

# Beyond fecal diversion: stoma-related morbidity in a cohort of 318 children

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## ABSTRACT

**Aims:** To evaluate complications occurring from intestinal stoma formation to closure in children and to investigate the associations between complication development and demographic and clinical characteristics.

**Methods:** This single-center retrospective study included 318 pediatric patients who underwent intestinal stoma formation between January 1, 2019, and December 31, 2025. Demographic and clinical characteristics and complications occurring before stoma closure were evaluated. Groups were compared using Pearson's Chi-square test and Welch's t-test. Variables associated with complication development were examined using multivariable logistic regression analysis. Collinearity between gestational age and birth weight was assessed using Pearson correlation and variance inflation factors (VIF), and three multivariable models were compared.

**Results:** At least one complication was identified in 105 patients (33.0%). Peristomal dermatitis occurred in 54 (17.0%), stoma prolapse in 22 (6.9%), wound dehiscence in 20 (6.3%), bleeding in six (1.9%), and adhesive/band-related ileus in three patients (0.9%). The complication rate was 38.2% in the emergency surgery group and 21.4% in the elective group ( $p=0.003$ ). Patients who developed complications had a lower gestational age ( $37.8\pm4.2$  vs  $39.1\pm4.4$  weeks;  $p=0.011$ ) and lower birth weight ( $2360\pm480$  vs  $2510\pm310$  g;  $p=0.004$ ). Eight patients with prolapse underwent surgical intervention, whereas 14 were managed with close observation. Gestational age and birth weight were strongly correlated ( $r=0.79$ ; VIF 2.62). In the model including both variables, emergency surgery (odds ratio [OR] 2.42; 95% confidence interval [CI] 1.38-4.27) and birth weight (OR 0.88 per 100 g; 95% CI 0.79-0.98) remained associated with complications, whereas gestational age did not (OR 1.02 per week; 95% CI 0.93-1.11).

**Conclusion:** Stoma-related morbidity affected approximately one-third of children during the diversion period, underscoring that stoma formation represents a clinically relevant phase of care rather than a neutral bridge to definitive surgery. Emergency surgery and lower birth weight were independently associated with complication development, whereas the association of gestational age was not independent of birth weight. These findings support structured surveillance of stoma function, skin integrity, growth, and nutritional status throughout the period of diversion, particularly in higher-risk children.

**Keywords:** Child, enterostomy, colostomy, ileostomy, postoperative complications

## INTRODUCTION

Intestinal stoma formation plays an important role in the surgical management of congenital and acquired gastrointestinal disorders in children. Fecal diversion is used to achieve bowel decompression, protect a distal bowel segment or anastomosis, and facilitate staged surgical treatment. Nevertheless, from the time of stoma formation until restoration of intestinal continuity, the stoma itself constitutes an additional source of morbidity. Peristomal skin problems, prolapse, stenosis, retraction, and complications requiring reoperation have all been reported in children.<sup>1,2</sup>

In patients with anorectal malformations in particular, stoma location and configuration may influence both stoma care and subsequent reconstruction.<sup>3</sup>

Reported complication rates in pediatric studies vary widely because of differences in patient characteristics, follow-up duration, and complication definitions. Some studies have evaluated only major complications requiring intervention, whereas others have also included events managed conservatively. Vogel et al.<sup>4</sup> separately examined



major morbidity after stoma formation and closure in young children, whereas Tan and Deogracias<sup>5</sup> focused on major complications in a large pediatric population. Neonatal series that also include minor events provide a broader picture of stoma-related morbidity.<sup>6</sup> Accordingly, the assessment period and outcome definitions must be clearly specified when complication rates are interpreted.

Gestational age, birth weight, and clinical condition at the time of surgery are patient-related factors that may be associated with complication development. Associations have been reported between lower birth weight and gestational age and complications in infants, and between lower preoperative weight and complications in neonates with necrotizing enterocolitis.<sup>7,8</sup> However, these associations have not been consistent in studies using reoperation as the outcome.<sup>9</sup> In addition, growth may be adversely affected while an enterostomy remains in situ in neonates.<sup>10</sup>

The aim of this study was to evaluate complications occurring until stoma closure or the end of available follow-up in 318 children who underwent intestinal stoma formation and to investigate associations between complication development and demographic and clinical characteristics.

## METHODS

### Ethics

The study was approved by the Clinical Researches Ethics Committee of Ankara Bilkent City Hospital (Date: 15.06.2026, Decision No: E2-26-368) and was conducted in accordance with the principles of the Declaration of Helsinki. Owing to the retrospective nature of the study, the requirement for individual informed consent was waived by the ethics committee.

### Study Design and Patient Population

This single-center retrospective study included 318 pediatric patients who underwent intestinal stoma formation between January 1, 2019, and December 31, 2025. Gender, gestational age, birth weight, presence of comorbidity, urgency of surgery, stoma type, and complication development were evaluated.

Comorbidity was defined as the presence of cardiac, renal, neurologic, or other associated anomalies documented in the medical records, excluding the primary disease that prompted stoma formation. Surgical procedures were classified as emergency or elective. Stomas were analyzed in two groups: colostomies and small-bowel stomas; ileostomies, jejunostomies, and duodenostomies were included in the small-bowel stoma group. Patients with anomalies affecting more than one organ system were counted in each applicable descriptive category; for comparative analyses, comorbidity was coded as present or absent. The small-bowel stoma group was formed because of the small number of patients in the individual subgroups.

### Assessment of Complications

The primary outcome was the development of at least one stoma-related complication or related surgical wound complication during the period from stoma formation to closure. For patients whose stoma had not been closed, follow-

up was censored at the date of the last clinical record within the study period; for patients who died before closure, follow-up was censored at the date of death. Surgical complications related to or occurring after stoma closure were excluded. Dermatitis and severe dermatitis were analyzed within the same category.

Management of prolapse and episodes of adhesive/band-related ileus occurring before stoma closure were recorded. Anthropometric course and nutritional support were evaluated as secondary descriptive outcomes.

Weight-for-age measurements were obtained retrospectively from routine clinical records. Weight-for-age z scores were calculated using the WHO Child Growth Standards.<sup>11</sup> Enteral nutritional support was provided to patients with a z score below -2. Measurement dates were not standardized, and anthropometric findings were analyzed descriptively.

### Statistical Analysis

Categorical variables were presented as number and percentage, and continuous variables as mean±standard deviation. Patients with and without complications were compared using Pearson's chi-square test and Welch's t-test.

Variables associated with complication development were evaluated using multivariable binary logistic regression analysis. Regression results were reported as odds ratios (ORs), 95% confidence intervals (CIs), and p values. All tests were two-sided, and  $p < 0.05$  was considered statistically significant. Gestational age was entered per one-week and birth weight per 100-g increase. Collinearity was assessed using the Pearson correlation coefficient and VIF ( $>5$  considered problematic). Three multivariable logistic regression models were fitted: model 1, urgency+gestational age+birth weight; model 2, urgency+gestational age; model 3, urgency+birth weight. Model fit was compared using the Akaike information criterion (AIC). Analyses were performed using Python (SciPy, statsmodels).

## RESULTS

### Patient Characteristics

Of the 318 patients included in the study, 186 (58.5%) were boys and 132 (41.5%) were girls. Stoma formation was performed under emergency conditions in 220 patients (69.2%) and electively in 98 (30.8%). A colostomy was present in 143 patients (45.0%), whereas 175 (55.0%) had a small-bowel stoma. Comorbidities were recorded in 88 patients (27.7%). Within the small-bowel stoma group, 128 patients had an ileostomy (73.1%), 42 a jejunostomy (24.0%), and 5 a duodenostomy (2.9%). Among patients with comorbidities, cardiovascular anomalies were present in 52 (16.4% of the cohort), renal in 23 (7.2%), and neurological in 20 (6.3%); categories were not mutually exclusive.

At least one complication developed in 105 patients (33.0%), whereas no complication was documented during the available follow-up in 213 (67.0%). Demographic and clinical characteristics according to complication status are presented in **Table 1**.

**Table 1.** Demographic and clinical characteristics of patients with and without complications

| Variable                         | Complication present (n=105) | No complication (n=213) | P     |
|----------------------------------|------------------------------|-------------------------|-------|
| Gender, male/female, n           | 63/42                        | 123/90                  | 0.701 |
| Gestational age, weeks, mean±SD  | 37.8±4.2                     | 39.1±4.4                | 0.011 |
| Birth weight, g, mean±SD         | 2360±480                     | 2510±310                | 0.004 |
| Comorbidity, present/absent, n   | 25/80                        | 63/150                  | 0.280 |
| Emergency stoma formation, n (%) | 84 (38.2)                    | 136 (61.8)              | 0.003 |
| Elective stoma formation, n (%)  | 21 (21.4)                    | 77 (78.6)               | -     |
| Colostomy, n (%)                 | 53 (37.1)                    | 90 (62.9)               | 0.166 |
| Small-bowel stoma, n (%)         | 52 (29.7)                    | 123 (70.3)              | -     |

SD: Standard deviation. Percentages are row percentages within the relevant surgical urgency or stoma category. Pearson's Chi-square test was used for categorical variables and Welch's t-test for continuous variables. A single p value is reported for each comparison of surgical urgency and stoma type. The small-bowel stoma group includes ileostomy, jejunostomy, and duodenostomy.

### Factors Associated with Complication Development

Complications developed in 84 of 220 patients (38.2%) who underwent emergency stoma formation and in 21 of 98 patients (21.4%) who underwent elective stoma formation. Emergency surgery was associated with higher unadjusted odds of complication development (OR, 2.26; 95% CI, 1.30-3.94;  $p=0.003$ ).

Mean gestational age was 37.8±4.2 weeks in the complication group and 39.1±4.4 weeks in the group without complications. The mean between-group difference was -1.30 weeks (95% CI, -2.30 to -0.30;  $p=0.011$ ). Mean birth weight was 2360±480 g and 2510±310 g, respectively, corresponding to a mean difference of -150 g (95% CI, -251.64 to -48.36;  $p=0.004$ ).

No statistically significant association was identified between gender and complication development (male/female OR, 1.10; 95% CI, 0.68-1.77;  $p=0.701$ ). Similarly, the presence of comorbidity was not significantly associated with complications (OR, 0.74; 95% CI, 0.43-1.27;  $p=0.280$ ).

The complication rate was 37.1% (53/143) among patients with colostomies and 29.7% (52/175) among those with small-bowel stomas. This difference was not statistically significant (unadjusted OR, 1.39; 95% CI, 0.87-2.23;  $p=0.166$ ).

Gestational age and birth weight were strongly correlated (Pearson  $r=0.79$ ,  $p<0.001$ ). In model 1, VIFs were 2.62 for both gestational age and birth weight and 1.00 for urgency. In model 1, emergency surgery (OR 2.42; 95% CI 1.38-4.27;  $p=0.002$ ) and birth weight (OR 0.88 per 100 g; 95% CI

0.79-0.98;  $p=0.016$ ) were independently associated with complications, whereas gestational age was not (OR 1.02 per week; 95% CI 0.93-1.11;  $p=0.708$ ). In model 2, gestational age was associated with complications (OR 0.93; 95% CI 0.89-0.99;  $p=0.012$ ), and in model 3 birth weight was associated (OR 0.89 per 100 g; 95% CI 0.84-0.95;  $p<0.001$ ). Emergency surgery remained associated in all models (OR 2.30-2.42). Model 3 had the lowest AIC (388.3 vs 390.2 for model 1 and 394.1 for model 2) (Table 2). Crude complication rates within the small-bowel stoma group were 22/128 for ileostomies (17.2%), 25/42 for jejunostomies (59.5%), and 5/5 for duodenostomies.

### Distribution of Complications

Peristomal dermatitis was recorded in 54 patients (17.0%), stoma prolapse in 22 (6.9%), wound dehiscence in 20 (6.3%), bleeding in six (1.9%), and adhesive/band-related ileus in three (0.9%) (Table 3).

**Table 3.** Complications recorded before stoma closure

| Complication                | Number of patients, n | Entire cohort, % |
|-----------------------------|-----------------------|------------------|
| At least one complication   | 105                   | 33.0             |
| Peristomal dermatitis       | 54                    | 17.0             |
| Stoma prolapse              | 22                    | 6.9              |
| Wound dehiscence            | 20                    | 6.3              |
| Bleeding                    | 6                     | 1.9              |
| Adhesive/band-related ileus | 3                     | 0.9              |

Eight of the 22 patients with prolapse (36.4%) underwent surgical intervention. The remaining 14 patients (63.6%), in whom intestinal content continued to pass through the stoma, were managed with close observation without additional surgery for prolapse; stoma closure was performed at the earliest clinically appropriate time. Three patients with adhesive/band-related ileus underwent adhesiolysis before stoma closure.

Review of follow-up records for weight-for-age suggested a less favorable pattern of weight gain among children with small-bowel stomas, whereas age-appropriate weight was generally maintained in patients with colostomies. Enteral nutritional support was provided to patients with a weight-for-age z score below -2. Among patients assessed after stoma closure, an improvement in weight gain was observed. Because measurements were not obtained at standardized time points, these observations do not establish stoma-specific growth trajectories or a causal effect of stoma closure on growth.

**Table 2.** Multivariable logistic regression analysis of factors associated with complication development

| Variable                                      | Model 1                 | Model 2                 | Model 3                  |
|-----------------------------------------------|-------------------------|-------------------------|--------------------------|
| Emergency vs elective surgery, OR (95% CI); p | 2.42 (1.38-4.27); 0.002 | 2.30 (1.32-4.03); 0.004 | 2.41 (1.37-4.25); 0.002  |
| Gestational age (per week), OR (95% CI); p    | 1.02 (0.93-1.11); 0.708 | 0.93 (0.89-0.99); 0.012 | -                        |
| Birth weight (per 100 g), OR (95% CI); p      | 0.88 (0.79-0.98); 0.016 | -                       | 0.89 (0.84-0.95); <0.001 |
| AIC                                           | 390.2                   | 394.1                   | 388.3                    |

OR: Odds ratio, CI: Confidence interval, AIC: Akaike information criterion, VIF: Variance inflation factor. Model 1: Urgency+gestational age+birth weight, Model 2: Urgency+gestational age, Model 3: Urgency+birth weight. Pearson  $r$  (gestational age-birth weight)=0.79; VIF 2.62 for both variables in model 1.



## DISCUSSION

In this study, at least one complication was recorded while the stoma remained in situ in 105 of 318 children (33.0%) who underwent intestinal stoma formation. Peristomal dermatitis was the most common complication, followed by prolapse and wound dehiscence. Emergency stoma formation and lower birth weight were independently associated with complication development, whereas lower gestational age was not independent of birth weight. Approximately one-third of patients with prolapse required surgical intervention.

Comparison of complication rates across pediatric stoma studies requires caution because of differences in patient populations and outcome definitions. Steinau et al.<sup>1</sup> reported a complication rate of 38.2% after enterostomy formation. Although this is close to the 33.0% rate observed in our cohort, the studies differ in age distribution, primary disease, and follow-up characteristics. Sarac reported<sup>12</sup> greater morbidity in a smaller pediatric series, with skin complications being particularly prominent. In the study by Massenga et al.,<sup>13</sup> which included both children and adults, the complication rate in the pediatric subgroup was 26.7%. Only the separately reported pediatric results from that study are appropriate for comparison with our cohort.

The severity threshold used to define a complication also directly influences reported rates. Vogel et al.<sup>4</sup> reported major morbidity rates of 27% after stoma formation and 23% after closure in young children. In the large pediatric series by Tan and Deogracias,<sup>5</sup> the rate of major complications was 9.8%. These rates are not directly equivalent to the outcome used in our study, which also included conservatively managed events such as dermatitis. The neonatal enterostomy study by Wolf et al.<sup>6</sup> likewise demonstrated that inclusion of minor events broadens the estimated overall burden of morbidity. Therefore, differences in complication rates between centers may reflect not only surgical outcomes but also how events are defined and documented.

The outcome in our study was restricted to the period from stoma formation to stoma closure. Events related to the closure procedure or occurring after closure were not included. In studies encompassing both stoma formation and closure, such as the study by Alghamdi et al.,<sup>14</sup> wound-related and intestinal obstruction outcomes should be interpreted with this distinction in mind. The study by O'Connor and Sawin<sup>15</sup> in premature infants also demonstrated substantial morbidity; however, assessment among survivors and inclusion of closure-related events limit direct comparison with our study.

The inclusion of patients whose stomas had not yet been closed or who died before closure also warrants consideration. In these patients, follow-up was censored at the last clinical record or at death. Accordingly, the rate reported in our study represents the frequency of complications documented over observation periods of varying duration; it does not represent the cumulative probability that every patient would experience a complication by the time of stoma closure.

The complication rate was higher among patients who underwent emergency stoma formation than among those undergoing elective procedures. The nature of the underlying disease requiring urgent intervention, physiological instability, and perioperative inflammatory burden may have contributed to this association. Because these features could not be evaluated in sufficient detail in our study, the direct effect of emergency surgery cannot be disentangled from the effects of the primary disease and overall clinical condition.

Xu et al.<sup>16</sup> reported univariable associations between nutritional status, inflammation, and incisional complications in children with very-early-onset inflammatory bowel disease caused by defects in interleukin-10 signaling; however, no statistically significant independent factor was identified in multivariable analysis. Although findings from this specific patient group cannot be directly generalized to the broader pediatric stoma population, they underscore the need to consider surgical urgency together with disease severity. The association observed in our study should not be interpreted as suggesting that clinically necessary emergency surgery should be delayed.

The lower gestational age and birth weight observed among patients who developed complications are consistent with the findings of Bethell et al. in infants with enterostomies.<sup>7</sup> Aguayo et al.<sup>8</sup> also reported associations between lower gestational age, lower preoperative weight, and stoma complications in neonates with necrotizing enterocolitis. However, birth weight and weight at the time of surgery are distinct clinical measures and should not be used interchangeably.

Bælum et al.<sup>9</sup> found no significant difference in birth weight or gestational age between infants with necrotizing enterocolitis who did and did not require reoperation. This discrepancy may be related to patient selection, sample size, and the use of reoperation as the outcome. In our study, gestational age and birth weight were strongly correlated ( $r=0.79$ ). Although VIF values (2.62) were below the conventional threshold, this correlation limits separation of their independent effects. Gestational age lost its association after adjustment for birth weight, whereas birth weight remained associated, and the model with birth weight alone had the lowest AIC. Birth weight may therefore capture most of the maturity-related risk in this cohort, but this should be interpreted cautiously.

No statistically significant difference in complication frequency was observed between the colostomy and small-bowel stoma groups. However, this finding does not establish that the two stoma groups have equivalent complication profiles. Vogel et al.<sup>4</sup> identified ileostomy as being associated with major morbidity, whereas the prediction model developed by Zeng et al.<sup>17</sup> in infants identified small-bowel stoma as a variable associated with complication development. Differences in age, primary disease, complication severity, and analytical methods may explain the divergence between those studies and our findings.

In our study, the small-bowel stoma group included ileostomies, jejunostomies, and duodenostomies, which limits evaluation of differences related to the anatomical level



of the stoma. In addition, comparisons based on broad stoma categories do not adequately capture stoma location and technical configuration.

Ileostomies (73.1%), jejunostomies (24.0%) and duodenostomies (2.9%) may differ in absorptive capacity and fluid/electrolyte losses. Crude complication rates differed across subtypes (17.2%, 59.5% and 5/5, respectively), so the nonsignificant colostomy–small-bowel comparison may mask subtype-specific patterns.

Cardiovascular anomalies were the most frequently documented associated abnormalities, followed by renal and neurological anomalies. The composite binary comorbidity variable was not significantly associated with complications; this does not exclude subtype-specific risks.

The large colostomy series by Çiğdem et al.,<sup>2</sup> the experience of Peña et al.<sup>3</sup> in anorectal malformations, and the more recent study by Klein et al.<sup>18</sup> highlight the importance of anatomical and technical features of colostomy formation. In light of these studies, details such as the bowel segment used, loop versus divided stoma configuration, and the relationship of the stoma to the planned definitive operation should be recorded in a standardized manner. Prolapse and skin complications were also prominent in the study by Hamdi et al.<sup>19</sup> in patients with anorectal malformations. Nevertheless, such disease-specific series should not be used as a universal benchmark for all pediatric patients with stomas.

Peristomal dermatitis was recorded in 54 patients (17.0%) and was the most frequent complication. This finding demonstrates that stoma-related morbidity is not limited to events requiring reoperation. Structured monitoring of skin findings and stoma-care problems may help distinguish transient events from persistent care-related difficulties. Our study was not designed to compare the effectiveness of specific stoma-care products or nursing interventions.

Prolapse was recorded in 22 patients (6.9%), eight of whom required surgical intervention. The 14 patients in whom intestinal content continued to pass through the stoma were closely observed, and stoma closure was undertaken at the earliest clinically appropriate time. This approach illustrates that prolapse management was individualized according to clinical findings and bowel function. Johnson's<sup>20</sup> systematic review and retrospective series highlighted the range of treatment strategies used in children and the limited comparative evidence available. Because treatment allocation was not randomized in our study, the relative superiority of conservative and surgical approaches cannot be determined.

Three patients (0.9%) underwent surgery for adhesive/band-related ileus before stoma closure. This finding indicates that morbidity while a stoma remains in situ may extend to the need for repeat abdominal surgery. Adhesion-related obstruction occurring after closure represents a different outcome and was therefore not included in the primary complication assessment in our study.

Coletta et al.<sup>21</sup> reported their experience with tube enterostomy in selected neonates across three centers.

Such studies provide a rationale for evaluating alternative techniques in specific clinical settings. However, small and highly selected series should not be regarded as evidence of superiority over conventional stoma techniques. The heterogeneous and retrospective nature of our cohort likewise precludes determination of an optimal technique.

The burden of living with a stoma is not limited to local and surgical complications. Chong et al.<sup>10</sup> demonstrated adverse growth trajectories from stoma formation to closure in neonates with enterostomies after necrotizing enterocolitis. Bethell et al.<sup>7</sup> also evaluated growth outcomes in infants with enterostomies. In the descriptive clinical observations included in our study, children with small-bowel stomas appeared to have a less favorable anthropometric course, and enteral nutritional support was provided to those with measurements below -2 standard deviations. The observation that patients evaluated after closure reached age-appropriate anthropometric values supports continued growth monitoring after restoration of intestinal continuity. However, without standardized measures, predefined assessment time points, and the number of patients evaluated at each time point, neither a stoma-type-specific difference in growth nor a causal effect of stoma closure on growth can be established. Post-closure growth observations should therefore be interpreted separately from pre-closure surgical complications.

### Limitations

The single-center retrospective design of this study is susceptible to underdocumentation of minor complications, particularly those managed outside the surgical unit. Differences in follow-up duration, as well as follow-up ending at death or at the last clinical record before stoma closure, may have influenced complication ascertainment. The use of broad anatomical stoma categories and the binary classification of comorbidity may not fully capture the clinical heterogeneity of the cohort. Ileostomies, jejunostomies and duodenostomies were combined, and comorbidity was analyzed as a binary variable. Gestational age and birth weight were highly correlated, limiting separation of their independent effects. Anthropometric measurements were not obtained at standardized time points; therefore, changes in weight or weight-for-age z scores cannot be attributed directly to the stoma, and conclusions about stoma-specific growth trajectories should be made with caution.

### CONCLUSION

Intestinal stoma formation in children should be regarded not merely as a temporary step toward definitive reconstruction but as a distinct period of clinically meaningful morbidity. Approximately one-third of patients experienced at least one complication while the stoma remained in situ; peristomal dermatitis predominated, and a substantial proportion of prolapses required operative management. The associations with emergency surgery and lower birth weight identify clinically vulnerable groups who may warrant closer surveillance. A structured, risk-adapted follow-up pathway integrating assessment of stoma function, skin integrity, growth, and nutritional status may help recognize complications earlier and optimize care throughout the



diversion period. Prospective studies using standardized complication definitions and longitudinal nutritional assessment are needed to clarify modifiable risk factors and determine whether targeted stoma-care strategies can reduce morbidity.

## ETHICAL DECLARATIONS

### Ethics Committee Approval

The study was approved by the Clinical Researches Ethics Committee of Ankara Bilkent City Hospital (Date: 15.06.2026, Decision No: E2-26-368).

### Informed Consent

This retrospective study used pre-existing anonymized patient data. No additional intervention was performed, and there was no direct patient contact. The study was approved by the Ethics Committee, and the requirement for written informed consent was waived by the ethics committee.

### Peer Review Process

This manuscript was subject to external peer review.

### Conflict of Interest

The authors declare no conflicts of interest related to this study.

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### Author Contributions

Conceptualization: AUU, CİÖ; Design: AUU, CİÖ; Supervision: AUU, CİÖ; Materials: AUU, CİÖ; Data Collection and/or Processing: AUU, CİÖ; Analysis and/or Interpretation: AUU, CİÖ; Literature Review: AUU, CİÖ; Writing: AUU, CİÖ; Critical Review: AUU, CİÖ.

## REFERENCES

- Steinau G, Ruhl KM, Hörnchen H, Schumpelick V. Enterostomy complications in infancy and childhood. *Langenbecks Arch Surg.* 2001; 386(5):346-349. doi:10.1007/s004230100243
- Çiğdem MK, Onen A, Duran H, Öztürk H, Otçu S. The mechanical complications of colostomy in infants and children: analysis of 473 cases of a single center. *Pediatr Surg Int.* 2006;22:671-676. doi:10.1007/s00383-006-1718-4
- Peña A, Migotto-Krieger M, Levitt MA. Colostomy in anorectal malformations: a procedure with serious but preventable complications. *J Pediatr Surg.* 2006;41(4):748-756. doi:10.1016/j.jpedsurg.2005.12.021
- Vogel I, Eeftink Schattenkerk LD, Venema E, et al. Major stoma related morbidity in young children following stoma formation and closure: a retrospective cohort study. *J Pediatr Surg.* 2022;57:402-406. doi:10.1016/j.jpedsurg.2021.11.021
- Tan AYE, Deogracias JMC. Major stoma complications in pediatric patients in a tertiary hospital in a low-middle-income country: a retrospective cohort study. *Pediatr Surg Int.* 2024;40:208. doi:10.1007/s00383-024-05791-0
- Wolf L, Gfroerer S, Fiegel H, Rolle U. Complications of newborn enterostomies. *World J Clin Cases.* 2018;6(16):1101-1110. doi:10.12998/wjcc.v6.i16.1101
- Bethell G, Kenny S, Corbett H. Enterostomy-related complications and growth following reversal in infants. *Arch Dis Child Fetal Neonatal Ed.* 2017;102(3):F230-F234. doi:10.1136/archdischild-2016-311126
- Aguayo P, Fraser JD, Sharp S, St Peter SD, Ostlie DJ. Stomal complications in the newborn with necrotizing enterocolitis. *J Surg Res.* 2009;157(2):275-278. doi:10.1016/j.jss.2009.06.005
- Bælum JK, Rasmussen L, Qvist N, Ellebæk MB. Enterostomy complications in necrotizing enterocolitis (NEC) surgery, a retrospective chart review at Odense University Hospital. *BMC Pediatr.* 2019;19:110. doi:10.1186/s12887-019-1488-5
- Chong C, van Druten J, Briars G, et al. Neonates living with enterostomy following necrotizing enterocolitis are at high risk of becoming severely underweight. *Eur J Pediatr.* 2019;178(12):1875-1881. doi:10.1007/s00431-019-03440-6
- WHO Multicentre Growth Reference Study Group. WHO Child Growth Standards: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development. Geneva: World Health Organization; 2006.
- Sarac F. Intestinal stoma types, indications and complications in pediatric patients: a three-year single-center experience with necrotizing enterocolitis as the leading indication. *Med Bull Haseki.* 2025;63(5):281-287. doi:10.4274/haseki.galenos.2025.80299
- Massenga A, Chibwae A, Nuri AA, et al. Indications for and complications of intestinal stomas in the children and adults at a tertiary care hospital in a resource-limited setting: a Tanzanian experience. *BMC Gastroenterol.* 2019;19:157. doi:10.1186/s12876-019-1070-5
- Alghamdi HA, Alqahtani MSM, Asiri HMM, et al. Investigating colostomy-related morbidity in children following stoma formation and closure in a tertiary hospital, Abha, Saudi Arabia: a retrospective cohort study 2024. *BMC Pediatr.* 2024;24:630. doi:10.1186/s12887-024-05089-z
- O'Connor A, Sawin RS. High morbidity of enterostomy and its closure in premature infants with necrotizing enterocolitis. *Arch Surg.* 1998; 133(8):875-880. doi:10.1001/archsurg.133.8.875
- Xu X, Zhou Y, Tan Z, et al. Risk factors for stoma and incision complications of enterostomy in children with very early-onset inflammatory bowel disease: a prospective cohort study. *Eur J Pediatr.* 2025;184:146. doi:10.1007/s00431-024-05952-2
- Zeng Z, Hu Y, Hou S, Yang R, Shi Z, Li X. Risk factors for complications after infantile enterostomy: development of a clinical prediction model. *Front Public Health.* 2025;13:1566789. doi:10.3389/fpubh.2025.1566789
- Klein T, Guarnizo-Diaz GS, Semaan A, Boemers TM, Vahdani RM. Colostomy complications in patients with anorectal malformations. *Langenbecks Arch Surg.* 2025;410:210. doi:10.1007/s00423-025-03795-5
- Hamdi MA, Mohamed WM, Al-Ani UFT. The colostomy complications in anorectal malformation: a retrospective study. *J Coloproctol.* 2021; 41(3):286-288. doi:10.1055/s-0041-1730259
- Johnson P. Intestinal stoma prolapse and surgical treatments of this condition in children: a systematic review and a retrospective study. *Surg Sci.* 2016;7:400-426. doi:10.4236/ss.2016.79057
- Coletta R, Zulli A, O'Shea K, Mussi E, Bianchi A, Morabito A. Minimizing enterostomy complication in neonates, lessons learnt from three European tertiary centres. *Children (Basel).* 2022;9(2):162. doi:10.3390/children9020162