Tap Water Left-Sided Antegrade Continence Enema Based On the Monti's Principle: A Suitable Alternative for the Fecally Soiled Child in a Developing Country?

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Background/ Purpose: In developing countries, conservative management of fecal soiling with intractable constipation often fails in a large proportion of children primarily due to lack of a constant supply of medications. The Malone antegrade continence enema (MACE) has provided independence and improved quality of life in this patient population, nevertheless, the long washout times, the unpredictable bowel movement and abdominal cramps are cited as drawbacks of the classic right-sided access. Herein we present our experience with a variation of this principle utilizing the left colon as a source of intestinal conduit and enema delivery portal with tap water as the sole irrigant. Our aim is to further validate the utility and feasibility of this recent modification to the classic MACE in our patient population with special reference to the negative socio-economic impact of managing this devastating problem in a developing country.

Materials & Methods: From February 2003 to March 2006, we operated 23 children (11 boys, 12 girls, mean age 11.6±2.5 years, range 8-17) with organic intractable constipation and fecal soiling who failed conservative management. Original diagnosis was; neural tube defect (16), high anorectal malformation (4), persistent Cloaca (2) and perineal trauma (1). A left antegrade continence enema (LACE) was constructed utilizing the Monti’s principle by detaching a ring of the left colon on its vascular pedicle, opening it at the antimesenteric border followed by longitudinal resuturing to create a long tube which is implanted in an antireflux tunnel to the left colon, and brought to the skin level on a VQZ stoma. Continence washouts were started 3 weeks thereafter with plain tap water. Assessment included washout volume, duration, spacing, ability to sustain soiling-free intervals, complications, enema related symptoms and the impact of the procedure on the lifestyle of the child.

Results: Twenty-two patients where available for follow up (16.7±7.5 months, 5-30). Enema volume, duration and spacing were 776.3±315.5 cc (400-1500), 23.4±11.8 minutes (10-60) and 1.8±0.7 days (1-3) respectively. Mean duration for adjustment was 3.6±1.7 months (1.5-8). LACE related complications occurred in 5 (23%) patients (1 distal necrosis and fecal fistula, 2 proximal stenosis, 1 stomal stenosis, 1 intestinal obstruction). Fifteen (68%) achieved full fecal continence, 4 (15%) had occasional “accidents” and 3 (14%) remained incontinent and diaper dependant. None had symptoms suggestive of hyponatremia from tap water. Overall, 19 patients (83%) reported improvement in their quality of life.

Conclusion: In a motivated child, the LACE is an effective procedure for the problem of intractable constipation and fecal soiling. Addressing the left colon allows shortening of enema volume and duration, reduces enema related symptoms and offers a predictable bowel evacuation. Tap water is a safe, cheap and readily available irrigant that allows more compliance with the irrigation regimens in developing countries. The Monti’s principle offers an efficient durable conduit and obviates the need for the currently popular stoma buttons with their high cost and need for regular replacement. Affected Children in developing countries can benefit from this procedure in their battle against a devastating pathology in a resource-constrained environment.

Index Word: Left antegrade continence enema, Monti, MACE, fecal incontinence, constipation, children
INTRODUCTION

Ecal soiling is a major psychological and social handicap for the severely constipated child. In this age group, patients affected are usually victims of neural tube defects, polyoperated high anorectal malformations and Hirschsprung’s disease, or pelvic floor injuries involving the sphincter complex leaving the child simply with a “perineal colostomy”. Conservative management of these children include dietary modification with high residue diet, bulking agents, stool softeners, suppositories and fleet enemas on regular timed basis. Nevertheless, a large proportion fails to respond adequately to these regimens in spite of adequate compliance. Even in those fortunate few with successful bowel management, the issue of independence from their guardians starts to surface as the child goes into adolescence. This is frequently pronounced in the neural tube defect population who are mostly wheelchair-bound and have difficulty to access their perineum to perform a successful enema.

In the Early 1990’s, a major step forward in managing these children was introduced by Malone et al describing the concept of an “Antegrade Continence Enema” otherwise known as the MACE. Inspired by the Mitrofanoff principle in continent urinary diversion, the appendix is used to create a continent catheterizable access to the cecum where a catheter introduced through the skin stoma delivers an irrigant solution to flush the colon in an antegrade manner. This revolutionary concept not only allowed evacuation and cleaning of the colon on predetermined timings, but as well, provided an easier access for enema delivery, that can be performed by the child himself while sitting on toilet independent from his caretaker. With increased experience, several issues have surfaced, the appendix, as the originally described conduit, is sometimes found either of limited utility being extremely short, previously excised, or is mostly utilized in a concomitant or a previous Mitrofanoff procedure. Among the solutions proposed to address this problem, Monti et al described a technique in which a ring from the gastrointestinal tract is detached on its feeding vessels, opened it on its antimesenteric border, retubularized longitudinally over a catheter, tunneled in an antireflux manner into the reservoir wall and exteriorized to the skin level as a continent catheterizable channel.

The classic MACE is often long and tedious for handicapped children, as the volume of washout from cecum to rectum is usually appreciable especially in neuropathic bowel of patients with neural tube defects. In 2002, Liloku et al proposed constructing a left-sided access to shorten the duration of these enemas. Their initial results were encouraging and have been followed by few other reports citing the less duration of enema and a more predictable bowel movement compared to the classic right-sided continence access.

Herein we present our experience with the left antegrade continence enema (LACE) based on the Monti’s principle and utilizing tap water as the sole irrigant fluid, with special consideration to the negative socio-economic impact of managing children with severe constipation and fecal soiling in a developing country.

PATIENTS AND METHODS

Patient Population: From February 2003 to March 2006, 23 children suffering from severe constipation and fecal incontinence, refractory to conservative management, underwent creation of a LACE utilizing the Monti’s principle in conduit reconstruction. Eleven patients were boys and 12 were girls. Mean Patient age was 11.6±2.5 years. The original diagnosis was neural tube defect (13 Meningomyelocele, 2 sacral agenesis, 1 Diastomatomyelia), high anorectal malformation (4), persistent cloaca (2) and perineal trauma(1). All patients were diaper dependent among which 13 (57%) were socially regressed and failed proper scholastic achievement primarily due to their fecal soiling problem.

Patient Preparation: Counseling of children and their guardians was performed on several preoperative visits to explain the potential and expectations of the procedure, and to forecast the motivation of the child and his family for acquiring full social cleanliness as well as dryness especially in the neural tube defect population. The child is admitted 2-3 days before the procedure for stool disimpaction and a formal bowel preparation.

Technique: A schematic presentation of the key operative steps is shown in Figure 1. The procedure is performed using a midline abdominal incision,
mobilizing the left colon from the splenic flexure down to the proximal sigmoid. A ring (donut) of the proximal left colon, 2-3 cm in length (Figure 1A,1B & 2) is isolated on its vascular pedicle ensuring the presence at least 2 feeding vessels within. The donut is then opened at its antemesenteric border creating a rectangle (Figure 1C& 3) which is tubularized longitudinally over a 14F Nelaton catheter by running absorbable suture sparing 1 cm at both ends, thus creating a conduit of 11-13 cm in length with a bipolar V-shaped configuration (Figures 1D& 4). The vascular pedicle is made to pass lateral to the colon. A 4 cm T-shaped seromuscular incision is then performed on a suitable Tenia of the proximal left colon with undermining of the edges (Figure 5), followed by opening the colonic mucosa at the transverse limb of the T, and performing an anastomosis between the proximal end of the conduit and the colon with interrupted absorbable sutures over the 14F Nelaton catheter. The seromuscular flaps are then closed over the proximal part of the conduit creating a 3-4 cm antireflux tunnel (Figures 1E & 6) followed by a colocolic anastomosis restoring intestinal continuity. The distal end of the conduit is tunneled in the anterior abdominal wall of the left upper quadrant, and anastomosed to the skin utilizing Ransley’s VQZ flap technique which produces a wide stoma with a submerged mucocutaneous anastomosis (Figure 7).

The colon is fixed to the anterior abdominal wall by several interrupted sutures to avoid traction and kinking of the conduit and a drain is left near the area of the anastomosis. The 14 F catheter was kept in for 3 weeks. In 4 patients with deficient colonic length and/or extensive adhesions (1 cloaca, 2 anorectal malformations, 1 reoperative), an ileal rather than a colonic Monti’s conduit was utilized following the same principles and exteriorized to the left lower quadrant.

Follow up: After discharge, the patients returned within 3 weeks from the procedure. The Nelaton tube is removed and the conduit is calibrated. A Gastrographin study is done to confirm the position of the new tube in the colon. The child and guardians are instructed to start daily irrigation with 200-300 cc of tap water and further adjust the volume and frequency according to the individual response of each patient (with a ceiling of 1000 cc /day unless otherwise instructed by the treating surgeon). The enema was delivered while the child is sitting on toilet using a 60cc syringe or by gravity. The enema timing was instructed to be late in the afternoon to allow passage of post-enema leakages overnight, so that the child is anticipated to be totally clean the following morning. Irrelevant to the enema frequency, the child/caretaker are asked to calibrate the stoma once daily as a routine, aiming to reduce the incidence of stomal stenosis. Follow up visits were arranged every 2-3 months in the first 6 months and 4-6 monthly thereafter. The treatment outcome is evaluated in terms of enema volume, duration (time on toilet from enema administration to evacuation), spacing, duration for adjustment, number of accidents or frank soiling episodes in the last month of follow up, difficulty in catheterization, development of abdominal cramps and finally the ability to reintegrate back to social activities. The procedure is considered successful if after a period of adjustment, it enables the child to acquire a clean perineum in a predictable pattern most of the time by regular timed evacuation of the colon through the LACE. Published reports utilizing the same technique and including complete sets of data were tabulated for comparative purposes. Whenever appropriate, data are presented as mean ±SD (range)

When the LACE was part of a total continence procedure involving a concomitant bladder augmentation, Mitrofanoff procedures and bladder outlet reconstruction, the LACE came last in order. Construction of the skin stoma for both the LACE and the Mitrofanoff was performed as a final step to avoid unnecessary traction on the conduits by the abdominal retractors. In the neural tube defect patients with Venticuloperitoneal shunts, the shunt was wrapped at the beginning of the procedure with gauze soaked with Gentamycin and Metronidazole to avoid its contamination during the procedure.
Fig 1. Schematic presentation of the LACE-Monti procedure: A) Marking of a 2-3 cm ring at middle the left colon after mobilization. B) The ring is detached on its vascular pedicle. C) Opened at the antemesenteric border creating a rectangle. D) Longitudinal running suture stopping 1cm short of its ends creating a conduit 11-13 cm in length, a 4 cm T shaped seromuscular incision in Tenia of proximal colon with undermining of its edges. E) Anastomosis of proximal end of conduit to the continence mucosa at the transverse limb of the T and closure of the seromuscular flaps over it creating a 3 cm antireflux tunnel. Distal end brought to skin level with a VQZ stoma. Colocolic anastomosis completes the procedure.

Fig 2. The donut is detached from proximal left colon on an adequate vascular pedicle.

Fig 3. Opening of the antemesenteric border creating a 2.5×11 cm rectangle. Inset shows completed tubularization over a 14F catheter.
RESULTS

Mean Follow up was 16.7±7.5 months (5-30). One patient was lost after one postoperative visit making 22 patients available for analysis at long term. In 14 patients (61%) with neuropathic bladders, concomitant procedures on the urinary tract level were performed including; ileal bladder augmentation, Mitrofanoff procedure and bladder outlet reconstruction, aiming collectively to reduce the intravesical pressure and achieve dryness.

Postoperative complications related to the LACE occurred in 5 patients (23%). One girl had distal conduit necrosis and breakdown with formation of a stomal abscess. It was drained leaving a fecal fistula that closed spontaneously after 4 months of watchful waiting. She underwent reconstruction of a LACE in the distal left colon by an ileal Monti’s conduit exteriorized through the left lower quadrant. One boy had stenosis at the skin stoma that underwent dilatation and eventually required surgical revision by a Y-V plasty. Two patients experienced difficult catheterization from stenosis at the proximal anastomosis. They underwent endoscopic assessment and were dilated over a guide wire and an indwelling catheter was left for 6 weeks, followed by removal and daily dilatation by the child/guardian at home with a favorable response. One boy developed adhesive Intestinal obstruction 3 months after the procedure. He failed to respond to conservative...
management and underwent exploration and adhesiolysis with an uneventful recovery.

In all patients, tap water was used as the irrigant fluid. 15 patients (68%) achieved full fecal continence, 4(15%) had occasional “accidents” or frank soiling episodes and 3 (14%) remained incontinent and diaper dependant in spite of improvement of their constipation. In the 19 patients (83%) who achieving “satisfactory” cleanliness, the enema volume, duration and spacing were 776.3±315.5 cc (400-1500), 23.4±11.8 minutes (10-60) and 1.8±0.7days (1-3) respectively. The mean duration for adjustment was 3.6±1.7 months (1.5-8).Three patients (13.6%) experienced tolerable abdominal cramps with the enema, in 2 of them these have ceased after warming water before administration. Four patients (18%) experienced occasional regurgitation of fecal matter and/or gas leaks through the stoma.

By end of follow up, 11 out of 13 socially regressed children have shown a positive attitude and were integrated back to school and other group activities. Overall, 19 patients/caretakers (83%) expressed a definite improvement in the quality of life due to the procedure. Patient demographics and summary of results are shown in Table 1.

**DISCUSSION**

Fecal incontinence has a significant negative impact on the social confidence and well-being of children with organic intractable constipation. Conservative regimens for management employ a combination of dietary modification, bulking agents, stool softeners and rectal enemas on regular timed basis. However, these are prone to failure for various reasons of which non-compliance and lack of motivation come first on the list. The need to acquire cleanliness for those patients living in developing countries is by no means different from their peers in the developed world. Given the fact that patient/caretaker motivation and continued commitment are indispensible in management of this devastating problem, the constrained resources make it difficult for many of them to obtain a regular supply of these medications, forcing the child to go back to “square one” once the treatment is interrupted. Such a demoralizing situation often translates with time to lack of interest, an introversive attitude and social segregation in spite of an initial high compliance potential.

The introduction of the antegrade continence enema concept by Malone et al has opened a new chapter in the management of affected children. By allowing colonic evacuation at regular intervals, the child can typically acquire most of the time a soiling-free status. Furthermore, with the readily accessible stoma for enema delivery on the abdominal wall, the patient can reclaim autonomy and independence from his caretakers. However, the significant experience accumulated worldwide with the technique has shown some limitations of the classic MACE. These are primarily related to the fact that, the irrigant fluid has to traverse two areas well known for their high compliance, namely the cecum and the sigmoid, which results in long and tedious washout times and somehow less predictable bowel movement. To address this problem, Liloku et al proposed the left colonic access for enema delivery assuming that clearance of the left colon and sigmoid would be sufficient for the child to have soiling-free intervals. Their preliminary results were encouraging with 83% success rate. The utility of this concept in shortening the irrigation time and a more knowable bowel behavior has been further confirmed by other reports in recent literature.

Motivated by its proposed advantages, we adapted the left colonic access for antegrade enema construction. The success rate in this series (83%) compared favorably with others reporting the classic MACE (61-99%). The mean enema volume of saline or water reported with the classic access ranged from 1000-1500 cc with some extremes in other series, either reporting smaller mean volumes when additive phosphate enema is utilized, or using an average of 3 liters of tap water. In our cohort of patients, the mean volume requirements were relatively less (776.3±315.5 cc, 400-1500), and the duration of enema appeared to be relatively shorter (23.4±11.8 minutes 10-60) compared to MACE patients (30 minutes,10-90). The frequency of the enema however, did not increase in comparison to that reported with MACE (2 days, 1-4). This is actually advantageous to the child’s commitment and compliance with the regimen employed. Our results as well compare favorably to other reports utilizing the same technique for LACE construction with regard to the success of bowel management, toll of complications and reduced incidence of abdominal cramps. (Table2).

To establish a permanent continent access to the left colon, three options are available so far; button devices, colonic flaps and the Monti’s reconfigured bowel tubes. Buttons may be placed by either a
They are usually employed in patients who do not require laparotomy for simultaneous reconstructive procedures. In spite of some annoyances like dislodgement and gas/fecal leak beneath the buttons, their functional results are found comparable to the original MACE procedure.23,28 The use of these low profile buttons is popularized in North America23,24,26,27 and in Europe,25,28 unfortunately the cost of these devices, and the need for regular replacement every few months have made them fall out of favor when considering LACE for our cohort of patients. Colonic flaps have been successfully used as continent conduits with the LACE,29 nevertheless, a high rate of stomal stenosis was encountered (45%). This might be attributed to the fact that the conduit is created from merely half or less of the bowel circumference, and part of its length is consumed in creation of the antireflux tunnel which might compromise its effective span from the colonic wall to the skin and incur tension on the mucocutaneous conduit to be anastomosed in the deep subcutaneous tissue rather than at the skin level.1

This bridging effect relieves an otherwise inevitable tension in this particular situation. However in this regard, it should be emphasized that design of the skin stoma is only one factor contributing to the survival and “well-being” of the conduit. We fully agree with Churchill et al6 in stressing that accurate harvest of the bowel for bowel irrigation. Stomal stenosis (4.5%, 1/22) has responded favorably to endoscopic manipulation and prolonged intubation during which both patients were able to use the conduit effectively.20

The toll of complications requiring reoperation was 23% (5/22). Most of these were dealt with on ambulatory basis. Proximal conduit stenosis (9%, 2/22) has responded favorably to endoscopic manipulation and prolonged intubation during which both patients were able to use the conduit effectively for bowel irrigation. Stomal stenosis (4.5%, 1/22) required eventually a Y-V pasty which is again a short one day procedure. Nevertheless, in the case of distal conduit necrosis that developed a fecal fistula, prolonged hospitalization was needed for conservative management and a subsequent redo procedure. Similar cases of serious complications as stomal closure,7 or frank necrosis with fecal peritonitis have been reported.4 Albeit their relative low incidence and the eventual successful outcome in most, they exhibit the high-end of the morbidity potential of these procedures. Taking this in consideration and to the fact that an appreciable number of patients require a concomitant lower urinary tract reconstruction, which has its complications by its own right, we believe that it must be shown that candidate patients and their caretakers are highly motivated to improve their lifestyle, and should be well informed beforehand about all possible complications. This cannot be more emphasized in counseling children and adolescence in whom acquisition of full social continence for urine and stool is the sole indication to operate rather than upper urinary tract salvage per se. Twenty-three patients operated at three tertiary referral centers, with a rate of only 2-3 patients/center/year attests to careful adherence to this policy.

Stomal stenosis is often described as the commonest complication with continent catheterizable conduits (10-41%).13,31,33 The rate is higher in those used for antegrade continence enema than in those for Mitrofanoff procedure.12,18 A contributing factor might be the superior frequency of catheterization with the latter acting as an “autodilatation”. Stomal stenosis has been much reduced in this series (1/22, 4.5%). We instructed our patients to daily calibrate their stomas irrelevant to frequency of irrigation. Utilization of Ransley’s VQZ technique might be contributing as well.4,34,35 Interestingly, we observed that this technique offered a special advantage in the obese child where on occasions; the conduit reaches the skin level with tension. The skin flaps, designed generously enough, allowed the distal end of the conduit to be anastomosed in the deep subcutaneous tissue rather than at the skin level. This bridging effect relieves an otherwise inevitable tension in this particular situation. However in this regard, it should be emphasized that design of the skin stoma is only one factor contributing to the survival and “well-being” of the conduit. We fully agree with Churchill et al6 in stressing that accurate harvest of the bowel for bowel irrigation. Stomal stenosis (4.5%, 1/22) has responded favorably to endoscopic manipulation and prolonged intubation during which both patients were able to use the conduit effectively for bowel irrigation. Stomal stenosis (4.5%, 1/22) required eventually a Y-V pasty which is again a short one day procedure. Nevertheless, in the case of distal conduit necrosis that developed a fecal fistula, prolonged hospitalization was needed for conservative management and a subsequent redo procedure. Similar cases of serious complications as stomal closure,7 or frank necrosis with fecal peritonitis have been reported.4 Albeit their relative low incidence and the eventual successful outcome in most, they exhibit the high-end of the morbidity potential of these procedures. Taking this in consideration and to the fact that an appreciable number of patients require a concomitant lower urinary tract reconstruction, which has its complications by its own right, we believe that it must be shown that candidate patients and their caretakers are highly motivated to improve their lifestyle, and should be well informed beforehand about all possible complications. This cannot be more emphasized in counseling children and adolescence in whom acquisition of full social continence for urine and stool is the sole indication to operate rather than upper urinary tract salvage per se. Twenty-three patients operated at three tertiary referral centers, with a rate of only 2-3 patients/center/year attests to careful adherence to this policy.

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By using tap water as the exclusive irrigant fluid, we were able to cut down the expenses of phosphate enemas and saline supply. Although commonly used, lethal and near lethal incidences of hyperphosphatemia/hypocalcaemia have been associated with sequential delivery of phosphate enemas.\textsuperscript{36-38} Another commonly used irrigant is homemade saline which is considered as a cheap and readily available alternative, but on occasions as well has been reported to cause fatal hypernatremia\textsuperscript{39} Tap water has been shown to be a safe irrigant in large series utilizing the classic MACE.\textsuperscript{40, 41} Nevertheless, some reports gave a high incidence of fatigue (87.5\%) and headache (21\%) due to hyponatremia especially with large volumes mounting up to 3 liters or more.\textsuperscript{16, 42} In our group of patients, none experienced these symptoms. Abdominal cramps were reported with high incidence in some series with the MACE up to 85\%,\textsuperscript{43} and cited as the cause for abandoning irrigation.\textsuperscript{10, 33, 42} Three patients in the current series (13.7\%) experienced cramps of which two were relieved after warming water. Comparatively, other reports with same technique\textsuperscript{4, 7} had as well a low incidence of cramps with a range of 0-21\% (Table 2). The lower volumes of irrigant installed, the exclusion of a large area of the colon from the washout, and the proponing effect of gravity with the LACE would offer a reasonable explanation for reduction in enema related symptoms.

An improvement in the quality of life should be the endpoint and is the ultimate aim of the procedure. Indeed 19/22 of patients (83\%) reported satisfaction with the LACE. The basic issue in all patients receiving this form of treatment is that each represents an individual trial and error system. Caretakers should be informed that considerable experimentation, time and patience are needed to reach an optimal regimen for enema delivery. In our cohort of patients, the period of adjustment was 3.6±1.7 months (1.5-8). Interestingly, in spite of rigorous patient selection, a boy with sacral agenesis further refused to continue using his enema although he had a “successful procedure” with easy catheterization and 2 days of soiling-free intervals, reflecting an example of poor patient motivation. On the contrary, another who “failed” to adjust his enema to complete cleanliness and remained technically incontinent has expressed satisfaction with improvement in his constipation, less abdominal distention and avoiding major soiling episodes of his diapers in public. These two patients, along with similar scenarios reported in literature\textsuperscript{33, 42, 44, 45} act as instructive cases that exhibit the variation in satisfaction among this population. We have learned that application of the standard of “full” continence per se may be defied by some of them. A highly motivated child and family are the cornerstone for success, meanwhile, significant improvement rather than perfection might be the realistic expectation, consequently; we believe that candidate patients and their families should be counseled accordingly.

**CONCLUSION**

The LACE appears be a valuable treatment option for the problem of intractable constipation and fecal soiling in children. It targets the stool where it is hardest, benefits from gravity and bypasses the right and transverse colon with utilization of less irrigant volumes, shorter duration, less enema related cramps and a predictable bowel evacuation. The utilization of tap water as a safe, cheap and readily available alternative, allows more compliance with the irrigation regimen for children residing in developing countries. The Monti’s principle offers a feasible and durable conduit that obviates the need for stoma buttons with their relatively expensive cost and need for regular replacement. Indeed, the LACE with Monti’s conduits has received high praise from our patients and their families after years of battling constipation and fecal incontinence in a resource-constrained environment.
Table 1. Demographics and summary of results for 23 patients included in the study.

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<th>Duration (min)</th>
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Abbreviations: MMC: Meningomyelocele, HARM: High Anorectal Malformation, DMM: Diastomatomyelia, SA: Sacral Agenesis, PT: Perineal Trauma, PC: Persistent Cloaca, CM: Continence Monti, IM: Ileal Monti, IC: Ileocystoplasty, MFF: Mitrofanoff Procedure, BOR: Bladder outlet reconstruction. NA: Not applicable *Distal necrosis of the continence Monti reoperated by an ileal Monti to distal left colon and exteriorized to left lower quadrant. ** Occasional leak of gas and/or fecal material from the stoma. *** abandoned the enema at last follow up due to lack of motivation.
Table 2. Series in literature utilizing the LACE-Monti procedure compared to current series.

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<tr>
<th>Reference</th>
<th>Number of patients</th>
<th>Age (Y)</th>
<th>Irrigant used</th>
<th>Volume (cc)</th>
<th>Duration (min)</th>
<th>Spacing (D)</th>
<th>cramps</th>
<th>Conduit Complications</th>
<th>Success Rate% (no)</th>
<th>Follow up (m)</th>
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<tr>
<td>Liloku et al[4]</td>
<td>7</td>
<td>13.4±4.8 (8-21)</td>
<td>Saline</td>
<td>331.7±109 (200-500)</td>
<td>19.2±13 .2 (10-45)</td>
<td>2.3±0.5 (2-3)</td>
<td>None</td>
<td>Conduit necrosis(1)</td>
<td>Stomal stenosis(1)</td>
<td>85.6%(6) 8.1±6.4 (1.5-17)</td>
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<td>Churchill et al[6]</td>
<td>18</td>
<td>13.3±9 (2-33)</td>
<td>Saline</td>
<td>360±216 (50-850)</td>
<td>18±12 (5-60)</td>
<td>1.1±0.6 (0.5-3)</td>
<td>17.6%(3)</td>
<td>Stomal closure(1)</td>
<td>Stomal stenosis (2)</td>
<td>83%(15) 24±9 (1-35)</td>
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<td>Ahn et al[5]</td>
<td>10</td>
<td>9.7±7.2 (3-25)</td>
<td>Saline</td>
<td>308±202 (80-800)</td>
<td>23±9.1 (10-30)</td>
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<td>Stomal Stenosis(1)</td>
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<td>90%(9) 6±4.6 (1-14)</td>
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<td>Kim et al[7]</td>
<td>19</td>
<td>10±8 (3-34)</td>
<td>Saline</td>
<td>731.6±355.5 (250-1500)</td>
<td>28.7±12 .6 (15-60)</td>
<td>1.8±0.8 (0.3-3)</td>
<td>21%(4)</td>
<td>Stomal closure (2)</td>
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<td>73.7%(14) 20.7±9.7 (3-37)</td>
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<td>Current series</td>
<td>23</td>
<td>11.6±2.5 (8-17)</td>
<td>Water</td>
<td>776.3±315.5 (400-1500)</td>
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<td>1.8±0.7 (1-3)</td>
<td>13.6%(3)</td>
<td>Distal conduit necrosis (1)</td>
<td>Stomal stenosis (1) Proximal conduit stenosis (2) Intestinal Obstruction(1)</td>
<td>Total 5 (23%) 16.7±7.5 (5-30)</td>
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</table>

REFERENCES


