

Comparative Study of Modified Duhamel's and Transanal Endorectal Pullthrough Procedures in the Surgical Management of Hirschsprung's Disease - A Prospective Study

K.V. Sathyanarayana¹, M. Sreekanth²

ABSTRACT

Introduction: Hirschsprung's disease (HD) surgical management has moved from multistage open procedures to single-stage transanal surgical techniques. Two frequently used techniques are the Modified Duhamel's (MD) retrorectal pull-through procedure and the transanal endorectal pull-through (TEPT) procedure. Study aimed to compare postoperative results of Modified Duhamel's and Transanal Endorectal Pullthrough procedures in Hirschsprung's disease irrespective of age at definitive procedure. Post operative course, complications such as intestinal leaks, enterocolitis and time taken for restoration to normal bowel pattern.

Materials and methods: It was prospective study done at the Department of Paediatric surgery, Niloufer Hospital for Women and Children, Osmania Medical College Hyderabad, over a period of 24 months from November 2014 to October 2016, that includes 78 cases of Hirschsprung's disease. Out of 78 (n=78) cases, Modified Duhamel's procedure was performed in 45 patients and Transanal Endorectal pull through procedure (TEPT), was performed in 33 patients.

Results: In the present study out of 78 patients 24 were females and 54 were males. The male to female ratio was 2.25:1. Mean age in Duhamel's group is 18.77 months where as the mean age in TEPT group was 8.67 months. Average TEPT (124 mins) surgical procedure was lengthy than compared to Duhamel procedure (108 min). The intraoperative findings included classical segment 70, and long segment 8. Feeds resumed in 5.11 days and 2.33 days in Duhamel's and TEPT procedure cases respectively on an average.

Conclusion: Transanal endorectal pull-through work well in patients with Hirschsprung's disease for the classical segment and long segment variants.

Keywords: Hirschsprung's Disease HD, Modified Duhamel's MD, Transanal Endorectal Pullthrough TEPT

INTRODUCTION

Hirschsprung's disease (HD) is a congenital condition that is caused by the absence of ganglion cells in the submucosal and myenteric plexuses of the distal intestine.^{1,2} The surgical management of HD has moved from multistage open procedures to single-stage transanal surgical techniques.³ Two frequently used techniques are the Modified Duhamel's(MD) retrorectal pull-through procedure^{4,5} and the transanal endorectal pull-through (TEPT) procedure.⁶ Both the techniques can involve laparoscopy as a means for taking biopsies to identify the transition zone and for mobilizing the colon.⁵ In Duhamel technique, a section of aganglionic rectum is left and connected to a segment of

ganglionic colon (side-to-side) as a pouch reservoir, whereas in the TEPT technique direct anastomosis is made just above the dentate line.^{6,7}

The latter can be done by leaving a seromuscular rectal cuff (Soave like) or with a full-thickness resection of the distal colon and rectum (Swenson-like). More than two decades have passed since the implementation of the laparoscopic Duhamel and TEPT techniques as the treatment strategies for HD. However, there is an ongoing debate about many key issues, such as which technique is preferable and the time of execution of these procedures. It is unclear if one of these techniques yields significantly better and disease-specific outcomes. The TEPT procedure, first developed by De La Torre and Langer, was a Soave-like transanal endorectal submucosal dissection with an endorectal pull-through, leaving an aganglionic rectal muscular cuff.^{6,7}

This surgical procedure has also been modified to a transanal Swenson-like operation which does not require dissection in the submucosal plane but a straight resection of the full-thickness colon just above the dentate line.⁸ Furthermore, TEPT can be precluded by an open, trans-umbilical or laparoscopic biopsy for localization of the transition zone. Laparoscopy is then often used for mobilization of the aganglionic distal sigmoid colon. In Duhamel procedure, the distal part of the aganglionic colon (rectum) remains in situ. After the resection, the ganglionic colon is placed in the avascular retro-rectal plane and stapled or sutured side-to-side to the native aganglionic rectum.^{9,10} This was initially an open procedure however, since the 1990s it has been performed laparoscopically with good results.⁹ It can be a fully laparoscopic procedure, or a Pfannenstiel incision can

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be used.^{9,10}

In recent years some centres of pediatric surgery have transitioned from performing the Duhamel's the TEPT procedure in almost all cases^{12,13}, but most surgeons appear to stick to their preferred surgical technique. There is little evidence supporting the superiority of one procedure over other either in general or in specific cases, although some authors prefer the Duhamel's procedure in long-segment disease. This was a prospective study that includes all the cases of classical and long segment Hirschsprung's disease with levelling colostomy, subjecting them to both types of procedures i.e. Modified Duhamel's and Trans anal Endorectal Pullthrough in our institution. This study also emphasizes the need for strict follow ups at regular intervals following both the surgical procedures done for Hirschsprung's disease.

MATERIAL AND METHODS

The study was done at the Department of Paediatric surgery, Niloufer Hospital for Women and Children, Osmania Medical College over a period of 24 months from November 2014 to October 2016, includes 78 cases of Hirschsprung's disease were done to compare the results of both the procedures with respect to age at definitive procedure, post operative course and complications such as postoperative leaks, enterocolitis and time taken for restoration of normal bowel pattern.

Patients with short segment, classical and long segment Hirschsprung's disease who had undergone colostomy are included in our study. Patients diagnosed with total colonic aganglionosis, extended aganglionosis, total intestinal aganglionosis, and intestinal neuronal dysplasia were excluded from our study.

Out of 78 cases of Hirschsprung's disease, Modified Duhamel's procedure was performed in 45 patients and TEPT procedure was performed in 33 patients. The selection operative procedure for a case was at random. Rectal biopsy, plain X-ray abdomen and contrast enema were done in all the patients. Prior to surgery, the colon was decompressed and enterocolitis, if present, controlled. Nutritional status was also evaluated and optimized.

Surgical procedure of TEPT: We found that routine preoperative mechanical bowel preparation was sufficient along with Intravenous prophylactic broad spectrum antibiotics in all patients. The operation was done under general anesthesia. Patient placed in supine position colostomy was dismantled and resection of the both stomal ends done. Proximal bowel was lengthened with its vascularity on marginal artery of Drummond. Distal bowel is mobilized up to peritoneal reflection. both ends of the stomas are anastomosed water tight. The patient was placed in extended lithotomy position at the end of the operating table. The rectum and sigmoid colon are irrigated from below until clear.

An anal retractor or retraction sutures were placed to expose the anus and distal rectal mucosa. The rectal mucosa was circumferentially incised using cautery >5 mm above the dentate line, depending on the size of the child. Multiple fine

sutures were placed in the proximal cut edge of the mucosal sleeve, and traction was applied while the endorectal submucosal dissection was carried proximally. When the submucosal dissection has been completed, the rectal muscle cuff was divided circumferentially. Dissection then continues proximally, dividing all vessels as they enter the rectum, staying right on the rectal wall and sigmoid are delivered through the anus. Throughout this dissection, blood vessels are divided using cautery or ligated, depending on their size. The rectal muscular cuff was then split longitudinally, posteriorly to avoid constriction of the pulled through bowel. The sigmoid colon was pulled down until we see the anastomotic part that was done during the abdominal dissection. Then the anastomosis dismantled and the proximal ganglionic part of the sigmoid colon anastomosed to the cut edge of the anal mucosa with a series of 4-0 polyglactin sutures.

Steps of Modified Duhamel's Procedure: The procedure here was same as above till the dissection of distal bowel up to peritoneal reflection, then the rectal stump was closed two centimetres above the peritoneal reflection. The opening of the mesorectum provides good access to the retro-rectal space. This space was cleaved down to the pelvic floor between the preserved sacrogenitopubic laminae. A curved forceps fitted with a small sponge was pushed down to the posterior wall of the anal canal and was diverted through the anus, which may be dilated previously.

A posterior semicircular incision was made about 1–1.5 cm above the anal margin, just 0.5cm. above the dentate line. The mucosa and the internal sphincter are opened to the retro-rectal space, which was filled with the sponge introduced abdominally. The sponge and the tip of the clamp are protruded through the anus and provisional sutures are introduced at the two angles of the anal incision.

Using the sponge as a guide, another forceps was drawn in a retrograde direction through the retro-rectal space into the peritoneal cavity. The proximal portion of the colon was then grasped and pulled downwards into the retro-rectal space and through the posterior anal incision. After securing vitality and hemostasis of the pulled-through colon, the anastomosis was performed with interrupted re-absorbable sutures by attaching the posterior part of the pulled through colon to the lower lip of the anal incision. Thereafter, the anterior part of the pulled through colon was attached to the upper part of the incision, creating an end-to-side colorectal anastomosis. The spur was cut using a 55mm linear stapler gun to create a rectal reservoir.

In the postoperative period majority of the patients were treated conservatively like in patients who were having increased frequency of stools in transanal pull through with constipated diet and medications and in patients with chronic constipation were treated with laxatives and rectal enemas in patients that underwent Duhamel procedure. Patients with enterocolitis were treated with broad spectrum antibiotics and rectal washes. Patients who developed rectal stump leaks were treated with diversion colostomy in some patients and some patients were subjected to redo pull through in

Duhamel group. Patients with anal stenosis or stricture in the TEPT group were treated with anal dilatations. Patients with intestinal obstruction which developed in both the group of patients underwent re-exploratory laparotomy and adhesiolysis.

After surgery, patients were followed up at the third, sixth month and at the end of one year. During follow up various parameters were noted which include, perianal examination, stool frequency history, anal continence, episodes of constipation, episodes of enterocolitis and spur associated complications. Laboratory investigations are done in patients who had enterocolitis as complication and radiological studies along with rectal biopsy in patients with chronic constipation. The observation and results were statistically analysed. The observations were focused on certain parameters which include patient age, weight and nutritional status, rectal and colostomy site biopsy,

postoperative resumption of oral feeds, number of episodes of enterocolitis and stool frequency. Patients were analysed and categorized into two groups based on surgical procedure and according to the outcome. These include cases with satisfactory outcome and incomplete therapeutic response.

STATISTICAL ANALYSIS

The mean values of postoperative complications and morbidity were calculated including the standard error using Microsoft excel 2007. The P value was calculated by the Chi square test, and unpaired t test using www.openepi.com, and www.graphpad.com. P value <0.05 was considered significant.

RESULTS

This prospective study done at Department of Paediatric surgery, Niloufer Hospital, Osmania Medical College over a period of 24 months from November 2014 to October

	Male	Percentage	Female	Percentage
Classical segment	52	74%	18	25%
Long segment	2	25%	6	75%

Table-1: Involvement of intestinal segments in the procedures

Complications	DUHAMAL	%	TEPT	%	P value	
Rectal stump leak	5	11%	0			
Obstruction	4	8.80%	2	6%	0.3216	
Enterocolitis	9	20%	4	12%	0.1781	
Burst abdomen	2	4.40%	1	3%	0.3742	
Constipation	10	22.20%	2	3%	0.0253	Significant
Death	3	6.50%	1	3%	0.236	
Prolonged ileus	4	8.8	3	9%	0.4877	
Loose stools	0		4	12%		
Perianal excoriation	2	4.40%	4	12%	0.1046	

Table-2: Post-operative complications

	A. Gunnarsd ó ttir ⁹⁸			present study		
	D-group (n = 18)	T-group (n = 11)	p value	Duhamel	TEPT	p value
	Mean ± SD (range)	Mean ± SD (range)		n=45	n=33	
age at operation (months)	5.6 ± 5.7 (1– 23)	4.8 ± 5.2 (1– 24)	0.351	18.73 ± 20.14	8.67 ± 4.3	0.0062
operative time (min)	154 ± 35 (112 – 235)	146 ± 25 (101 – 197)	0.513	108.22 ± 8.19	124.69 ± 4.49	0.0001
start of per oral feeding (days)	2.0 ± 1.5 (0– 7)	0.3 ± 0.5 (0– 2)	< 0.001	5.18 ± 0.58	2.33 ± 1.08	0.0001
postoperative hospital stay (days)	6.9 ± 3.8 (3 – 16)	4.4 ± 1.5 (2 – 8)	0.038 *			0.0001

Table-3: Comparison of our study with other study

	A. Gunnarsd ó ttir ¹⁴					Present study				
	D Group	%	T Group	%	P value	D Group	%	T Group	%	P Value
	(n = 17)		(n = 11)			n=45		n=33		
re-operations	12	71	2	18	0.018	7	15%	3	9%	0.1994
routine anal dilatations	0	0	10	91	< 0.001	1	2%	3	9%	0.0872
perianal excoriations	4	24	5	46	0.409	2	4%	5	15%	0.0511
Enterocolitis	2	12	2	18	1	9	20%	4	12%	0.1781
Constipation	10	59	3	27	0.137	10	22%	2	6%	0.0253
daily laxative medications	5	29	3	27	1	5	11%	1	3%	0.093
Soiling	3	18	1	8	1	5	11%	1	3%	0.093

Table-4: Comparison of other variables in our study with other study

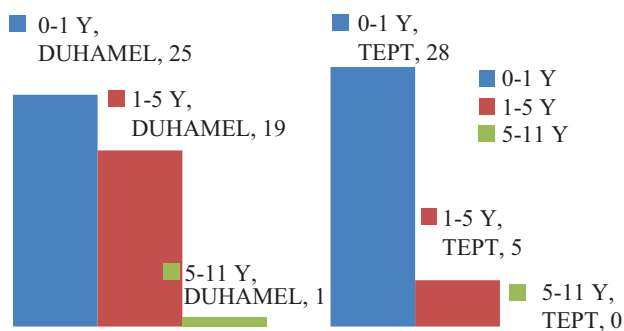


Figure-1: Distribution of age in study groups

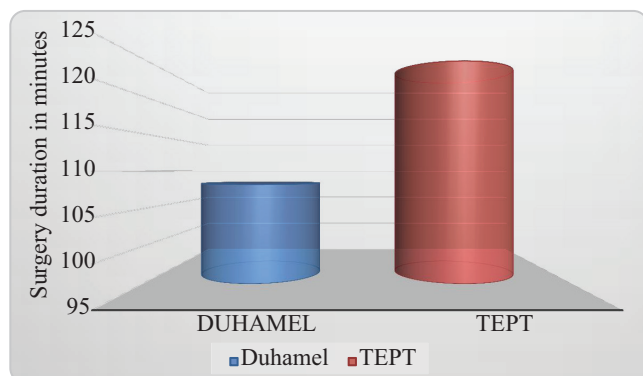


Figure-2: Average duration of time for surgery in study

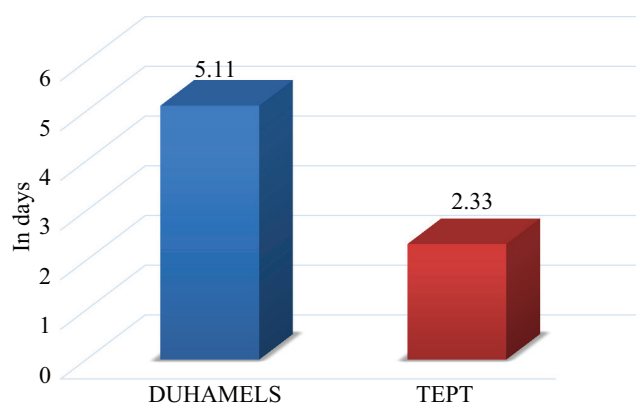


Figure-3: Feeds resumed in days

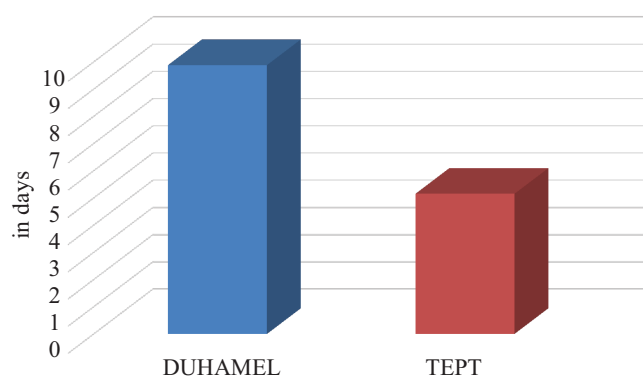


Figure-4: Average days for discharge

2016 includes 78 cases of Hirschsprung's disease. Out of 78 (n=78) cases of Hirschsprung's disease, Modified Duhamel's procedure was performed in 45(58%) patients and Transanal Endorectal pull through procedure was performed in 33 (42%) patients. In present study out of the 78 patients 24

were females and 54 were males. The male to female ratio was 2.25:1.

The present study 19 patients of < 1 year, 18 patients of age between 1-5 years, 8 patients of age between 5-11 years have undergone Duhamel's procedure where as 29 patients of <1 year, 4 patients of age between 1-5 years have undergone TEPT (figure-1). Mean age group in Duhamel 18.77 months where as the mean age group in TEPT was 8.67 months. Average operating time in TEPT 124 mins was lengthier than Duhamel's procedure time of 108 min. The intraoperative findings included number of patients with classical segment 70 and long segment 8 (table-1). Feeds resumed in 5.11 days and 2.33 days in Duhamel's and TEPT procedure cases respectively on an average (figure-3). TEPT procedure has less number of days of hospital stay than that of Duhamel procedure (figure-4). In Duhamel group 5 patients have rectal stump leak, 4 patients presented with obstruction, 9 patients got enterocolitis, 2 patients got burst abdomen, in 10 patients constipation observed during follow up which was significant (p=0.025), death in 3 patients, prolonged ileus in 4 patients, none had loose stools during follow up period. Perianal excoriation occurred in 2 patients (table-2). There was a significant difference between the two groups in occurrence of post-operative complications. In TEPT group of patients suffered from post-operative complications in the form of enterocolitis, intestinal obstruction, ileus and anal stenosis/stricture with increased frequency of stools, while in Duhamel group enterocolitis, intestinal obstruction, rectal stump leak and constipation.

DISCUSSION

Hirschsprung's disease (HD) is a congenital condition characterized by the absence of ganglion cells in the submucosal and myenteric plexus of the distal bowel. This causes a form of functional intestinal obstruction. It is thought to be the result of a failure of neuronal (ganglion) cells to migrate fully caudal during embryonic life. Although the evolution of surgical techniques in the treatment of HD has provided tremendous improvement in patient outcomes, there are certain aspects of treatment that could be improved. With regards the Modified Duhamel versus TEPT technique, evidence is insufficient to recommend one technique over the other and the surgeon's experience is the key factor determining the choice of procedure.

Following surgery for Hirschsprung's disease, patient may either have increased stool frequency or constipation. Satisfactory response following definitive procedure for Hirschsprung's disease includes near normal stool frequency without frequent soiling of clothes with good continence and appropriate growth for age. Partial response shows altered stool frequency, requires anal dilatations and rectal enemas frequently to resume normal activity. Patients with therapeutic failure exhibit no reduction in stool frequency and the patient develops recurrent enterocolitis and features of failure to thrive. In another group of patients, chronic constipation, faeculoma formation and enterocolitis were seen.

This prospective study IN=78 cases of Hirschsprung's disease, Duhamel procedure was performed in 45 patients and Endorectal pull through procedure was performed in 33 patients.

The male to female ratio in present series was 2.25:1. Mean age group in Duhamel was 18.73 months where as the mean age group in TEPT was 8.67 months (Figure-1). Among 78 patients 45 underwent Duhamel's procedure and 33 underwent Transanal Endorectal Pullthrough. One patient having down's syndrome, underwent Duhamel's procedure. Radiological studies done before initial procedure levelling loop colostomy in both procedures, were plain x-ray erect abdomen shows absence of gas shadow in the pelvis. Contrast enema x-ray shows reversal of recto-sigmoid ratio with variable length of narrowed segment and transitional zone and dilated proximal bowel loops, the variables are classified as classical segment and long segment. All patients in our study who underwent both procedures with rectal biopsy showed absence of ganglion cells and colostomy site shows presence of ganglion cells (Table-1).

TEPT technique has become widely used worldwide because of many advantages with this procedure. The procedure reduces the risk of damage to the pelvic structures, less expensive, and usually faster recovery after surgery with good functional bowel results. TEPT can be performed as staged procedure with initial levelling colostomy and after few months definitive procedure or laparoscopic assisted pull-through can be performed as primary procedure without diversion colostomy.

In spite of frequent defecations in the immediate postoperative period our findings suggested that there was a trend toward decreasing numbers of bowel movements per day with improved continence in both groups over the later postoperative period.

Oral feeding in the Duhamel Group was started 5th post operative day and in TEPT group on 2nd post operative day and this was significantly sooner than Duhamel Group. (Figure-3)

The hospital stay was also significantly shorter for the TEPT Group and the amount of analgesics used after surgery was also less, most patients receiving only acetaminophen. It is clear that changes in surgical practice and postoperative care constantly take place, which might influence and bias results in different time periods. There was slight difference in the mean operative time between the TEPT (124.69 hours) and the Duhamel Groups (108.2 hours) (Figure-2). Fever was common on the first 1 – 2 postoperative days in both groups. Patients routinely received prophylactic antibiotics (metronidazole and ceftriaxone) as a single dose at the start of the operation. None of the patients had abscess formation in the anastomosis. Six patients in the Duhamel Group had leakage from the rectal stump, requiring re-operation. Among the 6 patients with leak 2 patients underwent redo pullthrough in which 1 patient died on 5th postoperative day. Remaining 4 patients underwent diversion colostomy, one patient underwent re-exploration and adhesiolysis for intestinal obstruction on 8th postoperative day.

Three patient in the TEPT Group underwent re-exploratory laparotomy and adhesiolysis for intestinal obstruction and 3 patients needed anal dilatations for anal stricture that required repeated dilatations. Three patients in TEPT group (9%) had mild enterocolitis and in 8 patients had enterocolitis. Duhamel group (17%). The incidence of postoperative enterocolitis encountered in our study were mild with foul-smelling diarrhoea and abdominal distension without fever. (Table-2) Patients responded promptly to treatment with oral metronidazol rate was ceptable.

According to A. Gunnarsd ó ttir¹⁴ study, reoperations and need for anal dilatations are more in Duhamel group which is statistically significant. In the present study constipation in post operative period is statistically significant between the two groups as shown by P value.

Teitelbaum, in his study on neonatal pull through, quoted its total rate of enterocolitis as 42.3%.¹⁶ In his other study involving neonates and older children, the rate of enterocolitis was 75%.⁸ Our total rate of enterocolitis of 12% was way below their rates.

The rates of constipation of other authors ranged from 3% to 28%.^{17,18} Our rate of constipation was 6%, comparable with other authors utilizing similar technique but their subjects were not only neonates. The rate of incontinence from 0% to 16% in various series¹⁹⁻²² was lower than our rate of soiling of 3%. Our rate, however, included the patients with constipation who later developed soiling. Our rate of soiling without constipation was 6%.

CONCLUSION

To conclude, Transanal Endorectal Pull-through proved to work well for our patients with Hirschsprung's disease for the Classical segment and Long segment variants. Starting of feed is sooner, the first bowel movement occurred sooner and they had a significantly shorter hospital stay with fewer interventions postoperatively than the patients operated on with the Modified Duhamel's pull-through procedure. Transanal pull through patients showed less incidence for postoperative enterocolitis, failure to thrive, redo surgery and need for anti-constipating medications than that of Duhamel pull through patients. There was statistically significant better parents' satisfaction and quality of life in transanal group than Duhamel pull through.

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