler.

A drain was placed in 18 (62.1%) of 29 cases closed intraperitoneally, and no drain was placed in 11 (37.9%). A drain was placed in 25 (69.4%) of 36 cases that were closed extraperitoneally, and no drain was placed in 11 (30.6%) (Table 2). Although 1 patient, whose colostomy was closed extraperitoneally, developed a fecal fistula complication, no drainage was applied during the closure procedure; in 2 of 3 patients, whose colostomies were closed intraperitoneally, then developed a fistula, drainage was applied. There was no mortality in our cases who underwent colostomy closure. The average length of stay in the hospital during the colostomy closure procedure applied to our cases was 18 (4-40) days.

#### 4. Discussion

In colorectal surgery, stoma creation is common. The creation of a diversion stoma is indicated in patients with both benign and malignant colorectal diseases. In such cases, stoma creation has been reported to reduce the rate of anastomotic leakage and related reoperations significantly. Although stoma closure is considered a simple surgical procedure, it is very difficult to deal with complications that may develop due to the procedure.

In our study, the age distribution of patients whose colostomies were opened and closed for various reasons varied between 17 and 83 years, with a mean age of 55 years. Similar results have been reported in the literature. In a 12-year retrospective cohort analysis by Krebs et al., 136 (62%) patients were male, and 82 (38%) were female. They reported a mean age of 64 years[1]. In the studies conducted by

Anderson et al., colostomy was performed in 31.9% of the cases as a result of various abdominal traumas, in 28.9% as a result of diverticulitis complication, and 13% as a result of colon neoplasia [2]. In our study, neoplastic diseases and abdominal traumas constitute a larger group, while inflammatory diseases constitute a smaller group. In the study of Capone et al., the main indication was colorectal cancers, with a rate of 44% [3].

The optimal timing for colostomy closure is still unclear. In our series, the time from colostomy application to closure ranged from 1 month to 1 year. Closures made before 3 months are stated as early closure, and closures made after 3 months are defined as late closure. In our study, in most of our cases, we applied the closure procedure at the end of the 3rd month, in parallel with the current practice. Kech et al. recommended closure of the colostomy after an interval of at least 3 months to reduce the complication rate [4]. They argued that in addition to the regression of edema and inflammation in the tissue, it should take this long for the patient to feel ready for a second operation. Mosdell et al. reported that early closure of the colostomy is technically more difficult and causes more bleeding and that the morbidity is higher in patients whose colostomy is closed before 6 months [5]. Fleming et al. predicted a median 7-month wait for colostomy closure following acute diverticulitis[6]. Resio et al. found the safest stoma closure time between 45 and 110 days in their diverticulitis series of 1660 patients [7]. Velmahos et al. did not find a significant difference in morbidity in the early and late closure of traumatic colostomies (3 months), but they found early closure technically easier [8]. Herrle et al., in a multicenter study of 120 cases, found a median of 5 months for stoma closure in patients with rectal cancer. They found that this period doubled in those who received only adjuvant chemotherapy [9]. In a study by Meleagros et al., tumor recurrence was observed more frequently in patients with tumors in early stoma closure (before 3 months), and it was reported that the surveys of these patients were worse[10]. In our series, complications were more common in cases with an early colostomy closure time.

The intraperitoneal method was used in 29 (44.6%) and the extraperitoneal method in 36 (55.4%) of 65 cases whose colostomies were closed. The extraperitoneal closure method has been the preferred method in our clinic. Of 36 cases (55.4%) that were closed extraperitoneally, 8 (22.2%) were closed over a single layer, and 28 (77.8%) were closed over a double layer. 6 (20.7%) of 29 cases whose colostomy was closed intraperitoneally were closed using single layer, 15

(51.7%) double layer, and 8 (27.6%) were closed using stapler. Colostomy closure over a double layer is the surgical technique we prefer more in both methods. In a series of 126 cases by Pitman, all cases were closed intraperitoneally, and closure with double-layer sutures was preferred in the majority [11]. Paik et al., in their series of 84 cases, used staplers in 85% of their patients who underwent intraperitoneal closure [23]. In the literature of many cases where extraperitoneal and intraperitoneal closure methods were applied, different authors compared these methods. Those who recommend extraperitoneal closure argue that if fistula develops in the intraperitoneal method, the possibility of widespread peritonitis and death is high [1,13].

Advocates of intraperitoneal closure state that the chance of stercoral fistula formation in this method is very low [11,13,14,15]. In the intraperitoneal method, the peritoneum rapidly removes microorganisms transmitted around the closed part from the anastomosis area. In the extraperitoneal procedure, however, the chance of infection and leakage around the anastomosis increases since this function is unavailable.

Kohler et al. preferred intraperitoneal closure because of incisional hernia and enterocutaneous fistula [15]. In our series, in 9 stercoral fistulas that developed complications, the extraperitoneal closure method was used in 4 cases (50%), and the intraperitoneal closure method was used in 3 cases. These data do not lead to the conclusion that extraperitoneal closure will be more risky than intraperitoneal closure, as mentioned in the literature.

Anderson et al. stated that laparoscopic colostomy closure can be done without needing a second major intra-abdominal operation because it provides patients with a shorter recovery period and causes less pain [24]. De Wever et al. reported that when they opened terminal colostomies with TA 55 stapler, they observed less morbidity in the closure method [17].

The suture technique used in colostomy closure is also important. Studies have shown that the "inverting" suture technique is superior to the "everting" suture technique[1]. In our clinic, the "inverting" technique is used more often. It is very important that the sutures are passed through the submucosa. The quantity and quality of the collagen tissue contained here affects the success of the anastomosis.

Collagen amount decreases by 23% in single sutures and around 30% in continuous sutures, and the return of collagen amount to normal values occurs more quickly in single sutures [1]. Doberneck reported that the complication rate was the same in anastomoses closed with double-row and single-row suture material [18]; Yajko stated that morbidity is higher in single-row suture application [19]. Our study found that 3 of our patients who developed 4 stercoral fistulas were closed over a double layer.

The most common complications in the literature are surgical site infection, fecal fistula, early mechanical bowel obstruction, evisceration, eventration, anastomosis opening, and intra-abdominal abscess [5,18,20]. In Pittman's series of 726 cases, surgical site infection and stercoral fistula rank first with 18 and 11 cases [11]. In the 12-year cohort analysis of Krebs et al., post-operative ileus (12%) and surgical site infection (5%) were the most common complications[1]. In Varnell's series of 69 cases, 19 surgical site infections and 5 cases of anastomotic leakage were detected [21].

Complications were observed in 9 (13.8%) of 65 patients who underwent colostomy closure. Fecal fistula developed in 4 cases (50%), surgical site infection in 3 cases (37.5%), and atelectasis in 2 cases (25%). These data are in agreement with the literature. Varnell is of the opinion that advanced age is a factor that increases morbidity in colostomy closure[21]. There are authors in the literature who do not consider age as a risk factor for colostomy closure[1,9]. In our study, age was a factor that did not affect morbidity.

Beck et al. argue that complications are less in loop colostomies[18]. Examining the relationship between colostomy type and complications, Varnell observed that the complications of loop colostomies are less than those of end colostomies and that complications of mucous fistula are less common in the end colostomies compared to the Hartmann procedure[21]. Knox and Resio reported a significant increase in morbidity in the closure of colostomies opened due to diverticulitis[7]. Varnell, on the other hand, found a low morbidity rate in traumatic colostomy closures[21]. In our series, 6 of our 9 cases who developed complications were tumor cases, while 3 cases had traumatic lesions. We found these data in accordance with the literature.

It is stated that intraperitoneal drainage increases the complication of anastomotic leakage. While this rate is 1.6% in series without intraperitoneal drainage, it is around 5% in those with drainage[11]. Fonseca et al. found that the presence or absence of drains was not significantly associated with complications [22]. 18 (62.1%) of 29 intraperitoneal closures were closed with drainage, 11 (37.9%) without drain, 25 (69.4%) of 36 extraperitoneal closures with drainage, and 11 (30.6%) without drain. Of the 4 cases with stercoral fistula, 3 cases were closed intraperitoneally, and 2 had drainage.

The other 1 case was closed extraperitoneally, and no drainage was applied. When closure methods and drainage are examined in terms of wound infection, the rate of wound infection is reported to be between 2.1% and 41% in the literature [23]. In our study, this rate was 4.6% with 3 cases. While it is emphasized in the literature that there will be a significant decrease in wound infection if a drain is placed under the skin. The application of subcutaneous drainage was not found to be significant in our series. Park et al. left the

incision open at the beginning and suggested that primary closure in the late period reduces the possibility of wound infection[23]. We did not apply such a practice to any of our patients.

Varnell and Doberneck stated that preoperative irrigation of the distal segment and systemic antibiotics and oral agents would reduce morbidity[18,21]. In studies comparing hand anastomoses and stapling, no difference was found except for shortening the operation time with stapling[22].

We encountered no complications in 8 cases in which we used staplers. There were no deaths in our series. In our cases, the hospital stay ranged from 4 to 40 days, with an average of 18 days. This period is slightly longer than the average 11-13 days stated in the literature[22].

## 5. Conclusion

We determined that in 65 of our cases whose colostomies were closed, colostomy closure should be performed at the end of the 3rd month in order to minimize complications and morbidity. Considering the complications of our cases, it is seen that this is in accordance with the rates stated in the literature. The complication rate is slightly higher when intraperitoneal closure methods are used. Most of our cases that developed complications were cases where Hartmann colostomy was applied due to cancer. Therefore, extreme care should be taken in colostomy closure in patients with the Hartmann procedure. The type of colostomy and the type of disease played a role in developing complications, and age was not found to be important. In our study, we concluded that the extraperitoneal colostomy closure method is a more successful and preferable method compared to the intraperitoneal approach since the complications are less and the results are satisfactory.

## References

- [1] Bojan Krebs et al., "Factors Affecting the Morbidity and Mortality of Diverting Stoma Closure: Retrospective Cohort Analysis of Twelve-Year Period," *Radiol Oncol*, vol. 53, no. 3, pp. 331-336, 2019 [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [2] E. Anderson et al., "Colostomy closure--A Simple Procedure?," *Diseases of the Colon & Rectum*, vol. 2, no. 7, pp. 466-468, 1979 [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [3] Rodrigo Capona et al., "Surgical Intervention for Mechanical Large Bowel Obstruction at a Tertiary Hospital: Which Patients Receive a Stoma and how Often are they Reversed?," *The American Journal Surgery*, vol. 221, no. 3, pp. 594-597, 2021 [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [4] Keck James. O et al., "Reversal of Hartmann's procedure: Effect of Timing and Technique on Ease and Safety," *Diseases of the Colon & Rectum*, vol. 37, no. 3, pp. 243-248, 1994. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [5] Dale M. Mosdell MD, and Raymond C. Doberneck MD, "Morbidity and Mortality of Ostomy Closure," *The American Journal Surgery*, vol. 162, no. 6, pp. 633-637, 1991. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [6] Fergal J. Fleming, and Peter Gillen, "Reversal of Hartmann's Procedure Following Acute Diverticulitis: Is Timing Everything?," *International Journal of Colorectal Disease*, vol. 24, no. 10, pp. 1219-1225, 2009. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [7] Benjamin J. Resio et al., "Association of Timing of Colostomy Reversal With Outcomes Following Hartmann Procedure for Diverticulitis," *JAMA Surg*, vol. 154, no. 3, pp. 218-224, 2019. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [8] MD George C. Velmahos et al., "Early Closure of Colostomies in Trauma Patients--A Prospective Randomized Trial," *Surgery*, vol. 118, no. 5, pp. 815-820, 1995. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [9] Herrle, Florian M.D et al., "Quality of Life and Timing of Stoma Closure in Patients With Rectal Cancer Undergoing Low Anterior Resection With Diverting Stoma: A Multicenter Longitudinal Observational Study," *Diseases of the Colon & Rectum*, vol. 59, no. 4, pp. 281-290, 2016. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [10] L Meleagros et al., "Influence of Temporary Faecal Diversion on Long-Term Survival After Curative Surgery for Colorectal Cancer." *British Journal of Surgery*, vol. 82, no. 1, pp. 21-25, 1995. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [11] Donna M. Pittman M.D, and Lee E. Smith M.D, "Complications of Colostomy Closure," *Diseases of the Colon & Rectum*, vol. 28, no. 11, pp. 836-843, 1985. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [12] Dr.Naveen K G, Dr. Ravi N and Dr. Nagaraj B R, "Blunt Abdominal Trauma: Making Decision of Management with Conventional and Ultrasonography Evaluation," *SSRG International Journal of Medical Science*, vol. 1, no. 2, pp. 1-10, 2014. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [13] M.E. Foster, D.J. Leaper, and R.C.N. Williamson, "Changing Patterns in Colostomy Closure: The Bristol Experience 1975-1982," *British Journal of Surgery*, vol. 72, no. 2, pp. 142-145, 1985. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [14] J P Paredes et al., "Colostomy Closure: Is It An Intervention Without Risk?," *Revista Espanola de Enfermedades Digestivas*, vol. 86, no. 4, pp. 733-737, 1994. [[Google Scholar](#)] [[Publisher Link](#)]
- [15] A. Köhler, S. Athanasiadis, and M. Nafe, "Postoperative Results of Colostomy and Ileostomy closure. A Retrospective Analysis of Three Different Closure Techniques in 182 Patients," *Chirurg*, vol. 65, no. 6, pp. 529-532, 1994. [[Google Scholar](#)] [[Publisher Link](#)]
- [16] Dr.Sharmila Borkar, Dr.Roopesh Sureshan, Dr.Vilas Gowler and Dr.Abhinav Pai, "Blood Conservative Strategies during Surgery," *SSRG International Journal of Medical Science*, vol. 5, no. 8, pp. 18-22, 2018. [[CrossRef](#)] [[Publisher Link](#)]

- [17] I. De Wever, M. Van de Moortel, and M. Stas, "Temporary Colostomy in Suprlevator Pelvic Exenteration. A Comparative Study Between Stapled Loop and Loop Colostomy," *European Journal Surgical Oncology*, vol. 22, no. 1, pp. 87-84, 1996. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [18] R.C. Doberneck, "Revision and Closure of the Colostomy," *Surgical Clinics of North America*, vol. 71, no. 1, pp. 193-201, 1991. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [19] R.Douglas Yajko et al., "Morbidity of Colostomy Closure," *The American Journal Surgery*, vol. 132, no. 3, pp. 304-306, 1976. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [20] Porter J. A. M.D et al., "Complications of Colostomies," *Diseases of the Colon & Rectum*, vol. 32, no. 4, pp. 299-303, 1989. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [21] J. Varnell, and L.B. Pemberton, "Risk Factors in Colostomy Closure," *Surgery*, vol. 89, no. 6, pp. 683-686, 1981. [[Google Scholar](#)] [[Publisher Link](#)]
- [22] Alexandre Z. Fonseca et al., "Colostomy Closure: Risk Factors for Complications," *Arquivos Brasileiros de Cirurgia Digestiva*, vol. 30, no. 4, pp. 231-234, 2017. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [23] Bomina Paik et al., "Postoperative Outcomes of Stoma Takedown: Results of Long-term Follow-up," *Ann Coloproctol*, vol. 34, no. 5, pp. 266-270, 2018. [[CrossRef](#)] [[Google Scholar](#)] [[Publisher Link](#)]
- [24] A. Anderson Craig et al., "Laparoscopic Colostomy Closure," *Surgical Laparoscopy & Endoscopy*, vol. 3, no. 1, pp. 69-72, 1993. [[Google Scholar](#)] [[Publisher Link](#)]