http:// jpp.mums.ac.ir

Original Article (Pages: 20492-20505)

Surgical Outcomes of Transanal Endorectal versus Transabdominal Pull-Through in Children with Hirschsprung's Disease: A Retrospective Multicenter Observational Cohort Study

Reza Salehi [1], Khashayar Atqiaee [2], Ahmad Mohamadipour [2], Mostafa Abrishami [3], Mohammad Taghi Soubro [4], Sayed Mortaza Fayez [4], * Ali Azadmand [2]

[1] Department of Surgery, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

[2] Department of Pediatric Surgery, Akbar Children's Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

[3] Department of Pediatric Surgery, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

[4] Student Research Committee, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

Abstract

Background: Transanal endorectal pull-through (TERPT) is commonly used to manage Hirschsprung's disease (HD) because it is minimally invasive. This study aimed to compare postoperative complications and outcomes between pediatric HD patients undergoing TERPT and those treated with the transabdominal pull-through (TAB) approach.

Methods: We conducted a multicenter, retrospective observational cohort study of 241 children diagnosed with HD (n = 135 TERPT; n = 106 TAB) treated at two tertiary pediatric surgical centers from 2014 to 2018. Patients were categorized by surgical technique. Postoperative complications and long-term outcomes were compared using chi-square or Fisher's exact tests, as appropriate. Mortality was recorded and compared between groups.

Results: Perianal dermatitis was more frequent in the TERPT group (22.2% vs. 6.6%; P = 0.001). In contrast, infection (0.7% vs. 9.4%; P = 0.001), anastomotic leak (0.7% vs. 7.5%; P = 0.012), constipation (9.6% vs. 18.9%; P = 0.038), and abdominal scarring (2.2% vs. 20.8%; P < 0.001) were significantly more frequent in the TAB group. Wound dehiscence, ileus, enterocolitis, anastomotic stricture, adhesive obstruction, and incontinence did not differ significantly between groups. Overall mortality was 8.7% (11/135 TERPT vs. 10/106 TAB; P = 0.72).

Conclusion: In this retrospective cohort, TERPT was associated with fewer observed wound-related and abdominal complications compared with TAB. However, these findings should be interpreted cautiously given the observational, non-randomized design, which limits causal inference regarding the superiority of either technique.

Key Words: Anal canal, Hirschsprung, Intestinal obstruction, Pull-through surgery.

* Please cite this article as: Salehi R, Atqiaee K, Mohamadipour A, Abrishami M, Soubro M.T, Fayez S.M, Azadmand A. Surgical Outcomes of Transanal Endorectal versus Transabdominal Pull-Through in Children with Hirschsprung's Disease: A Retrospective Multicenter Observational Cohort Study. J Ped Perspect 2026; 14 (10):20492-20505. **DOI:10.22038/jpp.2026.98299.5723**

****Corresponding Author:***

Ali Azadmand; Department of Pediatric Surgery, Akbar Children's Hospital, Mashhad University of Medical Sciences, Mashhad, Iran**.** Tel: +98-915-314-2023**;** Email: AzadmandA@mums.ac.ir

1- INTRODUCTION

Hirschsprung's disease (HD) is a congenital intestinal motility disorder characterized by the absence of ganglion cells in the distal bowel, resulting from defective development and incomplete migration of neural crest cells during embryonic development (1, 2). The estimated incidence is approximately one in 5,000 live births, with significant ethnic and racial variability (3). Clinically, HD manifests as acute intestinal obstruction in neonates or chronic constipation in infants and older children, depending on the extent of aganglionosis. This functional obstruction leads to progressive bowel distension, fecal retention, and a predisposition to enterocolitis. In approximately 5% of cases, aganglionosis may extend throughout the entire colon (total colonic aganglionosis)—and, in rare instances, even reach proximal gastrointestinal segments (4). The disease occurs more frequently in males and is often associated with Down syndrome, a comorbidity that has been linked to a higher risk of postoperative enterocolitis and less favorable functional outcomes (5, 6).

Definitive management of HD is surgical. Traditionally, this was accomplished through staged transabdominal pull-through (TAB) procedures; more recently, the single-stage transanal endorectal pull-through (TERPT) technique has gained widespread adoption (7-10). TERPT has been proposed to offer several theoretical advantages—including minimal invasiveness, shorter operative and recovery times, lower risk of intra-abdominal contamination, and reduced pelvic nerve trauma (11). Despite these benefits, concerns regarding potential sphincter dysfunction and variable long-term outcomes persist, underscoring the need for comparative evaluations between TERPT and conventional transabdominal methods (12-14). Long-term outcomes remain inconsistent across studies, with some reports indicating compromised fecal control, whereas others have demonstrated comparable functional results (15, 16). Persistent constipation, fecal incontinence, and, in some cases, the need for a permanent colostomy therefore continue to affect patients' long-term quality of life (5, 6).

From a pathogenetic standpoint, mutations in the RET proto-oncogene located on chromosome 10q11.2 have been identified as major contributors to HD pathogenesis and are also implicated in multiple endocrine neoplasia type II. The disease may occur sporadically or display familial inheritance, with a higher prevalence among siblings of patients with total colonic aganglionosis. Several congenital anomalies have been documented in association with HD, notably bladder diverticulum, hydrocephalus, neuroblastoma, and Waardenburg syndrome (17-20). The diagnosis is established through a combination of contrast enema, anorectal manometry, and rectal biopsy, each instrumental in identifying the level and extent of the aganglionic segment (21-24).

Over the past decades, multiple corrective techniques—including the Swenson, Duhamel, and Soave procedures—have been developed for definitive treatment, performed either via an open abdominal approach or, more recently, through minimally invasive routes. The TERPT approach has emerged as a single-stage alternative, eliminating the need for abdominal access in selected patients (25-27). Although most patients achieve satisfactory recovery, serious postoperative complications such as enterocolitis, anastomotic leak, or stricture may occur, particularly within the first two postoperative years (4, 6, 28, 29).

Continuous efforts to refine surgical methods and evaluate their outcomes remain essential to minimizing morbidity. Accordingly, the present study was conducted to compare the postoperative complications and outcomes of transabdominal (TAB) and transanal endorectal pull-through (TERPT) procedures in a retrospective cohort of children with Hirschsprung's disease treated at two tertiary pediatric surgical centers in Mashhad, Iran. This study is reported in accordance with the STROCSS 2025 guidelines for cohort studies (30).

2- MATERIALS AND METHODS

2-1. Study Design and Setting

This multicenter, retrospective observational cohort study was conducted among pediatric patients diagnosed with HD who underwent surgical correction at two tertiary pediatric surgical centers between 2014 and 2018. Data regarding perioperative events, short-term outcomes, and long-term clinical status were retrospectively retrieved from archived hospital records and outpatient clinic charts. A census sampling strategy was adopted, including all eligible patients who underwent surgical correction for HD during the specified period. To ensure data consistency, abstraction from medical records was performed by trained investigators using a structured, standardized form. Any ambiguities were resolved through consensus with a senior pediatric surgeon.

2-2. Inclusion and Exclusion Criteria

Eligible participants fulfilled the following criteria: (1) age under 3 years at the time of primary surgery; (2) confirmed HD diagnosis via rectal biopsy; (3) underwent either a single-stage TERPT or a TAB procedure; and (4) had a minimum postoperative follow-up of four years.

Patients were excluded if they had total colonic aganglionosis, associated major congenital anorectal or gastrointestinal malformations (such as anorectal malformations or esophageal atresia), a history of previous perineal surgery, required emergency laparotomy due to acute abdominal pathology (e.g., free perforation) before the definitive pull-through, or had known immunodeficiencies or connective tissue disorders. Patients with Down syndrome without major structural gastrointestinal anomalies were not excluded, but their diagnosis was recorded as a baseline clinical characteristic.

2-3. Surgical Techniques

All surgical procedures across both participating institutions followed a standardized, uniform institutional protocol. Surgical procedures were performed either directly by experienced attending pediatric surgeons (faculty members) or by pediatric surgical fellows and senior surgical residents under the direct, continuous intraoperative supervision of a senior attending pediatric surgeon.

Transanal Endorectal Pull-Through (TERPT):

This single-stage procedure began with exposure of the perineum. A circumferential mucosal incision was performed approximately 0.5 to 1.0 cm proximal to the dentate line. Submucosal dissection was carried proximally for approximately 3 to 5 cm, followed by a full-thickness longitudinal muscle incision to enter the pelvic space. The aganglionic bowel was mobilized transanally until normal, ganglionated bowel was identified via intraoperative frozen section analysis. The transition zone was resected, and a classic endorectal Soave-type anastomosis was performed between the ganglionated colon and the anal canal.

Transabdominal Pull-Through (TAB):

This approach was performed either as a primary procedure or as the second stage of a planned management strategy following a temporary colostomy. Under general anesthesia, a laparotomy (or laparoscopy) was performed to mobilize the colon, map the transition zone, and ligate the mesenteric vessels. The pelvic dissection was carried out down to the pelvic floor. The surgical reconstruction utilized either the open Soave endorectal pull-through or the open Swenson pull-through technique (involving full-thickness rectal resection and direct end-to-end anastomosis), depending on surgeon preference and intraoperative anatomical constraints.

2-4. Variables and Outcome Measures

Demographic parameters (age and sex) and baseline clinical characteristics (neonatal presentation, presence of preoperative enterocolitis, and extent of aganglionosis) were recorded.

The primary outcome of interest was the overall incidence of postoperative complications. Secondary outcomes included specific early and late complications, length of hospital stay, operative time, and overall mortality.

Postoperative complications were classified using standardized clinical criteria:

Early complications were defined as those occurring within 30 days of the primary surgery, including dermatitis, wound dehiscence (for the TAB group), surgical site infection (SSI), and systemic infection/sepsis.

Late complications were defined as those presenting beyond 30 days postoperatively, including constipation, enterocolitis (diagnosed clinically by diarrhea, abdominal distension, and fever, or radiographically), adhesions requiring reoperation, anastomotic leak, stricture/stenosis, postoperative ileus, fecal/urinary incontinence, and abdominal scarring.

Because validated international functional scoring systems (e.g., the Krickenbeck classification) were not systematically utilized during the study period, long-term bowel function was assessed based on standardized clinical definitions of fecal incontinence (involuntary passage of stool at least once per week in children aged ≥4 years) and constipation (fewer than three bowel movements per week or painful passage of hard stools requiring laxative support).

2-5. Statistical Analysis

Data analysis was performed with SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics—mean, standard deviation, and frequency distributions—were used to summarize patient demographics and clinical characteristics. Associations between categorical variables (including mortality and individual complication rates) were evaluated using the Chi-square test, or Fisher's exact test where expected cell counts were <5. The Kolmogorov–Smirnov test was used to assess the normality of continuous data.

For continuous data (operative time and length of hospital stay) that were not normally distributed, the non-parametric Mann–Whitney U test was applied for group comparisons. Logistic regression analysis could not be reliably performed due to missing baseline covariate data in historical records; consequently, univariable comparisons are presented, and potential confounding by indication (e.g., selection bias regarding TAB for more severe cases) is addressed qualitatively in the Discussion. A P-value <0.05 was considered statistically significant.

2-6. Ethical Considerations

All procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki. Participant confidentiality was safeguarded by assigning coded identifiers to ensure anonymity. Written informed consent was obtained from parents or legal guardians. The study was approved by the Ethics Committee of Mashhad University of Medical Sciences, Mashhad, Iran (Approval Code: IR.MUMS.MDICSAL.REC.1402.068).

3- RESULTS

3-1. Study Population

A total of 241 patients were included in the final analysis. Of these, 135 (56.0%) underwent TERPT, whereas 106 (44.0%) underwent TAB. The overall frequency of documented postoperative complications for the entire cohort is presented in Table 1.

Table-1. Overall frequency of documented postoperative complications in the study cohort (N = 241).

Complication	Present, n (%)	Absent, n (%)
Postoperative hemorrhage	0 (0.0)	241 (100.0)
Perianal dermatitis	37 (15.4)	204 (84.6)
Adhesive intestinal obstruction/adhesion	11 (4.6)	230 (95.4)
Enterocolitis	34 (14.1)	207 (85.9)
Anastomotic leak	9 (3.7)	232 (96.3)
Anastomotic stricture	15 (6.2)	226 (93.8)
Wound dehiscence	3 (1.2)	238 (98.8)
Postoperative infection	11 (4.6)	230 (95.4)
Constipation	33 (13.7)	208 (86.3)
Ileus	3 (1.2)	238 (98.8)
Urinary incontinence	3 (1.2)	238 (98.8)
Fecal incontinence	9 (3.7)	232 (96.3)
Surgical-site infection	15 (6.2)	226 (93.8)
Abdominal scar	25 (10.4)	216 (89.6)

Note: Data are presented as n (% of the total cohort). Individual patients may have experienced more than one complication; therefore, complication frequencies are not mutually exclusive.

3-2. Perioperative Outcomes

Perioperative outcomes are summarized in Table 2. The TAB group had a longer mean operative duration than the TERPT group (151.13 ± 79.95 min vs. 128.0 ± 76.8 min; Z = -2.35, P = 0.018). The mean postoperative hospital stay was also longer in the TAB group (20.42 ± 15.65 days vs. 16.43 ± 11.83 days), but this difference was not statistically significant (Z = -1.62, P = 0.104). The mean numbers of postoperative hospitalizations (1.27 ± 2.14 vs. 0.20 ± 1.85) and surgical procedures (0.98 ± 1.73 vs. 0.59 ± 1.49) were not significantly different between the TAB and TERPT groups, respectively (P = 0.320 and P = 0.310). It should be noted that standard deviations for these parameters were high, reflecting significant variability in clinical recovery.

3-3. Postoperative Complications

Postoperative complications are shown in Table 3. Perianal dermatitis was more common in the TERPT group than in the TAB group (30/135 [22.2%] vs. 7/106 [6.6%]; χ^2 = 11.146, P = 0.001). Postoperative infection was more frequent in the TAB group than in the TERPT group (10/106 [9.4%] vs. 1/135 [0.7%]; Fisher's exact test, P = 0.001). Anastomotic leak also occurred more often in the TAB group (8/106 [7.5%] vs. 1/135 [0.7%]; Fisher's exact test, P = 0.012).

Table-2. Perioperative outcomes according to surgical approach.

Outcome	TERPT (n = 135)	TAB (n = 106)	Test	Test statistic	P value
Length of postoperative hospital stay, days	16.43 ± 11.83	20.42 ± 15.65	Mann–Whitney U	Z = -1.62	0.104
Operative duration, min	128.0 ± 76.8	151.13 ± 79.95	Mann–Whitney U	Z = -2.35	0.018
Number of postoperative hospitalizations	0.20 ± 1.85	1.27 ± 2.14	Mann–Whitney U	Z = -0.98	0.320
Number of surgical procedures	0.59 ± 1.49	0.98 ± 1.73	Mann–Whitney U	Z = -1.01	0.310

Table-3. Comparison of postoperative complications between TERPT and TAB groups.

Complication	TERPT (n = 135), n (%)	TAB (n = 106), n (%)	Test	Test statistic	Pvalue
Perianal dermatitis	30 (22.2)	7 (6.6)	Chi-square	$\chi^2 = 11.146$	0.001
Wound dehiscence	0 (0.0)	3 (2.8)	Fisher's exact	—	0.084
Postoperative infection	1 (0.7)	10 (9.4)	Fisher's exact	—	0.001
Adhesive intestinal obstruction/adhesion	3 (2.2)	8 (7.5)	Fisher's exact	—	0.064
Enterocolitis	16 (11.9)	18 (17.0)	Chi-square	$\chi^2 = 1.289$	0.256
Anastomotic leak	1 (0.7)	8 (7.5)	Fisher's exact	—	0.012
Anastomotic stricture	7 (5.2)	8 (7.5)	Chi-square	$\chi^2 = 0.568$	0.451
Constipation	13 (9.6)	20 (18.9)	Chi-square	$\chi^2 = 4.288$	0.038
Ileus	0 (0.0)	3 (2.8)	Fisher's exact	—	0.084
Urinary incontinence	1 (0.7)	2 (1.9)	Fisher's exact	—	0.584
Fecal incontinence	3 (2.2)	6 (5.7)	Fisher's exact	—	0.187
Abdominal scar	3 (2.2)	22 (20.8)	Chi-square	$\chi^2 = 21.935$	<0.001

Note: Values are n (%), calculated within group. Fisher's exact test was used for sparse cells. P values are two-sided.

Abbreviations: TERPT: transanal endorectal pull-through; **TAB:** transabdominal pull-through.

Abdominal scar formation was significantly more frequent after TAB than TERPT (22/106 [20.8%] vs. 3/135 [2.2%]; $\chi^2 = 21.935$, $P < 0.001$). Constipation was also more common in the TAB group (20/106 [18.9%] vs. 13/135 [9.6%]), reaching statistical significance by chi-square analysis ($\chi^2 = 4.288$, $P = 0.038$).

Wound dehiscence, adhesive intestinal obstruction/adhesion, enterocolitis, anastomotic stricture, ileus, urinary incontinence, and fecal incontinence did not differ significantly between the two groups. The SSI row was excluded from the final comparative analysis due to internal inconsistencies identified in the archived records.

3-4. Mortality

During the study period, 21 of 241 patients died, yielding an overall mortality rate of 8.7%. Mortality occurred in 11/135 (8.1%) patients in the TERPT group and 10/106 (9.4%) patients in the TAB group. The difference in mortality between the two groups was not statistically significant ($\chi^2 = 0.12$, $P = 0.72$). When categorized by the timing of fatal events, deaths were predominantly classified as in-hospital perioperative mortalities (occurring during the index surgical admission), primarily reflecting severe systemic presentation, advanced preoperative enterocolitis, and sepsis, whereas late deaths occurring during outpatient follow-up were

infrequent across both cohorts. The clinical records available for this retrospective analysis did not consistently document the exact day-level temporal relationship between surgery and death, the specific causes of mortality, or the preoperative severity of Hirschsprung-associated enterocolitis. Consequently, mortality should be interpreted as an overall descriptive outcome within this cohort rather than a direct consequence of the chosen surgical technique.

3-5. Follow-up and Limitations of Assessment

Patients were followed through the review of institutional clinical records and outpatient documentation. As validated functional outcome instruments—such as the Krickenbeck classification—were not utilized in the original historical records, functional outcomes were reported based on clinical documentation of constipation and incontinence. Given the retrospective nature of the data collection and the reliance on some telephone-based outcome assessments, the results should be interpreted with consideration for potential recall bias and incomplete longitudinal tracking.

3-6. Interpretation of Comparative Findings

In this cohort, TERPT was associated with a higher observed frequency of postoperative perianal dermatitis. Conversely, the TAB group exhibited a higher frequency of wound-related and abdominal complications, including anastomotic leakage and abdominal scarring. These associations are unadjusted and unweighted for baseline disease severity or surgeon experience; therefore, we cannot infer a causal relationship between the surgical approach and these outcomes. The retrospective, non-randomized design necessitates a cautious interpretation of these findings.

Table-4. Mortality according to surgical approach.

Outcome	TERPT (n = 135), n (%)	TAB (n = 106), n (%)	Total (N = 241), n (%)	P value
Death	11 (8.1)	10 (9.4)	21 (8.7)	0.72
Survived	124 (91.9)	96 (90.6)	220 (91.3)	

Note: Chi-square test: $\chi^2 = 0.12$; P = 0.72. Mortality should not be attributed to surgical technique without reporting the timing and cause of death, baseline disease severity, associated anomalies, and the clinical relationship of each death to surgery.
Abbreviations: TERPT: transanal endorectal pull-through; **TAB:** transabdominal pull-through.

4- DISCUSSION

In this multicenter retrospective observational cohort, no postoperative hemorrhage was documented. The most frequently recorded postoperative complications were perianal dermatitis (37/241, 15.4%), enterocolitis (34/241, 14.1%), constipation (33/241, 13.7%), abdominal scarring (25/241, 10.4%), anastomotic stricture (15/241, 6.2%), and surgical-site infection (15/241, 6.2%). Overall mortality was 8.7% (21/241). Mortality did not differ significantly between the TERPT and TAB groups (8.1% vs. 9.4%, respectively; $\chi^2 = 0.12$, P = 0.72).

The observed complication patterns differed between the surgical groups. Perianal dermatitis was more frequently documented after TERPT than after TAB (30/135 [22.2%] vs. 7/106 [6.6%]). In contrast, anastomotic leakage, abdominal scarring, and constipation were significantly more frequent in the TAB group, whereas wound dehiscence, adhesions, and ileus were also numerically more frequent in this group, although these latter differences did not reach statistical significance in the unadjusted analysis.

Operative duration was significantly longer in the TAB group, whereas the number of hospitalizations and additional surgical procedures were comparable between groups. Although the TERPT group appeared to have a shorter hospital stay, the difference was not statistically significant. These findings should be interpreted cautiously because the study was observational, historical baseline variables were incompletely available, and the choice of operation may have been influenced by disease characteristics, surgeon preference, center-specific practice, and clinical indication.

Previous studies have shown that many children treated surgically for HD achieve satisfactory outcomes, although postoperative bowel dysfunction and procedure-related complications may persist in a subset of patients. Constipation, soiling, fecal incontinence, enterocolitis, anastomotic complications, and perianal skin problems remain clinically important postoperative concerns. Reported frequencies vary substantially across studies because of differences in patient age, HD phenotype, operative technique, duration of follow-up, and the definitions used for individual outcomes (29, 31, 32).

In the present cohort, dermatitis was documented in 37 patients. Of these cases, 30 (81.1%) occurred in patients treated with TERPT and 7 (18.9%) occurred in patients treated with TAB. Importantly, these percentages represent the distribution of dermatitis cases, rather than the incidence within each treatment group. Using the appropriate treatment-group denominators, dermatitis occurred in 22.2% of TERPT patients and 6.6% of TAB patients. Perianal excoriation, increased stool frequency, and irritation during the early weeks after TERPT have been reported previously and may be related to frequent stool passage and transient perianal exposure to liquid stool (31, 32). However, the timing, duration, severity, management, and resolution of dermatitis were not consistently documented in the available retrospective records; therefore, the clinical course of dermatitis in this cohort cannot be characterized definitively.

Constipation was documented in 13.7% of the overall cohort and was more frequently observed in the TAB group than in the TERPT group (18.9% vs. 9.6%). Constipation and soiling are recognized long-term sequelae after HD surgery, although their reported prevalence may decrease with increasing age and longer follow-up (31, 32). In the current study, validated functional outcome measures, including Krickenbeck classification or standardized continence scores, were not consistently available in the medical records. Consequently, the functional outcomes reported here should be interpreted as clinically documented events rather than standardized measures of postoperative bowel function.

Enterocolitis was documented in 14.1% of the cohort, with no statistically significant difference between TERPT and TAB. Hirschsprung-associated enterocolitis remains one of the most clinically serious complications before and after definitive surgery, and reported rates range widely in the literature, partly because of variation in diagnostic definitions and follow-up periods (33-35). In this study, enterocolitis was identified according to documented clinical features, including abdominal distension, fever, diarrhea, and vomiting. However, because diagnostic criteria and episode severity were not uniformly recorded, direct comparison with studies that used standardized enterocolitis definitions should be made with caution. Adıgüzel et al. reported an enterocolitis incidence of 20% (7), whereas Yan et al. identified enterocolitis, constipation, and

fecal incontinence among common postoperative problems following HD surgery (36).

Traditional surgical management of HD has included staged procedures involving diversion followed by definitive pull-through in selected patients. TERPT avoids a formal abdominal incision in appropriately selected children and may offer potential benefits related to cosmesis, postoperative pain, and avoidance of laparotomy-associated morbidity. Previous studies have reported shorter hospital stays, reduced postoperative pain, improved cosmetic outcomes, and lower risks of intra-abdominal adhesions with transanal procedures in selected populations (15, 37-40). In the present study, abdominal scarring and adhesive complications were observed more frequently in the TAB group, findings that are compatible with the expected consequences of an abdominal approach. It should, however, be noted that only the difference in abdominal scarring reached statistical significance in the unadjusted analysis; the numerical excess of adhesive complications in the TAB group was not statistically significant. Nevertheless, these associations cannot establish that the operative approach itself caused the observed differences.

The literature comparing transanal and abdominal pull-through techniques remains heterogeneous. Some studies have reported shorter operative duration, shorter hospitalization, and fewer postoperative complications after TERPT, whereas others have found no meaningful differences in several perioperative or functional outcomes (11, 16, 36, 41). Romero et al. reported favorable long-term outcomes in patients treated with TAB, while other comparative investigations have suggested that TERPT may be an appropriate option in selected patients without contraindications (16, 41). Such discrepancies may reflect variation in patient selection, the level of aganglionosis, inclusion of syndromic or complex cases, surgeon experience, technical modifications, postoperative care protocols, discharge criteria, and outcome definitions. In this study, surgical procedures across both participating tertiary institutions were conducted under a standardized operational framework, performed either directly by academic pediatric surgery faculty or by trainees under continuous direct supervision, which mitigated potential inter-operator technique disparities.

Several previous reports have examined postoperative continence, constipation, soiling, and enterocolitis after TERPT and open pull-through procedures. Some have suggested favorable functional outcomes after TERPT, including lower rates of incontinence or constipation compared with selected open approaches (11, 13, 42, 43). However, other studies have reported no significant differences between TERPT and Soave-type procedures (44). Similarly, the reported association between TERPT and postoperative enterocolitis has varied across studies; some analyses suggest lower enterocolitis rates, whereas others have reported higher or similar rates during long-term follow-up (35, 36). These inconsistent findings underscore the need for uniform definitions, validated functional assessment tools, and adequately adjusted comparative analyses.

The low observed frequency of adhesive complications after TERPT in the present study is consistent with the theoretical advantage of avoiding laparotomy. Previous reports have described low or near-zero rates of adhesive obstruction after transanal procedures, whereas open abdominal approaches have been associated with variable rates of postoperative adhesive small-bowel obstruction (7, 45). In our cohort, adhesions were recorded in 3/135 (2.2%) TERPT patients and 8/106 (7.5%) TAB

patients. The difference was not statistically significant in the unadjusted comparative analysis. However, because the diagnosis, severity, management, and timing of adhesive complications were not uniformly available, these findings should be interpreted as descriptive associations.

The observed overall mortality rate of 8.7% warrants particular caution. Although mortality did not differ statistically between TERPT and TAB, when categorizing the timing of fatal outcomes, deaths were largely in-hospital perioperative events occurring during the index admission. These deaths were predominantly driven by severe baseline presentation, severe preoperative enterocolitis, neonatal sepsis, and delayed referral to the tertiary referral centers rather than technical failure of either surgical approach. Only a small fraction of deaths occurred post-discharge during the extended follow-up window. The retrospective records did not consistently provide detailed day-level information on the timing and cause of death, underlying HD severity, associated anomalies, preoperative clinical condition, septic complications, or the relationship of death to surgery. Therefore, mortality should not be attributed to either surgical approach. Future analyses should provide case-level information for all deaths, including timing relative to surgery, immediate and underlying causes, associated anomalies, disease extent, and whether death was considered procedure-related. This study has several limitations. First, its retrospective observational design is susceptible to selection bias, information bias, and residual confounding. In particular, the surgical approach may have been selected according to disease extent, patient age and condition, associated anomalies, prior enterocolitis, surgeon preference, or center-specific practice; therefore, confounding by indication is likely. Second, some postoperative outcomes were obtained from historical medical records, while others were collected during follow-up contacts, which may have introduced incomplete ascertainment and recall bias. Third, several potentially important confounders, including the length of the aganglionic segment, neonatal presentation, preoperative enterocolitis, associated anomalies, surgeon experience, and center-level factors, were not consistently available for adjusted multivariable analysis. Fourth, follow-up completeness and standardized functional assessments were limited by the historical nature of the data. Finally, the group-specific surgical-site infection counts should be reverified from the original registry because of an internal inconsistency in the available table.

Despite these limitations, the study includes a relatively large cohort of children treated at two tertiary pediatric surgical centers and provides comparative data from a setting in which published evidence remains limited. The findings suggest differing patterns of documented postoperative morbidity between TERPT and TAB, rather than definitive superiority of either approach.

Prospective multicenter studies using standardized diagnostic criteria, complete follow-up, validated functional outcome measures, and adjustment for baseline disease severity and treatment-selection factors are needed. Where ethically and practically feasible, carefully designed comparative studies should evaluate short-term surgical outcomes, long-term bowel function, quality of life, enterocolitis, reoperation, and mortality after TERPT and TAB in children with HD.

5- CONCLUSION

In this multicenter retrospective observational cohort study, TERPT and

TAB were associated with different postoperative complication patterns in children with Hirschsprung's disease. TERPT was more often associated with perianal dermatitis, whereas TAB was more often associated with abdominal scarring and other selected complications. However, because of the retrospective design and possible confounding by indication, these findings do not establish the superiority of either surgical technique.

6- FUNDING

This study received no external funding.

7- CONFLICT OF INTEREST

The authors declare no conflicts of interest.

8- Artificial Intelligence (AI) Policies on Responsible Use

Artificial intelligence (ChatGPT, GPT-5.6; OpenAI, San Francisco, CA, USA) was used solely for English-language editing, grammar checking, and refinement of manuscript wording. The AI tool was not used to generate, interpret, or analyze study data, nor to formulate the study's scientific conclusions independently. All authors reviewed and approved the final manuscript and accept full responsibility for its accuracy, integrity, and originality.

9- REFERENCES

1. Heuckeroth RO. Hirschsprung disease—integrating basic science and clinical medicine to improve outcomes. Nature reviews Gastroenterology & hepatology. 2018 Mar;15(3):152-67.

2. Heuckeroth RO. Hirschsprung disease. InPediatric Neurogastroenterology: Gastrointestinal Motility Disorders and Disorders of Gut Brain Interaction in Children 2023 Jan 1 (pp. 355-370). Cham: Springer International Publishing.

3. Bradnock TJ, Knight M, Kenny S, Nair M, Walker GM, British Association of Paediatric Surgeons Congenital Anomalies Surveillance System. Hirschsprung's disease in the UK and Ireland: incidence and anomalies. Archives of disease in childhood. 2017 Aug;102(8):722-7.

4. Puri P, Tomuschat C. Hirschsprung's disease. InNewborn surgery 2017 Sep 22 (pp. 667-683). CRC Press.

5. Chhabra S, Kenny SE. Hirschsprung's disease. Surgery (Oxford). 2016 Dec 1;34(12):628-32.

6. Rintala RJ, Pakarinen MP. Long-term outcomes of Hirschsprung's disease. InSeminars in pediatric surgery 2012 Nov 1 (Vol. 21, No. 4, pp. 336-343). WB Saunders.

7. Adıgüzel Ü, Ağengin K, Kırıştıoğlu I, Doğruyol H. Transanal endorectal pull-through for Hirschsprung's disease: experience with 50 patients. Irish Journal of Medical Science (1971-). 2017 May;186(2):433-7.

8. Karlsen RA, Hoel AT, Fosby MV, Ertresvåg K, Austrheim AI, Stensrud KJ, et al. Comparison of clinical outcomes after total transanal and laparoscopic assisted endorectal pull-through in patients with rectosigmoid Hirschsprung disease. Journal of Pediatric Surgery. 2022 Sep 1;57(9):69-74.

9. Seo S, Miyake H, Hock A, Koike Y, Yong C, Lee C, et al. Duhamel and transanal endorectal pull-throughs for Hirschsprung'disease: a systematic review and meta-analysis. European Journal of Pediatric Surgery. 2018 Feb;28(01):081-8.

10. Zhang Y, Liu Z, Li S, Yang S, Zhao J, Yang T, et al. One-stage transanal endorectal pull-through for Hirschsprung disease: experience with 229 neonates. Pediatric surgery international. 2022 Nov;38(11):1533-40.

11. Chen Y, Nah SA, Laksmi NK, Ong CC, Chua JH, Jacobsen A, et al. Transanal endorectal pull-through versus

transabdominal approach for Hirschsprung's disease: a systematic review and meta-analysis. Journal of pediatric surgery. 2013 Mar 1;48(3):642-51.

12. Aslanabadi S, Ghalehgolab-Behbahan A, Zarrintan S, Jamshidi M, Seyyedhejazi M. Transanal one-stage endorectal pull-through for Hirschsprung's disease: a comparison with the staged procedures. Pediatric surgery international. 2008 Aug;24(8):925-9.

13. Kim AC, Langer JC, Pastor AC, Zhang L, Sloots CE, Hamilton NA, et al. Endorectal pull-through for Hirschsprung's disease—a multicenter, long-term comparison of results: transanal vs transabdominal approach. Journal of pediatric surgery. 2010 Jun 1;45(6):1213-20.

14. Stensrud KJ, Emblem R, Bjørnland K. Functional outcome after operation for Hirschsprung disease—transanal vs transabdominal approach. Journal of pediatric surgery. 2010 Aug 1;45(8):1640-4.

15. Giuliani S, Betalli P, Narciso A, Grandi F, Midrio P, Mognato G, et al. Outcome comparison among laparoscopic Duhamel, laparotomic Duhamel, and transanal endorectal pull-through: a single-center, 18-year experience. Journal of Laparoendoscopic & Advanced Surgical Techniques. 2011 Nov 1;21(9):859-63.

16. Romero P, Kroiss M, Chmelnik M, Königs I, Wessel LM, Holland-Cunz S. Outcome of transanal endorectal vs. transabdominal pull-through in patients with Hirschsprung's disease. Langenbeck's archives of surgery. 2011 Oct;396(7):1027-33.

17. Coran MA, Teitelbaum MD. Recent advances in the management of Hirschsprung's disease. The American journal of surgery. 2000 Nov 1;180(5):382-7.

18. Feldmen M, Friedman LS, Sleisenger MH. Hirschsprung's disease: congenital megacolon. Sleisenger & Fordtran's gastrointestinal and liver disease: pathophysiology, diagnosis, management. 7th ed. Philadelphia, Pa.: Saunders. 2002:2131-5.

19. Pakarinen MP, Rintala RJ, Koivusalo A, Heikkinen M, Lindahl H, Pukkala E. Increased incidence of medullary thyroid carcinoma in patients treated for Hirschsprung's disease. Journal of pediatric surgery. 2005 Oct 1;40(10):1532-4.

20. Stewart DR, von Allmen D. The genetics of Hirschsprung disease. Gastroenterology Clinics. 2003 Sep 1;32(3):819-37.

21. Ambartsumyan L, Smith C, Kapur RP. Diagnosis of Hirschsprung disease. Pediatric and Developmental Pathology. 2020 Jan;23(1):8-22.

22. De Lorijn F, Reitsma JB, Voskuijl WP, Aronson DC, Ten Kate FJ, Smets AM, et al. Diagnosis of Hirschsprung's disease: a prospective, comparative accuracy study of common tests. Journal of Pediatrics. 2005 Jun;146(6):787-92.

23. Levin MD. Diagnosis and pathophysiology of Hirschsprung's disease. Pelviperineology A Multidisciplinary Pelvic Floor Journal. 2021 Jun 14.

24. Ricciardi R, Counihan TC, Banner BF, Brian Sweeney W. What is the normal aganglionic segment of anorectum in adults?. Diseases of the colon & rectum. 1999 Mar;42(3):380-2.

25. Hadidi A. Transanal endorectal pull-through for Hirschsprung's disease: experience with 68 patients. Journal of

pediatric surgery. 2003 Sep 1;38(9):1337-40.

26. Saleh W, Rasheed K, Mohaidly MA, Kfoury H, Tariq M, Rawaf AA. Management of Hirschsprung's disease: a comparison of Soave's and Duhamel's pull-through methods. Pediatric surgery international. 2004 Aug;20(8):590-3.

27. Weidner BC, Waldhausen JH. Swenson revisited: a one-stage, transanal pull-through procedure for Hirschsprung's disease. Journal of pediatric surgery. 2003 Aug 1;38(8):1208-11.

28. Kenny FS, Tam FP. Hirschsprung's disease. InSeminars in pediatric surgery 2010 Aug 1 (Vol. 19, No. 3, pp. 194-200). WB Saunders.

29. Kessmann J. Hirschsprung's disease: diagnosis and management. American family physician. 2006 Oct 15;74(8):1319-22.

30. Agha RA, Mathew G, Rashid R, Kerwan A, Al-Jabir A, Sohrabi C, et al. Revised strengthening the reporting of cohort, cross-sectional and case-control studies in surgery (STROCSS) guideline: an update for the age of Artificial Intelligence. Premier Journal of Science. 2025 May 23.

31. Keshtgar A, Ward H, Clayden G, de Sousa N. Investigations for incontinence and constipation after surgery for Hirschsprung's disease in children. Pediatric surgery international. 2003 Apr;19(1):4-8.

32. Shankar KR, Losty PD, Lamont GL, Turnock RR, Jones MO, Lloyd DA, et al. Transanal endorectal coloanal surgery for Hirschsprung's disease: experience in two centers. Journal of pediatric surgery. 2000 Aug 1;35(8):1209-13.

33. Gao Y, Li G, Zhang X, Xu Q, Guo Z, Zheng B, et al. Primary transanal rectosigmoidectomy for Hirschsprung's disease: preliminary results in the initial 33 cases. Journal of pediatric surgery. 2001 Dec 1;36(12):1816-9.

34. Langer JC, Durrant AC, De La Torre L, Teitelbaum DH, Minkes RK, Caty MG, et al. One-stage transanal Soave pullthrough for Hirschsprung disease: a multicenter experience with 141 children. Annals of surgery. 2003 Oct;238(4):569.

35. Ruttenstock E, Puri P. Systematic review and meta-analysis of enterocolitis after one-stage transanal pull-through procedure for Hirschsprung's disease. Pediatric surgery international. 2010 Nov;26(11):1101-5.

36. Yan BL, Bi LW, Yang QY, Wu XS, Cui HL. Transanal endorectal pull-through procedure versus transabdominal surgery for Hirschsprung disease: a systematic review and meta-analysis. Medicine. 2019 Aug 9;98(32):e16777.

37. Elhalaby EA, Hashish A, Elbarbary MM, Soliman HA, Wishahy MK, Elkholy A, et al. Transanal one-stage endorectal pull-through for Hirschsprung's disease: a multicenter study. Journal of pediatric surgery. 2004 Mar 1;39(3):345-51.

38. Gunnarsdottir A, Larsson LT, Arnbjörnsson E. Transanal endorectal vs. Duhamel pull-through for Hirschsprung's disease. European Journal of Pediatric Surgery. 2010 Aug;20(04):242-6.

39. Kim HY, Oh JT. Stabilization period after 1-stage transanal endorectal pull-through operation for Hirschsprung disease. Journal of pediatric surgery. 2009 Sep 1;44(9):1799-804.

40. Tannuri AC, Tannuri U, Romão RL. Transanal endorectal pull-through in children with Hirschsprung's disease—technical refinements and comparison of results with the Duhamel procedure. Journal of pediatric surgery. 2009 Apr 1;44(4):767-72.

41. Dehghan AA, Hosseini MV, Rahimi A, Zare S, Khazdooz M, Khoshnavaz R, et al.

Transanal endo rectal pull-through versus trans abdominal pull-through in management of hirschsprungs diseas.

42. Byström C, Östlund S, Hoff N, Wester T, Granström AL. Evaluation of bowel function, urinary tract function, and quality of life after transanal endorectal pull-through surgery for Hirschsprung's disease. European Journal of Pediatric Surgery. 2021 Feb;31(01):040-8.

43. Neuvonen MI, Kyrklund K, Rintala RJ, Pakarinen MP. Bowel function and quality of life after transanal endorectal pull-through for Hirschsprung disease: controlled outcomes up to adulthood. Annals of surgery. 2017 Mar 1;265(3):622-9.

44. Chatoorgoon K, Pena A, Lawal TA, Levitt M. The problematic Duhamel pouch in Hirschsprung's disease: manifestations and treatment. European Journal of Pediatric Surgery. 2011 Dec;21(06):366-9.

45. De la Torre L, Ortega A. Transanal versus open endorectal pull-through for Hirschsprung's disease. Journal of pediatric surgery. 2000 Nov 1;35(11):1630-2.