ORIGINAL ARTICLE

Laparoscopic Assisted Versus Complete Transanal Pull-Through in Management of Hirschsprung Disease: A Short-Term Comparative Study

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ABSTRACT

Background: It is unclear whether laparoscopic-assisted transanal pull-through (LATP) or complete transanal pull-through (CTP) is superior for the surgical management of Hirschsprung's disease. The aim of the present work was to compare outcomes between both approaches.

Methods: We prospectively collected the relevant data about patients with Hirschsprung's disease who underwent LATP or CTP at our center from July, 2017 to July, 2019. Patients were matched based on age, birth weight, and level of aganglionosis. The study included 22 patients with Hirschsprung disease divided randomly into two groups. Group I was operated by complete transanal pull-through (CTP) and group II was operated by laparoscopic assisted technique (LATP).

Results: From our data, there was no statistical difference in length of stay or incidence of postoperative complications. Our pooled analysis of comparative studies including our results showed that operative time was significantly longer for the LATP group. Moreover, blood loss was significantly lower in the laparoscopic assisted group.

Conclusion: Clinical outcomes are comparable between LATP and CTP regarding postoperative complications and hospital stay. However, CTP offers shorter operative time and laparoscopic assisted offers less blood loss.

Keywords: Hirschsprung's disease, pull-through, laparoscopic, transanal.

INTRODUCTION

Hirschsprung's disease (HD) is one of the common reasons of intestinal obstruction in pediatrics. It is occurring due to developmental absence of ganglionic cells in the bowel which start distally at the internal sphincter and extend to varying proximal distances [1].The incidence of HD is approximately 1:5000 live births[1]. The presentation of Hirschsprung's disease begins from birth by history of delayed passage of meconium after 24 hours of age, constipation, vomiting which may be bilious and failure to thrive. Most of cases are presented and diagnosed in the neonatal period, however, diagnosis can be made in infancy, childhood or even in adulthood. Radiological manifestations help in diagnosis of HD [2], a plain abdominal radiograph and contrast enema can suggest presence of HD. Diagnosis is then confirmed with a rectal biopsy. Absence of ganglion cells and the presence of hypertrophic nerve trunks in rectal biopsy confirm the diagnosis [3]. Several surgical procedures for management of

HD had been described over decades of life [4]. Due to the rapid progress in minimally invasive surgery, modified pull-through techniques using laparoscopy to benefit from advantages of decreasing postoperative pain and better cosmesis [5, 6].The aim of the present study was to compare between the outcome of laparoscopic-assisted and transanal endorectal pull-through for Hirschsprung's disease over the time of 6 months' period. The primary outcome being evaluated was successful pull-through of a ganglionic segment with normal bowel movements post-operative. Secondary outcomes included operative time, blood loss, conversion rate, hospital stay and complication rates.

METHODS

This study was carried out in Pediatric Surgery Department, Zagazig University, Zagazig, Egypt. The study included 22 patients with Hirschsprung's disease randomly divided into two equal groups (n=11) using a computer-generated randomization table assigning patients randomly

into either CTP group or LATP group. Group I (11 patients) was operated by complete transanal pull-through (CTP) and group II (11 patients) was operated by laparoscopic assisted technique (LATP). Patients included in the study had to meet the following criteria: (1) Hirschsprung's disease proved by rectal biopsy, (2) Primary pull-through technique as the planned surgical decision, (3) Short segment or recto-sigmoid Hirschsprung's disease in contrast enema. While infants managed with stoma prior to definitive surgery, abdominal or multi-staged procedure as a surgical plan, long segment Hirshsprung's disease patients and infants planned for Duhamel-type anastomosis were excluded from the study.

Written informed consent was obtained from all participants and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association

(Declaration of Helsinki) for studies involving humans. All patients were diagnosed with Hirschsprung's disease by history of delayed passage of meconium for more than 24 hours at birth, abdominal distention, and constipation, physical examination, contrast enema (Fig. 1) and rectal biopsy. Preoperatively, mechanical bowel preparation was done in all cases. Operation was done under general endotracheal anesthesia. In group I, the child was placed in a supine position, with the buttocks brought to the end of the operating table, and propped slightly up with a folded towel. The legs were carefully padded and placed on wooden skis extending off the end of the table. Placement of either a self-retaining retractor (Lone Star) or a series of sutures that retract the anal verge. An incision 0.5 cm above the dentate line was done with cautery in a circumferential fashion. Traction sutures were placed on the mucosa/sub mucosal tube, and dissection was carried proximally (Fig. 2), primarily with blunt technique. Once dissection was carried proximal to the peritoneal reflection, the muscular layer was entered, and the dissection became full thickness. An incision was made in the posterior wall of the muscular cuff. If a free intraperitoneal plane is then achieved, the muscular cuff was divided circumferentially, converting the sub mucosal dissection into a full-thickness dissection. Division of the muscular cuff posteriorly down to the internal sphincter in the posterior midline; this splitting prevents the muscular cuff from retracting and causing a relative obstruction. Anastomosis was done with interrupted, fine, absorbable sutures by Vicryl 3/0 or 4/0 are placed circumferentially between the pull-through colonic segment and the anus at the dentate line with watertight anastomosis.

In group II, infants were positioned transversely on the operating table and prepared in a sterile manner circumferentially from nipples to toes. Older children were positioned with stirrups in the dorsal lithotomy position at the foot of the table. Three 5mm trocars were used. The first was placed through the umbilicus, and the remaining two in the right abdomen (Fig. 3). The first step in the operation was to determine the level of the transition zone, dilated zonem and spastic zone. Multiple biopsies are taken for frozen section examination. The mesocolon was divided using hook electro cautery for infants or an ultrasonic scalpel for older children. The mesocolon was divided close to the aganglionic bowel (Fig. 4). Rectal dissection was continued as far as possible down the pelvis before starting the transanal part of the procedure. Transanal dissection was started as in transanal pull-through. Data were collected including anesthesia and operative time, length of resection, colonic torsion, intraoperative complications, length of hospital stay, redo surgery for complications, stenosis, use of laxatives, episodes of HAEC (Hirschsprung Associated Enterocolitis) and constipation. Further surgery due to relevant complications will be defined as every procedure necessary under general anesthesia related to the pull-through procedure<30 days. All data were extracted into an electronic data sheet in a standardized manner.

STATISTICAL ANALYSIS

The collected data were computerized and statistically analyzed using SPSS program (statistical package for social science) version 25.0. Qualitative data were represented as frequencies and relative percentages and analyzed using Chi-square test, while quantitative data were expressed as mean±SD (Standard deviation). Independent t-test was used for quantitative variables in normally distributed data. For all analyses, a P value of <0.05 was considered significant.

RESULTS

Regarding demographic variables (Table 1), there was male predominance in both groups (2.6:1, 1.75:1 respectively) but with no statistical significance. There was no statistical significance regarding age at operation, weight at operation or birth weight. Regarding complete transanal group, there was one patient with down syndrome, three patients with cardiac anomalies, two patients with hypospadias while in the laparoscopic assisted group there was one patient with cardiac anomalies. Regarding operative data (Table 2), there was significant difference in mean operative time in both groups (116.36+7.48vs 211.81+15.21 respectively) demonstrating the highly significant

effect of the operative technique on the surgery time. Intraoperative blood loss was significantly higher in complete transanal group (122.72+34.37) in comparison with laparoscopic assisted group (50.63+8.57). In transanal pull-through, two patients needed covering stoma due to hugely dilated pull-troughed colon and unsecured anastomosis. Two cases in CTP group needed conversion to abdominal laparotomy as the aganglionic segment was too long to complete with complete transanal pull-through.

Regarding post-operative outcome (Table 3), the first bowel movement was not significant different between both groups (1.2±0.3 and 1.5±0.7 respectively). The patients in both groups started oral clear fluids at average of 48 hours after surgery. The hospital stay period was nearly the same in both groups. Regarding post-operative complications, in CTP group there were 3 patients (27.27%) suffered from postoperative stenosis compared to 1 patient (9.09%) in laparoscopic assisted group which needed regular daily dilatation for 3 months but none of them needed redo surgical intervention. Two patients (18.18%) in CTP group suffered from anastomotic leak discovered at 3rd and 7th day respectively and were re-explored and stoma was done. Regarding postoperative ileus, 3 patients in CTP had postoperative ileus, abdominal distension and delayed bowel movement with two of them treated successfully conservative with nasogastric tube insertion, intravenous fluids, correction of electrolyte disturbance and only one patient need re-exploration and stoma formation. While in laparoscopic assisted group, the 4 patients were treated successfully conservative. No wound infection cases were reported. In CTP group, two patients had postoperative sepsis and needed ICU admission; one of them was due to anastomotic leak and patient was admitted for one day after re-exploration and the other due to severe postoperative chest infection and unfortunately died after one week. Three patients in CTP group needed re-exploration; two for anastomotic leak and one for ileus. All of them were explored within 1st week postoperative. In laparoscopic assisted group, one patient needed re-exploration two weeks after surgery for obstruction which didn't respond to conservative management and was re-explored and adhesive bands were found and adhesiolysis was done. The follow up duration in both groups was 6.50+1.11 and 6.54+0.96 in CTP and laparoscopic assisted respectively (Table 4). In CTP group, 3 patients (27.27%) while only 2 (18.18%) in laparoscopic assisted presented with postoperative constipation which needed laxative administration with the regular follow up dilatation. Three patients (27.27%) in CTP group suffered from attacks of enterocolitis in the follow up period; one of them had two attacks with 2 months' interval while in laparoscopic assisted group two patients (18.18%) suffered from attack of enterocolitis in the follow up period. All cases were admitted and treated with rectal wash, intravenous antibiotic and fluids. All cases were discharged after improvement. In our study, one mortality case was recorded from sepsis and chest infection.

Table 1: Demographic data of patients in both groups:

Variable	Group I (Transanal) (n=11)	Group II (Lap-assisted) (n=11)	Test	P-Value
Age *(months)*				0.22
Mean+SD	5.36+0.92	5.81+0.75	T-Test	
Range	(4-7)	(5-7)		
Sex			χ^2	0.09
Male	8 (72.72%)	7 (63.63%)		
Female	3 (27.27%)	4 (36.36%)		
Male:Female	2.6:1	1.75:1		
Weight *(Kg)*				0.75
Mean+SD	5.63+0.67	6.72+0.64	T-Test	
Range	(5-7)	(6-8)		
Associated Anomalies			χ^2	
Down Syndrome	1 (9.09%)	0 (0%)		0.31
Cardiac Anomalies	3 (27.27%)	1 (9.09%)		0.27
Other Anomalies	2 (18.18%)	0 (0%)		0.14
Birth Weight *(Kg)*				0.45
Mean+SD	3.30+0.28	3.20+0.33	T-Test	
Range	(2.8-3.7)	(2.7-3.6)		
Kg: Kilogram; χ^2: Chi-Square test				

Table 2: Operative data in both groups:

Variable	Group I (Transanal) (n=11)	Group II (Lap-assisted) (n=11)	Test	P-Value
Operative Time (*min*) **Mean±SD** **Range**	116.36±7.48 (95-158)	211.81±15.21 (190-240)	T-Test	**<0.01****
Blood Loss (*ml*) **Mean±SD** **Range**	122.72±34.37 (100-200)	50.63±8.57 (40-65)	T-Test	**<0.01****
Covering Stoma	2 (18.18%)	0 (0%)	χ^2	0.14
Conversion to laparotomy	2 (18.18%)	--------	χ^2	0.65
min: minute, ml: millilitre, χ^2: Chi-Square test; **: Highly significant				

Table 3: Postoperative findings in both groups:

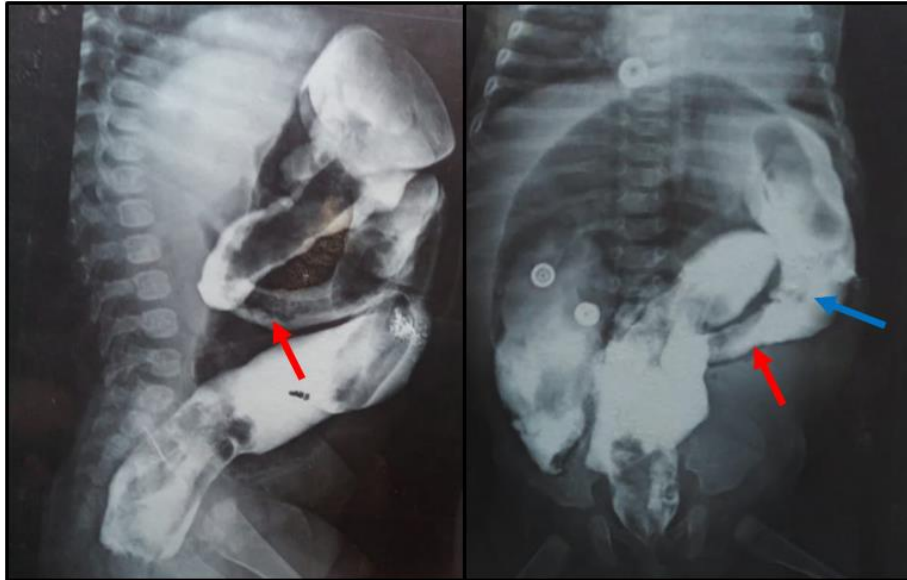| Variable	Group I (Transanal) (n=11)	Group II (Lap-assisted) (n=11)	Test	P-Value
First bowel movement (*Days*) **Mean±SD** **Range**	1.48±0.48 (1-2.4)	1.71±0.49 (1-3)	T-Test	0.27
Hospital Stay (*Days*) **Mean±SD** **Range**	5.1±0.83 (4-6)	4.54±1.03 (3-6)	T-Test	0.17
Complications			χ^2	
Colonic Torsion	0 (0%)	0 (0%)		---
Stenosis	3 (27.27%)	1 (9.09%)		0.27
Leakage	2 (18.18%)	0 (9.09%)		0.14
Ileus	3 (27.27%)	4 (36.36%)		0.65
Wound infection	0 (0%)	0 (0%)		---
Sepsis	2 (18.18%)	0 (0%)		0.14
Re-Exploration	3 (27.27%)	1 (9.09%)		0.27
χ^2: Chi-Square test				

Table 4: Follow-up results after discharge in both groups:

| Variable	Group I (Transanal) (n=11)	Group II (Lap-assisted) (n=11)	Test	P-Value
Laxative Use	3 (27.27%)	2 (18.18%)	χ^2	0.61
Enterocolitis **Number of patients** **Mean±SD of attacks**	3 (27.27%) 1.33±0.51	2 (18.18%) 1.14±0.37	χ^2 T-Test	0.61 0.32
Follow-up duration (*months*) **Mean±SD** **Range**	6.50±1.11 (5-8)	6.54±0.96 (5-8)	T-Test	0.92
Mortality	1 (9.09%)	0 (0%)	χ^2	0.31
χ^2: Chi-Square test				

Fig. 1: Contrast enema showing spastic (red arrow), transitional (blue arrow) zone in antero-posterior and lateral view.
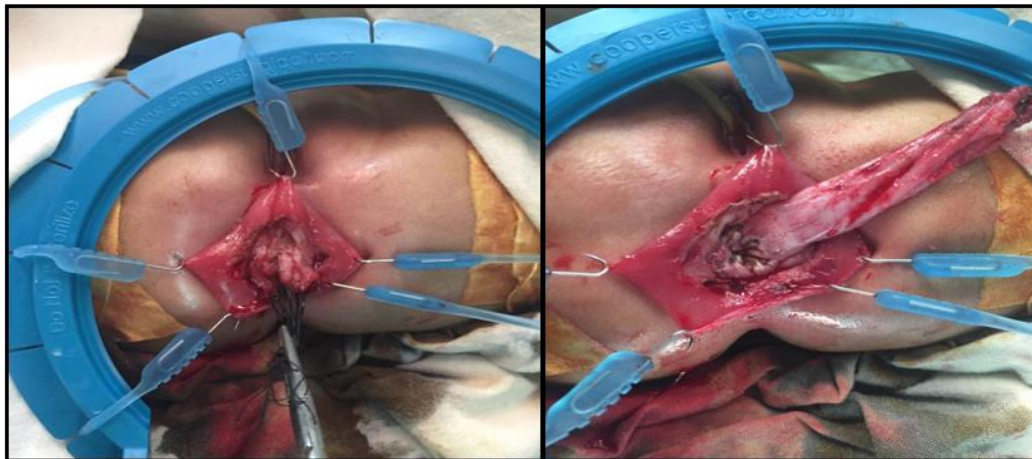
Fig. 2: Traction sutures are inserted and dissection is done.
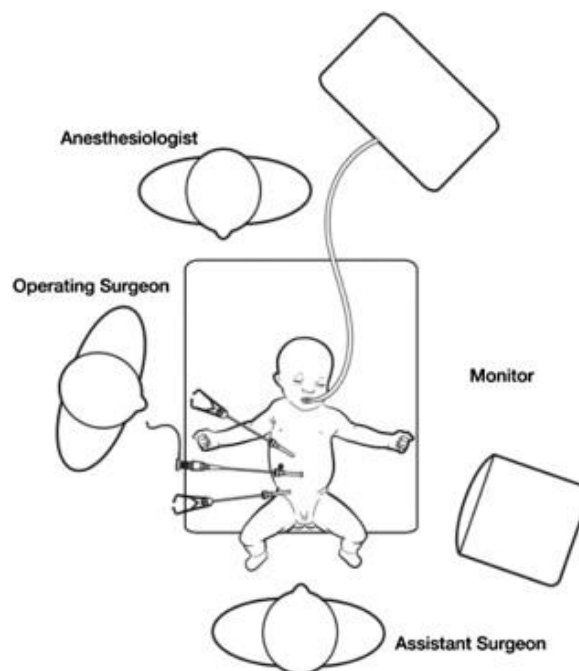
Fig. 3: Operating room setup and trocar positions.

Fig. 4: Dissection around the rectum with total division of the mesorectum.

DISCUSSION

HD occurs four times more common than females, [7] in our study exclusion criteria leading to different ratio. The other possible reason could be small number of included patients. Othercriteria as age, weight and extent of diseases are comparable in both groups which correlate with other reported series [9].We conducted a prospective chart review on matched patients who were undergoing CTP and LATP at Zagazig Pediatric Surgery Department. In present study the time for CTP is shorter than LATP which correlate with other studies. The difference in surgery duration between the procedures due to time taken in LATP for port insertion, position modification and port site closure [10]. Moreover, the still developing learning curve in laparoscopic skills require more time to perform the procedure and deal with occasional technical issues of laparoscopic devices and instruments. Also, more time was needed for preparation of frozen section and examination. In CTP there is no abdominal incisions and no scarring therefor less postoperative pain. Also, CTP doesn't need specialized instruments that reduce the cost of surgery and make it easy to be performed in any pediatric surgery center [11].

In the present study, Blood loss was less in LATP. This may be due to complete dissection of the mesentery of the colon laparoscopically decreasing blood loss during transanal dissection. In two cases in our study who were treated with CTP, abdominal exploration was needed as the aganglionic segment was too long to be completed transanal which add a benefit of using laparoscope during dissection and this correlate with other series [12].Theoretically, the risk of colonic torsion may

be risk in CTP, although in our study none of cases suffered from colonic torsion. In addition, due to poor visibility of the transition zone this may lead to more extensive resection of bowel in CTP [13]. Mean length of hospital stay and time to first oral feeding postoperative were not significantly different between LATP and CTP [13]. The two groups have the similar rates of major complications, including postoperative obstructive symptoms, stricture, leak, enterocolitis, fecal incontinence [14].According to our results which correlate with results in many other series comparing between two procedures, CTP is considered a safe choice for the surgical management of short segment HD. This is because CTP avoids complications related to trans-abdominal surgery (adhesive bowel obstruction, wound complications and pelvic nerve injury) [14].

LIMITATIONS OF THE STUDY

Only recto-sigmoid type was included in the study so long segment type comparative results can't be obtained. Lack of long-term follow-up results was another limitation, so the occurrence of long-term complication (e.g., fecal incontinence, retarded growth, recurrent episodes of enterocolitis) remained unknown.

CONCLUSIONS

CTP is a safe option for the surgical resection of aganglionic colonic short segment Hirschsprung but laparoscopic assisted pull-through facilitate dissection with less bleeding and provide good visualization of aganglionic colon which improve quality of pull-through.

RECOMMENDATIONS

Laparoscopy provides good visualization of transitional zone and should be used as possible

moreover, further studies on large sample and long follow up period.

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