



Are cecal wrap and fixation necessary for antegrade colonic enema appendicostomy?

Antti Koivusalo*, Mikko Pakarinen, Risto J. Rintala

Children's Hospital, Department of Paediatric Surgery, University of Helsinki, 00290 Helsinki, Finland

Index words:

ACE;
Appendicostomy;
Cecal wrap and fixation

Abstract

Introduction: In antegrade colonic enema (ACE) appendicostomy, cecal fixation on the inside of the abdominal wall and cecal wrap around the base of the appendix are often performed as an antireflux procedure. Whether cecal fixation and wrap and fixation (FW) are necessary is not known. In a retrospective study, we compared laparoscopic and open procedure with FW (LACEfw+ and OACEfw+) with laparoscopic procedure without FW (LACEfw-).

Materials and Methods: Between 1997 and 2004, 44 consecutive patients underwent an ACE appendicostomy for fecal incontinence. Eleven patients (1997-2000) had OACEfw+, 14 patients (2001 to 2003) had LACEfw+, and nineteen (2003-2004) had LACEfw-. The primary disorders included meningomyelocele (n = 17), imperforate anus (n = 12), sacral agenesis (n = 1), presacral teratoma (n = 1), osteosarcoma (n = 1), diastematomyelia (n = 1), tuberose sclerosis (n = 1), Hirschsprung's disease (n = 2), Down syndrome-associated refractory constipation (n = 1), Jacobsen syndrome (n = 1), and chronic constipation (n = 1). Twenty-eight patients had undergone previous abdominal surgery. Operative time, theatre time, length of hospitalization, and complications related with procedure and stoma were compared among the 3 groups.

Results: Age and age-adjusted body mass index did not differ statistically among the 3 groups. One LACEfw+ and 2 LACEfw- were converted. The median operative time was 38 minutes (range, 23-65 minutes) for OACEfw+, 78 minutes (50-135 minutes) for LACEfw+, and 40 minutes (25-120 minutes) for LACEfw- ($P < .05$). The median theatre time for OACEfw+ was 71 minutes (range, 50-107 minutes), for LACEfw+ 123 minutes (range, 70-173 minutes), and for LACEfw+ 75 minutes (57-160 minutes) ($P < .05$). The median length of hospitalization was 6 days (range, 3-8 days) for OACEfw+, 5 days (4-6 days) for LACEfw+, and 4 days (2-9 days) for LACEfw- ($P < .05$). Stomal revisions were required in 6 of 10 patients with open ACE, 7 of 14 patients with LACEfw+, and 2 of 19 patients with LACEfw-; stomal leak occurred in 3 of 11, 3 of 14, and 0 of 19 patients, respectively. Median follow-up time was 62 months (range, 36-94 months) for OACEfw+, 28 months (25-36 months) for LACEfw+, and 9 months (1-20 months) for LACEfw-.

Conclusion: Operative time for LACEfw+ was twice as long as that of LACEfw- and OACEfw+. Hospital time was shortest in LACEfw-. Stomal complications occurred in all 3 procedures. After a medium time follow-up, it appears that FW is unnecessary for ACE appendicostomy.

© 2006 Elsevier Inc. All rights reserved.

Presented at the 52nd Annual Congress of British Association of Paediatric Surgeons, Dublin, Ireland, July 12-15, 2005.

* Corresponding author. Tel.: +358504272512; fax: +358947175314.

E-mail address: antti.koivusalo@hus.fi (A. Koivusalo).

The construction of a continent appendicostomy for antegrade colonic enema (ACE) has become a widely used treatment for patients with fecal incontinence. The procedure is relatively simple, and the use and care of appendicostomy can easily be taught to the patients and their parents. Compared with the open ACE (OACE) procedure, laparoscopic ACE (LACE) offers the advantages of minimally invasive surgery (less operative trauma, less pain, and better cosmetic result) [1-5]. We have adopted LACE as the primary technique for appendicostomy in 2001. Our original technique for ACE includes cecal wrap around the appendix and cecal fixation to the anterior abdominal wall to prevent fecal leak. In our experience, cecal wrap and fixation (FW), in association with either OACE or LACE, had not eliminated fecal leak. Since April 2003, we have, to simplify and shorten the procedure, omitted FW. In this retrospective study, we compared the open and laparoscopic procedure with FW (OACEfw+ and LACEfw+) with the laparoscopic procedure without FW (LACEfw-). We hypothesized that the laparoscopic procedure requires the same amount of theatre time, needs less hospital days, gives better cosmetic result, and has a similar incidence of complications as in the open operation. We hypothesized also that omitting cecal wrap and fixation does not increase the frequency of fecal leak.

1. Materials and methods

Between 1997 and 2004, 44 consecutive patients underwent appendicostomy for fecal incontinence. The types of the primary disorders and previous abdominal operations are shown in Table 1.

Before the procedure, all patients and their parents were informed by the surgeon and a nurse specialist. To detect any significant outlet obstruction of the distal colon, all patients underwent a contrast enema examination. The

patients were allowed to choose whether the appendicostomy would be made in the right lower abdominal quadrant or the umbilicus.

Before the procedure, the patients had a large bowel preparation with polyethylglycol. The procedure was performed in general anaesthesia. Half an hour before the incision, the patients were given a single intravenous dose of cefuroxime (30 mg/kg) or ceftriaxone (80 mg/kg), together with metronidazole (7.5 mg/kg) as antibiotic prophylaxis. The open procedure was performed by using the McBurney incision. After sufficient mobilization of the appendix and cecum, a separate inverted V-shaped skin incision was made and the abdominal wall was suitably perforated for the pull-through of the appendix. The tip of the appendix was cutoff and a Foley balloon catheter (size Ch8-Ch12) was pushed into the cecum, and the balloon was filled with water under visual control. With absorbable stitches, the cecum was wrapped round the base of the appendix with sutures and fixed on the anterior abdominal wall. The tip of the appendix was then spatulated and sutured to the skin margins of the V-shaped incision to create a slitlike appendicostomy.

The laparoscopic procedure was started by an open insertion of a 5- or 10-mm port through the umbilicus, and after insufflation with CO₂, two 5-mm ports for instruments were inserted through right and left abdominal wall. The maximal intra-abdominal pressure was set on 11 mm Hg. The cecum and the appendix were identified, and the appendix was mobilized to reach the abdominal wall. Pull-through and catheterization of the appendix and FW were done the same way as in the open procedure. In the last 19 patients, the FW was omitted.

The Foley catheter remained in place 2 to 3 weeks after OACE and LACE with cecal fixation and wrap, and 4 to 6 weeks after LACE without FW. Flushing the bowel through the appendicostomy catheter was allowed 1 week after the operation. Intermittent catheterization was started after removal of the appendicostomy catheter.

Table 1 Clinical data of 44 patients with ACE

	OACEfw+ (n = 11)	LACEfw+ (n = 14)	LACEfw- (n = 19)
Age at operation, median (range) (y)	9.3 (5.1-23.5)	9.2 (4.3-17.0)	10.4 (4.8-22.9)
Body mass index, median (range) (kg/m ²)	15.8 (11.3-24.9)	16.7 (13.4-32.0)	17.1 (13.3-35.1)
Diagnosis	Meningomyelocele (n = 3), high anorectal malformation, tuberose sclerosis, osteosarcoma (hemipelvectomy)	Meningomyelocele (n = 7), high anorectal malformation, sacral agenesis, Jacobsen syndrome, presacral teratoma, refractory obstipation	Meningomyelocele (n = 9), high anorectal malformation, Hirschsprung's disease, Cornelia de Lange's syndrome, Currarino's triad
Previous abdominal operations	7 (63%) ventriculo-peritoneal shunt (n = 3), colostomy (n = 4)	9 (64%) ventriculo-peritoneal shunt (n = 6), colostomy (n = 3)	8 (63%) ventriculo-peritoneal shunt (n = 5), coloanal pull-through (n = 1), colostomy (n = 4), augmentation of the bladder (n = 2)

Table 2 The operative time, the theatre time, and the hospital stay required for ACE appendicostomy

	Operation time median (range) (min)	Theatre time median (range) (min)	Hospital stay median (range) (d)
OACEfw+ (n = 11)	35 (23-65)	57 (50-107)	6 (3-8)
LACEfw+ (n = 14)	71 (50-135)*	123 (70-175)	5 (4-6)
LACEfw- (n = 19)	40 (25-120)	75 (57- 160)	3 (2-9)**

* OACE and LACEfw- vs LACEfw+, *P* < .05.
 ** LACEfw- vs OACEfw+ and LACEfw+, *P* < .05.

We recorded the theatre time, operative time, in-hospital time, and immediate and late complications and conversions from laparoscopic to open procedure. The reoperations (dilatations, revision, and Deflux injection) were also recorded. During the outpatient follow-up, the use of the appendicostomy was classified as follows: no problems, mild problems, moderate problems, and severe problems. The patients were also asked whether ACE improved their quality of life.

Statistical analysis was made with Stat View computer program (Statview 512 Software, Brain Power, Calabasas Microsoft, CA, USA). Nominal frequencies were compared by using Fischer’s Exact test. Numerical frequencies and means were compared by using analysis of variance or Mann-Whitney test. *P* value less than .05 was considered significant.

2. Results

Of the 44 patients, 11 (29%) had OACE with FW (OACEfw+). Fourteen (37%) had the LACEfw+ and 19 (43%) had the LACEfw-. The median age at the procedure was 9.3 years (range, 5.1-23.5 years) in OACEfw+, 9.2 years (4.3-17.0 years) in LACEfw+, and 8.5 years (4.8-22.9 years) in LACEfw- (*P* = not significant). The median body mass index of the patients was 15.8 (range, 11.3-24.9) in OACEfw+, 16.7 (13.4-32.0) in LACEfw+, and 17.1 (13.3-35.1) in LACEfw- (*P* = significant). All

44 patients chose right lower quadrant for the appendicostomy site.

Of the 27 laparoscopic procedures, 3 (11%) were converted to laparotomy. The appendix of one patient in LACEfw+ was insufficient, and a Monti-Young tube was constructed via McBurney incision. Another LACEfw+ patient was converted because laparoscopy showed excessive intra-abdominal adhesions in the right lower quadrant. One patient with LACEfw- who had previous extensive adhesions and a perforation of the small bowel occurred during the cecal mobilization. Although the perforation was amenable to laparoscopic closure, a small midline laparotomy was preferred. Another patient in LACEfw- had meningocele and scoliosis, and extremely small abdominal cavity. The small bowel lied over the cecum, and the procedure was converted to an open one.

The operation time, the theatre time, and the length of hospitalization are summarized in Table 2.

The median follow-up for OACEfw+ was 62 months (range, 62-94 months), in LACEfw+ 28 months (25-36 months), and in LACEfw- 9 months (1-20 months). Thirty-eight patients had follow-up of at least 6 months. Various problems of the appendicostomy had caused at least one reoperation in 16 (36%) of the 44 patients (Table 3). At their latest outpatient visit, 14 (32%) of the 44 patients had problems with the appendicostomy (Table 3). In 10 of the 14 patients, the problems were associated with stomal stenosis and leak. Six patients had recurring stenosis of the stoma at cutaneous/subcutaneous level despite revisions. In 6 (13%) patients (OACEfw+, n = 3; LACEfw+, n = 3), fecal leak from the stoma began a median of 4 months (range, 2-12 months) postoperatively. In 5 patients, Deflux injections into the conduit decreased fecal reflux so that 3 patients had leak only after the enema was given and 2 patients occasionally. The sixth patient (OACEfw+) with severe fecal leak underwent open procedure with lengthening of appendiceal conduit by constructing a cecal tube per continuum with the appendix. To prevent restenosing of the stoma, 9 patients used stoppers in the appendiceal conduit.

In 3 patients, the enemas had continuously failed to empty the colon properly. In 2 patients, the proper frequency of flushing and the contents of the fluid are still to be found, and 1 patient had persisting peristomal excema. In 2 patients,

Table 3 Patient satisfaction concerning the use of ACE at the latest follow-up visit (follow-up time at least 6 months in 38 of 44 patients)

	No problems	Mild problems	Moderate problems	Severe problems	Thinks ACE has improved the quality of life
OACEfw+ (n = 11)	7	1	2	1	8
LACEfw+ (n = 14)	10	1	3	0	13
LACEfw- (n = 19)	13	2	3	1	16
Total (n = 44)	30	4	8	2	37

Table 4 Reoperations for appendicostomy problems

	No revisions	One or more revisions for stenosis	Revision for excess stomal mucosa	Revision for fecal leakage (Deflux injection into conduit, n = 4, antireflux operation, n = 1)
OACEfw+	5	4	1	2
LACEfw+	8	3	0	3*
LACEfw–	11	3	0	0
Total	28	10	1	5

* Includes one patient who had conversion to open procedure and construction of Monti-Young tube because of inadequate appendix.

1 with OACEfw+ and 1 with LACEfw+ recurrent stomal stenosis were cured by insertion of a Chaid catheter into the appendicostomy. The appendicostomy of one patient with LACEfw–, although initially well functioning, has closed spontaneously because of patient neglect.

3. Discussion

The present study showed that total laparoscopic appendicostomy for ACE is feasible, even in patients who have had previous abdominal surgery. Previously, published works have also showed that the results in terms of efficacy of bowel cleansing, incidence of stomal complications, and patient satisfaction are similar for laparoscopic and open ACE appendicostomy [1-3]. Levitt et al [6] introduced the plication of cecum around appendix and reported excellent results and no stomal leakage. We adopted this technique for the first 2 groups of our series. We decided to omit FW in our most recent group of patients with laparoscopic appendicostomy because these were cumbersome and time consuming to perform laparoscopically, and they did not seem to prevent fecal leak. However, we hypothesized that a long intra-abdominal appendix cecum in situ would act as an effective antireflux barrier.

Webb et al [2] used a technique similar to LACEfw– in 8 patients. They pulled the appendix through a trocar site instead of making a separate incision. Operation time in the series of Webb et al (average, 69 minutes) was somewhat longer than in our series (40 minutes for LACEfw–). During an average follow-up of 6 months, Webb et al reported no complications. Casale et al [3] compared laparoscopic ACE (in 6 patients) with a previous series of open ACE (in 20 patients); in both techniques, FW were used. Their average operation time was 118 minutes in the laparoscopic procedure and 128 minutes in the open procedure.

Webb et al [2] and Casale et al [3] reported no complications in their laparoscopic procedures after an average of 6 months follow-up, whereas Robertson et al [1] reported a series of laparoscopic ACE (30 patients, a technique similar to LACEfw–) in which 2 (7%) of 30 patients had fecal leak. In the present study, the incidence of fecal leak in OACEfw+ and LACEfw+ was 24%. After an average of 9 months' follow-up no leaks occurred in LACEfw– groups. Because most of the leaks in OACEfw+

and LACEfw+ manifested during the first year of ACE use, it appears that appendicostomy without cecal mobilization, fixation, and wrap is associated with lower incidence of leaks. The complications of the appendicostomy opening, stricture or mucosal prolapse, seem to occur irrespective of whether open or laparoscopic technique is used. In our whole series of 44 patients, the reoperation rate for all complications (within a median of 6 months postoperative) (Table 4) was 16 (36%) of 44, which is within the range published by Dey et al [7] (41%), Marshall et al [8] (55%), and Driver et al [9] (33%).

According to our results, the laparoscopic ACE procedure without FW reduces significantly the theatre time and the duration of laparoscopic ACE procedure. Also, the hospital stay was shorter in patients in LACEip– group. These results prompted us to begin to perform ACE in selected patients (no severe associated diseases, no previous abdominal surgery, and no need to overnight in hospital) as day-surgery cases.

References

- [1] Robertson RW, Lynch AC, Beasley SW, et al. Early experience with the laparoscopic ace procedure. *Aust N Z J Surg* 1999;69:308-10.
- [2] Webb WA, Barraza M, Crump JM. Laparoscopic appendicostomy for management of fecal incontinence. *J Pediatr Surg* 1997;32:457-8.
- [3] Casale P, Grady RW, Feng WC, et al. A novel approach to the laparoscopic antegrade continence enema procedure: intracorporeal and extracorporeal techniques. *J Urol* 2004;171:817-9.
- [4] Lynch AC, Beasley SW, Robertson RW, et al. Comparison of results of laparoscopic and open antegrade continence enema procedures. *Pediatr Surg Int* 1999;15:343-6.
- [5] Karpman E, Sakti D, Kurzrock EA. Laparoscopic antegrade continence enema (Malone) procedure: description and illustration of technique. *Tech Endourol* 2002;6:325-8.
- [6] Levitt MA, Soffer SZ, Pena A. Continent appendicostomy in the bowel management of fecally incontinent children. *J Pediatr Surg* 1997; 33:138-41.
- [7] Dey R, Ferguson C, Kenny SE, et al. After the honeymoon—medium-term outcome of antegrade continence enema procedure. *J Pediatr Surg* 2003;38:65-8.
- [8] Marshall J, Hutson JM, Anticich N, et al. Antegrade continence enemas in the treatment of slow-transit constipation. *J Pediatr Surg* 2001; 36:1227-30.
- [9] Driver CP, Barrow C, Fishwick J, et al. The Malone antegrade colonic enema procedure: outcome and lessons of 6 years' experience. *Pediatr Surg Int* 1998;13:370-2.