Original Article

Factors influencing urinary retention following freehand transperineal prostate biopsy: Insights from a tertiary care center study

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ABSTRACT

Objectives: In this study, we evaluated the risk factors for urinary retention after freehand transrectal ultrasound (TRUS) guided transperineal prostate biopsy (TPB).

Patients and Methods: Data from 102 cases of freehand TPB at a single institution were retrospectively collected and analyzed. All patients underwent magnetic resonance imaging (MRI)-TRUS cognitive fusion TPB using a transperineal needle guide, with systematic biopsies from 10 prostate sectors and additional MRI-guided targeted biopsies. Exclusions comprised patients with coagulation abnormalities, prior prostate surgeries including biopsy, active urinary tract infection, or a lack of pre-biopsy multiparametric MRI.

Results: 14/102 (13.72%) had urinary retention and required urethral catheterization for voiding difficulty or discomfort along with a bladder volume of ≥500 ml. Patients with retention exhibited significantly larger prostate volumes (median 75 cc vs. 40 cc; $P < 0.05$). Receiver operating curve analysis revealed a prostate volume threshold of 57.5 cc and a core number cutoff of 23 for predicting post-TPB urinary retention, with sensitivities of 78.57% and 85.71%, specificities of 75% and 82.95%, positive predictive values of 33.33% and 44.44%, and negative predictive values of 95.75% and 97.33%, respectively, whereas the number of biopsy cores correlated positively with the development of urinary retention (median 25 vs. 22; $P < 0.05$). Urinary retention was independent of the patient’s age, comorbidities, presenting prostate-specific antigen levels, prebiopsy severity of lower urinary tract symptoms, and use of alpha-blockers.

Conclusion: Patients with larger prostates and higher number of biopsy cores are at a higher risk of postfreehand TPB urinary retention and should receive appropriate counselling. Targeted biopsies alone, rather than a full template, may help mitigate urinary retention in these high-risk groups.

INTRODUCTION

The utilization of transperineal prostate biopsy (TPB) for the diagnosis of prostate cancer is on the rise. Recent guidelines from the European Association of Urology (EAU) advocate systematic TPB as the preferred technique over systematic transrectal prostate biopsy (TRB) for the diagnosis of clinically significant prostate cancer (csPCa).[1]

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The EAU strongly recommends multiparametric magnetic resonance imaging (mpMRI) before the prostate biopsy, both in biopsy-naïve and previous negative biopsy patients, as the MRI pathway improves the detection of csPCa and minimizes the risk of detecting insignificant prostate cancers.[2] In cases where the MRI reveals a doubtful lesion, MR-targeted biopsy can be obtained using various methods

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such as cognitive guidance, US/MR fusion software, or direct in-bore guidance. Recent literature including systematic reviews show similar overall prostate cancer detection rates among the three image-guided techniques.[3-5]

TPB exhibits superior accessibility to the anterior and apical regions of the prostate compared to the TRB. A recent meta-analysis comparing MRI-targeted TRB and MRI-targeted TPB showed that the TPB exhibited greater sensitivity in detecting csPCa with rates of 86%, especially for tumors situated in the anterior region. In comparison, the sensitivity of TRB was 73%.[6] In addition, TPB significantly reduces the infectious complications compared to the TRB.[7,8] Patients undergoing TPB face a higher likelihood of experiencing a urinary retention, which can ultimately result in an overnight hospital stay or the need for readmission, in contrast to those who undergo TRB (1.9% vs. 1.0%).[8] As per the NICE guidelines for transperineal template biopsy of the prostate, the incidence of urinary retention ranges from 1.6% to 11.4%.[9] However, some studies have reported the urinary retention rates as high as 25%.[10] Urkmez *et al*. conducted a comparison between the two techniques of TPB and observed that the freehand TPB exhibited a significantly lower urinary retention rate than grid-based TPB (1% vs. 10%), whereas, both the techniques maintained a similar cancer detection rate.[11]

In this study, we assessed the factors that contribute to the development of urinary retention following freehand transrectal ultrasound (TRUS) guided TPB.

METHODS

Study population

One hundred and twenty-four patients underwent TPB at a single tertiary level hospital from January 2022 to May 2023. The data, of all men who were undergoing TPB, was collected prospectively. In view of our growing concerns about the postbiopsy urinary retention rate, we conducted a retrospective analysis of the data to identify risk factors affecting the rate of urinary retention after the TPB.

The inclusion criteria was: patients with raised prostate-specific antigen (PSA) and mpMRI prostate showing lesions with Prostate Imaging-Reporting and Data System version 2.1 (PI-RADS v2.1) score of ≥3 associated with normal or abnormal digital rectal examination. Exclusion criteria were patients with (a) coagulation abnormalities, (b) previous surgeries of the prostate including biopsy, (c) active urinary tract infection, and (d) those who did not undergo a mpMRI prior to the biopsy.

Study procedure

Preprocedure workup

All patients underwent mpMRI of the prostate before the biopsy, and a sodium phosphate enema was administered the night before the procedure to ensure proper rectal emptying. A single dose of second-generation cephalosporin (cefuroxime 1.5 g i.v.) was administered as the preoperative antibiotic after a test dose, 30 min before the procedure. All TPBs were performed by a single urologist with experience in conducting over 100 TRBs.

Biopsy technique

Patients were placed in the low dorsal lithotomy position. Paper tape was employed to lift the scrotum away from the perineum. Perineal skin was prepared with 5% povidone–iodine. The majority of the patients underwent the procedure under spinal anesthesia. Nevertheless, for patients undergoing TPB under local anesthesia, the skin and subcutaneous tissue anterior to the anal opening were infiltrated with 2% lignocaine. The visualization of the prostate was achieved using a biplanar bk5000 TRUS probe, model E14CL4b (9048) (BK ultrasound, Peabody, MA). A bilateral periprostatic nerve block was administered by injecting an extra 20 mL of 2% lignocaine solution into the periapical region of the prostate using a 20G spinal needle, targeting the posterolateral neurovascular bundles at the level of the prostate's apex under TRUS guidance through the transperineal route. Biopsies were taken utilizing a transperineal needle guide affixed to the TRUS probe (UA1232, BK Medical Aps, Copenhagen, Denmark) [Figure 1]. It holds a 9-point stepper grid in position, facilitating the insertion of needles at various depths. Biopsies were obtained using an 18-gauge Bard® Max-Core™ Disposable Core Biopsy needle. Using the real-time TRUS imaging, the biopsy needle was carefully inserted coaxially to reach just distal to the intended area before being fired. The template used for taking the biopsy is illustrated in Figure 2. Typically, the most common approach involved obtaining 20 systematic cores during the TPB, and two additional cores, from each of the targeted lesion identified on the mpMRI, were acquired. For smaller prostates with a volume <30 cc, sampling from the base of the prostate was not performed.

Study variables

Data parameters were systematically extracted to include patient's details such as demographics, comorbidities, history of prior prostatic diseases, PSA level at presentation, severity of lower urinary tract symptoms (LUTS) on the International Prostate Symptom Score (IPSS), use of alpha-blockers, prostate volume as measured on the mpMRI, type of anaesthesia for the TPB, and the number of biopsy cores taken.

The primary objective focused on the post-TPB urinary retention, which was characterized by the requirement for inserting a urethral catheter due to inability to void or for patient's discomfort, along with a bladder volume of ≥500 ml after the designated period of observation.

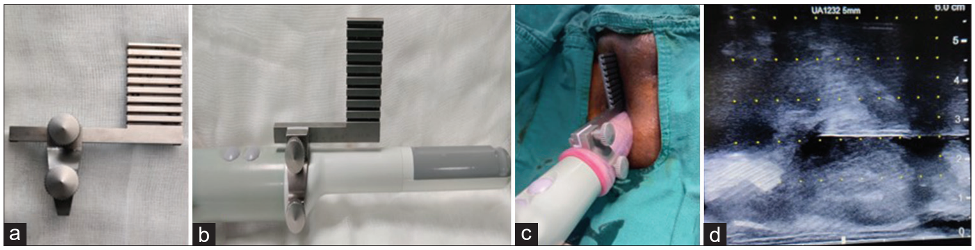

Figure 1: (a and b) Transperineal needle guide (UA1232, BK Medical Aps, Copenhagen, Denmark) mounted on transrectal ultrasound probe for transperineal prostate biopsy (TPB) (c) Freehand TPB (d) Position of the needle in the sagittal plane

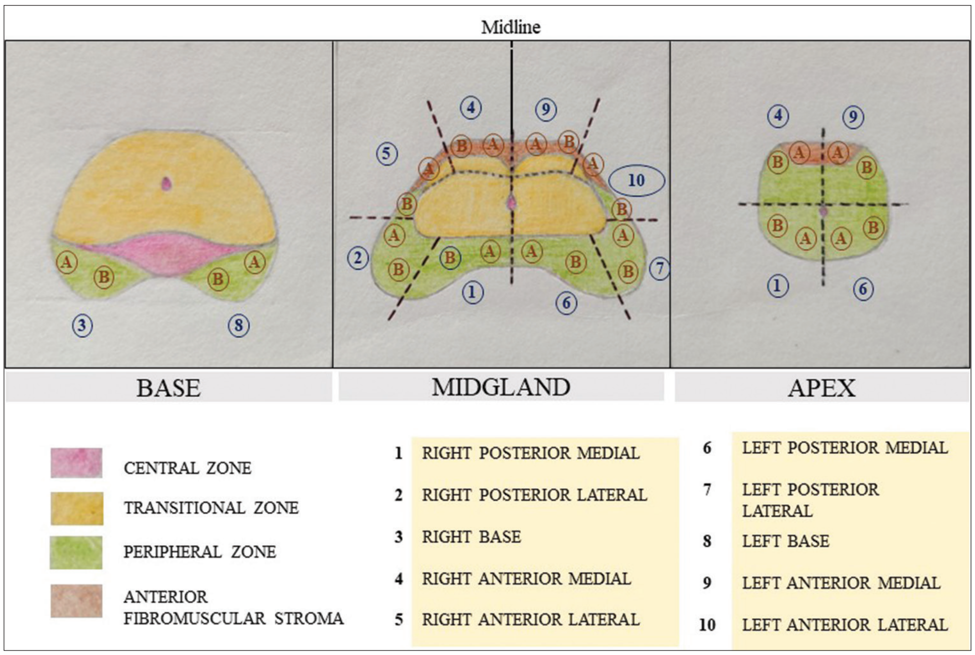

Figure 2: Freehand transperineal biopsy template

Statistical analysis

Statistical analysis was performed using IBM SPSS version 20.0 software (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY, USA: IBM Corp.). The Kolmogorov–Smirnov test was used to test the normality of the data. The results of descriptive analysis were compared using statistical measures such as mean, median, range, standard deviation, and interquartile range, depending on the distribution of the data. The Mann–Whitney *U*-test was employed to assess the statistical significance of continuous variables between the groups with and without retention. The receiver operating curve (ROC) was used to find the cutoff value of significant factors predicting urinary retention. Diagnostic measures such as sensitivity, specificity, predictive value positive, and negative value predictive were computed.

RESULTS

Twenty-two patients did not satisfy the specified inclusion criteria and were, consequently, excluded from the study. Therefore, a total of 102 cases were accessible for retrospective data collection and analysis. Patient demographics, comorbidities, and perioperative data of the study population are mentioned in Table 1. Out of the 102 patients, 14 (13.72%) experienced urinary retention within 24 h of TPB and were subsequently catheterized. Thirteen patients voided successfully after the first voiding trial, given 72 h post-catheterization, and one patient voided after a second catheter-free trial conducted 1-week post-procedure.

Patients in the retention group had significantly larger prostate volume (median 75 cc vs. 40 cc; $P < 0.05$). The ROC curve analysis showed that a prostate volume cutoff of 57.5 cc predicted the post-TPB urinary retention with a sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of 78.57%, 75%, 33.33%, and 95.75%, respectively [Figure 3a]. Similarly, there was a positive correlation between the number of cores obtained and the incidence of urinary retention (median 25 vs. 22; $P < 0.05$). The ROC curve analysis showed that a cutoff of 23 for the number of cores predicted post-TPB urinary retention with the sensitivity, specificity, PPV, and NPV of 85.71%, 82.95%, 44.44%, and 97.33%, respectively [Figure 3b].

Table 1: Demographic details, associated comorbidities, and factors influencing urinary retention

Parameters	Nonretention (*n*=88)	Retention (*n*=14)	Difference (*P*)
Age (years) (mean±SD)	68.37±7.01	65.92±6.89	0.22
Comorbidities, *n* (%)			
Diabetes	38 (43.18)	4 (28.5)	0.38
Hypertension	52 (59.09)	9 (64.28)	0.78
Coronary artery disease	17 (16.67)	2 (14.28)	0.65
Alpha-blocker usage	31 (35.22)	6 (42.8)	0.57
PSA, median (IQR)	11.8 (6.8–18.75)	14.5 (8.81–25.05)	0.183
MRI prostate volume (cc), median (IQR)	40 (31.25–59.0)	75 (54–106)	<0.05
Spinal anesthesia: LA	79:9	13:1	0.72
Number of biopsy cores, median (IQR)	22 (19–23)	25 (24–26)	<0.05

PSA=Prostate-specific antigen, MRI=Magnetic resonance imaging, LA=Local anesthesia, IQR=Interquartile range, SD=Standard deviation

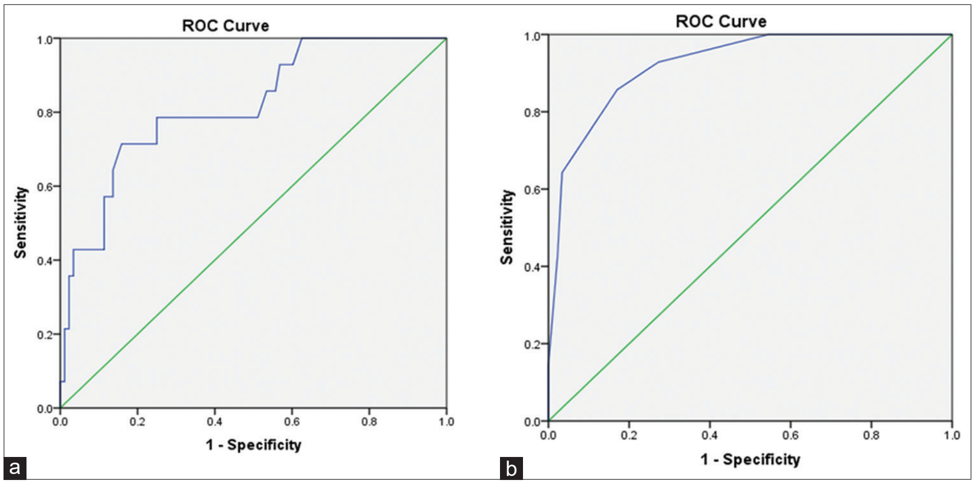

Figure 3: (a) Receiver operating curve (ROC) analysis showing the association of prostate volume for predicting posttransperineal prostate biopsy (TPB) urinary retention. (b) ROC curve analysis showing the number of prostate cores for predicting post-TPB urinary retention

Patient's age, comorbidities, PSA at presentation, and the use of alpha-blockers were found to be unrelated to the incidence of urinary retention. While not achieving statistical significance, prebiopsy LUTS did influence the incidence of urinary retention. In the retention group, 42% of the patients exhibited severe LUTS before the biopsy, compared to 27.22% of the patients who had a urinary retention.

DISCUSSION

Initially, the TPB was performed utilizing the grid and the stepper technique for a systematic saturation biopsy of the prostate and required general anesthesia. This grid-based approach involves using a brachytherapy needle guide which consists of a grid with spaced holes at 5 mm intervals. When sampling the entire prostate gland, this technique can result in obtaining 50–70 cores.[12,13] In contrast to the transrectal approach, the transperineal route provides a benefit in the terms of enhanced detection of the lesions situated in the anterior and the apical regions of the prostate.[14] The spatial distribution of the tumor, obtained through the template-guided TPB, generally aligns with that observed in the radical prostatectomy specimens.[15]

Recently, there is a resurgence in TPB which is primarily attributed to the adverse effects of the TRB such as the infectious complications and limitations in tissue sampling.[16] A recent meta-analysis revealed that the TPB resulted in a significantly lower incidence of rectal bleeding (RR = 0.02, 95% CI 0.01–0.06) and fever (RR = 0.26, 95% CI 0.14–0.28) in comparison to the TRB, but had a similar incidence of acute urine retention.[17] Nonetheless, as indicated by a comprehensive population study in the United Kingdom, there was a notable disparity in the rates of readmission for urinary retention between the TPB and TRB (1.9% vs. 1%).[8]

In August 2016, the PrecisionPoint™ Transperineal Access System (Perineologic, Cumberland, MD) was approved by the United States Food and Drug Administration, which enables urologists to perform TPB through freehand technique with a minimal number of skin punctures.[18] Urkmez *et al*. found a significantly lower rate of urinary retention with the freehand TPB than with the grid-based technique as the former omits the sampling of the adenoma region.[11] In our study, we used the UA 1232 puncture attachment attached to the biplanar transducer.

The incidence of urinary retention within our group was 13.7%. Several recent studies, using the PrecisionPoint™

freehand transperineal Access System, have shown a lower incidence of urinary retention.[19-21] Meyer *et al*. found that 4.2% of the patients experienced post-TPB urinary retention.[18] Most of the studies were performed under local anesthesia (LA). Initially, we performed the TPB under spinal anesthesia and observed that 13 patients experienced urinary retention. In contrast, urinary retention occurred in only one of the 10 TPBs performed under LA. However, this correlation was not statistically significant. We endeavoured to identify additional risk factors that could potentially contribute to the urinary retention after the biopsy procedure.

As anticipated in a clinical setting, individuals with a larger prostate are predisposed to urinary retention post biopsy. This can be attributed to the reactive edema and obstructive consequences arising from the multiple needle punctures. In our cohort, we found that a prostate volume of ≥57.5 cc has 78.57% sensitivity and 75% specificity in identifying the patients who will develop urinary retention post-TPB. Kum *et al*.[22] concluded that a prostate volume of >75 cc was associated with urinary retention and Willis *et al*.[23] reported that a volume of >68 cc is a risk factor for urinary retention.

The presence of preoperative LUTS also influences the likelihood of urinary retention. Kum *et al*. noted that 45% of the patients who experience urinary retention had moderate-to-severe LUTS, whereas this proportion was only 26% in those who did not develop retention.[22] As per few studies, a high IPSS score serves as a risk factor for postprostate biopsy urinary retention.[24,25] In our study, we observed that 11 of the 14 patients (78.57%) who developed urinary retention exhibited moderate-to-severe LUTS, whereas 49 out of the 88 patients (55.6%) exhibited similar symptoms in the non-retention group. However, this difference did not reach statistical significance ($P = 0.1$).

While specific evidence supporting a reduction in the incidence of acute urinary retention post TPB with alpha-blockers does not exist, limited evidence indicates that alpha-blockers may be helpful after TRUS guided prostate biopsies. Bozlu *et al*. reported a reduction in the incidence of acute urinary retention from 9% to 3% in patients who received tamsulosin before the TRUS-guided prostate biopsy.[26] In our cohort, 36.28% of the patients were already on long-term alpha-blockers, and a significant difference, in the incidence of urinary retention when compared to patients who were not taking alpha-blockers, could not be found. Similarly, Kum *et al*. also did not find a benefit of prophylactic alpha-blockers in preventing the post-TPB urinary retention.[22]

Several studies have established a correlation between a higher number of biopsy cores and the incidence of post-procedural urinary retention.[27-29] Kum *et al*. identified a direct association between the number of biopsy cores taken and the incidence of urinary retention (median 35 vs. 32 biopsy cores, $P = 0.045$).[22] Similarly, Willis *et al*. also identified a positive relationship between the incidence of urinary retention and the number of cores obtained (mean cores 55 vs. 51; $P > 0.05$).[23] In our cohort, we also found that a larger number of cores was one of the predictors of urinary retention following the TPB. Minimizing the number of biopsy cores with the MRI pathway[30] might prove advantageous in mitigating urinary retention, consequently lowering the rates of prolonged hospital stay and yielding cost-effective outcomes.

The limitation of this study was its retrospective design involving a limited patient cohort and the lack of uroflowmetry data before the biopsy procedure. The absence of a standardized definition for urinary retention, coupled with the existence of multiple definitions, can lead to varying rates of urinary retention in different studies. In our study, we used a cutoff value of 500 ml, which might contribute to a higher rate of urinary retention.

CONCLUSION

Patients with larger prostate volumes and a larger number of obtained biopsy cores are more susceptible to experience a postfreehand TPB urinary retention and should receive appropriate counselling. Opting for selective targeted biopsies, rather than a complete template, could potentially avert urinary retention in the identified high-risk groups.

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