Posterior Sagittal Approach: Megasigmoid Resection and Anal Reconstruction for Severe Constipation and Fecal Incontinence After Anoplasty

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Purpose: The aim of this study was to present the technique of megasigmoid resection and anal reconstruction by complete posterior sagittal approach for the children with severe constipation and fecal incontinence after anoplasty.

Methods: Six patients (age, 2 to 18 years) born with imperforate anus and originally treated with perineal anoplasty suffered from intractable constipation and fecal incontinence. Contrast enema showed massive dilated and aperistaltic rectosigmoid colon with fecal impaction. Resection of the dilated bowel and anal reconstruction were completely performed by posterior sagittal approach.

Results: The mean operating time was 205 minutes (range, 125 to 265 minutes) and the average length of resected colon was 23.3 cm (range, 10 to 40 cm). There were no intraoperative or postoperative complications. By 2 to 4 months after the operation, all patients obtained voluntary bowel movement. On follow-up at 6 to 24 months postoperative, no patient had constipation or required use of the laxatives again. Four of 6 patients suffered from grade 1 soiling, and the other 2 had grade greater than 1 soiling. None had urinary retention or incontinence after the procedure.

Conclusion: Resection of dilated rectosigmoid colon and anal reconstruction for the patients with severe constipation and fecal incontinence after anoplasty can be performed successfully using a posterior sagittal approach.
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INDEX WORDS: Anorectal anomaly, anoplasty, constipation, fecal incontinence, megasigmoid, resection.

CONSTIPATION and fecal incontinence are 2 of the most frequent functional problems in children after surgery for all types of anorectal malformations. Various theories have been postulated to account for this, including rectosigmoid hypomotility,[1] intestinal neuronal dysplasia or aganglionosis,[2] and abnormalities in density and distribution of c-*Kit*–positive interstitial cells of Cajal (ICC) in the sigmoid colon.[3] Several nonsurgical approaches have been used in these patients with variable success. However, some of these patients need reoperation for anoplasty and sigmoid resection. Powell et al[4] and Cloutier et al[5] performed resection of the dilated bowel with a pull-through procedure; the constipation was relieved; however, the problem of bowel control remained. Moss[6] achieved good result by anterior resection of the megasigmoid and redo sagittal anorectoplasty. Peña and Behery[7] also recognized that megasigmoid was a source of incontinence and recommended its resection.

Based on the reported successes of the posterior sagittal approach and perineal approach for rectal resection in Hirschsprung's diseases,[8-10] we developed a simplified operation in which megasigmoid resection and anal reconstruction could be accomplished using a completely posterior sagittal approach for the patients with severe constipation and fecal incontinence.

MATERIALS AND METHODS

Between May 1997 and December 1998, 6 patients with intractable constipation and fecal incontinence were treated in Beijing Children's Hospital. The clinical data are summarized in Table 1. The main features of our patients are as follows. (1) The original anoplasty was performed by the perineal approach. (2) The rectum was completely mislocated anteriorly or posteriorly to the striated muscle complex tract (Fig 1). (3) There was strong muscle contraction at the anal dimple. (4) A severely dilated and aperistaltic rectum and distal sigmoid colon was shown by contrast enema. The proximal bowel, however, was normal in size and showed good peristalsis (Fig 2). (5) There was no stenosis of the mislocated anus and the rectum. (6) Before the current operation, all patients had been treated by daily enema to empty the colon for at least 6 months; however, the megasigmoid was not reduced in size. When the treatment by enema was stopped, the stool would reaccumulate in the aperistaltic megasigmoid in spite of high doses of laxatives. Finally, fecal overflow or incontinence resulted. The parameters described by Peña[11] were used for clinical evaluation of the bowel function.

1. Voluntary bowel movement is defined as the act of feeling the urge to use the toilet and holding the bowel movement until the patient reaches the bathroom.

2. Soiling is defined as the involuntary leaking of small amount of stool. This sign is quantified as grade 1 when the soiling occurs occasionally in minimal amounts, and the patient has no social problem. Grade 2 refers to soiling that occurs every day but does not cause any

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Table 1. Summary of Clinical Data

Case No.	Sex	Age (yr)	Original Defect*	Age at Primary Operation	Clinical Manifestision	Diameter of Colon (cm)	Sacrum
1	F	2	Vaginal fistula, high anorectal anomaly	1 mo	Anus mislocated anterior to SMC	12	Normal
2	M	2	Prostatic fistula	4 d	Anus misplaced posterior to SMC, recurrent prostatic fistula	10	Normal
3	F	12	Cloaca	5 yr	Anus misplaced anterior to SMC	10	Normal
4	F	18	Vaginal fistula	7 yr	Anus misplaced anterior to SMC	20	Normal
5	M	4	Bulbar fistula	3 d	Anus misplaced anterior to SMC	10	Normal
6	M	10	Bulbar fistula	2 d	Anus misplaced anterior to SMC	10	S4,S5 missing

Abbreviation: Striated muscle complex.

*The diagnosis was made by surgeons in the local hospital.

social problems. Grade 3 refers to soiling that is constant and represents a social problem to the patient.

3. Constipation is defined as the incapacity to empty the rectum spontaneously every day. It is quantified as grade 1 when the constipation is manageable by changes in diet, grade 2 when the patient requires laxatives, and grade 3 when the patient requires enemas.

Perioperative Management

No patient underwent colostomy before the operation. The colon was decompressed with saline enemas, and the patients were fed with a low residual diet for 1 week. Twelve hours before the surgery, the patients fasted, and no antibiotics were administered. The patient fasted for the first 5 days after surgery, and intravenous fluid and ampicillin or claforan and metronidazole were given.

Operative Procedure

The operation was performed with the patients in a prone jack-knife position. A midline skin incision was made from the level of the midsacrum to the anus. The coccyx, the levator muscle, and the striated muscle complex were divided in the midline under the guidance of electrical stimulation. To make the incision in the center of the muscle complex, a rectangular forcep was inserted inside the pelvic side of the levator through the coccygeal incision; then the levator or the muscle complex was pushed up and divided down to the anal dimple along its longitudinal fibers. The fascia of Waldeyer was opened, and the rectal wall was exposed. Multiple fine sutures were tagged at the mucocutaneous junction for traction. A circumferencial incision was made around the anus, and the plane of cleavage between the rectal wall and the surrounding tissue was developed. The rectum was mobilized by dissecting close to the adventitia rectalis,[12] which could be identified by traction on the rectum and distinguished from the surrounding muscle complex with electrical stimulation. This dissection was performed all the way up to the supralevator space, and, eventually, the peritoneal reflection was reached and opened anteriorly and laterally. A loop of rectum gradually was mobilized by dividing of vessels and bands posteriorly and laterally. By traction on the rectum, the mesenteric vessels and bands could be exposed easily, ligated, and divided under direct vision (Fig 3). Provided the rectal mesentery was freed, the megasigmoid could be pulled easily through out of the incision by moderate traction (Fig 4). The mesentery of the sigmoid colon was divided until the proximal normal bowel was reached and freed without tension up to the proposed anastomotic line. Attention should be taken to preserve the colonic vascular arcades, which approach the colonic wall from either side. The entire rectum and the dilated hypertrophic segment of sigmoid colon were resected, and a new anus was reconstructed by relocating the proximal normal sigmoid colon into the tract of the longitudinal striated muscle fibers and attaching to the muscle complex anteriorly and posteriorly. Because the diameter of the

Fig 1. Preoperatory external appearance of the mislocated anus.

Fig 2. Contrast enema in patient 5 shows that the rectosigmoid colon is enormously dilated, whereas the proximal sigmoid colon appears normal.

Fig 3. The dilated rectosigmoid is freed by dividing the band and vessels in the mesentery.

colon usually is larger than the width of the longitudinal muscle tract, the posterior wall of the colon was folded inward longitudinally rather than excised to fit the size of the muscle tract. The wound was closed in layers, and a new anal opening was made according to the limit of the longitudinal muscle tract. No drains were placed.

Anal dilatation was started from fifteenth day after the operation. All patients underwent regular follow-up in our outpatient department for 6 months to 2 years at regular 3- to 6-month intervals.

Routine histological examination of all specimens from the megasigmoid and the normal colon was performed with H&E staining. The specimens were reviewed by a pathologist for the presence of ganglion cell. Hypoganglionosis is diagnosed according to the density of ganglion cells in the myenteric plexus of the proximal normal colon and the dilated colon.[13]

RESULTS

The mean operating time was 205 minutes (range, 125 to 265 minutes), and the average length of resected colon was 23.3 cm (range, 10 to 40 cm; Table 2). The neorectum was well vascularized, and its wall was kept uninjured during the procedure. Histology of the dilated bowel showed hyaline degeneration and fibrosis of the smooth muscle and hypoganglionosis in myenteric plexus (Fig 5). The average numbers of nerve cells per millimeter were 4.8 ± 1.6 in the dilated colon and 8.5 ± 2.1 in the proximal colon, respectively ($P < .05$).

Table 2. Summary of Results

Patient No.	Colon Resected (cm)	Intraoperative Bleeding (mL)	Operating Time (min)	Pathology
1	10	25	210	Hypoganglionosis, hyaline degeneration, mild fibrosis
2	10	30	255	Hypoganglionosis, hyaline degeneration, mild fibrosis
3	10	20	135	Hypoganglionosis, hyaline degeneration, severe fibrosis
4	40	20	240	Hypoganglionosis, hyaline degeneration, severe fibrosis
5	40	30	125	Hypoganglionosis, hyaline degeneration, mild fibrosis
6	30	30	265	Hypoganglionosis, hyaline degeneration, severe fibrosis

All patients started postoperative bowel function within the first 24 hours, and oral feeding was resumed on the sixth day. There were no intraoperative or early postoperative complications. No patient had wound infection. During the first 2 weeks, 2 patients had 8 to 15 bowel movements per day, whereas the others only had 3 movements daily. Subsequently, frequency of bowel movements became normal in all of them with 1 to 3 bowel movements per day within 2 to 4 months after surgery. Daily rectal dilatation was carried out for 3 months.

Follow-up ranged from 6 months to 2 years (Table 3). Fecal continence was achieved in our series 4 months after surgery. The patients passed soft-formed stool. The major problem after the operation is occasional soiling of underwear, which often occurs at night. Four of 6 patients

Fig 4. Photograph taken after completed mobilization of the dilated rectosigmoid showing the proximal normal colon well vascularized.

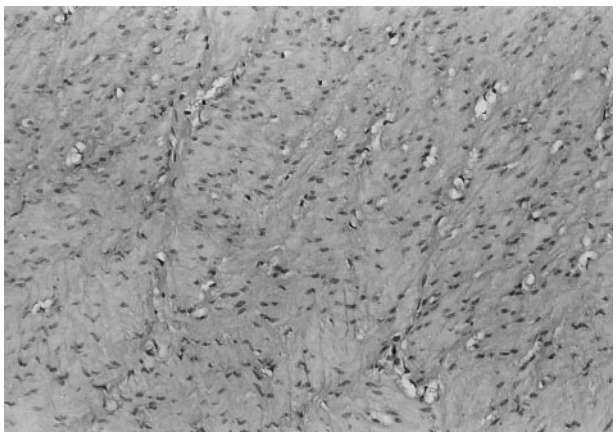

Fig 5. Histological section of the dilated bowel shows hyaline degeneration of the smooth muscle cells with interstitial fibrosis and hypoganglionosis in myenteric plexus. (H&E, original magnification ×200.)

Table 3. Evaluation of Bowel Function

	No. of Patients	
	Before Operation	After Operation
Voluntary bowel movement	0/6	6/6
Soiling		
Grade 1	0/6	4/6
Grade >1	6/6	2/6
Constipation		
Grade 0	0/6	6/6
Grade >1	6/6	0/6

had grade 1 soiling, and the other 2 had grade greater than 1 soiling. No patients had constipation and used laxative again. Urine retention or incontinence was not found postoperatively.

Barium enema examination showed that the patients had normal diameter of large bowel. Whole gut transit time was measured in the patients. Twenty markers were taken orally, and 14 had been passed by day 1 in 3 cases and by day 2 in the other 3 cases.

DISCUSSION

Much confusion exists about the function of the rectum in bowel control. Kiesewetter[14] stressed the predominant role of the rectum and sigmoid colon, considering it to be crucial for fecal continence. However, anatomic observations and clinical evidence show that the rectum is not a necessary organ for fecal continence.

1. Histologically, there are no major differences in the innervation between the rectum and other parts of the colon.[15-18]

2. There are abundant organized nerve endings in the tissue surrounding the rectum, ie, muscle spindle and tendon organ in the striated muscle complex, Pacinian corpuscle, genital corpuscle, Golgi-Mazzoni body, Meissner's corpuscle, globular ending in the regions of anal proper, plane between the internal sphincter and the external sphincter, and the presacral space.[15-18] It is clear now that these organized sensory nerve endings are the receptors responsible for fecal sensation and reflex contraction of the striated muscle complex.[19]

3. The patients who had undergone resection of rectum and colo-anal anastomosis showed that internal sphincter reflexes and bowel control were intact, suggesting that the receptor must lie outside the rectal wall.[20]

4. Internal anal sphincter, consisting of smooth musculature, may contribute as much as 80% of the resting anal pressure, and this high pressure clearly is a factor in continence preventing rectal content leakage before internal sphincter relax reflex is evoked.[21] However, division of the internal sphincter muscle causes only a minor functional disability,[22] suggesting its function can be compensated by the surrounding striated muscle complex.

5. Parks and Percy[23] reported acceptable function in over 90% of patients having straight coloanal anasatomosis with continence being normal in 50% and nearly normal in 46%. All patients in series of Localio et al[24] had normal continence after abdominosacral resection for midrectal cancer. These various clinical and investigative observations suggest that the rectum and the internal sphincter are not the major factors maintaining continence.

Our study results show that the dilatation of rectosigmoid colon in our series is not caused by mechanical obstruction, because anorectal stenosis had been excluded before the operation. The result does not exclude the possibility that the mislocated anus may increase the resistance for defecation and lead to the dilatation of the proximal bowel.[25] Histologically, hypoganglionosis, hyaline degeneration, and fibrosis of the smooth muscle are the most obvious features in the dilated colon. We are not quite sure whether these changes are the cause or result for the bowel dilatation and dysfunction, because with the increase of the bowel diameter, the density of the neuronal cells in the bowel possibly would decrease. In these 6 cases, there is no evidence to show that the dilated bowel could resume to normal by conservative bowel management involving the use of daily enema and high doses of laxatives. Rectosigmoid resection is an effective alternative to cure the patient with megasigmoid after anorectoplasty.

Soiling is a major postoperative complication after resection of the dilated rectum and sigmoid. This result is in keeping with that of low anterior rectal resection and colo-anal anastomosis for rectal cancer.[26] The etiology of soiling in our series is probably 2-fold. First, there is a reduction in the reservoir capacity of the neorectum. The second factor probably relates to absence of normal internal anal sphincter in our patients, because originally they had high or intermediate type of imperforate anus.

The posterior sagittal approach offers a direct exposure to the rectum and urethra, a better definition of the striated muscle complex, and a more objective way to reconstruct the arrangement between the neorectum and the muscle complex. Similar approaches have been used successfully for rectal and sigmoid resection for Hirschsprung's disease and rectal cancer. We believe that wound infection after posterior sagittal approach mainly results from tension and poor vascularization at the anorectal anastomotic line. In the current approach, the sigmoid colon is released fully, its mesenteric vascular arcades are preserved, and the neorectum is located in the muscle complex without any tension. This is the reason no wound infection occurs in our series even though colostomy has not been performed.

The technique in our study has the following advantages: bowel is not opened intraperitoneally and, there-

fore, the risk of adhesion formation presumably decreases. Also, correction of fecal incontinence, repare of rectourethral or vaginal fistula, and resection of the dysfunctional rectum and sigmoid colon can be done in 1 stage. One potential hazard with this technique is uncontrolled bleeding from the mesenteric vessels when the mesocolon is being divided, so extreme care should be taken to obtain hemostasis by ligation of the mesenteric vessels and bands of the colon. Another potential hazard is necrosis of the neorectum, which could be avoided by preserving the straight colonic arteries, which go laterally to the bowel. Because the posterior sagittal approach offers a limited surgical field for the abdominal cavity, we believe that this approach would not be appropriate for a child in whom the dilated segment was suspected or known to be beyond the limit of the sigmoid colon, or for anticipated difficulty in achieving adequate mobilization of the colon. Fortunately in most cases, dilatation is confined to the rectum and sigmoid colon.

This approach might be useful not only for the transabdominal resection of the sigmoid colon but also for surgery for high rectal stump in anorectal agenesis. We suggest that using posterior sagittal approach, the rectal pouch could be mobilized to the length needed for pull-through procedure adequately without resorting to an abdominal approach.

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