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Two-stage laparoscopic approaches for high anorectal malformation: Transumbilical colostomy and anorectoplasty ☆

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ABSTRACT

Background: Trans-umbilical colostomy (TUC) has been previously created in patients with Hirschsprung's disease and intermediate anorectal malformation (ARM), but not in patients with high-ARM. The purposes of this study were to assess the feasibility, safety, complications and cosmetic results of TUC in a divided fashion, and subsequently stoma closure and laparoscopic assisted anorectoplasty (LAARP) were simultaneously completed by using the colostomy site for a laparoscopic port in high-ARM patients.

Methods: Twenty male patients with high-ARMs were chosen for this two-stage procedure. The first-stage consisted of creating the TUC in double-barreled fashion colostomy with a high chimney at the umbilicus, and the loop was divided at the same time, in such a way that the two diverting ends were located at the umbilical incision with the distal end half closed and slightly higher than proximal end. In the second-stage, 3 to 7 months later, the stoma was closed through a peristomal skin incision followed by end-to-end anastomosis and simultaneously LAARP was performed by placing a laparoscopic port at the umbilicus, which was previously the colonostomy site. Umbilical wound closure was performed in a semi-opened fashion to create a deep umbilicus.

Results: TUC and LAARP were successfully performed in 20 patients. Four cases with bladder neck fistulas and 16 cases with prostatic urethra fistulas were found. Postoperative complications were rectal mucosal prolapsed in three cases, anal stricture in two cases and wound dehiscence in one case. Neither umbilical ring narrowing, parastomal hernia nor obstructive symptoms was observed. Neither umbilical nor perineal wound infection was observed. Stoma care was easily carried-out by attaching stoma bag. Healing of umbilical wounds after the second-stage was excellent. Early functional stooling outcome were satisfactory.

Conclusions: The umbilicus may be an alternative stoma site for double-barreled colostomy in high-ARM patients. The two-stage laparoscopic approaches for high-ARM, TUC and stoma closure with simultaneously LAARP are both technically feasible and safe with excellent cosmetic result.

In 2000, Georgeson et al. [1] firstly reported the laparoscopically assisted anorectal pullthrough (LAARP) for patients with high anorectal malformations (ARMs). Since 2004, we have treated high imperforate anus with LAARP which provides excellent visualization of the rectal fistula, allows for an accurate placement of the bowel through the center of the levator sling, and has also excellent cosmetic results of abdominal wall during the newborn period. Temporary colostomy was necessary for some infants with high ARMs to divert and need of the fecal stream for decompression. However, we noticed that colostomies created in the upper or lower abdominal quadrant via an abdominal incision could cause obvious scars, even using LAARP procedures [2].

Recently, the use of the umbilicus as an alternative site for temporary colostomy has been reported in children with ARMs or Hirschsprung's disease (HD) and is considered to be a feasible, safe, and produces excellent cosmetic result [3,4]. In 2005, Sauer et al. [5] created umbilical loop stoma as a preliminary procedure for complicated HD, and reported that pouching was easy and the stoma was cosmetically pleasing when reversed. In 2012, Hamada et al. [6] considered that the umbilicus may be an alternative stoma site for temporary loop colostomy in infants with intermediate ARMs, who undergo anorectoplasty via a non-abdominal approach. However, temporary colostomies have not previously been created at the umbilicus in patients with high ARMs. We describe a two-staged surgical technique for trans-umbilically double-barreled colostomy and subsequently colostomy closure followed by laparoscopic anorectoplasty in patients with high ARMs, and assess the feasibility, safety, complications and cosmetic results of this procedure.

1. Materials and methods

1.1. Patients

From May 2011 to September 2013, 20 consecutive neonates and infants (birth weight ranged from 2090 to 4110 g) were treated by

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transumbilical colostomy (TUC), subsequently colostomy closure and laparoscopic anorectoplasty were done (age ranged from 3 to 7 months) at the Department of Pediatric Surgery, Wuhan Union Hospital of Tongji Medical College affiliated to Huazhong University of Science and Technology, China. The study was commenced after ethical approval was granted by the Local Ethics Committee of the hospital. A retrospective analysis was performed for 20 patients with high ARMs as shown in Table 1. The location of the fistula was diagnosed base on the clinical presentation and magnetic resonance imaging (MRI) study. TUC was created at the transverse colon in 15 patients and the sigmoid colon in 5 patients.

1.2. Surgical procedures

After induction of general anesthesia, a circumferential skin incision was made at the umbilical cord stump. The skin, subcutaneous tissue, and fascia were cored out vertically. The umbilical vessels and urachal remnant were individually ligated and divided (Fig. 1a). A loop of sigmoid colon was identified and exteriorized through the opening in the fascia and peritoneum under laparoscopy, and identification of transverse colon through the umbilicus directly. For severe distended colon we pre-punctured the stomal site to reduce the colon size and in order to pull it out conveniently without contamination. A colostomy was created in double-barreled fashion with a high chimney more than 3 cm above the level of the skin, and the loop was divided completely at the same time. The two diverting ends both located in the umbilicus incision with the distal end half closed and slightly higher than proximal end. The interspaces between adjacent walls of two ends were closed and the bowel wall was fixed separately to the peritoneum. A polylactic acid anti-adhesive barrier film (Divine Medical technology Co. Ltd, Shanghai, China) was placed in a peristomal fashion to avoid peri-umbilical adhesions, and the deep fascia was closed with interrupted 5-0 absorbable seromuscular stitches (Fig. 1b and c).

Several months later, the stoma was closed through a peristomal skin incision followed by end-to-end anastomosis, and simultaneously laparoscopic-assisted anorectoplasty was performed by placing a 5 or 10-mm laparoscopic port in the previous colostomy site and two additional 3-mm trocars, one to the right and one to the left approximately 2 cm from the umbilicus (Fig. 2) for laparoscopic mobilization of the sigmoid colon and rectal pouch, fistula division and fistula repair. The muscle stimulator was used to contract the striated muscle complex (SMC) to detect the center of the anal sphincter. Under laparoscopic guidance, the pelvic floor channel was constructed by inserting a STEP trocar between the muscle contraction center and the pubococcygeus muscle. The distal rectal tissue was grasped and pulled down through the pelvic tunnel, and the rectum was sutured to the perineal skin (Fig. 3). The incision was washed repeatedly using 0.5% iodine and warm 0.9% normal saline while suturing. A tube was maintained in the new anus after operation. Umbilical wound was reconstructed with a subcutaneous purse string suture of 4-0 absorbable sutures leaving a central open area to create a deep circular scar resembling a normal umbilicus. Antibiotics were commenced at induction of anesthesia and continued for 72 h. Total parenteral nutrition (TPN) was used for 5 days postoperatively in all patients, and the perianal area was kept clean and dry carefully. Digital examination and serial anal dilatation were commenced 2 weeks after surgery. The follow-up protocol was bi-weekly visit for 3 months, monthly visit for 6 months to 1 year.

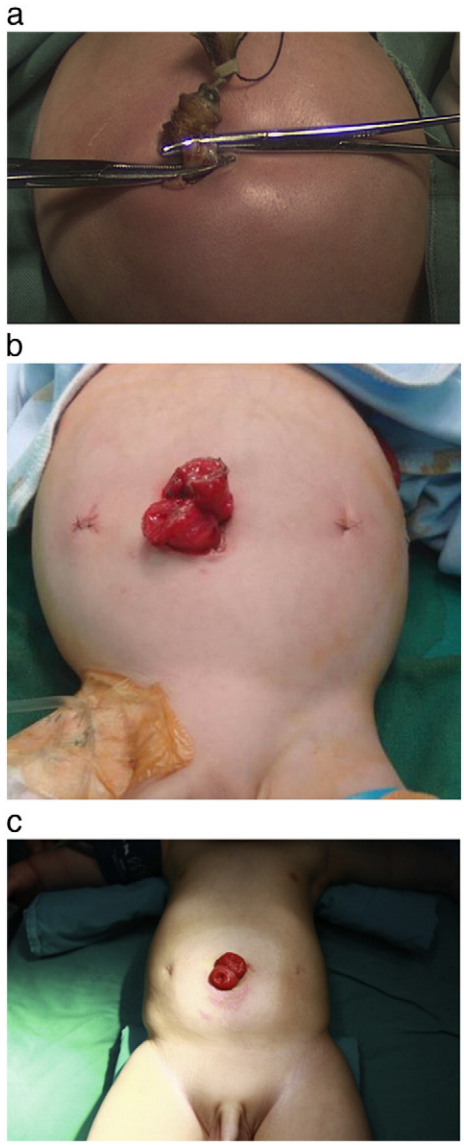

Fig. 1. Surgical technique of trans-umbilical divided sigmoid colostomy. (a) Coring out of the umbilicus at 1 day after birth, (b) divided sigmoid colostomy formation under laparoscopy, and (c) the appearance of colostomy at 5-month-old boy.

Table 1
Patients' characteristics.

No. of patient	Time at TUC (days)	Age at LAARP (months)	Type of recto- fistula	VACTERL
1	1	3	Prostatic urethra	VSD, left kidney agenesis
2	0	3	Bladder neck	Sacral bone hypoplasia, VSD
3	2	4	Prostatic urethra	ASD
4	0	7	Bladder neck	Cryptorchidism
5	1	4	Prostatic urethra	VSD
6	1	4	Prostatic urethra	Bilateral cryptorchidism
7	1	5	Bladder neck	Left kidney agenesis, cryptorchidism
8	1	4	Prostatic urethra	Meckel's diverticulum
9	3	6	Prostatic urethra	None
10	2	4	Prostatic urethra	VSD
11	1	5	Prostatic urethra	None
12	1	5	Prostatic urethra	None
13	1	4	Bladder neck	Right kidney agenesis
14	3	5	Prostatic urethra	Sacral bone hypoplasia
15	0	4	Prostatic urethra	VSD, right kidney agenesis
16	2	5	Prostatic urethra	None
17	1	7	Prostatic urethra	ASD
18	1	4	Prostatic urethra	Left cryptorchidism
19	2	3	Prostatic urethra	ASD
20	2	6	Prostatic urethra	None

VSD—ventricular septal defect ASD—atrial septal defect.
0, the day at birth; 1, 1 day after birth.