ORIGINAL RESEARCH
General Urology

Doi: 10.4274/jus.galenos.2023.2023-6-6
J Urol Surg, 2023;10(3):206-212

The Effect of Targeted Antibiotic Prophylaxis on Lower Urinary Tract Symptoms Following Prostate Biopsy: A Prospective Randomized Trial

Ahmet Yüce[1], Erdal Benli[1], Abdullah Çırakoğlu[1], Mevlüt Keleş[1], Nurullah Kadim[1], İsmail Nalbant[2]

[1]Ordu University Faculty of Medicine, Department of Urology, Ordu, Turkiye
[2]Lokman Hekim University Faculty of Medicine, Department of Urology, Ankara, Turkiye

What's known on the subject? and What does the study add?

Prostate biopsy is the most common diagnostic procedure in urology practice. It is generally an easily applicable and well-tolerated method, but lower urinary tract symptoms (LUTS) has an important place among the increasing complication rates recently. There is no consensus in the literature regarding risk factors and prophylactic measures for biopsy-associated LUTS. Targeted antibiotic prophylaxis is recommended by recent studies and guidelines, especially for patients at risk. In our study, it was seen that targeted prophylaxis had a significant effect on biopsy-associated LUTS, and it could be an important method in preventing LUTS complaints.

Abstract

Objective: Targeted antibiotic prophylaxis in prostate biopsy is recommended for patients at risk due to increased complication rates seen in recent years. Lower urinary tract symptoms (LUTS) is currently one of the most prevalent complications with a rate of more than 40%. The study examined the effects of targeted antibiotic prophylaxis on biopsy-related LUTS and to compare the results with standard prophylaxis.

Materials and Methods: A total of 240 patients were included in the study, 120 of whom had been administered targeted antibiotic prophylaxis and 120 of whom had received ciprofloxacin treatment between January 2021-Januray 2023. Patients' results before the procedure, on the 7th day, and in the first month were prospectively recorded and compared.

Results: While Qmax mean values were measured as 18.3±5.1 mL/s in the targeted prophylaxis group and 17.4±4.6 mL/s in the control group (p=0.157) before the procedure, these values were found to be 14.6±3.3 mL/s and 11.7±4.1 mL/s (p<0.001) on the 7th day and 16.8 16.8±4.3 mL/s and 14.9±3.5 mL/s (p=0.013) in first month, respectively. IPSS mean scores of the groups were calculated as 16.8±4.3 mL/s and 14.9±3.5 mL/s (p=0.013) before the procedure, respectively, while these scores were found to be 18.12±6.1 and 22.97±7.4 (p<0.001) on the 7th day and 17.5±5.5 and 22.8±7.5 (p<0.001) in the first month, respectively.

Conclusion: In this study, we found that targeted antibiotic prophylaxis had a significant effect on preventing biopsy-related LUTS. We believe that routine application of targeted antibiotic prophylaxis can be effective in reducing the rates of biopsy-related LUTS.

Keywords: Prostate biopsy, prostate cancer, targeted prophylactic antibiotherapy, lower urinary tract symptoms

Introduction

Prostate cancer is the most prevalent solid organ cancer observed in males, and it is the second most prevalent type of cancer that leads to malignancy-related mortality worldwide (1). The prevalence of prostate cancer increases by 2-3% every year in Europe and the USA (2). Among the reasons for this increase are the widespread use of prostate-specific antigen (PSA) screening tests and the increasing role of multiparametric magnetic resonance imaging applied in the pre-biopsy period (3). Hence, prostate biopsy is the most frequently used diagnostic procedure in urology, and its application number in Europe and the USA is more than two million (4). Most of these applications are performed with a transrectal approach, and although there are new techniques developing today, the most frequently used

Correspondence: Ahmet Yüce MD, Ordu University Faculty of Medicine, Department of Urology, Ordu, Turkiye
Phone: +90 506 217 61 64 **E-mail:** ahmetyuce7@gmail.com **ORCID-ID:** orcid.org/0000-0003-2931-3927
Received: 20.06.2023 **Accepted:** 07.07.2023

Cite this article as: Yüce A, Benli E, Çırakoğlu A, Keleş M, Kadim N, Nalbant İ. The Effect of Targeted Antibiotic Prophylaxis on Lower Urinary Tract Symptoms Following Prostate Biopsy: A Prospective Randomized Trial. J Urol Surg, 2023;10(3):206-212.

method is still transrectal ultrasound (TRUS) guided biopsy, which is also the standard procedure for pathological sampling in the diagnosis of prostate cancer (5).

TRUS guided prostate biopsy is a method that is easily applied and well tolerated. However, a significant increase in biopsy-related complications has recently been reported (6). One of the current debates over this issue is related to antibiotic prophylaxis to be applied before the procedure. In studies conducted and American Urological Association guidelines, it has been stated that targeted antibiotic prophylaxis applied because of culture obtained through rectal swab is more successful compared to standard fluoroquinolones prophylaxis or augmented prophylaxis, and that a decrease by 84% in complication rates has been achieved (7).

Lower urinary tract symptoms (LUTS) that develop following prostate biopsy are among the more frequently observed complications compared to infectious complications such as fever and sepsis (8). These complaints usually develop because of a biopsy procedure and causes related to the application procedure such as trauma, edema, inflammation, and infection. The probability of LUTS development following TRUS-guided prostate biopsy is reported to be 40% (9). In the literature, there are studies that were conducted in order to determine risk factors for urination complaints that may develop after TRUS-guided prostate biopsy and in which medical agents that could be applied prophylactically for LUTS were used; however, there is no clear procedure related to this issue (10).

In relevant guidelines, targeted antibiotic prophylaxis is recommended especially in risky patients due to its effect on post-biopsy complications (11). However, the number of prospective randomized trials that examined the effects of this procedure on LUTS is rather limited. Therefore, it was aimed in the present study to examine whether targeted antibiotic prophylaxis has a more significant effect on LUTS compared to fluoroquinolone prophylaxis and to discuss the results obtained considering the literature.

Materials and Methods

In the study, the data of 240 patients who underwent prostate biopsy between January 2021 and January 2023 and were followed up by prospectively recording their information were analyzed. Using GPower 3.1 software, it was calculated that the sample size should be at least n=220 (110+110) for a statistical power of 0.95 at alpha=0.05 level. The study was conducted in line with the principles of the Declaration of Helsinki and was approved by the local ethics committee of Ordu University, Turkiye (approval no: 2021/208, date: 23.09.2021). Written informed consent of the patients included in the study was obtained before the procedure.

TRUS - guided 12-quadrant prostate biopsy was applied to patients who presented to the urology outpatient clinic and who had serum PSA levels of 4 ng/mL and abnormal digital rectal examination findings. The patients were divided into two groups according to pre-planned randomization. While routine ciprofloxacin prophylaxis was applied to one group of patients, the other group was administered antibiotic prophylaxis in line with the antibiogram obtained from the rectal sample, which was previously taken through the rectal swab method. Antibiotic prophylaxis was applied as 1-day prophylaxis, once 2 h prior to the procedure and once at the 12th hour post-procedure 12th hour.

The patients' age, body mass index (BMI), comorbidities, biochemical parameters, serum PSA values, medical treatment for BPO, antibiogram results of the targeted antibiotic prophylaxis group and antibiotic agents used in prophylaxis, number of nocturia, maximum urinary flow rate (Qmax) values, prostate volumes (P.V.), and international prostate symptom scores and detailed points were analyzed.

The International Prostate Symptom Score (IPSS) is a validated and current 7-item questionnaire that inquires about patients' lower urinary tract complaints. It examines incomplete emptying (urinary retention), need to urinate again in less than 2 h (frequency), intermittent urination (intermittency), inability to hold urination (urgency), decrease in urinary flow rate (weak stream), difficulty in starting urination (straining), and number of nocturia. Also, it is a commonly used questionnaire in diagnosis and follow-up of patients with the addition of quality of life to urinary symptoms.

Patients who were below the age of 40 years, who had life expectancy of less than 10 years, who had undergone rectal or pelvic surgery, who had active urinary system infection, who received pelvic radiotherapy, who were suspected to have neurogenic urination symptoms, whose postvoiding residue amount was more than 150 mL, whose Qmax value was below 15 mL/s and who needed additional treatment for BPO, and who had rectal anomaly or a disease that might affect rectal flora were excluded from the study.

Statistical Analysis

In the analysis of the data obtained because of the study, SPSS 21.0 package software was used. Kolmogorov-Smirnov test was employed in determining whether the data were normally distributed. Nonparametric tests of Mann-Whitney U, Wilcoxon Signed-Ranks test, and mixed pattern ANOVA were used in the analysis of the data. Statistical significance level was set as $p<0.05$.

Results

In the group that was administered targeted antibiotic prophylaxis, the mean age was found to be 65.6±7.2 years (n=120), while it was determined to be 65.3 65.3±6.4 years (n=120) in the control group. BMI values were calculated as 28.7±3.7 kg/m^2 and 29.3±4.2 kg/m^2, respectively (p=0.858). No significant difference was found between the groups in terms of systemic diseases and prevalence rates (Table 1). The mean serum PSA value measured before the procedure was found to be 24.45±6.66 ng/mL in the targeted antibiotic phylaxis group, while it was determined to be 25.41±6.53 ng/mL in the control group, with no significant difference between them (p=0.958). No significant difference was observed between the groups before the procedure in terms of inflammatory parameters of C-reactive protein (p=0.919), sedimentation (p=0.501), fibrinogen (p=0.444) values, blood count results, and biochemical parameters (Table 2).

According to the antibiogram results of the group from which rectal swab was taken, the most frequently growing agents were *Escherichia coli* in 74 patients (62%), enterobacterial in 22 patients (18%), klebsiella in 14 patients (12%), and pseudomonas in 10 patients (8%). In line with the antibiogram results, antibiotic agents administered the most were ceftriaxone in 44 patients (36.7%), gentamicin in 30 patients (25%), amikacin in 22 patients (18.3%), ceftazidime in 14 patients (11.7%), and ciprofloxacin in 10 patients (8.3%) (Figure 1).

When LUTS prevalence was questioned as yes/no after the biopsy was applied to the patients, 36 patients (30%) in the targeted antibiotic prophylaxis group responded as yes, while 70 patients (58.3%) responded as yes (p=0.002). The number of urinations during the daytime was 4.8±2.1 in the prophylactic group and 4.7±2.3 (p=0.775) in the control group before the procedure, while it was found to be 5.6±2.7 and 7.7±3.5 (p=0.03) respectively on the post-procedure 7th day and 5.5±2.8 and 6.8±3.7 (p=0.044) respectively in the post-procedure 1st month.

In the pre-procedure period, while the Qmax value was determined as 18.3±5.1 mL/s in the prophylaxis group, it was measured as 17.4±4.6 mL/s in the control group (p=0.157). The Qmax value was measured as 14.6±3.3 mL/s and 11.7±4.1 mL/s on the post-procedure 7th day (p<0.001), and it was calculated to be 16.8±4.3 mL/s and 14.9±3,5 mL/s (p=0.013) respectively in the post-procedure 1st month. The mean P.V. value before the procedure was 50.77±25 mL in the targeted prophylaxis group and 46.47±27 mL in the control group (p=0.511).

Table 1. Systemic diseases and their distribution in the groups

Comorbidities	Targeted prophylaxis n (%)	Control n (%)	p
Diabetes Mellitus	30 (25.0%)	36 (30.0%)	0.580
Hypertension	32 (26.6%)	33 (27.5%)	0.856
Cardiac	32 (26.6%)	28 (23.3%)	0.676
COPD, asthma	14 (11.7%)	8 (6.7%)	0.347
Neurological	6 (5.0%)	12 (10.0%)	0.315
Psychological	6 (5.0%)	18 (15.0%)	0.74

COPD: Chronic obstructive pulmonary disease

Table 2. Distribution of serum parameters in the groups

Groups	Targeted prophylaxis	Control	p
PSA (ng/dL)	24.45±95.9	25.41±87.35	0.985
Creatinine	0.94±0.21	1.02±0.30	0.108
CRP	0.58±1.28	0.61±1.03	0.919
Sedimentation	13.4±9.2	15.0±14.9	0.501
Fibrinogen	363.6±89.1	375.21±83.5	0.444
LDH	198.48±54.0	191.22±46.47	0.474
Calcium	9.38±0.4	9.53±0.7	0.184
Hemoglobin (g/dL)	14.76±1.28	14.57±1.57	0.503
WBC	7.07±1.5	7.6±2.1	0.133

CPR: C-reactive protein, LDH: Lactate dehydrogenase, PSA: Prostate specific antigen, WBC: White blood cell

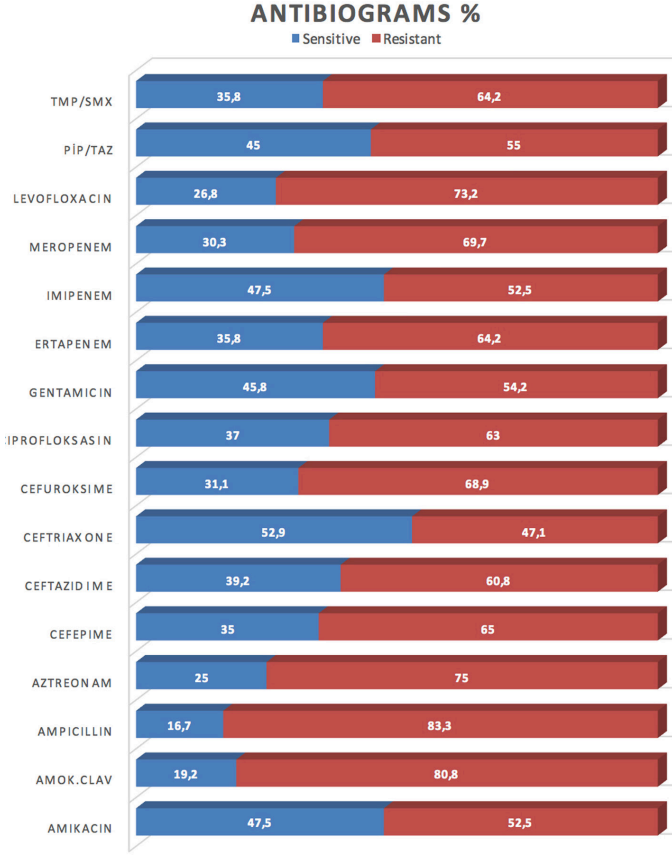

Figure 1. Antibiogram profiles obtained by rectal swab

In the evaluations made over the patients' IPSS questionnaire items and their total scores, the feeling of residue after urination before the procedure was found to be 2.08±1.0 in the prophylaxis group and 2.32±1.1 (p=0.055) in the control group, while these values were 2.37±1.3 and 3.10± 1.6 (p=0.009), respectively, on the post-procedure 7th day and 2.22±1.2 and 2.95±1.5 (p=0.006) respectively in the post-procedure 1st month. The patients' need for urination in less than 2 h was determined as 1.78±0.7 in the prophylaxis group and 2.25±0.9 (p=0.004) in the control group, while it was 2.08±0.9 and 2.86±1.3 (p<0.001) respectively on the post-procedure 7th day and 2.07±0.9 and 2.98±1.7 (p<0.001) respectively in the post-procedure 1st month. The patients' intermittent urination complaints before the procedure were found to be 1.88 1.88±0.7 in the prophylactic group and 2.05±0.9 (p=0.69) in the control group, while they were 2.93±1.1 and 3.57±1.5 (p<0.001) respectively on the post-procedure 7th day and 2.53±1.1 and 3.52±1.5 (p<0.001) respectively in the post-procedure 1st month. The patients' complaints regarding difficulty in holding urination before the procedure were found to be 1.82 1.82±0.7 in the prophylaxis group and 2.28±1.1 (p=0.007) in the control group, while they were 2.43±1.2 and 3.13±1.5 (p=0.006) respectively on the post-procedure 7th day and 2.35±1.1 and 3.08±1.4 (p=0.003) respectively in the post-procedure 1st month. Decreases in urinary flow rate before the procedure were found to be 1.95 1.95±0.8 and 2.22±1.2 (p=0.139) in the prophylaxis group and the control group, respectively, while they were 2.83 2.83±1.3 and 3.18±1.5 (p=0.175) respectively on the post-procedure 7th day and 2.73±1.2 and 3.25±1.4 (p=0.039) respectively in the post-procedure 1st month. Difficulty in starting urination before the procedure was found to be 1.68±0.8 and 2.37±1.1 (p<0.001) in the two groups, respectively, while it was 2.43±1.1 and 3.15±1.4 (p=0.003) on the post-procedure 7th day and 2.37±1.0 and 3.17±1.4 (p=0.001) in the post-procedure 1st month. Finally, nocturia complaint before the procedure was found as 3.03±1.5 and 3.08±1.4 (p=0.859) in the groups, respectively, while this value was 3.33±1.5 and 3.85±1.4 (p=0.063) on the post-procedure 7th day and 3.23±1.5 and 3.88±1.4 (p=0.02) in the post-procedure 1st month (Table 3).

While the patients' quality of life (QoL) score before the procedure was 2.4±1.0 in the targeted prophylaxis antibiotic group and 2.7±1.3 (p=0.057) in the control group, it was determined to be 2.8±1.3 and 3.6±.1.6 (p=0.004) respectively on the post-procedure 7th day and 2.6±1.1 and 3.5±1.6 (p=0.002) respectively in the post-procedure 1st month.

Discussion

In this study, it was determined that the application of targeted antibiotic prophylaxis before prostate biopsy was significantly effective on LUTS with respect to standard prophylaxis. When IPSS total scores of the patients who underwent prostate biopsy were examined, it was seen that this value was 13.93±4.1 in the prophylaxis group and 16.67±5.6 before the procedure (p=0.03), while their scores were calculated as 18.1±6.1 and 22.9±7.4 respectively on the post-procedure 7th day, which was a statistically significant difference (p<0.001). The patients' total scores were calculated as 17.5±5.5 and 22.8±7.5 respectively in the post-procedure 1st month (p<0.001) (Table 3). When the effective factors on the values in both patient groups were analyzed, it was seen that the increase in the scores of the prophylaxis group determined in the measurements performed at different times was statistically significantly lower according to the mixed pattern ANOVA test compared to the control group (p<0.001). It was determined that targeted antibiotic prophylaxis had a positive effect in terms of preventing LUTS that might develop after prostate biopsy compared to the control group (p=0.001) (Figure 2).

LUTS is among the leading complications that are frequently seen the most following prostate biopsy with rates reaching up

Table 3. Comparison of IPSS questions before the procedure, on the 7th day and in the1st month

	Before			7th day			1st month		
IPSS	Targeted Prophylaxis	Control	p	Targeted Prophylaxis	Control	p	Targeted Prophylaxis	Control	p
Q1	2.08±1.0	2.32±1.1	0.055	2.37±1.3	3.10±1.6	0.009	2.22±1.2	2.95±1.5	0.006
Q2	1.78±0.7	2.25±0.9	0.004	2.08±0.9	2.86±1.3	<0.001	2.07±0.9	2.98±1.7	<0.001
Q3	1.88±0.7	2.05±0.9	0.69	2.93±1.1	3.57±1.5	<0.001	2.53±1.1	3.52±1.5	<0.001
Q4	1.82±0.7	2.28±1.1	0.007	2.43±1.2	3.13±1.5	0.006	2.35±1.1	3.08±1.4	0.003
Q5	1.95±0.8	2.22±1.2	0.139	2.83±1.3	3.18±1.5	0.175	2.73±1.2	3.25±1.4	0.039
Q6	1.68±0.8	2.37±1.1	<0.001	2.43±1.1	3.15±1.4	0.003	2.37±1.0	3.17±1.4	0.001
Q7	3.03±1.5	3.08±1.4	0.859	3.33±1.5	3.85±1.4	0.063	3.23±1.5	3.88±1.4	0.02
Total	13.9±4.1	16.6±5.6	0.03	18.1±6.1	22.9±7.4	<0.001	17.5±5.5	22.8±7.5	<0.001
QoL	2.4±1.0	2.7±1.3	0.057	2.8±1.3	3.6±1.6	0.004	2.6±1.1	3.5±1.6	0.002

IPSS: International prostate symptom score, Q: Question, QoL: Quality of Life

to 40% (12). There are various causes of LUTS development after prostate biopsy. Prostatic edema that may develop because of inflammation after the procedure and trauma caused by the biopsy procedure are especially the first ones that come to mind. periprostatic blockage applied during the procedure is effective in the development of LUTS (13). In addition to the inflammation developing in the prostatic tissue, expansion of intestinal microbiota due to transrectal application and gradual spreading of bacteria resistant to prophylactic agents administered routinely in intestinal microbiota today are becoming a serious problem (14). It is thought that other than the septic complications caused by resistant strains, localized infections and inflammatory problems occupy a significant place in biopsy-related urination disorders, and LUTS complaints occur because of bladder outflow resistance along with all these causes (15). For this reason, there are studies in the literature in which various agents such as fluoroquinolones and additionally fosfomycin, cephalosporins, aminoglycosides, ertapenem, trimethoprim, and metronidazole are used alone or in combination. Currently, fluoroquinolones can be used frequently in current randomized controlled trials and were routinely applied to patients in the control group in our study. It has been stated that patients' complaints regarding LUTS generally continue for one month after transrectal prostate biopsy (16). When the risk factors that could create a sensitivity towards LUTS in patients before the procedure are examined, it has been stated in the literature that prostate volume does not affect post-procedure urination symptoms, that postvoiding residue amount has no effect on IPSS score after the procedure, that the number of cores sampled during the procedure and symptoms do not correlate, and that procedures applied to the transitional zone do not create an additional risk factor for urination symptoms (17,18). It has also been indicated that the presence of LUTS before the procedure is not exacerbate existing symptoms (19). The presence of LUTS is usually considered a factor that causes patients to present to a doctor in early periods. In some studies, it was attempted to use a PSA value between 4 and 10 ng/mL as a predictive value for determining the presence of LUTS. However, it was stated that the presence of LUTS did not have any effect on biopsy results and post-biopsy complications (20). Nevertheless, it has been stated in some studies that biopsy-related LUTS should be considered especially in patient groups with IPSS score above 20 (21). In this study, pre-procedure IPSS scores were determined as 13.9±4.1 in the targeted antibiotic prophylaxis group and 16.6±5.6 in the control group. A higher IPSS score in the control group before the procedure is not considered as an additional risk factor in the literature. When the increases in IPSS scores in both groups are compared, it is seen that the increase in the prophylaxis group was lower compared to the control group, that their biopsy-related LUTS rate was lower, and that targeted biopsy had significant effects on LUTS (p<0.001) (Figure 3).

When IPSS questions are examined in detail in both groups, it is seen that the difference between the two groups resulted especially from the need to urinate in less than two hours and urgency and storage symptoms such as difficulty in holding urination. Although there is no significant difference between the groups in terms of the presence of additional diseases such as diabetes, long-term changes related to chronic diseases can be effective in reducing the differences in scores (22,23). Patients' awareness levels about changes occurring in the long term also affect the responses given. Regarding the symptoms inquired through the 7 questions in the IPSS questionnaire as yes/no before the procedure in the present study, incomplete emptying was found in 38 patients (31.7%) in the prophylaxis group and in 52 patients (43.3%) in the control group (p=0.190);

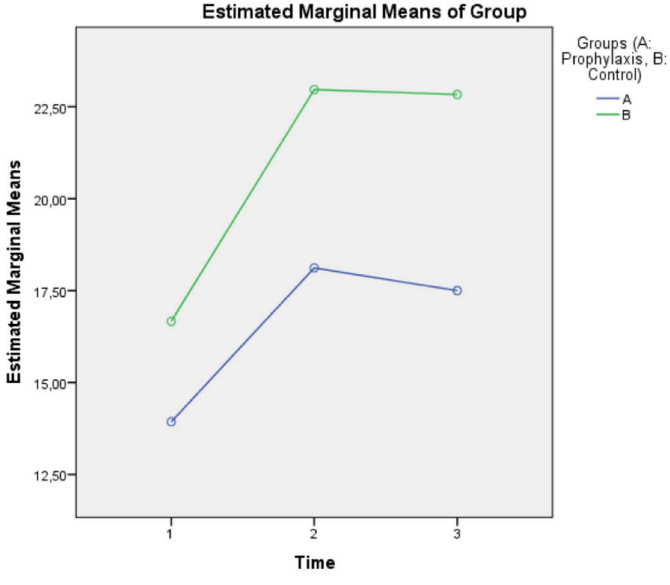

Figure 2. According to the mixed pattern ANOVA test, targeted prophylaxis is significantly effective in preventing biopsy-related LUTS (p=0.001)

LUTS: Lower urinary tract symptoms

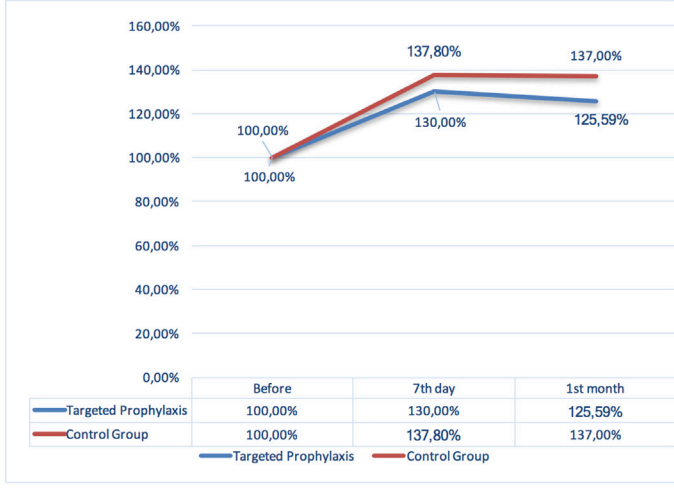

Figure 3. Percentage comparison of the total scores of the groups

need to urinate again in less than two hours was determined in 20 patients (16.7%) in the prophylaxis group and in 38 patients (31.7%) in the control group; intermittent urination was found in 58 patients (48.3%) and 74 patients (%61.7), respectively (p=0.145); inability to hold urination and urgency was determined in 38 patients (31.7%) and in 46 patients (38.3%), respectively (p=0.448); decrease in urinary flow rate was found in 70 patients (58.3%) and in 72 patients (60%), respectively (p=0.854); difficulty in starting urination was identified in 47 patients (39.2%) and in 63 patients (52.5%), respectively (p=0.75); and nocturia complaint was determined in 45 patients (37.5%) and in 39 patients (32.5%), respectively (p=0.236). When they were asked verbally, no significant difference was observed between the groups in terms of complaints. In addition, lack of a significant difference between the groups in terms of Qmax values before the procedure and IPSS scores being lower than 20 in both groups before the procedure are important in terms of evaluating the study results. Therefore, when the increases in IPSS scores after the procedure are compared, the significantly higher increase in the IPSS score of the control group shows that targeted antibiotic prophylaxis application could be an effective method in terms of preventing biopsy-related LUTS. Because of infectious complications developing after transrectal prostate biopsy, the frequency of prostate biopsy applications through transperineal methods is increasing. However, LUTS complaints and retention problems are more frequently witnessed in transperineal applications as well (24, 25). When both infection and LUTS-related problems involved in applications through transrectal method and increased LUTS risk in the transperineal method, need for anesthesia, difficulty in performing the procedure, and increased costs thereof are considered, it is thought that targeted antibiotic prophylaxis is increasingly becoming a more effective and significant method (26).

Study Limitations

The study being conducted at a single center and the absence of urodynamic studies regarding LUTS complaints are the limitations of this study. There is a need for multicenter studies with larger samples to evaluate the effects of targeted antibiotic prophylaxis on LUTS complaints.

Conclusion

Although there still exist different opinions on prophylactic antibiotic regimens before prostate biopsy, targeted antibiotic prophylaxis has been recommended by studies and guidelines in recent years. Because of the present study, it was determined that targeted antibiotic prophylaxis had a significant effect on LUTS, which is a common problem frequently seen after prostate biopsy. We believe that applying targeted antibiotic prophylaxis as a routine treatment would be a significant method for preventing LUTS complaints and infectious complications.

Ethics

Ethics Committee Approval: The study was conducted in line with the principles of the Declaration of Helsinki and was approved by the local ethics committee of Ordu University, Turkiye (approval no: 2021/208, date: 23.09.2021).

Informed Consent: Written informed consent of the patients included in the study was obtained before the procedure.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.Y., E.B., A.Ç., İ.N., Concept: A.Y., E.B., A.Ç., İ.N., Design: A.Y., E.B., İ.N., Data Collection or Processing: A.Y., A.Ç., M.K., N.K., Analysis or Interpretation: E.B., A.Ç., M.K., N.K., Literature Search: A.Y., M.K., N.K., Writing: A.Y.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declare that they have no relevant financial.

References

1. Boehm BE, York ME, Petrovics G, Kohaar I, Chesnut GT. Biomarkers of Aggressive Prostate Cancer at Diagnosis. Int J Mol Sci 2023;24:2185.
2. Siegel RL, Miller KD, Wagle NS, Jemal A. Cancer statistics, 2023. CA Cancer J Clin 2023;73:17-48.
3. O'Connor LP, Lebastchi AH, Horuz R, Rastinehad AR, Siddiqui MM, Grummet J, Kastner C, Ahmed HU, Pinto PA, Turkbey B. Role of multiparametric prostate MRI in the management of prostate cancer. World J Urol 2021;39:651-659.
4. Pradere B, Veeratterapillay R, Dimitropoulos K, Yuan Y, Omar MI, MacLennan S, Cai T, Bruyère F, Bartoletti R, Köves B, Wagenlehner F, Bonkat G, Pilatz A. Nonantibiotic Strategies for the Prevention of Infectious Complications following Prostate Biopsy: A Systematic Review and Meta-Analysis. J Urol 2021;205:653-663.
5. Jhan JH, Huang SP, Li WM, Li CC, Huang TY, Ke HL, Huang CN, Chou YH, Wen SC. Outcomes and complications after transrectal ultrasound-guided prostate biopsy: A single-center study involving 425 consecutive patients. Urol Sci 2018;29:129-133.
6. Sosenko A, Owens RG, Yang AL, Alzubaidi A, Guzzo T, Trabulsi E, Danella J, Diorio G, Reese A, Tomaszewski J, Ginzburg S, Smaldone M, Fonshell C, Syed K, Jacobs B, Singer EA, Raman JD. Non-infectious complications following transrectal prostate needle biopsy - Outcomes from over 8000 procedures. Prostate Int 2022;10:158-161.
7. Glick L, Vincent SA, Squadron D, Han TM, Syed K, Danella JF, Ginzburg S, Guzzo TJ, Lanchoney T, Raman JD, Smaldone M, Uzzo RG, Tomaszweski JJ, Reese A, Singer EA, Jacobs B, Trabulsi EJ, Gomella LG, Mann MJ. Preventing Prostate Biopsy Complications: to Augment or to Swab? Urology 2021;155:12-19.
8. Efesoy O, Bozlu M, Çayan S, Akbay E. Complications of transrectal ultrasound-guided 12-core prostate biopsy: a single center experience with 2049 patients. Turk J Urol 2013;39:6-11.

9. Kölükçü E, Beyhan M, Atılgan D. Factors affecting complications of transrectal ultrasound-guided prostate biopsy: A cohort study with 403 patients in a single center. J Surg Med 2019;3:183-186.
10. Chung SJ, Jung SI, Ryu JW, Hwang EC, Kwon DD, Park K, Kim JW. The preventive effect of tamsulosin on voiding dysfunction after prostate biopsy: a prospective, open-label, observational study. Int Urol Nephrol 2015;47:711-715.
11. Rothe K, Querbach C, Busch DH, Gschwend JE, Hauner K. Antibiotic prophylaxis for transrectal prostate biopsy : In the context of restricted indications for fluoroquinolones and antibiotic stewardship. Urologe A 2022;61:160-166.
12. Wadhwa K, Carmona-Echeveria L, Kuru T, Gaziev G, Serrao E, Parashar D, Frey J, Dimov I, Seidenader J, Acher P, Muir G, Doble A, Gnanapragasam V, Hadaschik B, Kastner C. Transperineal prostate biopsies for diagnosis of prostate cancer are well tolerated: a prospective study using patient-reported outcome measures. Asian J Androl 2017;19:62-66.
13. Glaser AP, Novakovic K, Helfand BT. The impact of prostate biopsy on urinary symptoms, erectile function, and anxiety. Curr Urol Rep 2012;13:447-454.
14. Piekarska K, Zacharczuk K, Wołkowicz T, Mokrzyś M, Wolaniuk N, Nowakowska M, Szemplиński S, Dobruch J, Gierczyński R. The molecular mechanisms of fluoroquinolone resistance found in rectal swab isolates of Enterobacterales from men undergoing a transrectal prostate biopsy: the rationale for targeted prophylaxis. Ann Clin Microbiol Antimicrob 2021;20:81.
15. Temi AP, Gbenga OJ. Prevalence of voiding dysfunction after finger-guided prostate needle biopsy in Nigerian men. Med Sur Urol 2017;6:1-4.
16. Klein T, Palisaar RJ, Holz A, Brock M, Noldus J, Hinkel A. The impact of prostate biopsy and periprostatic nerve block on erectile and voiding function: a prospective study. J Urol 2010;184:1447-1452.
17. Aktas BK, Bulut S, Gokkaya CS, Ozden C, Salar R, Aslan Y, Baykam MM, Memis A. Association of prostate volume with voiding impairment and deterioration in quality of life after prostate biopsy. Urology 2014;83:617-621.
18. Başer A, Baykam MM, Çağlayan MS, Aydın C, Yaytokgil M, Ekici M. Voiding Dysfunctions and Prevention after Prostate Biopsy. Prospective Observational Study. Black Sea Journal of Health Science 2021;4:114-119.
19. Weight CJ, Kim SP, Jacobson DJ, McGree ME, Boorjian SA, Thompson RH, Leibovich BC, Karnes RJ, St Sauver J. The effect of benign lower urinary tract symptoms on subsequent prostate cancer testing and diagnosis. Eur Urol 2013;63:1021-1027.
20. Dobruch J, Modzelewska E, Tyloch J, Misterek B, Czapkowicz E, Bres-Niewada E, Borówka A. Lower urinary tract symptoms and their severity in men subjected to prostate biopsy. Cent European J Urol 2014;67:177-181.
21. Zisman A, Leibovici D, Kleinmann J, Cooper A, Siegel Y, Lindner A. The impact of prostate biopsy on patient well-being: a prospective study of voiding impairment. J Urol 2001;166:2242-2246.
22. Bedir S, Kilciler M. Transrektal Ultrasonografi Eşliğinde Yapılan Prostat Biyopsisinin Komplikasyonları. Turk Urol Sem 2011;2:218-222.
23. Pop-Busui R, Braffett BH, Wessells H, Herman WH, Martin CL, Jacobson AM, Sarma AV. Diabetic Peripheral Neuropathy and Urological Complications in Type 1 Diabetes: Findings From the Epidemiology of Diabetes Interventions and Complications Study. Diabetes Care 2022;45:119-126.
24. Thomson A, Li M, Grummet J, Sengupta S. Transperineal prostate biopsy: a review of technique. Transl Androl Urol 2020;9:3009-3017.
25. LR, Zhang CG, Lu LX, Ruan L, Lan JH, Feng SQ, Luo JD. Comparison of ultrasound-guided transrectal and transperineal prostate biopsies in clinical application. Zhonghua Nan Ke Xue. 2014;20:1004-1007.
26. Akgüneş E, Aydın M, Görgün S, Günal Ö, Bitkin A, Keleş M, Atilla MK, Irkilata L. The Evaluation of Goal-Directed Antibiotics Prophylaxis Applied Via Rectal Swab Before Transrectal Ultrasound-Guided Prostate Biopsy. Bull Urooncol 2022:21;52-57.