

Comparison of open diverticulectomy and endoscopic diverticulum fulguration in patients with acquired symptomatic bladder diverticula

Diverticulectomy vs. fulguration

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Abstract

Aim: In this study, we aimed to compare patients with acquired symptomatic bladder diverticula who underwent open diverticulectomy or endoscopic diverticulum fulguration.

Material and Methods: The data of patients between January 2018 and January 2023 were retrospectively reviewed. Demographic data, laboratory parameters, and perioperative and postoperative data were noted. International Prostate Symptom Score (IPSS) and Quality of Life (QOL) scores were analyzed. Patients who underwent open diverticulectomy were classified as Group 1 and patients who underwent endoscopic diverticulectomy were classified as Group 2.

Results: A total of 15 patients were included in the study. The operation time was 67 ± 21.2 minutes in Group 1 and 22.3 ± 10.1 minutes in Group 2, with a significantly shorter operation time in Group 2. ($p=0.001$) The mean hospital stay was 3.1 ± 1.2 days in Group 1 and 1.1 ± 0.3 days in Group 2, with a significantly shorter hospital stay in Group 2. ($p=0.01$) The rate of symptom improvement was similar. There was a significant decrease in PMR measurements in both groups in the postoperative period. QoL evaluation showed a significant increase in both groups. The complication rates were similar.

Discussion: In patients with symptomatic bladder diverticula, endoscopic fulguration provides similar efficacy and safety to open surgery. It can be preferred in comorbid patients with high anesthesia risk due to shorter operations and hospital stays.

Keywords

Open Diverticulectomy, Endoscopic Fulguration, Bladder Diverticula

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This study was approved by the Ethics Committee of Umraniye Training and Research Hospital (Date: 11-05-2023, No: 158)

Introduction

Bladder diverticula are divided into congenital and acquired. [1] Congenital diverticula are usually seen in childhood and involve all layers of the bladder. [2] Acquired bladder diverticula are caused by herniation of the bladder mucosa through weakened detrusor muscles. This is often caused by conditions such as benign prostatic hyperplasia (BPH), bladder neck stenosis, and urethral strictures that cause outlet obstruction. [2] Treatment is indicated in patients who are symptomatic or develop complications.

Open, laparoscopic, and robotic surgical methods have been described as treatment options. [2] Especially in patients with more comorbid conditions and high anesthesia risk, in the presence of diverticula below 4 cm, the endoscopic fulguration technique described by Orandi et al. [3] There are studies indicating that this technique is also reliable in larger diverticulum sizes. [2, 4, 5]

In this study, we aimed to compare patients with acquired symptomatic bladder diverticula who underwent open diverticulectomy or endoscopic diverticulum fulguration.

Material and Methods

The data of patients who underwent open diverticulectomy or trans-urethral diverticulum neck excision for symptomatic bladder diverticulum between January 2018 and January 2023 were retrospectively reviewed. All operations were performed by surgeons who completed the learning curve at Ümraniye Training and Research Hospital.

Patients older than 18 years with symptomatic acquired bladder diverticulum were included in the study. Patients with previous open bladder operations, a history of bladder tumor, neurogenic dysfunction, a history of pelvic radiotherapy, and patients with missing data were excluded.

Demographic data, ASA scores, and Charlson Comorbidity Index scores were noted. Laboratory parameters such as creatinine and PSA were analyzed. International Prostate Symptom Score (IPSS) and Quality of Life scores were analyzed. The quality of life questionnaire was evaluated with the SF-36 form. Diverticulum sizes, prostate volumes, uroflowmeter parameters, and follow-up times were noted. Perioperative and postoperative operation times, complications, hospital stay, and catheterization times were noted. In the endoscopic method, surgical success was defined as at least 80% reduction in diverticulum size at the 3rd month of evaluation. Complications were classified according to the Clavien-Dindo Classification.

Patients who underwent open diverticulectomy were classified as Group 1 and patients who underwent endoscopic diverticulectomy were classified as Group 2 and the 2 groups were compared.

Surgical Technique

Endoscopic Incision

The bladder was accessed transurethrally with the help of a 26 Fr resectoscope. The diverticular mucosa was completely fulgured with the help of a rollerball electrode. Afterward, the diverticulum mouth was incised with plasma vaporization. At the end of the operation, a 3-way catheter was inserted and continuous irrigation was applied.

Open Surgical Technique

The retzius cavity was entered by crossing the folds with the Phannelstein incision. The cystoscopy was performed transurethrally and white light was used inside the diverticulum. In this way, the diverticulum was identified through the incision. Suspension sutures were placed and the diverticulum was incised from the intact bladder tissue. The bladder was then closed in 2 layers and the layers were closed by placing a drain in the lumen. Continuous irrigation with a 3-way catheter was applied postoperatively.

Postoperative Follow-up

The duration of catheterization was determined according to the surgeon's preference. In both groups, cefazolin 1000 mg was administered as antibiotic prophylaxis 30 min before the start of surgery. Operative success was evaluated by CT cystography 3 months after the procedure. In addition, uroflowmeter and IPSS values were measured.

Statistical Analysis

Whether the numerical data showed normal distribution was evaluated by the Kolmogorov-Smirnov test. Normally distributed numerical data were compared with the Student T test. Chi-square or Fisher's exact test was used to compare categorical variables when appropriate. A paired samples t-test was used for in-group before and after comparisons. A significant p-value < 0.05 was accepted. R 3.3.2 software was used for the applications.

Ethical Approval

This study was approved by the Ethics Committee of Umraniye Training and Research Hospital (Date: 11-05-2023, No: 158).

Results

After the application of inclusion and exclusion criteria, a total of

Table 1. Demographics and functional outcomes. BMI: Body Mass Index TUR-P: Trans urethral resection of the prostate

Parameters (mean ± SD)	Total (n=15)	Group 1 (n=5)	Group 2 (n=10)	P
Age (year)	64,1 ± 8,1	59,8 ± 4,6	66,3 ± 8,7	0,149
BMI (kg/m ²)	23 ± 2	23,1 ± 3,2	22,9 ± 2,2	0,604
Charlson Comorbidity Index	4 (2-11)	3 (3-5)	5,5 (2-11)	0,113
ASA (n ; %)				0,009
1	4 (26,7)	4 (80)	0 (0)	
2	4 (26,7)	1 (20)	3 (30)	
3	4 (26,7)	0 (0)	4 (40)	
4	3 (20)	0 (0)	10 (66,7)	
Previous Surgery (n ; %)				
Open Prostatectomy	2 (13,3)	2 (40)	0 (0)	0,032
TUR-P	12 (80)	2 (40)	10 (100)	0,022
Bladder Stone	5 (33,3)	2 (40)	3 (30)	0,699
Diverticular Stone	8 (53,3)	1 (20)	7 (70)	0,119
Creatinine (mg/dL)	0,9 ± 0,2	0,9 ± 0,3	0,9 ± 0,1	0,732
PSA (ng/ml)	2,8 ± 1,3	2,7 ± 1,2	2,8 ± 1,4	0,969
Operation Time (minutes)	39 ± 11,9	67 ± 21,2	22,3 ± 10,1	0,001
Catheterization time (day)	9,1 ± 1,7	13,1 ± 1,1	7,4 ± 2,2	0,03
Length of Stay (day)	1,8 ± 0,9	3,1 ± 1,2	1,1 ± 0,3	0,01
Follow Up Time (months)	23,9 ± 12,8	22 ± 11,9	24,9 ± 13,8	0,696
Relief of Symptoms (n ; %)	13 (86,6)	5 (100)	8 (80)	0,078

Table 2. Functional outcomes between two groups

Variables	Total (n=15)		Bladder Diverticulectomy (n=5)		Diverticulum neck incision (n=10)		Preop-Postop Change	Inter-group Comparison
	Preop	Postop	Preop	Postop	Preop	Postop		
IPSS	27,8 ± 5	4,8 ± 2,4	27,4 ± 6,8	4,4 ± 2,8	28,1 ± 4,2	5 ± 2,3	<0,001	0,971
Qmax (ml/s)	9,7 ± 3,4	21,7 ± 6,4	10,4 ± 5,1	25,9 ± 7,6	9,3 ± 2,4	19,6 ± 4,8	<0,001	0,124
Volume (cc)	293,3 ± 90,3	341,6 ± 93,5	282 ± 89,6	390,4 ± 91,6	299 ± 94,9	317,3 ± 88,7	0,019	0,079
PVR (cc)	179,2 ± 61,4	56,1 ± 30	170,4 ± 80,3	45 ± 15,6	183,7 ± 54,2	61,7 ± 35,6	<0,001	0,917
QoL	5,2 ± 0,5	1,1 ± 0,7	5,2 ± 0,8	1 ± 0,7	5,3 ± 0,41	1,2 ± 0,7	<0,001	0,816
Diverticula Size (mm)	53,2 ± 9,5	6,8 ± 4,2	58,4 ± 6	3 ± 4,2	50,7 ± 10,1	8,8 ± 2,7	<0,001	0,021

IPSS: International Prostate Symptom Score PVR: Post voiding residual urine QoL: Quality of Life

Table 3. Complications according to Clavien-Dindo Classification

Complications			
Clavien Dindo Classification (n ; %)			0,211
Grade 1			
Hematuria		3 (20)	0 (0)
			3 (30)
Grade 2			
ERT		1 (6,6)	1 (20)
			0 (0)

ERT: Erythrocyte replacement therapy

15 patients were included in the study, 5 (33.3%) in Group 1 and 10 (66.6%) in Group 2. The mean age of the patients included in the study was 64.1 ± 8.1 years. There was no significant difference between the two groups in age, BMI, and Charlson Coordination Index scores. ASA scores were significantly higher in Group 2.

The rates of BPH were similar between the two groups. Group 1 had a significantly higher rate of previous trans vesical prostatectomy and Group 2 had a significantly higher rate of previous transurethral prostatectomy. There was no significant difference between bladder stone and diverticulum stone rates. Preoperative serum creatinine and PSA levels were similar. The operation time was 67 ± 21.2 minutes in Group 1 and 22.3 ± 10.1 minutes in Group 2, with a significantly shorter operation time in Group 2. (p= 0.001) The catheterization time was 13.1 ± 1.1 days in Group 1 and 7.4 ± 2.2 days in Group 2, with a significantly shorter catheterization time in Group 2. (p=0.03) The mean hospital stay was 3.1 ± 1.2 days in Group 1 and 1.1 ± 0.3 days in Group 2, with a significantly shorter hospital stay in Group 2. (p=0.01) The mean follow-up period was 23.9 ± 12.8 months, with no significant difference between the two groups. When the rate of symptom improvement during the follow-up period was evaluated, 86.6% of the patients improved in total, and no significant difference was observed between the two groups. In group 2, symptoms persisted in 2 patients (20%) (Table 1).

When the functional results were evaluated, a significant decrease in IPSS values before and after treatment was detected in both groups. IPSS scores improved at a similar rate between the two groups. Significant improvements in Qmax values were detected in both groups after treatment. Improvement rates were similar between the two groups. Although there was a significant increase in bladder capacity in both groups in the postoperative period, there was no difference between the groups. There was a significant decrease in PMR measurements

in both groups in the postoperative period, but there was no difference between the groups. Quality of life evaluation showed a significant increase in both groups. This increase was similar between the groups. Diverticulum dimensions showed a significant decrease in the postoperative period in both groups, but this rate was higher in Group 1. (Table 2)

Grade 1 and Grade 2 complications were detected in all patients. Erythrocyte Replacement Therapy was needed in 1 patient (20%) in Group 1 and hematuria was detected in 2 patients (20%) in Group 2. There was no difference in complication rates between the groups (Table 3).

Discussion

Acquired bladder diverticula develop when the mucosa protrudes from the weakened bladder tissue [6]. In patients with lower urinary tract obstruction, high pressure due to detrusor contraction during micturition and chronicization of this condition is involved in the etiology of acquired bladder diverticula. [6] The diverticulum wall contains mucosa, subepithelial connective tissue, very rare detrusor muscle fibers, and adventitial tissues from inside to outside [7]. Causes of intravesical obstruction such as anterior and posterior urethral valves, urethral strictures, BPH, neurogenic dysfunction, and detrusor sphincter dyssynergia can lead to this condition [8]. Since they often develop secondary to obstruction, they are known as diseases of advanced age.

Acquired bladder diverticula are often asymptomatic and are usually diagnosed on routine abdominal ultrasonography [1]. In the presence of larger diverticula, lower urinary tract infections, voiding disorders, pelvic pain, and hematuria may be detected [9].

Large diverticula can cause post-mictional residue, bladder stones, urinary tract infections, and local compression [6]. Surgical treatment aims to prevent these symptoms and complications [2]. Surgical technique may vary according to

diverticulum size, location, presence of additional anomalies, and surgeon's preference [1].

The first surgical method in the treatment of bladder diverticulum was described by Alexander in 1884 and Czerni in 1897. [10] The technique was later developed by Lerche [11]. The transvesical technique was described by Young in 1906, the extravesical or combined technique by Barnes in 1939, then open surgery, endoscopic fulguration [1, 4]. Today, open, endoscopic, laparoscopic, and robot-assisted systems are successfully applied [1]. Laparoscopic and robotic techniques have replaced open surgery in many centers [12, 14]. Endoscopic treatments are generally reported for smaller-sized diverticula [3, 15, 16]. However, as a result of developments in endoscopic methods, studies are reporting that diverticula between 20 ml and 700 ml are treated endoscopically [17].

There are numerous case series on endoscopic management of bladder diverticula. Transurethral fulguration, first described by Orandi et al. in a series of 17 patients, resulted in complete resolution in 5 patients and volume reduction in 9 patients [3]. Similarly, Clayman et al. reported complete resolution in 5 patients and volume reduction in 1 patient in a study of 6 patients [16]. Yamaguchi et al. reported complete resolution in 26 of 31 patients in a study of 31 patients. [18] Martov et al. reported 95% success rate in a series of 29 patients in which the diverticulum neck was endoscopically incised [17]. In a study conducted by Rippa et al. in a series of 21 patients, failure of the procedure was reported in only 1 patient [19]. In a study conducted by Pacella et al [2], laparoscopic and endoscopic methods were compared. Although both methods were found to be safe and effective, endoscopic methods were reported to have a shorter operation time and success in 75% of cases. The fact that endoscopic methods can be performed under spinal anesthesia is also an advantage for comorbid patients [2]. It is also reported to have a shorter learning curve compared to open/laparoscopic and robotic surgeries [2].

It is also reported to have a shorter learning curve compared to open/laparoscopic and robotic surgeries [2]. In addition, in case of failure of the procedure, subsequent open/laparoscopic or robotic surgeries are not affected. Endoscopic methods have become a good alternative in diverticulum surgery due to successful results and better functional outcomes [20]. In our study, it was found that although the group that underwent endoscopy was more comorbid, complication and success rates were similar. In addition, shorter operation time, catheterization time, and hospital stay were found in the endoscopic method.

Limitation

Our study has some limitations. The small number of patients and the retrospective nature of the study are the main limitations of the study. The fact that the group that underwent endoscopy was more comorbid suggests heterogeneous groups, but the fact that the results were similar despite this indicates the reliability of endoscopic methods. More large series, randomized controlled studies are needed in this regard.

Conclusion

In patients with symptomatic bladder diverticula, endoscopic fulguration provides similar efficacy and safety to open surgery. It can be preferred in comorbid patients with high anesthesia risk due to shorter operations and hospital stays.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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