Comparison between pure transanal soave and laparoscopic assisted techniques in treatment of children with Hirschsprung disease

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Background
Several operative techniques have been developed for the treatment of Hirschsprung's disease in the past decades. One-stage trans-anal pull-through was first performed in 1998.
Objectives
To evaluate early postoperative complications after laparoscopic assisted and pure trans-anal Soave for recto-sigmoid Hirschsprung's disease.
Patients and methods
This prospective study was performed on 20 pediatric patients with Hirschsprung's disease from January 2021 to January 2023 at Ainshams university hospitals. The patients were divided into two equal groups: group (A) underwent pure transanal trans-anal Soave, and group (B) underwent laparoscopic assisted trans-anal soave. Demographic, clinical data, preoperative investigations, operative records, postoperative outcome were studied.
Results
After one year of follow up staining/soiling in group A was present in 2(occasional staining); while group B, staining/soiling was present in 2(occasional staining). There was no statistically significant difference between the two group's early post-operative follow up as regard, anastomotic leakage, anastomotic stricture and intestinal obstruction, enterocolitis, buttock excoriation and morbidity leading to colostomy. However, there was a statistically significant difference regarding duration of the whole operation being longer in the lap group (160–210 min) compared to (95–140 min) in the pure trans anal group. While on the other hand, there was no significant statistical difference regarding the anal stretch timing in both groups as 122.5 min in pure trans-anal group while it was 100 min in laparoscopic assisted trans-anal group.
Conclusion
Laparoscopically assisted trans-anal soave was less invasive but has the same clinical outcome compared with trans-anal Soave as regard stooling function and postoperative follow up.

Keywords:
hirschsprung comparison, laparoscopic assisted results, pure transanal soave results

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Introduction

Hirschsprung disease (HD) is a congenital disorder defined by the absence of ganglion cells at the Meissner's plexus of the submucosa and Auerbach's plexus of the muscularis in the terminal rectum that extends in a variable distance proximally. Its prevalence varies from 1 to 1.63 per 5000 births [1].

HD diagnosis nearly always necessitates surgical intervention. A variety of pull-through surgeries have been identified. The traditional Swenson's technique involves proctectomy, pulling the healthy ganglionated colon through, and anastomosing it to the anus. Novel surgical procedures (e.g., Duhamel's, and Soave's procedures) have the advantage of preserving the intricate innervation to the rectum and bladder [2]. Abdominal assisted surgeries has a huge burden on the patient starting form an abdominal wound which leaves a long scar and causes severe pain postoperatively not only but also it is associated with prolonged hospital stay for proper analgesics administration and wound dressings

Recent trends in surgery for Hirschsprung's disease have been toward earlier repair and fewer surgical

stages [3]. The transanal Soave pull through is essentially the same operation that has been performed open for decades, but it avoids the need for a laparotomy and intraabdominal mobilization of the rectum. For this reason it theoretically should not be associated with a higher complication or failure rate. Because the anal dissection is above the anoderm, and therefore no somatic pain fibers are cut, the operation should not be accompanied by pain. The lack of intraabdominal dissection should result in a shorter time to feeds and to discharge and possibly a lower incidence of intraabdominal adhesion formation, and the lack of large abdominal incisions should produce a superior cosmetic result [4]. Recent advances in minimal-access surgery have led to the successful application of laparoscopic-assisted techniques for the surgical management, a laparoscopic-assisted approach diminishes surgical trauma to the peritoneal cavity and anal canal due to less time of anal stretching [2].

This Prospective study compares between pure transanal Soave and laparoscopic assisted Soave as regarding the intraoperative time, postoperative hospital stay and complications as leakage, stricture, and enterocolitis

Patients and methods

This prospective randomized controlled study comparing pure trans-anal with lap assisted trans-anal approach for the management of HD was conducted at the Pediatric Surgery unit, Ain Shams University hospitals over a two year duration starting from January 2021 to January 2023. It includes patients between 3 months and 3 years old with Hirschsprung's Disease with recto-sigmoid level while patients with previous operation for Hirschsprung's disease or underwent leveling colostomy were excluded. Informed consent was taken from the parents, Ethical committee approval was taken with number No.IRB00006379.The Patients are divided into 2 groups (randomization has been achieved using sealed envelope): Group 1: with pure trans-anal Soave technique while Group 2: with laparoscopic assisted trans-anal Soave technique.

All patients demographic data and clinical history has been studied, full physical examination including general examination, abdominal examination as inspecting and palpating the abdomen and the colon, per rectal examination should be done,. Evaluation of the investigations done in the form of: Abdominal X-rays, GG enema (the enema should be done without colon preparation, without balloon inflation, with good lateral view to notice the recto-sigmoid ratio and to observe the level of discrepancy and with post evacuation film). Patients were admitted at our Ain Shams University department two days prior to the surgery and were kept NPO under the coverage of IV broad spectrum antibiotics, preoperative labs were withdrawn, including CBC, coagulation profile, LFTS and KFTs. Rectal washes were done with saline solution calculated according to the patient's weight (20cc/Kg) every 6 h .Intraoperatively nasogastric ryle, urinary catheter were inserted.

Surgical techniques

Pure Transanal Soave following general anaesthesia, the kid was put into lithotomy position with the knees and hips remained bent to provide access to the patient's perineum. The youngster was then positioned at the end of the operating table with the feet secured to a cross bar at the end of the table (using gauze and plaster). Caudal blocks could be administered. The placement of an anal retractor (Lone Star Medical Products).

Following circumferential cautery incision of the rectal mucosa at a distance of 20–30 mm from the dentate line (depending on the patient's age), the submucosal plane was created. The proximal cut edge of the mucosal cuff was tacked with several small stitches to provide traction. Proximal endorectal dissection was next carried out. There is no change in the submucosal plane. After the submucosal dissection had advanced proximally to a position above the peritoneal reflection, the rectal muscle was severed circumferentially and the whole thickness of the rectum and sigmoid was propelled out into the anus. This required the division of the rectal and sigmoid vessels, which may be done under direct vision using cautery or ligatures. When the transition zone was reached, full-thickness biopsy sections were obtained, and frozen sections verified the presence of ganglion cells.

The resection of the aganglionic segment was extended approximately 5–10 cm proximal to the identified transition zone. This modest extension of the dissection allowed for removal of dysfunctional bowel, which was often present proximal to the transition zone and not readily identified by rapid frozen section biopsy. The rectal muscular cuff was split longitudinally either anteriorly or posteriorly. The rectal cuff was grasped with Allis clamps on either side of the intended point of transection anteriorly or posteriorly. Traction was applied to the Allis clamps and the cuff was split. The Allis clamps were reapplied

distally and more of the cuff was divided. This process was repeated until the rectal cuff was split anteriorly or posteriorly down to a point 5 mm above the dentate line. The intussuscepted cuff was trimmed and then returned to the pelvis. The colon was then divided, and a standard Soave-Boley anastomosis was performed. The anastomosis was performed using absorbable braided suture (4-0 Vicryl). This anastomosis should be water tight to avoid leakage and cuff abscess formation. Care has to be taken to minimize tension on the pull-through segment after anastomosis.

Laparoscopic assisted transanal soave

At the end of the surgical table, infants were positioned supine. During the transanal dissection, the legs were supported by a cross bar at the end of the table, with the knees and hips remained bent. However, as the laparoscopic procedure progressed, the cross bar was raised to the level of the operating table. The surgeon operated laparoscopically while positioned on the infant's right side. The body was prepared and wrapped circumferentially from the level of the nipples to the knees. Through the umbilicus, the pneumoperitoneum was acquired using an open method. For the most part, all age groups were able to sustain pressures of 10–12 mm of water. These individuals' development of hypercapnia was avoided by mild hyperventilation. The scope was a 5-mm 0° or 30° model. Three ports are required, one each at the right and left hypochondria. The fourth port, which was placed next to the second port at the left hypochondrium, may be required for the correct handling of the colon. The zone of transition will be located. Laparoscopic Metzenbaum scissors were used to take a seromuscular sample for histologic levelling. Once more, the detected transition zone was located 5–10 cm proximal to the excision of the aganglionic segment. After determining the proximal resection level, a window was created via the rectosigmoid mesocolon next to the colon. In order to avoid the late scarring of the muscular cuff left following the mucosal sleeve resection of the rectum, the main distal branches of the inferior mesenteric artery and vein were retained wherever possible. The peritoneal reflection in the pelvis was reached via the distal extension of the mesenteric window in the sigmoid mesocolon. To make the transanal dissection simpler in these individuals, this dissection was prolonged much below the peritoneal reflection in older children. After the colon has been dissected laparoscopically, the procedure is continued using just the trans-anal approach. The pedicle was laparoscopically evaluated for the possibility of internal herniation or twisting after the pneumoperitoneum was reinserted. Internally, the rectal cuff was examined and straightened if necessary. Absorbable sutures were used to close any possible internal hernias. The ports were taken out and the pneumoperitoneum was expelled. The neorectoanal angle was sometimes preserved by inserting the laparoscope right before the anastomosis to make sure there was no intraabdominal haemorrhage, twisting of the pull-through intestine, or stress on the pulled colon. With the use of skin strips and fascial sutures, the port sites were sealed.

Intra-operative anal retraction time was recorded in two groups in addition to, the whole operative time. Sending the excised colon for pathological analysis.

For 12–24 h, patients were maintained on intravenous (IV) fluids and nasogastric decompression. Antibiotics IV were administered for 48 h, and longer if required. On day 2, the urinary catheter was withdrawn, and oral feeding was started after the bowel noises had returned. When the patient could tolerate a complete oral diet, the post-operative hospital stay was documented, and the patient was released.

Follow up after one week, to check the sites of the ports and after three weeks to perform per-anal digital examination to check for any signs of stricture.

Postoperative follow up looking for signs of early postoperative complications as anastomotic leakage was done by daily checking of vital data, abdominal examination and tolerance of oral feeding was noticed and aid with abdominal xrays or pelvi-abdominal Ultrasound was used in required cases. Stricture formation, which was evaluated through digital rectal examination after 3 weeks feeling the anastomotic line, the distance between the anal verge and the site of the anastomosis, the anal tone and the need for regular Hegar's dilatation. After surgery. Parents were taught to perform home dilatation with Hegar dilators in cases of stricture. Signs of enterocolitis were recorded using the Hirschsprung associated enterocolitis score (Table 1).

While postoperative follow up for late complications as rolled cuff which was checked through per rectal examination and GG enema lateral view should be done in cases of suspicion.

Results

This study had a total of 20 patients, 16 of whom were males and 4 of whom were females. a median age of 19

months and 6.22 months. All of the 10 LAP aided trans-anal group patients and 6 of the 10 patients in the pure trans-anal group were male. The mean age at surgery was 20.66 months for the trans-anal group and 18.62 months for the LAP Assisted trans-anal group.

There was no statistically significant difference between the two groups as regard demographic data, (age, sex, weight at the time of the operation, contrast study), this denotes that both groups are actually comparable.

In Group A two cases developed enterocolitis and were managed conservatively. Three cases developed anastomotic stricture and were managed by regular Hegar's dilatation. Anastomotic leakage occurred in one patient and was managed by transverse defunctioning colostomy. Pathological processing of the resected colon revealed adequate proximal margin in all patients.

Table 1 Hirschsprung associated enetrocolitis score

HAEC score	Score
Diarrhea with explosive stool	2
Diarrhea foul-smelling stool	2
Diarrhea with bloody stool	1
History of enterocolitis	1
Physical examination	
Explosive discharge of gas and stool on rectal examination	2
Distended abdomen	2
Decreased peripheral perfusion	1
Lethargy	1
Fever	1
Radiologic examination	
Multiple air fluid levels	1
Dilated loops of bowl	1
Sawtooth appearance with irregular mucosa lining	1
Cut-off sign in rectosigmoid with absence of distal air	1
Pneumatosis	1
Laboratory	
Leukocytosis	1
Shift to left	1
Total	20

In Group B one case developed enterocolitis and was managed conservatively .one case developed anastomotic stricture and was managed by regular Hegar's dilatation. Anastomotic leakage occurred in one patient and was managed by transverse defunctioning colostomy. Pathological processing of the resected colon revealed adequate proximal margin in all patients.

There was no statistically significant difference between the two group's early post-operative follow up as regard, anastomotic leakage, anastomotic stricture and intestinal obstruction, enterocolitis, buttock excoriation and morbidity leading to colostomy. However, there was a statistically significant difference regarding duration of the whole operation being longer in the lap group (160–210 min) compared to (95–140 min) in the pure trans anal group. While on the other hand, there was no significant statistical difference regarding the anal stretch timing in both groups as 122.5 min in pure trans-anal group while it was 100 min in laparoscopic assisted trans-anal group.

After one year of follow up, staining/soiling in group A was present in 2 (occasional staining); while group B, staining/soiling was present in 2(occasional staining).

Table 2 shows no statistically significant difference between the two groups regarding weight and age at operation, duration of anal stretching, nor total hospital stay with p value (>0.05). However, there was a statistically significant difference regarding duration of the whole operation being longer in the lap group, with p value (<0.05).

Table 3 shows no statistically significant difference between the two groups regarding anastomotic leakage, remnant rolled cuff, anastomotic stricture,

Table 2 Conparing Weight at the operation, age at the operation,Total operative duration,anal stretching duration and total hospital stay between the two groups

	Type of group				
	Lap (N = 10)	Pure (N = 10)	Mann-Whitney test		
	Median (IQR)	Median (IQR)	z	*P* Value	Sig.
Weight at operation (Kg)	9.5 (7–16)	7.75 (6–8)	–1.942	0.052	NS
Age at operation (Years)	2 (1–3)	2 (0.67–3)	–0.585	0.559	NS
Duration of whole operation	180 (162–210)	122.5 (95–140)	–2.272	0.023	S
Duration of anal stretching	100 (80–120)	122.5 (95–140)	–1.520	0.129	NS
Total hospital stay (days)	7 (6–7)	7 (5–7)	–0.520	0.603	NS

Table 3 Comparing postoperative early complications between the two groups

	Type of group			
	Lap (N = 10)	Pure (N = 10)	Fisher's Exact test	
	N (%)	*N* (%)	*P* value	Sig.
Anastmotic leakage				
No	9 (90%)	9 (90%)	1.00s	NS
Yes	1 (10%)	1 (10%)		
Remnant rolled cuff				
No	9 (90%)	9 (90%)	1.00	NS
Yes	1 (10%)	1 (10%)		
Anastomotic stricture				
No	9 (90%)	7 (70%)	0.582	NS
Yes	1 (10%)	3 (30%)		
Anal fissure				
No	1 (10%)	4 (40%)	0.303	NS
Yes	9 (90%)	6 (60%)		
Post operative enterocolitis				
No	9 (90%)	8 (80%)	1.00	NS
Yes	1 (10%)	2 (20%)		

anal fissure nor postoperative enterocolitis with p value (>0.05).

Discussion

Despite having a frequency of just 1 in 5000 infants, HD, also known as intestinal aganglionosis, is the most prevalent congenital enteric neuropathy [5]. It results in persistent distal intestine spasms, compensatory proximal intestine hypertrophy and expansion, constipation, abdominal distention, and intestinal obstruction [6]. This condition is brought on by a defect in the cranial-caudal migration of vagal neural-crest cells along the intestine during early embryonic development.

The surgical treatment of HD has gradually advanced since the condition's first comprehensive description in 1889. Swenson promoted excision of the distal, aganglionic colon after realizing that HD results from functional blockage in this region. In order to reduce the danger of neurovascular damage, Duhamel later described a retrorectal anastomosis and Soave an extramucosal dissection. Since it was initially reported, primary endorectal pull-through without enterostomy has grown in favour. The Complete transanal pullthrough has been further developed to incorporate minimally invasive techniques [2] because it has no abdominal incisions, which prevents post-operative discomfort and lowers the danger of abdominal adhesions.

A growing trend in the treatment of HD is the utilization of minimally invasive procedures thanks to advancements in laparoscopic tools and surgical technology. Surgery with laparoscopic assistance is appropriate for long-segment, total-colon HD and related conditions. Less trauma, a straightforward procedure with improved safety and efficacy, and less problems are its benefits [7].

However, 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.

In the current study, there was a statistically significant difference regarding duration of the whole operation being longer in the lap group.which can be explained due to our early experience in the LAPT in addition due to the time consumed inserting the ports and adjusting the ergonomics.Likely, a meta-analysis conducted on five eligible studies comprising 405 patients. This meta-analysis detected that two studies reported data on duration of operation in 102 patients (52 CTP, 50 LAPT). Analysis using a fixed-effects model revealed a mean difference of 50.29 min shorter operative time with a totally transanal technique (95% CI 60.74 to 39.83, $P < 0.00001$) [8]. Shawkat *et al.*, 2019 found that duration of surgery with two studies demonstrating a significantly shorter duration of operation time for CTP compared with LAPT. This may be due to avoidance of time spent accessing the abdomen with a laparoscopically assisted procedure and concords with results from studies comparing open abdominal procedures with transanal pull-through [4]. It may be likely to be subject to a degree of case selection, it is possible that cases with shorter, less complicated disease segments were preferentially chosen for CTP [9].

Additionally, the Karlsen *et al.*, 2022 trial, which had 91 patients and 46 CTP and 45 LAPT operations. According to this study's authors, the median operating time for CTP was 158 (84-318) minutes while the median operating time for LAPT was 176 (95–318) minutes (P=0.34). The operating times in the studies range due of a variety of parameters, such as age (the younger the age, the less time is required), adherent musosa, preoperative enterocolitis, and intraoperative bleeding (the older the kid, the more bleeding) [10].

With reference to postoperative complications, the current study reported that there was no statistically significant difference between the two groups regarding anastomotic leakage, remnant rolled cuff, anastomotic stricture, nor post-operative enterocolitis.

This was in agreement with Karlsen *et al.*, 2022 who found that early complications were common after both CTP and LAPT. Excluding stoma related complications, 16 (35%) CTP patients experienced a total of 18 complications, and 18 LAPT patients (40%) experienced a total of 22 complications. There was no significant difference in overall complication rates between the procedures. Clavien-Dindo grade IIIb complications were registered in 2% of CTP patients compared to 9% of LAPT patients ($P = 0.20$). **ABD** ALZAHER ABUELGHATT *et al.*, 2018 found that there was no statistically significant difference between the two group's early post-operatives follow up as regard, anastomotic leakage, anastomotic stricture and intestinal obstruction, enterocolitis, buttock excoriation and morbidity leading to colostomy. There was statistically significant difference between the two group's operative data as regard, operative time (120–180 min for group A and 50–120 min in group B). Similar results reported by Ahmed & Abd Elwahab, 2017.

In a similar vein, instances of children with diagnosed Hirschsprung's disease under the age of 18 who had total transanal pull-through or laparoscopic-assisted transanal pull-through were retrospectively evaluated (CTP). Major problems did not vary significantly (OR 1.75, 95% CI 0.76–4.04, $P = 0.19$[11]).

Study limitation

The limitations of the study are the small sample size, more time is needed to follow up and compare the patients' continence.

Conclusion

From the current study, it was concluded that:

Both pure trans-anal and laparoscopic assisted Soave are feasible and durable in treatment of HD.

Future plan: Is doing both Laparoscopic and pure trans anal parts simultaneously can minimize the whole operative time.

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Conflicts of interest

There are no conflicts of interest.

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