Small contracted bladders posing bigger problems: Etiology, presentation, and management and a short review of literature

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ABSTRACT

The purpose of this study was to assess various etiologies, diagnosis and management. This rare entity is a neglected condition which should always be under clinical suspicion by broad speciality of practitioners for early treatment. Retrospective data collected from 2018 to 2021 in the All India Institute of Medical Sciences Rishikesh was used. All patients diagnosed with the small contracted bladder in the given period were included. The primary outcome of the study was to find out the common causes, early tests used for diagnosis and management done in the patients of small contracted bladder attending this tertiary care centre. Between 2018 and 2021, a total of 12 patients were diagnosed to have small capacity bladder (SCB). The most common symptom was frequency (75%). On cystoscopy, 33.33% (n = 4) had less than 50 ml and 66.66% (n = 8) had 50-100 ml bladder capacity respectively. 37.5% (n = 3) were diagnosed by urine AFB culture, 62.5% (n = 5) were diagnosed by urine for PCR, 62.5% (n = 5) were diagnosed by radiological investigations. Eight patients (66.66%) underwent surgical treatment in cases diagnosed as tuberculosis like augmentation cystoplasty and supra-trigonal cystectomy. Other rare causes found were eosinophilic cystitis, radiation induced contracture and BCG induced contracture. Small capacity bladder is an unusual condition, with still dilemma on the definition of small capacity and only few literature mentioning the causes, diagnosis and treatment. Even though tuberculosis is a common cause of SCB, still rare causes should always be kept in mind for relieving patient symptoms at the earliest.

Keywords: Augmentation cystoplasty, small contracted bladder, tuberculosis

Introduction

The small capacity bladder is a chronic debilitating condition with differed etiologies and troubling symptoms, associated with decreased quality of life, psychological changes, and patients being relinquished. Patients with this rare clinical condition present with a myriad of clinical manifestations, and the dilemma in the diagnostic approaches compels the late presentation ensuing larger number requiring a surgical procedure. It is a less debated topic and needs to be addressed to have a better understanding among health care professionals. This urological condition is reversible when associated with an active infection. However, irreversible changes set in during the later stages, due to the structural bladder contracture with complete loss of bladder compliance and elasticity requiring reconstructive surgeries to mend it. The small capacity bladder can be due to varied conditions, and tuberculosis is one of the major causative factors.

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Tuberculosis is a significant problem worldwide and is more prevalent in Southeast Asia. Genitourinary tuberculosis affects mainly the kidneys via hematogenous spread further leading to patchy cystitis followed by chronic inflammation and contracture of the bladder. End-stage renal failure, auto nephrectomy, ureteric strictures, thimble bladder, epididymitis, prostatitis, orchitis, and infertility are common sequelae. We here review 12 cases with different pathologies, unique diagnoses, and specific management in patients with no prior history of exposure to tuberculosis.

**Patients and Methods**

Retrospectively data of all patients in the last 24 months were analyzed. We used the diagnostic criteria introduced by Kapoor et al., which requires one major and/or two minor criteria for the diagnosis of genitourinary tuberculosis (GUTB).

Other causes of the contracted bladder were confirmed by the combined use of histological diagnosis, cystoscopy, radiological investigations. Those patients diagnosed with GUTB were administered 2 months of induction chemotherapy followed by 4 months of the maintenance phase. Reconstructive surgery was done in the cases of the contracted bladder that was implausible with chemotherapy alone.

**Results**

A total of 12 patients were diagnosed to have a small capacity bladder in the study period. The mean age was 50.83 years, and there were nine males (75%) and three females (25%). The most common symptom with which the patient presented were frequent urination (75%), dysuria (58%), hematuria (40%), flank pain (8%), fever (8%), and incontinence (8%). A total of 58.33% (n = 7) of the patients were symptomatic for more than 6 months, with just 41.66% of patients having an initial presentation of fewer than 6 months. [Table 1]

The common risk factors elicited during this study were two patients received intravesical bacillus Calmette-Guérin (BCG) therapy for nonmuscle invasive bladder cancer (NMIBC), one patient had exposure to radiation therapy for uterine malignancy, six patients had prior exposure to anti-tubercular treatment (ATT), and three patients had cystitis with urine culture positive and were under antibiotic therapy. Cystoscopy was done in all twelve patients, with <50 mL capacity demonstrated in four patients (33.33%), and 50–100 mL in the remaining eight patients (66.66%). On micturating cystourethrogram (MCT), 58.33% (n = 7) showed contracted bladder with reflux, [Figure 1a, b] and 41.66% (n = 5) demonstrated contracted bladder with no reflux. [Table 2]

Cystoscopy was done in one patient showing erythematous mucosa, red velvety mucosa, ulceration, and punch biopsy of the bladder mucosa confirmed it to be a case of eosinophilic cystitis. [Figure 2].

Subsequently, he was started on medical therapy. One patient was diagnosed with radiation cystitis (small capacity bladder) following radiation therapy (external beam radiation therapy of 50 Gray’s in 25 fractions over 5 weeks for uterine malignancy and was offered 200 IU of intravesical botulinum [Figure 3].

One patient underwent a total vaginal hysterectomy with procidentia with urinary incontinence (continuous) following surgery. She was diagnosed with an overactive bladder (confirmed on the urodynamic study) who was started on anticholinergic therapy. Two patients had BCG-induced bladder contracture, following which BCG was stopped, and early cystectomy with diversion was performed.

Eight patients (66.66%) underwent surgical treatment, of which five patients underwent augmentation cystoplasty with diversion, one patient underwent supra-trigonal cystectomy with diversion, and two patients underwent early cystectomy with diversion.

| Table 1: Demographic and clinical profile |
|------------------------------------------|
| Parameters                          | Value |
| Age (years)                        | 50.83 (17-65) |
| Sex                                | Male 9 (75%) |
|                                    | Female 3 (25%) |
| Time of initial presentation (months) | 9 months |
|                                      | <6 months 5 (41.66%) |
|                                      | >6 months 7 (58.33%) |
| Previous history of ATT             | 6 (50%) |
| Pulmonary TB                       | 5 |
| GUTB                               | 1 |
| Abdominal TB                       | 0 |
| Initial presentation               | 9 (75%) |
| Frequent urination                 | 7 (58%) |
| Burning micturition                 | 5 (42%) |
| Hematuria                          | 1 (8%) |
| Flank pain                         | 1 (8%) |
| Fever                              | 1 (8%) |
| Incontinence                       | 1 (8%) |
| Additional risk factors            | 2 |
| BCG Therapy                        | 1 |

![Figure 1: a: MCU of a patient of small capacity bladder (approx. 80 mL) with Left VUR. b: MCU of a patient with small capacity bladder (approx. 60 mL) with Left Grade V VUR and right grade IV VUR](image.png)
Urine acid-fast bacilli (AFB) culture was sent routinely for 5 days as per the standard protocol; 37.5% (n = 3) showed tubercle bacilli as compared to 50%–90% in previous literature.[4] Urine TB-PCR is a fully automated real-time Hemi-nested PCR system that helps in the rapid diagnosis of TB and rifampin (RIF) resistance in under 3 h.[5] Of the eight cases, urine PCR was positive in 62.5% (n = 5). Urine culture has a specificity of 100%, and urine TB-PCR had a 93%–98% specificity.[6] Radiological imaging like plain X-ray, MCU, intravenous pyelogram (IVP), and contrast-enhanced computed tomography (CECT) had been used for the ease of diagnosis. Renal calcifications were seen in 7% to 14% on plain X-ray, moth-eaten calyces on IVP. CT and MCU demonstrated pyelonephritis, ureteral strictures, cystitis with vesicoureteral reflux, and small capacity bladder [Figure 4a, b]. We found radiological abnormalities in 62.5% (n = 5) compared to the literature revealing in 63%–96% cases.[4]

The patients with contracted bladder for GUTB received at least 6–8 weeks of the induction phase of the anti-tubercular regimen (isoniazid, rifampicin, pyrazinamide, and ethambutol). Our patients received anti-tubercular therapy (ATT) with a mean of 30.57 weeks. A minimum of 4 weeks of ATT administration is required in order to stabilize the lesion and for better planning of reconstructive surgery.[7] [Table 2]

On follow-up, all the patients were satisfied with decreased symptoms, and a cystogram showed an improved capacity of the bladder. [Figure 5] The mean capacity of the bladder was 247.5 mL, revealed on voiding diary after 3 months of follow-up. As compared to the preoperative voiding diary showing a mean of 75 mL capacity, there was a significant improvement in capacity (30% increase).

**Discussion**

A small contracted bladder (Schrumpfbase in German) was initially described in 1917 by Krotoszyner, where he demonstrated various extravesical and intravesical causes, the cystoscopic diagnosis, and case-based management of contracted bladder. He took 50 cc bladder capacity as standard.[7] But still, the International Continence Society (ICS)
Table 2: Investigations and treatment

| Investigations                        | Value   |
|---------------------------------------|---------|
| Positive urine culture                | 4 (33.33%) |
| E. coli                               | 3 (75%)  |
| Pseudomonas                           | 1 (25%)  |
| Urine for PCR                          | 5 (62.5%) |
| Urine for AFB culture                  | 3 (37.5%) |
| Serum adenosine deaminase (ADA)        | 1 (12.5%) |
| MCU                                   |         |
| Contracted bladder with reflux         | 7 (58.33%) |
| Contracted bladder with no reflux      | 5 (41.66%) |
| Cystoscopy                            |         |
| Capacity (<50 mL)                     | 4 (33.33%) |
| Capacity (50-100 mL)                  | 8 (66.66%) |
| CT Urography                          |         |
| Cystitis with VUR                      | 7 (58.33%) |
| Pyelonephritis/pyonephrosis            | 2 (16.66%) |
| Others (ureteric stricture, small capacity bladder) | 2 (16.66%) |
| Treatment                             |         |
| 1. Medical treatment                   |         |
| Oral antihistaminic, corticosteroids, and antibiotics (Eosinophilic Cystitis) | 1 |
| BCG withdrawn                         | 2 |
| Anticholinerges                        | 1 |
| Intravesical botulimum                 | 1 |
| 2. Surgical treatment                  |         |
| Augmentation cystoplasty               | 5 |
| Supratrigonal cystectomy with diversion| 1 |
| Early cystectomy with diversion        | 2 |

has not defined inflammatory contracted bladder (ICB), and there are no guidelines yet specifying the capacity of the bladder in ICB.

Any factor causing inflammation of the urothelium like radiation, bacterial cystitis, cyclophosphamide exposure, and radiation may disrupt the impermeable barrier formed by the apical layer of the urothelium. Visco-elastic property is due to the presence of collagen and elastin in the submucosal layer of the bladder. An increase in type III: I collagen ratio due to the expression of type III collagen mRNA and a decrease in elastin gene expression causes noncompliant bladder. Detrusor muscle loses its elasticity, and the bladder shrinks due to multiple factors like interstitial cystitis causing infiltration of mast cells or in chronic GUTB.

**Various etiological factors**

**Malakoplakia**

The term “malakoplakia” (from Greek Malako “soft” and Plako “plaque”) is a rare chronic granulomatous disease that most commonly affects the bladder (40%) in the genitourinary tract. Microscopically it is characterized by Von-Hansemann cell, which are histiocytes, and Michaelis-Gutmann bodies with a characteristic “owl eye appearance.” So, the biopsy is essential for diagnosis. Antibiotics are the mainstay of medical treatment. Surgical management is rarely required.

**Eosinophilic cystitis**

In 1960, Brown and Palubinskas first described this rare clinicopathological condition. It is a predominately Ig-E–mediated hypersensitivity reaction. On cystoscopy, it shows a velvety, erythematous, polypoidal lesion, and gross mucosal edema. The biopsy is essential for diagnosis. Histologically, there is a chronic inflammatory infiltrate of eosinophils in the lamina propria and detrusor layer leading to the contracted bladder. This condition is self-limiting, and initial management includes nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroids, and cyclosporine.

**Intravesical chemotherapy (BCG, MITOMYCIN C)**

Contracture of the bladder following administration of intravesical agent is an uncommon but serious complication. BCG-induced contracture is seen in less than 1% of cases and is more common after maintenance therapy. Treatment consists initially of stoppage of BCG, and gradual bladder hydrodistension is also helpful. If conservative measures fail, then augmentation cystoplasty or cystectomy is carried out.

**Tuberculosis**

Tuberculosis is a major health problem in south-eastern countries, and GUTB is the second most common extrapulmonary TB. GUTB has a varied presentation from asymptomatic to nonspecific symptoms, with irritative symptoms being the most common and the others like fever, weight loss, abdominal pain, and anorexia. Urine culture, using liquid culture media Becton Dickinson Diagnostic Instrument Systems, Sparks, Md (BACTEC), is a highly sensitive test (80%–97%) for the identification of mycobacterium. Urine for GeneXpert (PCR) also has a high sensitivity of 94% with a specificity of 88%.

Initially, due to active infection, cicatrization occurs in the dome, but the trigone and bladder neck are spared, which is a reversible process. But over time, the bladder wall loses its elasticity and compliance and forms a thimble bladder which can only be treated by a definitive reconstructive procedure like augmentation cystoplasty.

**Ketamine**

Ketamine is not only a commonly used IV anesthetic drug but also a recreational drug due to its dissociative and hallucinogenic properties. Chronic usage may be associated with small, painful bladder, frequency, incontinence, hematuria, and papillary necrosis. The best treatment is avoiding the drug, and the majority of patients may require reconstructive surgery (e.g. cystectomy).

**Radiation**

It is initially associated with edema followed by cellular destruction, and increased fibroblast leads to collagen deposition, causing a decrease in bladder compliance. Endoscopic injection of botulinum toxin into the bladder has resulted in significant improvement in bladder capacity from 105 to 250 mL.
Table 3: Review on the most important causes, diagnosis and management

| Author            | Year | Case report | Cause | M/C symptom                  | Investigation                                                                                     | Treatment                        |
|-------------------|------|-------------|-------|------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------|
| Gupta et al       | 2006 | Retrospective study | GUTB  | Irritative symptom (70.54%)  | Increased ESR (83.81%), Mantoux positive (48.83%)                                                | Antitubercular drug              |
| Teegavarapu et al | 2005 | Review      | Eosinophilic cystitis | Frequency, dysuria, hematuria, and suprapubic pain | Cystoscopy: erythematous, polyoid velvety red lesions and gross mucosal oedema             | Reconstructive surgery           |
| Huan et al        | 2015 | Case report | Malakoplakia | LUTS with asthma            | Cystoscopy + biopsy: Lamina propria infiltrated by foamy macrophages- containing Michaelis-Gutmann bodies | 1. Antibiotics (Quinolones + trimethoprim + /rifampicin) |
| Liu et al         | 2019 | Review      | Intravesical therapy | Chemical cystitis (35%) with irritative LUTS (M/C) | Microbiological studies: - 48% Tissue biopsy -65.5% Histopathological examination of specimen- 86.3% | 1. Hydrodistension               |
| Srirangam et al   | 2012 | Case report | Ketamine | LUTS microhematuria         | Cystoscopy - ulceration and active bleeding with a significantly reduced functional bladder capacity. | 2. Oral steroids + ATT            |
| Rajaganapathy et al | 2013 | Review      | Radiation | Dysuria, frequency and urgency | Cystoscopy - Erythema, edema, and telangiectasia, bleeding ulcers, fistulas or fibrosis with reduction in bladder capacity | 3. Reconstructive surgery        |
| Ferrara et al     | 2018 | Case report | Schistosomiasis | Irritative LUTS with hematuria | Radiological: diffuse thickening of bladder wall with pseudo polypoid lesion | Discontinue medications          | 4. Partial/totallyctectomy       |

Schistosomiasis

Schistosoma hematobium is the causative agent and is seen mostly in developing countries. The chronic phase is characterized by a contracted, fibrotic, thick-walled bladder with curvilinear calcifications. Oral praziquantel is the drug of choice for schistosomiasis and is responsible for eradicating adult worms, but it doesn’t affect the compliance of the bladder.[20]

Clinical Spectrum

The usual clinical presentations of the small capacity bladder are lower urinary tract symptoms. On cystoscopy, the inflammatory contracted bladder wall is seen as deep red angry color with irregular and ragged ulcerated areas with uneven edges with multiple hemorrhagic spots and trabeculations.[7]

Meticulous diagnosis is a roadmap for management. Diagnosis may require multiple modalities like radiological [computed tomography (CT) urography, IVP, MCU, or magnetic resonance imaging (MRI)], cystoscopy, ultrasound abdomen to get postvoid residual urine, noninvasive tests like bladder diary, uroflow, and urodynamics.

The most common etiology found was genitourinary tuberculosis which was seen in seven cases, intravesical BCG induced in two cases, one case each of overactive bladder due to recurrent urinary tract infection, radiation cystitis, and eosinophilic cystitis. A total of 33.33% presented with bladder capacity <50 mL, and 66.66% had bladder capacity 50–100 mL. The most common procedure performed to correct this problem was augmentation cystoplasty (50%), supratrigonal cystectomy with diversion (8.33%), and radical cystectomy with diversion (16.66%).

Genito-urinary tuberculosis is an extraordinary impostor, early finding requires a high record of doubt as the majority of the early elements are ambiguous and vague. In the recent times, the use of minimally invasive surgery (robotics and laparoscopy) has expanded the incidence of early surgical attempts to get the best results. The impact of untreated tuberculosis on the genitor-urinary system is decimating, with the majority of the patients having genuine sequelae as obstructive uropathy and renal failure. Due to the booming of the new sets of investigations, we are more mindful and astute now about the pathogenesis and disease progression. As still, the literature lacks on various etiologies, diagnosis, and management, this study was intended to create awareness on the small contracted bladder. [Table 3]

Conclusion

The contracted bladder is a rare condition that can due to a spectrum of urological pathologies. We, in this article, present a few important causes responsible for the small capacity bladder, accurate diagnosis, and specific management to curb it. Assessment and management should be tailored according to the etiology and stage of this vesical entity. Clinical suspicion is key to diagnosis, and amalgamation of knowledge is essential between pathologists and urologists for early diagnosis and the benefit of the patient.

Take Home Message

- A small capacity bladder is a substantial impostor, compelling keen observation, expeditious diagnosis, and congruous management.
- A judicious decision in regards to medical and surgical management in this uncommon ought to be reasonably taken.
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There are no conflicts of interest.

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