

Continent urinary diversion with short appendices in obese patients: the initial results of a surgical option

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Abstract: Introduction: Many patients need to be submitted to a continent urinary derivation surgery. Lost of bladder compliance secondary to neurogenic bladder injuries, severe and untractable urethral stenosis are some of the main indications. We present here the initial results and outcomes of twelve procedures performed using the association between Mitrofanoff's principle and Monti's technique as a surgical option for a continent urinary diversion in patients with short appendices or obese. Materials and Methods: We analyzed data from twelve patients who were submitted to ileocistoplasty and urinary continent derivation by association between Mitrofanoff's principle and Monti's technique performed from January 2009 to December 2012 in our institution. In all patients the appendices were too short to reach the skin, some of them, because of the obesity. Results: Twelve patients were submitted to the Mitrofanoff and Monti techniques association. The most common surgical complications were stoma skin stenosis (02 cases) and urinary leakage through the re-opened bladder neck in 02 patients. Urinary infection (01 case) was the main clinical complication. Eleven patients are totally adapted to intermittent clear catheterization through the navel and satisfied with urinary continence and quality of life. There were no deaths and no urinary or intestinal fistulas secondary to the procedure. Conclusions: The association between Mitrofanoff's principle and Monti's technique is safe, feasible and a very useful alternative in urologic cases, (i.e., severe and untractable urethral stenosis and low compliance neurogenic bladder, for example) of continent urinary diversion, when the ileocecal appendix is too short to reach the skin (i.e., obese patients).

Keywords: Mitrofanoff, Principle, Monti, Technique, Bladder Augmentation, Urethral Stenosis, Continent Urinary Diversion

1. Introduction

The management of neurogenic micturitional dysfunction and urinary incontinence has been revolutionized by the introduction of clear intermittent catheterization (CIC) by Lapides in 1972⁽¹⁾, and later, by the description of the "trans-appendicular continent cystostomy" by Mitrofanoff in 1980⁽²⁾. Mitrofanoff launched a new concept whereby the bladder could be emptied by a route other than the urethra. This concept led to the publication of many alternatives to the appendix conduit, including the transverse ileal (Yang-Monti)^(3,4) tube, and conduits constructed from ureter,

Fallopian tube, tabularized preputial transverse island flap, and longitudinally tabularized ileal and gastric segments. Further experience with the procedure, and the onset of complications such as stomal stenosis and leakage, instigated the description of various stomal options and conduit implantation techniques. More recently, laparoscopic and robotically assisted techniques have also been performed.⁽⁵⁾

Hydronephrosis, reflux and renal failure are serious complications that occur in patients with neurogenic overactive bladder. Such patients should be treated starting in childhood with clean and intermittent catheterization along with anticholinergics in the presence of detrusor

overactivity. In severe cases (i.e., sphincter dyssynergia), there are greater risks of renal failure⁽⁶⁾. When, irrespective of the treatment, the patient has an unsatisfactory outcome and the bladder compliance is lost, it is imperative to carry out surgery aimed at reducing bladder storage pressure.⁽⁷⁾ Our service routinely uses ileocystoplasty and, for patients unable or not adapted to intermittent catheterization, the Mitrofanoff's principle is used to form a continent stoma (in which the vascularized ileocecal appendix is anastomosed at the skin and bladder, with a nonrefluxing valve and continent stoma). After, we perform the closure of the bladder neck in the urinary incontinent patients with leak point pressure < 20 cmH₂O.⁽⁷⁾ This procedure is also a good alternative for severe and intractable urethral stenosis.⁽⁸⁾

Some times during the surgery, it is found a short ileocecal appendix that is insufficient to reach the skin (i.e., obese patients). In 2011, Rodrigues Jr. et al. published a case report⁽⁷⁾ using the Monti's technique (an ileal segment of 2-3 cm that is open longitudinally and reconfigured transversally, modeled by a 12-Fr urethral catheter) associated with the Mitrofanoff's principle to solve this problem.

Now, we present here the initial results and outcomes of the last 12 procedures performed in our institution, using the association between the Mitrofanoff's principles and Monti's technique in obese patients or those with short ileocecal appendices, unable to reach the skin.

2. Materials and Methods

We analyzed data from twelve adult patients who were submitted to ileocystoplasty and urinary continent diversion by association between Mitrofanoff's principle plus Monti's technique, as idealized by Rodrigues Jr.,⁽⁷⁾ performed from January 2009 to December 2012 in our institution. Patients with neurogenic bladder who were submitted to this procedure had unsatisfactory clinical progression despite treatment with intermittent catheterization and anticholinergics. Others not suitable for catheterization, developed low bladder compliance (< 12,5 mL/cmH₂O), some of them with vesicoureteral reflux, although their renal function was still preserved, and bladder augmentation (ileocystoplasty) was indicated. Patients with urethral stricture and considered for continent urinary diversion were initially submitted to the traditional techniques of urethroplasty with bad outcomes.

Surgical technique: The patients have been hospitalized 24 hours before surgery and started on a liquid diet without waste, and fasting of 8 hours preceding the procedure. Appropriate preoperative planning is required to position the skin incision to allow adequate mobilization of the appendix to the bladder. This can be achieved through a low midline incision. Mobilization of the ascending colon along the line of Toldt may be required to gain mobilization of the appendix and its mesentery. Once the cecum has been mobilized the base of the appendix is amputated, leaving a

small cuff of cecum with the appendix. Use of the cuff at the stoma may decrease the risk of stenosis. The cecum is closed in a fashion similar to an open appendectomy.

To perform the bladder augmentation, it was used 15 cm of ileum, 20 cm from the ileocecal valve, that was opened longitudinally and reconfigured into a "U" shape (ileocystoplasty), with continent derivation (Mitrofanoff's principle). A location is selected for implantation of the appendix into the bladder. The location is based on the length of the appendix, the mobility of the bladder, and the location for the appendix stoma. Typically, the distal end of the appendix is tunneled into a posterolateral position within the bladder. The appendix should be brought up to reach the skin without tension, and care must be taken not to twist the pedicle or to occlude it as it passes through the abdominal wall fascia. The base of the appendix often can be hidden within the umbilicus, which allows elimination of a small but obvious abdominal stoma. For prevention of kinking and problems with catheterization, it is advisable to maintain as short a conduit as possible.

During the surgeries, we found short ileocecal appendices (or obese patients) that were insufficient to reach the skin. Then it was decided (as idealized by Rodrigues Jr.⁽⁷⁾) to make an association between the Mitrofanoff's principle and the Monti's technique of ileal conduit by which we performed an anastomosis of distal stump of the appendices to the bladder with an antireflux valve. After, the proximal stump of the appendices was anastomosed to an ileal segment of 2.0 cm that was open longitudinally and reconfigured transversally (Monti technique), modeled by a 12-Fr urethral catheter, and finally, the distal stump was sutured at the patient's navel. A security suprapubic cystostomy (22-Fr) was performed and a Foley catheter (12-Fr) was left through the continent conduit for 21 days and then, the bladder neck was closed in two layers using 2.0 Vicryl, in urinary incontinent patients with leak point pressure < 20 cmH₂O.

In general, the diet was released from the third day postoperatively and gradually progressed. The patients were discharged between the sixth and tenth postoperative day. Patients in our center have an indwelling catheter through Mitrofanoff (12-Fr Foley catheter) and a suprapubic catheter (22-Fr Foley), both of which are initially left on free drainage.

The patients were discharged home with both catheters in situ for 4 weeks, the Mitrofanoff catheter being spigotted to avoid accidental expulsion and damage to the conduit. The patients are prescribed regular anti-cholinergic medication (e.g. oxybutinin) in order to reduce bladder spasms. After this period, the patient is brought back to the ward, where the Mitrofanoff catheter is removed, and the family trained to perform CIC. Once CIC is established, the suprapubic catheter is taken out. The patients are normally advised to catheterize every 6 hours during the day, and should be able to stay dry overnight if their reservoir is of appropriate capacity and compliance.

3. Results

Twelve patients (10 males and 2 females) were submitted to the procedure as described above, three of them had untractable urethra stenosis, 09 with low compliance neurogenic bladder (05 raquimedular trauma and 04 myelomeningoceles), (Table 1).

The three patients with urethral stricture had been previously treated unsuccessfully with urethroplasties (2-3 procedures each). All of the urethral strictures were posttraumatic and associated with hip fracture. The patients were using a suprapubic catheter.

Although the renal function of patients was still preserved, the bladder augmentation was indicated preventively because of the lost of its compliance.

Table 1. Showing all the indications of the association between Mitrofanoff procedure and Monti's technique.

Association: Mitrofanoff + Monti	
Indications	Neurogenic Bladder (9)
	- Raquimedular Trauma (5) - Myelomeningocele (4)
	Severe Urethral Stenosis (3)
	Total 12 Cases*

*(12 appendices did not reach the skin at navel level)

The ileocecal appendices of all these patients were too short and did not reach the skin (navel), main reason to perform the association between Mitrofanoff's principle with Monti's technique (as idealized by Rodrigues Jr.⁽⁷⁾).

Table 2. Showing the complications of association between Mitrofanoff procedure plus Monti's technique.

Association: Mitrofanoff + Monti	
Complications:	Number of Patients
Clinical Treatment:	
Urinary Sepsis	01
Surgical Treatment:	
Stoma Stenosis (skin)	02
Opening of Bladder Neck (leakage)	02
Bladder lithiasis	01
Ureteral lithiasis	01
Abdominal wall (resuture)	01
No Deaths or Fistulas	

The outcome of patients and more common complications are shown in table 2. Eleven patients are totally adapted to the intermittent clear catheterization and satisfied with the urinary continence (no leakage), and their quality of life, without pads, no cystostomy tubes and no indwelling catheter. One patient developed urinary sepsis at 21^o post-operative day after removed the cystostomy. He was conservatively treated with antibiotics and clinical life support, with good outcome. Two patients had stoma (skin of the navel) stenosis, corrected with a circular incision and fibrosis resection.

In nine patients we performed the bladder neck closure because severe urinary incontinence and leak point pressure less than 20 cmH₂O. Two patients of them had late re-opening of the bladder neck, despite of the closure in two layers, being submitted to a new surgical approach; one had good outcome, however the other (a female), even after three reoperations, remained with an open bladder neck and urinary leakage. This patient, several months later, had a right ureteral lithiasis, been underwent to a laser trans-ureteroscopy lithotripsy and pig-tail implantation. Another patient with a large bladder lithiasis formation was underwent to open cystolithotomy.

There were no deaths and no urinary or intestinal fistulas secondary to the procedure.

4. Discussion

The Mitrofanoff principle, originally described in 1980⁽²⁾, has been a mainstay in the armamentarium of pediatric urologists and reconstructive surgeons for creation a continent catheterizable stoma using the appendix. This principle involves the use of a small-caliber tube (appendix) implanted into a compliant bladder or reservoir with a nonrefluxing anastomosis to provide a convenient and effective method of emptying the bladder.⁽⁷⁾ The concept of an antirefluxing tunnel was borrowed from the ureteral re-implantation technique described by Coffey in 1911.⁽⁹⁾

Monti's tube offers a Mitrofanoff-based alternative. It was first described by Eshghi in 1986⁽¹⁰⁾ but was popularized by Monti *et al.*⁽⁴⁾ and Yang *et al.*⁽³⁾ About 2-3 cm of ileum are incised longitudinally opposite the mesentery and subsequently transversally retubularized to create a pedicled tube of 18 Fr lumen up to 9-cm long. This procedure is technically easy, and the small part of ileum it requires is always available.⁽¹¹⁾ These techniques are useful for continent urinary derivation in patients with untractable urethral stenosis and low compliance neurogenic bladder.

Nowadays, there is a remarkable increase in obesity of patients around the world. Thus, the ileocecal appendices may be too short to reach the skin. As an alternative to solve this problem, Rodrigues Jr. *et al.*⁽⁷⁾ reported a case in 2011, of successful association between Mitrofanoff principle and Monti's technique. Now, we report here the initial results of 12 procedures performed in obese patients or those with short ileocecal appendices, submitted to a

continent urinary diversion. The adipose tissue of the abdomen in obese patients is very thick, and the appendix could be too short to reach the skin, even at the right iliac fossa. Another relevant factor is that the navel's skin, naturally already through the abdominal wall, facilitates the anastomosis with the continent conduit, making the patient's abdomen more aesthetically pleasing.⁽⁷⁾

Problems with Mitrofanoff catheterization are common and may be due to narrowing at skin level or problems within the channel. This explains the variety of stomal sites and techniques used to fashion the anastomosis to the skin.⁽⁵⁾

The main problem experienced by patients was difficult catheterization through the continent catheterizable channels. Although most problems occurred in the first 12 months after operation, we have a patient experiencing new difficulties even 3 years after the original operation. The majority of catheterization problem was due to skin-level stenosis and occurred with similar frequency for umbilical stomas. There appears to be an increased risk of stenosis when the divided appendix is used. It is important to recognize that this problem can be solved with dilatation and a period of indwelling catheter without surgical revision.⁽¹²⁾

The umbilicus and the lower abdomen have been the commonest sites of the stoma on the abdominal wall. The simplest stomas are created by direct anastomosis of the intestinal conduit to the skin, or using a V-flap combined with spatulation of the intestinal conduit.⁽¹³⁾

Stomal stenosis can occur in 29% of Mitrofanoffs and is less common with Monti conduit and umbilical stomas.⁽¹⁴⁾ We had two cases of stoma stenosis, both resolved with a simple surgery (circular incision and resection of the fibrosis), after two sessions of unsuccessful dilations.

Narayanaswamy et al.⁽¹⁵⁾ suggested that difficulty with catheterization was more likely to occur with a Yang-Monti conduit. In their study, 26% of patients with appendico-vesicostomies, mostly sited in the right lower quadrant, had problems with CIC (clear intermittent catheterization), whereas 60% of patients with an ileo-vesicostomies had problems catheterizing their channel. Only half of these Monti channels were found to be stenotic. Lemelle et al.⁽¹⁶⁾ also compared Yang-Monti (ileum and sigmoid) and appendix channels following the Mitrofanoff and Malone principles, in a study of 65 conduits. At 5-years follow up, 94% of channels were still in use Castellan et al.⁽¹⁷⁾ also found no difference in the incidence of complications in Yang-Monti channels (23%) versus appendix conduit (21%) at a mean follow up of 4 years.

The stenotic conduit may be evaluated endoscopically, whereby an appropriately sized cystoscope is inserted retrogradely into the conduit via the abdominal stoma.⁽¹⁸⁾ Endoscopy allows differentiation between a true stenosis requiring dilatation or revision.

Another surgical complication that we had was urinary incontinence through the bladder neck (re-opened) in two cases. Bladder neck closure is an irreversible procedure

requiring compliance catheterization of a cutaneous stoma, and historically has been reserved for intractable incontinence after prior failed procedures.⁽¹⁹⁾

In a review, Dave and Khoury summarized outcomes after surgical management of the bladder neck in children with complex incontinence and neurogenic bladder.⁽²⁰⁾ Continence was achieved after bladder neck injection in 0% to 43% of patients, 47% to 88% after bladder neck slings and 57% to 91% for bladder neck reconstruction.^(19,20) The high variability of results in their analysis was partially explained by a significant heterogeneity of surgical approaches and techniques as well as differing definitions of continence.

In 2012, Kavanagh et al.⁽¹⁹⁾ achieved a continence rate of 96% after bladder neck closure in a patient population with a variety of diagnosis after a median follow-up of 69 months. However, this high rate of continence comes with a price and the Kavanagh et al. revision was not trivial. Although initial failure of the closure itself occurred in only 1 patient (4%), the need for further urological interventions was 39% overall. The most common cause of surgical intervention after bladder neck closure is related to bladder and renal calculi (11% each).

In our series, we found less than 10% of bladder neck closure complications (1 patient of 9) with persistent urinary incontinence, even after three re-operations. Disadvantages include the true challenging to access the urinary tract in case of stone formation (particularly for renal, ureteral and bladder lithiasis).⁽¹⁹⁾

One patient of the study developed urinary infection and sepsis at 21° postoperative day. He was treated with antibiotics at the intensive unit care. Routinely we did not use prophylactic antibiotics. Ten years after introducing the concept of CIC, Lapides and colleagues⁽²¹⁾ published a follow up study of 255 children on CIC, and noted that although 56% of patients showed bacteriuria, only 11% actually developed a symptomatic urinary tract infection.

There now seems to be a general consensus that asymptomatic bacteriuria is not treated with antibiotics.^(22,23) A randomized, controlled trial has shown that it is also not necessary, on CIC, to use prophylactic antibiotics.⁽²⁴⁾

The frequent need for re-operation is well recognized as well as the optimal choice of procedure, location of stoma and site of implantation into the bladder continues to be a matter of debate.⁽²⁵⁾

Reconstruction to achieve continence has been assumed to improve health-related quality of life. Early evaluation of small numbers of patients undergoing reconstruction including bladder augmentation do not always show improved status on objective questionnaires compared with preoperative studies or control patients without surgery despite what generally would be considered to be good clinical results.^(26,27)

Patient-reported scores also do not always correlate with those noted by their parents. Most evaluation of surgical techniques to date has focused on results and complications from the perspective of surgeons. Future evaluation should

include objective, patient-reported consideration. Tools to acquire that information must be validated for longitudinal study of these patients and their disease processes.

Although bladder augmentation with continent urinary diversion works well for most patients who require it, newer medical regimens and neuromodulation may prove effective for some patients who presently do not respond to conservative measures.⁽²⁸⁾

5. Conclusions

The association of Mitrofanoff's principle and Monti's technique (as idealized by Rodrigues Jr.⁽⁷⁾) is safe, feasible, and a very useful alternative in urologic cases (i.e., severe and untractable urethral stenosis and low compliance neurogenic bladder) of continent urinary diversion when the ileocecal appendix is too short to reach the skin (i.e., obese patients).

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