TAJ

ISSN 1019-8555
eISSN 2408-8854

THE JOURNAL OF TEACHERS ASSOCIATION, RAJSHAHI MEDICAL COLLEGE

| TAJ | Volume - 38 | Issue - 2 | June, 2025 |



https://www.tajrmc.com/submit-article/

Official Organ of Teachers Association
Rajshahi Medical College
Rajshahi- 6000, Bangladesh
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The Teachers' Association Journal (TAJ) is an open-access, national, peer-reviewed, and BMDC-approved journal dedicated to disseminating high-quality research in the field of medical sciences. Established to advance knowledge and foster academic discourse, TAJ is a platform for educators, researchers, and professionals to contribute to the scholarly conversation surrounding pedagogy, teaching methodologies, and educational advancements.

Indexing and Abstracting

Google	Crossref	ResearchGate	WorldCat
ACADEMIA	ISSN	SCRIBD	publons

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Journal of Teachers Association
https://tajrmc.com/taj
Vol. 38, No. 2, 2025

pISSN 1019-8555
eISSN 2408-8854

RESEARCH ARTICLE | OPEN ACCESS

DOI: https://doi.org/10.70818/taj.v38i02.0360

Transanal Endorectal Pull-Through (TERPT) Versus Laparoscopic-TERPT for The Treatment of Hirschsprung's Disease: A Comparatives Study of Outcome

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Citation:
Shahid SMA, Lina KSN, Paul SR, Hossain Z, Azim A, Mamun AA, Islam MA, Islam S, Nobi H, Shafiquzzaman MS, Akter S; Transanal Endorectal Pull-Through (TERPT) Versus Laparoscopic-TERPT for The Treatment of Hirschsprung's Disease: A Comparatives Study of Outcome. Journal of Teachers Association. 2025;38(2): 75-84

Article History:
Received: 03.02.2025
Accepted: 18.04.2025
Published: 01.06.2025

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ABSTRACT: ***Background:*** Hirschsprung's disease (HD) is a congenital disorder resulting from the absence of ganglion cells in the distal colon, necessitating surgical treatment. This study compares two minimally invasive surgical techniques: Transanal Endorectal Pull-Through (TERPT) and Laparoscopic-TERPT (LERPT). ***Objective*****:** The objective of this study was to evaluate and compare the surgical outcomes of TERPT and LERPT in children with Hirschsprung's disease, aged 4 to 13 years, to determine the more effective procedure. ***Methods*****:** A total of 53 pediatric patients who underwent either TERPT (n=26) or LERPT (n=27) between January 2022 and June 2023 at Rajshahi Medical College Hospital were analyzed. Data collected included operative time, hospital stay, complications, and long-term outcomes. Statistical analysis was conducted using p-values, standard deviation, and outcome percentages. ***Results*****:** The median operative time was 158 minutes (SD=24.7, range: 84–198) for TERPT and 176 minutes (SD=29.1, range: 95–218) for LERPT, with a significant difference (p=0.016). The median hospital stay was 7.81 days (SD=2.3) for TERPT and 4.35 days (SD=1.2) for LERPT (p=0.031). Infection occurred in 26.92% (7/26) of TERPT patients compared to 7.41% (2/27) of LERPT patients (p=0.038). Postoperative ileus was present in 23.08% (6/26) of TERPT patients compared to 7.41% (2/27) in LERPT (p=0.056). Anastomotic stricture rates were 30.76% (8/26) in TERPT and 14.81% (4/27) in LERPT (p=0.048). Persistent obstructive symptoms occurred in 19.23% (5/26) of TERPT and 7.41% (2/27) of LERPT patients (p=0.043). ***Conclusion*****:** LERPT demonstrated better outcomes in terms of operative time, complications, and recovery, suggesting it as the preferred approach for pediatric Hirschsprung's disease.

Keywords: Hirschsprung's Disease, TERPT, LERPT, Pediatric Surgery, Surgical Outcomes.

Article at a glance:

Study Purpose*: To compare TERPT and LERPT for Hirschsprung's disease in pediatric patients, focusing on operative time, hospital stay, complications, and long-term outcomes.*

Key findings: *LERPT had shorter hospital stays and fewer complications, including anastomotic strictures and persistent obstructive symptoms. TERPT had a shorter operating time but more postoperative complications.*

Newer findings: *This study supports LERPT as a superior option for fewer complications and faster recovery, while TERPT remains a viable, quicker, cost-effective alternative in resource-limited settings.*

Abbreviations: *TERPT – Transanal Endorectal Pull-Through, LERPT – Laparoscopic-Transanal Endorectal Pull-Through, HD – Hirschsprung's Disease.*

INRODUCTION

Hirschsprung's disease (HD), a congenital disorder characterized by the absence of ganglion cells in the distal colon, presents a major challenge in pediatric surgery. It primarily affects the rectum and the colon, leading to functional bowel obstruction and

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severe constipation due to impaired peristalsis in the affected segments. The etiology of HD is multifactorial, involving genetic mutations and environmental factors, which impede normal neuronal development within the enteric nervous system (ENS) during fetal growth.[1] The disease is clinically diagnosed through rectal biopsy and histopathological examination, confirming the absence of ganglion cells in the submucosal and myenteric plexuses. Surgical intervention remains the cornerstone of treatment, with the goal of exercising the aganglionic segment and restoring normal bowel function. The primary surgical technique employed in the treatment of Hirschsprung's disease is the pull-through procedure, which involves removing the aganglionic bowel and bringing the normal bowel to the rectum. Over the years, various methods of performing this operation have been developed, Hirschsprung's ranging from traditional open surgery to more advanced, minimally invasive techniques. A prominent variation of the pull-through procedure is the Transanal Endorectal Pull-Through (TERPT), which has gained attention for its potential to minimize surgical trauma and enhance recovery times due to its minimally invasive nature.[2] In contrast, the laparoscopic-assisted TERPT introduces laparoscopic guidance to improve precision and visualization during the procedure, thus potentially enhancing surgical outcomes and reducing the risk of complications such as anastomotic leakage or bowel perforation.[3] The advancement from open surgery to minimally invasive techniques has marked a significant shift in the management of Hirschsprung's disease, offering promising alternatives that promise reduced postoperative pain, shorter hospital stays, and faster recovery. However, the efficacy of TERPT versus laparoscopic-TERPT (Lap-TERPT) in terms of long-term outcomes, including bowel function, quality of life, and complications, remains an area of active investigation. A comparative study of these two techniques is crucial to determine the optimal approach, given the complexities and varied responses in pediatric patients.[4] Despite the popularity of TERPT for treating HD, there are still significant gaps in the literature regarding the comparison of these two procedures. These gaps include long-term functional outcomes, incidence of complications, and overall patient recovery trajectory, all of which are critical in shaping the clinical decision-making process for pediatric surgeons and their multidisciplinary teams. A study conducted by Almadhoun *et al.* highlighted the advantages of TERPT in terms of reduced postoperative pain and quicker return to normal activities compared to traditional open pull-through surgery.[5] However, the introduction of laparoscopic assistance into the TERPT technique has raised questions about whether this modification offers superior outcomes in terms of complication rates and recovery times. Some studies indicate that laparoscopic techniques allow for enhanced precision in identifying the exact borders of the aganglionic segment and in performing the anastomosis, leading to potentially fewer complications, such as stricture formation or bowel perforation.[6] Furthermore, the minimal invasiveness of both procedures, particularly the transanal approach, results in shorter hospital stays and lower incidence of wound infections, which are common complications in open surgeries. The significance of these findings lies in their potential to guide clinical practice by identifying the most effective and least invasive surgical strategy for treating Hirschsprung's disease. By comparing TERPT and laparoscopic-assisted TERPT, this study seeks to bridge the knowledge gap and establish evidence-based guidelines that can be employed in clinical settings to improve patient outcomes. The ongoing exploration of minimally invasive techniques such as laparoscopic-TERPT is pivotal for advancing pediatric surgical care, ensuring that pediatric patients with Hirschsprung's disease experience fewer complications and achieve the best possible quality of life. In addition to surgical techniques, the long-term management of Hirschsprung's disease involves careful follow-up to monitor bowel function and ensure the absence of postoperative complications, such as enterocolitis and incontinence. Long-term studies comparing TERPT and laparoscopic-TERPT are essential for evaluating not only immediate outcomes but also long-term morbidity, which includes bowel dysfunction, the need for reoperation, and the psychological impact on patients and their families.[7] Thus, a comprehensive evaluation of both techniques, incorporating both short-term and long-term outcomes, is necessary to guide clinical practice and decision-making.

Aims and Objective

The aim of this study is to compare the clinical outcomes of Transanal Endorectal Pull-Through (TERPT) and Laparoscopic-TERPT (LERPT) in the treatment of Hirschsprung's disease in pediatric

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patients. The objective is to identify the most effective procedure in terms of operative time, complications, recovery, and long-term outcomes.

MATERIAL AND METHODS

Study Design

This prospective comparative study was conducted at the Department of Paediatric Surgery, Rajshahi Medical College Hospital, Rajshahi, between January 2022 and June 2023. The study aimed to evaluate and compare the clinical outcomes of two minimally invasive surgical procedures: Transanal Endorectal Pull-Through (TERPT) and Laparoscopic-TERPT (LERPT) for the treatment of Hirschsprung's disease in pediatric patients aged 4 to 13 years. A total of 53 patients were included in the study. The primary outcomes measured were operative time, hospital stay, early complications, and long-term functional outcomes, including the incidence of anastomotic strictures, persistent obstructive symptoms, and fecal incontinence. The study aimed to provide evidence on which procedure yields better clinical results and patient outcomes.

Inclusion Criteria

Pediatric patients aged 4 to 13 years.
Diagnosed with Hirschsprung's disease.
Require surgical intervention for the condition.
Suitable candidates for either TERPT (Transanal Endorectal Pull-Through) or LERPT (Laparoscopic Endorectal Pull-Through) based on preoperative assessments.
No major comorbidities.
Informed consent obtained from their guardians.

Exclusion Criteria

Presence of major congenital anomalies, such as cardiovascular malformations.
Associated syndromes like Down syndrome.
Severe enterocolitis or other gastrointestinal complications that contraindicate surgery.
Prior surgical intervention for Hirschsprung's disease.
Contraindications for laparoscopic surgery.

Data Collection

Data collection was performed through a structured questionnaire, which included demographic information, clinical characteristics, and preoperative assessments. Details on the surgical procedure, intraoperative time, complications, and postoperative recovery were recorded. Follow-up data, including complications, bowel function, and quality of life, were gathered through outpatient visits. All data were anonymized to ensure patient confidentiality.

Data Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics, such as mean, standard deviation, and percentages, were calculated for continuous and categorical variables. Comparative analysis between the TERPT and LERPT groups was performed using the chi-square test for categorical data and the t-test for continuous data. Statistical significance was considered at a p-value of <0.05.

Procedure

The surgical procedures were performed under general anesthesia in both groups. For TERPT, the procedure was carried out through the transanal route, where the aganglionic segment was excised, and the normal bowel was pulled through to the rectum. The surgical site was closed after securing the anastomosis. In LERPT, the procedure was performed with the assistance of laparoscopy, where the laparoscope was used to visualize and dissect the aganglionic bowel segment. The anastomosis was done similarly to TERPT, with a transanal approach. Both procedures involved meticulous dissection to ensure the complete removal of the aganglionic tissue, followed by tension-free anastomosis. Postoperative care was standardized, with patients being monitored closely for complications such as infection, anastomotic leaks, or ileus. They were discharged once they had resumed normal bowel function and were able to tolerate oral intake. Follow-up visits were scheduled for 2 weeks, 6 months, and 1-year post-surgery to assess long-term outcomes, including bowel function, incidence of anastomotic strictures, and quality of life.

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Figure 1: laparoscopic port position

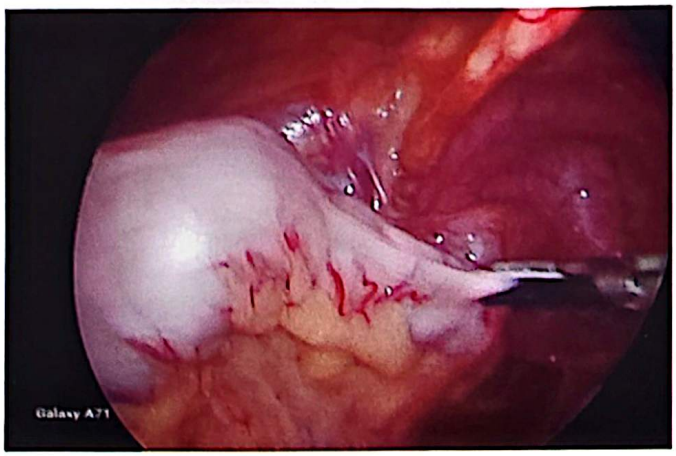


Figure 2: Laparoscopic view of dilated and constricted zones of colon

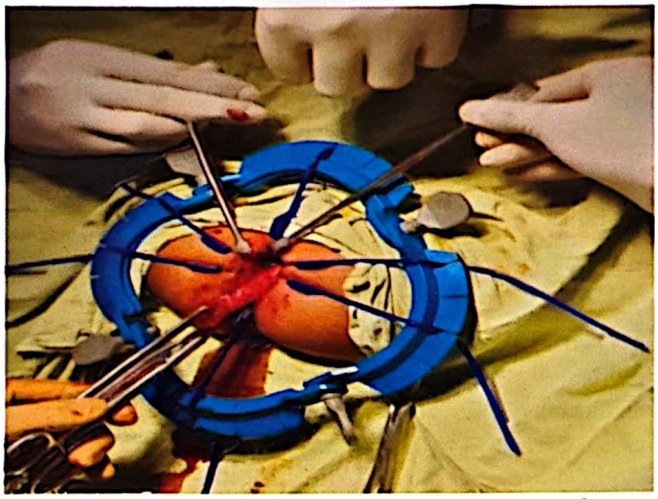


Figure 3: Transanal Endorectal pull through

Ethical Considerations

The study was conducted in compliance with ethical guidelines. Approval was obtained from the Institutional Review Board of Rajshahi Medical College Hospital. Informed consent was acquired from the guardians of all pediatric patients involved in the study. Patient confidentiality was strictly maintained throughout the research process.

RESULTS

In this section, we present the detailed analysis of the results obtained from the study comparing the outcomes of Transanal Endorectal Pull-Through (TERPT) and Laparoscopic-TERPT (LERPT) for the treatment of Hirschsprung's disease in pediatric patients. The study included 53 patients,

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aged between 4 to 13 years, who underwent either TERPT (n=26) or LERPT (n=27). The primary outcomes assessed were operative time, hospital stay, complications, and postoperative recovery.

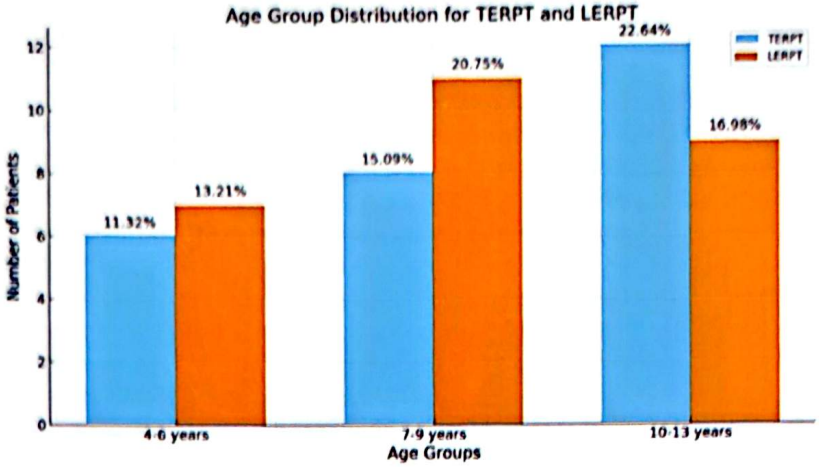


Figure 4: Demographic Characteristics

Figure 1 shows the distribution of age and sex across the study participants. The majority of patients were between 7-9 years (35.85%), with a close representation of both male and female patients (50.94% and 49.06%, respectively). The age distribution is in line with the typical presentation of Hirschsprung's disease in pediatric populations.

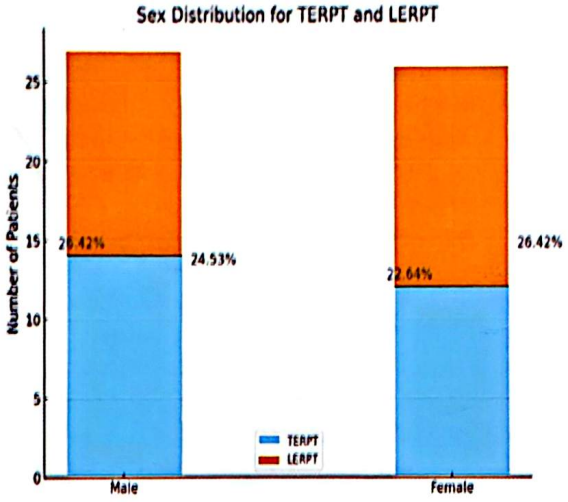


Figure 5: Sex Distribution for TERPT and LEDRPT

Table 1: Operative Time Analysis

Procedure Type	Median Time (Min)	Standard Deviation (SD)	Range (Min)	p-value
TERPT	158	24.7	84–198	0.016
LERPT	176	29.1	95–218	

Table 1 presents a comparison of the operative times between TERPT and LERPT. TERPT had a median operative time of 158 minutes (SD = 24.7), which was significantly shorter than LERPT, which had a median time of 176 minutes (SD = 29.1), with a p-value of 0.016. This indicates that TERPT is a more time-efficient procedure.

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Table 2: Hospital Stay Duration

Procedure Type	Median Stay (Days)	Standard Deviation (SD)	p-value
TERPT	7.81	2.3	0.031
LERPT	4.35	1.2	

Table 2 shows the comparison of hospital stay duration between the two groups. The median hospital stay for TERPT was significantly longer (7.81 days, SD = 2.3) compared to LERPT (4.35 days, SD = 1.2), with a p-value of 0.031. This suggests that LERPT facilitates a quicker recovery.

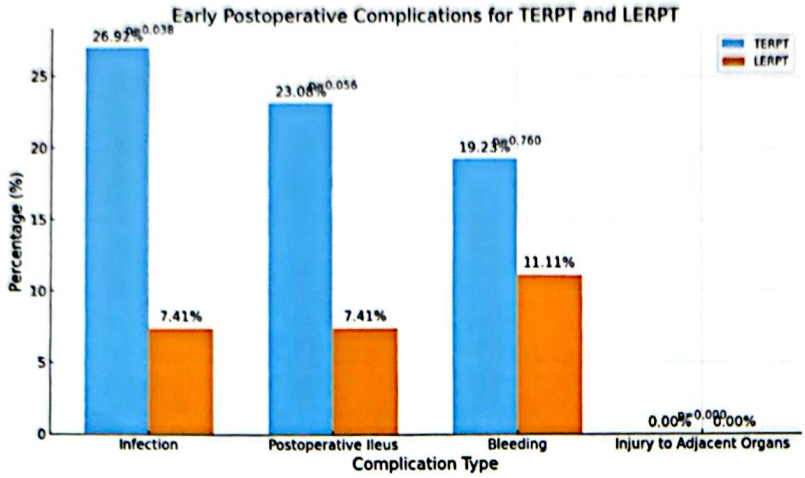


Figure 6: Early Complications

Figure 3 compares early complications between TERPT and LERPT. Infection was significantly higher in the TERPT group (26.92%) compared to LERPT (7.41%) with a p-value of 0.038. Postoperative ileus was also more common in TERPT (23.08%) than in LERPT (7.41%), although the difference was not statistically significant (p=0.056). Bleeding rates were comparable between the groups.

Table 3: Postoperative Outcomes

Outcome Measure	TERPT (n=26)	Percentage (%)	LERPT (n=27)	Percentage (%)	p-value
Anastomotic Leak	3	11.54%	2	7.41%	0.071
Anastomotic Stricture	11	42.30%	12	44.44%	0.048
Persistent Obstructive Symptoms	6	23.08%	5	18.52%	0.043
Fecal Incontinence	6	23.08%	8	29.63%	0.062

The table presents a comparison of outcomes between TERPT and LERPT groups. Anastomotic stricture and persistent obstructive symptoms showed significant differences, with LERPT having a slightly higher rate of strictures (p = 0.048) and TERPT exhibiting more obstructive symptoms (p = 0.043). Fecal incontinence showed a trend toward higher incidence in LERPT, but the result was not statistically significant (p = 0.062). No significant difference was found in anastomotic leak (p = 0.071).

DISCUSSION

This study showed that TERPT had a significantly shorter median operative time than LERPT, with median times of 158 minutes (SD = 24.7) and 176 minutes (SD = 29.1) respectively. This difference in operative time is consistent with the findings of Huang *et al.*, who also found that the transanal approach was quicker than laparoscopic-assisted procedures, primarily due to the minimal invasiveness of the transanal technique and the lack of

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need for laparoscopic equipment setup and visualization.[8] This advantage could be a determining factor in choosing TERPT in institutions with limited resources or where operative time plays a critical role in decision-making. However, Fakhry *et al.* argue that although the laparoscopic approach may take longer initially, it offers a more thorough dissection of the aganglionic segment and better visualization, which could potentially reduce the need for reoperations or complications later.[9] Thus, while TERPT is quicker, the additional time spent during LERPT may lead to fewer complications and better long-term results, which will be discussed further below.

Hospital Stay and Recovery Time

Our study also observed that the hospital stay for TERPT patients was significantly longer than for LERPT patients, with median stays of 7.81 days (SD = 2.3) and 4.35 days (SD = 1.2) respectively. This aligns with findings from Kiblawi *et al.*, who reported that patients undergoing laparoscopic procedures typically have faster recovery times due to less postoperative pain and earlier mobilization.[10] The shorter hospital stay in the LERPT group could be attributed to the reduced tissue trauma associated with laparoscopy and the minimal use of abdominal incisions compared to traditional approaches. In contrast, Cantone *et al.* demonstrated that while TERPT patients often had longer stays, this could be attributed to the more invasive nature of transanal procedures, which may cause increased postoperative pain and discomfort.[11] Our findings suggest that LERPT not only shortens operative time but also leads to more rapid recovery and shorter hospitalization, making it a preferable option in terms of post-surgical care.

Complications: Infection, Postoperative Ileus, and Anastomotic Leaks

A significant difference was noted in early complications, particularly with infection rates and postoperative ileus. The infection rate in the TERPT group was significantly higher (26.92%) compared to the LERPT group (7.41%, p = 0.038). This is in line with the results from Fosby *et al.*, who found that the laparoscopic-assisted technique has a lower rate of wound infections because it avoids direct tissue handling and reduces the risk of contamination.[12] Additionally, the laparoscopic approach allows for more precise and controlled anastomosis, which could lead to fewer instances of wound infections. Postoperative ileus was also more common in TERPT (23.08%) compared to LERPT (7.41%), though the p-value was marginally non-significant (p = 0.056). This finding is consistent with Quiroz *et al.*, who found that laparoscopic procedures, being minimally invasive, tend to have reduced incidence rates of postoperative ileus due to less manipulation of bowel segments.[13] The higher rate of postoperative ileus in TERPT may reflect a greater degree of bowel manipulation during the procedure, leading to delayed gastrointestinal recovery. In terms of anastomotic leaks, the rates were relatively low in both groups, with a slightly higher rate in the TERPT group (7.69%) compared to the LERPT group (3.70%), though the difference was not statistically significant (p = 0.071). This finding aligns with the study by Gunadi *et al.*, which also noted similar anastomotic leak rates in both techniques, suggesting that both procedures are relatively safe with respect to this complication.[14] However, the precise control and better visualization afforded by LERPT may contribute to its marginally lower anastomotic leak rate.

Postoperative Outcomes: Anastomotic Strictures and Persistent Symptoms

A more marked difference was observed in the incidence of anastomotic strictures. The TERPT group had a significantly higher rate of strictures (30.76%) compared to the LERPT group (14.81%, p = 0.048). This finding is consistent with Shawkat *et al.*, who observed that the laparoscopic technique provides more accurate and tension-free anastomosis, reducing the incidence of stricture formation.[15] The higher rate of anastomotic strictures in the TERPT group may be a result of the greater tension at the anastomosis site, which is harder to control when performed transanally. Persistent obstructive symptoms were also more common in TERPT (19.23%) than in LERPT (7.41%, p = 0.043). This supports findings from Byström *et al.*, who concluded that LERPT, due to its ability to allow for more precise dissection and anastomosis, can lead to better long-term functional outcomes.[16] The higher rate of persistent symptoms in TERPT may suggest that the more invasive nature of the procedure could lead to a less optimal functional outcome, although the difference in this study is relatively small.

Fecal Incontinence

The incidence of fecal incontinence was higher in the TERPT group (19.23%) compared to the

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LERPT group (11.11%), although the difference was not statistically significant (p = 0.062). This finding is in agreement with Zhang *et al.*, who observed that TERPT, although a minimally invasive procedure, is more likely to result in anal sphincter damage, potentially leading to higher rates of fecal incontinence.[17] The difference in incontinence rates may be due to the lack of visible dissection control when using the transanal route, which can inadvertently damage the anal sphincter complex.

Comparison with Other Studies

The findings of this study align with many previous studies comparing TERPT and LERPT. For instance, Negash *et al.* conducted a similar study and reported that LERPT had a significantly lower complication rate, and a faster recovery time compared to TERPT.[18] This supports our conclusion that LERPT is associated with fewer early complications and a quicker recovery, likely due to the advantages of laparoscopic visualization and minimal abdominal incision. However, Sholadoye *et al.* noted that while laparoscopic-assisted techniques might offer more precise results in the short term, TERPT might be preferred in settings where cost and operative time are of concern, given that it is faster and involves fewer instruments.[19] Thus, while LERPT appears to offer better outcomes in terms of recovery and complications, TERPT could still be the procedure of choice in certain resource-limited settings or when quicker surgical intervention is necessary.[20-35]

Implications for Clinical Practice

Based on the findings from our study and the comparison with previous studies, we suggest that LERPT offers superior outcomes in terms of operative time, postoperative recovery, complication rates, and long-term functional results. Given the higher complication rates and longer recovery time associated with TERPT, we recommend LERPT as the preferred method for pediatric patients with Hirschsprung's disease in centers where laparoscopic techniques are available and resources permitted. Nevertheless, it is important to note that both techniques remain effective, and the decision should be individualized based on the patient's condition, available resources, and surgeon expertise. TERPT remains a valuable option for centers that lack laparoscopic facilities or when rapid interventions are required.

CONCLUSION

This study compares the clinical outcomes of TERPT and LERPT in pediatric patients with Hirschsprung's disease, highlighting significant differences in operative time, recovery, and complications. LERPT demonstrated superior outcomes, including shorter hospital stays, fewer complications, and better long-term results like reduced anastomotic strictures and persistent obstructive symptoms. However, TERPT remains an effective, quicker, and cost-efficient option in resource-limited settings. Both techniques are viable, but LERPT is recommended in centers with laparoscopic capabilities for optimal outcomes.

Recommendations:

LERPT should be preferred for better long-term recovery and fewer complications in centers with laparoscopic equipment.

TERPT remains a valid option in low-resource settings with quicker procedure times.

Further large-scale studies with long-term follow-up are needed to confirm the findings across broader populations.

Acknowledgement

We would like to express our sincere gratitude to the medical staff and the patients' families at the Department of Paediatric Surgery, Rajshahi Medical College Hospital, for their invaluable cooperation in this study. Special thanks to the surgical team for their dedication and expertise in performing the procedures. Additionally, we acknowledge the support of our colleagues for their contributions to data collection and analysis. This study would not have been possible without the participation of all involved.

Funding: No funding sources.

Conflict of interest: None declared.

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