

## ORIGINAL PAPER

# Urinary bladder diverticulum and its association with malignancy: an anatomical study on cadavers

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### Abstract

Present work was directed to study the prevalence and anatomical basis of diverticulum formation and its association with malignancy inside the urinary bladder on cadavers. Urinary bladder diverticulum and its complications including malignancy has been reported by different authors based on their study on radiological findings and endoscopy. Present study was undertaken on cadavers to meet the aforementioned objectives. Thirty properly embalmed cadavers (19 males and 11 females) of different ages were dissected. Sagittal section of pelvis was studied. Urinary bladder was incised to expose the interior and it was examined for the presence of diverticulum (including number and location). Detailed history of the cause of death of cadavers with diverticulum was studied to determine how many of them suffered from urinary bladder diverticular carcinoma. 23.4% cadavers (31.6% males and 9.1% females) showed presence of urinary bladder diverticulum. The location of the diverticulum in all the cadavers was on superior and lateral side of the ureteric opening on the posterior surface of the urinary bladder. Diverticulum of one male cadaver aged 74 years was complicated by malignancy. Our study observed greater prevalence of diverticulum formation as compared to previous reports. In the present work, 14.3% diverticulum of the urinary bladder showed malignant change, which is more than earlier reports in the literature. Urinary bladder diverticulum should neither be neglected nor ignored. Appropriate early treatment (including the cause) of the diverticulum should be undertaken to avoid complications like malignancy which will finally ensure longevity.

**Keywords:** cadaver, anatomy, urinary bladder, diverticulum, malignancy.

### ☞ Introduction

A diverticulum is an outpouching of a hollow (or a fluid filled) structure, which can be formed inside different organs in the body. Increase in the intravesical pressure (3–5 times) causes the urinary bladder mucosa to insinuate itself between muscle bundles of bladder resulting in development of a mucosal extravasational sac or saccule which further results in formation of diverticulum [1, 2]. Regarding the site of diverticulum formation; the most likely site to be affected is the area adjacent to the ureteral orifice where the longitudinal muscle fibers are absent and the outpouching is facilitated [3, 4].

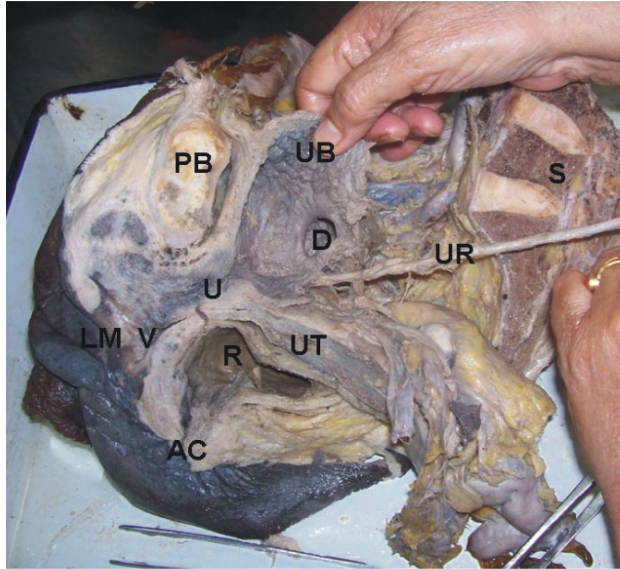
Diverticula in urinary bladder is mucosal outpouching of the bladder not having the muscle layer resulting in loss of its contractile activity which will finally lead to urinary stasis. This will later manifest as stone formation and urinary tract infection predisposing to malignancy. Faysal MH and Freiha FS [5] concluded that stasis of carcinogens in bladder diverticula predisposes the epithelium of urinary bladder to neoplasm formation. Shakeri S *et al.* [6] and Dondalsky M *et al.* [7] reported

that 2–7% of patients with diverticula in the urinary bladder develop neoplasm within the diverticula. Correction of outlet obstruction is first suggested in patients with diverticula formed secondary to obstruction; since many of these diverticula spontaneously resolve with relief of the obstruction. Many authors have reported repeatedly regarding diverticulum formation in the urinary bladder based on endoscopy and imaging techniques [1–15]. Present work was undertaken on cadavers to study the prevalence and anatomical basis including the site and number of diverticulum formation in the urinary bladder.

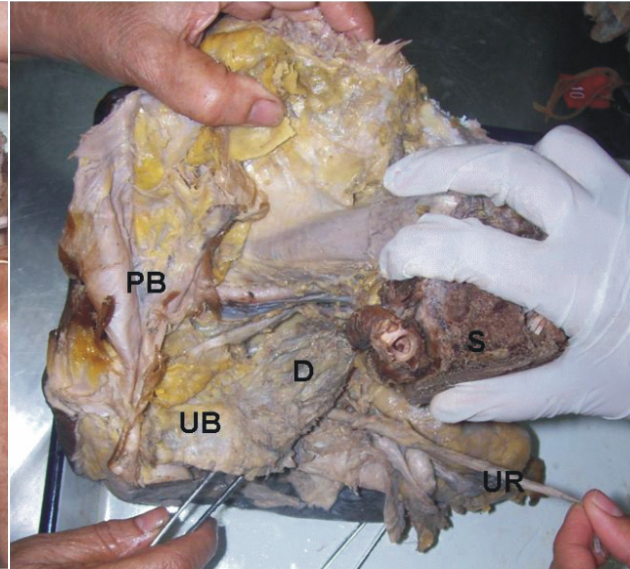
### ☞ Material and Methods

Thirty properly embalmed and formalin fixed cadavers were studied. Cadavers (19 males and 11 females) were studied with age range between 25 to 75 years. Pelvis of aforementioned cadavers was dissected to examine the urinary bladder. Urinary bladder was incised to expose the internal mucosal surface and lumen. Mucosal surface was checked for presence or absence of diverticulum formation. Prevalence of diverticulum forma-

tion including its number in all the cadavers of different age and sex was recorded. Specimens were studied for the site of diverticulum (superior, inferolateral or posterior surface). The diverticulum site was studied in relation to the ureteric opening on the posterior surface. Detailed history including the cause of death of all the cadavers were checked and studied to reveal how many of them suffered from urinary bladder diverticular carcinoma.



**Figure 1** – Median view of the sagittal section of female pelvis showing diverticulum of the urinary bladder. PB: Pubic bone; U: Urethra; V: Vagina; LM: Labia majora; R: Rectum; AC: Anal canal; UT: Uterus; S: Sacrum; UB: Urinary bladder; D: Diverticulum; U: Ureter.



**Figure 2** – Lateral view of the sagittal section of female pelvis showing diverticulum of the urinary bladder. PB: Pubic bone; S: Sacrum; UB: Urinary bladder; D: Diverticulum; U: Ureter.

**Table 1** – Details of the cadavers showing diverticulum formation in the urinary bladder

SN.	Sex	Age [years]	No. of diverticulum	Surface of urinary bladder affected	Diverticulum site in relation to the ureteric opening	Presence of malignant changes in the diverticulum
1.	Male	50	1			No
2.	Male	29	2			No
3.	Female	70	1			No
4.	Male	74	1	Posterior	Above and outer side	Yes
5.	Male	66	1			No
6.	Male	56	1			No
7.	Male	61	1			No

In six out of thirty (16.7%) specimens, only one diverticulum was observed whereas one specimen showed two diverticula in the urinary bladder (Table 1). All the seven specimens showed diverticulum formation in the posterior surface of the urinary bladder (Table 1). The location of the diverticulum in all the seven cadavers was above and on the outer side of the ureteric opening (Table 1). History of one male cadaver aged 74 years with one diverticulum formed on the upper and lateral side of the ureteric opening on the posterior surface confirmed death by transitional cell carcinoma of the urinary bladder diverticulum (Table 1).

## Discussion

In our study, 23.4% of cadavers showed presence of diverticulum in the urinary bladder. The high prevalence

## Results

Seven out of thirty (23.4%) cadavers showed presence of diverticulum in the urinary bladder. In six out of nineteen (31.6%) males and one out of eleven (9.1%) females diverticulum was detected in the urinary bladder (Figures 1 and 2).

One cadaver aged 29 years showed diverticulum; whereas six cadavers with diverticulum were more than 50 years of age (Table 1).

can be explained as follows. Majorities of cases diagnosed as urinary bladder diverticulum are actually pseudo-diverticulum, which is difficult to distinguish through endoscopy and radiological imaging techniques. They are composed of only mucosa and serosa, which is formed in areas lacking muscle fibers.

Diverticulum of the urinary bladder is far more common in males than females (ratio of 9:1) [6, 7]. According to Russell RCG *et al.* [1], 95% of cases, the patient of bladder diverticula is a male over 50 years of age. Our observation showed greater prevalence of diverticulum formation (31.6% in males and 9% in females) as compared to aforementioned reports by different authors. Its prevalence is more in men as compared to women, which is multifactorial. One important factor contributing to diversity between both

the sexes is diverticula formation secondary to development of benign prostatic hypertrophy (more common in old age) resulting in bladder outlet obstruction [8].

In less than 5% cases, a diverticulum is complicated by neoplasm [1]. Haecker A *et al.* [3] opined that incidence of primary neoplasm arising in vesical diverticula varies from 0.8 to 13%. In our study, 14.3% diverticulum of the urinary bladder was complicated by malignant changes. The deficiency of muscle fibers in a diverticulum facilitates tumor invasion to proceed rapidly and easily in the perivesical tissue as compared to normal bladder wall with muscle tissues [3]. Tumors arising in the vesical diverticula has poor prognosis because of early transmural infiltration as compared to the neoplasm originating within the main bladder lumen [6, 7].

### ☐ Conclusions

Hence, in aforementioned context we propose that urinary bladder diverticula should never be ignored and neglected. Appropriate therapeutic measures (medical and surgical) including the treatment of the cause leading to the diverticulum formation should be employed for increased survival and better results of the patients.

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