Predictors of Unsuccessful Trials without Catheters in Acute Urinary Retention Secondary to Benign Prostatic Hyperplasia

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ABSTRACT

Introduction: Acute urinary retention (AUR) is the most important event in the natural history of benign prostatic hyperplasia (BPH) that calls for urinary catheterization. Trial without catheter (TWOC) is an ambulatory care protocol, failure of which requires re-catheterization, a follow-up visit, subsequent evaluation, and surgical intervention. The aim of the study was to identify independent predictors of unsuccessful TWOC.

Methods: The present study enrolled 83 patients with a first episode of AUR secondary to BPH. We have recorded details of various factors, including age, international prostate symptom score (IPSS), total prostate volume (TPV), transition zone volume (TZV), transition zone index (TZI), intravesical prostatic protrusion (IPP), and residual urine volume (RUV) drained following catheterization. Administration of 0.4 mg of tamsulosin once a day for 7 days was given to all following catheterization and TWOC performed on the eighth day. Our definition of unsuccessful trial was the inability to pass urine or post-void residual urine > 150 mL on ultrasound, with a maximum flow rate < 10 mL/sec. Statistical Package for the Social Sciences (SPSS) 16.0 was used for statistical analysis. Multivariate analysis was performed to identify independent predictors. Independent *t*-test and Fisher's exact tests were used for other statistical analysis where a P value of < 0.05 was considered significant. Receiver operating characteristic curves (ROC) were constructed using cutoff values for independent predictors.

Results: TWOC was unsuccessful in 48 (57.83%) patients. Multivariate analyses revealed that age (odds ratio = 1.069; 95% CI = 1.002-1.140; *P* value = 0.042), TZV (odds ratio = 1.662; 95% CI = 1.035-2.670; *P* value = 0.035), TZI (odds ratio = 0.00; 95% CI = 0.00-0.150; *P* value = 0.032), and RUV (1.003, 1.000-1.007, 0.38) are independent predictors of a failed trial. The failure rates of the voiding trial based on grades I to III IPP were 2.08% (1 of 48 cases), 10.41% (5 of 48), and 18.75% (9 of 48).

Conclusion: Our data suggested that age, IPP, TZV, TZI, and RUV are significant risk factors for unsuccessful TWOC. Evaluation of a first episode of AUR secondary to BPH in respect to the previously mentioned factors may guide urologists during subsequent evaluation and treatment without giving a failed trial.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is commonly associated with spontaneous acute urinary retention (AUR) and is regarded as a sign of disease progression [1-3]. Management of this condition must begin with identifying risk factors for developing AUR, regular follow-up, and surgical intervention for those who might benefit. Surgery should be delayed when possible to reduce the risk of perioperative morbidity and mortality as well as to allow the bladder to recover its contractility. Trial without catheter (TWOC) is a novel approach, and it should be considered for those with spontaneous AUR, with a success rate of 23 to 40% [4,5]. A successful trial not only delays surgery, but may also avoid it. Nevertheless, incidence of an unsuccessful trial is high for re-catheterization. Failed trials could be avoided by identifying significant, independent risk factors. We should

selectively consider those patients who are at a high risk of failure and counsel them for further management to extend elective surgery, without considering an unnecessary catheter-free trial. The aim of our study was to evaluate independent risk factors of unsuccessful trials.

METHODS

Study Design

This was a prospective study conducted at our urology department from January 2012 to March 2013. Ethical approval was obtained from the Research and Ethics Committee of the institute.

Inclusion and Exclusion Criteria

Eighty-three male patients 45 years or above who presented to the urology clinic with a first episode of AUR secondary to BPH were included in this study. Informed written consent was taken from the participants. Exclusion criteria included patients receiving medical treatment for BPH and overactive bladder, the presence of gross hematuria/urinary tract infection/chronic constipation, known or suspected carcinoma of the prostate on digital rectal examination (DRE)/transrectal ultrasound (TRUS), the presence of stricture urethra/vesical calculus, failed catheterization, bed-ridden/ severely comorbid patients, a history of recent anesthesia/surgery, and neurological disorders affecting continence.

Data Collection and Statistical Analysis

All the eligible patients were initially managed with peri-urethral catheters (PUC), and the residual urine volume (RUV) drained with the catheter was recorded. Details of the various parameters, including age, international prostate symptom score (IPSS), total prostate volume (TPV), transition zone volume (TZV), transition zone index (TZI), and intravesical prostatic protrusion (IPP) were also recorded. The transition zone index is the ratio of the transition zone to total prostate volume. TRUS was used for volumetric measurements of the prostate (Figure 1) using the ellipsoid formula keyed into the ultrasound machine (SonoAce X6, Medison). Intravesical prostatic protrusion was measured by calculating the vertical distance from the protruded tip to the circumference of the bladder at the prostate base taken at the mid-sagittal view (Figure 2). Intravesical prostatic protrusion was graded I to III according to the classification system used by Nose et al. [6]. Administration of 0.4 mg of tamsulosin once a day for 7 days was given to all following catheterization and TWOC performed on the 8th day. We have defined an unsuccessful trial as the inability to pass urine or post-void residual urine > 150 mL on ultrasound with a maximum flow rate < 10 mL/sec, similar to what's described by Osman et al. [7]. Statistical analysis was

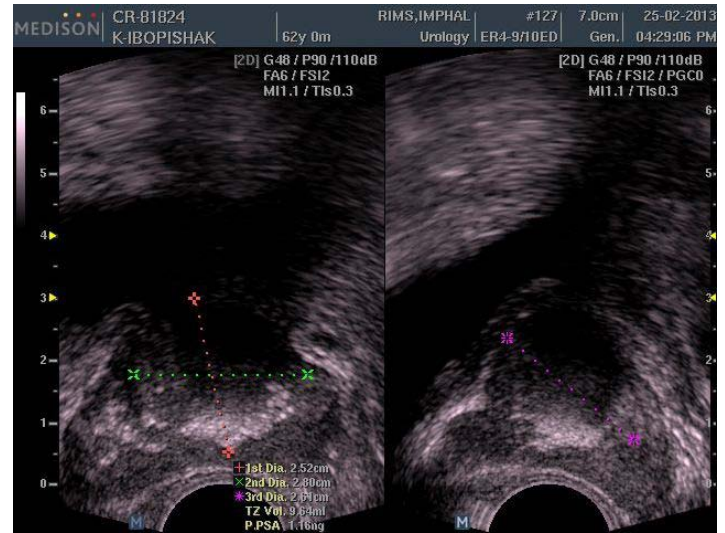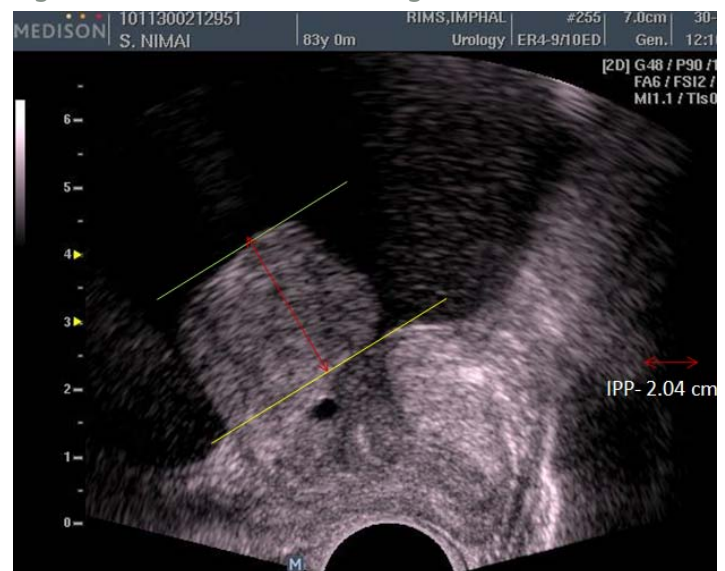Figure 1. TRUS for volumetric measurement of the prostate.

Figure 2. Grade III IPP on mid-sagittal view of TRUS.

performed using SPSS 16.0. An independent *t*-test was used to determine the statistically significant difference between the means in 2 groups (successful and unsuccessful). Multivariate analysis was performed to identify which were independent predictors of an unsuccessful trial. A Fisher's exact test was used to determine significant differences between grades of IPP in respect to TWOC outcomes. Receiver operating characteristic

Table 1. Parameters with their respective means.

Parameter (Mean Value)	Successful TWOC N = 35	Unsuccessful TWOC N = 48	*P* Value
Age	62.77 ± 10.18 (46-85)	71.79 ± 6.98 (57-87)	0.047
PSA	5.39 ± 4.06 (0.50-16.23)	6.03 ± 5.37 (0.78-24.19)	0.072
TPV	48 ± 15.66 (30.09-89.51)	57.36 ± 19.15 (28.76-102.31)	0.196
TZV	17.79 ± 7.1 (5.42-36.93)	25.44 ± 12.6 (2.69-56.5)	0.003
TZI	0.36 ± 0.06 (0.17-0.45)	0.42 ± 0.13 (0.10-0.66)	0.002
IPSS	21.97 ± 8.69 (7-35)	22.62 ± 7.31 (11-35)	0.223
RUV	499.7 ± 137.7 (197.66-721.36	652.73 ± 225.81 (124.6-1067.07)	0.008

TWOC: trial without catheter; N: number; PSA: prostate specific antigen; TPV: total prostate volume; TZV: transition zone volume; TZI: transition zone index; IPSS: international prostate symptom scores; RUV: residual urine volume drained with catheter.

Table 2. Multivariate analysis showing independent risk factors.

		B	SE	Wald	df	Sig	Exp (B)	95% CI for Exp (B) Lower	95% CI for Exp (B) Upper
Step 1a	Age	0.67	0.033	4.135	1	0.042	1.069	1.002	1.140
	PSA	-0.039	0.053	0.536	1	0.464	0.962	0.867	1.140
	TPV	-0.184	0.099	3.455	1	0.063	0.832	0.685	1.010
	TZV	0.508	0.242	4.425	1	0.035	1.662	1.035	2.670
	TZI	-22.177	10.348	4.593	1	0.032	0.00	0.00	0.150
	IPSS	-0.021	0.034	0.388	1	0.534	0.979	0.915	1.047
	RUV	0.003	0.002	4.306	1	0.038	1.003	1	1.007
	constant	2.175	4.527	0.231	1	0.631	8.798	-	-

SA: prostate specific antigen; TPV: total prostate volume; TZV: transition zone volume; TZI: transition zone index; IPSS: international prostate symptom scores; RUV: residual urine volume drained with catheter; Exp (B): odds ratio

(ROC) curves were constructed using cutoff values for different significant predictors. A *P* value of < 0.05 was considered statistically significant.

RESULTS

An unsuccessful trial was observed in 48 (57.83%) patients. Table 1 shows the parameters with their respective means. The mean age (71.79 ± 6.98) of the TWOC failure group was significantly higher than the successful group, with a *P* value of 0.047. Mean values of TZV, TZI, and RUV were significantly different in both groups, with a *P* value of 0.003, 0.002, and 0.008, respectively. Significant association (*P* = 0.001) was observed between the IPP and TWOC outcome. Multivariate analysis is shown in Table 2, which revealed age (odds ratio = 1. 069; 95% CI = 1.002-1.140; *P* value = 0. 042), TZV (odds ratio = 1.662; 95% CI = 1.035-2.670; *P* value = 0. 035), TZI (odds ratio = 0. 00; 95% CI = 0. 00-0.150; *P* value = 0. 032), and RUV (1.003, 1.000-1.007, 0.38) as independent risk factors. Table 3 compares the grades of IPP in respect to TWOC outcome, and it shows grade III intravesical prostatic protrusion is an important risk factor. The area under receiver operating characteristics (AUROC) curve for independent predictors, including age, TZV, TZI, and RUV, were 0.771, 0.695, 0.737, and 0.736, respectively (Figure 3). A cutoff value of 69 for age detected TWOC failure with sensitivity and specificity of 66.70% and 80.10%, respectively (Figure 4). A cutoff value of 22.88 mL for TZV showed sensitivity (54.20%) and specificity (77.10%) for the prediction of unsuccessful
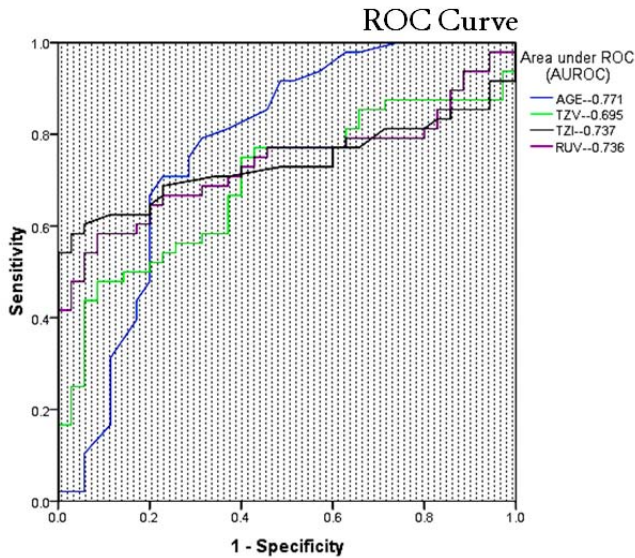
Table 3. Grades of IPP with respect to TWOC outcome.

Grades of IPP (mm)	Successful TWOC N = 35	Unsuccessful TWOC N = 48	P Value
grade I	11 (31.43%)	1 (2.08%)	P = 0.001
grade II	3 (8.57%)	5 (10.41%)	
grade III	0	9 (18.75%)	

grade I versus grade II: P = 0.018
grade II versus grade III: P = 0.082
grade I versus grade III: P = 0.001

grade I (< 5 mm); grade II (5-10 mm); grade III (> 10 mm)
IPP: intravesical prostate protrusion; TWOC: trial without catheter; N: number

Figure 3. Area under receiver operating characteristics (AUROC) curve for independent predictors.

Figure 4. Receiver operating characteristics (ROC) curve constructed using cutoff values for age.

Figure 5. ROC curve constructed using cutoff values for TZV.

TWOC (Figure 5). Similarly, a cutoff value of 0.42 and 654 mL showed sensitivity and specificity of 62.50%, 88.60% for TZI (Figure 6), and 58.30%, 88.60% for RUV, respectively (Figure 7).

DISCUSSION

Trial without a catheter has become a standard practice worldwide for men with BPH and AUR. According to the Agency for Health Care Policy and Research guidelines one of
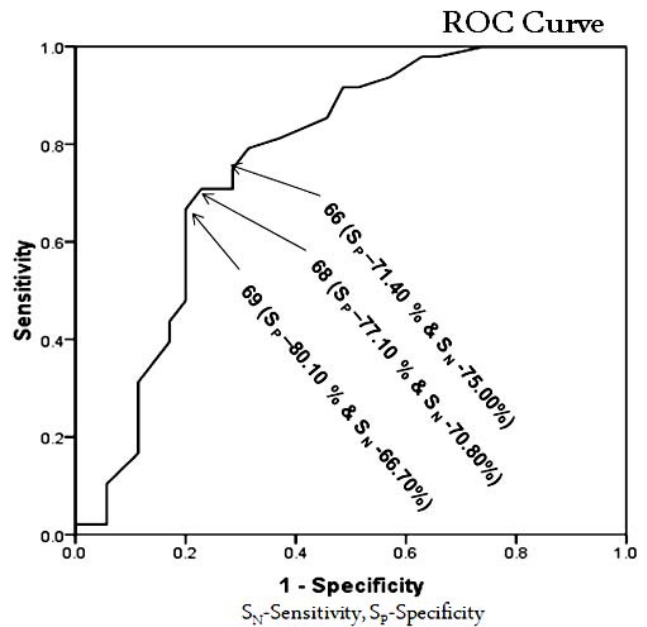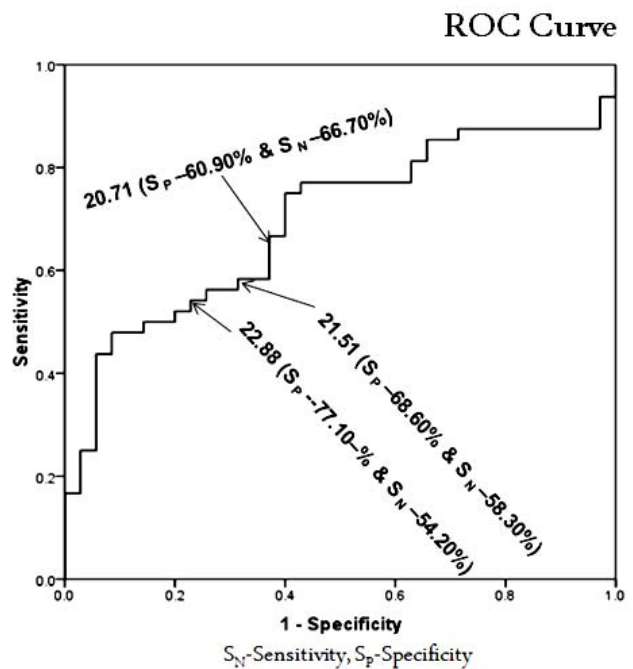
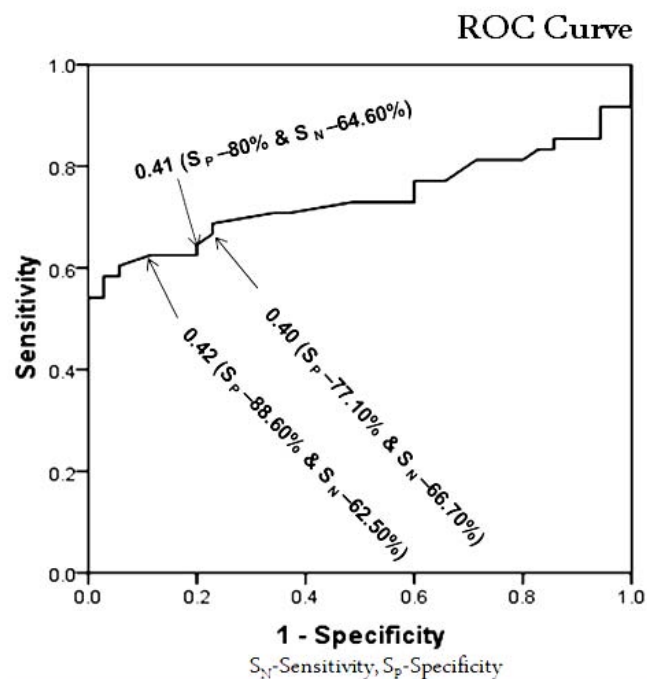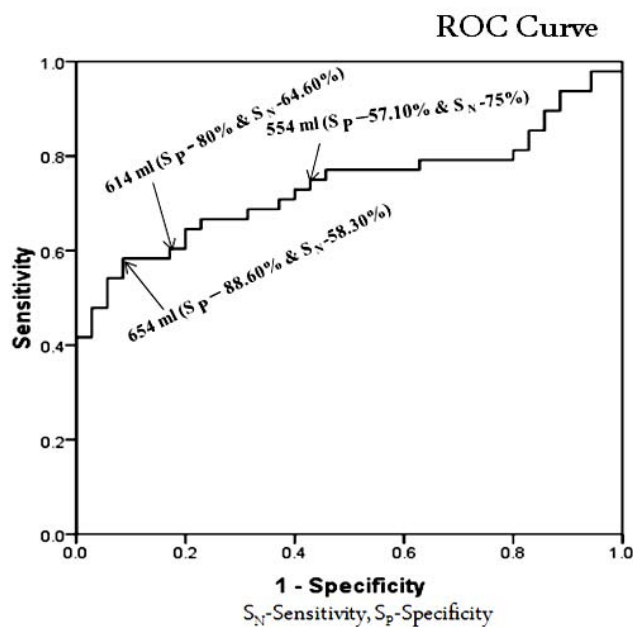Figure 6. ROC curve constructed using cutoff values for TZI.

Figure 7. ROC curve constructed using cutoff values for residual urine volume (RUV) drained at first catheterization.

the absolute indications for primary surgical management of BPH is refractory urinary retention/unsuccessful catheter trial [8]. From the viewpoint of the patient, refractory retention is usually a feared situation, with increasing agony, a visit to the emergency room, re-catheterization, follow-up visits, an attempt at catheter removal, and eventual recovery or surgery. Overall it is an uncomfortable and time-consuming process. In this study we evaluated the significant risk factors that could predict the outcome of TWOC, especially in respect to failure. The presence of significant predictors of an unsuccessful trial in patients with a first episode of AUR secondary to BPH can avoid re-catheterization-related discomfort and agony with selective consideration for elective surgery. In this study we found that IPP, TZI, TZV, RUV, and age are independent risk factors for unsuccessful trials. Intraprostatic protrusion was found to be one of the significant predictors, which was consistent with the observations of Osman et al. [7], Tan et al. [9], Shanmugasundaram et al. [10], and Paramananthan et al. [11].

Comparing grades of IPP, a significant difference was noticed in grade I and III ($P = 0.001$) but not in grade II and III ($P = 0.082$), as shown in Table 3. Transition zone index and RUV were found to be significant predictors, with high specificity (88.60%) for a

cutoff value of 0.42 and 654 mL, respectively. Similarly, age and TPV were also significant predictors, with a specificity of 80.10% and 77.10% for a cutoff value of 69 and 22.88 mL, respectively. Analyzing AUROC for different risk factors, we found that age has a maximum area (Figure 3), meaning it can predict the outcome better. Although prostate volume was considered one of the predictors of an unsuccessful trial, we have observed that it is the TZV and TZI that predicts the outcome, not the TPV. International prostate symptom score (IPSS) did not predict the outcome in our study as opposed to what was observed by Bhomi et al. [12]. PSA did not predict the outcome in our study, which is in ordinance with the findings of Zeif et al. [13]. In the Reten-World survey by Emberton et al. [14], age (> 65 years) and RUV (> 1L) drained at catheterization were found to have a high probability of unsuccessful trial, but the present study showed a higher cutoff value for age (69 years) and a lower cutoff value for RUV (654 mL). According to Shanmugasundaram et al. [10], residual urine > 500 mL, gland size > 50 mL, and age older than 65 years are associated with failed trial. Cystometrography (CMG) is a more invasive procedure and not recommended for routine evaluation of BPH patients [15]. The most important indication of urodynamic studies in patients with BPH is those having chronic urinary retention (CUR) because detrusor under activity (DUA) is seen in low-pressure chronic retention (LPCR). As our inclusion criterion was patients with a first episode of

AUR, we have not evaluated the effect of CMG parameters to predict the outcome of TWOC.

Observational studies have suggested alpha-blockers significantly improve the outcome of TWOC, with success rates between 48 to 62% [16-20]. Patients receiving 5-alpha reductase inhibitors may have impact on TWOC outcome. Reynard et al. [21] have demonstrated that anticholinergics used in BPH patients leads to a small increase in post-void residual (PVR) without significantly increasing the risk of AUR. Considering this, patients receiving alpha-blockers, 5-alpha reductase inhibitors, and anticholinergics were excluded from the study. The duration of catheterization before TWOC alters the chance of a successful trial of catheter removal [4,14,22]. In one study, a successful TWOC was achieved in 44% of patients after the first day of catheterization, in 51% of patients after the second day, and in 62% of patients after 7 days. [23] In this study, we considered TWOC on the eighth day. Clean intermittent self-catheterization (CISC) is a safe, simple, and well-accepted technique that may also increase the rate of successful spontaneous voiding. A period of CISC prior to TURP may be useful in patients with LPCR, as it may allow recovery of bladder contractility. A urethral catheter within the bladder has been found to result in bacterial colonization of the bladder at a rate of 4% a day, an important factor accounting for a significant increased morbidity from infection. However, in this study peri-urethral bleeding was noticed in 3 patients following catheterization, and no patient developed a febrile UTI.

CONCLUSION

An unnecessary trial of catheter removal should be avoided in patients with acute urinary retention secondary to BPH. Unsuccessful trial not only lengthens the overall process but also possess discomfort from the patient's standpoint. Our data suggests that age, TZV, TZI, RUV, and IPP are important independent predictors of unsuccessful TWOC. Identifications of values higher than or equal to the cutoff for specific independent risk factors can substantially predict the failure of TWOC. Therefore, we would recommend not performing TWOC once these risk factors are identified.

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