

# CONTINENT URINARY DIVERSION IN CHILDREN WITH NEUROGENIC BLADDER

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## ABSTRACT

**Objectives:** We evaluate the initial experience of continent urinary diversion procedure in children with neurogenic bladder dysfunction. **Material & method:** The study was conducted retrospectively by collecting data from patient medical records of Cipto Mangunkusumo General Hospital Jakarta, from 2003 to 2012, and by clinic or phone interviews with parents of patients. We included children age 0-18 years, diagnosed with congenital neurogenic bladder and underwent continent urinary diversion. **Results:** There are eight cases with continent urinary diversion in Cipto Mangunkusumo General Hospital and found only 7 cases which met the inclusion criteria with more girls than boys. Most common etiology was spina bifida (57%). Most of the patients complained of recurrent urinary tract infection (UTI), and the most frequent technique used was Mitrofanoff (72%) with complications (33%). **Conclusion:** Continent urinary diversion procedures performed in Cipto Mangunkusumo General Hospital were Mitrofanoff and Monti. Of seven cases performed, initial evaluation showed good results after continent urinary diversion. Patients reported improved quality of life with achievement of continence, decreased recurrent infections and preservation of kidney function.

**Keywords:** Neurogenic bladder, Mitrofanoff techniques, Yang-Monti.

## ABSTRAK

**Tujuan:** Mengevaluasi pengalaman awal pelaksanaan prosedur diversi urin kontinen pada pasien neurogenic bladder pada anak. **Bahan & cara:** Penelitian ini dilakukan secara retrospektif dengan mengumpulkan data yang terdapat pada rekam medis pasien yang datang berobat ke Rumah Sakit Cipto Mangunkusumo (RSCM) Jakarta, dari tahun 2003 sampai 2012, dan dengan wawancara orang tua pasien melalui telepon ataupun saat pasien kontrol ke poliklinik. Pasien anak usia 0-18 tahun, dengan diagnosis neurogenic bladder kongenital, dan menjalani prosedur diversi urin kontinen. **Hasil:** Terdapat 8 kasus dengan tindakan diversi urin kontinen yang dilakukan di RSCM dan hanya 7 kasus didapatkan memenuhi kriteria inklusi dengan perempuan lebih banyak dari laki-laki. Etiologi tersering adalah spina bifida (57%). Sebagian besar pasien mengeluhkan infeksi saluran kemih (ISK) berulang, dan teknik yang paling banyak dipakai adalah Mitrofanoff (72%) dengan komplikasi (33%). **Simpulan:** Prosedur diversi urine kontinen yang telah dikerjakan adalah Mitrofanoff dan Yang-Monti. Dari tujuh kasus yang dilaporkan, evaluasi awal memberikan hasil yang baik setelah dilakukan prosedur diversi urin kontinen. Kualitas hidup pasien meningkat dengan keadaan kontinen, ISK berkurang dan fungsi ginjal terpelihara.

**Kata kunci:** Neurogenic bladder, teknik Mitrofanoff, Yang-Monti.

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## INTRODUCTION

Neurogenic bladder disorder is a complex problem in pediatric urology patients. If not properly managed, neurogenic bladder may cause recurrent infections, severe disorders of the bladder, vesicoureteric reflux and kidney disorders that may

lead to renal failure and need for dialysis or transplantation. In addition, complications of neurogenic bladder dysfunction, such as incontinence, difficulty/inability to urinate, or significant post-void residual urine, may cause physical and psychological disturbances in patients that may interfere the quality of life.<sup>1-4</sup>

The main objective of neurogenic bladder treatment is to achieve continence, urine storage at low intravesical pressure and protect the urinary tract. Accepted standard for initial management with wide spread application is clean intermittent catheterization (CIC) in combination with anticholinergic medication. This combination is reported to have a fairly high success rate of 81%.<sup>1-4</sup>

Surgery is required in certain cases, for example, failed combination therapy, increased bladder outlet pressure, poor outcome with anticholinergic drugs, presence of psychological problems and the privacy of pubertal patients to perform CIC through the urethra. Surgical procedures include continent urinary diversion, in which continent access to the bladder is made, and, if necessary, coupled with bladder augmentation in patients with small bladder capacity. Some of the options for continent urinary diversion include appendicovesicostomy (Mitrofanoff) and ileovesicostomy (Yang-Monti, double Monti). The selection of the surgical technique is performed according to the condition and the pathophysiology of each case in order to obtain optimal results with minimal morbidity. The most important and influential factor on the outcome of surgery in children is the compliance of patients and parents to achieve expected results.<sup>1-4</sup>

Management of children with neurogenic bladder using continent urinary diversion method is complex and still rarely performed in Indonesia. Literature on continent urinary diversion, whether on procedures, outcomes, and compliance, remains rare in Indonesia. However, it does not mean that this procedure cannot be applied in this country. Selection of patients with appropriate indications and discipline, cooperation and support from the parents are requirements to achieve expected results.

## OBJECTIVE

We evaluate the initial experience of the implementation of the continent urinary diversion procedure in children with neurogenic bladder.

## MATERIAL & METHOD

Subjects were patients who came for treatment to Cipto Mangunkusumo General Hospital with inclusion criteria such as pediatric patients (aged 0-18 years), diagnosed with congenital neurogenic bladder, and underwent urinary

continence diversion procedures. The exclusion criteria were patients who underwent continence urinary diversion procedure for other reasons, or patients diagnosed with neurogenic bladder who underwent other forms of therapy, such as CIC with combined treatment. Data were collected retrospectively from medical records of consecutive patients and from parent interviews in the clinic or over the phone.

## RESULTS

From table 1, 8 cases of continent urinary diversion in Cipto Mangunkusumo General Hospital conducted from 2003 to 2012, 7 cases met the inclusion criteria, while 1 case was excluded due to the diagnosis of bladder atony as the patient found difficulties in urination resulting from non-neurogenic factors (urethral stricture).

Case 1 was a two-year-old boy who had a complaint of recurrent urinary tract infection (UTI). This patient also suffered from anal atresia. When he underwent colostomy in Makassar, the stoma was made from a segment of ileum. The patients had impaired growth due to malnutrition. Finally, the ileostomy was closed and replaced with colostomy in Jakarta. From supportive examination, urological abnormalities found were right renal agenesis, neurogenic bladder ec spina bifida, type-3 PUV, and left ureteral reflux grade 5. The patient was planned for Mitrofanoff procedure, but the appendix was difficult to identify because of a history of previous laparotomy, so a ileovesicostomy using spiral Monti method was carried out. Surgical wound healing was going well and no acute postoperative complications were found. On day 15, urine secretion leaked out from urostoma up to 3 weeks and then stopped spontaneously. The parents of the patient could be taught how to perform CIC and routinely underwent CIC every 6 hours and the patient could also spontaneously void through the urethra. Compliance and cooperation among the parents and the patient in undergoing CIC was satisfactory during the treatment, but when the patient returned to Papua, the patient no longer attended follow up visits. On phone evaluation 3 and 6 months after surgery, CIC was not performed anymore because the patient was able to urinate spontaneously.

Case 2 was a 19-month-old girl visited the clinic with urinary leakage when crying. Another complaint is recurrent UTIs. Abdominal ultrasound examination revealed bilateral grade 4-5 vesico-

**Table 1.** Patient characteristics, surgery, and complications

	n	%
Average age	6.8 years	Range (1-14 years)
Sex		
Male	3	43
Female	4	57
Neurogenic bladder etiology		
Spina bifida	4	57
Sacral agenesis	3	43
Types of urine diversion		
Mitrofanoff	5	72
Spiral Monti	1	14
Mitrofanoff + Yang-Monti*	1	14
Surgical indication		
Repeated UTI	6	86
Incontinence	1	14
Mitrofanoff Procedure		
Without complication	4	66
With complication	2	33
With complication and requiring further operation**	1	
Monti procedure		
Without complication	1	100
With complication	0	0
Perioperative problems		
Leakage	2	28.5
Infection	2	28.5
Stenosis	2	28.5

\* To this patient Mitrofanoff procedure was performed, but failed and subjected to revision using Yang-Monti continent urinary diversion.

\*\* Represents one of two patients who experienced complications of Mitrofanoff procedure.

ureteral reflux. X-ray of antero-posterior/lateral lumbosacral showed imperfect sacrum shape, while thoracolumbal spine was fine. Cystoscopy showed normal bladder neck, bladder mucosa showed heavy trabeculation, both urethral orifices were difficult to assess with 4F catheters and bladder capacity was 25cc. Voiding cystourethrography (VCUG) examination showed that the bladder was like a pine tree, the bladder wall was not smooth with grade IV-V left vesicoureteral reflux, and diverticulosis. The results of urine culture and urinalysis showed repeated urinary tract infection (UTI). The patient was diagnosed with neurogenic bladder, grade V vesicoureteral reflux, agenesis of the sacrum, UTI complex, non-functional right kidney, microcephaly, malnutrition, and impaired growth. Conservative therapy with anticholinergic drugs for 1 month did

not bring improvement and, due to small bladder capacity, bladder augmentation was followed with ureterocystoplasty (the dilated ureter was considered sufficient for bladder augmentation material) and urinary diversion was done with Mitrofanoff procedures. Wound healing went well and there were no acute postoperative complications. The patient was discharged after the parents could perform CIC, compliance and cooperation between the patient and the parents in carrying out CIC was good.

Case 3 was an 8-year-old boy presenting with chief complaint of disability in spontaneous urination and suffered from sacral agenesis. Previously, the patient had undergone posterior sagittal anoplasty (PSA) procedure in Moh. Hoesin Hospital, Palembang. VCUG examination showed grade III left and grade I right ureteral reflux when

40 cc contrast was filled into the bladder. Bladder capacity was 70 cc. Bilateral ureteral reflux and bladder capacity profile was small. The patient could not urinate as the bladder neck did not open. Urodynamic examination showed detrusor overactivity and infravesicular obstruction. The patient was admitted with a diagnosis of neurogenic bladder, bilateral vesicoureteral reflux and agenesis of the sacrum. Patient performed bladder augmentation with ileocystoplasty and Mitrofanoff technique. Surgical wound healing was fine and no acute postoperative complications were found. The parents and patient were then taught CIC procedure, compliance and cooperation of the parents and the patient for CIC was well. Afterwards, CIC could done by the patient himself on a regular basis every 3-4 hours. After returning to Palembang, the patient regularly visited Moh. Hoesin Hospital Palembang, regularly. Up to the moment, CIC has been performed regularly without difficulties. The patient rarely had UTI and both kidneys function well.

Case 4 was male pediatric patient of five-year-old visited the emergency department with a chief complaint of the loss of consciousness due to uremia and a lump on the left and right abdomen since 1 week before hospital admission. From the history and examination we found hydronephrosis of both kidneys, anal atresia, undescended left testicle, midshaft penile hypospadias and UTI. Micturition complaints suffered by the patients was difficulty to urinate, often accompanied by straining and taking a dive position to facilitate urination. Ultrasound examination showed bilateral hydronephrosis grade IV with thin parenchyma. Renogram results showed left/right GFR: 0.4/22.2 ml/min, with left/right split function 1.9/98%. VCUG results revealed normal capacity and contour of the bladder, bilateral reflux right/left grade 3/4, and there was no urine coming out in the voiding phase. Urethrocystoscopy showed neurogenic bladder with urinary retention. Posterior urethral valves was not found, and the bladder capacity was 370 cc. The patient was then performed left ureteroneocystostomy and Mitrofanoff. Postoperative urine did not come out of the stoma. Stenosis and signs of inflammation and obstructive ileus were found. The patient subsequently underwent exploratory laparotomy and we found ileus was circular in 2 loops in the anterior Mitrofanoff which showed partial necrosis. The appendix was removed and release of adhesions was carried out. After a period of healing, the patient was planned to undergo urinary diversion procedure

Yang-Monti method. After the second surgery, no acute complications were found. CIC compliance could not be assessed because the patient had just undergone the surgery.

Case 5 was female pediatric patient, age 5 years, was referred from Muara Enim, South Sumatra, with complaint of oozing urination with anal (cloacal) atresia, and recurrent UTIs. Cystoscopy examination of the cloaca revealed three orifices, each to the bladder neck, rectum and vagina. The patient underwent PSA procedure. Six months later, she underwent Mitrofanoff surgery. There were no postoperative complications and acute wound healing was going well. Then, the patient's parents were taught CIC. Compliance and cooperation between the parents and the patient in CIC was satisfactory.

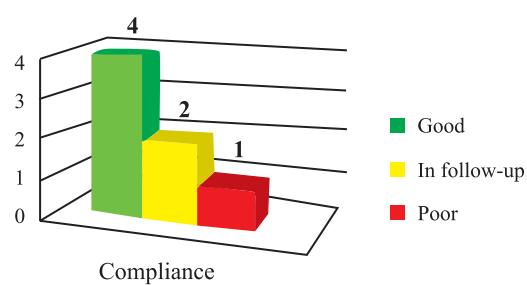
Case 6 was a female patient age 14 years, came with complaint of unsatisfactory voiding since the last 5 years with intermittent hematuria. Examination revealed recurrent UTI with serum urea and creatinine within normal limits. VCUG examination showed grade IV bilateral VUR with neurogenic bladders and chronic cystitis. CT urography demonstrated bilateral excretion malfunction. The patient was diagnosed with neurogenic bladder, bilateral VUR and spina bifida. Mitrofanoff procedure was performed. Postoperatively, the patient had no complications. Wound healing was quite good. In the sixth week postoperation complication of stenosis was found at the site of appendix insertion into the bladder. Nasogastric tube (NGT) 8 Fr was inserted into mitrofanoff entry but some resistance was encountered. Insertion of 10 Fr tube could not enter the bladder, due to resistance in proximal of the Mitrofanoff channel. Then 8 Fr tube was left with guidewire, and it was dilated by 12 Fr tube. In week 8, patient complained of lower abdominal pain. Culture revealed the presence of *E. coli*. After stenosis and infection could be resolved, the patient underwent CIC with good compliance.

Case 7 was female patient aged 13 years suffered from spina bifida. Urinary disorder suffered by the patient was frequent incontinence, difficulty in voiding and incomplete bladder emptying. In video urodynamic examination, detrusor overactivity incontinence was observed, detrusor underactivity during voiding with residual urine of 150 cc, bladder capacity 350 cc. The patient then underwent Mitrofanoff procedure. Postoperatively, the patient did not experience acute complications, and wound

**Table 2.** Summary of patients.

Cases	Diagnosis	Accompanied abnormalities	Indications	Operative Technique	Perioperative problems
Male, 2 years	Neurogenic bladder ec spina bifida	<ul style="list-style-type: none"> <li>Repeated UTI</li> <li>Right kidney agenesis</li> <li>PUV type-3</li> <li>VCUG: grade 5 left vesicoureteral reflux</li> <li>Post ileostomy&amp; anal atresia</li> </ul>	<ul style="list-style-type: none"> <li>Inhibited voiding with much post-micturition urine residue</li> </ul>	Spiral Monti	Leakage
Female, 19 months	Neurogenic bladder ec sacrum agenesis	<ul style="list-style-type: none"> <li>VCUG: grade 4-5 bilateral vesicoureteral reflux, pine cone bladder + diverticulosis, small bladder capacity</li> <li>Repeated UTI</li> </ul>	<ul style="list-style-type: none"> <li>Urine incontinence</li> <li>Anticholinergic therapy failure</li> <li>Small bladder capacity (25 cc)</li> </ul>	Mitrofanoff + Bladder augmentation	-
Male, 8 years	Neurogenic bladder ec sacrum agenesis	<ul style="list-style-type: none"> <li>Repeated UTI</li> <li>VCUG: grade 3 vesicoureteral reflux, small bladder capacity, unable to void spontaneously</li> <li>Urodynamic: detrusor overactivity + infravesicular obstruction</li> <li>Post-PSA (posterior sagittal anoplasty) anal atresia</li> <li>Right club hand</li> </ul>	<ul style="list-style-type: none"> <li>Urinary retention ec detrusor overactivity</li> <li>Small bladder capacity (70cc)</li> </ul>	Mitrofanoff+ Bladder augmentation	-
Male, 5 years	Neurogenic bladder ec spina bifida	<ul style="list-style-type: none"> <li>VCUG: grade 3 and 4 bilateral vesicoureteral reflux, normal bladder capacity and contour, no urine discharge during voiding phase.</li> <li>Non-functional right kidney</li> <li>Penile mid shaft hypospadias, left undescended testicle, right testicular retractile</li> <li>Post-anoplasty anal atresia</li> <li>Renal failure</li> <li>Repeated UTI</li> </ul>	<ul style="list-style-type: none"> <li>Urinary retention</li> <li>CKD</li> </ul>	Mitrofanoff Yang-Monti*	Infectious stenosis
Female, 5 years	Neurogenic bladder ec sacrum agenesis	<ul style="list-style-type: none"> <li>Repeated UTI</li> <li>Cloaca-type anal atresia</li> <li>Cystoscopy: cloaca with 3 lumens (vagina, bladder neck and rectum)</li> </ul>	<ul style="list-style-type: none"> <li>Urine incontinence</li> </ul>	Mitrofanoff	-
Female, 14 years	Neurogenic bladder ec spina bifida	<ul style="list-style-type: none"> <li>Repeated UTI</li> <li>Kidney function disorder</li> <li>VCUG: grade IV vesicoureteral reflux, pine cone bladder and uneven contour</li> </ul>	<ul style="list-style-type: none"> <li>Unsatisfactory urination, repeated hematuria</li> </ul>	Mitrofanoff	Leakage Infectious stenosis
Female, 13 years	Neurogenic bladder ec spina bifida	<ul style="list-style-type: none"> <li>Videourodynamics : <ul style="list-style-type: none"> <li>- Detrusor overactivity incontinence</li> <li>- Detrusor underactivity during voiding (PVR 150 cc)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Urinary incontinence</li> </ul>	Mitrofanoff	-

\* Case 4: the operation was performed twice because complications occurred in the first operation



**Figure 1.** Adherence/compliance.

healing was quite well. In the second week postoperatively, the patient tried to undergo CIC through the stoma, but NGT no. 8 could not be inserted. Then, it was decided to keep the urethral catheter and planned to do CIC again 1 week later. In third week, while trying to perform CIC, NGT 8 Fr could be inserted and then maintained. In view of the time of incidence, it could have been caused by postoperative edema of the appendiceal segment. Special measures were not necessary, just with conservative measures. Summary of patients is seen in Table 2. The compliance of the seven patients can be observed (Figure 1).

## DISCUSSION

Mitrofanoff procedure was introduced by Dr. P. Mitrofanoff in 1980.<sup>5-7</sup> The principle of this procedure is to create a channel between the skin of the abdomen and urine container (can be either artificial bladder or container) that has a continence function with valve mechanism where catheter can be inserted in.<sup>7-10</sup> Appendix or ureter can be used to create the channel and intermittent catheterization can be performed.<sup>6,7,11</sup> Indications for Mitrofanoff procedure in pediatric cases are pediatric patients suffering from bladder disorders with severe impaired bladder function such as neurogenic bladder, bladder exstrophy, posterior urethral valve, and so on, which require urinary diversion procedure.<sup>5,12-14</sup>

Yang-Monti procedure was introduced in 1993 as an alternative for Mitrofanoff procedure if appendix is not available or can not be used.<sup>15</sup> In 1997, Monti et al. introduced the technique of 'simple tube' and 'double tube' procedure.<sup>16</sup> The principle of Yang-Monti procedure is the making of continental drains from the bladder to the abdominal skin (usually the umbilicus), into which catheter can be inserted, using a piece of ileum.<sup>17</sup> Many studies

have shown that Mitrofanoff procedure provides good results.<sup>18,19</sup> Several studies suggest Mitrofanoff revision surgery is required in 16-20% of cases.<sup>20,21</sup> The complications that can occur are urinary incontinence, stoma stenosis, perforation of the appendix, urine leakage from the duct, and fistula of the appendix.<sup>17-23</sup> Leslie et al. found 18.5% of pediatric cases subjected to Yang-Monti procedure required reoperation with 8.3% necessitating stoma repair, and 10.7% required surgical repair of the bladder.<sup>17,23</sup> The complications that can occur in Yang-Monti procedure is incontinence, stenosis, fistula, and infection.<sup>23-25</sup>

Patients who underwent continent urinary diversion procedures in this study had an average age of 6.8 years (range 1-14 years) with 57% females and 43% males. The cause of neurogenic bladder in this study was spina bifida (57% of cases).

Urinary incontinence, voiding difficulties and urinary retention are common complaints found patients with neurogenic bladder. This complaint is detrimental to quality of life and becomes an indication for continent urinary diversion procedure in our patients. Continent urinary diversion procedures mostly done at Cipto Mangunkusumo General Hospital is Mitrofanoff. This is not unlike the situation in many other countries, Mitrofanoff is a procedure of continent urinary diversion performed by many urologists in many countries.<sup>2</sup>

Monti procedure is performed in two cases, in patients with difficulties of appendix identification (patients who have undergone laparotomy, ileostomy and colostomy due to anal atresia) and in those where Mitrofanoff procedure produces complications that results in appendix necrosis requiring Yang-Monti procedure. Yang-Monti procedure is performed as a continent urinary diversion in revision surgery after prior failure of Mitrofanoff procedure (appendiceal necrosis). In addition to continent urinary diversion procedures, both cases are subjected to bladder augmentation procedure with an indication of a small bladder capacity.

Perioperative problems include seepage, stenosis and infection, which occurred in two out of seven cases. The two cases with complications are those that underwent Mitrofanoff procedure. The complication rate of Mitrofanoff procedure in Cipto Mangunkusumo General Hospital was 33%. The results obtained were more or less in accordance with the results of other studies, suggesting that revision surgery for Mitrofanoff is required in 16-20% of cases.<sup>20,21</sup> Complication rate of Monti

procedure could not be evaluated because this procedure was performed only in 1 patient.

One of the cases with complications, the case four, required continent urinary diversion revision surgery. Mitrofanoff procedure in the case failed because there was intestinal segment that entered and ensnared between appendix pedicle used as a stoma with the bladder. This condition causes stoma stenosis, further followed with UTI and necrosis of the appendix. Such complications are rare. The cause in this case is entry of intestinal gas through use of laryngeal mask for anesthesia. It is characterized by postoperative abdominal distension of the patient. When we conducted repeat laparotomy, we found intestinal segments ensnaring appendix pedicle and causing intestinal loops. Appendix segment was removed and urinary diversion was performed with cystostomy. After recovery, revision surgery with Yang-Monti technique was performed because there had been no more appendix that could be used. The operation went well and the patient went home with good condition. Although postoperative complications were not found, complication rates of Monti procedure could not be evaluated since this new procedure was performed only in 1 patient.

After undergoing continent urinary diversion procedures, continence was achieved in all cases. However, to support successful management of children with neurogenic bladder, good collaboration and compliance of the patients and parents/family in performing CIC and treatment follow up. In this study, compliance and cooperation after urinary continence diversion procedures was quite satisfactory. There was one case in which the stoma had closed since the parents did not perform CIC anymore. This was because the patient had been able to urinate spontaneously, so the parents felt that CIC was no longer needed and since the patient did not visit any longer, kidney condition is unknown and adequately spontaneous voiding were not known.

## CONCLUSION

Continent urinary diversion procedures that has been done in Urology of Cipto Mangunkusumo General Hospital is Mitrofanoff and Monti. Of the total of seven cases performed, the initial evaluation gives good results after urinary diversion continence procedure. Improved quality of life of patients with the achievement continence, overcome recurrent UTI problems and kidney function can be retained.

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