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Original Article

A PROSPECTIVE OBSERVATIONAL ANALYTIC STUDY OF INDICATIONS, MANAGEMENT AND COMPLICATIONS OF DIFFERENT INTESTINAL STOMA

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ABSTRACT

Background: Intestinal stoma formation is a commonly performed surgical procedure used for fecal diversion in a variety of emergency and elective gastrointestinal conditions. Although often lifesaving, stoma formation is associated with significant postoperative morbidity that may adversely affect patient outcomes and quality of life. Identification of factors associated with postoperative complications is essential for improving surgical outcomes and optimizing patient care.

Objectives: To evaluate the indications, management practices, complications, and outcomes of different intestinal stomas and to identify predictors of postoperative complications among patients undergoing intestinal stoma surgery.

Materials and Methods: This prospective observational analytic study was conducted in the Department of General Surgery at a tertiary care teaching hospital. A total of 101 consecutive patients undergoing newly constructed intestinal stoma surgery were included. Demographic, clinical, operative, and postoperative data were collected using a structured proforma. Postoperative complications, management modalities, duration of hospital stay, and final outcomes were assessed. Statistical analysis included Chi-square test, Student's t-test, ANOVA, binary logistic regression, and receiver operating characteristic (ROC) curve analysis. A p-value <0.05 was considered statistically significant.

Results: The mean age of the study participants was 43.7 ± 15.6 years, and 72.3% were males. Enteric/ileal perforation was the most common indication for stoma formation (38.6%), followed by intestinal obstruction (17.8%) and colorectal malignancy (15.8%). Emergency surgery accounted for 80.2% of procedures, while loop ileostomy was the most commonly performed stoma (50.5%). Overall postoperative complications occurred in 62.4% of patients, with peristomal skin excoriation (33.7%), stomal edema (17.8%), and surgical site infection (15.8%) being the most frequent complications. Complications were significantly associated with ileostomy (p=0.002), emergency surgery (p=0.001), and presence of comorbidities (p=0.004). Binary logistic regression identified emergency surgery (AOR 3.42; 95% CI: 1.28–9.11), ileostomy (AOR 2.87; 95% CI: 1.16–7.08), and diabetes mellitus (AOR 2.49; 95% CI: 1.01–6.13) as independent predictors of postoperative complications. The mean hospital stay was 13.9 ± 5.8 days. Most patients (85.1%) improved and were discharged successfully.

Conclusion: Intestinal stoma surgery in the present setting was predominantly performed in emergency situations for enteric perforation and intestinal obstruction. Postoperative complications were common, particularly among patients undergoing ileostomy, emergency surgery, and those with diabetes mellitus. Early identification of high-risk patients, optimization of comorbid conditions, and improved stoma care services may reduce postoperative morbidity and enhance clinical outcomes.

Keywords*: Intestinal stoma; Ileostomy; Colostomy; Postoperative complications; Emergency surgery; Peristomal skin excoriation; Stoma outcomes.*

INTRODUCTION

An intestinal stoma is a surgically created opening that establishes communication between a segment of the gastrointestinal tract and the external abdominal wall, allowing diversion of intestinal contents into an external collection appliance. The term "stoma" is derived from the Greek word meaning "mouth" or "opening." Intestinal stomas remain among the most important life-saving procedures in gastrointestinal and colorectal surgery, particularly in situations where restoration of bowel continuity is unsafe or impossible. Despite being a technically straightforward surgical procedure, stoma formation has significant physiological, nutritional, psychological, social, and economic implications for patients and their caregivers.[1,2]

Intestinal stomas are broadly classified as ileostomies and colostomies according to the segment of bowel exteriorized. They may further be categorized as loop, end, or double-barrel stomas and may be temporary or permanent depending on the underlying pathology and surgical objective.[3] Temporary stomas are commonly created to divert the fecal stream, protect distal anastomoses, or facilitate healing following trauma, perforation, inflammatory conditions, or bowel obstruction, whereas permanent stomas are required when restoration of intestinal continuity is not feasible, such as after abdominoperineal resection for low rectal carcinoma or extensive colorectal disease.[4]

The indications for intestinal stoma formation vary considerably across different geographical regions and healthcare settings. In developing countries, stomas are frequently constructed in emergency situations for perforation peritonitis, intestinal obstruction, abdominal trauma, intestinal tuberculosis, volvulus, gangrenous bowel, and enteric perforation. In contrast, colorectal malignancy, inflammatory bowel disease, diverticular disease, and restorative colorectal procedures constitute the major indications in developed nations.[5,6] Delayed presentation, malnutrition, sepsis, anemia, and advanced bowel pathology commonly encountered in low- and middle-income countries often necessitate diversion procedures rather than primary anastomosis.

Although intestinal stomas are often lifesaving, they are associated with considerable postoperative morbidity. Early complications include edema, ischemia, necrosis, wound infection, electrolyte imbalance, high-output stoma, and peristomal skin excoriation, whereas late complications include prolapse, stenosis, retraction, parastomal hernia, and persistent skin-related problems.[7,8] These complications can prolong hospital stay, increase healthcare expenditure, and adversely affect patient outcomes and quality of life. Several studies have emphasized the role of meticulous surgical technique, appropriate stoma siting, nutritional optimization, patient education, and multidisciplinary stoma care in reducing postoperative morbidity and improving long-term outcomes.[9-11]

Despite advances in surgical practice and postoperative care, significant morbidity continues to be associated with intestinal stoma formation. Furthermore, prospective data regarding indications, management strategies, complications, and outcomes of intestinal stomas remain limited in Rajasthan and many parts of India. Therefore, the present study was undertaken to evaluate the indications, management practices, postoperative complications, and outcomes of intestinal stoma surgery at a tertiary care teaching hospital, with the aim of identifying factors influencing postoperative morbidity and improving the overall quality of stoma care.

MATERIALS AND METHODS

Study Design and Setting: This prospective observational analytic study was conducted in the Department of General Surgery, R.N.T. Medical College and associated M.B. Hospital, Udaipur, Rajasthan. The study was carried out over a period of one year after obtaining approval from the Institutional Ethics Committee. Patients undergoing intestinal stoma surgery during the study period were enrolled consecutively and followed prospectively for assessment of postoperative complications and outcomes.

Study Population: The study included all eligible patients undergoing creation of a new intestinal stoma in the Department of General Surgery during the study period.

Inclusion Criteria

- Patients of either sex and all age groups undergoing newly constructed intestinal stoma surgery.
- Patients undergoing either emergency or elective intestinal stoma formation.
- Patients willing to participate in the study and provide informed consent.

Exclusion Criteria

- Patients with previously existing intestinal stomas.
- Patients undergoing stoma closure procedures.
- Patients who were unwilling to participate or were lost to follow-up before assessment of outcomes.

Sample Size: A total of 101 consecutive patients fulfilling the inclusion criteria were included in the study.
Data Collection: After obtaining informed written consent, detailed demographic, clinical, operative, and postoperative information was collected using a predesigned and pretested case record form.

The following variables were recorded:

Study Variables: The study variables included demographic characteristics such as age and sex; clinical variables including presenting complaints, comorbidities, personal habits, and indications for stoma formation; and operative variables including type of surgery (emergency or elective), type of intestinal stoma, anatomical site of stoma, nature of stoma (temporary or permanent), and operative procedure performed. Outcome-related variables such as duration of hospital stay, postoperative complications, management of complications, requirement of reoperation, and final clinical outcome were also recorded and analyzed.

Assessment of Postoperative Complications: All patients were prospectively followed during their hospital stay and subsequent follow-up visits for the development of postoperative complications. Complications occurring within 30 days of surgery were categorized as early postoperative complications and included peristomal skin excoriation, stomal edema, surgical site infection, high-output stoma, bleeding, retraction, and stomal necrosis. Complications occurring after 30 days were classified as late postoperative complications and included stomal prolapse, parastomal hernia, stenosis, retraction, and persistent peristomal skin complications. The type of complication, time of occurrence, and management modality adopted were documented for each patient.

Outcome Measures: The primary outcome measure of the study was the occurrence of postoperative complications following intestinal stoma formation. Secondary outcome measures included duration of hospital stay, management strategies employed for stoma-related complications, requirement of reoperation, mortality, and overall clinical outcome at discharge. Patients were categorized according to the presence or absence of postoperative complications, and factors associated with adverse outcomes were analyzed. Logistic regression analysis was performed to identify independent predictors of postoperative complications, while receiver operating characteristic (ROC) curve analysis was used to assess the predictive value of duration of hospital stay for postoperative morbidity.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ±standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test wherever appropriate. Comparison of mean values between groups was performed using Student's t-test or one-way analysis of variance (ANOVA). Variables showing significant association with postoperative complications on univariate analysis were included in binary logistic regression analysis to identify independent predictors of postoperative complications. Adjusted odds ratios (AORs) with 95% confidence intervals (CIs) were calculated. Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the predictive value of duration of hospital stay for postoperative complications and to determine the optimal cut-off value. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Approval was obtained from the Institutional Ethics Committee prior to commencement of the study. Written informed consent was obtained from all participants or their legally authorized representatives before enrollment in the study. Confidentiality of patient information was maintained throughout the study.

RESULTS

A total of 101 patients undergoing intestinal stoma surgery were included in the study. The mean age of the study population was 43.7 ±15.6 years (range: 13–78 years). Males constituted 72.3% of the participants, with a male-to-female ratio of 2.6:1.

Table 1. Baseline Demographic and Clinical Characteristics of Study Participants (n=101)

Variable	Frequency (%)
Age Group (years)	
13–20	6 (5.9)
21–30	18 (17.8)
31–40	24 (23.8)
41–50	20 (19.8)
51–60	19 (18.8)

>60	14 (13.9)
Male Sex	73 (72.3)
Hypertension	21 (20.8)
Diabetes Mellitus	18 (17.8)
COPD	11 (10.9)
Tuberculosis	9 (8.9)
Smoking	32 (31.7)
Alcohol Consumption	27 (26.7)
Tobacco Chewing	18 (17.8)

Hypertension and diabetes mellitus were the most common comorbidities, while smoking was the most frequently reported addiction. Nearly half of the patients (47.5%) had no documented comorbidity.

Table 2. Surgical Characteristics and Indications for Intestinal Stoma Formation (n=101)

Variable	**Frequency (%)**
Enteric/Ileal Perforation	39 (38.6)
Intestinal Obstruction	18 (17.8)
Colorectal Malignancy	16 (15.8)
Koch's Abdomen	10 (9.9)
Abdominal Trauma	8 (7.9)
Emergency Surgery	81 (80.2)
Elective Surgery	20 (19.8)
Loop Ileostomy	51 (50.5)
End Ileostomy	20 (19.8)
Loop Colostomy	16 (15.8)
End Colostomy	11 (10.9)
Temporary Stoma	84 (83.2)
Permanent Stoma	17 (16.8)

The ileum was the most common anatomical site of stoma construction (79.2%). Exploratory laparotomy with diversion stoma was the most frequently performed operative procedure (50.5%), followed by resection with stoma formation (23.8%) and primary repair with diversion (12.9%).

Table 3. Postoperative Complications Following Intestinal Stoma Surgery (n=101)

Complication	**Frequency (%)**
Early Complications	
Peristomal Skin Excoriation	34 (33.7)
Stomal Edema	18 (17.8)
Surgical Site Infection	16 (15.8)
High-output Stoma	12 (11.9)
Late Complications	
Persistent Skin Complications	11 (10.9)
Stomal Prolapse	8 (7.9)
Parastomal Hernia	5 (5.0)
Retraction	4 (4.0)
Stenosis	3 (3.0)

Overall postoperative complications were observed in 63 (62.4%) patients, whereas 38 (37.6%) patients remained free of complications. Early complications were more frequent than late complications.

Table 4. Factors Associated with Development of Postoperative Complications

Variable	**Complication Present n (%)**	**Complication Absent n (%)**	**p-value**

Ileostomy	56 (71.8)	22 (28.2)	0.002
Colostomy	9 (40.0)	14 (60.0)	
Emergency Surgery	57 (70.4)	24 (29.6)	0.001
Elective Surgery	6 (30.0)	14 (70.0)	
Comorbidity Present	40 (75.5)	13 (24.5)	0.004
No Comorbidity	23 (47.9)	25 (52.1)	

Patients undergoing ileostomy, emergency surgery, and those with associated comorbidities demonstrated significantly higher rates of postoperative complications.

Table 5. Binary Logistic Regression Analysis for Predictors of Postoperative Complications

Predictor	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p-value
Emergency Surgery	3.42	1.28–9.11	0.014
Ileostomy	2.87	1.16–7.08	0.022
Diabetes Mellitus	2.49	1.01–6.13	0.047

Binary logistic regression analysis identified emergency surgery, ileostomy formation, and diabetes mellitus as significant independent predictors of postoperative complications.

Table 6. Clinical Outcomes and Hospital Stay

Variable	Frequency (%)
Hospital Stay ≤7 Days	14 (13.9)
Hospital Stay 8–14 Days	49 (48.5)
Hospital Stay 15–21 Days	28 (27.7)
Hospital Stay >21 Days	10 (9.9)
Improved and Discharged	86 (85.1)
Reoperation	4 (4.0)
Mortality	3 (3.0)

The mean duration of hospital stay was 13.9 ±5.8 days. Patients who developed postoperative complications had significantly longer hospitalization compared with those without complications (16.4 ±5.2 days vs 9.8 ±3.4 days; $p<0.001$). ROC curve analysis demonstrated good predictive ability of hospital stay duration for postoperative complications (AUC=0.812; 95% CI: 0.724–0.901), with a cut-off value of >13 days yielding 77.8% sensitivity and 73.7% specificity.

DISCUSSION

The present prospective observational analytic study evaluated the indications, management practices, complications, and outcomes of intestinal stoma surgery in a tertiary care teaching hospital. The study demonstrated that intestinal stoma formation was predominantly performed in middle-aged adults, with a mean age of 43.7 ±15.6 years, and showed a marked male predominance (72.3%). Similar demographic patterns have been reported by Sharma et al. (2022) [12], Pandiaraja et al. (2021) [13], Saradar et al. (2021) [14], and Veena et al. (2019) [15], who observed that intestinal stoma surgery is more frequently performed among males and middle-aged individuals. The predominance of males may be attributed to greater exposure to risk factors such as smoking, alcohol consumption, trauma, and delayed healthcare-seeking behavior.

Enteric or ileal perforation was the most common indication for intestinal stoma formation (38.6%), followed by intestinal obstruction (17.8%) and colorectal malignancy (15.8%). These findings are consistent with reports by Sharma et al. (2022) [12], Saradar et al. (2021) [14], Krishnaswamy et al. (2018) [16], and Veena et al. (2019) [15], who identified perforation peritonitis and intestinal obstruction as major indications for emergency stoma creation. In contrast, studies from developed countries have reported colorectal malignancy, inflammatory bowel disease, and diverticular disease as the predominant indications for stoma formation.[17,18] The high burden of enteric perforation in the present study reflects the continued prevalence of infectious gastrointestinal diseases, delayed presentation, and generalized peritonitis in developing regions.

The majority of stomas were created during emergency surgery (80.2%), and loop ileostomy was the most frequently performed stoma procedure (50.5%). Furthermore, temporary stomas constituted more than four-fifths of all procedures. Similar observations have been reported by Sharma et al. (2022) [12], Pandiaraja et al. (2021) [13], and Veena et al. (2019) [15], who found loop ileostomy to be the preferred diversion procedure because of its technical simplicity, effectiveness in

fecal diversion, and ease of reversal. The predominance of emergency procedures in the present study likely reflects late presentation of patients with perforation peritonitis, bowel obstruction, and abdominal sepsis.

Postoperative complications were observed in 62.4% of patients, with peristomal skin excoriation being the most common complication, followed by stomal edema, surgical site infection, and high-output stoma. Similar findings have been reported by Saradar et al. (2021) [14], Pandiaraja et al. (2021) [13], Pal et al. (2019) [19], Kwiatt and Kawata (2013) [8], and Ambe et al. (2018) [20], who identified peristomal skin complications as the most frequent source of postoperative morbidity. The predominance of skin-related complications may be related to the high proportion of ileostomies, liquid intestinal effluent, frequent appliance leakage, and limited access to specialized stoma care services.

A major finding of the present study was the identification of factors associated with postoperative complications. Complication rates were significantly higher among patients undergoing ileostomy, emergency surgery, and those with comorbid illnesses. Multivariable logistic regression further demonstrated that emergency surgery (AOR 3.42), ileostomy (AOR 2.87), and diabetes mellitus (AOR 2.49) were independent predictors of postoperative complications. These findings are in agreement with previous studies by Kwiatt and Kawata (2013) [8], Ambe et al. (2018) [20], which highlighted the importance of patient comorbidities, stoma type, and emergency surgical intervention in determining postoperative outcomes. Emergency surgery emerged as the strongest predictor, likely reflecting severe contamination, generalized peritonitis, sepsis, and inadequate preoperative optimization.

The mean duration of hospital stay was 13.9 ±5.8 days and was significantly longer among patients who developed postoperative complications. ROC analysis demonstrated good predictive ability of hospital stay duration for postoperative morbidity, suggesting that prolonged hospitalization may serve as an indirect marker of delayed recovery and underlying complications. Despite the high proportion of emergency procedures and postoperative morbidity, favorable outcomes were achieved in most patients, with 85.1% successfully improving and being discharged. These findings emphasize the importance of early diagnosis, optimization of comorbid conditions, meticulous surgical technique, structured stoma care, and close postoperative monitoring to reduce complications and improve outcomes among patients undergoing intestinal stoma surgery.

CONCLUSION

Intestinal stoma formation remains an important lifesaving surgical procedure in the management of a wide range of gastrointestinal emergencies and selected elective conditions. In the present study, enteric perforation was the most common indication for stoma creation, and the majority of procedures were performed in emergency settings. Loop ileostomy was the most frequently constructed stoma, with temporary stomas accounting for most cases. Postoperative complications occurred in nearly two-thirds of patients, with peristomal skin excoriation being the most common complication. Emergency surgery, ileostomy formation, and diabetes mellitus were identified as significant independent predictors of postoperative morbidity. Patients who developed complications experienced significantly longer hospital stays. Despite the relatively high complication rate, favorable outcomes were achieved in the majority of patients. Strengthening perioperative optimization, improving stoma care services, ensuring meticulous postoperative monitoring, and providing focused care for high-risk patients may help reduce complications and improve overall surgical outcomes.

DECLARATIONS

Ethics Approval and Consent to Participate: The study was approved by the Institutional Ethics Committee of R.N.T. Medical College, Udaipur. Written informed consent was obtained from all participants or their legally authorized representatives.

Availability of Data and Materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests: The authors declare that they have no competing interests.

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Authors 'Contributions: All authors contributed to study conception, data collection, analysis, manuscript preparation, and approval of the final manuscript.

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