



## A Surgical Technique to Eliminate the Blind Rectal Pouch in Duhamel Operation for Hirschsprung Disease

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### ABSTRACT

**Aim:** Duhamel operation is widely used in the definitive treatment of Hirschsprung disease (HD) because of its many advantages. However, various modifications of Duhamel's classical technique have been developed to eliminate the blind rectal pouch. In this series, we present our modification of the Duhamel-Martin technique.

**Materials and Methods:** A new modification was applied to eliminate the blind rectal pouch in seven consecutive patients. After using a stapler between the pulled-through colon and the aganglionic rectum, mucosectomy was performed at the proximal end of the aganglionic blind pouch, and an acceptable small rectal ampullary volume was obtained.

**Results:** Radiologically, the rectal aganglionic blind pouch was eliminated, and no complications were observed during the follow-up period.

**Conclusion:** This new, simple, and promising modification eliminates the aganglionic pouch and its complications, which is a significant disadvantage of Duhamel's operation.

**Keyword:** *Hirschsprung disease, Duhamel pull-through, colorectal septum, blind rectal pouch, mucosectomy*

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## Introduction

In 1948, Swenson et al., described the first successful definitive treatment for Hirschsprung's disease (HD)<sup>(1)</sup>. Different surgical methods, with various technical problems, have been presented ever since. Most techniques, including Swenson's transanal, Duhamel's retrorectal, and Soave's endorectal pull-through operations, have evolved from multistage open surgeries to single-stage minimally invasive ones, with many new modifications made over the decades. The preferred methods have also changed. In a recent survey, the Duhamel technique was preferred by 16% of surgeons in the treatment of standard-segment HD and 52% of surgeons in the treatment of total colonic aganglionosis (TCA)<sup>(1)</sup>. Many modifications of the Duhamel technique have been developed to eliminate the blind rectal pouch, and more than one dozen surgeries have been attempted in this regard<sup>(2)</sup>.

Numerous surgeons have suggested dissecting and closing the rectum as low as possible. However, pelvic dissection deprives Duhamel's operation of its main advantage, which is limited perirectal dissection<sup>(3)</sup>. In this study, a method for creating a small rectum without advanced pelvic dissection is presented.

## Material and methods

Seven patients who were diagnosed with HD (six males and one female) in the Dicle University Medical Faculty Hospital Pediatric Surgery Clinic between January and June 1992, were included in this study. No additional congenital anomalies or family history were detected in these patients. The patient's age at diagnosis ranged from one month to eight years. The age at operation ranged from 10 months to 8.5 years. In all patients, HD was initially

diagnosed by radiological examination with barium enema and then confirmed by histological examination of a rectal biopsy specimen. Colostomy was performed in all patients at different stages after the diagnosis (Table 1).

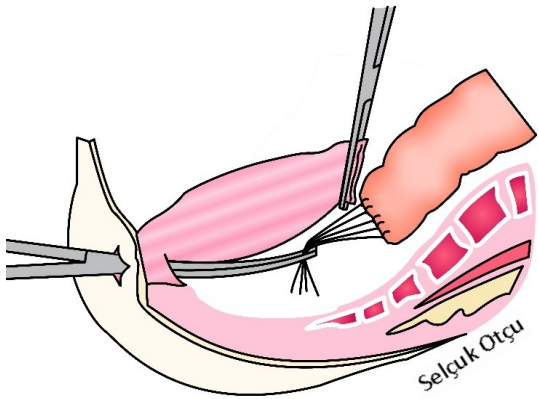
The aganglionic segment ended in the rectum and rectosigmoid and splenic flexure in 1, 3, and 3 patients, respectively. The Duhamel-Grob-Martin technique with mucosectomy modification, which we developed to eliminate the aganglionic blind pouch, was performed in the patients. Postoperatively, patients were evaluated for early results, complications, and rectal reservoirs.

## Technique

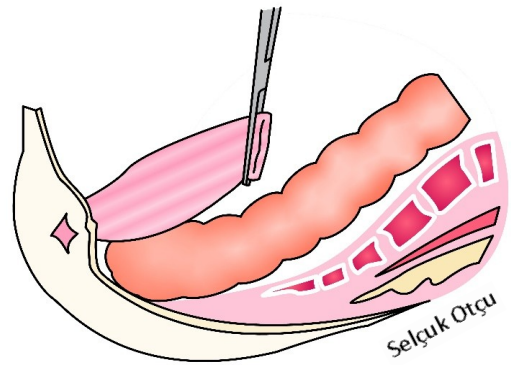
Under general anesthesia, the patient was placed in a supine position. The skin was prepared from the nipples to the toes, the legs were placed in stockinets, a nasogastric tube was inserted, and a Foley-type urinary catheter was inserted into the bladder. After entering the abdomen, the presence of ganglion cells was confirmed by frozen section examination. The aganglionic bowel mesentery was prepared for resection, and the bowel was resected at the level of the peritoneal floor. The end of the ganglionic colon, which would be pulled through, was closed continuously with absorbable sutures and interrupted with nonabsorbable sutures in two layers; the colon mesentery was labeled with different sutures for orientation during the pull-through procedure (Fig. 1). Peritoneal folds and the rectum were suspended, and the back of the rectum and presacral area extending to the midline lower pelvic level were prepared by blunt dissection using the index finger. In the perineal stage of the operation, the patient was placed in the lithotomy position. After anal dilation, the rectum was irrigated with saline and povidone-iodine. The anus was opened with a retractor, and the retrorectal area was reached by opening the posterior rectal wall with a

**Table 1.** Characteristics of the patients who underwent the modified surgery

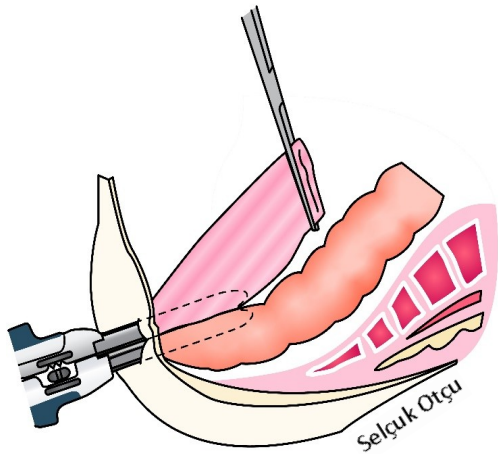
Patient No.	1	2	3	4	5	6	7
Male/Female	Male	Male	Male	Male	Male	Male	Female
Diagnosis/ Stoma Opening	1 Months	6 Months	2 Days/ 8 Months	6 Months	8 Years	4 Years/ 7 Years	8 Years
Definitive Operation	10 Months	12 Months	18 Months	36 Months	8 Years	7.2 Years	8.5 Years
Transition Zone	Splenic Flexure	Splenic Flexure	Rectosigmoid	Rectosigmoid	Rectum	Rectosigmoid	Splenic Flexure



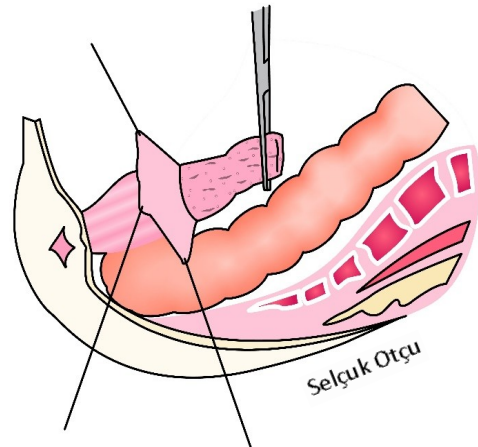
**Figure 1.** After resection of the aganglionic colon, the end of the ganglionic colon was closed with sutures and pulled down from the retrorectal cavity with a clamp.



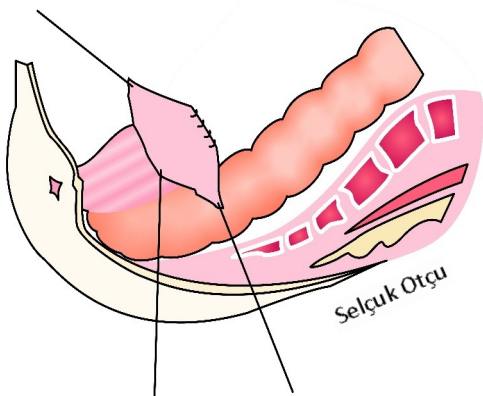
**Figure 2.** The ganglionic pulled-through colon was anastomosed to the aganglionic rectum.



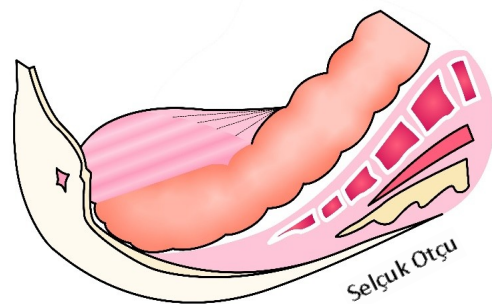
**Figure 3.** The colorectal septum, was divided with a 5 cm GIA linear cutter stapler.



**Figure 4.** Mucosectomy was performed by peeling the rectal mucosa until the proximal end of the mechanical suture.



**Figure 5.** The peeled mucosa was resected, its end closed with continuous chromic sutures.



**Figure 6.** The seromuscular space was approximated to the adjacent pulled-through colon.

2-cm transverse incision, 1 cm above the dentate line. Traction sutures were placed in the four corners of the transverse incision, and then the two spaces were united. The ganglionic colon was pulled down from the retrorectal cavity through a transverse incision, using a long, curved clamp. The end of the colon that had been pulled through was excised and anastomosed to the rectum with interrupted sutures in one layer using 3-0 Vicryl (Fig. 2). The colorectal septum, formed between the pulled-through ganglionic colon and aganglionic rectum, was divided with a 5-cm GIA linear cutter stapler (Fig. 3). The staple lines were oversewn continuously using absorbable sutures. In the last stage, after returning to the abdomen, the clamp holding the upper end of the rectal stump was opened. The stump was irrigated with saline and povidone-iodine. To eliminate the blind part of the colorectal septum that had not been divided with the stapler, a mucosectomy was performed by peeling the rectal mucosa until the proximal end of the mechanical sutures was reached (Fig. 4). The length of the

mucosectomy segment varied between 2 and 7 cm, depending on the age of the patient and the length of the rectum. The peeled mucosa was resected and the end closed with continuous absorbable sutures (Fig. 5). The seromuscular space was approximated and sutured to the adjacent colon; the repaired peritoneum was brought over (Fig. 6). The abdominal wall was closed layer-by-layer, without drain placement. Histopathological examinations confirmed aganglionosis in the resected colon specimens, and ganglion cells were observed in the distal end of the colon that had been pulled through.

### Results

The modified Duhamel technique was performed in seven patients diagnosed with HD. The patients' characteristics are shown in Table 1. There were no intraoperative complications. Mortality and early morbidity were not observed in any patient. The patients were followed up and observed for early and late postoperative complications.



**Figure 7.** Postoperative lateral barium enema roentgenogram of patient 2, following the new Duhamel modification, demonstrated normal pulled-through colon and ampulla, aganglionic blind rectal pouch was not seen.



**Figure 8.** Postoperative lateral barium enema roentgenogram of patient 6, following the new Duhamel modification, demonstrated normal pulled-through colon and ampulla, aganglionic blind rectal pouch was not seen.





**Figure 9.** Barium enema roentgenogram of a patient that was operated at the same clinic without new modification demonstrates a blind pouch.



**Figure 10.** Barium enema in a patient that was operated at the same clinic without new modification demonstrates colorectal septum reformation.

Early complications including fever, wound infection and dehiscence, pelvic abscesses, abdominal distension, intra-abdominal hematoma, mechanical intestinal obstruction, anastomotic stricture, and leakage, were not observed. Late complications including constipation, enterocolitis, soiling, stricture, perineal excoriation, and genitourinary complications, were not observed. In all patients, a contrast enema was performed six weeks postoperatively; no blind rectal pouch was observed, and a normal pulled-through colon and ampulla were observed (Figs. 7 and 8). All colostomies were closed two months after definitive surgery. The radiological data of patients who had previously undergone conventional Duhamel procedure at the same clinic and had developed a blind pouch (Fig. 9) were compared with those of the patients in this study. Postoperatively, none of our patients required additional treatment with laxative or antidiarrheal agents. Four patients older than three years of age were continent and regularly defecated, two patients under three years of age passed a solid stool once

daily, and the other patient passed a semiliquid stool twice daily.

Close follow-up of the patients for 6-10 months results were reported in this study.

#### **Discussion**

One commonly used technique for the treatment of HD is the Duhamel retrorectal pull-through procedure. In this technique, the neorectum consists of two parts: the anterior half, which is the sensitive nonperistaltic aganglionic rectum, and the posterior half, which is the peristaltic ganglionic colon<sup>(4)</sup>. Although optimum conditions are created for the patient to defecate normally, the aganglionic blind pouch formed in these patients causes fecaloma formation, enterocolitis, and intestinal and urinary obstruction, which often require reoperation<sup>(5,6)</sup>. These complications, which are specific to Duhamel surgery remain a concern for experts in the field<sup>(7)</sup>.

All authors accept that the common septum must be divided or minimized to eliminate the blind pouch<sup>(2,8)</sup>. However, no unique method has been developed by

surgeons to prevent the blind pouch, and the Duhamel technique is probably the most modified surgical technique applied to date. Some of the major modifications are described below.

Early modifications of the Duhamel procedure to eliminate the blind pouch aimed to completely remove the common septum. Martin and Altmeier<sup>(9)</sup> reported the use of colorectal anastomosis with spur-crushing clamps. Zachary and Lister<sup>(10)</sup> developed a new clamp model with two enterotribes that could be compressed further each day. Ikeda<sup>11</sup> managed to eliminate a larger portion of the septum with oval clamps and a Z-shaped anastomotic method. Wilcox and Bill<sup>(12)</sup> aimed to remove the septum using non-slipping spur-crushing clamps. In this technique, the clamps remain in the rectum for a week or more, and during this period, the patient stays in the inactive Bryant orthopedic position. Additionally, Sulamaa designed a similar clamp for the same purpose<sup>(12)</sup>.

As these modifications to eliminate the blind pouch were ineffective, anastomosis at a second site was added using different techniques. Soper and Miller<sup>(13)</sup> described the use of two crushing Kocher clamps to split the colorectal septum, and since the main problem was the pouch, they performed anastomosis at a second site between the tip of the rectum and the colon. Canty<sup>(14)</sup> performed additional anastomosis of the proximal end of the stump to the colon for the same purpose. Steichen et al.,<sup>(15)</sup> presented another technique involving only the application of mechanical sutures, using a linear stapler to the septum and using a circular stapler proximal end of the stump to the colon. Becmeur et al.,<sup>(16)</sup> reported that manual suturing of the top of the rectal stump did not make any significant difference in terms of blind pouch formation when compared with stapling. After a complete review of the modifications, Vransky et al.,<sup>(2)</sup> determined that for the success of the Duhamel technique, a sufficiently long stapler is required to eliminate the colorectal septum, along with a maximum blind pouch of 5-7 cm.

In recent years, few studies have been conducted to determine the optimal length of the neorectum. They reported that an excessively long pouch can cause fecaloma and an excessively short rectal pouch will be insufficient for reservoir formation; thus, the optimal length of the rectal pouch in the Duhamel

procedure remains a matter of debate<sup>(17)</sup>. Becmeur et al.,<sup>(16)</sup> measured the rectal stump radiologically with a barium enema to predict complications, and they reported that a small/short rectum yields better functional results and continence, as in our study. Antao et al.,<sup>(18)</sup> reported that fecal incontinence was associated with poorer psychological outcomes and that a short rectal pouch (3.5 cm) produced good fecal continence in their technical modification for treating standard-segment HD with an open procedure. Lamas-Pinheiro et al.,<sup>(19)</sup> reported easier creation of a smaller rectal stump using the hybrid endoscopic method. Zhang et al.,<sup>(17)</sup> reported that a rectal pouch (3.5–4.5 cm) created an adequate reservoir for TCA with a laparoscopic procedure.

Although not commonly reported, reformation of the septum is another complication of Duhamel surgery. In patients with HD previously treated with the modified Duhamel-Martin technique in our clinic, a blind pouch due to septal reformation was detected by rectal examination and confirmed by sigmoidoscopy and radiography (Fig. 10). The reformed septum was again divided using a GIA stapler. Dudgeon et al.,<sup>(20)</sup> reported that after discharge, patients should undergo a simple rectal examination at two-week intervals for a minimum of six weeks and that any septum formed during this period can be split with a finger, thus preventing the need for colotomy. Similarly, Chatoorgoon et al.,<sup>(21)</sup> reported a patient who underwent septal reformation resection twice. In this study, the time for septal reformation elapsed, and it was not detected during follow-up. In addition to mucosectomy, closure of the stapled edges with continuous sutures may have prevented the reformation of the septum.

The reasons for the formation of fecaloma in Duhamel surgery are not limited to a double-cavity rectum due to incomplete separation of the colorectal septum or septal reformation. The single-cavity megarectum itself, which cannot be completely emptied, can cause fecaloma and overflow incontinence, requiring reoperation<sup>(21)</sup>. The main disadvantages of the Duhamel procedure, including both megarectum and colorectal septal formation, are eliminated with our simple modification<sup>(22)</sup>.

Regardless of the pull-through method performed in the definitive treatment of HD, the main goal is that the aganglionic rectum, which is left in place to

preserve perirectal and perianal innervation, should not affect peristalsis by causing mechanical obstruction or enterocolitis due to spasm. This outcome was achieved using our technique to eliminate blind pouches. Mucosectomy was performed on the part of the aganglionic rectum that was below the peritoneal reflection and above the colorectal spur, which was divided using a stapler. Thus, rectal innervation was preserved in the form of a seromuscular cuff. No technical problems were encountered during mucosectomy. By closing the peeled mucosa with sutures, the connection between the two parts of the rectum was severed, the pelvic splanchnic nerves were protected, and a small rectal ampullary volume was obtained. In our patients, the colorectal spur with the potential for fecal stasis, was divided using a 5-cm GIA stapler. Colorectal spurs could be wholly divided using a longer stapler, or anastomosis could be applied at a second site between the proximal tip of the rectum and the ganglionic colon. However, a large rectal ampulla that can cause fecal stasis would form again instead of a blind pouch.

All of the patients underwent colostomy because in the years of the study, the standard practice of the Hirschsprung disease was 3-stage repair<sup>(2)</sup>, patients presented later in life and had significant colonic distension or enterocolitis at the time of diagnosis.

This was a dissertation study on a new surgical technical modification with limited clinical experience. Statistically, the number of patients was small, the patients were older than those in present-day literature, and the close follow-up time was short-term for HD. Larger series of younger patients and the application of this technique with advanced surgical procedures will provide more clinical data.

## Conclusion

Our results demonstrate that the Duhamel pull-through method with blind pouch mucosectomy modification is a safe, effective, and feasible procedure.

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