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Original Article

Feasibility and Early Outcomes of Continent Catheterizable Stomas Using Cecal/Colon and Ileum for Children with Fecal Incontinence as an Alternative to Appendicular Malone Antegrade Continence Enema

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Conflict of Interest
No potential conflict of interest relevant to this article was reported.

ABSTRACT

Purpose: The introduction of Malone antegrade continence enema) in the management of children with fecal incontinence has brought remarkable improvement in patient care, Malone originally described appendix as a conduit and it has become widely accepted. However, surgeons are faced with situations where appendix is not available, the selection and creation of other conduit is always a challenge. We present our technique and experience with the use of alternative catheterizable conduits for antegrade continence enema (ACE).
Methods: Retrospective review of children who underwent ACE procedure in our institution from March 2009 to January 2014. The details retrieved: indication, reason for non availability of appendix, type of conduit, complications and patient's satisfaction.
Results: Five children were identified in whom the appendix was not available or suitable. In four children cecal/colon-based flap was used and in one child, ileal (Monti) segment was used to create a conduit. The mean follow-up was 3.2 years. All patients were satisfied with the procedure and no stenosis or loss of conduit was noted in the follow-up.
Conclusion: Continent catheterizable conduit for ACE can be accomplished with transverse tubularized intestinal segments and cecal/colonic flaps, with excellent outcome, irrespective of tissue used. Surgeon's preference and the patient's peculiar anatomy should determine the surgical technique to be used.

Keywords: Malone antegrade continence enema; Left-colon antegrade continence enema; Fecal incontinence

INTRODUCTION

Malone antegrade continence enema (MACE) is a well-established procedure in the management of fecal incontinence and intractable constipation. Children with neurogenic bowel especially associated with meningomyelocele and high anorectal malformation

APS Advances in Pediatric Surgery

Author Contributions

Conceptualization: S.G.; Data curation: S.S.; Formal analysis: R.S.; Methodology: J.V.; Supervision: N.B.M.; Validation: R.S.; Visualization: N.B.M.; Writing - original draft: S.S.; Writing - review & editing: S.S., G.S.

contribute to a majority of patients requiring this procedure. Appendix is the most common used conduit for construction of MACE. In situations, where appendix is not available or not suitable, the selection and creation of other conduit is always a challenge. Many different conduits have been described in literature, including Monti technique, cecal button, cecal flap, ascending colon flap and descending colon flap [1-3]. There are certain principles to guide for optimum conduit in a particular patient. We present our experience and surgical technique with the use of different intestinal segments for creation of conduit.

METHODS

We reviewed our data from March 2009 to January 2014 for children undergoing MACE procedure for fecal incontinence. The study was conducted after approval from Institutional Review Board of Indira Gandhi Institute of Child Health (IGICH), India. We assessed our data from previous records maintained by us; indications, type of conduit, complications and patient satisfaction were evaluated. For children, who underwent antegrade continence enema (ACE) procedure, the preoperative counseling and assessment of compliance was decisive. ACE was offered, once parents and child had used bowel management through enema and were agreed for the procedure. All patients were investigated with barium enema to look for anatomy of colon especially dilatation and redundancy of sigmoid.

1. Surgical technique

After full mechanical bowel preparation, child was shifted for surgery. ACE was performed through a midline laparotomy incision in supine position. After entering into the peritoneal cavity, the anatomy of small and large intestine was assessed for vascularity, mobility and for concomitant additional procedure like bladder augmentation. In situation where appendix was not suitable or not available, the procedure was initiated with mobilization of necessary bowel segment from its attachment and release of adhesions. The conduit was prepared over 10 French (10 F) catheter, using the cecum or ileum or colon. The conduit (tube) was pulled through a wound in the lower-right or lower left quadrant of the abdomen (depend upon the nearest possible distance), and a V–Y skin flap (previously marked site in sitting position) was created for stomal opening.

1) Cecal flap

The flap was based on the anti-mesenteric blood supply, junction of caecum and colon was identified, a flap of width 1.5 cm and the length of 5 cm were marked (**Figs. 1-3**). This flap was raised over stay sutures; a tube was constructed over 10 F catheter with 4-0 vicryl-interrupted sutures. Single row of sutures was placed. The defect in the colon was closed in two layers. The tubularized flap was turned on itself and imbrications done to create anti-reflux mechanism.

2) Left colonic flap

The markings for the flap were similar to the technique explained under cecal flap. The site was in the region of descending colon.

3) Monti (ileum)

The standard technique of spiral Monti was used [4]. A 3 to 3.5 cm segment of ileum was isolated in continuation of the segment harvested for bladder augmentation (**Fig. 4**). The

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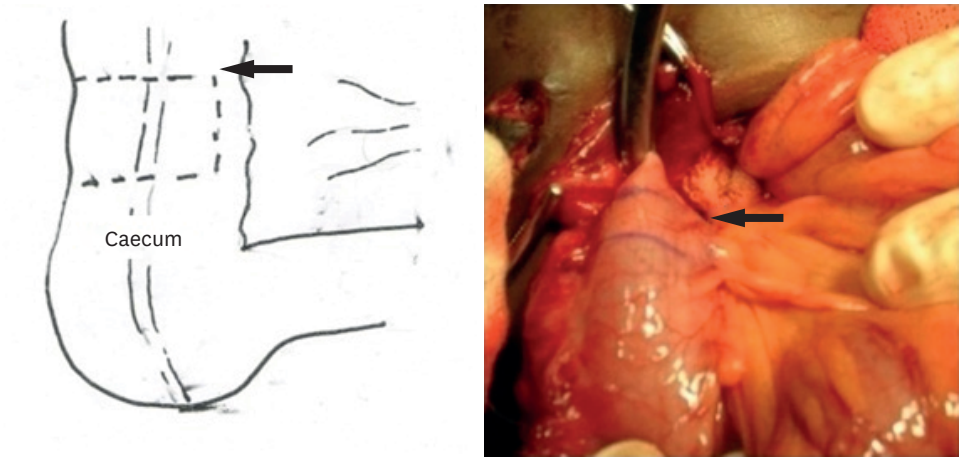

Fig. 1. Marking of cecal flap (black arrow), size 1.5×5 cm.

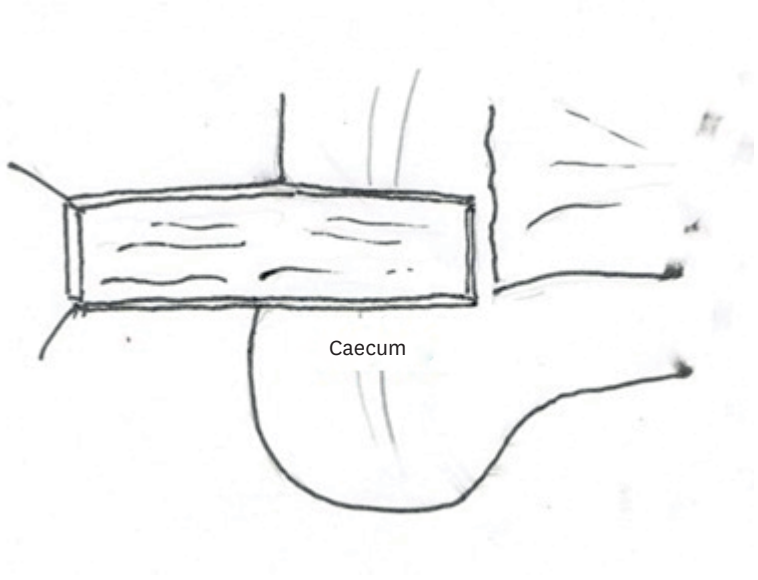

Fig. 2. Creation of cecal flap.

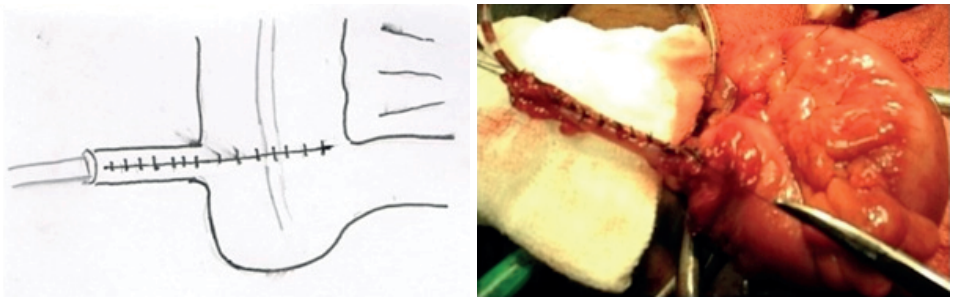

Fig. 3. Completed reconstructed conduit.

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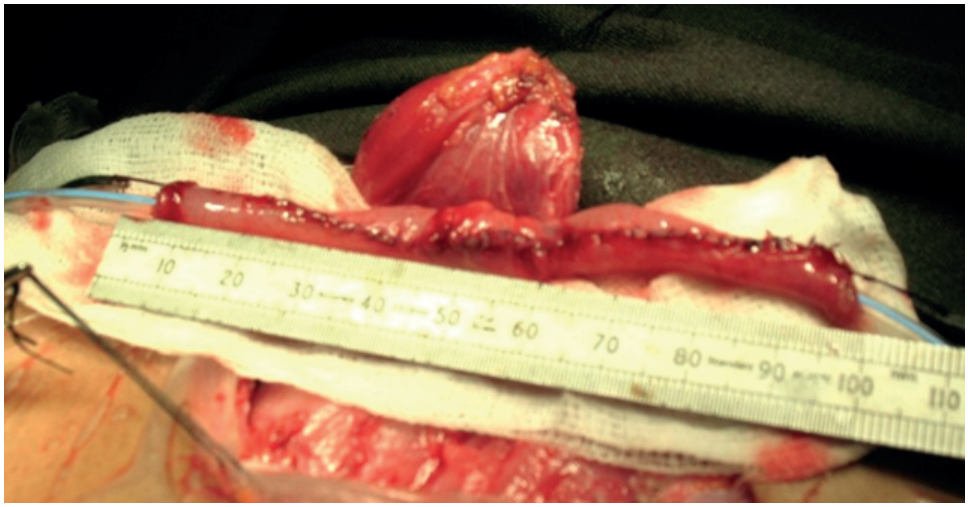

Fig. 4. Reconstructed spiral Monti ileal conduit.

tube was opened with a spiral incision; tube was reconstructed over No. 10 F catheter with single layer interrupted sutures.

2. Postoperative course and assessment

Conduit usage for enema (tap water) was done from second postoperative week; an indwelling catheter remained in the stoma for 3 weeks postoperatively. During follow-up patients were assessed for; presence of complications, volume of the enema utilized, frequency of enema, time needed for performing the enema. We also assessed degree of patient satisfaction; the patients were asked to give a score on a scale from 1 (= poor) to 10 (= excellent) to rate the improvement in their quality of life, before and after the construction of ACE, that was assessed during hospital visit or on telephonic interview. The criteria for determination of fecal continence were based on the Malone criteria [5]. Full success (totally clean, experiencing only minor leakage of the washout at night), partial success (clean but with occasional major leakage) and failure (regular fecal incontinence episodes) [5]. Improvements in bowel function after ACE were based on subjective assessments from parents as well as objective measures of decreased episodes of fecal incontinence.

RESULTS

During this study period, total of 11 children had undergone ACE procedure. Out of these, in 6 children the appendix was used as a conduit and in 5 children, appendix was not available or not suitable. The patient characteristics and postoperative results are presented in **Tables 1** and **2**, respectively. There was no intra-operative and postoperative complication. On follow-up, there were no stomal stenosis or access problems. The child in whom descending colon was used for conduit had leakage of enema fluid during the first two months postoperative. We reduced his enema fluid (tap water) from 500 mL to 250 mL and it was required twice daily to achieve continence. The other four children used enema, once in a day. The follow-up period was 1 to 5 years (range) with a median of 3.2 years. All patients were satisfied and had "full success" according to Malone criteria. All patients have experienced improvement in quality of life, the median score on satisfaction scale was 4.2 (out of 10) before surgery, and it was 7.6, post ACE.

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Table 1. Patient characteristics

Case	Age (yr)/sex	Primary diagnosis	Reason for unavailability of appendix	Type of conduit created
1	12/M	High ARM with absent sacrum	Previous appendicectomy	Descending colon flap
2	5/F	MMC with bowel and bladder involvement	Used for Mitrofanoff	Cecal flap
3	8/M	MMC with bowel and bladder involvement	Used for Mitrofanoff	Cecal flap
4	10/F	MMC with bowel and bladder involvement	Unsuitable appendix	Ileal tube; Monti technique
5	6/M	High ARM	Previous appendicectomy	Cecal flap

ARM, anorectal malformation; MMC, myelomeningocele.

Table 2. Postoperative results

Case	Type of conduit	Complication	Enema frequency	Enema volume (mL); duration (min)	Leak from rectum	Leak from stoma
1	Descending colon flap	Nil	Twice daily	250; 15–20	No	No[a)]
2	Cecal flap	Nil	Once daily	500; 20–30	No	No
3	Cecal flap	Nil	Once daily	500; 20–30	No	No
4	Monti tube	Nil	Once daily	500; 30	No	No
5	Cecal flap	Nil	Once daily	500; 20–30	No	No

[a)]Initially it was present then subsides gradually.

DISCUSSION

Malone originally described the antegrade enema procedure and the appendix is organ of choice for creating catheterizable conduit, in situations where appendix is not available, many alternatives have been described as a substitute for appendix [5-7]. There has been concern regarding the utilization of colon or ileum for creating conduits. These are mainly due the occurrence of complications requiring revisions and the durability of the conduit for repeated catheterization in long term. Wound infection, stomal stenosis and stomal leak were the commonest complications reported [6,7].

The main complication described to be associated with colonic flaps has been stomal stenosis. The incidence of stomal stenosis with colonic flap is reported as high as 70% [8,9]. We did not encounter any stenosis in the four children who had colon based conduits in our limited follow-up. Other complications described in the literature include flap necrosis, leak of fecal material from stoma, infection, obstruction and development of granulation tissue [8-10]. We also encountered stomal leakage of enema fluid in a child with descending colon flap and child responded to the reduced volume of enema. Another difficulty that can be encountered with colonic flap is deficiency of length. This may be a relative contraindication in obese children, where an ileal conduit may be preferred. A review of left-colon antegrade continence enema (LACE) literature concluded that results of LACE procedures are encouraging, especially in light of the lower amount of enema fluid required, the quicker enema transit time and fewer complications [3]. Overall outcome is comparable to that of ACE procedure. The only disadvantage with left colonic conduit was twice daily requirement of enema. Otherwise, the left colon is the more physiologically appropriate location, with a decrease in the risk of water absorption as well as a decrease in the time required for enema administration and washout, thereby more chance of increasing patient satisfaction and compliance. The enema performed in right colon often is long and tedious for handicapped patients, as the volume of washout from the cecum to the rectum is large.

Ileum (Monti technique) has been described as an alternative to appendix; concern is the excessive secretion of mucus from the stomal site has been reported for utilization of ileum

[4]. Another disadvantage of using ileum could be the requirement of an additional bowel anastomosis. In our patient we harvested the graft in sequence with the ileum utilized for bladder augmentation, hence there was no need for additional anastomosis.

In a review of 282 patients undergoing MACE procedure, majority of patients received appendicular conduit, an equal number of patients underwent ileal or colonic based conduits. They had not found any conduit technique inferior to the other [2]. The only identifiable problem was an early occurrence of stomal stenosis in children undergoing colonic flaps.

The points to be considered for choice of conduit in the absence of appendix are; underlying disease, patient symptoms (incontinence or constipation), body habitus of patient, redundancy of sigmoid colon, anal sphincter tone and requirement of concomitant procedure like bladder augmentation and Mitrofanoff. The primary outcome measure in this study was the successful use of ACE in managing symptoms, determined by continued use at follow-up, although it is not the ideal measure to assess improvement in symptoms.

In conclusion, continent catheterizable conduit for ACE can be accomplished with transverse tubularized intestinal segments and cecal/colonic flaps, with excellent outcome, irrespective of tissue used. Surgeon's preference and the patient's peculiar anatomy should determine the surgical technique to be used.

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