

Research Article

Transanal Endorectal Pull-Through With or Without Laparoscopic Assistance

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Abstract

Hirschsprung's disease requires surgical treatment. Depending on the form of aganglionosis and severity of pathology, open or minimally invasive, transanal endorectal pull-through with or without laparoscopic assistance may be used.

The objective of the research was to study the efficiency of using transanal endorectal pull-through with and without laparoscopic assistance for treating Hirschsprung's disease in children. We compared outcomes between approaches.

Materials and Methods. Over the period 2011-2016, 145 children with Hirschsprung's disease were surgically treated using transanal endorectal pull-through (n=81) and laparoscopic-assisted transanal endorectal pull-through (n=64). A systematic literature review and meta-analysis were carried out.

Results. We noticed that transanal endorectal pull-through without laparoscopic assistance could be easily used in children under 4 years of age with aganglionosis including the sigmoid colon without significant colon dilatation considering a significant mesosigmoid mobility at such age. In other cases, we used laparoscopic-assisted transanal endorectal pull-through. The advantages of laparoscopic stage included the possibility for correct planning of surgical strategy, a thorough revision of the affected colon, determination of aganglionosis level, mobilization of the mesenterium, elimination of the adhesions and ligaments holding the colon, thereby avoiding tension in coloanal anastomosis, control and prevention of pull-through colon twisting which may cause an obstruction. In older patients, the proximal end of the rectum could be dissected laparoscopically. This allowed transanal endorectal pull-through to be performed quicker and safer. In the postoperative period, patients underwent rehabilitation with good functional results. Two children developed coloanal anastomotic dehiscence which was corrected by open stage treatment.

Conclusions. Age-related and anatomical features of the colon in the patients with Hirschsprung's disease allowed performing transanal endorectal pull-through with or without laparoscopic assistance. Significant dilation of the colon, aganglionosis above the sigmoid area and the patient's age over 4 years were indications for performing transanal endorectal pull-through with laparoscopic assistance. In other cases, transanal endorectal pull-through could be performed without laparoscopic assistance. The laparoscopic-assisted transanal endorectal pull-through procedure turned to be a safe and feasible technique for patients with Hirschsprung's disease.

Keywords

Hirschsprung's disease; treatment; laparoscopy; results; children.

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Problem statement and analysis of the latest research

Hirschsprung's disease (HD) belongs to a group of severe congenital abnormalities of the colon. The

incidence rate of this abnormality worldwide has increased by 15 times over recent years (from 1: 30000 to 1: 2000 living infants). This was significantly promoted by the intensification of early diag-

Table 1. Types of aganglionosis and patients' age.

Type of aganglionosis	Patients' age of (years)				Total
	<1	1-3	4-5	>6	
Rectal	13	45	30	17	105 (72.41%)
Rectosigmoid	14	19	3	1	37 (25.52%)
Subtotal	1	2	-	-	3 (2.07%)
Total	28 (19.31%)	66 (45.52%)	33 (22.76%)	18 (12.41%)	145 (100%)

nosis [2, 8]. There were developed many surgical techniques for HD treatment; the so-called "classical" methods proposed by O. Swenson (1948), B. Duhamel (1956), F. Rehbein (1959), F. Soave (1963), H. Lynn (1956) are among them [1, 9]. In addition, many of them were modified [10]. However, none of the methods produced desired good functional results [3, 10, 18, 19].

Minimally invasive technique is currently a modern method of correcting many surgical diseases and is applied in different fields of pediatric surgery.

Georgeson K.E. et al. conducted a multicenter study in 1999 and found that the technique of primary laparoscopic-assisted transanal endorectal pull-through (TEPT) in HD was the new gold standard [6, 7].

In 2008, he published his new research with some technical modifications [8]. Other authors joined the implementation and discussion of this technique emphasizing positive and problematic issues of this direction of HD surgical treatment [2, 4, 5, 8, 12].

The objective of the research was to study the efficiency of TEPT with and without laparoscopic assistance for treating Hirschsprung's disease in children.

1. Materials and Methods

From October 2011 to December 2016, 145 children with HD were treated using minimally invasive technique: 81 patients were operated on using TEPT method and 64 patients were operated on using primary laparoscopic-assisted TEPT (Table 1). Among them, there were 28 (19.31%) patients at the age up to 1 year, 66 (45.52%) patients at the age of 1 to 3 years, 33 (22.76%) patients at the age

of 4 to 5 years and 18 (12.41%) patients over 6 years of age. Rectal aganglionosis was diagnosed in 105 (72.41%) patients; rectosigmoid aganglionosis was observed in 37 (25.52%) patients; subtotal aganglionosis was detected in 3 (2.07%) patients (Table 1).

Diagnosis was made based on diagnostic tests (careful anamnesis, physical examination, blood and urine tests, electrocardiogram, abdominal ultrasound) and special methods of investigation (irrigography, irrigoscopy, contrast radiography of the digestive tract, sigmoidoscopy, colonoscopy, anorectal manometry, histological study, determination of acetylcholinesterase activity).

2. Results and Discussion

After diagnosis of HD was made, the patients were prepared for surgery. In infants, colonic lavage was carried out using cleansing enemas. In older patients, siphon enemas were applied.

We noticed that TEPT without laparoscopic assistance could be easily used in children under 4 years of age with aganglionosis including the sigmoid colon without significant colon dilatation considering a significant mesosigmoid mobility at such age. In other cases, laparoscopic assisted TEPT was applied [21].

Two teams worked simultaneously during laparoscopic-assisted TEPT in HD. The team of laparoscopic intervention stage included 1 surgeon and 1 assistant and the team of transanal rectal dissection and endorectal pull-through stage comprised 1 surgeon and 2 assistants.

In the operating room, children were put in the lithotomy position. Three ports 5.5 mm in diameter were used: the 1st one below the umbilicus for

30° optics, the 2nd and 3rd were working ports for the surgeon (the left upper and right lower quadrants).

An inspection was performed to determine the area of colon resection. After the revision of the distal intestine, the colon was mobilized starting from the peritoneal transitory fold to the necessary resection level by ligating and crossing the mesenteric vessels and separating it along the flanks.

After determination of the proximal resection line, we started mesenteric dissection using the Harmonic scalpel and bipolar diathermy coagulator to avoid bleeding from the mesenteric vessels. The mesentery was observed to be allocated closer to aganglionic area and transition segment. If aganglionic area was longer than the mid-point of sigmoid colon, the intestine, which was to be pulled through at the proximal end of the transition area, was mobilized in such a way that arterial vessels were preserved to maintain blood circulation being important in intestine pull-through in the pelvic area.

Usually, we additionally mobilized the colon with a view to providing resection of 10-20 cm of the colon above the transition area. This colon is usually not functional and may be the reason for defecation delay and chronic enterocolitis occurring after radical surgeries for HD.

The next stage involved transanal allocation of the rectum, namely its demucosation to peritoneal transitional fold forming the serous-muscular compartment similar to Soave operation.

Before this, the anus was extended by applying extending ligatures around the entire circumference of the anus. Perfect expansion of the anus was achieved by applying 6-8 retraction sutures around it from dentate line and perianal skin (3 cm) in the radial direction. These sutures were tied for anus evagination which simplified transanal dissection.

From 0.5 to 1 cm above the dentate line, the mucous membrane was dissected and stay sutures were placed around its circumference. Stay sutures were placed both before and after rectal mucosal dissection which promoted mucosal traction and facilitated endorectal dissection. Endorectal dissection was continued in the proximal direction until

the muscle layer of the rectum easily evaginated. Another sign that our dissection reached the level of the abdominal cavity was bleeding arrest in blunt separation of the mucosa from the muscle layer.

The posterior wall of the muscular compartment was further dissected 1-2 cm above endorectal dissection of the mucosa. If we did not reach the level of the transition folds, we continued allocation of the mucous membrane until we reached free access to the abdominal cavity. Then, the intestine was placed back for compartment revision. The compartment should be at least 5 cm in length, and the posterior wall must be dissected to the level of 1 cm above the line of the intended anastomosis formation. Dissection of the posterior wall is important for the neorectum to be free as non-dissected compartment narrows already formed rectum in most patients. Pull-through is not a problem when pouch dissection is conducted above the level of the intended anastomosis. Transanal dissection extends anal pouch (serous-muscular compartment) to such a width that would allow the formation of normal rectal reservoir. A reduction in the muscular layer of non-dissected compartment usually may reach such an extent that it prevents the formation of a rectal pouch in the neorectum which, in turn, can cause relapse.

The mobilized colon was pulled through via the muscular compartment to the level of the intended colon resection and colo-anal anastomosis was applied using interrupted absorbable sutures. The endotracheal tube was applied over the line of anastomosis with its fixation to the buttock skin.

Pneumoperitoneum was re-performed for visualization and revision of pull-through intestine. Attention was paid to correct placement of the intestine since the neorectum turn by 180 degrees, for example, can cause bowel obstruction. In addition, the mesenteric window of pull-through colon was carefully examined to prevent internal hernia, namely intestinal loop defects. If the window is observed, it should be sutured with interrupted stitches.

Then, pneumoperitoneum was eliminated, and the ports were removed. The sites of port application were sutured.

The duration of laparoscopic-assisted TEPT in

HD was 120-175 min; hospital stay lasted 7-14 days, the length of colon removed was 20-65 cm. Follow-up duration in the postoperative period constituted from 1 month to 3 years.

Coloanal anastomotic dehiscence was noted in two children due to early activity of the patient in the early postoperative period which was corrected by open stage treatment. It included ascending colon colostomy (stage 1), coloanal anastomosis repair (stage 2), colostomy closure with colon patency restoration (stage 3).

In the remote period, all children underwent rehabilitation treatment with good functional results [13, 15, 16].

When performing this surgery, TEPT is a fragment of the method of primary laparoscopic-assisted TEPT. The main advantages of TEPT method in the complex of laparoscopically assisted TEPT include low injury rate, low probability of abdominal organ trauma, minimized blood loss, reduced risk of developing adhesions in the abdominal cavity, reduction in the duration of surgical treatment and patient's being under anesthesia, more favorable postoperative period with simplified patient care, reduction in children's hospital stay.

We consider severe anus injury during rectum demucosation and further mobilization of pull-through intestine to be the main disadvantages of TEPT method which may be the main reason for anal sphincters failure [14, 15, 20]. This requires further thorough investigations with the search for, development and implementation of more sparing technical elements of this stage.

Generally, the advantages of laparoscopic-assisted TEPT involve the fact that it provides an opportunity for planning and surgical strategy of adequate HD correction in children [13, 16, 17]. Laparoscopic stage offers the opportunity for a thorough revision of the affected colon, specification of aganglionosis area level and avoiding incorrect assuming of normal intestine segment as long aganglionosis area.

Laparoscopic revision allows us to easily remove the mesenteric end without tension. Such intervention allows eliminating the additional ligaments holding the rectum, provides an opportunity

to avoid coloanal anastomosis tension, and to control the correct position of pull-through intestine to prevent its twisting which may cause an obstruction. In older patients, the proximal end of the rectum may be dissected laparoscopically making TEPT quicker and safer.

Generally, laparoscopic assistance creates better conditions for transanal dissection and makes the operation simpler and faster.

3. Conclusions

1. Age-related and anatomical features of the colon in the patients with HD allowed performing TEPT with or without laparoscopic assistance.
2. Significant dilation of the colon, aganglionosis above the sigmoid area and the patient's age over 4 years were indications for performing TEPT with laparoscopic assistance.
3. In other cases, TEPT could be performed without laparoscopic assistance.
4. The laparoscopic-assisted TEPT procedure turned to be a safe and feasible technique for patients with HD.

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