



Importance of Transrectal Povidone-iodine Activity in Reducing Infections After Prostate Biopsy

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Abstract

Objective: To investigate the effectiveness of transrectal povidone-iodine antiseptic solution in minimizing infections following transrectal ultrasound-guided prostate biopsy.

Materials and Methods: We retrospectively analyzed the medical records of 240 patients who underwent TRUS-guided biopsy at our clinic between January 2016 and December 2020. All patients received antibiotic prophylaxis prior to the procedure. The patients were categorized into three groups: Group 1, which served as the control, received only antibiotic prophylaxis; Group 2, which consisted of patients administered transrectal povidone-iodine via a catheter syringe; and Group 3, which underwent povidone-iodine rectal cleansing. The primary objective was to compare infection rates and complications among the three groups, with a particular emphasis on the combined effect of povidone-iodine and prophylactic antibiotics versus antibiotics alone.

Results: Infection rates were notably reduced in patients who received povidone-iodine interventions ($p < 0.05$). Febrile infections occurred in 10 cases (4.25%) patients in Group 1, in whom ciprofloxacin alone was administered. In contrast, febrile complications were observed in 3 cases in Group 2, and only 2 cases in Group 3, corresponding to rates of 1.3% and 0.8%, respectively.

Conclusion: The combination of transrectal povidone-iodine and prophylactic antibiotics demonstrated significant efficacy in minimizing febrile infectious complications associated with TRUS-guided biopsy.

Keywords: Antibiotic prophylaxis, prostate biopsy, rectal suppository, povidone-iodine, gavage injector

Introduction

Prostate cancer (PCa) is the most frequently diagnosed malignancy in men worldwide. Since the pivotal study by Stamey et al., (1) prostate-specific antigen (PSA) has become the most significant and widely utilized biomarker for detecting PCa. The diagnosis of PCa has seen notable improvements with the introduction of transrectal ultrasound-guided prostate biopsy (TRUS-Bx), which remains the preferred diagnostic technique for suspected cases. Annually, approximately 400,000 new PCa cases are reported across Europe (2).

Despite negative biopsy results, numerous TRUS-Bx procedures are still performed. The biopsy process involves accessing the prostate through the rectum, which is an area rich in blood vessels and bacterial flora. This area increases the risk of infection. Urological infections following biopsies primarily originate from bacterial contamination in the rectum. Despite being generally safe and well-tolerated, prostate biopsies can result in adverse effects, including sexual dysfunction due to psychological stress,

rectal bleeding, urinary retention, hemospermia, hematuria, and post-biopsy pain.

Acute urinary tract infections, prostatitis, and epididymitis, as well as rare but severe complications like urosepsis with life-threatening outcomes may also occur (3). Among the most frequently observed complications post-TRUS-Bx are hemospermia (5.7-89%) and hematuria (14.4-84%), followed by rectal bleeding (1.3-39.6%). Dysuria occurs in 7-7.2% of cases, whereas urinary tract infections and sepsis are reported at rates of 6.1% and 0.5%, respectively (4).

To mitigate these infectious complications, various preventive measures have been introduced, with antibiotic prophylaxis being the primary approach. Antibiotic prophylaxis aims to limit bacterial colonization at the biopsy site. Another preventive method involves antiseptic measures, such as rectal povidone-iodine cleansing, to minimize bacterial contamination at the biopsy needle entry point. Additional preventive strategies include rectal cleansing using enemas and the use of smaller, calibrated needles (5).

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Our study focused on evaluating the effectiveness of these preventive approaches, particularly comparing the rates of infectious complications among patients undergoing TRUS-Bx using different prophylactic strategies.

Materials and Methods

The records of patients who underwent transrectal ultrasound-guided biopsy (TRUS-Bx) at our clinic from January 2016 to December 2020 were retrospectively analyzed. This study was conducted in accordance with the ethical principles stated in the Declaration of Helsinki. All participants received information regarding the use of their data for scientific purposes, and written consent was obtained from each participant. Ethical clearance for this research was obtained from the Ethics Committee of Tokat Gaziosmanpaşa University Medical Faculty (approval number: 83116987-031, date: 05.01.2023).

Operation Techniques

Two hundred forty patients who underwent TRUS-guided biopsy (TRUS-Bx) were randomly assigned to three equally sized groups. The criteria for performing biopsies included PSA levels >2.5 ng/mL and/or abnormalities detected during digital rectal examination.

Exclusion criteria comprised patients on anticoagulant therapy, individuals with chronic liver disease, renal failure, a history of PCa or repeated biopsies, bleeding disorders, malignancies in other pelvic organs, and concurrent rectal conditions, such as hemorrhoids, polyps, strictures, or fissures.

All patients received a total dose of 1500 mg of ciprofloxacin (750 mg twice daily) for 5 days, beginning 2 days before the procedure. Sodium phosphate enema (19 g monobasic sodium phosphate and 7 g dibasic sodium phosphate, libalax) was administered 2-4 h prior to biopsy. Urine culture negativity was verified before biopsy. During the procedure, the participants were positioned in the left lateral decubitus position with their left knee flexed.

After carefully applying the inclusion and exclusion criteria, the first 80 patients who met the specified time intervals were assigned to Group 1, the next 80 to Group 2, and the remaining 80 to Group 3. Statistical analysis was conducted to compare these groups.

In Group 1, only antibiotic prophylaxis. Group 2 received 30 cc of povidone-iodine via a 50 mL gavage syringe into the rectum (Figure 1). In Group 3, the rectal wall was cleaned for 2 min using gauze soaked in povidone-iodine (Figure 2).

For all patients, the biopsy method was selected randomly, and a standard 12-core biopsy procedure was performed using an 18 G biopsy needle (Geotek Medikal, Turkey) with an automatic biopsy gun. If any suspicious area was identified during TRUS-Bx, one or two additional biopsies were collected.

After biopsy, patients were transported to the hospital ward and discharged on the same day. Patients were informed of potential complications, such as dysuria, rectal bleeding, hematuria, and anal pain, which typically resolve spontaneously. Patients presenting with a body temperature exceeding 37.8 °C and symptoms like chills, urinary urgency, frequency, or dysuria within 3 days after the procedure were advised to seek emergency care.

Those with a body temperature of 37.8 °C or higher were hospitalized, and further evaluations, including urinalysis, urinary culture, and blood culture, were conducted for all admitted patients.

Statistical Analysis

Statistical evaluations included group numbers, medians, and 25th (Q1) and 75th (Q3) percentiles. Analyses were conducted using the MedCalc software (version 20.009). To assess normality within the groups, the Kolmogorov-Smirnov test was applied.

Because the groups did not meet the assumptions of a normal distribution, the Kruskal-Wallis test was applied. Bonferroni correction was used for multiple comparisons across groups. Statistical significance was determined at the $p < 0.05$ threshold.

Results

A retrospective analysis was conducted on patient records, which included prostate volume, demographic information, PSA levels, underlying diabetes mellitus, and infectious complications. The groups exhibited similarities in prostate volume, average age, PSA levels, PCa rates, and diabetes mellitus incidence (Tables 1, 2).

Infection occurred in 10 cases (4.2%) patients receiving ciprofloxacin antibiotic prophylaxis alone (Group 1). Febrile infections were identified in 3 cases in Group 2 and only 2 cases in Group 3, corresponding to infection rates of 1.3% and 0.8%, respectively. Groups receiving povidone-iodine treatment exhibited a significant decrease in infection rates ($p < 0.05$).

Blood and urine culture analyses were performed for all hospitalized patients due to infection. The most common microorganisms isolated were *Escherichia coli* (80%), *Klebsiella pneumoniae* (10%), and *Staphylococcus* spp. (10%). Following

Table 1. Demographic characteristics, PSA level and prostate volume of patients

	Groups									p-value
	Group 1 (n=80)			Group 2 (n=80)			Group 3 (n=80)			
	Median	25.P	75.P	Median	25.P	75.P	Median	25.P	75.P	
Age	61	58	63.5	61	58	63.5	61	58	63.5	ns
PSA level (ng/mL)	9.9	7.85	11.5	9.9	7.8	11.5	9.9	7.85	11.5	ns
Prostate volume (cc)	62	53.5	76.5	61.5	54.5	76.5	62	54.5	76.5	ns

ns: No significance, PSA: Prostate-specific antigen, *significant difference at the level of < 0.001 with Kruskal-Wallis test

Table 2. Incidence of infectious complications, diabetes mellitus and prostate cancer rates								
		Groups						p-value
		Group 1 (n=80)		Group 2 (n=80)		Group 3 (n=80)		
		n	%	n	%	n	%	
Diabetes mellitus	Yes	9	3.7	10	4.2	11	4.6	ns
	No	71	29.6	70	29.2	69	28.7	
Prostate cancer	Yes	13	5.4	14	5.8	14	5.8	ns
	No	67	27.9	66	27.5	66	27.5	
Infectious complications	Yes	10	4.2	3	1.3	2	0.8	<0.05*
	No	70	29.2	77	32.1	78	32.5	

ns: No significance, *significant difference at the level of <0.05 with chi-square test

successful medical treatment, all patients were discharged after an average hospitalization period of 7 days, achieving full recovery.

Discussion

TRUS-Bx remains the primary diagnostic modality for PCa. However, complications related to biopsy can result in significant morbidity and mortality, including susceptibility to severe infections, such as sepsis, hospitalization, and, in rare cases, mortality. This makes infection a critical concern in the procedure (4).

To address the rising resistance to quinolones, research over the past decade has focused on exploring alternative strategies. These include modifying antibiotic regimens, incorporating preoperative rectal swab cultures, employing targeted antibiotic prophylaxis, disinfecting biopsy needles with formalin, and using mucosal antisepsis methods like povidone-iodine before transrectal biopsy. Additionally, alternative approaches, such as the transperineal biopsy method, have been investigated (6). In this study, we utilized mucosal antisepsis and povidone-iodine prior to biopsy.

Guidelines from both the European Urology Association and the American Urology Association suggest the use of

oral or intravenous fluoroquinolone prophylaxis to reduce infectious complications prior to TRUS-Bx (7). Nevertheless, the optimal choice of antibiotics and the appropriate duration for prophylaxis remain subjects of debate. Among the available fluoroquinolones, ciprofloxacin is commonly favored for TRUS-Bx because of its superior penetration into prostate tissue and potent activity against intestinal flora and coliform bacteria (8).

Although ciprofloxacin has a metabolic rate of 50-70% in urine, it is significantly more active than norfloxacin. Nonetheless, recent studies have identified a concerning rise in quinolone resistance, contributing to increased hospitalization rates after prostate biopsy, with some studies reporting up to 50% resistance rates (8). Despite ciprofloxacin’s widespread use, our study revealed higher postoperative infection rates (4.2%) in Group 1. In comparison, infection rates in Groups 2 and 3 decreased significantly to 1.3% and 0.8%, respectively.

Rectal swab culture-based prophylaxis has been thoroughly investigated; however, uncertainty persists regarding its routine use among patients receiving TRUS-Bx. Recent research has indicated that targeted prophylaxis does not significantly reduce severe infectious complications. Studies comparing targeted and empirical antibiotic prophylaxis to prevent sepsis following transrectal prostate biopsy found no significant differences in sepsis rates across large patient cohorts (9).



Figure 1. 30 cc of povidone-iodine in a 50 mL gavage syringe

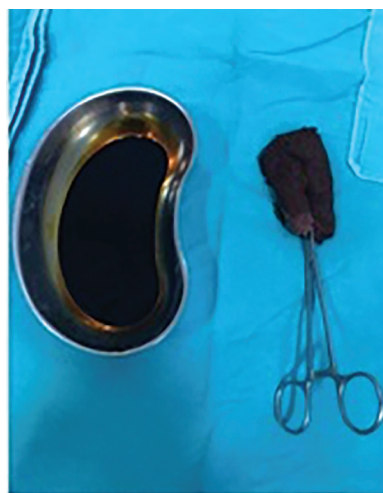


Figure 2. Gauze patch soaked in povidone-iodine

Large-scale studies have also highlighted the limitations of targeted prophylaxis, including high costs, the need for multiple clinic visits, insufficient support from microbiology laboratories, and specific requirements for culture media. These factors have cast doubt on the practicality of targeted prophylaxis in routine clinical settings. Overall, its benefits appear to be limited.

It has been reported that cleaning biopsy injection tips with 10% formalin between procedures effectively reduces infectious complications after TRUS-Bx (10). Although statistical significance has not been firmly established, experiments have demonstrated formalin's potential to inhibit bacterial growth, particularly bacteria resistant to fluoroquinolones. However, the lack of prospective, randomized controlled studies on formalin disinfection limits its clinical application. Comprehensive clinical trials are required to validate the effectiveness of formalin disinfection and to promote its wider implementation in clinical settings.

Multiple studies comparing transrectal and transperineal prostate biopsies suggest that the transperineal method is equally effective as TRUS-Bx for diagnosing PCa (11). The transperineal technique has shown a lower rate of infectious complications when compared to the transrectal approach. Nevertheless, although the transperineal biopsy has a safer profile, it comes with certain drawbacks, including the need for general anesthesia, increased costs, longer procedure times, and specialized equipment requirements (12). However, its lower infection rates highlight the potential of transperineal biopsy as a viable technique to TRUS-Bx.

As discussed earlier, various strategies have been employed in clinical practice to minimize complications following prostate biopsy. In this study, we evaluated the efficacy of povidone-iodine through two distinct methods and observed a significant reduction in infection rates.

Povidone-iodine, widely recognized for its ability to reduce infection risks in colorectal surgery and wound care, was combined with prophylactic antibiotics before TRUS-Bx to further mitigate infection risks (13). Prior studies have demonstrated the superior effectiveness of povidone-iodine when used alongside antibiotics for infection prevention (14).

It is well-established that enema use alone is insufficient for preventing infections during TRUS-Bx (15). According to EAU guidelines, rectal disinfection with povidone-iodine before TRUS-Bx is recommended (16). In our study, we observed that the combined use of povidone-iodine and enema significantly lowered infection rates following biopsy procedures.

Previous studies have explored various preoperative rectal cleansing methods and povidone-iodine applications. Ghafoori et al. (17) showed that administration of a povidone-iodine solution into the rectum effectively decreased the rate of infectious complications after TRUS-Bx. Similarly, Park et al. (18) reported that compared with povidone-iodine enemas, povidone-iodine suppositories were more effective in minimizing infections.

Additional studies have shown that direct cleansing of the rectal dome and perianal region with povidone-iodine reduces post-

biopsy infection risks by limiting rectal microbial colonization (19). Chen et al. (20) introduced a rectal cleansing technique using povidone-iodine-soaked gauze to target the prostate area, which led to a 9.5% decrease in post-procedure infection rates.

Research evaluating povidone-iodine rectal cleansing for prebiopsy preparation has strongly supported its role in reducing infections. A meta-analysis further confirmed that combining antibiotics with povidone-iodine disinfection significantly lowers overall infection rates (21).

In a retrospective analysis conducted at a Korean hospital, Hwang et al., (22) reported that povidone-iodine enemas notably decreased. Our study similarly evaluated two rectal applications of povidone-iodine and found a substantial reduction in infection rates, which is consistent with prior research.

In contrast, Abughosh et al. (23) reported a 42% relative reduction in infection rates using povidone-iodine rectal cleansing in a large-scale study involving 865 patients, although this finding was not statistically significant. Conversely, Ryu et al. (24) found that povidone-iodine suppositories had no significant impact on complication rates.

Additionally, our study included evaluations using the International Prostate Symptom Score and the Sexual Health Inventory for Men questionnaires. No significant differences were observed in lower urinary tract symptoms or sexual function. However, our research exclusively focused on infectious complications, and no quality of life assessments were performed (24).

Study Limitations

Several limitations of our study should be acknowledged. First, its retrospective design, which relies on data extracted from medical records and TRUS-Bx procedure notes, introduces inherent constraints, such as limited data availability and potential bias. Additionally, although urine analysis was performed for all patients, more comprehensive assessments, including blood culture, urine culture, and other laboratory tests, were selectively conducted for hospitalized individuals presenting with febrile symptoms.

Moreover, asymptomatic or mildly symptomatic outpatients may have been excluded from our analysis. Additionally, the sample size was relatively small, and its single-center design restricted the generalizability of the findings. To overcome these limitations and ensure more robust conclusions, future studies should include larger-scale, prospective, and randomized clinical trials.

Conclusion

Our findings demonstrate that combining transrectal 10% povidone-iodine injection administered via a gavage syringe with antibiotic prophylaxis, as well as performing povidone-iodine rectal cleansing, is an effective, affordable, and practical approach for reducing infectious complications associated with TRUS-Bx.

Ethics

Ethics Committee Approval: Ethical clearance for this research was obtained from the Ethics Committee of Tokat Gaziosmanpaşa University Medical Faculty (approval number: 83116987-031, date: 05.01.2023).

Informed Consent: Written consent was obtained from each participant.

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Footnotes

Authorship Contributions

Surgical and Medical Practices: F.F., K.Y., Concept: F.F., K.Y., Design: F.F., K.Y., Data Collection or Processing: F.F., K.Y., Analysis or Interpretation: F.F., K.Y., Literature Search: F.F., K.Y., Writing: F.F., K.Y.

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