

Clinical effects of ascending colon patching ileorectal heart-shaped anastomosis on total colonic aganglionosis

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Abstract. – **OBJECTIVE:** We studied the clinical effects of ascending colon patching ileorectal heart-shaped anastomosis in treating total colonic aganglionosis.

PATIENTS AND METHODS: From June 2006 to June 2013, 15 children with severe abdominal distension, low small intestine obstruction and intestinal perforation in the neonatal period, were enrolled in this study. In phase I, patients received emergency terminal ileum stoma plus multi-site colonic biopsy and 6 to 12 months later, ascending colon patching ileorectal heart-shaped anastomosis was conducted in phase II. The occurrence of postoperative complications was recorded. Patients' defecation and anal manometry during the follow-up period were monitored and recorded. All operations were successful, and the average hospitalization time was 10.5 days, and the average amount of bleeding was 30 mL.

RESULTS: There were 2 cases of enterocolitis, but no intestinal anastomotic leakage, no incision infection, no anal stenosis and no mortality. Postoperative follow-up lasted for 1 to 2 years with an average of 1.2 years. Perianal redness and erosion occurred in an early stage after the operation, but disappeared after 6 months. Postoperative defecation frequency was about 6 to 9 times, but after 2 years this frequency reduced to 2 to 3 times. Feces transformed from watery into soft forms. Normal results were obtained in the detection of serum K^+ , Na^+ , Cl^- , HCO_3^- , hemoglobin, albumin and globulin levels in postoperative follow-up. Rectal rest pressure and anal canal rest pressure after a radical operation on megacolon were significantly lower than those of before operation ($p < 0.05$).

CONCLUSIONS: Ascending colon patching ileorectal heart-shaped anastomosis preserved right hemicolon with relatively good absorptive capability and complied with the physiology of colon. Meanwhile, the ileorectal heart-shaped anastomosis was conducted. The anastomotic stoma was in an oblique heart shape, and its aperture was wide and in different planes without

stenosis, blind bag and gate syndrome. We concluded that ascending colon patching ileorectal heart-shaped anastomosis was an effective and feasible method for the radical operation on total colonic aganglionosis.

Key Words:

Total colonic aganglionosis, Ascending colon patching, Heart-shaped anastomosis.

Introduction

Total colonic aganglionosis (TCA) is a kind of functional obstruction, characterized by the absence of intrinsic ganglion cells in the myenteric and submucosal plexuses of the bowel wall. As a special type of aganglionosis, TCA only accounts for 5% to 15% of all children with megacolon¹. Patients suffering from this condition have multiple complications, and often require reoperation. TCA lesion originates in rectum and extends proximally over a variable distance of the bowel. TCA represents a significant challenge for pediatric surgeons because the further the lesion extends, the more difficult its management becomes¹⁻³. Lesions can affect the entire colons and some ileums, and the fatality rate is relatively high¹⁻³. With the development of new surgical methods, the overall fatality rate of TCA has been reduced from 40.9% to 15.8%, but the fatality rate in children remains high (35.5%)⁴. In addition to a higher fatality rate, the recovery of anorectal function in children patients after TCA operation also needs to be closely monitored. In this study we retrospectively analyzed 15 TCA patients who received ascending colon patching ileorectal heart-shaped anastomosis. Meanwhile, the anorectal functions, physical development, life quality and possible complications, were followed up after operation.

Patients and Methods

Patients

From June 2006 to June 2013, 15 children with severe abdominal distension, low small intestine obstruction and intestinal perforation in neonatal period were enrolled in this study. There were 10 males and 5 females, and 11 cases suffered from delayed passage of meconium, severe abdominal distension and difficult defecation after birth, while 4 patients suffered from digestive tract perforation. Patients underwent surgical procedures when they were 7 to 28 days old with an average of 20.5 days. All patients received terminal ileum fistulization and operation was carried out in 6 to 12 months after fistulation with an average of 7.5 months. Patients' weights ranged from 5.1 to 7.5 kg with an average weight of 7.0 kg. The study was approved by the Ethics Committee of Xuzhou Children's Hospital. Signed written informed consents were obtained from the guardians all participants before the study.

Operation Methods

Before operation, intubation of gastric tube and urinary catheter was carried out. General anesthesia, routine disinfection and draping were performed. The legs of patients were wrapped. Fusiform incision around anastomosis was made to expose subcutaneous tissue and muscular layer. Ileocolic artery and 10 cm of ascending colon were preserved, and the rest of small colon was removed. The proximal intestinal tube of anastomotic stoma was protected well, while anterior and posterior walls and two sidewalls of rectum were free, with the posterior wall reaching near dentate line and the anterior wall reaching below peritoneal reflection. Both legs were left hanging when the anal dilatation was conducted. 4.0 cm from anterior wall and about 1.0 cm from posterior wall of the rectum were kept on dentate line. The terminal intestinal tube of anastomotic stoma was dragged out without tension while the mesentery was free from distortion. The preserved 10 cm ascending colon and dragged ileum were anastomosed (side-to-side anastomosis with 3-0 absorbable suture). The anastomotic stoma was higher in front and lower in the back and took an oblique heart-shaped anastomosis. Meanwhile, seromuscular layer was embedded. After the completion of anastomosis, no problem was encountered in blood supply of patch. We placed an abdominal cavity drainage tube connected to aseptic bag. No bleeding was detected in abdominal cavity.

Statistical Analysis

Anorectal manometry values before and after operation were compared. SPSS16.0 software (SPSS Inc., Chicago, IL, USA) was used for statistical analysis and data were expressed as (\pm s). Comparisons were tested by the *t*-test. $p < 0.05$ meant that the difference was statistically significant.

Results

All operations were successful and the average of length of stay was 10.5 days, and the average amount of bleeding was 30 mL. There were only 2 cases of enterocolitis, but no intestinal anastomosis leakage or incision infection or anal stenosis or death cases. Postoperative follow-up was set for 1 to 2 years with an average of 1.2 years. The frequency of defecation in the early phase after the operation was 6 to 9 times, but after 2 years it reduced to 2 to 3 times and the form of feces was changed from watery to soft. There was a case with fecal pollution but no fecal incontinence. Levels of K^+ , Na^+ , Cl^- , HCO_3^- , hemoglobin, albumin and globulin in serum were all within the normal range. Patients' growth and development were excellent, and comparable to those of normal children. Rectal rest pressure and anal canal resting pressure after radical megacolon operation were significantly lower compared with those before the operation ($p < 0.05$). Before operation, the measurements revealed that the average rectal rest pressure was (18.75 ± 3.15) mmHg, significantly higher than that of normal children. This might be caused by the spasmodic contraction of rectum in the affected segment and high intestinal wall tension. Average rectal rest pressure at 6 months after operation was (10.00 ± 1.85) mmHg. Postoperative average anal canal rest pressure was (19.88 ± 3.87) mmHg, which was significantly lower than before operation (32.00 ± 4.81) mmHg. The difference in anal canal rest pressure before and after operation was statistically significant ($p < 0.05$). Anorectum inhibitory reflex occurred in one case (Table I).

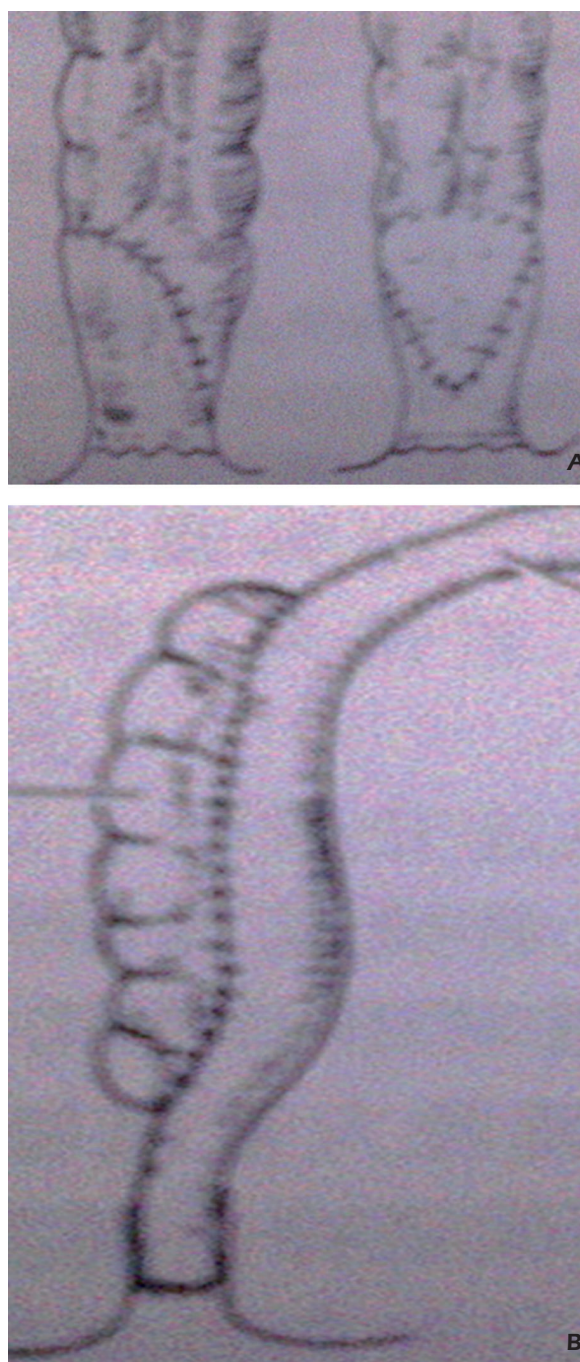
Discussion

Total colonic aganglionosis is a rare type of congenital megacolon⁴. Neonatal morbidity of children patients is characterized by a series of low intestinal obstruction symptoms, inclu-

Table 1. Anorectum pressure before and after anal improvement radical operation.

	Rectal rest pressure (mmHg)	Anal canal rest pressure (mmHg)
Before operation	18.75 ± 3.15	32.00 ± 4.81
sIX months after operation	10.00 ± 1.85*	19.88 ± 3.87*
<i>t</i>	10.69	8.47

ding abdominal distension, constipation, delayed meconium exclusion and bilious vomiting. This condition is often diagnosed late and the delay usually causes digestive tract perforation in sick children. Prior studies reported that⁵ the perforation can be located in aganglionic ileum. In suspected cases, a complete examination should be conducted to determine whether there are any changes in ileum migration section. For suspected cases with congenital megacolon, especially for the total colonic aganglionosis, total colon and ileum should be examined thoroughly during laparotomy in order to exclude mechanical ileus. The single enterectomy, intestinal anastomosis and repair of perforation should be conducted carefully. For children without mechanical ileus, rapid pathological diagnosis should be conducted to identify the range of intestinal tube involved by aganglionosis, thus to determine the location of enterostomy. The fistulation location is selected in the transitional section between hypertrophic dilated ileum and its distal ileum. There is a huge number of nerve plexus and ganglion cells between mucous membrane of proximal intestine (fistulation location) and muscle, which is helpful for postoperative defecation. It is believed that after being diagnosed with total colonic aganglionosis during operation, staging operation should be conducted⁶. Ileostomy must be conducted in phase I and radical operation in phase II. In Boley and Martin method, we reserve ileocecal valve, ascending colon or descending colon, or perform total colectomy and ileoanal anastomosis. In patients with resected colon, ileocecus and terminal ileum may suffer from malabsorption of short chain fatty acids as well as Vitamin B and bile acid deficiency. They also have a higher morbidity from cholelithiasis. Boley and Martin operation reserve a part of the colon that is involved in water, electrolyte and nutrient absorption. Absorption function of left hemicolon is relatively weaker than that of right hemicolon and the right hemicolon is closer to ileum. Other reports⁷ showed that colon with implanted patch tends to shrink over the years without forming fatal ileus.

**Figure 1.** (A) Ileorectal heart-shaped anastomosis; (B) Ascending colon-ileum patching.

Since total colonic aganglionosis has a wide range of lesions, the whole colon is usually removed during the radical operation. This removal not only affects water re-absorption, but also may lead to dysfunction of small intestine caused by recolonization of intestinal flora; therefore, it affects the absorption of vitamins and minerals^{8,9}. We reserved right hemicolon with strong absorption capability, and conducted terminal ileum fistulization to make a part of ileum colon metaplasia. Therefore, maintain the electrolyte and acid-base balance after operation reduce the postoperative defecation frequency and improve defecation characteristics. There was a risk of anastomotic leakage due to the rather long anastomotic stoma and larger wound surface. We actively corrected the hypoproteinemia before operation, strengthen nutrition to support treatment, and applied linear cut stapler (Johnson & Johnson, New Brunswick, NJ, USA) to conduct anastomosis to reduce the operation time. Meanwhile, we ensured a good blood supply, strict sterile operation and proper postoperative antibiotic therapy. Subsequently, we conducted ileorectal oblique heart-shaped anastomosis to provide necessary condition for the reflection of awareness of defecation, as well as expanding anastomotic stoma to ensure defecation channel. Since the anastomotic stoma was in oblique heart shape, its aperture was wide and in different planes without stenosis. Anal dilatation was not necessary after operation and no blind bag or gate was left. Embedding the normal ileum into the back wall of rectum provided a better peristalsis force for defecation. At the same time, partial removal of rectum's muscle sheath reduced the cases of enteritis after operation, and improved the nutrient absorption. There were only 2 cases of enterocolitis and they were both treated and discharged. None of patients needed anal dilatation after operation. Currently, rectoanal manometry is widely used for the preoperative diagnosis of congenital megacolon and evaluation of postoperative anal functions^{10,11}. The combination of rectoanal manometry before and after congenital megacolon operation and postoperative defecation can evaluate postoperative anal functions and analyze postoperative measurement indexes. Rectoanal manometry examinations include rectal rest pressure, anal canal rest pressure, anal canal maximal contraction pressure, anal canal longest contraction time, rectal compliance, rectoanal inhibitory reflex (RAIR) and detection of bowel motion (rectal systolic pressure, anal canal diastolic pressure, etc.). In

children, some of these examinations are extremely difficult to conduct and most children need to be sedated before examination. Therefore, the most common detection methods include rectoanal inhibitory reflex, rectal rest pressure and anal canal rest pressure. Anal canal rest pressure after operation was significantly lower than that before operation. Probably, this was caused by the removal of rectus muscle sheath and internal sphincter. Also, a better defecation function was obtained after operation without the occurrence of constipation.

Conclusions

Ascending colon patching ileorectal heart-shaped anastomosis provided the following advantages: (1) compared to left colon, right colon has a stronger capability to absorb water and electrolytes; (2) ileoanal heart-shaped anastomosis is in oblique heart shape and its aperture is wide and in different planes. It has no stenosis, with less complications and good long-term effects.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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