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Morbidity and Mortality Following Intestinal Ostomy Surgery: A 16-Month Prospective Cohort Study

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Abstract

Background and objectives

Intestinal stomas are widely practised in cases of various gastrointestinal emergencies and in selected elective procedures. Nevertheless, the morbidity and mortality of stoma patients are high in low- and middle-income environments. This study assessed the pattern of complications and short-term outcomes after stoma creation in a tertiary centre in central India. It also explored factors associated with poor outcomes in adult and paediatric patients.

Methods

This prospective observational cohort study was conducted at All India Institute of Medical Sciences (AIIMS) Bhopal between September 1, 2023 and December 31, 2024. Ninety-eight consecutive patients who underwent intestinal stoma creation were enrolled. Structured proformas were used to record demographic variables, clinical status, operative details and postoperative complications. Follow-up was conducted at 15 days, one month and six months to broadly evaluate the early (⩽30 days) and late (>30 days to six months) complications. Statistical tests included the chi-square or Fisher's exact test, t-test and Mann-Whitney U test ($P < 0.05$); unadjusted odds ratios (ORs) were calculated with 30-day death as the outcome.

Results

The majority of procedures were performed in an emergency (82.7%), with the most common type being ileostomy (66.3%). In 75.5% of patients, early complications occurred, with the most frequent ones being peristomal skin excoriation (49.0%) and wound infection (24.5%), and high-output stoma occurred in 11 patients (11.2%), all after emergency surgery. The total 30-day mortality was 21.4%. On unadjusted analysis, preoperative combined shock and sepsis (OR 39.3, 95% CI 8.2-187.3) and deranged renal function (OR 22.9, 95% CI 6.0-87.4) were strongly associated with 30-day mortality; all 21 deaths occurred among patients who required postoperative ICU care. Among the 77 patients alive at 30 days, late complications occurred in 11 (14.3%), mainly parastomal hernia (7.8%) and stoma prolapse (6.5%).

Conclusions

Emergency stoma creation was associated with high early morbidity and 30-day mortality, concentrated in physiologically compromised patients. Outcomes may be improved by optimising resuscitation and early control of sepsis, as well as increased postoperative monitoring. Also, protocolised management of high stoma output and dehydration, and better access to structured stoma-care services.

Categories: General Surgery, Emergency Medicine, Gastroenterology
Keywords: colorectal surgery, colostomy, ileostomy, intestinal stoma, postoperative complications, prospective studies

Introduction

Intestinal stomas are surgically formed openings used to divert faeces due to temporary or permanent gastrointestinal decompression. These include ileostomies, jejunostomies and colostomies. They are an obligatory part of operative treatment of a broad range of diseases, including perforation peritonitis, intestinal obstruction, malignancy, trauma and congenital anomalies [1]. They are also routine procedures performed in both emergency and non-emergency settings and are usually lifesaving for critically ill patients. Depending on the underlying pathology, stomas can be of different types. Ileostomies are often created due to inflammatory or neoplastic pathology. Colostomies are often performed in cases of lower bowel obstruction or colorectal malignancy. Jejunostomies are used in cases of pathology of the proximal bowel. Although stomas have therapeutic value, they play a crucial role in determining postoperative outcomes, recovery and quality of life.

Stoma-related morbidity is still significant in the world, especially in low- and middle-income countries (LMICs) where postponed presentation, inadequate perioperative support and inadequate stoma support further deteriorate the situation [2]. Early complication rates have been reported to be between 54% and 63% within 30 days of creation, and the most common issues include skin excoriation, wound infection, necrosis and high-output stomas (HOSs) [3-5]. All these complications can develop late (prolapse, parastomal hernia, retraction), and they may be present in up to 51% of patients; they commonly necessitate further treatment. The rates of mortality due to stoma creation are diverse based on the severity of the disease and the urgency of the surgical intervention, and an increase in mortality rates in cases of emergency admission and in patients with sepsis or multiorgan failure is reported. These complications have a significant physical and psychological effect on patients and add to the increased healthcare expenditures by raising the hospitalisation period and the need for an intensive care unit (ICU) [6,7].

Several risk factors are used to determine the postoperative complications and survival after stoma surgery. Determinants associated with the patient include advanced age, comorbid conditions and poor nutritional state, especially hypoalbuminaemia and anaemia, which are correlated with adverse events by 3.1 and 2.6, respectively [8,9]. Disease-associated risks, such as sepsis, shock, perforation, peritonitis and congenital anomalies, significantly impair prognosis, with emergency operation having up to four-fold higher complication rates compared to non-emergency procedures [8,9]. Postoperative outcomes are also influenced by surgical factors, such as the urgency of the operation, the nature and degree of the stoma and the surgeon's experience, with emergency surgery being associated with increased morbidity and mortality in selected emergency general surgery populations [10]. Pathophysiologically, the systemic inflammatory response associated with sepsis and shock may disrupt tissue perfusion, slow down healing and predispose patients to wound breakdown and premature stoma failure [11]. The interaction among these factors is crucial for improving perioperative management and preventing adverse events.

The contribution of emergency abdominal surgery is disproportionate in India, where perforated peritonitis represents almost 38% of stoma indications in various series. Research constantly demonstrates a high morbidity and mortality caused by a late presentation, malnutrition, sepsis and shock. Postoperative mortality rates range from 11.7% to 16.36%, and complications like wound infection (18.4%) and respiratory complications (10.5%) are common [12]. Although emergency stoma is prevalent, limited prospective data describe complete risk and outcome profiles, particularly in Madhya Pradesh, central India. Current research rarely compares adult and paediatric populations or incorporates early and late complications. Interestingly, the lack of systematic data at the All India Institute of Medical Sciences (AIIMS) Bhopal limits evidence-based advances in perioperative optimisation and postoperative stoma care.

Due to the large number of cases of emergency surgery, the frequency of presentation with shock and sepsis and the likely presence of significant perioperative morbidity, as clinically evident, there is an immediate necessity for solid prospective data to inform risk stratification and to optimise the process of perioperative care. To enhance outcomes, it is crucial to understand the interactions among demographic factors, nutritional status, physiological derangements and surgical urgency.

Therefore, the present study aimed to evaluate the complications and outcomes of intestinal stoma creation in a tertiary-care centre. The primary objectives were to determine (i) the incidence and pattern of early (≤30 days) and late (>30 days to six months) stoma-related complications and (ii) 30-day all-cause mortality. Secondary, exploratory objectives were to (iii) describe unadjusted associations between preoperative clinical and operative factors (including shock, sepsis, hypoalbuminaemia, renal dysfunction, operative urgency and stoma configuration) and these outcomes and (iv) compare outcomes between adult and paediatric patients and between emergency and elective procedures.

Materials And Methods

Study setting

The study was a prospective observational cohort study conducted in the Department of General Surgery at the AIIMS Bhopal, a tertiary care teaching hospital in Central India. The department serves both urban and rural patients of Madhya Pradesh and other neighbouring states.

Study design and period

This prospective, observational cohort study was conducted from September 1, 2023, to December 31, 2024 (16 months). Patients were recruited throughout this period, and follow-up of the last patients enrolled (December 2024) continued until June 30, 2025, so that every patient alive at 30 days had the opportunity for a six-month assessment. The reporting followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational studies.

Study population and sampling

Paediatric (<14 years old) and adult patients (≥14 years old) were eligible to participate in the study; individuals had to have undergone stoma formation (ileostomy, jejunostomy, colostomy, etc.) during the study period. Patients were enrolled using a consecutive (non-probability) sampling technique, without

randomisation; that is, every eligible patient presenting during the study period was approached for enrolment in the order in which they presented.

Potential confounding variables

Potential confounding variables that could influence postoperative morbidity and mortality independently of stoma type or surgical urgency were identified a priori and recorded prospectively. These included age, sex, pre-existing comorbidities, preoperative nutritional status, haemoglobin concentration, serum albumin concentration, shock, sepsis, renal dysfunction, hepatic dysfunction and other indicators of disease severity. These variables were examined in univariate analyses. Because only 21 deaths occurred, a multivariable regression model incorporating multiple potential confounders was not considered sufficiently reliable and was therefore not performed. Residual confounding cannot consequently be excluded.

Eligibility criteria

Patients of any sex undergoing emergency or elective intestinal stoma surgery at AIIMS Bhopal were eligible for inclusion. Eligible indications included congenital anorectal anomalies, inflammatory bowel disease, trauma, malignancy, intestinal perforation, intestinal obstruction, ischemia, fistula and other conditions requiring intestinal diversion. Patients undergoing faecal diversion for trauma, including grade 4 perineal injuries due to road traffic accidents, falls, etc., were included; all such procedures were performed as emergencies. Patients were excluded if written informed consent could not be obtained from the patient or, where applicable, from a parent or legally authorised representative; or if the stoma had been created at another institution before referral to AIIMS Bhopal.

Sample size

The sample size was calculated a priori using the formula $n = \frac{4pq}{d^2}$, where p represents the anticipated incidence of early stoma-related complications, $q = 1 - p$, and d represents the allowable absolute precision. Based on a previously reported incidence of 54.1% for early stoma-related complications following emergency intestinal stoma surgery, p was taken as 0.541, q as 0.459, and an absolute precision of 10 percentage points was assumed [5]. This yielded a minimum sample size of approximately 99 patients. A total of 98 eligible patients were enrolled during the study period. The calculated value was 99.3; with 98 patients enrolled, the achieved absolute precision was ±10.1 percentage points, and at the observed early complication rate (75.5%), the 95% confidence interval (CI) half-width was ±8.5 percentage points, so the pre-specified precision was met.

Data collection

Data were collected prospectively using a pre-tested, structured proforma (Appendices). Information was recorded at admission, intra-operatively, at discharge and during follow-up visits. Variables collected included demographic data (age and sex); clinical parameters (stoma indication, comorbidities and preoperative nutritional status); operative details (urgency (elective or emergency), bowel segment used (small or large bowel), stoma type (end, loop or double barrel), operative findings and intra-operative complications); and the postoperative course (ICU requirement, duration of hospital stay, daily stoma output and fluid balance, serum electrolytes and creatinine, complications, mortality and stoma reversal). Follow-up visits were scheduled at 15 days, one month and six months postoperatively; patients unable to attend in person were followed up by telephone.

At each follow-up visit, a standardised clinical examination was performed and recorded on the pro forma (Appendices): stoma colour and viability, protrusion, mucocutaneous junction, peristomal skin, appliance fit and leakage, stoma output and clinical signs of dehydration, wound status, presence of a parastomal bulge on standing and coughing, prolapse, retraction and stenosis on digital examination. The timing and content of these assessments are summarised in Figure *4*.

Postoperative complications were classified as early, occurring within ⩽30 days of surgery (e.g., wound infection, peristomal skin excoriation, mucocutaneous separation, stoma necrosis, stoma oedema, stoma retraction, HOS, early reintervention with the indications) or late, occurring between >30 days and six months (stoma prolapse, retraction, parastomal hernia, mucocutaneous separation and peristomal skin excoriation). Complications were classified by their time of onset. Mortality was recorded as all-cause in-hospital mortality and all-cause 30-day mortality.

Definitions

Shock was defined as systolic blood pressure <90 mmHg or mean arterial pressure <65 mmHg requiring fluid resuscitation and/or vasopressor support (age-appropriate thresholds in children). Sepsis was defined as suspected or confirmed infection with acute organ dysfunction (Sepsis-3 criteria), and combined shock and sepsis as both being present preoperatively. Renal dysfunction (deranged renal function test (RFT)) was defined as serum creatinine >1.2 mg/dL, and hepatic dysfunction (deranged liver function test (LFT)) as

serum bilirubin >1.2 mg/dL and/or transaminases >2 times the upper limit of normal. HOS was defined as stoma output >1.5 L/24 hours on two or more consecutive days in adults (> 20 mL/kg/day in children). Stoma necrosis was defined as dusky or black stomal mucosa on clinical examination; mucocutaneous separation as detachment of the stomal mucosa from the peristomal skin; and peristomal skin excoriation as erythema, erosion, or ulceration of the peristomal skin. Complications were not graded prospectively using the Clavien-Dindo classification; therefore, the need for reintervention (equivalent to Clavien-Dindo grade III or higher) and ICU admission were recorded as markers of complication severity.

Outcome measures

The primary outcome was the incidence and pattern of stoma-related and general postoperative complications, together with all-cause 30-day mortality. Secondary (exploratory) outcomes were the unadjusted associations of complications and mortality with demographic variables, stoma indication, preoperative nutritional status, comorbidities, organ failure status, operative urgency, stoma segment and configuration, ICU stay, total hospital stay and timing of stoma reversal.

Interventions and follow-up

All patients underwent stoma creation according to the department's standard surgical protocols. Stoma sites were marked preoperatively in elective cases; in emergencies, the site was chosen intra-operatively. Stomas were brought out through a circular skin and fascial trephine through the rectus abdominis muscle. Ileostomies and jejunostomies were everted (Brooke technique) to a spout of approximately 2-3 cm, and colostomies were matured flush to 1 cm; the mucosa was sutured to the dermis with interrupted absorbable sutures. Perioperative care, including antibiotic prophylaxis, electrolyte management and stoma care, was provided in accordance with Institutional guidelines. No dedicated entero-stomal therapy nurse service, stoma clinic or stoma helpline was available during the study period. Stoma care and patient education were provided by ward nursing staff and surgical residents, and patients were advised to attend the surgical outpatient clinic or emergency department if problems arose. Stoma reversal was performed when clinically appropriate, usually after eight to 12 weeks, depending on the underlying pathology and patient recovery.

Statistical analysis

IBM SPSS Statistics for Windows, Version 26 (IBM Corp., Armonk, NY) was used to analyse data. Continuous variables were assessed for distributional characteristics. Normally distributed continuous variables were summarised as mean ± standard deviation (SD) and compared between two groups using the independent-samples Student's t-test. Non-normally distributed continuous variables were summarised as median and interquartile range (IQR) and compared using the Mann-Whitney U test. Categorical variables were summarised as frequencies and percentages and compared using the Pearson chi-square (χ^2) without continuity correction. Fisher's exact test was used when the expected frequency in one or more cells was insufficient for the Pearson chi-square test. Unadjusted odds ratios (ORs) with 95% CIs (Woolf method) were calculated for binary outcomes, with 30-day death coded as the outcome event and absence of the factor as the reference category; where a cell count was zero, an OR was not estimated. Because only 21 deaths occurred, the ORs are imprecise and are presented as descriptive measures of association rather than estimates of independent effect. Late complication rates were calculated among patients alive and at risk beyond 30 days (n = 77). All statistical tests were two-tailed, and a P-value <0.05 was considered statistically significant. There were no missing baseline or 30-day outcome data; therefore, no imputation was performed. The statistical test used for each comparison is stated in the table footnotes.

Ethical considerations

The study adhered to the Indian Council of Medical Research (ICMR) National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017) and the Declaration of Helsinki (2013 revision). Ethical approval was obtained from the Institutional Human Ethics Committee (IEC), AIIMS Bhopal, prior to commencement of patient recruitment (Ref: LOP-AIIMS/BPL/IECSR/JAN/23/PG/20).

Written informed consent was obtained in English or Hindi from all participants or legal guardians. For minors under 18 years, assent was also obtained. Patient confidentiality was ensured through de-identification and secure, password-protected data storage accessible only to study investigators.

Results

The study involved a total of 98 patients, of whom 80 (81.6%) were adults and 18 (18.4%) were paediatric patients. The mean age of the group was 32.5 years. The median age of the group was 32.50 years, and adults were significantly older than paediatric patients (Student's t-test, P < 0.001). There were 59 (60.2%) male participants. The majority of surgeries were performed in the emergency setting (81; 82.7%). Clinical status at baseline varied between children and adults, with adults having more cases of shock, sepsis and combined shock with sepsis. More than two-thirds of the study population (68; 69.4%) had anaemia, and over half (55; 56.1%) had hypoalbuminaemia.

The demographic and surgical distribution of the study population is illustrated in Figure *1*, and baseline

characteristics are summarised in Table 1.

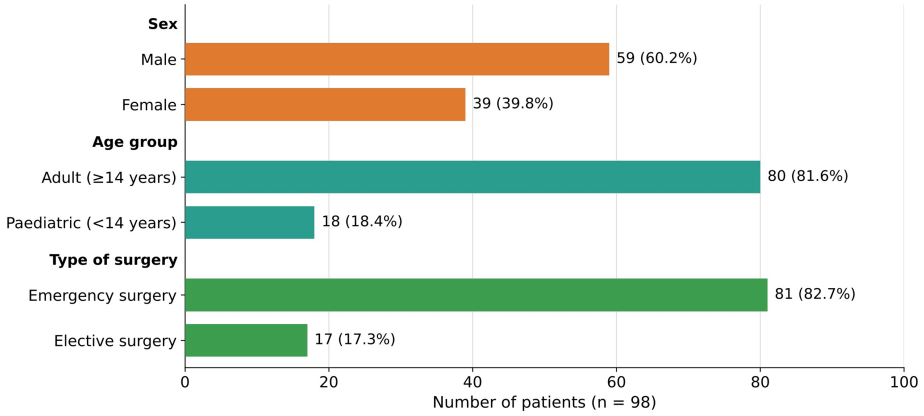


FIGURE 1: Distribution of Study Population by Demographics and Surgical Type

Parameter	n (%)	Emergency n (%)	Elective n (%)	P-value
Type of stoma created				
Ileostomy	65 (66.3)	60 (92.3)	5 (7.7)	<0.001
Colostomy	23 (23.5)	11 (47.8)	12 (52.2)	-
Jejunostomy	10 (10.2)	10 (100.0)	0 (0.0)	-
Early complications (≤30 days)	74 (75.5)	68 (84.0)	6 (35.3)	<0.001
Peristomal skin excoriation	48 (49.0)	43 (53.1)	5 (29.4)	0.076
Wound infection	24 (24.5)	24 (29.6)	0 (0.0)	0.01
Mucocutaneous separation	20 (20.4)	19 (23.5)	1 (5.9)	0.182
Stoma necrosis	13 (13.3)	11 (13.6)	2 (11.8)	1
High-output stoma	11 (11.2)	11 (13.6)	0 (0.0)	0.203
Stoma oedema	9 (9.2)	9 (11.1)	0 (0.0)	0.352
Stoma retraction	3 (3.1)	3 (3.7)	0 (0.0)	1
Early re-intervention required	22 (22.4)	21 (25.9)	1 (5.9)	0.108
For stoma necrosis alone	10 (10.2)	9 (11.1)	1 (5.9)	-
For mucocutaneous separation	4 (4.1)	4 (4.9)	0 (0.0)	-
Combined necrosis + separation	2 (2.0)	2 (2.5)	0 (0.0)	-
For stoma retraction	2 (2.0)	2 (2.5)	0 (0.0)	-
For other indications (not related to stoma)	4 (4.1)	4 (4.9)	0 (0.0)	-
Late complications (> 30 days; n = 77 alive at 30 days)	11(14.3)	10 (16.4)	1(6.3)	0.442
Parastomal hernia	6 (7.8)	5 (8.2)	1(6.3)	1
Stoma prolapse	5 (6.5)	5 (8.2)	0 (0.0)	0.577
ICU admission required	50 (51.0)	47 (58.0)	3 (17.6)	0.002
Mean hospital stay (days)	18.4 ± 12.4	18.9 ± 12.6	15.8 ± 11.2	0.342
Median (IQR)	17 (11-26)	17 (11-27)	13 (9-21)	-

TABLE 1: Stoma-Related Complications and Outcomes (n = 98)

Comparisons between the emergency and elective groups were performed using the Pearson chi-square (χ^2) test (or Fisher's exact test where expected cell counts were <5) for categorical variables, and Student's t-test for the normally distributed continuous variable (hospital stay, mean ± SD); a two-tailed P-value <0.05 was considered statistically significant. Stoma-type rows show percentages; late complications use survivors at 30 days (61 emergency, 16 elective) as denominators.

Abbreviations: ICU, intensive care unit; IQR, interquartile range; SD, standard deviation. Units: hospital stay in days.

The most indicative sign of stoma creation was perforation peritonitis, followed by intestinal obstruction, rectovaginal fistula, anorectal malformations and Hirschsprung disease. Congenital abnormalities and fistulas were the most frequent elective procedures, whereas emergency indications accounted for the largest number of cases, particularly perforation peritonitis and mesenteric ischaemia. Three adults underwent faecal diversion for grade 4 perineal trauma, all as emergencies. All the indicators are shown in Table *2* and represented in Figure *2*.

Indication	Total n (%)	Adult n (%)	Paediatric n (%)	Emergency n (%)	Elective n (%)
Perforation peritonitis	40 (40.8)	37 (46.3)	3 (16.7)	40 (100.0)	0 (0.0)
Intestinal obstruction	21 (21.4)	21 (26.3)	0 (0.0)	21 (100.0)	0 (0.0)
Anorectal malformation	4 (4.1)	0 (0.0)	4 (22.2)	1 (25.0)	3 (75.0)
Rectovaginal fistula	8 (8.2)	3 (3.8)	5 (27.8)	3 (37.5)	5 (62.5)
Hirschsprung disease	4 (4.1)	0 (0.0)	4 (22.2)	1 (25.0)	3 (75.0)
Mesenteric ischemia	6 (6.1)	6 (7.5)	0 (0.0)	6 (100.0)	0 (0.0)
Carcinoma rectum	3 (3.1)	3 (3.8)	0 (0.0)	2 (66.7)	1 (33.3)
Complex fistula-in-ano	2 (2.0)	2 (2.5)	0 (0.0)	2 (100.0)	0 (0.0)
Perineal injury (trauma), grade 4	3 (3.1)	3 (3.8)	0 (0.0)	3 (100.0)	0 (0.0)
Anastomotic leak	2 (2.0)	2 (2.5)	0 (0.0)	2 (100.0)	0 (0.0)
Familial adenomatous polyposis	2 (2.0)	0 (0.0)	2 (11.1)	0 (0.0)	2 (100.0)
Miscellaneous	3 (3.1)	3 (3.8)	0 (0.0)	0 (0.0)	3 (100.0)

TABLE 2: Indications for Stoma Creation by Age Group and Surgical Urgency (n = 98)

Values are presented as numbers (n) and percentages (%): column percentages for total, adult and paediatric; row percentages for emergency and elective. No formal statistical comparison (e.g., chi-square test) was performed.

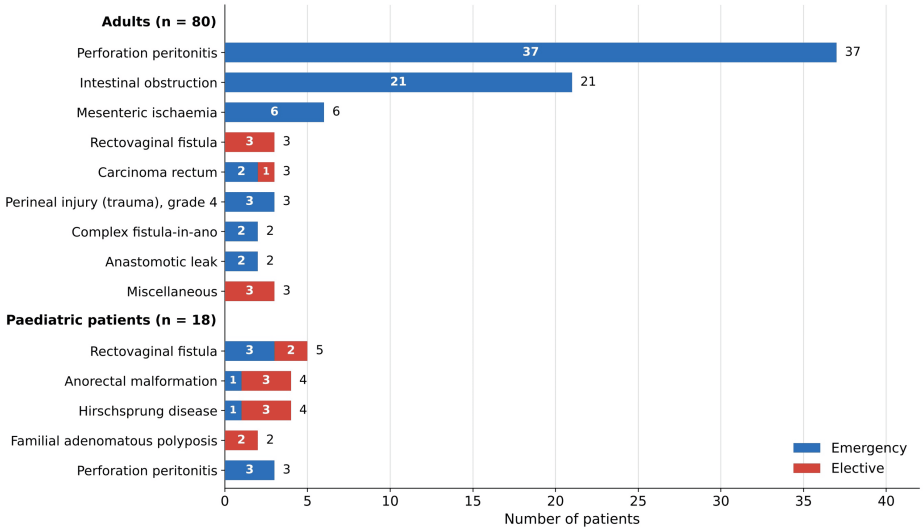


FIGURE 2: Spectrum of Indications for Stoma Creation (n = 98)

Ileostomy was the predominant stoma formed, and colostomy and jejunostomy came after that. The early postoperative complications were present in 74 of 98 patients (75.5%), and they were mainly peristomal skin excoriation and wound infection. HOS developed in 11 patients (11.2%), all after emergency procedures and all after small-bowel stomas (nine ileostomies and two jejunostomies). A small group of patients, especially those with stoma necrosis and mucocutaneous separation, required early reintervention. Late complications were less common: among the 77 patients alive at 30 days, 11 (14.3%) developed a late complication, mainly parastomal hernia (6; 7.8%) and stoma prolapse (5; 6.5%). Table *3* summarises the stoma-related outcomes, early and late complications and ICU requirements. Figure *3* illustrates the early complications with different types of stomas.

Parameter	n (%)	Emergency n (%)	Elective n (%)	P-value
Type of stoma created				
Ileostomy	65 (66.3)	60 (92.3)	5 (7.7)	<0.001
Colostomy	23 (23.5)	11 (47.8)	12 (52.2)	-
Jejunostomy	10 (10.2)	10 (100.0)	0 (0.0)	-
Early complications (≤30 days)	74 (75.5)	68 (84.0)	6 (35.3)	<0.001
Peristomal skin excoriation	48 (49.0)	43 (53.1)	5 (29.4)	0.076
Wound infection	24 (24.5)	24 (29.6)	0 (0.0)	0.010
Mucocutaneous separation	20 (20.4)	19 (23.5)	1 (5.9)	0.182
Stoma necrosis	13 (13.3)	11 (13.6)	2 (11.8)	1.000
High-output stoma	11 (11.2)	11 (13.6)	0 (0.0)	0.203
Stoma oedema	9 (9.2)	9 (11.1)	0 (0.0)	0.352
Stoma retraction	3 (3.1)	3 (3.7)	0 (0.0)	1.000
Early re-intervention required	22 (22.4)	21 (25.9)	1 (5.9)	0.108
For stoma necrosis alone	10 (10.2)	9 (11.1)	1 (5.9)	-
For mucocutaneous separation	4 (4.1)	4 (4.9)	0 (0.0)	-
Combined necrosis + separation	2 (2.0)	2 (2.5)	0 (0.0)	-
For stoma retraction	2 (2.0)	2 (2.5)	0 (0.0)	-
For other indications (unrelated to stoma)	4 (4.1)	4 (4.9)	0 (0.0)	-
Late complications (> 30 days; n = 77 alive at 30 days)	11(14.3)	10 (16.4)	1(6.3)	0.442
Parastomal hernia	6 (7.8)	5 (8.2)	1(6.3)	1.000
Stoma prolapse	5 (6.5)	5 (8.2)	0 (0.0)	0.577
ICU admission required	50 (51.0)	47 (58.0)	3 (17.6)	0.002
Mean hospital stay (days)	18.4 ± 12.4	18.9 ± 12.6	15.8 ± 11.2	0.342
Median (IQR)	17 (11-26)	17 (11-27)	13 (9-21)	-

TABLE 3: Stoma-Related Complications and Outcomes (n = 98)

Comparisons between the emergency and elective groups were performed using the Pearson chi-square (χ^2) test (or Fisher's exact test where expected cell counts were <5) for categorical variables, and Student's t-test for the normally distributed continuous variable (hospital stay, mean ± SD); a two-tailed P-value <0.05 was considered statistically significant. Stoma-type rows show percentages; late complications use survivors at 30 days (61 emergency, 16 elective) as denominators.

Abbreviations: ICU, intensive care unit; IQR, interquartile range; SD, standard deviation. Units: hospital stay in days.

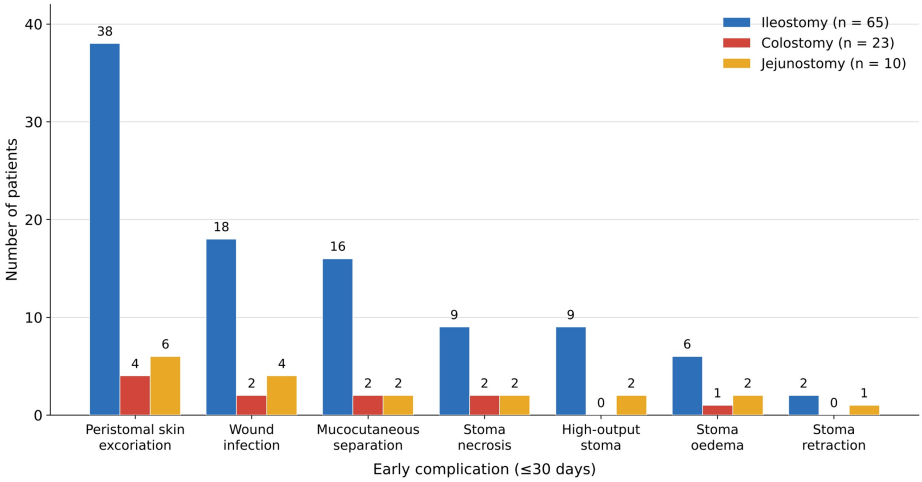


FIGURE 3: Early Postoperative Complications by Stoma Type

There was an overall mortality rate of 21 of 98 patients (21.4%), and almost all the mortality occurred in patients who presented with shock and sepsis (19 of 21 deaths; 90.5%). On unadjusted analysis, combined shock and sepsis (OR 39.3, 95% CI 8.2-187.3) and deranged RFTs (OR 22.9, 95% CI 6.0-87.4) were strongly associated with mortality. The CIs were wide because of the small number of deaths, so the magnitude of these estimates should not be over-interpreted. Emergency surgery (OR 5.25, 95% CI 0.65-42.1) and hypoalbuminaemia (OR 2.31, 95% CI 0.81-6.59) were not significantly associated with mortality. Mortality differed between ileostomy and colostomy on pairwise comparison, but the overall comparison across the three stoma types was not significant (χ^2, P = 0.064), and ileostomies were created predominantly in emergency, septic patients. All 21 deaths occurred in patients admitted to the ICU postoperatively (21 of 21 deaths vs 29 of 77 survivors); because ICU admission is a postoperative event and a marker of illness severity, it is reported descriptively rather than as a risk factor. HOS was not associated with mortality (two of 21 deaths vs nine of 77 survivors; P = 1.000). The shorter hospital stay of deceased patients reflects early death and is not a prognostic factor. Table *4* summarises the factors associated with mortality.

Variable	Deaths n (%)	Survivors n (%)	Mortality OR (95% CI)	P-value
Overall mortality	21 (21.4)	77 (78.6)	-	-
Preoperative and operative factors				
Shock + sepsis present	19 (90.5)	15 (19.5)	39.3 (8.2-187.3)	<0.001
Shock only	1 (4.8)	5 (6.5)	-	1.000
Sepsis only	1 (4.8)	8 (10.4)	-	0.679
Neither shock nor sepsis	0 (0.0)	49 (63.6)	NE	<0.001
Emergency surgery	20 (95.2)	61 (79.2)	5.25 (0.65-42.1)	0.110
Elective surgery	1 (4.8)	16 (20.8)	Reference	-
Low albumin (<3.5 g/dL)	15 (71.4)	40 (51.9)	2.31 (0.81-6.59)	0.111
Normal albumin (≥3.5 g/dL)	6 (28.6)	37 (48.1)	Reference	-
Deranged RFT	18 (85.7)	16 (20.8)	22.9 (6.0-87.4)	<0.001
HCV positive	2 (9.5)	0 (0.0)	NE	0.044
Stoma type				0.064 (overall)
Ileostomy	18 (85.7)	47 (61.0)	-	0.034
Colostomy	1 (4.8)	22 (28.6)	-	0.022
Jejunostomy	2 (9.5)	8 (10.4)	-	1.000
Hospital stay (days)				
Mean ± SD	10.6 ± 11.7	20.5 ± 11.8	-	<0.001
Median (IQR)	5 (3-12)	19 (13-28)	-	-
Postoperative course (descriptive; not risk factors)				
High-output stoma	2 (9.5)	9 (11.7)	0.80 (0.16-4.00)	1.000
Postoperative ICU admission	21 (100.0)	29 (37.7)	NE	<0.001

TABLE 4: Factors Associated With 30-Day Mortality (Unadjusted Analysis) (n = 98)

Odds ratios (OR) with 95% confidence intervals (CI) and P-values were derived from unadjusted 2 × 2 analysis (outcome: 30-day death; reference: factor absent, i.e., non-exposed patients), using the Pearson chi-square (χ^2) test or Fisher's exact test for categorical comparisons, and Student's t-test for hospital stay (mean ± SD, normally distributed); a two-tailed P-value <0.05 was considered statistically significant Dashes - indicate an OR/CI not computed (reference category, heading, or small cell counts) or a p-value not applicable.

Abbreviations: HCV, hepatitis C virus; ICU, intensive care unit; IQR, interquartile range; NE, not estimated (zero cell); RFT, renal function test; SD, standard deviation. Units: hospital stay in days; albumin in g/dL.

Of the 98 enrolled patients, 21 died within 30 days, and 77 were alive at 30 days. Of these, 77 completed six-month follow-up in person, and none were lost to follow-up. Participant flow and the follow-up schedule are shown in Figure *4*.

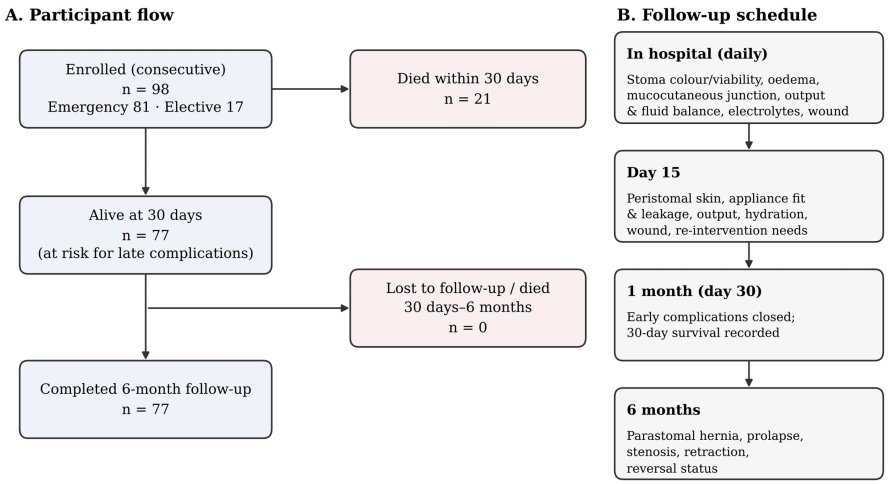


FIGURE 4: Participant Flow and Follow-Up Schedule

(A) Flow of patients from enrolment to six-month follow-up. (B) Timing and content of the clinical assessments at each follow-up visit.

Discussion

Among 98 consecutive intestinal stomas in the prospective cohort study in a tertiary care centre in central India, we found high rates of early morbidity (74 of 98 patients, 75.5%, had one or more early complications) and high rates of 30-day mortality (21 of 98 patients, 21.4%), and this burden was concentrated in patients with combined shock and sepsis and those requiring postoperative ICU care [13-15]. The cohort was characterised by emergency operations, ileostomy predominance, frequent preoperative hypoalbuminaemia and anaemia and a high proportion of patients presenting in haemodynamic compromise, contextualising the complication and mortality rates observed. These indicate that when emergency presentations and physiological derangement are the order of the day, stoma construction remains a risky operation whose outcomes appear to be related more to host physiology and timing than to stoma configuration, although this could not be confirmed by adjusted analysis [13-15].

Our research has both strengths and weaknesses. Among its strengths are the prospective design with consecutive enrolment, the prespecified definition of early and late complications and the systematic follow-up at six months that encompassed both the surgical and medical consequences. This permitted assessment of unadjusted associations between preoperative physiological malfunction (shock, sepsis, deranged RFT) and survival in the short term. Nonetheless, due to the small sample size (n = 98) and the limited number of observed events (21 deaths and 11 late complications), statistical power for multivariable modelling and subgroup analysis was low; thus, clinically plausible variables (e.g., hypoalbuminaemia, elective vs emergency status) were not always statistically significant even with consistent directional effects. As noted under Methods, formal multivariable adjustment for confounding variables (age, comorbidity, nutritional status, disease acuity) could not be performed because of the limited number of events, and residual confounding cannot be excluded. Case-mix bias (preponderance of emergency ileostomies) and the comparatively brief follow-up (six months) also restrict generalisability to elective stoma groups, as well as to the long-term consequences of parastomal hernia development or enduring quality-of-life outcomes. Lastly, the availability of ostomy nursing and local supply of appliances at the resource and system level (availability of ostomy nursing, local appliance supplies) was not measured prospectively and could have had an effect on the peristomal complications of the skin.

In comparison with previously published studies, our findings align with the fact that the rates of complications associated with a stoma are highly heterogeneous, as reported in the literature. However, they also underscore the dismal short-term results in emergencies following a diversion. A systematic review of randomised trials and observational cohorts discovered a wide range of morbidity in stoma cases (2.9-81.1), with peristomal skin issues and parastomal hernia being some of the most frequent [16]. These findings are also related to our higher rates of emergency presentation (81 of 98 patients, 82.7%) and the tendency to concentrate morbidity among emergency presentations (shock and sepsis). In our cohort, preoperative combined shock and sepsis showed the strongest unadjusted association with mortality; this is biologically plausible (systemic inflammation, impaired perfusion and multiorgan dysfunction) and congruent with the broader literature of sepsis, which demonstrates significantly higher mortality rates in patients with severe sepsis/shock and organ dysfunction [17,18].

Because only univariate analyses were possible, the associations reported here should not be read as

independent or causal effects. Shock, sepsis, renal dysfunction, emergency surgery and ileostomy formation co-occurred in the sickest patients and are best interpreted together as markers of disease severity at presentation. The ORs for combined shock and sepsis and for renal dysfunction were large but had very wide CIs, reflecting the small number of deaths, so their magnitude should not be over-interpreted. Similarly, the apparent difference in mortality between ileostomy and colostomy probably reflects confounding by indication, as ileostomies were created mainly for perforation peritonitis in septic patients, whereas colostomies were more often elective. Postoperative ICU admission and length of hospital stay describe the clinical course rather than predict it.

There are two other practical comparisons that are interesting. First, HOS - observed in 11 of 98 patients (11.2%) in our cohort, although not associated with mortality (two of 21 deaths vs nine of 77 survivors; P = 1.000) - is an acknowledged and potentially fatal complication unless timely determined and managed; published series note HOS incidences in the low-teens and highlight the importance of protocolized fluid/electrolyte replacement, anti-diarrheal therapy and early involvement of the nurse in feeding as mitigation measures [19,20]. Second, evidence supporting preoperative stoma-site marking and structured stoma care (entero-stomal therapy nurse counselling, early outpatient follow-up) increasingly shows reduction of early stomal complications and improved patient independence; in emergency contexts, the benefits are increasingly recognised when feasible. These are system-level interventions, which may be altered, but might potentially be effective at diminishing the skin-excoriation and appliance-related issues that dominated this cohort [21,22].

HOS deserves particular emphasis. It occurred in 11 of 98 patients (11.2%), all after emergency surgery and all after small-bowel stomas. Although it was not associated with 30-day mortality in this cohort, high output is an important and potentially preventable cause of dehydration, hypokalaemia, hypomagnesaemia, acute kidney injury, prolonged hospital stay and readmission [19,20]. In our setting, the risk extends beyond discharge, because many patients live far from the hospital, may not recognise early signs of dehydration and may lack access to oral rehydration solutions or laboratory monitoring. We therefore recommend daily output charting for all small-bowel stomas, a defined output threshold that triggers treatment, early oral rehydration solution with restriction of hypotonic fluids, anti-motility agents, scheduled electrolyte and creatinine checks and clear written discharge advice on when to seek care [19,20,23].

Several practical aspects of emergency stoma care in a resource-limited setting are likely to have contributed to our results. Many patients presented late, often after referral from peripheral centres, with established peritonitis and septic shock, which delayed resuscitation and source control. No dedicated enterostomal therapy nurse was available, so preoperative stoma-site marking was rarely possible in emergencies, and postoperative stoma education was delivered by ward nurses and surgical residents with competing duties. There was no stoma clinic or helpline that patients could contact after discharge, and scheduled reviews by medical staff were limited to the 15-day, one-month and six-month visits. The range of appliances, skin barriers, accessories and ointments was limited and often unaffordable, so patients could not easily change to a better-fitting system when leakage or excoriation occurred. These gaps plausibly explain much of the peristomal skin excoriation and appliance-related morbidity observed. A trained stoma nurse, a stoma clinic with a contact number, access to a range of appliances and skin-care products, and regular early review are feasible system-level improvements for centres like ours [21,22].

There are multiple practice, policy and future research implications of the findings. These data support the clinical argument that preoperative optimisation and control of sepsis should be prioritised, and that patients who cannot be optimised should be recognised as being at very high risk and monitored more actively in the postoperative phase (liberal ICU admission criteria, early electrolyte monitoring and low-threshold reintervention). Pragmatic measures that can be implemented in similar tertiary centres serving mixed urban-rural populations, based on the literature and potentially effective in reducing prevalent, easily preventable morbidity, include the strengthening of emergency surgical pathways (timely antibiotics, sepsis bundles and transfer protocols); early enterostomal therapy nurse involvement; homogeneous HOS-monitoring protocols; and perioperative nutritional input (with attempts to rectify hypoalbuminaemia where possible) [23].

This prospective cohort study shows that intestinal stoma construction in a predominantly emergency caseload is associated with frequent early complications and substantial short-term mortality, and that death was concentrated among patients with systemic physiological compromise (shock, sepsis, deranged renal function), all of whom required postoperative ICU care. Because these associations are unadjusted, they should be interpreted as markers of disease severity rather than independent predictors. Early shock/sepsis recognition and reversal, uniform postoperative HOS care, preoperative marking and enhanced ostomy support services are feasible areas of intervention that have the likelihood to decrease morbidity and increase survival. Larger multicentre cohorts with extended follow-up (including quality-of-life measures) in the future will be essential to both optimise risk modelling and to determine whether the interventions suggested above at the system level can be associated with better patient-centred outcomes in other similar LMICs.

Limitations

This study has several limitations. The relatively small sample size of 98 patients and the limited number of outcome events, including 21 deaths and 11 late complications, reduced the statistical power available for multivariable analysis and subgroup comparisons. Consequently, clinically relevant factors such as hypoalbuminaemia and emergency operative status did not consistently achieve statistical significance despite showing associations in the expected direction. Because only unadjusted analyses were possible, the associations reported for shock, sepsis, renal dysfunction and operative urgency overlap substantially, as these factors co-occur in the sickest patients; they should be interpreted as markers of disease severity rather than independent or causal risk factors, and residual confounding is likely. The cohort was also heterogeneous, combining adult and paediatric patients, emergency and elective procedures and congenital, inflammatory, malignant, traumatic and septic indications with different baseline risks. The predominance of emergency ileostomies may also have introduced case-mix bias and limits the generalisability of the findings to elective stoma populations. The predominance of emergency ileostomies may also have introduced case-mix bias and limits the generalising ability of the findings to elective stoma populations. Complication severity was not graded prospectively using a validated system such as the Clavien-Dindo classification, and postoperative ICU admission, being a consequence of illness severity, could be interpreted only as a marker of severity rather than as a risk factor. In addition, the six-month follow-up period was insufficient to assess longer-term outcomes such as parastomal hernia, persistent stoma-related problems and quality of life. Finally, system-level factors, including access to trained ostomy nurses, a dedicated point of contact after discharge, regular review by medical staff, the range of skin barriers and ointments available, availability and affordability of stoma appliances and adherence to structured stoma-care protocols, were not prospectively evaluated and may have influenced the occurrence of peristomal skin and appliance-related complications.

Conclusions

Intestinal stoma construction in a predominantly emergency surgical population was associated with a high incidence of early complications and substantial 30-day mortality. Preoperative shock, sepsis, and impaired renal function showed the strongest unadjusted associations with 30-day mortality, and all deaths occurred among patients who required postoperative intensive care. Early mortality was concentrated in patients with severe physiological compromise; whether this effect is independent of stoma type and operative urgency could not be determined without adjusted analysis. Early recognition and correction of shock and sepsis, timely postoperative electrolyte monitoring, standardised management of high stoma output and dehydration, preoperative stoma-site marking and improved access to stoma nurses, appliances and follow-up services may help reduce preventable morbidity. Larger multicentric studies with longer follow-up and assessment of quality-of-life outcomes are required to validate these associations and evaluate the effectiveness of these interventions.

Appendices

Structured data collection proforma			
A. Identification and enrolment			
Study ID		Date of enrolment	
Age (years)		Age group	□ Adult (≥14 y) □ Pediatric (<14 y)
Sex	□ Male □ Female	Weight (kg)	
Date of admission		Date of surgery	
Written informed consent	□ Patient □ Parent/LAR	Assent (minors <18 y)	□ Yes □ N/A
Contact number for telephone follow-up (kept separately from de-identified data)			
B. Indication for stoma creation			
□ Perforation peritonitis	□ Intestinal obstruction	□ Mesenteric ischemia	
□ Rectovaginal fistula	□ Anorectal malformation	□ Hirschsprung disease	
□ Carcinoma rectum	□ Complex fistula-in-ano	□ Anastomotic leak	
□ Familial adenomatous polyposis	□ Trauma	Other: _____	
If trauma, mechanism	□ Road traffic accident □ Fall □ Assault □Other: _____		
Duration of symptoms before presentation	_____ hours/days	Referred from another centre	□ Yes □ No

C. Comorbidities and preoperative clinical status							
Comorbidities							
□ None		□ Diabetes mellitus		□ Hypertension			
□ Chronic kidney disease		□ Chronic liver disease		□ Cardiac disease			
□ Chronic respiratory disease		□ HIV positive		□ HBsAg positive			
□ HCV positive		□Malignancy		□ Other: _____			
Systolic BP/MAP (mmHg)	_____ / _____	Heart rate (/min)					
Vasopressor required	□ Yes □ No	Shock*	□ Yes □ No				
Source of infection		Sepsis* (Sepsis-3)	□ Yes □ No				
Combined shock + sepsis*	□ Yes □ No	SOFA/qSOFA score					
Parameter	Value	Parameter	Value				
Haemoglobin (g/dL)		Serum creatinine (mg/dL)					
Total leucocyte count (/mm³)		Blood urea (mg/dL)					
Serum albumin (g/dL)		Total bilirubin (mg/dL)					
Serum sodium (mmol/L)		AST/ALT (IU/L)					
Serum potassium (mmol/L)		Serum lactate (mmol/L)					
E. Operative details							
Urgency	□ Emergency □ Elective	Preoperative site marking	□ Yes □ No				
Operating surgeon	□ Consultant □ Resident	Time from admission to surgery	_____ hours				
Operative findings							
Stoma type	□Ileostomy □ Jejunostomy □ Colostomy						
Configuration	□ End □ Loop □ Double-barrel						
Primary procedure							
Intra-operative complications	□ None □ Yes: _____						
F. Postoperative course (in hospital)							
ICU admission	□ Yes □ No	ICU stay (days)					
Mechanical ventilation	□ Yes □ No	Date of discharge/death					
Total hospital stay (days)		In-hospital death	□ Yes □ No Cause: _____				
Daily stoma output and fluid balance							
Parameter	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day __
Stoma output (mL/24 h)								
Intake/output (mL)								
Na+/ K+(mmol/L)								
Creatinine (mg/dL)								
G. Early complications (≤30 days)								
Complication	Present	Date of onset	Management/reintervention				
Wound infection	□ Yes □ No						

Peristomal skin excoriation	□ Yes □ No		
Mucocutaneous separation	□ Yes □ No		
Stoma necrosis	□ Yes □ No		
Stoma oedema	□ Yes □ No		
Early stoma retraction	□ Yes □ No		
High-output stoma	□ Yes □ No		
Other: _____	□ Yes □ No		
Reintervention required	□ Yes □ No	Date	
Indication for reintervention	□ Necrosis □ Mucocutaneous separation □ Retraction Other: _____		
Procedure performed			

H. Follow-up examination			
Item	Day 15	1 month (day 30)	6 months
Date of visit			
Alive	□ Yes □ No	□ Yes □ No	□ Yes □ No
Stoma color			
Stoma protrusion (cm)			
Mucocutaneous junction intact			
Peristomal skin (erythema/erosion/ulceration)			
Appliance fit/leakage			
Stoma output (mL/24 h) and character			
Signs of dehydration (thirst, oliguria, dizziness)			
Wound status			
Parastomal hernia			
Stoma prolapse			
Stoma retraction			
Stenosis (digital examination)			
Need for reintervention/readmission			
Stoma reversal done (date)			
Details of abnormal findings:			

TABLE 5: Structured Data Collection Proforma

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Bharati Pandya, Sai Ganesh, Roshan Chanchlani, Meena Kumari

Acquisition, analysis, or interpretation of data: Bharati Pandya, Sai Ganesh, Roshan Chanchlani, Meena Kumari

Drafting of the manuscript: Bharati Pandya, Sai Ganesh, Roshan Chanchlani, Meena Kumari

Critical review of the manuscript for important intellectual content: Bharati Pandya, Sai Ganesh, Roshan Chanchlani, Meena Kumari

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Human Ethics Committee, AIIMS Bhopal issued approval LOP-AIIMS/BPL/IECSR/JAN/23/PG/20. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

References

1. Babu R, Ushanjali V, Gutha VM, Reddy KY: Unveiling complexity: an in-depth analysis of intestinal stomas-indications, complications and surgical outcomes. Int J Sci Re. 2024, 13:66-7.
2. Elnaim AL, Wong M, Sagap I: Intestinal stomas; basics, complications and controversy: systematic review . Acad Med Surg. 2024, 7:10.62186/001c.127121
3. Wu TW, Chung WY, Ng HE, et al.: The frequency of stoma-related readmissions after emergency and elective ileostomy formation: the Leicester experience. Cureus. 2024, 16:e73158. 10.7759/cureus.73158
4. Maglio A, Malvone AP, Scaduto V, Brambilla D, Denti FC: The frequency of early stomal, peristomal and skin complications. Br J Nurs. 2021, 30:1272-6. 10.12968/bjon.2021.30.22.1272
5. MacDonald S, Wong LS, Ng HJ, et al.: Post-operative outcomes and identification of risk factors for complications after emergency intestinal stoma surgery - a multi-centre retrospective study. Br J Surg. 2023, 110:388-001. 10.1093/bjs/znad388.001
6. Krishnamurty DM, Blatnik J, Mutch M: Stoma complications. Clin Colon Rectal Surg. 2017, 30:193-200. 10.1055/s-0037-1598160
7. Kann BR: Early stomal complications. Clin Colon Rectal Surg. 2008, 21:23-30. 10.1055/s-2008-1055318
8. Zubillaga MA, Alvarez-Bautista FE, Cárdenas-Lailson E, et al.: Stoma-related complications: frequency of postoperative morbid events and factors related to adverse outcomes. J Coloproctol. 2024, 44:242-8. 10.1055/s-0044-1800890
9. Yang SS, Yu CS, Yoon YS, Yoon SN, Lim SB, Kim JC: Risk factors for complications after bowel surgery in Korean patients with Crohn's disease. J Korean Surg Soc. 2012, 83:141-8. 10.4174/jkss.2012.83.3.141
10. Feeney T, Castillo-Angeles M, Scott JW, Nitzschke SL, Salim A, Haider AH, Havens JM: The independent effect of emergency general surgery on outcomes varies depending on case type: a NSQIP outcomes study. Am J Surg. 2018, 216:856-62. 10.1016/j.amjsurg.2018.03.006
11. Gharde P, Manekk RS, Gharde PM, et al.: Pathophysiology of risk factors for post operative complications . F1000Res. 2023, 12:1234. 10.12688/f1000research.138265.1
12. Nabi I, Munjewar C, Ranjan G, et al.: Spectrum of perforation peritonitis at a tertiary healthcare centre: a prospective cohort study of 1908 cases. Hellenic J Surg. 2016, 88:181-5. 10.1007/s13126-016-0312-z
13. Bansal AR, Ahluwahlia PS, Bansal J, et al.: Preoperative predictors of morbidity in patients with perforation peritonitis: can early identification prevent mortality?. J Surg Surgical Res. 2023, 10:001-5. 10.17352/2455-2968.000159
14. Jain NK, Jain MG, Maini S, et al.: A study of clinical profile and management of perforation peritonitis in a tertiary health centre located in Central India. Int Surg J. 2017, 4:981. 10.18203/2349-2902.isj20170847
15. Mani Singh L, Nayak A: Study of mortality and morbidity of patients operated in emergency for ileal perforation peritonitis in central india. J Evol Med Dent Sci. 2016, 5:2809-12.
16. Malik T, Lee MJ, Harikrishnan AB: The incidence of stoma related morbidity - a systematic review of randomised controlled trials. Ann R Coll Surg Engl. 2018, 100:501-8. 10.1308/rcsann.2018.0126
17. Mohamed AK, Mehta AA, James P: Predictors of mortality of severe sepsis among adult patients in the medical intensive care unit. Lung India. 2017, 34:330-5. 10.4103/lungindia.lungindia_54_16
18. Bidart JP, Rosa RG, Bessel M, Pedrotti LG, Goldani LZ: Mortality predictors in patients with suspected sepsis in the emergency department of a tertiary care hospital: a retrospective cohort study. Int J Emerg Med. 2024, 17:74. 10.1186/s12245-024-00655-9
19. Seifarth C, Augustin LN, Lehmann KS, Stroux A, Lauscher JC, Kreis ME, Holmer C: Assessment of risk factors for the occurrence of a high-output ileostomy. Front Surg. 2021, 8:642288. 10.3389/fsurg.2021.642288
20. Beattie RM: Highlights from this issue . Frontline Gastroenterol. 2022, 13:93. 10.1136/flgastro-2022-102108
21. Nozawa H, Sasaki S, Hayashi C, et al.: Preoperative stoma site marking reduces postoperative stoma-related complications in emergency surgery: a single center retrospective cohort study. Scand J Surg. 2024, 113:40-9. 10.1177/145749692311862
22. Shi V, McKechnie T, Anant S, et al.: The impact of preoperative stoma education on postoperative outcomes for patients with new stomas after colorectal surgery: a systematic review and meta-analysis. Tech Coloproctol. 2025, 29:183. 10.1007/s10151-025-03213-4
23. Santamaría MM, Villafranca JJ, Abilés J, Ruiz FR, Navarro PU, Goitia BT: Impact of a nutrition consultation on the rate of high output stoma-related readmission: an ambispective cohort study. Sci Rep. 2021, 11:16620. 10.1038/s41598-021-96136-7