TIMING OF THE STOMA REVERSAL, WHAT IS THE SAFE PERIOD?: A RETROSPECTIVE OBSERVATIONAL STUDY

GIRIDHAR ASHWATH* , ESHWAR KATHIRESAN MANASIJAN , ANTHONY P ROZARIO

Department of General Surgery, St John's Medical College Hospital, Bengaluru, Karnataka, India.
*Corresponding author: Giridhar Ashwath; Email: drgiridharashwath@gmail.com

ABSTRACT

Objective: The objective of the study is to determine the most suitable timing for the reversal of enteric stomas and to investigate the complications associated with the presence and reversal of stomas among different age groups and genders.

Methods: This was a retrospective study conducted in the Department of General Surgery of a tertiary care medical institute. The institutional ethical committee approved the study. We reviewed the digitally recorded data of patients who had undergone both the creation and reversal of stomas at our institution over various time intervals spanning from January 2017 to December 2022. Beyond the electronically stored clinical data encompassing patient demographics, stoma type, and complications encountered between stoma insertion and reversal, we conducted a thorough review of the database containing information on outpatient follow-ups for a month. The gender and age distribution, indications for surgery, type of stoma, and its correlation with age and gender were analyzed. Duration from surgery to stoma reversal and complications were also analyzed. Categorical data were presented as frequency and percentage, whereas quantitative data were summarized using the mean and standard deviation. Closure of the stoma after surgery was compared based on age and sex, employing an independent t-test.

Results: In this study 82 patients undergoing stoma surgery, 68.29% were male and 31.71% were female. The mean age of male and female patients was found to be 44.26 and 35.96 years, respectively. Males had a higher median duration for ileostomy and jejunostomy reversals at 14 and 17 weeks, respectively, whereas females showed longer durations for ileostomy at 15 weeks. Common indications for surgery included intestinal obstruction (32.9%) and peritonitis (20.7%). Post-stoma closure 50% of the patients experienced complications, with 24% occurring within 1 month of reversal. Major complications occurred in 41% of cases, including parastomal hernia and suspected anastomotic leaks. Minor complications were observed in 28 patients, representing 35% of all surgeries.

Conclusion: Stoma reversal between 8 and 12 weeks post-surgery is recommended for minimizing complications and avoiding psychological burden. While early closure may reduce hospital stay, it increases the risk of infections. Optimal timing for stoma closure is complex, requiring personalized, collaborative decision-making.

Keywords: Intestinal obstruction, Surgical stoma, Stoma reversal, Complications.

INTRODUCTION

Stomas have been historically documented to have been invented in the early 18th century. Initially designed to remedy obstructions in the intestines, they were subsequently modified to address a diverse range of ailments associated with both congenital as well as acquired conditions [1]. While the creation of a stoma used to be the treatment of choice for any intestinal disease and injury, the intestinal suture was considered "a mighty procedure in a highly vulnerable organ" and therefore was always regarded as a dangerous option for surgical treatment. The occurrence of complications associated with this essential treatment continues to be significant, with data suggesting that they may reach as high as 70% [2]. This is despite the fact that there have been breakthroughs in surgical procedures and supplies for stoma care. One crucial aspect of managing patients with enteric stomas is determining the optimal timing for stoma reversal and there remains a notable absence of consensus and uniform guidelines regarding the ideal timing for stoma closure, despite the crucial nature of this procedure in clinical practice [3]. As novelty stands, transient small bowel stoma is closed at durations of 8–12 weeks after the initial operation [4]. In addition, various patient factors, including pre-existing medical conditions and overall health status, also play a role in the absence of a consensus. Consequently, health-care professionals frequently face challenges when it comes to determining the most suitable moment for stoma reversal, leading to variations in clinical approaches and results [5].

Deciding when to reverse a stoma is a multifaceted subject that takes into account a range of factors, including clinical, surgical, and patient-related considerations. When considering stoma closure, it is important to thoroughly evaluate clinical factors such as the seriousness of the underlying condition, the type of stoma, and the risks during the operation [6]. However, when a stoma is created in emergency settings or for non-malignant indications, the timing of its reversal can be quite subjective, depending on factors related to the treating team or the patient. Furthermore, various factors need to be considered when determining the optimal time for stoma reversal, including the technical aspects of the surgery, bowel function, and the integrity of the anastomosis. Furthermore, the decision-making process and outcomes after the reversal can be greatly influenced by a range of patient-related factors, such as age, gender, existing health conditions, and psychosocial factors [7].

People with a stoma must adapt to a different physical appearance, alterations in their daily routines, adjustments to their lifestyle, and changes in their social standing [8]. The delay in reversing a stoma can have negative effects on a patient's physical activity, social life, and financial situation. Therefore, the closure of a temporary stoma is often eagerly awaited as it signifies a resumption of normalcy and alleviates the burden on both the individual and the community [9]. While there is a wealth of published articles discussing indications for stomas, the available evidence regarding the optimal timing for stoma reversal is

somewhat limited [10]. This research paper primarily seeks to address the current gaps in knowledge by conducting an analysis for the most suitable timing for the reversal of enteric stomas. Our secondary goal is to investigate the complications associated with the presence and reversal of stomas among different age groups and genders and thus provide insights into stoma management, ultimately improving outcomes for patients who undergo stoma reversal.

METHODS

This was a retrospective study conducted in the department of general surgery of a tertiary care medical institute. The research was initiated after receiving authorization from the Institutional Ethics Committee (IEC number: 244/2022). Due to the nature of the study design, informed consent was waived and the research commenced by reviewing the digitally recorded data spanning from January 2022 to December 2022. Beyond the electronically stored clinical data encompassing patient demographics, stoma type, and complications encountered between stoma insertion and reversal, we conducted a thorough review of the database containing information on outpatient follow-ups for a month maintained to understand the different complications encountered during the duration of the stoma. To ensure accuracy, the data extraction procedure was closely supervised by multiple reviewers, addressing any potential observer bias. We meticulously established specific criteria for inclusion and exclusion, which helped create a consistent group of participants and enhanced the reliability and generalizability of our results. The criteria for inclusion ensured that only patients over the age of 18, with enteric stomas of various benign conditions such as trauma, intestinal obstruction, inflammatory bowel disease, and those who had both the creation and reversal of stomas at our institution over various time intervals. On the other hand, the criteria for exclusion ruled out those under the age of 18, and patients with permanent stomas or stomas created due to malignant conditions.

Upon examination of a total of 161 patient files, a total of 82 individuals were patients who had undergone both the creation and reversal of the stoma at the hospital over a span of 5 years, from January 2017 to December 2022. Out of the 82 patients analyzed, the majority were male (68.29%) whereas the remaining were female (31.71%). With ages ranging from 19 to 65.

This study investigated the adverse consequences that occurred during the time between stoma creation and reversal, as well as the complications observed during the follow-up period. The goal is to establish a connection between the length of time the stoma was in place and the occurrence of these complications. The complications were assessed between the creation and reversal of the stoma and within the first 30 days after discharge. Post-operative deaths were defined as deaths within 30 days of the procedure or during the same hospital stay. The time period from stoma creation to closure was >10 days in all. The stoma care nurse provided attentive care to patients, addressing any concerns related to their stoma that arose during their time in the hospital or during outpatient visits. This allowed for a comprehensive medical history to be compiled, incorporating medical records from the stoma care clinic and the outpatient clinic.

Statistical analysis was conducted on the collected data, encompassing outcomes post-surgery along with the complications observed. The analysis considered different time durations of the closure of stoma procedure types, and patient demographics, including age and sex. Categorical data were presented as frequency and percentage, whereas quantitative data were summarized using the mean and standard deviation. Closure of the stoma after surgery was compared based on age and sex, employing an independent t-test. The Chi-square test was utilized to summarize the proportion of various complications, with a significance level of $p<0.05$ indicating statistical significance. To ensure the accuracy and dependability of our results in the face of variations in imputation methodologies, we performed sensitivity analyses to assess the robustness of the results. In smaller sample sizes, outliers can have

a significant impact on the mean by distorting it, whereas their effect on the median may not be as pronounced. Even though there were only a few outliers in our study when it came to the time between creating and reversing stomas, their presence had a significant impact on the average due to the large differences involved. As a result, we have calculated the data in this study using medians.

RESULTS AND DISCUSSION

The cohort of our study had a total of 82 patients among whom 56 (68.29%) were male and 26 (31.71%) were female. There was a significant male preponderance in cases with a M: F ratio of 1:0.46 (Fig. 1).

We noticed the male patients had a mean age of 44.26. In contrast, female patients tend to be younger, with an overall mean age of 35.96. However, the total number of male patients present in the age group of 21–30 was the same as the age group 41–50, whereas a greater number of females was in the age group of 31–40. The analysis of various types of stoma showed that the duration of different types of stoma varied between the different age groups as well as genders. Males typically underwent reversal of stoma after a duration of 14 weeks for ileostomy, 20 weeks for colostomy, and 17 weeks for jejunostomy. While females underwent reversal after a duration of 15 weeks for ileostomy, 20 weeks for colostomy, and 15 weeks for jejunostomy (Table 1).

The most common indications of surgery were intestinal obstruction and peritonitis, accounting for 32.9% and 20.7% of cases, respectively, followed by trauma and inflammatory bowel disease and etiologies such as mesenteric ischemia, fistula, and abscess. The "other" category included stomas created for complications related to previous gastrointestinal surgeries and had a frequency of 3.66% (Fig. 2).

The analysis of the variations in stoma duration based on age and gender showed that the females generally experienced longer durations compared to males, and some variability across different age groups. When considering variations across age groups, it was noted that among males, the age group 31–40 shows the highest duration for colostomy
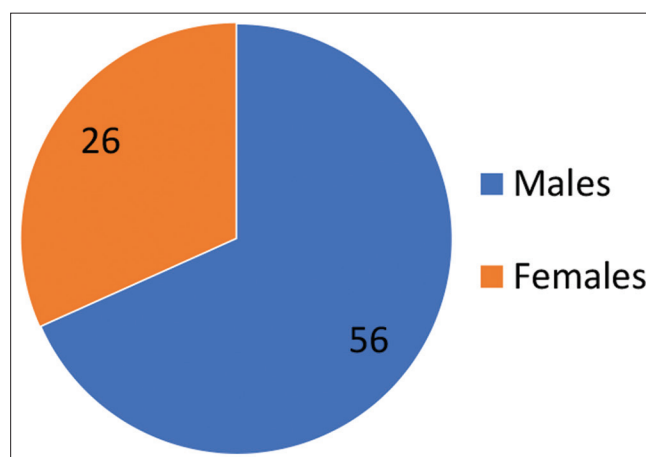

Fig. 1: Gender distribution of studied cases

Table 1: Comparison of ostomy types and median duration by gender

Gender wise distribution of median duration	Ileostomy	Colostomy	Jejunostomy
Total males	37	17	2
Male median duration of stoma	14 weeks	20 weeks	17 weeks
Total females	20	5	1
Female median duration of stoma	15 weeks	20 weeks	15 weeks

(19 weeks) and jejunostomy (15 weeks), whereas for females, the highest duration for colostomy was seen in the 41–50 age group (39 weeks). For ileostomy, the duration remains relatively consistent across age groups, with slight fluctuations. Jejunostomy, on the other hand, with fewer instances across all age groups. Data for jejunostomy were sparse compared to ileostomy and colostomy, as it was relatively uncommon compared to ileostomy and colostomy (Table 2).

For ileostomy, both males and females underwent stoma reversal surgeries within a wide range of timeframes. While the majority of reversals occurred after 12 weeks, a notable number were also performed within 8–12 weeks post-initial surgery. This variability suggests individualized approaches based on patient-specific factors and clinical judgment. Colostomy reversals, on the other hand, displayed a slightly different pattern. Most reversals for males and females occurred after 12 weeks, indicating a tendency toward longer healing periods or other clinical considerations before reversal surgery. Finally, even though there were only three jejunostomy creations and reversals recorded, they exhibited the least variability of reversals usually occurring after 12 weeks across both genders (Table 3).

In the cohort of 82 patients who underwent stoma creation surgery, 50% of them had experienced complications. Post the closure of the stoma 24% of patients experienced at least one complication within a duration of 1 month since the date of the stoma reversal surgery. The complications were categorized into major and minor based on their severity and the necessary treatment required. Major complications included conditions that necessitated additional interventions of prolonged hospitalizations or re-hospitalizations, whereas minor complications were less severe and were typically managed conservatively with medications or dietary modifications. Major complications were observed in 34 patients representing 41% of all surgeries. These included parastomal hernia in six patients, suspected anastomotic leaks in seven patients, bowel obstruction requiring surgical interventions in eight cases, surgical site infections (SSI) in nine cases, incisional hernia in two cases, and prolapse in two cases. Other major complications such as necrosis and stomal retraction were not observed in the cohort. Minor complications were observed in 28 patients, representing 35% of all surgeries. These conditions included skin irritation in eight cases, short-term ileus in six cases, and electrolyte imbalance in 14 cases. Electrolyte imbalances in the ileostomy patients included hypokalemia observed in seven cases and hyperkalemia observed in two cases whereas hyponatremia was more common in colostomy patients observed in three cases.

Of all the stomas created four of them were closed before 8 weeks, 21 cases were closed between the duration of 8–12 weeks, and 57 cases were closed after 12 weeks. The time to complication onset was also recorded which revealed that in patients who had ileostomy, the complications occurred post 14 weeks from the first surgery. Although not many patients have undergone early closure of stoma, three of the four cases were observed to have complications such as skin irritation and SSI. In patients whose closure of stoma was carried about between 8 and 12 weeks, 11 patients have been reported to have complications which included short-term ileus and anastomotic leaks. Major complications such as stomal prolapse and parastomal hernia along with minor complications such as electrolyte imbalances were most commonly observed in patients who had late closure of stoma (Table 4).

Stoma formation is a frequently performed procedure in the field of surgery, particularly in the realm of colorectal surgery. Nevertheless, there is ongoing debate regarding the duration for which the stoma should be maintained. Typically, the reestablishment of intestinal continuity is performed after a period of 8–12 weeks [11] as this time interval provides an opportunity for recovery following the initial surgery, allowing for the reduction of intra-abdominal adhesion and the healing of inflammation and swelling at the stoma site. However, some stomas can remain open for extended periods of time, ranging from months to even years, and may even subsequently become permanent [12]. Therefore, it is crucial to provide adequate guidance and preparation, just as much as the actual creation of the stoma, as a stoma can have. Delayed reversal can occur due to a range of factors, such as adjuvant chemotherapy after surgery or unrelated to surgery and sometimes even administrative challenges as the decision to perform a reversal operation is often considered a lower priority compared to more complex and urgent surgeries, which can contribute to the delay [13]. In addition, it is important to consider the significant psychological and emotional effects that come with living with a stoma.
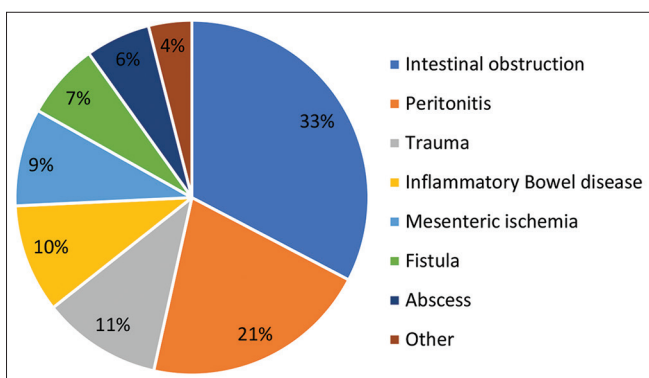

Fig. 2: Indications of surgeries in studied cases

Table 2: Duration of stoma in weeks by age groups and gender

Age groups (years)	Ileostomy		Colostomy		Jejunostomy	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**
<20	14	15	-	8	-	-
21–30	15	13	15	21	28	-
31–40	14	17	19	18	-	15
41–50	13	13	31	39	10	-
51–60	15	18	17	-	-	-
>60	14	-	21	25	-	-

Table 3: Average surgical duration for stoma creation by type and gender

Stoma Type	Gender	Duration in weeks		
		8	**8–12**	**12**
Ileostomy	Male	1	13	23
	Female	1	7	11
Colostomy	Males	1	0	16
	Females	1	0	5
Jejunostomy	Males	0	1	1
	Females	0	0	1

Table 4: Complications of enteric stoma

Complications	Ileostomy	Colostomy	Jejunostomy
Complications observed with stoma *in situ*	Parastomal hernia Stomal prolapse Stomal retraction	Skin irritation Stomal stenosis Parastomal hernia	Electrolyte imbalance
Complications observed after the reversal of stomal	Bowel obstruction Incisional hernia Necrosis	Short term ileus Surgical site infection	Anastomotic leak

Temporary stomas have negative effects on the quality of life (QoL). Since stomas also lead to significant reductions in physical activity and role functioning, patients are observed to acquire negative body image. Other problems experienced by colostomy patients involve odor and gas control [14]. The patients usually can manage these obstacles by paying attention to foods and medications ingested, using various deodorant products, and maintaining meticulous personal hygiene.

Over the past few years, there have been significant improvements in surgical techniques and perioperative care, resulting in a trend toward performing stoma reversals at an earlier stage for certain patients. Studies have explored the feasibility and safety of reversing stomas within a shorter time frame, as early as 2 weeks, with favorable outcomes in terms of post-operative complications and patient well-being [15].

To ensure the best possible well-being of patients, it is important to regularly evaluate the long-term outcomes and QoL after stoma reversal. Our research directly compared the outcomes of closing early and closing late. Nevertheless, the complications associated with stomas serve as a reminder of the need for cautious decision-making when determining the appropriate timing for closure.

The patterns in stoma duration among various age groups and genders fluctuate according to the changing demands and difficulties experienced by patients at different stages of life, suggesting potential variations in recovery or management approaches depending on age. Even though on observing the results, the duration before a stoma is reversed is comparatively longer in women than in men, when it comes to different age groups and the length of time a stoma is in place, it seems that stomas created in people under the age of 20 are closed earlier than in other age groups. However, the age and gender of patients did not have a significant impact on the outcome (p>0.05).

Temporary diverting stomas are constructed to minimize associated complications such as sepsis and peritonitis, which may be caused by anastomotic leaks. However, it is important to note that these stomas do not directly reduce the occurrence of anastomotic leaks. Although in our cohort there were no recorded deaths after surgery of stoma closure, it is worth noting that other studies have reported varying mortality rates, ranging from <1% to 10%. Although the frequency of morbidity has consistently been documented as being on the higher end. The most common issues related to ileostomy closure involve mechanical problems such as small bowel obstruction following inflammatory conditions such as peritonitis. No cases of stoma necrosis or stoma retraction were observed among the patients [16].

In our systematic approach to the research, the initial stages revolved around understanding of the existing literature while also analyzing the retrospective clinical data from our hospital. By doing so, we are able to compare the various outcomes among the distinct groups of cohorts of the various researches. The rate of morbidity in our cohort is higher than previously reported rates both during the duration of the stoma as well as after the reversal of the stoma. At the same time, we have observed some similarities in the list of complications observed.

A significant percentage of cases (8%) experienced dehydration caused by increased ostomy output, resulting in the loss of fluids and electrolytes, during the period of stoma, particularly after the creation. There is a wide range of complications that can occur after stoma closure, and one of the most commonly seen is wound infection, regardless of the type of stoma, age, or sex. Existing research suggests complication rates ranging from as low as 12% to 70%. This difference could be due to variations in patient characteristics, surgical techniques, or our stricter definition of complications encompassing both major and minor issues [17].

All ostomy procedures were intended to be closed between 8 and 12 weeks following the initial surgery and before closure, a contrast enema examination, sometimes accompanied by endoscopy, was performed to verify adequate healing of the anastomosis. We observed a correlation between later stoma closure (beyond 12 weeks) and a higher incidence of complications, particularly major ones such as parastomal hernias and prolapse. While the optimal timing for reversal surgery remains debatable, our findings suggest potential benefits to earlier closure (between 8 and 12 weeks) to minimize complication risk. This aligns with some recent studies advocating for earlier reversal when medically feasible [18].

We also wish to highlight the prevalence of electrolyte imbalances, particularly hypokalemia, as a frequent minor complication, especially in jejunostomy patients. Existing research often focuses on more severe complications, and this finding underscores the importance of monitoring for and managing electrolyte imbalances after stoma reversal.

Research has shown that smoking significantly raises the chances of developing a wound infection after surgery. Certain surgical techniques are often favored over others due to their advantages, such as loop ileostomies being less bulky, less malodorous, less prone to prolapse, and associated with fewer complications upon reversal. Although reversing Hartmann's procedure can pose challenges, with a significant morbidity rate exceeding 50%. There are distinct differences in the complications associated with ileostomy and colostomy. There is a significant occurrence of parastomal hernia with the colostomy, whereas the ileostomy tends to have more skin-related complications. These complications can lead to higher medical expenses, longer hospital stays, and a greater need for follow-up care, as well as an increased risk of developing further complications. There are several factors that can increase the risk of complications following stoma reversal. These include SSI, a longer time between stoma creation and closure, diseases with significant peritoneal contamination, advanced age, the type of stoma, and the overall condition of the patient [19].

There are several advantages to closing a stoma within 3 months. One benefit is the reduction in health-care costs associated with stoma care supplies. Another advantage is the improvement in the patient's QoL due to the restoration of bowel function and elimination of stoma maintenance. There is a potential drawback to early closure, which is the possibility of an anastomotic leak. This can occur when the bowel segments do not heal properly. Delayed resolution on the flip side, there are benefits to consider such as a lower risk of anastomotic leak due to a longer healing period that goes beyond 3 months [20]. There are a few drawbacks to late closure. One is the higher health-care costs associated with prolonged stoma care. In addition, patients may experience stoma-related issues for an extended period, potentially impacting their overall well-being [21]. However, it is essential to carefully select patients and closely monitor them during the perioperative period in such cases. Many studies have reported that the closure of stomas within 10 days of the initial operation proved to be a safe and viable option for certain patients [22]. This approach also proved to be cost-effective, as it resulted in shorter hospital stays and reduced expenses on stoma appliances. Utilizing advanced methods such as the enhanced recovery after surgery (ERAS) system for stoma reversal. In a recent study, Madan *et al.* conducted a randomized controlled trial to compare the outcomes of patients undergoing elective stoma reversal surgery using an ERAS pathway versus standard care [23]. Studies have shown that utilizing ERAS pathways can lead to improved outcomes in cases involving stoma reversal, as opposed to following standard care protocols. A recent study revealed that the implementation of ERAS resulted in accelerated functional recovery, decreased hospitalization duration, and a lower incidence of SSI [24]. The ERAS protocol incorporates various components such as pre-operative carbohydrate loading, avoiding mechanical bowel preparation, implementing goal-directed fluid therapy, and promoting early mobilization. The incidence of post-operative nausea/vomiting, pulmonary complications, and urinary tract infections were comparable in both the ERAS and standard care groups.

In our study, even though not a lot of individuals had undergone reversal of stoma before the anticipated duration of 8 weeks, we observed that early closure did not reduce the complications observed. As the duration of the stoma increased beyond the expected duration of 12 weeks, the percentage of individuals experiencing complications has also increased in cases of ileostomy but not colostomy as a longer duration of colostomy is often preferred over a shorter duration due to the time needed for inflammatory adhesions to subside, reducing interference during stoma closure [25]. Since our cohort only had a lesser number of individuals who had undergone jejunostomy, the findings were not reliable or generalizable.

Limitation

The absence of a control group makes it more challenging to draw causal conclusions and make direct comparisons. Patient factors and surgeon factors have not been analyzed and also the sample size was relatively small. To make the data on the duration between the creation and reversal of ostomy more reliable, larger studies, or meta-analyses should be conducted.

CONCLUSION

It is crucial for patients and their families to be provided with thorough support and education regarding stoma care, potential complications, and the process of reversal. Working alongside specialized stoma nursing teams can significantly improve patient satisfaction and outcomes. After stoma reversal, it is crucial to closely monitor and address any potential complications that may arise during the post-operative period.

In our cohort, closure within 8 weeks of the index operation, has been explored as a feasible option, showing potential benefits. However, stoma reversal typically occurring between 8 and 12 weeks post-surgery is recommended for better outcomes. As observed, early closure may lead to an increased risk of wound infections but could result in a shorter overall hospital stay. On the other hand, stoma reversal between 8 and 12 weeks is associated with lower complication rates and may be a safer choice for most patients. Thus, we would like to infer that the optimal timeframe for stoma closure is between 8 and 12 weeks, as it minimizes complications and also does not burden the patients psychologically. Although, this duration is subject to change if the patient experiences other complications that may cause delays.

Another important finding was that complications occurred independently of sex, age, type of surgery, and timing of closure. The ideal timing for stoma closure remains a complex decision. Balancing the potential benefits of early closure, such as improved QoL, with the risk of complications necessitates a personalized approach. Our study underscores the importance of stoma-specific complications and the need for further research to optimize closure timing for improved patient outcomes. Collaborative decision-making involving patients, surgeons, and stoma care nurses is crucial when determining the most suitable closure time frame for each individual.

CONFLICT OF INTEREST

None.

REFERENCES

1. Black PK. History and evolution of stomas. Br J Nurs. 1994;3(1):6-11. doi: 10.12968/bjon.1994.3.1.6, PMID 8142733
2. Davis B, Rivadeneira DE. Complications of colorectal anastomoses: Leaks, strictures, and bleeding. Surg Clin North Am. 2013;93(1):61-87. doi: 10.1016/j.suc.2012.09.014, PMID 23177066
3. Resio BJ, Jean R, Chiu AS, Pei KY. Association of timing of colostomy reversal with outcomes following Hartmann procedure for diverticulitis. JAMA Surg. 2019;154(3):218-24. doi: 10.1001/jamasurg.2018.4359, PMID 30476948
4. Hindenburg T, Rosenberg J. Closing a temporary ileostomy within two weeks. Dan Med Bull. 2010;57(6):A4157. PMID 20515604
5. Cheng Z, Dong S, Bi D, Wang Y, Dai Y, Zhang X. Early versus late preventive ileostomy closure following colorectal surgery: Systematic review and meta-analysis with trial sequential analysis of randomized controlled trials. Dis Colon Rectum. 2021;64(1):128-37. doi: 10.1097/DCR.0000000000001839, PMID 33306538
6. Fonseca AZ, Uramoto E, Santos-Rosa OM, Santin S, Ribeiro M Jr. Colostomy closure: Risk factors for complications. Arq Bras Cir Dig. 2017;30(4):231-4. doi: 10.1590/0102-6720201700040001, PMID 29340543
7. Sier MF, Van Gelder L, Ubbink DT, Bemelman WA, Oostenbroek RJ. Factors affecting timing of closure and non-reversal of temporary ileostomies. Int J Colorectal Dis. 2015;30(9):1185-92. doi: 10.1007/s00384-015-2253-3, PMID 26054385
8. Abdalla S, Scarpinata R. Early and late closure of loop ileostomies: A retrospective comparative outcomes analysis. Ostomy Wound Manage. 2018;64(12):30-5. doi: 10.25270/owm.2018.12.3035, PMID 30516478
9. Aljorfi AA, Alkhamis AH. A Systematic review of early versus late closure of loop ileostomy. Surg Res Pract. 2020 Aug 31;2020:9876527. doi: 10.1155/2020/9876527, PMID 32953972, PMCID PMC7481925
10. Bananzade A, Dehghankhalili M, Bahrami F, Tadayon SM, Ghaffarpasand F. Outcome of early versus late ileostomy closure in patients with rectal cancers undergoing low anterior resection: A prospective cohort study. Asian J Surg. 2023;46(10):4277-82. doi: 10.1016/j.asjsur.2023.01.099, PMID 36797086
11. Burghgraef TA, Geitenbeek RT, Broekman M, Hol JC, Hompes R, Consten EC, *et al*. Permanent stoma rate and long-term stoma complications in laparoscopic, robot-assisted, and transanal total mesorectal excisions: A retrospective cohort study. Surg Endosc. 2024;38(1):105-15. doi: 10.1007/s00464-023-10517-9, PMID 37932600
12. Chow A, Tilney HS, Paraskeva P, Jeyarajah S, Zacharakis E, Purkayastha S. The morbidity surrounding reversal of defunctioning ileostomies: A systematic review of 48 studies including 6,107 cases. Int J Colorectal Dis. 2009 Jun;24(6):711-23. doi: 10.1007/s00384-009-0660-z. PMID 19221766
13. Kairaluoma M, Rissanen H, Kultti V, Mecklin JP, Kellokumpu I. Outcome of temporary stomas. A prospective study of temporary intestinal stomas constructed between 1989 and 1996. Dig Surg. 2002;19(1):45-51. doi: 10.1159/000052005, PMID 11961355
14. Li N, Wei S, Qi Y, Wei W. The effects of enhanced recovery after surgery on wound infection, complications, and postoperative hospital stay in patients undergoing colorectal surgery: A systematic review and meta-analysis. Int Wound J. 2023;20(10):3990-8. doi: 10.1111/iwj.14287, PMID 37650448
15. Menegaux F, Jordi-Galais P, Turrin N, Chigot JP. Closure of small bowel stomas on postoperative day 10. Eur J Surg. 2002;168(12):713-5. doi: 10.1080/00000000000000008, PMID 15362581
16. Madan S, Sureshkumar S, Anandhi A, Gurushankari B, Keerthi AR, Palanivel C, *et al*. Comparison of Enhanced Recovery after Surgery (ERAS) pathway versus standard care in patients undergoing elective stoma reversal surgery- A randomized controlled trial. J Gastrointest Surg. 2023;27:2667-75.
17. Omundsen M, Hayes J, Collinson R, Merrie A, Parry B, Bissett I. Early ileostomy closure: Is there a downside? ANZ J Surg. 2012 May;82(5):352-4. doi: 10.1111/j.1445-2197.2012.06033.x. PMID 22507141
18. Paik B, Kim CW, Park SJ, Lee KY, Lee SH. Postoperative outcomes of stoma takedown: Results of long-term follow-up. Ann Coloproctol. 2018;34(5):266-70. doi: 10.3393/ac.2017.12.13, PMID 30304929
19. Murken DR, Bleier JI. Ostomy-related complications. Clin Colon Rectal Surg. 2019 May;32(3):176-82. doi: 10.1055/s-0038-1676995, PMID: 31061647; PMCID: PMC6494607
20. Robertson I, Leung E, Hughes D, Spiers M, Donnelly L, Mackenzie I, *et al*. Prospective analysis of stoma-related complications. Colorectal Dis. 2005;7(3):279-85. doi: 10.1111/j.1463-1318.2005.00785.x, PMID 15859968
21. Saini P, Gaba R, Faridi MS, Agarwal N, Kaur N, Gupta A. Quality of life of patients after temporary ileostomy for ileal perforation- A questionnaire based study. Indian J Surg. 2014;76(1):38-43. doi: 10.1007/s12262-012-0547-z, PMID 24799782
22. Sheetz KH, Waits SA, Krell RW, Morris AM, Englesbe MJ, Mullard A, *et al*. Complication rates of ostomy surgery are high and vary significantly between hospitals. Dis Colon Rectum. 2014 May;57(5):632-7. doi: 10.1097/DCR.0000000000000038, PMID 24819104, PMCID PMC4197143
23. Sherman KL, Wexner SD. Considerations in stoma reversal. Clin Colon Rectal Surg. 2017 Jul;30(3):172-7. doi: 10.1055/s-0037-1598157.

PMID 28684934, PMCID PMC5498167

24. Wu JS. Intestinal stomas: Historical overview. In: Fazio VW, Church JM, Wu JS, editors. Atlas of Intestinal Stomas. Boston: Springer; 2012. doi: 10.1007/978-0-387-78851-7_1

25. Zhen L, Wang Y, Zhang Z, Wu T, Liu R, Li T, *et al*. Effectiveness between early and late temporary ileostomy closure in patients with rectal cancer: A prospective study. Curr Probl Cancer. 2017 May-Jun;41(3):231-40. doi: 10.1016/j.currproblcancer.2017.02.007. PMID 28434582