

OUTCOMES OF THE MINIMALLY INVASIVE TRANS-ANAL ENDORECTAL PULL-THROUGH (TEPT) IN THE MANAGEMENT OF HIRSCHSPRUNG'S DISEASE IN DUHOK PEDIATRIC SURGERY CENTER: A RETROSPECTIVE STUDY

MOHAMMED HAZIM ALDABBAGH, MBChB, FIBMS (Ped. Surgeon)*

AYAD ABBASS MOHAMMED, MBChB, FIBMS (Ped. Surgeon)**

AHMED HAMEED AHMED, MBChB, FIBMS (Ped. Surgeon)***

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ABSTRACT

Background: Trans-anal Endorectal Pull-Through (TEPT) is a standard minimally invasive surgery for Hirschsprung's disease (HD). This study evaluates the clinical results of Soave-type TEPT at our institution, at the perioperative and post-operative period, specifically detailing complication management and final success rates.

Patients and Methods: We retrospectively reviewed 39 consecutive patients with HD who underwent Soave-type TEPT at Duhok Pediatric Surgery Center (January 2016–September 2024). All patients were initially managed with a protective colostomy. Before undergoing the main TEPT. Mean follow-up was 4.25 years (range: 1–9 years). A favorable functional outcome was defined as being asymptomatic or having only mild/transient symptoms.

Results: The cohort included 32 males and 7 females (mean operative time: 50 minutes). Initially, 30/39 patients (77%) achieved favorable functional outcomes; 25 (64%) were asymptomatic and 5 had mild symptoms. Complications occurred in nine patients (23%), primarily persistent constipation (n=4, 10%) and residual aganglionic segments (n=5, 13%). Four patients with residual aganglionosis underwent successful redo surgery, while one remains on medical therapy. Including redo procedures, the ultimate success rate reached 87% (34/39).

Conclusion: TEPT is a safe and highly effective procedure for pediatric HD. While complications like residual aganglionosis occur they are manageable through redo surgery. Our data confirms TEPT's efficacy and demonstrates its suitability to manage complicated cases, achieving an 87% overall success rate.

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Keywords: Hirschsprung's Disease, Trans-anal Endorectal Pull-Through, TEPT, Soave Procedure, Functional Outcome, Complications, Pediatric Surgery.

Hirschsprung's disease (HD) is a common congenital neurodevelopmental disorder, affecting about 1 in 5,000 live births. It is defined by the absence of parasympathetic ganglion cells in the distal colon, which results in a functional blockage of the intestine. Confirmation of the diagnosis requires a full-thickness rectal biopsy to prove aganglionosis^[1,2].

Historically, the surgical treatment of HD involved large abdominal operations. Today, however, the introduction of minimally invasive techniques, notably the Trans-anal Endorectal Pull-Through (TEPT), particularly the Soave approach, has revolutionized management. TEPT allows surgeons to remove the aganglionic bowel segment and pull healthy colon down to the anus without needing a major abdominal incision. This procedure is

* Assis. Prof., Consultant Pediatric Surgeon, Medical Education Dept., College of Medicine, University of Duhok.

** Hivi Pediatric Surgery Center, Duhok

*** Hivi Pediatric Surgery Center, Duhok

generally associated with clear benefits over older open methods, including shorter operative times, less blood loss, faster recovery, and a lower risk of long-term problems like incisional hernias^[3].

While TEPT is now a widely accepted procedure globally, there remains variability in the reported long-term functional results, specifically concerning rates of persistent constipation, residual aganglionosis, and continence issues, across different surgical centers^[4,5]. This variability led us to question our own institutional performance. Furthermore, because we do not have access to rapid intraoperative frozen section histopathology, ensuring complete resection of the aganglionic segment presents a specific technical challenge, making the success rate of our salvage operations a vital metric^[6].

Therefore, this study was undertaken to review and quantify the perioperative safety and functional outcomes of the Soave-type TEPT at the Duhok Pediatric Surgery Center. We aim to clearly articulate our specific complication profile and report the final, overall success rate of HD management for all patients, including those who required re-operation.

PATIENTS AND METHODS

This was a retrospective review of 39 consecutive patients diagnosed with Hirschsprung's Disease who were treated with a Soave-type Trans-anal Endorectal Pull-Through (TEPT) procedure at Duhok Pediatric Surgery Center at Hivi Pediatric Teaching Hospital, between January 2016 and September 2024.

Data were systematically collected from patient medical records, covering demographics, initial symptoms, diagnostic imaging (figure 1 shows colon contrast study), surgical details, complications, and the patient's functional status noted at their last clinical appointment. All patients' data was already anonymized and collected from records where consent was already obtained

and kept in their hospital records. The median duration of follow-up for the cohort was 4.25 years, with a range of 1 to 9 years. All cases with complete follow up history were included in the study. Cases with single stage surgery were excluded from the study to obtain more consistent results. All 39 patients were first treated with a protective colostomy before undergoing their definitive pull-through. The cohort was predominantly male (32 males, 7 females). Operative times for the primary TEPT were recorded. The removed aganglionic segments ranged from 10 to 32 cm in length.



Figure 1: Colon contrast study

The TEPT was performed via trans-anal mobilization. The aganglionic section of the colon was brought out through the anus, allowing for precise dissection and identification of the presumed transition zone without the need for a formal laparotomy. Healthy, ganglionic bowel was then pulled down through the resected distal rectal cuff. Finally, a tension-free anastomosis was created between the pulled-through healthy bowel and the anal canal, just above the dentate line. (Figure 2 explains these steps of the surgical

procedure, a: applying retraction, b: dissection of the aganglionic segment reaching the cone area, c: segment resected,

d: after resection, completion of the colo-anal anastomosis)

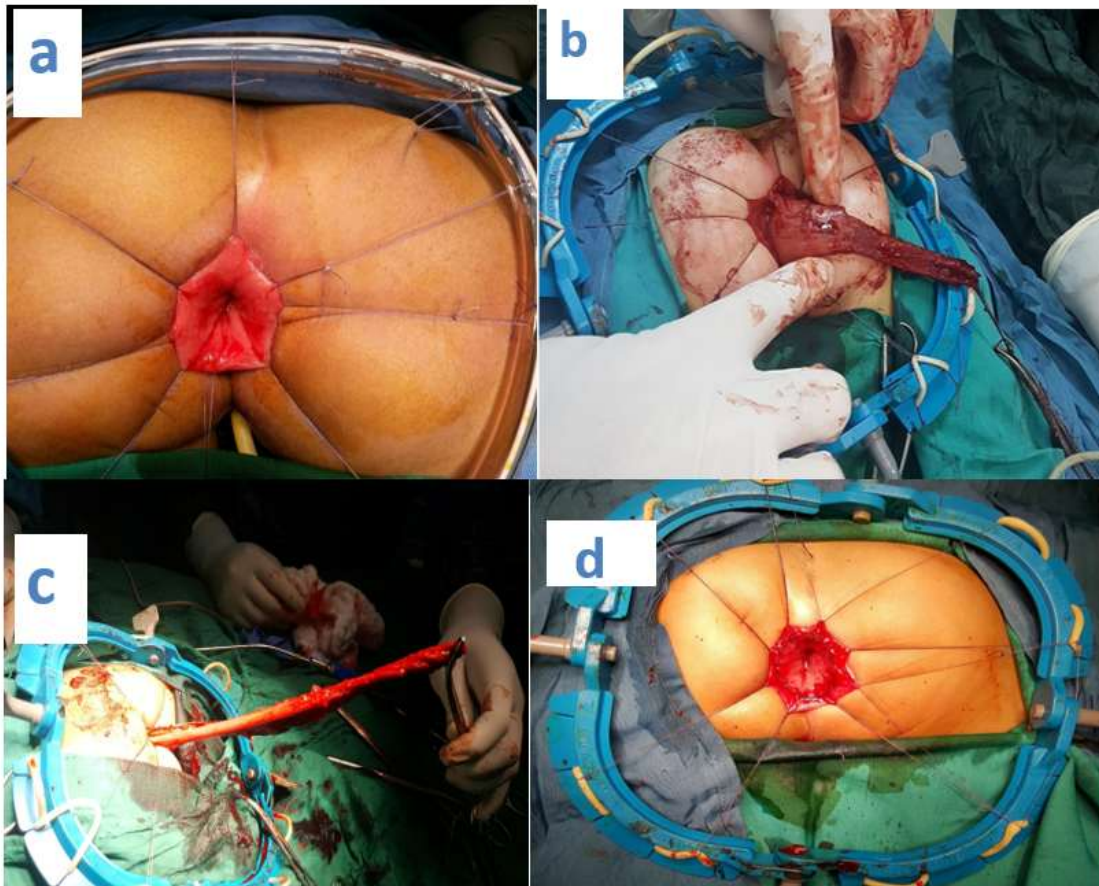


Figure 2: Surgical procedure, a: applying retraction; b: dissection of the aganglionic segment reaching the cone area; c: Example of segment resected; d: after resection, completion of the colo-anal anastomosis

Favorable functional outcome defined clinically as patients who achieved either full relief from symptoms with normal bowel movements or mild or temporary symptoms that either disappeared within one year or were managed successfully with minor interventions (e.g., temporary soiling, mild enterocolitis, or anastomotic stenosis manageable by routine dilation). Complication included persistent constipation needing continuous laxative therapy and/or recurrent enterocolitis, residual aganglionic segment leading to redo surgery, or anastomotic stenosis requiring frequent (>3) dilations. Overall Success Rate means the final number of

patients who achieved a favorable functional outcome after definitive surgical management (including successful primary TEPTs and successful redo surgeries) divided by the total cohort (N=39).

Descriptive statistics were used to report all variables. Continuous variables (e.g., operative time, segment length) are reported as Mean $\pm$ Standard Deviation (SD), while categorical variables are reported as frequencies and percentages. Confidence intervals (95% CI) were calculated using the Wilson Score method to account for the cohort size and ensure accurate interval estimation.

RESULTS

Our study showed a clear male predominance (32 males, 7 females). Regarding the presenting symptoms, (table1) the most frequent initial issue was a delay in passing meconium (82%),

followed closely by neonatal intestinal obstruction (56%) (Figure 3a). We also noted chronic constipation (44%) (Figure 3b) and a rare incidence of neonatal pneumoperitoneum (5%).

Table 1. Clinical characteristics and presenting symptoms of patients with Hirschsprung's Disease (N=39).

Clinical Feature	Number of Patients (n)	Frequency (%)
Delayed passage of meconium	32	82%
Neonatal intestinal obstruction	22	56%
Chronic constipation	17	44%
Neonatal pneumoperitoneum	2	5%

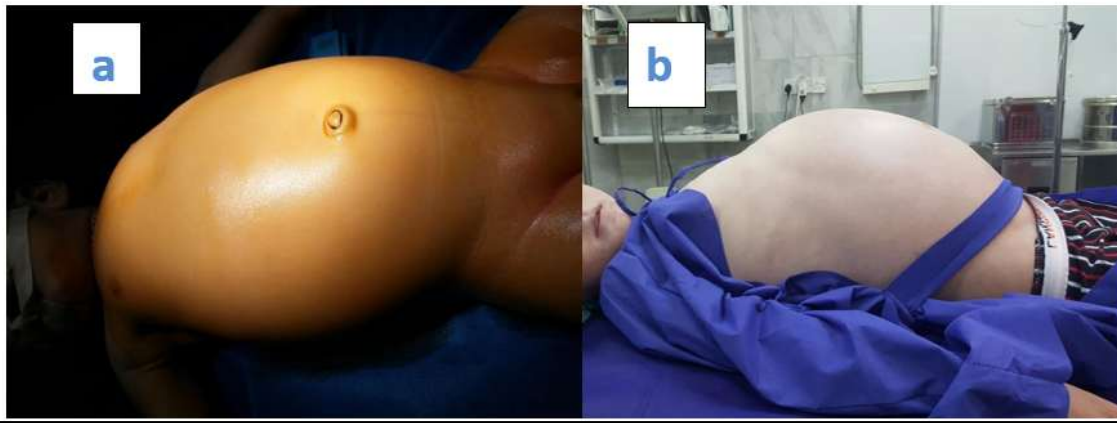


Figure 3: a. Neonatal intestinal obstruction; b. chronic constipation (loaded colon)

Regarding the surgeries, most of the patients (30/39) underwent a single TEPT surgery of the Soave type. However, some patients (5 patients) had residual aganglionic segment 4 of them required further surgical interventions: 2 patients underwent a second pull-through (TEPT), and 2 patients required a combined TEPT and open pull-through procedure. The average operative time for the initial TEPT was 50 minutes, with a range of 30 to 90 minutes. No patient required blood transfusion during the procedure.

At the median follow-up of 4.25 years, 30 patients (77%) were classified as having a favorable functional outcome (95% CI: 63.7%–90.1%). This included 25 patients (64%) who achieved completely asymptomatic status with normal bowel function., while 5 patients (13%) had mild or temporary symptoms (Table 2 clarifies details of the favorable outcomes). Nine patients (23%) experienced complications requiring either long-term medical management or re-operation (Table 3)

Table 2. Functional outcomes following TEPT at median follow-up of 4.25 years (N=39).

Outcome Category	Patients (n)	Percentage (%)
Favorable Outcome (Total)	30/39	77.0%
1. Asymptomatic (Normal bowel function)	25	64.1%
2. Mild or transient symptoms	5	12.8%
A. Temporary soiling (<1 year)	3	7.7%
B. Anastomotic stenosis (required dilation)	2	5.1%
C. Mild enterocolitis	1	2.6%

Table 3. Post-operative complications and secondary surgical management.

Outcome Category	Patients N (%)	Management Approach
Complications / Unfavorable Outcome	9 (23.1%)	
1. Residual Aganglionic Segment	5 (13%)	
A. Required Redo surgery	4 (10%)	2 Trans-abdominal; 2 Repeat TEPT
B. Managed conservatively	1 (3%)	Observation/Medical
2. Persistent chronic Constipation no residual segment	4 (10%)	Medical (Laxative therapy)

The identification of a residual aganglionic segment (5 patients) was the most significant complication. Four patients who underwent a redo operation (2 trans-abdominal and 2 repeat TEPTs) achieved a successful functional outcome and one is still on maintenance medical therapy. The overall success rate for definitive HD management in this cohort, inclusive of successful redo surgeries, was 87% (34/39 patients). (95% CI: 73.3%–94.4%).

DISCUSSION

This retrospective series confirms that the minimally invasive Trans-anal Endorectal Pull-Through (TEPT) is a safe and highly effective procedure for managing Hirschsprung's disease in our practice, reflected by the final high overall success rate of 87%. Other similar studies showed similar good results^[2,3]. The clinical presentation of Hirschsprung's Disease (HD) in our study demonstrated several notable similarities and contrasts when compared to the results of a large meta-analysis. Most significantly, delayed passage of meconium was the primary presenting symptom in our study, affecting 82% of patients. This is considerably higher than the 48% reported other the meta-analysis^[7]. This may be attributed to a higher proportion of neonatal-onset cases in our study, as our center is a referral center so other simpler cases with milder symptoms like chronic constipation may be treated medically by pediatricians. Our results regarding chronic constipation were close to other studies reporting a prevalence of 44%. This shows us that nearly half of the HD population presents with more insidious, chronic symptoms rather than

acute neonatal distress^[7]. Regarding acute presentations, our study found that 56% of patients suffered from neonatal intestinal obstruction. While the meta-analysis reported high rates of abdominal distention (83%) and vomiting (61%), which are the main clinical signs of the intestinal obstruction observed in our patients. we recorded a 5% incidence of neonatal pneumoperitoneum, a rare but critical problem, and other studies reported enterocolitis in more than 10 % of cases^[7]. Although many centers are managing their cases by single stage TEPT^[4] we included in our study cases that had a protective colostomy as a first stage and excluded those with single stage to obtain more reliable results. The colostomy stage was needed because either patients presented as emergency conditions like intestinal obstruction or their clinical conditions were unsuitable to start with pullthrough surgery like huge megacolon (figure 3b) or sometimes the facilities needed for pre- and post-operative care were not available at the center during their stay.

Our perioperative statistics, including a low mean operative time of 50 minutes and the fact that no transfusions were needed, align well with international reports talked about the benefits of the minimally invasive approach^[3]. These results lead to the low level of surgical stress associated with TEPT, facilitating faster patient recovery. Similar results were published in literature [4] while others reported much longer time longer like 150 minutes^[8]

A key finding from our study is the strong rate of favorable functional outcomes (77%) after a median follow-up of 4.25 years. With 64% of patients becoming

completely asymptomatic, our definition of a favorable outcome provides a reliable clinical endpoint. We achieved better continence outcomes than some published literature^[5,8,9], which we cautiously attribute to meticulous surgical technique or perhaps our medium-term follow-up length. We acknowledge the need for future work using validated functional scores to fully assess long-term continence. However, our results like others support the TEPT over conventional open methods^[10].

The 23% complication rate in our results like persistent constipation is a known challenge after HD some centers reported similar results others reported even higher^[8]. Enterocolitis was reported in 2.6 % of our cases however other studies reported higher incidence of recurrent attacks^[11]. Post-operative long-term incontinence, a problem that is reported in many series but we note a temporally incontinence as transient soiling lasted less than a year in our cases^[12]. More critically, identifying a residual aganglionic segment in 5 patients (13%) may be related to the setting of operating without intraoperative frozen section histopathology, a tool that is crucial for accurately defining the transition zone^[6]. The frozen section pathology study is unavailable in our center, so we rely on macroscopic visual judgment, then we send the excised segment to histopathology study, this carries an increased risk of failing to resect all aganglionic tissue. As we had 5 cases with this problem, we are seeking resources to implement or gain access to intraoperative frozen section aiming at improving the precision of the pull-through in the future. However, our method of using macroscopical diagnosis followed by postoperative histopathology study seems to be successful in 87% and it is used in other centers around the world when there is no access to the frozen section as published by many authors^[6].

Crucially, we successfully managed all 4 patients who required a redo operation with comparable results to the other patients in

our study and other studies managing such complex failures^[13]. This high salvage rate is what ultimately boosts our overall definitive management success rate to 87%. Limitations in this retrospective, single-center study, and the relatively small sample size may restrict the generalizability of our findings.

CONCLUSION

This study shows that the minimally invasive Trans-anal Endorectal Pull-Through (TEPT) is a highly reproducible, safe, and effective surgical procedure for pediatric Hirschsprung's disease in our institution. With high rate of successful functional outcomes in the majority of patients over a medium-term follow-up. Complications like residual aganglionosis pose ongoing technical challenges, but they can be managed effectively by redo of TEPT. We recommend longer period of observation and a bigger sample of patients in future studies.

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پوخته

دوره‌نجامه‌کانی نه‌شته‌رگری راکښانی کولون له ریځه‌ی کومه‌وه به کمترین ده‌ستپوه‌ردان TEPT
بۇ چاره‌سەرکردنی نه‌خوشی هیرشبرونگ له سه‌نته‌ری نه‌شته‌رگری مندلان له دهوک:
تویژینه‌وه‌یه‌کی گه‌رانه‌وه‌یی.

پیشه‌کی و نارمانج: نه‌شته‌رگری راکښانی ریخوله له ریځه‌ی کومه‌وه (TEPT) شپوازیکي سناندارد و پیشکوتووی که‌م‌برینه‌کاريه بۇ چاره‌سەرکردنی نه‌خوشی هیرشبرونگ (HD). هم توژینه‌وه‌یه هه‌لسه‌نگاندن بۇ نه‌جامه کلینیکیه‌کاني نه‌شته‌رگری TEPT له‌سەر شپوازی "سواقی" (Soave-type) له ناو‌نده‌که‌ماندا ده‌کات، له ماوه‌ی پیش و دواي نه‌شته‌رگری، به تاییه‌تی ورده‌کاريه‌کاني به‌ریو‌م‌بردنی ئالوزیه‌کان و ریژه‌ی سهرکوتنی کوتایی.

ریکتن فه‌کولینی: نیمه پیداجوونه‌وه‌یه‌کی گه‌رانهمیمان (Retrospective review) بۇ ۳۹ نه‌خوش کردوه که تووشبووی نه‌خوشی هیرشبرونگ بوون و نه‌شته‌رگری TEPT یان بۇ کراوه له سه‌نته‌ری نه‌شته‌رگری مندلان له دهوک (کانونی دوهمی ۲۰۱۶ تا ئه‌یلوولی ۲۰۲۴). هه‌موو نه‌خوشه‌کان له سه‌رتادا به فه‌غری کولون (Colostomy) پاریزگاریان لیکراوه. تیکرای ماوه‌ی به‌دواداچوون ۴.۲۵ سأل بووه (له نیوان ۱ بۇ ۹ سأل). نه‌جامی وه‌زیفی باش به‌وه پیناسه کراوه که نه‌خوشه‌که بی نیشانه بیت یان ته‌نها نیشانه‌ی سووک و کاتیی هه‌بیت.

نه‌جام: گروپه‌که پیکهاتبوو له ۳۲ نیر و ۷ مئ (تیکرای کاتی نه‌شته‌رگری: ۵۰ خوله‌ک). له سه‌رتادا، ۳۰ له کوی ۳۹ نه‌خوش (۷۷٪) نه‌جامی وه‌زیفی باشیان هه‌بوو؛ ۲۵ که‌سیان (۶۴٪) بی نیشانه بوون و ۵ که‌سیان نیشانه‌ی سووکیان هه‌بووه. ئالوزیه‌کان له نو نه‌خوشدا (۲۳٪) پرویاندا، به پله‌ی به‌که‌م فه‌بزی به‌رده‌وام (۴ نه‌خوش، ۱۰٪) و مانه‌وه‌ی پارچه ریخوله‌ی بی دهمار (۵ نه‌خوش، ۱۳٪). چوار له نه‌خوشانه‌ی پارچه‌ی بی دهماریان مابووه نه‌شته‌رگری دووباره‌ی سهرکوتوویان بۇ کرا، له کاتیکدا یه‌کیکیان له‌سەر چاره‌سهری پزیشکی ماوه‌ته‌وه. به هه‌ژمارکردنی نه‌شته‌رگری به‌دووبارمکان، ریژه‌ی سهرکوتنی کوتایی گه‌یشته ۸۷٪ (۳۹/۳۴).

دوره‌نه‌جام: نه‌شته‌رگری TEPT ریځه‌یه‌کی سه‌لامه‌ت و زور کاریگه‌ره بۇ نه‌خوشی هیرشبرونگ له مندلان. هه‌رچه‌نده ئالوزی و هک مانه‌وه‌ی پارچه‌ی بی دهمار رووده‌ده‌ن، به‌لام ده‌توانریت له ریځه‌ی نه‌شته‌رگری دووباره‌وه چاره‌سهر بکړین. داتا‌کامان کاریگه‌ری TEPT ده‌سه‌لمینن و گونجای هم ریځه‌یه نیشان ده‌ده‌ن بۇ به‌ریو‌م‌بردنی حاله‌ته ئالوزمکان، که ریژه‌ی سهرکوتنی گشتی ۸۷٪ ی به‌ده‌سته‌پناه‌وه.

الخلاصة

تقييم نتائج عملية سحب المستقيم عبر الشرج TEPT، وهي تقنية جراحية طفيفة التوغل تستخدم لعلاج داء هيرشبرونغ في مركز دهوك لجراحة الأطفال (مستشفى هيقي التعليمي للأطفال)

الخلفية والأهداف: تعد عملية سحب الأمعاء عبر الشرج (TEPT) جراحة نموذجية طفيفة التوغل لعلاج مرض هيرشبرونغ (HD). تقيم هذه الدراسة النتائج السريرية لعملية (TEPT) بطريقة "سوافي" في مؤسستنا، خلال الفترة المصاحبة للجراحة وبعدها، مع تفصيل علاج المضاعفات ومعدلات النجاح النهائية.

الطرق: قمنا بمراجعة استرجاعية لـ 39 مريضاً متتالياً مصاباً بمرض هيرشبرونغ خضعوا لعملية (TEPT) بطريقة "سوافي" في مركز دهوك لجراحة الأطفال (من يناير 2016 إلى سبتمبر 2024). تمت إدارة جميع المرضى في البداية عن طريق فغر القولون ثم إجراء العملية الرئيسية. بلغ متوسط فترة المتابعة 4.25 سنة (تتراوح بين 1-9 سنوات). تم تحديد النتيجة الوظيفية الجيدة على أنها غياب الأعراض أو وجود أعراض خفيفة/عابرة فقط.

النتائج: شملت المجموعة 32 ذكراً و 7 إناث (متوسط وقت العملية: 50 دقيقة). في البداية، حقق 30 من أصل 39 مريضاً (77%) نتائج وظيفية جيدة؛ حيث كان 25 مريضاً (64%) بلا أعراض، و 5 يعانون من أعراض خفيفة. حدثت مضاعفات لدى تسعة مرضى (23%)، تمثلت بشكل رئيسي في الإمساك المستمر (4 مرضى، 10%) ووجود أجزاء متبقية عديمة العقد العصبية (5 مرضى، 13%). خضع أربعة مرضى يعانون من بقاء أجزاء عديمة العقد لعملية جراحية ثانية ناجحة، بينما لا يزال مريض واحد يتلقى العلاج الطبي. وبإضافة العمليات التصحيحية، وصل معدل النجاح النهائي إلى 87% (39/34).

الاستنتاجات: تعتبر عملية سحب الأمعاء عبر الشرج (TEPT) إجراءً آمناً وفعالاً للغاية لعلاج مرض هيرشبرونغ لدى الأطفال. وعلى الرغم من حدوث مضاعفات مثل بقاء أجزاء عديمة العقد العصبية، إلا أنه يمكن السيطرة عليها من خلال الجراحة التصحيحية. تؤكد بياناتنا فعالية هذه التقنية وثبتت ملاءمتها لإدارة الحالات المعقدة، محققة معدل نجاح إجمالي بنسبة 87%.