# Bladder Neck Sling and Appendicovesicostomy Without Augmentation for Neurogenic Incontinence in Children

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**Purpose:** Most children undergoing bladder neck sling for neurogenic urinary incontinence also have undergone bladder augmentation. However, complications from enterocystoplasty and uncertainty regarding its indication during bladder outlet enhancement led us to perform slings without augmentation. Herein we report outcomes in consecutive patients.

**Materials and Methods:** A total of 30 patients with neurogenic bladder underwent tight 360-degree fascial sling wrap around the bladder neck and appendicovesicostomy without augmentation. Indications included detrusor leak point pressure less than 50 cm water and stress urinary incontinence. Urodynamics were obtained in all patients preoperatively, in 26 at a mean of 6 months postoperatively and in 16 at a mean of 24 months postoperatively.

**Results:** Satisfactory continence defined as 2 or fewer damp pads daily was achieved in 83% of patients with followup of 6 to 60 months (mean 22). Symptomatic hyperreflexia and/or loss of compliance developed in 8 patients postoperatively, which responded to anticholinergics in 7. The remaining patient underwent enterocystoplasty 18 months later, for an augmentation rate of 3%. No patient had hydronephrosis or reflux.

**Conclusions:** Evaluated parameters, including bladder capacity and compliance determined during preoperative urodynamics, did not predict the need for augmentation. Satisfactory continence can be achieved for neurogenic bladder by sling without enterocystoplasty.

*Key Words: urinary incontinence; urinary bladder, neurogenic; urologic surgical procedures*

Most children undergoing sling procedures for neurogenic incontinence also undergo enterocystoplasty simultaneously. Perez et al augmented 87% of cases during bladder neck sling, and in reviewing the literature to 1996 found that 70% of published cases included enterocystoplasty.[1] Similarly, 95% of 162 patients undergoing slings in 4 studies presented at the 2004 meeting of the American Urological Association also underwent augmentation (unpublished data). Reasons for enterocystoplasty during sling placement include presumed inadequate bladder capacity and concern for development of high intravesical pressure from increasing outlet resistance. Early experience with AUS demonstrated that bladder deterioration and upper tract damage can occur when outlet resistance is increased, and preoperative urodynamics do not reliably predict these changes. However, slings may not compress the outlet as efficiently as AUS, and enterocystoplasty entails a number of risks, including rupture and malignancy, which are potentially life threatening. We report our results with slings without augmentation in consecutive patients with neurogenic incontinence.

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## MATERIALS AND METHODS

A total of 30 children with neurogenic incontinence underwent sling for presumed sphincteric incompetence when urodynamic evaluation demonstrated DLPP less than 50 cm water or there was a history of stress urinary incontinence. Testing was done by a trained nurse under physician supervision with the patient seated upright. Fluid was infused by pump at 10% estimated bladder capacity per minute through a dual lumen 7Fr urethral catheter. Patients with hyperreflexia or decreased compliance were prescribed oral and/or intravesical oxybutynin, with urodynamics repeated 6 weeks later to document response.

The final preoperative evaluation in all cases showed detrusor areflexia. Expected bladder capacity was estimated by the formula, volume in ml = 30(age in years + 2). Actual bladder capacity was volume measured at less than 40 cm $H_2O$. Compliance (cc volume/cm $H_2O$) was determined at 75% of actual capacity for best representation of bladder storage conditions without the influence of a terminal increase in pressure at maximum capacity. Renal sonography (30 patients) and contrast cystography (28) were also obtained preoperatively, demonstrating absence of hydronephrosis and a smooth appearing bladder in all cases (see figure).

A dose of 0.2 mg/kg oxybutynin was given orally 3 to 4 times daily (maximum 5 mg per dosage). Oxybutynin was instilled intravesically twice daily, at a dose of 5 mg for preteens and 10 mg for teenagers.




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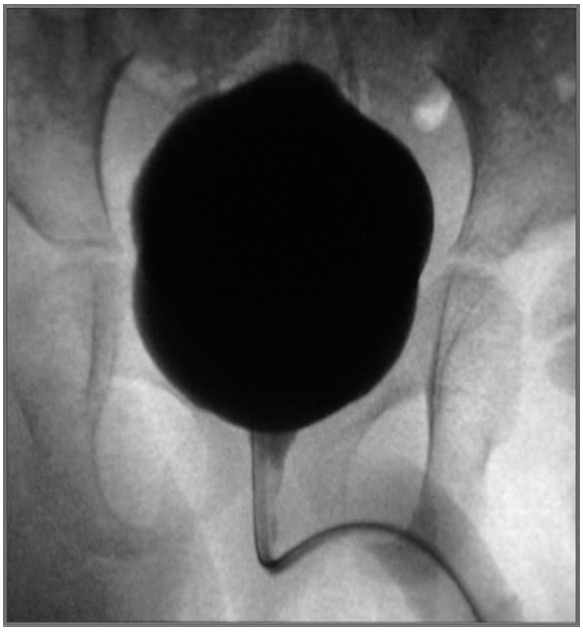

Access to the bladder outlet was facilitated by posterior midline dissection after mobilizing peritoneum from the dome as described by Lottmann et al.[2] The urethral catheter was removed and the bladder neck was encircled tightly by a rectus fascia strip, which subsequently was elevated and secured to the pubic periosteum. The bladder dome was hitched under the right rectus muscle near the umbilicus and appendicovesicostomy was performed. Other simultaneous procedures included closure of the vesicostomy (2 patients), ureteral reimplantation (2) and cystolithotomy (1).

At 3 weeks postoperatively intermittent catheterization every 3 hours and anticholinergics were resumed. A satisfactory outcome was defined as 2 or fewer damp pads per 24 hours and resolution of stress urinary incontinence. Initial postoperative urodynamic evaluation was planned for approximately 6 months after the procedure. Testing was performed as described preoperatively, except that the catheter was inserted through the appendicovesicostomy. Renal sonography was obtained at 6 months and then annually, while cystography was performed at approximately 6 months postoperatively.

## RESULTS

A total of 30 patients (18 males and 12 females) with neurogenic incontinence from sphincteric incompetence underwent bladder neck wrap and appendicovesicostomy without enterocystoplasty. Neurological lesions were myelomeningocele (27 patients), caudal regression (2) and spinal cord lipoma (1). The first 2 patients were operated on in 2001 and then the procedure was used in all children operated on from June 2002 to November 2005. Patient age ranged from 3 to 17 years (mean 8.6). Patient characteristics are summarized in table 1.

Followup ranged from 6 to 60 months (mean 22). Preoperatively, these children used 4 to 10 pads per 24 hours, reporting the pads typically were wet when changed and sometimes leakage showed on the outer clothing. Postoperatively, 17 patients reported no or only occasional minimal urinary leakage and were labeled "dry," 6 consistently had dampness manageable with 1 pad and 2 wore 2 pads daily. These 25 children (83%) were considered successfully improved. The remaining 5 patients, all males, remained wet, using more than 4 pads per 24 hours. Patient sex, age and ambulatory status did not predict surgical outcomes (table 2).

Preoperative and postoperative anticholinergic use is listed in table 1. At 6 months postoperatively anticholinergic therapy remained unchanged in 20 cases. Four patients began anticholinergics and 4 had the oral regimen augmented with intravesical instillations either empirically before postoperative urodynamics for diminished but persistent incontinence (2), or when urodynamics demonstrated uninhibited contractions (1), uninhibited contractions with decreased compliance (3) or areflexia with decreased compliance (2). One child using oral and intravesical medication preoperatively only took oral oxybutynin, while 1 child taking oral anticholinergics discontinued medication postoperatively.

Preoperative urodynamics were obtained in all patients, while initial postoperative studies were performed in 26 at an average of 6 months postoperatively (range 3 to 14). Excluding 1 boy who underwent augmentation, bladder capacity less than 40 cm $H_2O$ ranged from 80 to 500 cc (37% to 175% predicted by formula) preoperatively and from 90 to 500 cc (33% to 143%) postoperatively. Altogether, bladder volumes decreased in 14 patients, increased in 9 and were unchanged in 3. Compliance was 2 to 53 cc/cm $H_2O$ preoperatively and 5 to 37 cc/cm $H_2O$ postoperatively, with decreases in 14 patients, increases in 11 and no change in 1. Detrusor leak point pressure increased a mean of 12 cm water (range −5 to 42).

Urodynamics were repeated in 16 patients at a mean of 24 months (range 12 to 52) postoperatively. Following initial postoperative testing measured bladder capacity increased in 13 patients, was unchanged in 2 and decreased in 1.

One boy had a preoperative capacity of 160 cc (48%) and compliance of 13 cc/cm $H_2O$, which diminished postoperatively to only 40 cc volume (12%) with compliance of 1 cc/cm $H_2O$, and did not respond to anticholinergics. He underwent enterocystoplasty 15 months after the sling procedure, without development of upper tract changes, and was the only patient to undergo augmentation. No patient had hydronephrosis, and no new reflux was observed during cystography obtained in 22 patients postoperatively.

Incontinence persisted in 5 boys. In 2 boys DLPP decreased postoperatively from 50 to 25 cm $H_2O$ and from 30 to 25 cm $H_2O$, which was considered evidence of sling failure. One patient was successfully treated with dextranomer/hyaluronic acid urethral injection. In 2 cases DLPP increased from 10 to 30 cm $H_2O$ and from 25 to 56 cm $H_2O$ but the bladder neck remained visibly incompetent during fluoroscopic urodynamics, and so these cases were also considered sling failures. One of these patients also became dry following urethral injection. The boy who had loss of bladder volume and compliance leading to augmentation, as mentioned previously, had an increase in DLPP from 18 to 35 cm $H_2O$ from the sling.