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GENERAL UROLOGY

**Original Article**

# The effects of etiological factors on the results of augmentation enterocystoplasty: spinal cord injuries versus chronic tuberculosis cystitis

## *Etyolojik faktörlerin mesane ogmentasyon sonuçları açısından önemi: omurilik yaralanmaları ile kronik tüberküloz sistit karşılaştırması*

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## ABSTRACT

**Objective:** In our study, we aimed to compare the cystometric and clinic results of patients who underwent augmentation cystoplasty for the treatment of a contracted bladder, according to etiological factors such as chronic tuberculosis cystitis (CTC) and spinal cord injuries (SCIs).

**Materials and methods:** We retrospectively evaluated 26 patients with a contracted bladder due to CTC and SCI who underwent bladder augmentation in our clinic. The contracted bladder etiologies were SCI in 16 of patients (61.5%) and TBC in the remaining 10 patients (38.4%). The patients were evaluated preoperatively and postoperatively.

**Results:** The mean follow-up periods for patients with SCI and CTC were 98.5±31.3 and 83.2±35.3 months, respectively (p>0.05). Patients with SCI and CTC did not significantly differ with respect to the preoperative and postoperative mean bladder capacities or intravesical pressures. As additional postoperative treatments, Clean Intermittent Self-Catheterization (CISC) was performed in 5 (31.2%) SCI patients, and anticholinergic treatment was administered to 3 SCI patients (18.7%). Anticholinergic treatment was used postoperatively in only one patient with CTC (10%).

**Conclusion:** Augmentation cystoplasty is a useful treatment for patients with SCI and CTC. The postoperative urodynamic studies in these patients were similar. However, the requirement for additional treatments in patients with SCI, including anticholinergic agents and CISC, is more frequent than in patients with CTC in the postoperative period. Therefore, patients with SCI should be warned about additional postoperative treatments before augmentation cystoplasty, and CISC should be taught to these patients.


**Key words:** Spinal cord injuries; urinary bladder; urodynamics; urogenital tuberculosis.

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## ÖZET

**Amaç:** Bu çalışmamızda Kronik Tüberküloz Sistiti (KTS) ve Omurilik Yaralanmaları (OY) nedeniyle kontrakte mesane gelişen ve ogmentasyon sistoplasti uygulanan hastaların klinik ve sistometrik sonuçlarını karşılaştırmayı amaçladık.

**Gereç ve yöntem:** Kliniğimizde KTS ve OY'sına bağlı kontrakte mesane gelişen ve ogmentasyon sistoplasti uygulanan 26 hastayı retrospektif olarak değerlendirdik. Kontrakte mesane etyolojisi 16 (%61.5) hastada OY ve 10 (%38.4) hastada ise KTS idi. Hastalar preopertif ve postoperatif dönemlerde değerlendirildi.

**Bulgular:** OY ve KTS'li hastaların ortalama takip süreleri sırasıyla 98.5±31.3 ve 83.2±35.3 aydı (p>0.05). OY ve KTS'li hastaların preopertif ve postoperatif ortalama mesane kapasiteleri ve intravezikal basınçları arasında anlamlı bir faklılık yoktu. OY'lı 5 (%31.2) hastaya Temiz aralıklı kataterizasyon (TAK) ve 3 (%18.7) hastaya ise antikolinerjik tedavi postoperatif dönemde ek tedavi olarak uygulanmıştı. KTS'li grupta ise yalnızca bir (%10) hastaya postoperatif ek tedavi olarak antikolinerjik tedavi uygulanmıştı.

**Sonuç:** Ogmentasyon sistoplasti gerek OY'lı gerekse KTS'li hastalarda iyi bir tedavi seçeneğidir. Bu hastalardaki postoperatif ürodinamik çalışmalar benzer sonuçlar vermektedir. Ancak postoperatif dönemde antikolinerjik tedavi ve TAK gibi ek tedavi gereksinimi OY'lı hastalarda KTS'li hastalara göre daha sık olmaktadır. Bu yüzden, ogmentasyon sistoplasti öncesi OY'lı hastalar ek tedavi gereksinimi açısından uyarılmalı ve bu hastalar özellikle TAK uygulamasını öğrenmelidirler.


**Anahtar sözcükler:** Mesane; omurilik yaralanmaları; ürodinamikler; ürogenital tüberkülozis.

## Introduction

Augmentation cystoplasty was first described by Mikulicz nearly a century ago.[1] The main indication for this procedure is contracted bladder, which most commonly presents in patients with a history of chronic tuberculosis.[2] Contracted bladder with interstitial cystitis, radiotherapy or chemotherapy are acquired bladder augmentation less frequently.[3] Augmentation cystoplasty has recently been introduced for neurogenic bladder dysfunction and detrusor instability in patients with spinal cord injury, myelodysplasia and multiple sclerosis.[4,5]

Chronic tuberculosis cystitis (CTC) is secondary to renal tuberculosis and is associated with bilateral renal damage, ureteral stenosis or reflux. To protect the storage function of the bladder, the standard treatment for these patients is augmentation of the bladder using bowel segments.[6]

Detubularization of the bowel segments in these patients results in a greater volume and a lower pressure in the reservoir.[7] The choice of bowel segment is determined by the surgeon's preference because procedures using the ileum, sigmoid and ileocecal segments do not produce different results.[8]

Urinary incontinence is the most common problem in patients with spinal cord injury (SCI), and higher bladder pressure is well known to affect the upper urinary tract. Pharmacological treatment for detrusor hyperreflexia is ineffective and is limited by severe side effects. Augmentation cystoplasty is the gold standard treatment to protect the upper urinary tract with a continent, low-pressure, high-capacity reservoir.[9]

In this study, we aimed to compare the cystometric and clinical results of patients who underwent augmentation cystoplasty for the treatment of a contracted bladder, according to etiological factors including chronic tuberculosis cystitis and spinal cord injury.

## Materials and methods

We retrospectively evaluated 33 patients with a contracted bladder who underwent bladder augmentation at the Ankara Numune Education and Research Hospital 2nd Urology Clinic. Seven patients with neurological diseases, systemic diseases with neurological complications or undetectable *Mycobacterium tuberculosis* infection were excluded from the study. Twenty-six patients with a contracted bladder due to SCI or CTC were evaluated in this study. Seventeen patients were males (65.3%). The contracted bladder etiologies were SCI in 16 patients (61.5%) and CBC in the remaining 10 patients (38.4%). Patients were compared using ultrasonography, intravenous urography and urodynamic evaluations during the preoperative period and at the end of the first postoperative year. Blood urea nitrogen, creatinine and a urine analysis were also evaluated. Chronic tuberculosis cystitis (CTC) is diagnosed by examining urine every morning over a 3-day period and identifying *Mycobacterium tuberculosis* with PCR. Urethrocystoscopy was performed preoperatively for all patients to evaluate the ureteral orifices and additional pathologies in the bladder and urethra.

The bladder augmentations were performed by the same team of surgeons for all patients. The bladder was widely divided with a large sagittal incision without cystectomy. A 20-40 cm segment of the ileum taken 15 cm from then ileocecal valve was used for augmentation with its mesentery, and an ileostomy was performed. The ileum was detubularized and used to augment the bladder in a U configuration. A ureteroneocystostomy was performed simultaneously in 3 patients with high-grade vesicoureteral reflux.

A urodynamic examination was performed according to the guidelines and standardized terminology of the International Society of Continence.[10] A multichannel urodynamic machine (Teze MMSUD 2000-Holland model) was used. Eight French double-lumen transurethral catheters were placed antegrade in the patient's bladder. The bladder storage volume and bladder pressure were recorded while the bladder was filled with sterile, body-temperature 0.09% NaCl at a rate of 30-50 mL/min. The bladder pressure was recorded until the detrusor leak point was reached or until the patient experienced a sensation that would normally lead to immediate evacuation of the bladder. Filling was continued until the functional bladder capacity was reached as documented in the voiding diary of patients with bladder insensitivity.

In both groups of patients, blood urea nitrogen, creatinine and electrolyte levels were evaluated at 3, 6 and 12 months postoperatively, and urodynamic examinations and ultrasonography were performed 12 months postoperatively. Bladder capacity and intravesical pressure were evaluated in cystometric examinations and were compared with the preoperative cystometric results. The Mann-Whitney U test was used for statistical analysis, and $p<0.05$ was considered statistically significant.

## Results

The contracted bladder etiologies were SCI in 16 of 26 patients (61.5%) and tuberculosis in the remaining 10 patients (38.4%). Eleven patients with SCI (68.7%) and 6 patients with CTC (60%) were male. The mean ages of the patients with SCI and CTC were 31.18±14.6 and 46.2±19.25 years, respectively ($p>0.05$). Patients with CTC had histories of tuberculosis and pollakiuria, disuria and microscopic hematuria. Patients with SCI had histories of pollakiuria, urgency, urge or mixed incontinence in addition to neurological deficits.
High levels of serum creatinine were not observed in any of the

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patients during the preoperative or postoperative periods. The mean follow-up periods of patients with SCI and CTC were 98.5±31.3 and 83.2±35.3 months, respectively (p>0.05). The mean bladder capacities of patients with CTC were 83.3±44.5 ml preoperatively and 295.5±77.7 mL postoperatively. The mean intravesical pressure in CTC patients was 69.4±36.2 $cmH_20$ preoperatively and 28.2±11.1 $cmH_20$ postoperatively. The mean bladder capacity of patients with SCI was 78.1±38.7 ml preoperatively and 299.4±108.7 mL postoperatively. The mean intravesical pressure in SCI patients was 70.6±25.3 $cmH_20$ preoperatively and 31.3±10.7 $cmH_20$ postoperatively (Figure 1, 2). The preoperative and postoperative mean bladder capacities and intravesical pressures in patients with SCI and CTC did not significantly differ (p>0.05).

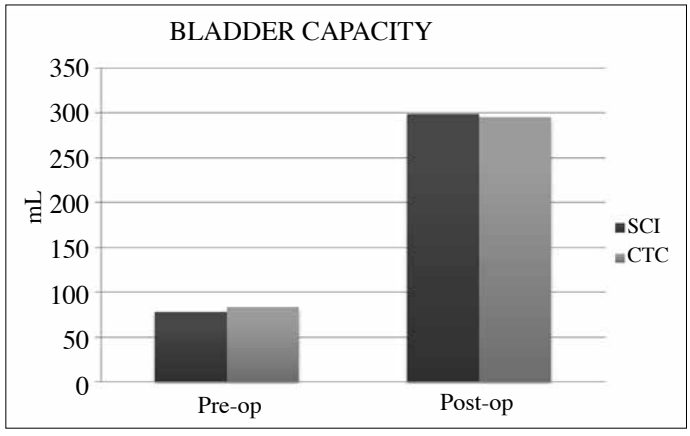


Figure 1. A comparison of the preoperative and postoperative bladder capacities in each group. The preoperative and postoperative values did not significantly differ between patients with CTC and SCI (p>0.05).

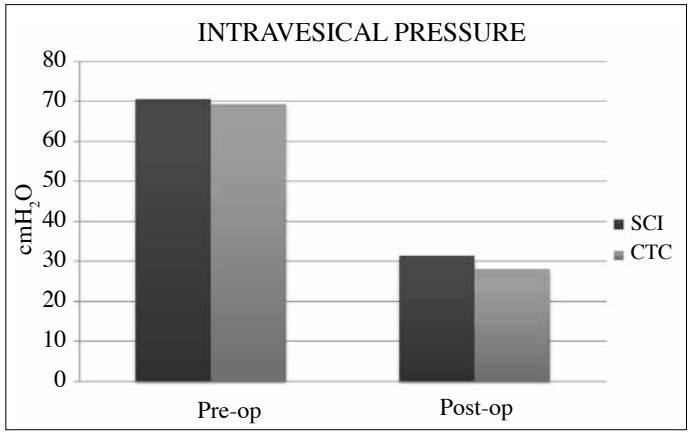


Figure 2. A comparison of the preoperative and postoperative intravesical pressures in each group. The preoperative and postoperative values did not differ between patients with CTC and SCI (p>0.05).

Vesicoureteral reflux (VUR) was observed in 7 patients with SCI (43.7%) and 2 patients with CTC (20%). In SCI patients, the VUR was unilateral in one patient and bilateral in the other six. In five of the SCI patients, the VUR was grade 1-2, and it was grade 3-5 in the remaining two patients. The VUR in the two CTC patients was grade 3-5. Although a ureteroneocystostomy was performed to treat the VUR simultaneously with augmentation for both CTC patients, only one patient with SCI underwent a simultaneous ureteroneocystostomy. VUR was not observed in any patient during the postoperative period (Table 1).

The postvoid residual urine volume was evaluated in all patients in a urodynamic investigation. Clean intermittent catheterization was performed in patients with a postvoid residual urine volume greater than 100 ml. Postoperatively, clean intermittent catheterization was performed in 5 patients with SCI (31.2%) and anticholinergic treatment in 3 patients with SCI (18.7%). Anticholinergic treatment was used postoperatively in only one patient with CTC (10%).

## Discussion

Bilateral renal colonization occurs initially via the hematogenic pathway in urogenital tuberculosis, and infection progresses from a single focal point in one of the kidneys.[11] CTC develops secondary to renal tuberculosis, and it may occur with renal damage, ureteral stenosis or reflux.[6] When ureteral tuberculosis develops, it is usually localized in the ureterovesical junction, and furthermore, it occurs with fibrosis and contraction of the bladder wall when it is localized in the bladder.[12] In our study, vesicoureteral reflux was detected in only two of the patients with CTC. However, renal damage and ureterovesical stenosis was not detected in any of the patients.

Bladder augmentation using bowel segments is the standard treatment for restoring bladder storage function in patients with CTC.[6]

Bladder augmentation using bowel segments is also performed in patients with SCI to reduce high intravesical pressure and increase bladder capacity while preserving upper urinary tract function. Vesicoureteral reflux may develop secondary to elevated intravesical pressure in patients with neurogenic bladder

**Table 1. A list of the additional pathologies in the patients**

| Additional pathologies | CTC | SCI |
|---|---|---|
| VUR (Grade 1-2) | 0 | 5 (31.2%) |
| VUR (Grade 3-5) | 2 (20%) | 2 (12.5%) |
| Unilateral Disfunctional Kidney | 0 | 0 |
| Chronic Renal Failure | 0 | 0 |

CTC: Chronic tuberculosis cystitis, SCI: Spinal cord injury, VUR: Vesicoureteral reflux

disorder, and spontaneous resolution of a vesicoureteral reflux usually occurs following the reduction of this pressure in most cases.[13,14] We detected a vesicoureteral reflux in 7 patients with SCI (43.7%) in our study. Only one of these patients simultaneously underwent a ureteroneocystostomy and augmentation cystoplasty; vesicoureteral reflux was not detected postoperatively in the remaining six patients.

The aim of augmentation cystoplasty is to create a large-capacity urinary reservoir to protect the upper urinary tract and provide continence.[15,16] Although every segment of the gastrointestinal tract has been used as augmentation material, bowel segments have been chosen as augmentation material in many procedures.[17,18] Lockhard et al.,[19] reported that the small bowel stored larger amounts of urine at a lower maximal detrusor pressure in the bladder than the large bowel. Conversely, Mitchell and Piser demonstrated that the large and small bowels have similar clinical urodynamic properties.[20] The type of intestinal segment used for augmentation cystoplasty is less important than the size and configuration. In our study, we used the ileal segment of the small bowel as augmentation material in patients with CTC and SCI. The two patient groups had lower intravesical pressures and increased bladder volume capacities postoperatively. No statistically significant difference was found between the two groups. We used a U configuration of the bowel segment in both groups of patients.

The worsening of renal function after bladder augmentation occurs in 0% to 15% of patients and is related to preoperative renal function.[8] Renal dysfunction and renal function deterioration were not detected in either group of patients after augmentation.

Involuntary contractions have been described in augmented bladders and can result in a poor clinical outcome when they reach amplitudes greater than 40 $cmH_20$ and start with a bladder filling volume lower than 200 mL.[21] However, the real clinical meaning of these contractions is not clear. Lytton and Green have demonstrated involuntary contractions with an amplitude greater than 40 $cmH_20$ and without voiding symptoms in about 40% of 19 patients with an augmented bladder.[7] Figueiredo et al.,[22] showed no statistical difference in the frequency of involuntary contractions in patients with poor and good results. In our study, we detected involuntary contractions in two patients with CTC (20%) and in four patients with SCI (25%). However, all but one patient with CTC and involuntary contractions had voiding symptoms and a good response to anticholinergic treatments.

All patients must learn how to perform clear intermittent self-catheterization (CISC) because there is no reliable way to predict before surgery whether a patient will be able to void spontaneously.[8] It was reported that the requirement and frequency of CISC in patients with neurogenic bladder did not change after augmentation cystoplasty.[23] The probability for requiring CISC is much higher in neuropathic patients because the underlying neurogenic pathology generally interferes with adequate sphincter and pelvic floor muscle relaxation.[8] The requirement for CISC was reported in various studies as 26-100% of patients, and it varied according to patient tolerance of residual urine.[15,19,24,25] However, the requirement for CISC has been shown to differ in patients with and without neurologic diseases according to the presence of high residual urine in the augmented bladder. In various studies, patients with CTC have been reported to require CISC in only 8% to 26% of cases, while 46% to 100% of neurological patients require CISC.[26,27] In our study, five patients with SCI required CISC (31.2%), while none of the patients with CTC required CISC in the postoperative period.

The effective treatment of tuberculosis is very important because it is an endemic disease in Turkey.[28] Augmentation cystoplasty is an effective treatment for voiding symptoms and for preserving the upper urinary tract in patients with CTC and SCI. However, dependent on etiological factors, patients require treatments such as CISC and anticholinergic agents in the postoperative period. Patients with SCI required these additional treatments more frequently in the postoperative period in our study. Therefore, providing information to patients, particularly those with SCI, before the procedure about additional postoperative treatments improves treatment compliance. We are convinced that analyzing urodynamic results in a wide series will be useful for determining the requirement for CISC in the postoperative period.

In conclusion, augmentation cystoplasty is a good treatment for increasing the capacity of the bladder and protecting the upper urinary tract by reducing the intravesical pressure in patients with SCI and CTC. The postoperative urodynamic studies in these patients were similar. However, the requirement for additional treatments in patients with SCI, such as anticholinergic agents and CISC, is more frequent than in patients with CTC in the postoperative period. Therefore, patients with SCI should be warned about additional postoperative treatments before augmentation cystoplasty, and CISC should be taught to these patients. Patients with SCI should be postoperatively evaluated more frequently and over a longer period than patients with CTC.

**Conflict of interest**

No conflict of interest was declared by the authors.

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