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Analysis of risk factors for complications following transurethral resection of the prostate

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Abstract. – OBJECTIVE: This study investigates the risk factors for complications following transurethral resection of the prostate and provides a reference for reducing postoperative complications.

PATIENTS AND METHODS: A retrospective analysis was conducted on 322 patients with benign prostatic hyperplasia who underwent transurethral resection of the prostate from April 2015 to January 2022. Among them, 214 patients had complete clinical and follow-up data. Clinical and follow-up data were collected, and both univariate and multivariate logistic regression analyses were performed to identify factors influencing the occurrence of postoperation transurethral resection of the prostate complications.

RESULTS: The incidence of complications after transurethral resection of the prostate was 19.16% (41/214). Among them, the incidence of Grade I-II complications was 14.96% (32/214), and Grade III-IV complications were 4.2% (9/214). The preoperative Quality of Life score (p<0.001) was identified as an independent risk factor for the occurrence of Grade I-II complications after transurethral resection of the prostate. The International Prostate Symptom Score (p=0.006) was identified as an independent risk factor for the occurrence of Grade III-IV complications after transurethral resection of the prostate.

CONCLUSIONS: The preoperative Quality of Life score is an independent risk factor for the occurrence of Grade I-II complications after transurethral resection of the prostate. The International Prostate Symptom Score is an independent risk factor for the occurrence of Grade III-IV complications after transurethral resection of the prostate.

Key Words:
Transurethral resection of the prostate, Complications, IPSS, QoL, Risk factors.

Introduction

Benign prostatic hyperplasia (BPH) is the most common age-related urological condition in males, with an 80% prevalence rate in 70-year-old men and up to 90% in those aged 81-90[1,2]. Prostate enlargement, increasing smooth muscle tension, and compression of the prostatic urethra lead to urinary leakage and lower urinary tract obstructive symptoms (LUTS), often necessitating medical intervention[3-5]. However, many men are reluctant to undergo surgical treatment due to potential impacts on sexual function[6]. Over time, a significant number of patients opt for surgical intervention when symptoms persist without relief. Among surgical treatments, transurethral resection of the prostate (TURP) is considered the gold standard[7-9]. Nevertheless, attention must be given to certain postoperative complications[10,11].

Common complications following TURP include bleeding, urinary tract infections, bladder neck injury, urethral stricture, rectal injury, and ureteral orifice injury[12-14]. The occurrence of postoperative complications brings substantial pain and economic burden to patients, emphasizing the necessity of minimizing such complications. This study explores the risk factors influencing the occurrence of complications after TURP, aiming to provide a reference for predicting postoperative complications and guiding clinicians in selecting treatment plans.

Patients and Methods

Study Population

A total of 322 BPH patients underwent TURP at the Department of Urology, Peking University First Hospital-Miyun Hospital, from April 2015 to January 2022. Among these, 214 patients had complete baseline and follow-up data. Clinical data, including baseline characteristics, preoperative International Prostate Symptom Score (IPSS), preoperative Quality of Life (QoL) scores, and postoperative complications, were collected. Post-TURP complications were classified accord-

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ing to the Clavien-Dindo complication grading system, with no Grade V complications in this study.

Inclusion criteria were as follows: 1. Age ≥50 years; 2. Imaging diagnosis of BPH; 3. Complete baseline and follow-up data.

Exclusion criteria were: 1. History of prostate cancer or postoperative pathology indicating prostate cancer; 2. Abnormal coagulation function; 3. Cardiopulmonary dysfunction.

Clinical variables in this study included age, BMI, diabetes, hypertension, hyperlipidemia, prostate volume, PSA, maximum flow rate, uroschesis, preoperative IPSS, and preoperative QoL. The study aimed to investigate the risk factors for the occurrence of Grade I-II and Grade III-IV complications following TURP in BPH patients.

Prostate volume (cm^3) was calculated as follows: volume = (transverse diameter × vertical diameter × anterior-posterior diameter). Uroschesis was defined as residual urine exceeding 100 ml.

This study adhered to the principles of the Helsinki Declaration (2013 revised edition) and received approval from the Ethics Committee of Peking University First Hospital-Miyun Hospital. The retrospective analysis of this study waived individual consent.

Surgical Technique

After successful anesthesia, the lithotomy position was adopted, and routine draping and disinfection were performed. A 25°F26 cystoscope (Hawk, Hangzhou, China) was inserted into the urethra to observe the hypertrophy of the prostate's lateral lobes, median lobe, and anterior lobe. The laser was used to first cut the left standard line at the level of the verumontanum in a horizontal arc. The left lobe was excised between the surgical capsule and the bladder neck. At the 5 o'clock and 12 o'clock positions of the urethra, both lobes were cut open, and the left lobe was pushed into the bladder. The same method was applied to address the right lobe of the median and anterior lobes. The urethral glands at the verumontanum level were trimmed, preserving the normal urethral mucosa, and thorough hemostasis was achieved on the prostate surface. A resector was used to crush and suction the prostate tissue, and upon withdrawing the scope, the urethra at the tip of the prostate was completely opened, presenting a "keyhole-like change". An F22 three-chamber large balloon (Bard, NJ, USA) silicone catheter was inserted, and continuous bladder irrigation was performed.

Follow-Up

The catheter was removed from the patient one week postoperatively. The occurrence of postoperative complications was confirmed through the hospital's medical record system and telephone follow-up. Complications within one year after the surgery were assessed through telephone follow-up. The occurrence of Grade I-II and Grade III-IV complications after TURP in patients with BPH was investigated as the outcome.

Statistical Analysis

Statistical analysis was conducted using SPSS 22.0 (IBM Corp., Armonk, NY, USA). Quantitative variables, including age, BMI, prostate cancer volume, PSA, maximum flow rate, uroschesis, preoperative IPSS, and preoperative QoL, were expressed as mean ± standard deviation for normally distributed data or median (range) for skewed data. For continuous variables, normally distributed variables were analyzed using *t*-tests, and non-normally distributed variables were analyzed using the Mann-Whitney U test. Fisher's exact probability test was used for categorical variables. Univariate and multivariate logistic regression analyses ($p<0.05$) were used to analyze independent risk factors for postoperative complications.

Results

Incidence of Complications after TURP

In this study, there were 173 patients without post-TURP complications and 41 patients with complications, resulting in a complication rate of 19.16%. Among them, 32 patients experienced Grade I-II complications, and 9 patients had Grade III-IV complications. The incidence rates were 14.96% for Grade I-II complications and 4.2% for Grade III-IV complications. Some patients simultaneously experienced multiple complications, and Table I provides a list of postoperative complications.

Risk Factor Analysis for Grade I-II Complications after TURP

Clinical data of patients without complications after TURP (n=173) and those with Grade I-II complications (n=32) are presented in Table II. The prostate volume for the uncomplication group was 114.29±48.47 cm^3, and for the Grade I-II complication group, it was 124.64±66.54 cm^3,

Table I. List of postoperative complications of TURP.

Grade	Complication
I	Fever (n = 17)
	Nausea and vomiting (n = 1)
	Prepuce edema (n = 1)
	Chest tightness/breath holding (n = 3)
	Electrolyte disturbance (n = 9)
II	Urine extravasation (n = 3)
	Postoperative limb numbness (n=1)
	Scrotal swelling (n = 1)
	Lung infection (n = 9)
	Epididymitis (n = 1)
	Difficulty urinating (n = 3)
	Intestinal obstruction (n = 1)
	Urinary incontinence (n = 2)
	Tachycardia (n = 1)
IIIa	Surgical hemostasis (n = 3)
IIIb	General anesthesia for blood extraction surgery (n = 2)
IVa	Angina pectoris (n=3)
IVb	Cerebral infarction (n=1)
V	Death (n = 0)

with no statistical difference between the two groups (p=0.299). The IPSS for the uncomplication group was 17.52±3.37, whereas for the Grade I-II complication group, it was 24.13±4.57, showing a significant statistical difference (p<0.001). The preoperative QoL score for the uncomplication group was 4.18±0.458, and for the Grade I-II complication group, it was 5.16±0.448, demonstrating a statistically significant difference (p<0.001). Univariate logistic regression and multivariate logistic regression analyses revealed that the preoperative QoL score (p<0.001) was an independent risk factor for Grade I-II complications after TURP (Table III).

Risk Factor Analysis for Grade III-IV Complications after TURP

Clinical data of patients without complications after TURP (n=173) and those with Grade III-IV complications (n=9) are shown in Table IV. The prostate volume for the uncomplication group was 114.29±48.47 cm^3, and for the Grade III-IV complication group, it was 167.54±103.98 cm^3, indicating a statistically significant difference between the two groups (p=0.003). The IPSS for the uncomplication group was 17.52±3.67, while for the Grade III-IV complication group, it was 31.89±2.67, revealing a statistically significant difference (p<0.001). The preoperative QoL score for the uncomplication group was 4.18±0.458, and for the Grade III-IV complication group, it was 6±0, demonstrating a statistically significant difference (p<0.001). Univariate logistic regression and multivariate logistic regression analyses indicated that IPSS (p=0.006) was an independent risk factor for Grade III-IV complications after TURP (Table V).

Table II. Baseline data of uncomplicated group and grade I-II complications group.

Variable	Uncomplicated group	Grade I-II complications group	*p*-value
Patients, n (%)	173 (84.4%)	32 (13.6%)	
Mean age (years)	70.53 ± 6.922	70.75 ± 8.080	0.873
BMI	22.76 ± 2.950	22.96 ± 2.80	0.725
Diabetes mellitus, n (%)			0.367
Yes	10 (5.8%)	0 (0.0%)	
No	163 (94.2%)	32 (100.0%)	
Hypertension, n (%)			0.406
Yes	47 (27.2%)	11 (34.4%)	
No	126 (72.8%)	21 (65.6%)	
Hyperlipidemia, n (%)			0.519
Yes	20 (11.6%)	5 (15.6%)	
No	153 (88.4%)	27 (84.4%)	
Uroschesis, n (%)			0.845
Yes	103 (60.0%)	18 (56.3%)	
No	70 (40.0%)	14 (44.7%)	
Prostate volume (cm^3)	114.29 ± 48.47	124.64 ± 66.54	0.299
PSA (ng/mL)	6.10 ± 6.17	5.92 ± 4.32	0.875
Maximum flow rate (ml/s)	4.43 ± 3.73	5.35 ± 4.27	0.219
Preoperative IPSS	17.52 ± 3.37	24.13 ± 4.57	< 0.001
Preoperative QoL	4.18 ± 0.458	5.16 ± 0.448	< 0.001

BMI, Body mass index; PSA, Prostate specific antigen; IPSS, International Prostate Symptom Score; QoL, Quality of Life.

Table III. Univariate and multivariate logistic regression analysis for grade I-II complications.

Variable	Univariate		Multivariate	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Mean age	1.004 (0.952-1.059)	0.873		
BMI	1.024 (0.900-1.164)	0.732		
Hypertension	0.712 (0.319-1.589)	0.407		
Hyperlipidemia	0.706 (0.244-2.041)	0.520		
Uroschesis	1.144 (0.534-2.451)	0.728		
Prostate volume	1.004 (0.997-1.011)	0.299		
PSA	0.995 (0.931-1.063)	0.874		
Maximum flow rate	1.063 (0.964-1.172)	0.219		
Preoperative IPSS	1.419 (1.266-1.591)	< 0.001	1.091 (0.923-1.290)	0.308
Preoperative QoL	24.526 (8.468-71.035)	< 0.001	14.490 (3.380-62.116)	< 0.001

BMI, Body mass index; PSA, Prostate specific antigen; IPSS, International Prostate Symptom Score; QoL, Quality of Life.

Table IV. Baseline data of uncomplicated group and grade III-IV complications group.

Variable	Uncomplicated group	Grade III-IV complications group	*p*-value
Patients, n (%)	173 (95.1%)	9 (4.9%)	
Mean age (years)	70.53 ± 6.922	70.56 ± 8.904	0.992
BMI	22.76 ± 2.95	23.18 ± 2.45	0.68
Diabetes mellitus, n (%)			1.000
Yes	10 (5.8%)	0 (0.0%)	
No	163 (94.2%)	9 (100%)	
Hypertension, n (%)			1.000
Yes	47 (27.2%)	2 (22.2%)	
No	126 (72.8%)	7 (77.8%)	
Hyperlipidemia, n (%)			1.000
Yes	20 (11.6%)	1 (11.1%)	
No	153 (88.4%)	8 (88.9%)	
Uroschesis, n (%)			0.370
Yes	103 (60.0%)	4 (44.4%)	
No	70 (40.0%)	5 (55.6%)	
Prostate volume (cm^3)	114.29 ± 48.47	167.54 ± 103.98	0.003
PSA (ng/mL)	6.10 ± 6.17	7.83 ± 4.56	0.368
Maximum flow rate (ml/s)	4.43 ± 3.73	3.48 ± 2.46	0.449
Preoperative IPSS	17.52 ± 3.67	31.89 ± 2.67	< 0.001
Preoperative QoL	4.18 ± 0.458	6 ± 0.001	< 0.001

BMI, Body mass index; PSA, Prostate specific antigen; IPSS, International Prostate Symptom Score; QoL, Quality of Life.

Table V. Univariate and multivariate logistic regression analysis for grade III-IV complications.

Variable	Univariate		Multivariate	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
Mean age	1.000 (0.909-1.101)	0.992		
BMI	1.049 (0.837-1.315)	0.678		
Hypertension	1.306 (0.262-6.510)	0.745		
Hyperlipidemia	1.046 (0.124-8.804)	0.967		
Uroschesis	1.839 (0.477-7.091)	0.376		
Prostate volume	1.103 (1.004-1.023)	0.007	0.996 (0.978-1.014)	0.667
PSA	1.038 (0.956-1.126)	0.375		
Maximum flow rate	0.927 (0.763-1.127)	0.449		
Preoperative IPSS	1.889 (1.243-2.871)	0.003	1.952 (1.208-3.155)	0.006
Preoperative QoL	1.200 (1.109-1.301)	0.992		

BMI, Body mass index; PSA, Prostate specific antigen; IPSS, International Prostate Symptom Score; QoL, Quality of Life.

Discussion

While various surgical methods exist for treating BPH, including bipolar transurethral resection of the prostate, holmium laser enucleation of the prostate, prostate artery embolization, and transurethral needle ablation, TURP remains the predominant approach[8,9,15-17]. Surgical treatments for BPH generally yield favorable outcomes but are not without complications[18]. This study aims to explore the risk factors for complications after TURP. Understanding these potential complications will assist urologists in providing appropriate counseling to patients and identifying and managing these conditions.

The main complications observed in this study included fever, electrolyte imbalance, extravesical leakage, bleeding, angina, and general anesthesia-related issues. Postoperative complications primarily concentrated on Grades I-II, showing some similarity to the occurrence of complications after TURP reported in previous studies[19]. Palmisano et al[20] reported that in their single-center series study involving 160 patients undergoing TURP, the main complications requiring rehospitalization were hematuria (6.8%) and infection (4.3%). Guo et al[21] reported a post-TURP secondary bleeding rate of 9.1% (n=173), with a reoperation rate of 22%. Türk et al[22] found a urethral stricture rate of 7.8% (4/51) after TURP. Although previous studies[13] identified bladder contraction, urethral stricture, and ureteral damage as relatively common severe complications after surgery, these were not observed in this study, likely due to meticulous intraoperative procedures and longer postoperative catheterization.

While Grade I-II complications after TURP may not cause serious harm to patients, they are more common and can significantly inconvenience patients. In this study, IPSS and preoperative QoL were found to be associated with the occurrence of Grade I-II complications, with preoperative QoL ($p<0.001$) identified as an independent risk factor for Grade I-II complications. A higher prostate QoL score indicates a more severe impact of symptoms on the quality of life, possibly suggesting poor urethral conditions and increased difficulty in the surgical procedure, thereby affecting the occurrence of postoperative complications.

Grade III-IV complications after TURP not only cause suffering to patients but also result in substantial economic losses. In this study, it was found that prostate volume ($p=0.003$), IPSS ($p<0.001$), and QoL score ($p<0.001$) were associated with the occurrence of Grade III-IV complications, with IPSS ($p=0.006$) identified as an independent risk factor for Grade III-IV complications after TURP. Baran[23] identified risk factors for complications after TURP in patients with acute uroschesis. However, in this study, uroschesis did not appear to play a significant role in the occurrence of complications after TURP. Elsaqa et al[24] found that prostate volume and surgical time were risk factors for urethral stricture and bladder neck contraction after transurethral resection. In this study, a correlation was similarly found between prostate size and Grade III-IV postoperative complications.

QoL score and IPSS, as subjective ratings, to some extent reflect the degree of urinary obstruction. Higher scores may indicate a more severe degree of obstruction, making the surgical procedure longer and more challenging, leading to increased bleeding and insufficient hemostasis, ultimately resulting in a series of postoperative complications. Preoperative QoL score and IPSS not only provide guidance for surgical selection but also serve as references for the occurrence of postoperative complications.

Limitations

Our study has certain limitations. It is a retrospective study, and some indicators influencing the occurrence of postoperative complications lack data. Additionally, being a single-center study may introduce some bias.

Conclusions

This study found that the incidence of complications after TURP is relatively high, consistent with previous research. The preoperative QoL score emerged as an independent risk factor for the occurrence of Grade I-II complications after TURP. Additionally, the IPSS was identified as an independent risk factor for the occurrence of Grade III-IV complications following TURP.

Funding

None.

Ethics Approval

The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and

resolved. The trial was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the Ethics Committee of Peking University First Hospital-Miyun Hospital (No.: 2023-017-001).

Availability of Data and Materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Informed Consent

Informed consent was waived due to the retrospective design of the study.

Conflict of Interest

None declared.

Authors' Contributions

(I) Conception and design: Rui Meng. (II) Administrative support: Rui Meng. (III). Provision of study materials or patients: Rui Meng, Weining Wang, Zhipeng Zhai, Chao Zuo. (IV) Collection and assembly of data: Rui Meng, Weining Wang, Zhipeng Zhai, Chao Zuo. (V) Data analysis and interpretation: Rui Meng. (VI) Manuscript writing: All authors. (VII) Final approval of manuscript: All authors.

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