

Evaluation of a Modified Duhamel Operation for Correction of Hirschsprung's Disease

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Twenty-one patients with Hirschsprung's Disease have been treated definitively over the past five years with a modified Duhamel operation employing an anastomotic stapling instrument for complete division of the colorectal spur. Use of this instrument has facilitated the operative procedure and has assured a reliable union between the colon and rectum. The long-term followup of this series of patients has verified the success of this modification of the Duhamel procedure for permanent correction of Hirschsprung's Disease.

OVER THE PAST TWENTY YEARS the Swenson, the Soave, and the Duhamel operations have been utilized widely for surgical correction of Hirschsprung's Disease. Each of these procedures has individual merits and each has undergone some degree of modification since its original description. A major criticism of the Duhamel operation has been the lack of a reliable and easy method for achieving complete division of the spur created by the side-to-side anastomosis between the rectum and the colon which is brought posterior to it. In 1968, the use of a new anastomotic stapling instrument was proposed for this purpose.¹ The present communication provides a long-term review of the results obtained with this technique and a description of subsequent modifications which have appeared to enhance the reliability of the procedure.

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Previous Clinical Experience

A review of the results in three patients treated for Hirschsprung's Disease at the University of Florida prior to adoption of the current operative technique illustrates a frequent complication of the Duhamel operation as originally performed. As demonstrated by the postoperative barium enema study of one of these patients (Fig. 1), incomplete division of the colorectal spur has often resulted, encouraging formation of a fecaloma in the redundant rectal pouch and producing partial intestinal obstruction by extrinsic compression of the posterior segment of colon. In all three cases performed prior to 1968, this complication eventually demanded reexploration and amputation of the redundant pouch with direct anastomosis of the proximal rectum to the adjacent wall of the posterior segment of colon. All three patients have subsequently developed normal bowel function with no evidence of fecal retention or soiling.

Current Clinical Experience

Based on experiences similar to those described above, a modification of the Duhamel operation was described for correction of Hirschsprung's Disease¹ using an anastomotic stapling instrument for primary division of the colorectal spur (Fig. 2). Since August 1968, 21 patients have undergone this procedure at the University of Florida under the supervision of one of the authors (JLT). In each instance, the following features have been incorporated in the surgical management of these patients:

1) Meticulous preoperative bowel preparation—in-

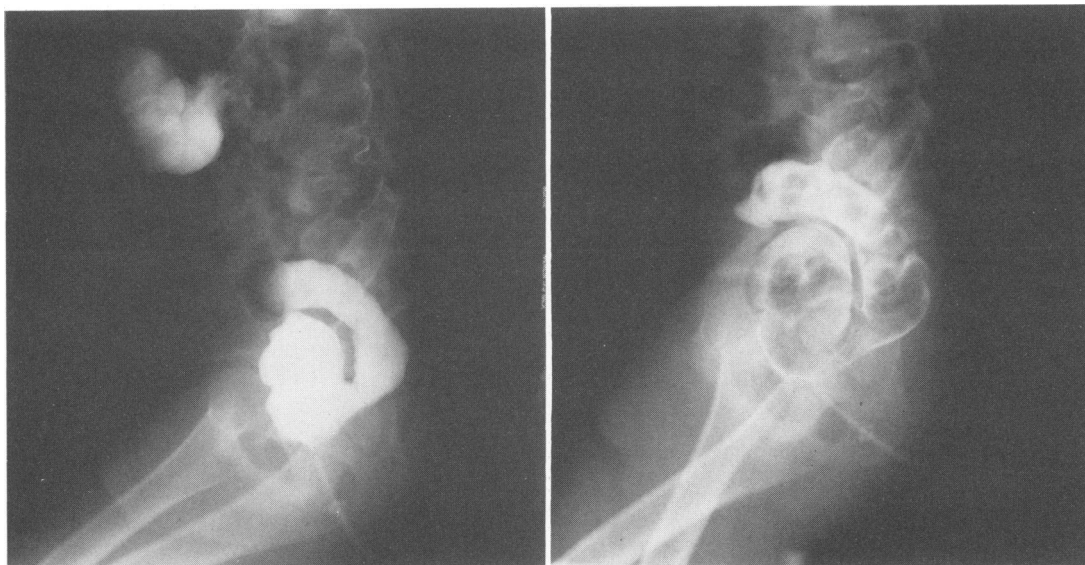


FIG. 1. (Left) Postoperative barium enema in a seven-year-old boy in whom the traditional Duhamel operation had been performed at 2 years of age. Incomplete division of the colorectal spur resulted in the development of a large, residual rectal pouch; (Right) Fecaloma formation in the blind rectal pouch produced compression and obstruction of the posterior segment of colon and eventually required revision of the upper anastomosis with obliteration of the rectal pouch. The patient has subsequently had an excellent anatomic and functional result.

cluding initiation of a clear liquid diet 5-7 days prior to surgery, administration of cleansing normal saline enemas daily until clear, and sterilization of the bowel with oral antibiotics for 48 hours prior to surgery.

2) Elimination of a proximal diverting colostomy—in those cases where a preliminary colostomy has not been required or in those where the colostomy has been located at the transition zone between normal and abnormal colon, a primary pull-thru and anastomosis has been performed without use of a proximal diverting colostomy for protection of the anorectal suture line. This approach has proven feasible in 20 of the 21 patients.

3) Resection of redundant proximal colon—in those instances where the normally innervated proximal colon has proven redundant, an effort has been made to include this segment with the resected specimen. When the transition zone has been located in the sigmoid colon, the splenic flexure has been mobilized and the inferior mesen-

teric artery has been divided in several of the younger patients. As a result of these maneuvers, the distal colon has usually assumed a straight course between the mid-transverse colon and the rectum, minimizing any tendency for fecal retention in a patulous colonic reservoir (Fig. 3).

4) Mobilization and division of the internal anal sphincter—a transverse incision has been made in the posterior anorectal wall at the mucocutaneous junction and the dissection has been extended obliquely upward and posteriorly into the presacral space so that the entire internal anal sphincter has been mobilized in continuity with the muscularis of the rectum. The internal anal sphincter has been divided subsequently along with the colorectal spur. Tenotomy scissors have proven helpful in performing the meticulous dissection which is required in this area for identification and preservation of the external anal sphincter. The distal anastomosis between the posterior walls of the colon and anus has been performed as originally described, using a double row of interrupted 4-0 catgut sutures to approximate, first, the serosa of the posterior wall of the colon to the deep layer of perianal tissue, and, next, the mucosa of the colon to the anal skin (Fig. 4).¹

5) Retroperitoneal dissection of the proximal rectum—the rectum has been mobilized proximally beneath the bladder, sufficiently to assure that the superior margin of the subsequent colorectal anastomosis has been located retroperitoneally within the pelvis and sealed from the peritoneal cavity.

6) Application of the anastomotic stapler from below—the colorectal spur has been readily divided by a single application of the anastomotic stapling instrument from below or, alternately, a strip of the colorectal spur has been removed in older infants by applying the stapler on both sides of a Kocher clamp placed in the center

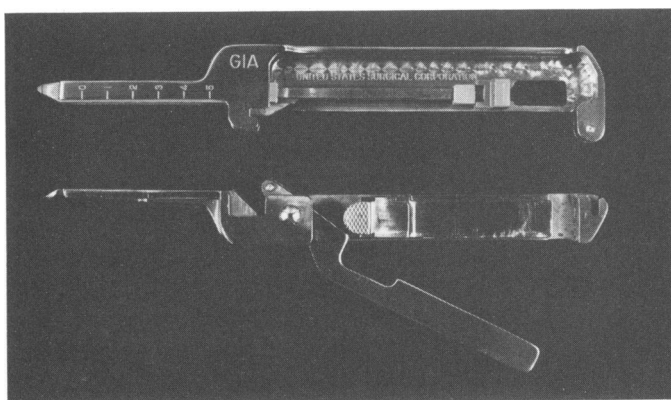


FIG. 2. GIA Auto Suture instrument. The carrier for the staples is inserted in the upper limb of this instrument and the anvil in the lower limb. After approximating and locking the two components, the central cutting bar in the upper limb is advanced and a double row of staples is inserted automatically on either side of an incision which is 5 cm in length (GIA Auto Suture Instrument, United States Surgical Corporation, 845 Third Avenue, New York, N. Y.)

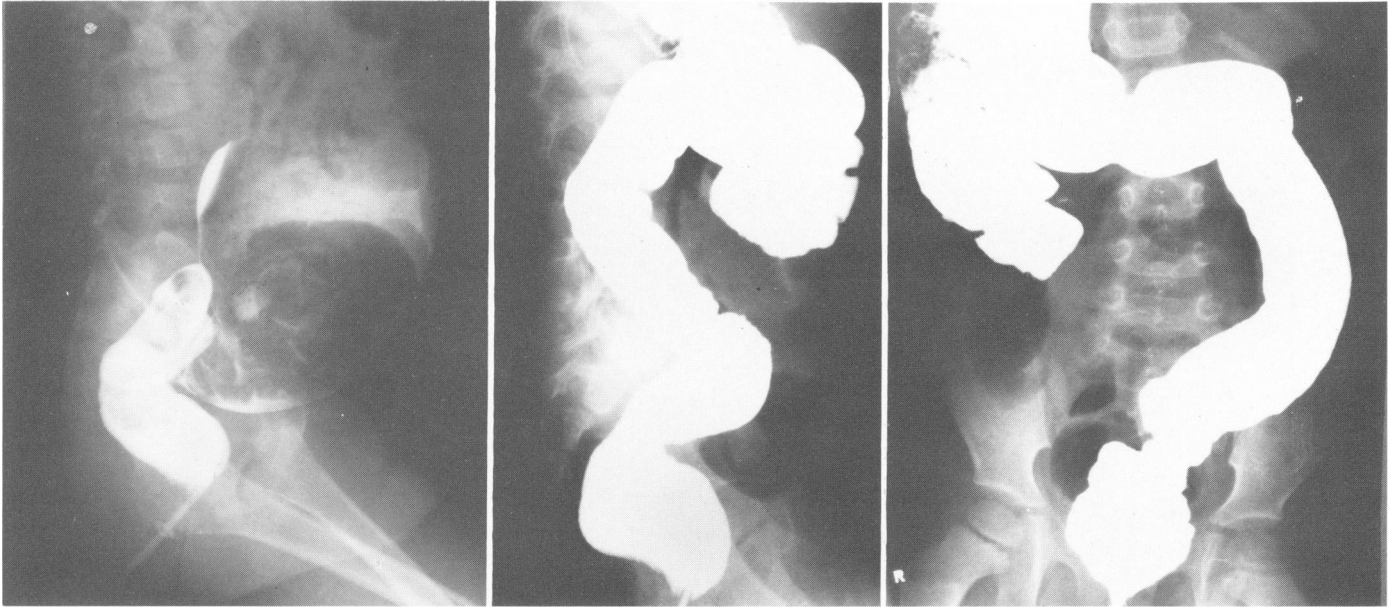


FIG. 3. (Left) Preoperative barium enema in a three-year-old boy demonstrating a distal aganglionic segment of rectum and colon with massive fecal accumulation in the proximal bowel. This patient presented with a history of alternating diarrhea and constipation since birth, a clinical picture which was not recognized as compatible with Hirschsprung's Disease; (Center and right) Lateral and A-P views of barium enema in same patient following modified Duhamel operation performed with anastomotic stapling instrument. The absence of a residual blind rectal pouch contrasts with the result depicted in Fig. 2. The level of the anastomosis is indicated by a peristaltic contraction on the A-P film. This segment filled normally on other films in the same study. The lack of redundant proximal colon is emphasized by the relatively straight contour of the descending limb. A 2½ year followup has confirmed an excellent operative result in this patient.

of the spur. The resulting 1.5 cm wide strip of colorectal spur has then been inverted and excised from above, through the proximal rectal lumen, thereby avoiding any redundancy of the newly created rectal ampulla. In order to minimize the length of the reconstructed rectum, the stapler has been applied only from below and not from both above and below as originally described for selected cases (Fig. 5).¹

The 5 cm partition cut in the colorectal spur has proven adequate in all patients to achieve visualization and completion of the anastomosis from above. In older patients, removal of the strip of spur, as described, has also facilitated exposure of the upper margin of staples through the proximal rectal lumen. Additional lengthening of the colorectal spur through a second application of the anastomotic stapler from above not only has proven unnecessary, but also may result in an excessively large rectal ampulla which could encourage fecal stasis.

7) Direct anastomosis between the upper margin of the rectum and adjacent colon—this anastomosis has been facilitated by extending the vertical incision which has been initiated distally in the colorectal spur by the anastomotic stapler, proximally onto the anterior wall of colon. The entire circumference of the rectal wall has then been approximated to the adjacent colon, beginning at the upper margin of staples bilaterally, with a running, inverting suture of 2-0 chromic catgut. The anterior aspect of this anastomosis has been further buttressed by several

interrupted Lembert sutures of 4-0 silk. This row of buttressing Lembert sutures has not proven necessary for the entire extent of the superior margin of the colorectal anastomosis (Fig. 6).¹

8) Routine use of gastrostomy—a Stamm gastrostomy has been performed routinely to facilitate postoperative gastric drainage and gastrointestinal decompression. The gastrostomy tube has been removed between the tenth and fourteenth postoperative day.

9) Thorough irrigation of the operative site—the pelvis, peritoneal cavity, and abdominal wall incision have been thoroughly irrigated with sterile normal saline prior to closure and the subcutaneous tissues of the abdominal wall have been further irrigated with 1% Neomycin solution following approximation of the fascial layers. Using this technique, primary closure of the skin has proven safe and feasible.

10) Postoperative antibiotics—all patients have been maintained on broad spectrum parenteral antibiotics for the first seven postoperative days.

11) Delayed postoperative feeding—oral feedings have been omitted until the fifth day following surgery or until normal peristalsis has returned in order to minimize stress on the anastomotic suture line.

12) Postoperative followup—an inherent responsibility of the surgeon is the assurance of close followup of these patients for several years following operative correction

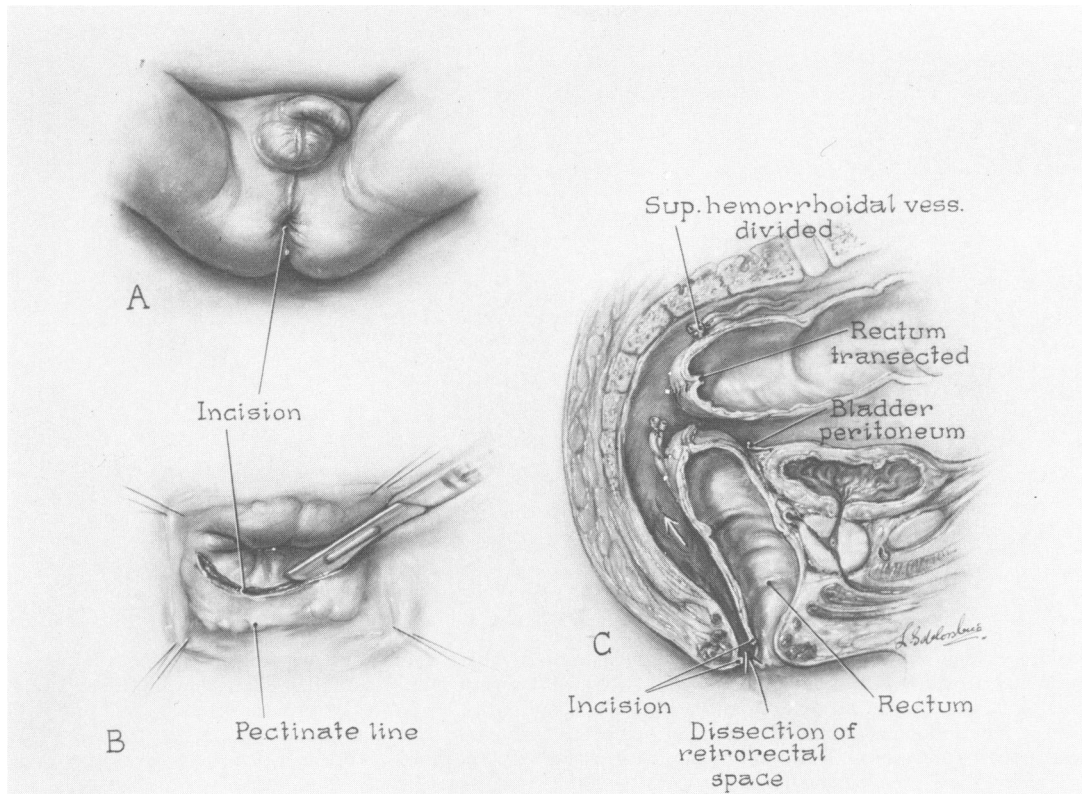


FIG. 4. Technique of modified Duhamel operation. (a & b.) The intraperitoneal portion of the aganglionic bowel has been resected. The rectal stump has been stapled closed and dissection carried down behind the rectum. The posterior half of the circumference of the anus is incised. c. The incision is carried through to the retrorectal space previously opened from above. d. the proximal colon is brought down into the retrorectal space and through the incision in the rectum. e. The posterior suture line is placed and the colonic pouch is transected. The suture line is continued to the superior rim of the incision in the rectum.¹

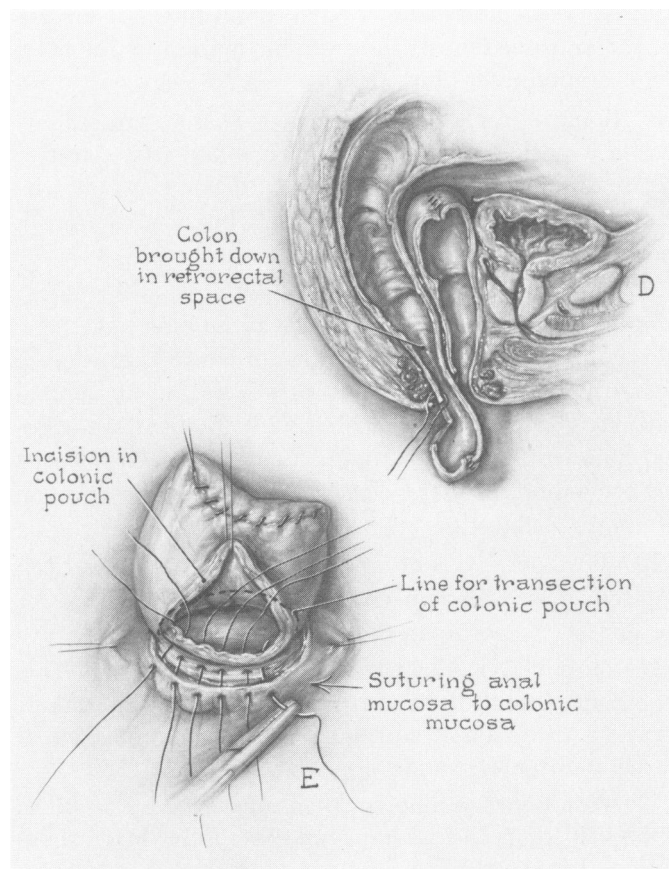
of Hirschsprung's Disease. Early identification and treatment of impending complications in these patients has prevented their progression.

Results

Employing the approach outlined above, a total of 21 patients have undergone operative correction of Hirschsprung's Disease since August, 1968. The oldest patient in this series was 17 years of age at the time of his modified Duhamel operation. Interestingly, a preliminary colostomy had not been performed in this patient and he had struggled for years with only partial relief of his symptoms through a regimen of daily enemas. This young man is now happily married and has remained entirely asymptomatic during the intervening 4½ years since surgery.

Seventeen of the 21 patients were 8–19 months of age at the time of definitive surgery while the remaining three patients were 10, 3 and 2½ years of age when surgical correction was performed. Fifteen of the patients had colostomies created 6–15 months prior to their corrective procedure. In all but one of these patients it was subsequently feasible to include the colostomy with the resected specimen and to perform a primary, distal anastomosis. In no instance was a proximal diverting colostomy created at the time of definitive repair.

The only instance of an anastomotic complication occurred in an infant with absence of ganglion cells throughout the entire colon, requiring use of the caecum



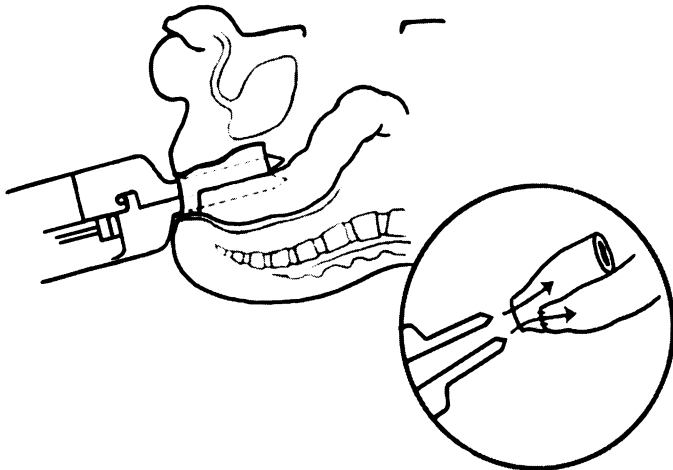


FIG. 5. Division of colorectal spur. Following completion of the distal anastomosis between the pulled colon and anus, the temporary staple closure of the rectal pouch is excised. The GIA anastomotic stapler is then introduced from below, with the two limbs of the instrument placed on either side of the colorectal spur. The instrument is locked and the central cutting bar advanced, simultaneously inserting two double rows of staples and cutting between them, completely dividing the spur.¹

for the distal anastomosis. A limited separation at the posterior anastomosis between the colon and anus allowed subsequent ulceration by the continuous stream of intestinal drainage and eventually required use of a temporary, diverting ileostomy for correction. The adjacent colorectal spur division, which had been performed with the anastomotic stapling instrument, was unaffected by this process. The area of ulceration promptly healed and the ileostomy was subsequently closed. The patient now enjoys normal bowel function with the exception of an increased frequency of stools because of the absence of any sizable colonic reservoir. The only other significant operative complication involved two patients in whom localized abdominal wound infections required removal of several skin sutures for drainage. In each instance, the incision healed promptly and there was no delay in recovery. In no patient has there been evidence of an anastomotic leak or abscess which required drainage.

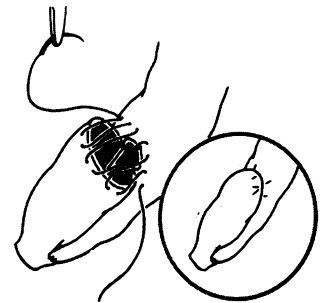
Long-term followup of these patients for periods of

DISCUSSION

DR. MARK M. RAVITCH (Pittsburgh): As Dr. Talbert said, the Soave and the Swanson and the Duhamel are all acceptable procedures, and his experimental and clinical work, I think, have very clearly demonstrated the utility and the place of this operative procedure. I can add reports on another 24 patients who have had this procedure. A little more than half of them done by a former associate, now at the University of Malaysia, and the others by members of the staff of the Children's Hospital at Pittsburgh, and also without any anastomotic leaks, or fecaloma formation.

I think it's important to point out that one of Dr. Talbert's statements probably represents a minority position, but I have to say that I agree with it, and that is that a colostomy is not manda-

FIG. 6. Completion of the colorectal anastomosis. The upper anastomosis is completed by extending the vertical incision which has been initiated distally in the colorectal spur by the anastomotic stapler, proximally onto the anterior wall of colon. The entire circumference of the transected rectum is then approximated to the adjacent colon, beginning at the upper margins of staples bilaterally, with a running, inverting suture of catgut. This technique completely eliminates the proximal rectal pouch which was responsible for the fecaloma formation and partial intestinal obstruction which sometimes followed the original Duhamel operation.¹



eight months to five years has confirmed the achievement of a good functional result in all cases. There has been no incidence of persistent, significant constipation and there has been no evidence of fecaloma formation. All patients who are now older than three years have achieved satisfactory bowel control with no evidence of fecal soiling. There has been no instance of postoperative enterocolitis.

Administration of stool softeners has proven adequate for management of the occasional patient who has been noted to develop mild constipation. Emphasis on regular bowel habits and instruction of the parents and child in the voluntary mechanisms for achieving complete rectal evacuation, through use of the abdominal muscles to increase intra-abdominal pressure, has appeared helpful in preventing constipation. Followup barium enemas have not indicated any tendency for formation of a redundant rectal pouch, as observed in earlier cases. Eighteen of these 21 patients have been seen in followup during the past six months.

Reference

1. Steichen, F. M., Talbert, J. L. and Ravitch, M. M.: Primary Side-to-Side Colorectal Anastomosis in the Duhamel Operation for Hirschsprung's Disease. *Surgery*, 64:475, 1968.

tory in these children if they are stable and can be brought to operation when there is no emergency condition. I agree with this completely.

I think this was a very fine presentation and a real contribution, and important to mention, too, that Dr. Talbert's studies of the manometric diagnosis of Hirschsprung's disease have been one of the important contributions to this subject.

DR. JAMES L. TALBERT (Closing discussion): Dr. Ravitch, I appreciate your kind comments regarding this paper. It has been rewarding to see how effective the anastomotic stapler has proved. In fact, the residents rotating with me from general surgery have been so impressed with the instrument that on their return to Dr. Woodward's adult service they have used it so frequently I have had difficulty obtaining it and have had to purchase a second anastomotic stapler.