



LITERATURE REVIEW

URINARY BLADDER DIVERTICULUM MANAGEMENT: LITERATURE REVIEW

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ABSTRACT

The bladder urothelium herniating through the muscularis propria of the bladder wall is known as a bladder diverticulum. Both congenital and acquired bladder diverticulum are possible. They occasionally have iatrogenic causes in adulthood and are frequently linked to obstruction of the bladder outlet. Although they are frequently seen in males with bladder obstruction, most diverticula are small and only need the same management as outlet obstructions. Recurrent urinary tract infection (UTIs), stones, tumors, ureteral blockage, and symptoms of insufficient bladder emptying are all indications for surgery. The type of surgery chosen depends on how much the patient's condition is due to the bladder diverticulum, as established by cystoscopy, urodynamics, and upper tract imaging.

Keyword: bladder diverticulum, voiding dysfunction, diverticulectomy

INTRODUCTION

Bladder diverticulum is defined as mucosal hernia of the bladder urothelium through the muscularis propria of the bladder wall. Bladder Outlet obstruction is usually present in the acquired bladder diverticulum. Although this abnormality is frequently asymptomatic, some may cause lower urinary tract symptoms (LUTS), hematuria, infection, stone formation, or malignant neoplastic change. To date, either in children or adult, bladder diverticulum has gathered a small interest in the textbooks and literature. Textbooks include only a couple of paragraphs on the subject and the literature contains small numbers of reports especially for surgical approaches.^{1,2,3}

SEARCH METHODS

This present review was conducted for the purpose of providing information regarding management of bladder diverticulum. The literature research was performed for the terms *bladder diverticulum vesical diverticula* and *diverticulectomy* using such database as MEDLINE in PubMed.

CLASSIFICATION

There are 2 types of bladder diverticulum: congenital (primary) diverticulum in childhood and acquired (secondary) diverticulum, which are typically seen in adulthood. Congenital bladder diverticulum is due to inherent weakness of bladder musculature whereas acquired bladder diverticulum is due to some kind of urinary outflow obstruction.^{4,5}



Primary bladder diverticulum usually presents in boys less than 10 years of age, and the incidence is estimated to be 1.7%. These are believed due to insufficient muscle layers of the ureterovesical junction, and usually present in the same location near the ureterovesical junction. Acquired diverticulum, on the other side, present in men during the sixth to seventh decade and are often asymptomatic. Various estimates on the incidence in men range from 1% to 8%. Diverticula are typically discovered in men during a workup for lower urinary tract symptoms. Bladder diverticula occur uncommonly in women. The main differences of the diverticulum classification are shown in the table below (Table 1).^{5,6}

Table 1: Classification of Urinary Bladder Diverticulum.⁵

Variables	Congenital Diverticulum	Acquired Diverticulum
Sex and age	Boys <10 years	Men >60 years
Number	Usually, soliter	Usually, multiple
Size	Usually, large	Usually, smaller
Location	Close to vesicoureteral junction	Close to vesicoureteral junction
Cystoscopy	No or minimal trabeculation	Trabeculated Bladder

CLINICAL MANIFESTATIONS

Bladder diverticulum do not have specific symptoms and usually discovered during a workup for a lower urinary tract symptom. Diverticula occur uncommonly in women and they are most commonly related with urethral obstruction as a result of bladder neck hypertrophy. Most of the urinary symptoms happened because due to improper functional muscular layer which can evacuate urine during the voiding phase. The retained urine is the main problem that made initial symptom of bladder diverticulum.^{1,5}

Large or multiple bladder diverticulum may present with incomplete bladder emptying, lower abdominal fullness, and double voiding. Recurrent Urinary Tract Infection (UTI) may be manifested with the development of bladder stones, urinary retention, and malignancy due to chronic irritation of the urine. According to the study of Burcu *et al* in turkey, the emptying symptoms were the most common reason for admission, but 12% of the patients presented with dysuria, 14% with hematuria, 10% with incontinence, 10% with flank pain, and 2% with chronic UTI.^{1,6,7}

DIAGNOSIS

The initial workup for patients suspected bladder diverticulum includes a thorough history and physical examination, including digital rectal examination. Because

diverticula are often attributed to bladder outlet obstruction, the role of benign prostatic obstruction must be considered. Urethral strictures, neoplasia of the prostate or bladder, posterior urethral valves, and a neurogenic bladder (e.g. multiple sclerosis, meningomyelocele, Menke's syndrome, and hyperreflexia in elderly females) may also be responsible.^{1,2}

Bladder diverticulum includes cellules and saccules. Both of them represent small outpouchings between hypertrophied bands of muscular layer, with saccules being larger than cellules. Several imaging modalities are useful to investigate bladder diverticulum such as ultrasonography (USG), voiding cystourethrography (VCUG), CT and MRI.^{4,5} The gold standard imaging method in the diagnosis of bladder diverticulum is VCUG (Fig. 1). This imaging provides additional information regarding the presence of Vesicourethral reflux (VUR) and the anatomy of the posterior urethra. Urology ultrasonography (US), computed tomography (CT), and intravenous pyelography (IVP) are other radiographic imaging that may be useful in diagnosing this rare bladder abnormality.^{1,4,5}

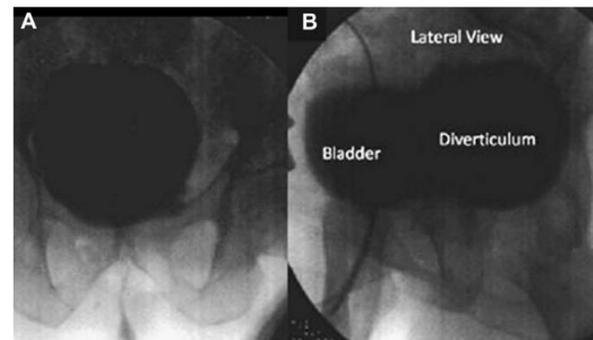


Figure 1: Voiding cystourethrography does not demonstrate the diverticulum in AP view (A), but the lateral view shows a posterior diverticulum (B).⁴

Urine analysis, urine culture and urine cytology should be considered, especially for diverticula patient that does not undergo the surgical management. Bladder diverticulum in adult should prompt further examination for bladder outlet obstruction or neuropathic vesicourethral dysfunction. A video-urodynamic study can be very helpful in the investigation of these patients. It may guide further management especially neurological problems to prevent recurrence and other complication. Endoscopic examination via flexible cystoscopy is often required to inspected the entire interior of some diverticula.^{1,4,5}



MANAGEMENT

The least invasive option for the management of bladder diverticulum is observation with surveillance. If the patient chooses observation, periodic reassessment includes cystoscopy and cytology to detect any malignant transformation are recommended.⁴

Diverticula can have varied in size and number, in some cases, are larger than the bladder. The diverticulum size does not appear to associate with patient complaints and therefore cannot be used as an absolute indication to proceed with surgical option.^{1,4}

Bladder outlet obstruction is implicated in most cases of bladder diverticulum. This condition can lead to detrusor muscle histologic changes and proceed to detrusor decompensation. Early surgical intervention of bladder outlet obstruction may slow and reversely affect this phenomenon.⁴

Surgical options are divided into an underlying urethral obstruction and those directed at the diverticulum itself. Furthermore, consideration should be given to whether to operate simultaneously either bladder outlet obstruction and bladder diverticulum, or to operate those alternately. The absolute indications for surgical management of bladder diverticulum are still undetermined. In General, Bladder diverticulectomy is indicated for the

treatment of LUTS associated to the diverticulum that are not responsive to medicine, or for the complications directly related to diverticula.^{1,8,9}

Primary bladder diverticulum in children especially primary isolated bladder diverticula (PBID) that are not related with ureterovesical junction (UVJ) comprise usually has a large size. Large diverticula with size >3 cm affect children to higher risk for urinary tract infections, voiding difficulties and stone formation, so these conditions are often surgically treated.^{6,8}

There are five methods for surgical bladder diverticulectomy approaches include transurethral incision of the diverticulum neck, open intravesical diverticulectomy and excision of mucosa, open extravesical diverticulectomy, laparoscopic diverticulectomy and robotically assisted laparoscopic diverticulectomy. Open surgical repair by either intravesical or extravesical approaches have been the treatment of choice for bladder diverticula in few decades ago. Furthermore, the advancement of the endourologic instruments are increasing volume of reports on the minimally invasive surgical approaches. The aim of these minimally invasive techniques are to achieve success rates similar to those of open surgery but with optimal post intervention condition

and less complications, such as shorter stays in hospital, improved cosmetic related to smaller incisions, and reduced pain medication.^{4,6,9,10}

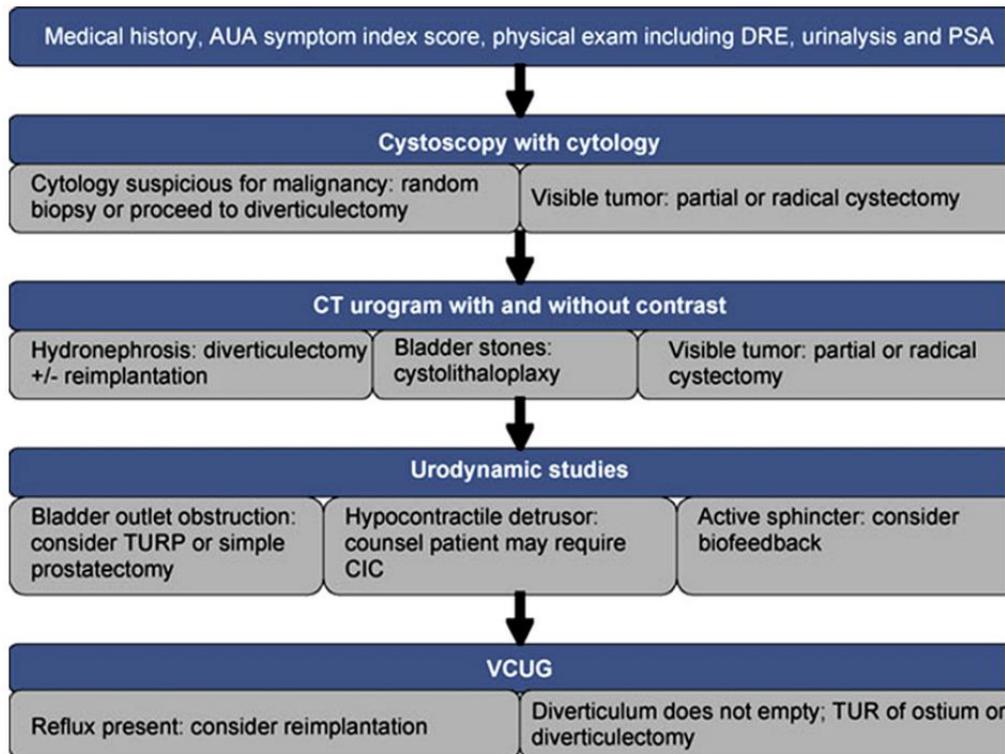


Figure 2: An algorithm for urinary bladder diverticulum management.⁴

In the last 2 decades, several studies have been conducted regarding management of bladder diverticulum. Some studies which are case report, case series, retrospective, cohort study represent the optional therapy for diverticula, specifically the indication of intervention, surgical approaches, outcomes and complications (Table 2).

**Table 2:** Studies describing Bladder Diverticulum.

Author	Year	Studies	n	Treatment	Successful outcomes	Complications
ShuangHong Jiang <i>et al.</i> ²	2020	Case Report	1	Transvesical diverticulectomy (size 207 x 93 x 208 mm), cystostomy and radical resection of rectal carcinoma	1	0
S. Celebi <i>et al.</i> ³	2015	Retrospective Cohort Study	14	6 patients with diverticula size >3 cm underwent transvesical diverticulectomy	14	0
Ali Rizazl Kural <i>et al.</i> ⁹	2009	Case Report	1	Diverticula size was 8x5x6 cm and prostate volume was 69 cc Robot-assisted bladder diverticulectomy (RABD) and Photoselective Vaporization of Prostate (PVP)	1	0
Jesus Moreno Sierra <i>et al.</i> ¹¹	2010	Case Report	1	RABD a 7-cm diverticulum in the posterior bladder wall, followed with TURP and greenlight laser vaporization in a second step1	1	0
Samet Senel <i>et al.</i> ¹²	2020	Case Report	1	A giant bladder diverticulum (17x13x10 cm) Open diverticulectomy after TURP	1	0

CONCLUSION

Urinary bladder diverticulum can be divided into congenital and acquired. A holistic examination of the patient has an important role

in making the diagnosis. The decision to treat the bladder outlet obstruction, diverticulum removal, or observe with regular surveillance has to be made with as much information as



possible. Gold standard radiographic techniques and recently advanced minimally invasive approaches have reduced complications with similar outcomes. Diverticulectomy indication if patient symptoms LUTS or/with relapse urinary tract infection. Many methods of diverticulectomy, preferred with operator choice or minimal invasive surgical seeing cosmetic results and minimal complications.^{4,5}

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