Long-term Follow-up of Sigmoid Bladder Augmentation for Low-compliance Neurogenic Bladder

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OBJECTIVE To assess the clinical and urodynamic outcomes of patients with low-compliance neurogenic bladder who were treated with sigmoid bladder augmentation (SBA) over a long-term follow-up.

MATERIALS AND METHODS We retrospectively reviewed 52 patients with low-compliance neurogenic bladder who underwent SBA alone or with antireflux techniques in our hospital from 2006 to 2014. Clinical outcomes regarding bladder function, incontinence, medications, catheterization schedules, subsequent interventions, bowel function, and patient satisfaction were addressed.

RESULTS The mean follow-up was 49 months. All patients experienced significant increases in safe cystometric capacity from 113.8 ± 65.9 mL to 373.1 ± 66.7 mL (P <.001), bladder compliance from 2.96 ± 1.55 mL/cm H_2O to 14.07 ± 5.45 mL/cm H_2O (P <.001), and decreases in creatinine from 88.1 ± 38.6 μmol/L to 77.1 ± 30.4 μmol/L (P <.001) compared with those before surgery. Six patients (11.5%) required anticholinergic medicine to control neurogenic detrusor overactivity, and 11 (21.1%) had recurrent febrile urinary tract infections after SBA. Among 47 prehydronephrosis patients (grade I-II in 10 and III-V in 37), 16 still had minor hydronephrosis after SBA, but the hydronephrosis had been improved significantly (all posthydronephroses were grade I-II instead). All patients reported significant improvements in constipation, and no patient had obvious metabolic acidosis or bladder perforation after SBA. All patients expressed extreme satisfaction with the operation.

CONCLUSION SBA provided durable clinical and urodynamic improvement for patients with low-compliance neurogenic bladder and constipation. SBA alone, without ureteral reimplantation, seemed sufficient for neurogenic bladder. Furthermore, there was a high level of patient satisfaction with SBA. UROLOGY 84: 697–701, 2014. © 2014 Elsevier Inc.

Neurogenic bladder dysfunction (NBD) often leads to high intravesical pressure, urinary incontinence, and vesicoureteral reflux (VUR). Long-term high intravesical pressure can cause further damage to the upper urinary tract (UUT). Bladder augmentation is an appropriate intervention for patients with NBD refractory to conservative medical therapies,[1] and it aims to create a large-capacity and good-compliance reservoir with a preserved UUT, allowing for socially acceptable continence.

Regardless of the bowel segment used, the compliance at capacity was significantly improved in the ileum and sigmoid groups.[2] The advantages of the sigmoid bowel, including being proximal to the bladder and having a thick muscular wall, large lumen, and abundant mesentery, guarantee adequate capacity and maneuverability for the bladder.[3] Simultaneous resection of the sigmoid colon for a larger reservoir of the bladder could benefit neurogenic bladder patients with improvement of intractable constipation.[4] Therefore, we believed that actively performing bladder augmentation with sigmoid segments (sigmoid bladder augmentation [SBA]) would be safe and proper for patients with NBD and that this technique could preserve the patients' renal function.

Although several clinical studies have shown excellent results with SBA,[4,5] the long-term urodynamic results of SBA remain insufficient because of the progressive nature of NBD. We evaluated the clinical and urodynamic outcomes and overall satisfaction in a group of patients with known neurogenic bladder who underwent SBA, with a maximum of nearly 8 years of follow-up. In addition, standard videourodynamic testing was performed to assess the long-term durability of bladder augmentation to provide low-pressure high-capacity urinary storage.

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MATERIALS AND METHODS

Patients

We retrospectively identified 29 male and 23 female patients with a maximum 8-year follow-up who underwent SBA in our hospital from 2006 to 2014. The mean patient age at the time of surgery was 21.7 years (range, 6-51 years). All the patients had a known diagnosis of NBD except for 2 patients (3.8%) whose diagnoses were unknown, and the diseases causing the NBD include trauma to the spinal cord in 2 cases (3.8%), myelomeningocele in 13 (25%), spina bifida in 2 (3.8%), tethered cord syndrome in 14 (26.9%), spinal cord tumors in 16 (30.8%), intracranial hemorrhage in 1 (1.9%), and lumbar surgery in 2 (3.8%). Of the 52 patients, 8 (15.3%) had urodynamically proven neurogenic detrusor overactivity, 35 (67.3%) had incontinence with an average bladder compliance of 2.66 ± 1.36 cm H_2O, 17 (32.7%) had no incontinence with an average bladder compliance of 3.63 ± 1.75 cm H_2O ($P < .05$), 41 (78.8%) had dysuria, 4 (7.6%) had ureteral orifice strictures, and the remainder had no UUT obstruction; in addition, 31 patients (59.6%) demonstrated VUR (bilateral in 24 and single in 7) on videourodynamic studies (VUDS). VUR was graded according to the International Reflux Study Group classification (grades I-II in 6 and grades III-V in 25). Forty-seven patients (90.3%) had hydronephrosis (bilateral in 36 and unilateral in 11), grade I-II hydronephrosis was found in 10 patients, and III-V in 37. All patients had various grades of constipation (one defecation in 3-5 days; Table 1).

Surgical Technique

The method of "clamshell" SBA was primarily performed[6] (Fig. 1). The native bladder was opened longitudinally on the sagittal plane. A 20- or 30-cm long segment of sigmoid colon was isolated with its vascular pedicle and was opened on its antimesenteric border to form a patch. The antimesenteric border was incised longitudinally, and a detubulized sigmoid patch was created. An incision was made laterally between the main branches of the inferior vesical vessels anterior to the trigone and ureteral orifice to a point approximately 2 cm from the internal urethral meatus. A tunneled reimplantation technique was performed in the native bladder for the antireflux procedure. The antireflux operation was performed by intravesical mobilization of the terminal ureter, with subsequent reimplantation through a new hiatus and a submucosal tunnel. The detubulized sigmoid patch was sutured onto the opened bladder with continuous Vicryl sutures in 1 layer. A double-J ureter catheter was inserted into each reimplanted ureter as a stent, and the augmented bladder was emptied with a urethral catheter and another catheter used as a bladder fistula. Another drain was put behind the pubis. Postoperative management included bladder irrigation with normal saline, beginning on the third day after surgery, using the indwelling catheters to prevent obstruction by secretions. The ureteral stents were removed within 4 weeks, immediately before a videourodynamic assessment. The patients were advised to continue with regular bladder irrigation even after discharge from the hospital, using clean self-intermittent catheterization (CSIC). After the SBA, anticholinergics (tolterodine 2-4 mg/d) were recommended for all patients who had an overactive bladder before the operation to control overactive contractions. Patients who had VUR pressure lower than 20-30 cm H_2O and higher grades IV-V before SBA would be treated with simultaneous antireflux.

Evaluation

Multichannel VUDS (Bonito; LABORIE, Mississauga, ON, Canada) was performed routinely as part of the preoperative evaluation and for postoperative urodynamic testing at the follow-up visit for all the patients. We performed VUDS in accordance with International Continence Society guidelines.[7] Safe cystometric capacity (the volume at which intravesical pressure increased by 40 cm H_2O from the beginning of bladder filling),[8] bladder compliance, VUR pressure, overactive contractions, and other urodynamic parameters were measured.

VUDS was performed routinely at 6 and 18 months after SBA and annually thereafter during the first several years, after that, we suggest the patient to have the VUDS follow-up once every 2-3 years. Routine postoperative follow-up at our institution also included renal ultrasonography and renal function test. Clinical outcomes regarding the frequency of CSIC and the catheterized volume, continence, the need for subsequent urological interventions, medication use, catheterization habits, bowel function, and patient evaluations of their quality of life and worries about the future were assessed via a questionnaire administered by mail or telephone interview.

At least 6 months after the operation, 7-point and 5-point Likert scales were used to assess patient satisfaction with their quality of life and their worries about the future, respectively. For the 7-point questionnaire on "satisfaction with quality of life," the patients rated their satisfaction on the following scale: 0—very good, 1—good, 2—mostly satisfied, 3—just so-so, 4—mostly dissatisfied, 5—unpleasant, and 6—very painful. For the 5-point questionnaire on "worries about the future," the patients rated their worry on the following scale: 0—none at all, 1—a little bit worried, 2—minor worry, 3—moderate worry, and 4—very worried.

Statistical Analysis

The results are reported as the means ± standard deviations. Statistical analysis was performed with SPSS software, version 13.0 (SPSS Inc, Chicago, IL). The independent *t* and paired *t* tests were used to compare the data. $P < .05$ was set as statistically significant.

RESULTS

Of the 52 patients, 37 patients received SBA alone, 3 received the SBA with simultaneous single ureter reimplantation, and 12 received SBA with bilateral reimplantation simultaneously. The mean follow-up was 49 months (range, 8-117 months). VUDS was performed at least half a year postoperatively for all the patients and annually or biennially thereafter. All patients routinely performed CSIC postoperatively. The mean number of times of CSIC per day was 5.4 ± 1.0, and the mean CSIC volume was 359.1 ± 78 mL (range, 210-600 mL). All the patients experienced significant increases in safe cystometric capacity ($P < .001$) and bladder compliance ($P < .001$) and decreases in creatinine and urea nitrogen ($P < .001$) compared with the levels before surgery (Table 2). There were also 16 patients who had minor hydronephrosis after SBA; however, their grade of hydronephrosis had been improved significantly than preoperative (all post-hydronephroses were grade I-II instead). All patients reported significant improvements in constipation (once defecation per 1-2 days), and no patient had obvious metabolic acidosis or bladder perforation after SBA.