

Clinical analysis of urinary tract infection in patients undergoing transurethral resection of the prostate

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Abstract. – OBJECTIVE: To analyze the related influencing factors of urinary tract infection in patients undergoing transurethral resection of the prostate (TURP).

PATIENTS AND METHODS: A total of 343 patients with benign prostatic hyperplasia admitted to this hospital from January 2013 to December 2016, were selected and treated by TURP. Patients were divided into infection group and non-infection group according to the occurrence of urinary tract infection after operation. The possible influencing factors were collected to perform univariate and multivariate logistic regression analysis.

RESULTS: There were 53 cases with urinary tract infection after operation among 343 patients with benign prostatic hyperplasia, accounting for 15.5%. The univariate analysis displayed that the occurrence of urinary tract infection in patients undergoing TURP was closely associated with patient's age ≥ 65 years old, complicated diabetes, catheterization for urinary retention before operation, no use of antibiotics before operation and postoperative indwelling catheter duration ≥ 5 d ($p < 0.05$). Multivariate logistic regression analysis revealed that age ≥ 65 years old, complicated diabetes, catheterization before operation, indwelling catheter duration ≥ 5 d and no use of antibiotics before operation were risk factors of urinary tract infection in patients receiving TURP ($p < 0.05$).

CONCLUSIONS: The patient's age ≥ 65 years old, catheterization before operation, complicated diabetes and long-term indwelling catheter after operation, can increase the occurrence of urinary tract infection after TURP, while preoperative prophylactic utilization of anti-infective drugs can reduce the occurrence of postoperative urinary tract infection.

Key Words:

Transurethral resection of the prostate (TURP), Urinary tract infection, Risk factors.

Introduction

Benign prostatic hyperplasia (BPH) is excessively common in males, approximately 50% in people aged 50 years old, and as high as 90% in those aged 90 years old¹. Half of the patients with BPH are complicated with progressive urinary tract irritation, also summarized as lower urinary tract symptoms (LUTS), which are manifested by irritative symptoms of bladder such as frequent micturition, urgent urination and painful urination, micturition and obstruction symptoms such as residual urine and urinary retention². Therapies for BPH include waiting and observation, medication and surgery³. For patients with moderate and severe prostatic hyperplasia, the most effective therapy is surgery at present, which has a variety of modes; therein, the open surgery was applied formerly, but transurethral resection of the prostate (TURP) has been widely utilized in recent years^{4,5}.

Although TURP has become increasingly mature and its postoperative effect is significant, there are still some complications after TURP due to older patients, many chronic medical diseases or bad habits such as smoking and drinking, unskilled operation⁶, mainly including urethral injury, postoperative bleeding, transurethral resection syndrome, bladder spasm, postoperative urinary infection, urethral stricture and urinary incontinence⁷⁻⁹. Genitourinary infection after TURP generally occurs within one week to one month after discharge, which is typically manifested as irritative symptoms of bladder such as frequent micturition, urgent urination and painful urination¹⁰. The body resistance in partial patients is relatively weak after the onset, coupled with the invasion surgery operation, resulting in

a high occurrence of urinary tract infection in patients after surgery, thus affecting the surgical effect¹¹. Hence, it is of great significance to investigate the related influencing factors of urinary tract infection after transurethral resection of the prostate in clinical practice.

The primary purpose of this study was to investigate the causes and prophylactic-therapeutic measures of urinary tract infection after TURP.

Patients and Methods

General Information

A total of 343 patients with benign prostatic hyperplasia admitted to our hospital from January 2013 to December 2016 were retrospectively analyzed. All patients were conformed to the diagnostic criteria of benign prostatic hyperplasia. Patients were confirmedly diagnosed *via* international prostate symptom score (I-PSS), quality of life (QOL) scale, serum prostate-specific antigen (PSA) and urodynamic examination, and treated by TURP. Exclusion criteria: (1) patients with prostatic carcinoma or previous history of pelvic or urethral surgery; (2) patients who were complicated with urethral stricture, urethral stone, vesical calculus or neurogenic cystitis; (3) patients with previous history of infection or immune dysfunction. The age of patients was 55-84 years old, with an average age of 64.4 ± 4.2 years old. Patients were divided into infection group and non-infection group according to the occurrence of urinary tract infection after operation. This experiment was carried out under the informed consent of patients and approved by the Ethics Committee of Binzhou Central Hospital.

Surgery

All patients were treated by prostate resectoscope (Olympus, Tokyo, Japan), and the surgery was completed by physicians and anesthetist in the same medical team. Epidural anesthesia or spinal anesthesia was utilized. The power of transurethral resection was 280 W and coagulation power was 80 W; normal saline solution was used as rinsing liquid. The three-cavity ureter was routinely indwelt after operation, followed by continuous bladder irrigation with normal saline.

Research Index

The occurrence and risk factors of urinary tract infection in patients after operation were analyzed by the questionnaire. The research in-

dexes included patient's age, body mass index (BMI), smoking history, hypertension, diabetes mellitus, catheterization for urinary retention before operation, use of antibiotics before operation, operation time and postoperative indwelling catheter duration.

Diagnostic Criteria for Urinary Tract Infection

Criteria for the diagnosis of urinary tract infection were according to the latest guideline of European Association of Urology. The methods are shown as follows: patients were treated with postoperative indwelling catheterization, and the sealed drainage bag was uniformly used. The urine was collected from patients at postoperative 3 d and 6 d under aseptic operation, followed by bacterial culture. If the same bacteria pathogen was simultaneously cultured from two mediums in the same patient, and the infection was confirmed when bacteria count $\geq 10^5$ CFU/mL.

Statistical Analysis

Statistical Product and Service Solutions (SPSS, Version X; IBM, Armonk, NY, USA) 20.0 software was used for analysis of clinical data. Measurement data were expressed as $\bar{x} \pm s$, and analyzed by *t*-test. Enumeration data were expressed by constituent ratio, and χ^2 test was utilized for intergroup comparison. Logistic regression analysis was used for the related factors of urinary tract infection. $p < 0.05$ suggested that the difference was statistically significant.

Results

Morbidity of Urinary Tract Infection

A total of 343 patients with benign prostatic hyperplasia were enrolled in this study; among them, there were 53 cases with urinary tract infection after operation, accounting for 15.5%. There were 316 cases with pathogenic bacteria in 343 specimens, and the detection rate was 92.13%; there were 238 cases of Gram-negative bacteria, accounting for 75.32%, and the most common for *Escherichia coli*, accounting for 39.56%. Gram-positive bacteria accounted for 23.73%; there were 3 cases with fungus, accounting for 0.95% (Table I).

Results of Univariate Analysis

The results of univariate analysis displayed that there was no statistically significant differ-

Table I. The Distribution of pathogens in urinary tract infection.

Pathogens	Number	Proportion (%)
Gram-negative bacteria	238	75.32
Escherichia coli	125	39.56
Proteus	42	13.29
Pseudomonas aeruginosa	28	8.87
Klebsiella	19	6.01
Acinetobacter baumannii	13	4.11
Others	11	3.48
Gram-positive bacteria	75	23.73
Enterococcus faecalis	43	13.61
Staphylococcus epidermidis	21	6.64
Others	11	3.48
Fungi	3	0.95

ence in patients complicated with hypertension between infection group and non-infection group ($p > 0.05$).

However, the proportions in patients with age ≥ 65 years old, complicated diabetes mellitus, catheterization for urinary retention before operation, no prophylactic use of antibiotics before operation and postoperative indwelling catheter

duration ≥ 5 d were distinctly higher in the infection group than those in the non-infection group, and the differences were statistically significant ($p < 0.05$) (Table II).

Results of Multivariate Analysis

Whether there was urinary tract infection in patients after operation was regarded as the dependent variable, and the independent variable with statistical significance *via* univariate analysis was set as the multivariable case. The results of multivariate logistic analysis displayed that urinary tract infection after TURP was closely associated with complicated diabetes, catheterization for urinary retention before operation, prophylactic use of antibiotics before operation and postoperative indwelling catheter duration; therein, patient's age ≥ 65 years old, complicated diabetes, catheterization for urinary retention before operation and postoperative indwelling catheter duration ≥ 5 d increased the risk of urinary tract infection; preoperative prophylactic use of antimicrobial agents is a protective factor that can reduce the risk of urinary tract infection after TURP (Table III).

Table II. Univariate analysis of urinary tract infection after TURP.

Factors	Infection group (n = 53)	Non-infection group (n = 290)	χ^2	<i>p</i>
Age				
< 65 y	14	164	16.302	0.000
≥ 65 y	39	126		
BMI				
< 24 kg/m ²	17	81	3.109	0.078
≥ 24 kg/m ²	36	209		
Smoking				
Yes	25	126	0.252	0.616
No	28	164		
Hypertension				
Yes	15	51	3.311	0.069
No	38	239		
Diabetes mellitus				
Yes	19	40	15.306	0.000
No	34	250		
Catheterization before operation				
Yes	27	88	8.531	0.003
No	26	202		
Prophylactic use of antibiotics				
Yes	31	223	7.901	0.005
No	22	67		
Operation time				
< 60 min	20	142	2.267	0.132
≥ 60 min	33	148		
Indwelling catheter time				
< 5 d	21	192	13.455	0.000
≥ 5 d	32	98		

Table III. Multivariate logistic regression analysis of urinary tract infection after TURP.

Factors	b	SE	Wald χ^2	OR	95% CI	<i>p</i>
Age	1.028	0.271	7.352	2.684	1.231-4.975	0.003
Diabetes	1.591	0.385	10.535	3.147	1.764-4.833	0.000
Catheterization before operation	3.076	0.483	3.197	2.969	1.385-9.139	0.006
Prophylactic use of antibiotics	-2.539	0.718	11.932	2.817	1.026-12.52	0.000
Indwelling catheter time	2.362	0.416	9.479	3.725	2.354-11.249	0.001

Discussion

TURP has advantages of wide indications, complete resection, long curative effect, less damage, less pain, faster recovery and shorter hospitalization, which is widely applied in the surgical therapy of benign prostatic hyperplasia and has become the gold standard of treatment^{12,13}. Although the damage caused by TURP is less than that *via* other surgical modes, there are still some complications in clinical operation, such as transurethral resection syndrome, bleeding, perforation, urinary tract infection, extravasation of rinsing fluid, urinary incontinence and urethral stricture; therein, urinary tract infection is one of the most common complications^{14,15}. Urinary tract infection is mainly caused by the interaction of urinary tract pathogens and host, bacterial virulence and inoculation amount and imperfect defense mechanism of host. Bacterial virulence greater than host resistance capability has become a necessary condition for the occurrence of urinary tract infection, but host resistance capability lower than bacterial virulence caused by the reduction of host immune function also leads to the occurrence of infection^{16,17}.

The results of analysis on 343 patients with benign prostatic hyperplasia treated by TURP indicated that the proportions in patients with age ≥ 65 years old, complicated diabetes, catheterization for urinary retention before operation, no use of antibiotics before operation and postoperative indwelling catheter duration ≥ 5 d were distinctly higher in the infection group than those in the non-infection group. Logistic regression analysis displayed that patient's age ≥ 65 years old, complicated diabetes, catheterization for urinary retention before operation, no use of antibiotics before operation and postoperative indwelling catheter duration ≥ 5 d were the correlation factors of the occurrence of urinary tract infection.

There are many reasons for this phenomenon. Firstly, body resistance in elderly patients is obviously reduced, susceptibility is increased,

degenerative change of prostate can decrease the function of whole urinary system and defense system of the urethra mucosa is decreased, so neurogenic bladder occurs, thus leading to micturition reflex disorder, increase of residual urine volume and the increased occurrence of urinary retention, which will facilitate the invasion and reproduction of bacteria¹⁸. Secondly, TURP belongs to a kind of invasive operation, and urethra mucosa is easily damaged by perioperative catheter intubation, which causes a greater impact on the patients' physiological environment, and makes more convenience for bacterial invasion¹⁹. Meanwhile, the placement time of catheter will also have a greater impact on postoperative urinary tract infection. For patients with catheterization before operation, urethral mucosa will be injured in different degrees by catheter inserted again, which damages body's normal urethral structure^{20,21}.

Additionally, due to the features of illness in patients with diabetes, body resistance is decreased obviously; biochemical metabolism disorder caused by long-term hyperglycemic state affects the body's defense function; urine glucose is able to increase bacterial growth conditions, which makes body is easy to be infected by pathogen infection, resulting in infection. Besides, the ability of protein synthesis is reduced in patients with diabetes, and the rate of catabolism is markedly accelerated, thus reducing body's ability to repair itself and immunity in varying degrees^{22,23}. The adaptation of antibiotics before operation can effectively inhibits the proliferation of pathogens in patients with asymptomatic bacteria and reduce the bacterial colonization in the urethra, thus effectively reducing the occurrence of urinary tract infection²⁴.

The following preventive measures can be taken according to the risk factors of urinary tract infection after TURP: (1) pay attention to the management for elderly patients, strictly grasp the indications of catheterization and avoid excessive intubation; (2) pay attention to the control

and treatment of basic diseases, actively control blood glucose and strengthen nutrition before operation for patients complicated with diabetes; (3) strictly enhance aseptic consciousness, standardize operation, master operation function, shorten the duration and number of catheterization before and after operation when illness allowed, and reasonably utilize antibiotics before operation.

Conclusions

The patient's age ≥ 65 years old, catheterization before operation, complicated diabetes and long-term indwelling catheter after operation can increase the occurrence of urinary tract infection after TURP, while preoperative prophylactic utilization of anti-infective drugs can reduce the occurrence of postoperative urinary tract infection. To master the related factors of urinary tract infection in patients undergoing TURP, it can provide a reliable theoretical basis for reducing the occurrence of urinary tract infection improving patient's prognosis.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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