Simultaneous Augmentation Cystoplasty and Cuff Only Artificial Urinary Sphincter in Children and Young Adults with Neurogenic Urinary Incontinence

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Abbreviations and Acronyms

AC = augmentation cystoplasty

AUS = artificial urinary sphincter

C-AUS = complete artificial urinary sphincter

CIC = clean intermittent catheterization

CO-AUS = cuff only artificial urinary sphincter

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Purpose: We review our experience with artificial urinary sphincter and augmentation cystoplasty in patients with neurogenic bladder. This is the largest known series to specifically evaluate cuff only artificial urinary sphincter at augmentation cystoplasty.

Materials and Methods: A total of 18 males underwent simultaneous artificial urinary sphincter and augmentation cystoplasty at our institution between 1982 and 2012, of whom 13 (72%) underwent cuff only artificial urinary sphincter. Outcomes included urinary continence, emptying modality, artificial urinary sphincter status, complications and additional procedures.

Results: Of the patients undergoing augmentation cystoplasty and cuff only artificial urinary sphincter 10 (77%) were initially continent. Average time of continence was 52.9 months. Four patients (31%) required no additional procedures and remained continent. Urinary incontinence developed in 3 patients (23%) immediately postoperatively and in 6 (46%) subsequently. Ultimately 9 patients (69%) required conversion to complete artificial urinary sphincter at a mean of 36.9 months postoperatively. Overall 12 patients (92%) were continent at followup. There were no artificial sphincter specific complications in patients undergoing the cuff only procedure with conversion to complete artificial urinary sphincter. After conversion to complete artificial urinary sphincter 3 patients (23%) experienced artificial sphincter specific complications. Reoperation was performed in 10 patients (77%), for 13 total procedures (1.3 per patient). There were no complications with cuff only artificial urinary sphincter and 6 complications with complete artificial urinary sphincter ($p = 0.025$). Finally, patients undergoing cuff only artificial urinary sphincter requiring revision were younger than those not requiring revision (15.6 vs 30.8 years, $p = 0.026$).

Conclusions: Simultaneous cuff only artificial urinary sphincter and augmentation cystoplasty appears safe and efficacious in patients with neurogenic bladder, with fewer complications than complete artificial urinary sphincter, and may provide definitive urinary continence in up to a third of patients. This procedure is technically easy, allows for outpatient revision, provides time for the child to mature and may be cost effective in avoiding placement of additional components in this select patient population.

Key Words: myelodysplastic syndromes; urinary bladder, neurogenic; urinary sphincter, artificial; urologic surgical procedures; urinary incontinence

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TREATMENT of neurogenic urinary incontinence remains a significant challenge for the reconstructive urologist. The condition occurs on a spectrum secondary to low urethral resistance, detrusor hyperreflexia, poor bladder compliance or any combination thereof. Etiologies include congenital, acquired and/or functional abnormalities of the lower urinary tract. The treatment goal is to safely correct urinary incontinence, preserve renal function and prevent recurrent urinary tract infections. Unfortunately this entity is frequently encountered in patients with myelodysplasia and bladder exstrophy who have failed conservative therapies such as clean intermittent catheterization and pharmacological treatment as well as multiple reconstructive measures.

Given the complexity of neurogenic urinary incontinence, bladder reservoir augmentation is frequently combined in a simultaneous or staged fashion with treatment of low bladder outlet resistance. Outlet procedures include bladder neck reconstruction, anterior bladder wall flaps, urethral lengthening with reimplantation, fascial slings, AUS and injection of bulking agents at the bladder neck.[1] The AUS device, which was developed by Scott et al in 1973 for sphincter incompetence,[2] has had few modifications in the last 40 years. Arguably the AMS 800® urinary control system remains the gold standard for the treatment of sphincteric incontinence. The efficacy in the pediatric and young adult population has been well documented, with reported continence rates of 80% in situ.[3] Additionally the AUS device allows some patients to maintain spontaneous voiding with intact detrusor function.[4]

Despite these benefits, concerns regarding the durability and safety of AUS remain valid, with mechanical failure in 20% to 30% of cases, erosion and/or infection necessitating explantation in 6.9% to 25%, and mean device survival of 7.4 years.[3–11] Furthermore, AUS effects on upper urinary tract growth, and prostatic growth in males, remain undefined. Finally, in the young patient a significant level of maturity and responsibility is required to operate the device, which precludes many patients from achieving functional urinary continence at a young age.

In an effort to decrease the risks associated with the artificial urinary sphincter insertion of the cuff only device at AC has been described previously.[12] Similar to the fascial wrap[13] and the Lima constrictor device,[14] when an appropriately sized AUS cuff is placed around the bladder neck, it may provide a level of circumferential external compression at reduced pressure compared to complete AUS, which allows for urinary continence while maintaining the ability to void spontaneously. Thus, unlike the C-AUS, which has a 19% erosion rate,[3] a CO-AUS may have a decreased risk of associated complications. As such, we hypothesized that CO-AUS with simultaneous AC is effective in producing urinary continence with minimal associated complications.

METHODS

We retrospectively reviewed the records of 2,200 patients who underwent AUS placement at our tertiary referral center between 1982 and 2012. A total of 13 consecutive male patients (median age 15 years, IQR 10 to 29) underwent simultaneous AC and CO-AUS and 5 (23 years, IQR 13 to 39) underwent C-AUS at AC (AMS 800) between 1988 and 2012. The etiology of lower urinary tract dysfunction in patients undergoing CO-AUS was myelomeningocele in 11, cauda equina injury in 1 and sacral agenesis in 1. Of patients undergoing C-AUS 3 had myelomeningocele, 1 had bladder exstrophy and 1 had sacral agenesis with posterior urethral valves. Mean followup was 77.9 months (range 0.2 to 260.1) in patients undergoing CO-AUS and 59.4 months (2.6 to 133.4) in those undergoing C-AUS.

Voiding cystourethrography was performed to evaluate the bladder neck and exclude vesicoureteral reflux. Persistently open bladder neck with the patient in the upright and resting positions implied outlet incompetence. Urodynamic evaluation included cystometry with measurement of detrusor leak point pressure, leak point pressure determination and uroflow. Depending on the study time frame, cystometry was done with carbon dioxide (50 to 100 ml per minute) or water infusion (25 ml per minute), and leak point pressure was determined by abdominal leak point pressure or urethral pressure profile. Bladder neck integrity and/or detrusor compliance information was available in 16 of 18 patients. Preoperative bladder capacity was 46 to 350 ml, abdominal leak point pressure was 8 to 65 cm H_2O and detrusor leak point pressure was 11 to 69 cm H_2O, with all patients demonstrating poor bladder compliance and evidence of sphincteric incompetence.

Patients who failed to become dry with CIC, medical therapy or previous bladder and/or outlet procedures, and who had the functional maturity to operate an AUS were considered candidates for this combined procedure. A posterior retrovesical approach to the bladder neck was used to place the AUS, as described previously.[15] AC and bowel closure were completed with copious bacitracin-saline irrigation performed before AUS placement. An AUS cuff was placed around the bladder neck in all patients. In patients undergoing CO-AUS after placement of the AUS cuff the tubing was passed through the rectus muscle and secured to the anterior rectus fascia for identification if AUS reservoir and pump placement were needed. In those undergoing C-AUS the reservoir was placed in the prevesical space and the pump was placed in the scrotum, with activation 6 weeks postoperatively. Simultaneous bilateral ureteroneocystostomy was performed in 3 patients and Mitrofanoff continent catheterizable stoma was performed in 1 at CO-AUS.