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Long-term outcomes of cutaneous vesicostomy in patients with neuropathic bladder caused by spina bifida

M. İrfan Dönmez [a,1], Alonso Carrasco Jr [b], Amanda F. Saltzman [b], Vijaya Vemulakonda [b], Duncan T. Wilcox [b]

[a]Department of Urology, University of Colorado Denver, Anschutz Medical Campus, Aurora, CO, USA

[b]Department of Pediatric Urology, Children's Hospital Colorado, Aurora, CO, USA

Correspondence to: M.İ. Dönmez, Department of Urology, University of Colorado Aurora, Anschutz Medical Campus, Aurora, CO, USA

m_irfan83@yahoo.com
(M.İ. Dönmez)

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Summary

Objective
To evaluate the outcomes of patients who underwent cutaneous vesicostomy for management of neuropathic bladder secondary to spina bifida. We hypothesize that vesicostomy, in select patients, is beneficial to prevent upper urinary tract deterioration (UTD), reduce febrile urinary tract infections (UTIs), and preserve renal function.

Study design
We performed a retrospective chart review on patients with spina bifida who underwent cutaneous vesicostomy at our institution between 2000 and 2016. Demographic information, indication for vesicostomy, pre and postoperative laboratory/radiologic studies, incidence of febrile UTIs, and urodynamic findings were abstracted.

Results
A total of 14 patients (eight females and six males) were identified. The indication for vesicostomy was UTD in four, recurrent febrile UTIs in five, parental request in two, both UTD and recurrent febrile UTIs in two, and both UTI and parental request in one patient. Seven patients had a median of three (range one to five) febrile UTI prior to surgery for cutaneous vesicostomy. Median creatinine level before surgery was 0.26 mg/dL (range 0.16–0.97). Either unilateral or bilateral ≥SFU Grade 2 hydronephrosis was present in six patients. Median age at vesicostomy creation was 26.5 months (range 4–96). Mean functional bladder capacity assessed during preoperative urodynamic studies was 107 mL (range 20–279), and detrusor sphincter dysynergia was present in all patients. High-grade vesicoureteral reflux (grade ≥3) was present in three patients, all with UTD. Mean follow-up after vesicostomy was 62.4 ± 39.3 months. After vesicostomy, only two of the seven patients with history of febrile UTIs experienced an additional febrile UTI. The median serum creatinine level was 0.36 mg/dL (range 0.2–0.58) at last follow-up. Moreover, 11/14 patients had no hydronephrosis and just two patients had unilateral SFU grade 1 hydronephrosis (Table).

Discussion
Worsening UTD, recurrent febrile UTIs, and high-pressure bladder despite maximal medical therapy are several reasons to consider more aggressive management of neuropathic bladders. In young patients, vesicostomy is able to protect the upper urinary tract, decrease rates of febrile UTI, and delay the need for bladder augmentation.

Conclusion
Vesicostomy is a safe method for temporary diversion of the lower urinary tract in patients with spina bifida who are refractory to conservative and minimally invasive treatments.

Table Summary of patients.

Nr	Sex	Preop Cr (mg/dL)	Preop renal US	Number of preop UTIs	Preop UDS (Cap/$Pdet_{max}$/DOA/DSD)	Age at surgery (months)	Follow-up (months)	Number of postop UTIs	Cr at last follow-up (mg/dL)	Final US	Age at vesicostomy takedown (months)
1	F	NA	Normal	1	20/50/+/+	27	26	2	NA	Normal	
2	F	0.22	Normal	3	65/43/+/+	15	38	0	0.33	Normal	
3	M	NA	L Gr 2 HN	3	166/55/+/+	96	23	0	0.52	Normal	
4	M	0.97	R Gr 1 HN	0	72/52/+/+	85	3	0	0.58	Normal	
5	F	0.25	R Gr 2 HN	5	100/72/+/+	86	62	1	0.2	R Gr 1 HN	
6	F	NA	Bil Gr 4 HN	1	131/100/+/+	26	120	0	0.27	NA	62
7	F	0.26	Bil Gr 2 HN	5	98/52/+/+	34	71	0	NA	Normal	
8	F	NA	NA	NA	NA	24	58	0	0.42	Normal	84
9	M	0.31	L Gr 1 HN	0	279/18/+/+	39	71	0	0.41	Normal	
10	M	NA	NA	NA	NA	4	74	0	0.38	Normal	60
11	F	NA	L Gr 2 HN	2	NA	9	132	0	0.36	L Gr 1 HN	59
12	M	NA	NA	NA	NA	12	NA	1	0.28	Normal	96
13	M	0.16	Bil Gr 3 HN	0	35/50/+/+	39	72	0	NA	Normal	
14	F	0.33	Bil Gr 1 HN	0	107/49/−/+	7	69	0	NA	Normal	

Cr = creatinine, preop = preoperative, US = ultrasonography, UTI = urinary tract infection, Cap = functional bladder capacity (mL), $Pdet_{max}$ = maximal detrusor pressure during filling phase (cmH_2O), L = left, R = right, HN = hydronephrosis (per SFU grading system), M = male, F = female, NA = not available.

[1] Present address. Department of Urology, Division of Pediatric Urology, Istanbul University, Istanbul Faculty of Medicine, Istanbul, Turkey.

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Introduction

The management of patients with neuropathic bladder secondary to spina bifida has evolved significantly over the last two decades. Early goals of management for these patients are to maintain a low pressure/high compliance bladder, prevent upper urinary tract deterioration (UTD), and preserve renal function. Initial treatment strategies include clean intermittent catheterization (CIC), anticholinergic medications, and detrusor botulinum toxin injection. When these fail, patients require more aggressive strategies such as bladder augmentation or vesicostomy [1].

All of the aforementioned treatment modalities have advantages and disadvantages. CIC requires motivated parents to perform this until the patient is old enough to assume this responsibility. Anticholinergics, oxybutynin being the only FDA-approved anticholinergic for children, can cause effects that may lead to non-compliance or need for drug cessation. Intra-detrusor botulinum toxin injection is the most recent and highly effective minimally invasive treatment strategy. However, it is successful in around 50% of patients, it is temporary (mean duration of efficacy 9 months), and its effectiveness can diminish over time [2]. Bladder augmentation or lower urinary tract diversion are generally the next steps. Bladder augmentation provides a low-pressure system, increases bladder capacity, and helps achieve continence, but can be associated with both short- and long-term complications. In young patients, it is associated with long-term metabolic derangements. In addition, bladder augmentation requires compliance by both the caregiver and patients to avoid complications such as bladder stones, recurrent infections, and bladder perforation, which can be associated with a 25% mortality [3].

Vesicostomy, an incontinent diversion, is a form of supra sphincteric urinary diversion that accomplishes the goal of maintaining a low-pressure urinary system. It is an alternative to bladder augmentation when conservative strategies have failed [4]. Vesicostomy has also been suggested as a permanent diversion for selected cases of neuropathic bladder [1].

The objective of our study is to evaluate the outcomes of patients who underwent cutaneous vesicostomy for management of neuropathic bladder secondary to spina bifida. We hypothesize that vesicostomy, in select patients, is beneficial to prevent UTD, reduce febrile urinary tract infections (UTIs), and preserve renal function.

Materials and methods

A retrospective chart review was performed. Patients with neuropathic bladder secondary to spina bifida who underwent vesicostomy between January 2000 and December 2016 were identified. Demographic information along with past medical/surgical history (ventriculoperitoneal shunt insertion, age at surgeries) and length of follow-up were abstracted. Pre-vesicostomy bladder management, medications, and indication for vesicostomy were reviewed. Pre- and postoperative laboratory (serum creatinine), radiologic studies (degree of hydronephrosis, cortical thinning, ureteric dilation, etc.), incidence of febrile UTI, and urodynamic findings (maximal detrusor pressure during filling, detrusor leak point pressure, and functional bladder capacity) were abstracted. Hydronephrosis was graded based on the Society of Fetal Urology (SFU) grading system [5]. All patients underwent cutaneous vesicostomy as described by Blocksom [6]. Indications for cutaneous vesicostomy included UTD despite proper anticholinergic treatment, recurrent febrile UTIs, non-adherence to CIC, and/or family preference. Postoperative complications such as need for revision, were noted. Fisher's exact test was used for statistical analysis. A p-value of less than 0.05 was accepted as clinically significant.

Ethical standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The conducted study was approved by Colorado Multiple Institutional Review Board (COMIRB) with protocol number 16—0881.

Results

A total of 1573 patients with spina bifida and resulting neuropathic bladder were evaluated and treated at our institution between 2000 and 2016. Of those, 14 patients (eight female) underwent cutaneous vesicostomy for management of their neuropathic bladder. Eleven patients had a ventriculoperitoneal shunt placed at an early age of life, and three were developmentally delayed and ventilator-dependent. The indication(s) for vesicostomy were UTD in four, recurrent febrile UTI in five, parental request in two, both UTD and UTI in two, and both UTI and parental request in one patient. Seven patients had a median of three (range one to five) febrile UTIs prior to surgery, with the remaining seven patients having no febrile UTI prior to vesicostomy. All patients who had a prior febrile UTI were subsequently managed with antibiotic prophylaxis.

Median serum creatinine level before surgery was 0.26 mg/dL (range 0.16—0.97). Either unilateral or bilateral $\geq$SFU Grade 2 hydronephrosis was present in six patients. Prior to vesicostomy, no patients had undergone previous urological surgery. All patients were on CIC and anticholinergics prior to surgery. Median age at the time of vesicostomy was 26.5 months (range 4—96). Mean functional bladder capacity assessed during urodynamic studies prior to surgery was 107 mL (range 20—279). Only one patient had leakage during preoperative urodynamic studies (DLLP 34 cm/H_2O). All patients showed neuropathic detrusor overactivity with a mean maximal detrusor pressure ($Pdet_{max}$) of 49 cm/H_2O during filling (range 18—100). Detrusor sphincter dyssynergia was present in all patients. High grade vesicoureteral reflux (grade $\geq$3) was present in only three patients, all of whom had UTD.

There were no 30-day postoperative complications. During follow-up, the main complication was stomal stenosis in three patients, one who also experienced chronic peri-stomal irritation. Of these three patients, stomal revision was performed at 4, 5, and 16 months after initial creation. Mean follow-up after vesicostomy was

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