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RESEARCH ARTICLES

The Predictive Value of Non-Invasive Urodynamic Parameters for the Curative Effect of TURP

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ABSTRACT

Purpose: To explore the predictive value of non-invasive urodynamic parameters for the efficacy of transurethral resection of the prostate (TURP).

Methods: 121 cases, Benign prostatic hyperplasia(BPH) patients were assessed retrospectively and were divided into good prognosis (group A) and poor prognosis (group B) according to the degree of improvement in maximum urinary flow rate, and the changes in ultrasound and non-invasive urodynamic parameters between the two groups were explored. **Results**: The PV, IPP, and PVR of group A were lower than those of group B ($P<0.05$), and Qmax of group A was more excellent than group B ($P<0.05$). The difference was statistically significant ($P<0.05$); There was no significant difference in DWT, age, and IPSS($P>0.05$). The ROC curve analyzes the diagnostic efficacy of each parameter in the diagnosis of the effectiveness of TURP. The results are ranked in order of 1/Qmax (AUC=0.777), PV (AUC=0.715), PVR (AUC=0.642), IPP (AUC=0.629), of which 1/Qmax has the best diagnostic efficiency, and it AUC=0.777, the best cutoff value is 0.12, the sensitivity is 0.81, and the specificity is 0.571. **Conclusion**: Preoperative application of non-invasive urodynamic parameters in BPH patients can better predict postoperative efficacy, especially Qmax has the best predictive effect.

KEYWORDS: Transurethral resection of the prostate ; Urodynamic studies ; Non-invasive.

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INTRODUCTION

BPH is a common urinary system disease in elderly men [1] and a common cause of lower urinary tract symptoms (LUTS) [2]. The current treatment methods for BPH include watchful waiting, drug therapy, and surgical treatment [3]. TURP is still the gold standard for removing bladder outlet obstruction (BOO) caused by BPH [4]. Urodynamic tests（UDS）are most commonly used to determine the degree of BOO in patients with BPH and predict postoperative effects before surgery [5]. However, the invasiveness of UDS and the required consumables increase the economic burden of patients and limit the clinical application of UDS [6]. Therefore, a simple, convenient and non-invasive examination is urgently needed to predict the postoperative curative effect of BPH patients.

MATERIALS AND METHODS

1.1 General Information : A retrospective analysis of 121 LUTS patients treated in Shaoyang Central Hospital from 2019 to 2021, combined with the patient's medical history, symptoms, and auxiliary examinations, all patients who indicated BPH performed ultrasound imaging urodynamic examination. Patients with surgical indications underwent TURP by the same experienced doctor, and the urine flow rate was reviewed one month after the operation. According to the postoperative improvement of maximum urinary flow rate, the patients were divided into group A (Qmax improvement value greater than or equal to 50% or Qmax>15ml/s, and it is defined as a good surgical effect [7]) 79 cases and group B (Qmax improvement value less than 50% and Qmax<15ml/s) 42 cases.

1.2 Inclusion criteria: (1) BPH diagnosis combined with the patient's medical history, symptoms, imaging, and urodynamic examinations. Exclusion criteria: (1) Patients with the nervous system, endocrine system, and other diseases easily affect bladder function; (2) Urethral stricture, or bladder neck contracture was diagnosed by cystoscopy.

1.3 Methods: In this study, an aerodynamic analyzer (Andromeda, Germany) and an N3-DC color Doppler ultrasound system (Shenzhen Mindray) were used to complete the urodynamic examination following the operating guidelines of the International Continence Society (ICS), And collect qualified urodynamic data.

1.4 Observation indicators: age; international prostate symptom score (IPSS); prostate volume (PV); Intravesical prostatic protrusion (IPP); detrusor wall thickness (DWT); maximum urine flow rate (Qmax); residual urine volume （PVR）。

1.5 The statistical method： All statistical analyses were performed using SPSS 25.0, and the normality of each data is tested. The continuous variables that conform to the normal distribution are expressed by the mean ± standard deviation (X±S), and the data that does not conform to the normal distribution is in use Value (quartile) [M(P25-P75)] expression.

RESULTS

2.1 The univariate analysis of urodynamic parameters in the diagnosis of BOO

The non-invasive urodynamic parameters of the two groups A and B were analyzed by univariate analysis. One-way analysis of variance was performed due to the normal distribution of age. The results showed that there was no statistically significant difference between the ages of each group (P>0.05); the remaining urodynamic parameters Mann-Whitney U test was performed, and the results showed that there was no statistically significant difference in IPSS and DWT between the two groups(P>0.05). The PV, bIPP, and PVR of group A are all smaller than those of group B (P＜0.05), and the Qmax of group A is greater than group B(P<0.05). The difference was statistically significant(P<0.05). (Table 1)

Table 1. Single factor analysis results of various urodynamic parameters

parameter	Group A	Group B	F / Z	P
Age(y)	71±8	71±7	0.618	0.434
IPSS (minutes)	23.5（21,25.25）	23（20,25）	-0.855	0.392
PV（ml）	52.5（35,74.25）	70（54,105）	-3.896	0.000
IPP（cm）	1.6（0.8,2.18）	2.1（1.3,2.6）	-2.340	0.019
DWT（mm）	4（3.5,5）	4.5（4,6）	-1.772	0.076
Qmax（ml/s）	8.85（6.88,11.30）	5.5（3.8,7.9）	-5.004	0.000
PVR（ml）	45（2.25,102.5）	85（31,161）	-2.567	0.010

Note: IPSS: score the international prostate symptoms; PV: prostate volume; IPP: Intravesical prostatic protrusion; DWT: detrusor wall thickness; Qmax: maximum urine flow rate; PVR: residual urine volume. The continuous variables that conform to the normal distribution are expressed by the mean ± standard deviation (X±S), and the data that does not conform to the normal distribution is in use Value (quartile) [M(P25-P75)] expression.

2.2 Analysis of ROC curve of each urodynamic parameter and regression model.

Draw the receiver operating characteristic curve (ROC curve) with statistically significant urodynamic parameters. Since Qmax is negatively correlated with the postoperative effect of TURP, the reciprocal of Qmax is taken. In the two groups, 1/Qmax has the highest diagnostic efficiency. The results are ranked in order of 1/Qmax (AUC=0.777), PV (AUC=0.715), PVR (AUC=0.642), IPP (AUC=0.629), of which the best cutoff value of 1/Qmax is 0.12, the sensitivity is 0.81, and the specificity is 0.571 (Table 2, Figure 1).

Table 2. Statistical chart of ROC curve of various urodynamic parameters

parameter	AUC	SE	P	95%CI	
				Lower	Upper
PV（ml）	0.715	0.048	0.000	0.621	0.810
IPP（cm）	0.629	0.051	0.019	0.530	0.729
Qmax（ml/s）	0.777	0.045	0.000	0.689	0.865
PVR（ml）	0.642	0.052	0.010	0.540	0.744

Note: PV prostate volume; IPP Intravesical prostatic protrusion; Qmax maximum urine flow rate; PVR residual urine volume.

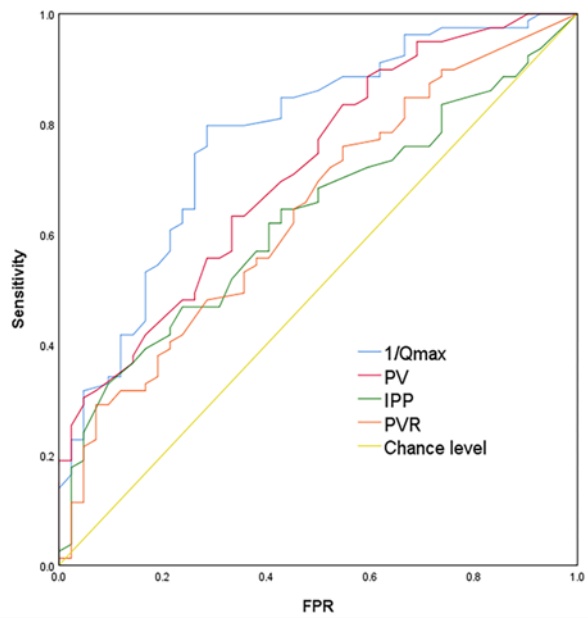

Figure1. Comparison of ROC curve analysis results of each parameter between the two groups

DISCUSSION

Prostatic hyperplasia is a common benign tumor in men [8]. Multiple factors cause the pathogenesis of BPH, and the existing research still cannot fully explain it. The current mainstream views include the theory of hormone endocrine disorders, the theory of gene regulation, growth factor regulation, the theory of epithelial-mesenchymal cells, and other theories [9]. BPH can be asymptomatic or only manifested as frequent urination early. When affected by external factors such as infection, transient dysuria can occur. At this time, it can be relieved after symptomatic treatment. As the disease progresses, BPH can cause bladder outlet obstruction. Suppose the drug treatment is ineffective or combined with severe complications such as repeated urinary retention, bladder stones, and impact on the upper urinary tract and detrusor. In that case, surgery should be performed[10]. The current gold standard for BPH is still TURP. However, clinically, 20% of BPH patients undergo TURP, and their symptoms have not been improved. Therefore, effective preoperative evaluation is an important factor in improving the prognosis of patients [11]. Related studies have shown that urodynamic testing in diagnosing BPH and the gold standard for predicting TURP results. Urodynamic testing is an invasive test that may cause hematuria and urinary tract infection. In addition, high costs and expensive equipment may limit its clinical application. On this basis, this study predicted the postoperative results of TURP by analyzing the non-invasive urodynamic parameters in the urodynamic examination.

Arif Demirbaset al. [12] studied 63 male patients who underwent TURP due to bladder outlet obstruction. The Qmax improvement value ≥ 10ml/S was defined as the cured group A, accounting for 52%(33/63); the Qmax improvement value <10ml /s was defined as group B, accounting for 48% (30/63). It was found that the IPP (2.7mm±2.7) of group A patients was much smaller than that of group B (9mm±2.9). The improvement value of PVR of group A patients (59.7ml± 58.1) is much smaller than group B (239ml±254), in which IPP and PVR are both risk factors for predicting the postoperative effect of TURP.

At present, there are few reports on predicting the curative effect of TURP by non-invasive urodynamic parameters. On this basis, this study included 121 BPH patients who met the requirements and recorded the preoperative age, IPSS, PV, IPP, DWT, Qmax, PVR, and Qmax. Rechecked one month after surgery, and divided them into two groups based on Qmax improvement value, good prognosis (group A) and poor prognosis (group B), compare the changes of each parameter between the two groups condition. The results found that the age differences, IPSS, and DWT between the two groups were not statistically significant (P>0.05). Considering that IPSS is related to the subjective consciousness of patients and the patient's ability to understand IPSS scores, young patients with strong understanding can be selected to continue further research; at the same time, early BOO can lead to compensatory hypertrophy of DWT, and after the detrusor cannot compensate for BOO, DWT will decrease due to decompensation, and decompensation of the detrusor indicates that the effect of TURP after TURP is not good. This study found that the PV, IPP, and PVR of group A were all lower than those of group B (P＜0.05), Qmax of group A is greater than group B (P＜0.05), suggesting that the larger the PV and IPP, the more PVR, and the smaller the Qmax, and the postoperative effect of TURP is better. Probably because the above parameters are commonly used to predict BOO, the greater the degree of obstruction, the better the curative effect after TURP. Among the above parameters, Qmax has the best predictive effect in diagnosing the efficacy of TURP, 1/Qmax (AUC=0.777), the best cut-off value is 0.12, the sensitivity is 0.81 and the specificity is 0.571. Therefore, non-invasive urodynamic parameters can also predict the efficacy of TURP simply and safely.

CONCLUSION

In short, when we want to perform TURP on BOO patients, we can consider combining the patient's PV, IPP, PVR, and Qmax, especially Qmax, to predict the patient's postoperative recovery. At the same time, we can further explore new non-invasive parameters and further conduct multi-factor analysis to improve the accuracy of the efficacy of TURP.

LIST OF ABBREVIATIONS

TURP: transurethral resection of the prostate; BPH: benign prostatic hyperplasia; LUTS: lower urinary tract symptoms BOO: bladder outlet obstruction; UDS: urodynamic tests; IPSS: international prostate symptom score; PV: prostate volume; IPP: intravesical prostatic protrusion; DWT: detrusor wall thickness; Qmax: maximum urine flow rate; PVR: residual urine volume;

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AUTHORS' CONTRIBUTIONS

The participation of each author corresponds to the criteria of authorship and contributorship emphasized in the Recommendations for the Conduct, Reporting, Editing, and Publication of Scholarly work in Medical Journals of the International Committee of Medical Journal Editors.

Indeed, all the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

COMPETING INTERESTS

The authors declare no competing interests with this case.

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REFERENCES

[1] Langan RC. Benign Prostatic Hyperplasia. Prim Care. 2019 Jun; 46(2):223-232. DOI: 10.1016/j.pop.2019.02.003

[2] Madersbacher S, Sampson N, Culig Z. Pathophysiology of Benign Prostatic Hyperplasia andBenign Prostatic Enlargement: A Mini-Review. Gerontology. 2019;65(5):458-464. DOI: 10.1159/000496289

[3] Dornbier R, Pahouja G, Branch J, McVary KT. The New American Urological Association BenignProstatic Hyperplasia Clinical Guidelines: 2019 Update. Curr Urol Rep. 2020 Jul 1;21(9):32. DOI: 10.1007/s11934-020-00985-0

[4] Gilling P, Barber N, Bidair M, Anderson P, Sutton M, Aho T, et al. WATER: A Double-Blind, Randomized,Controlled Trial of Aquablation vs Transurethral Resection of the Prostate in Benign Prostatic Hyperplasia. J Urol. 2018 May; 199(5):1252-1261. DOI: 10.1016/j.juro.2017.12.065

[5] Kim M, Jeong CW, Oh SJ. Effect of urodynamic preoperative detrusoroveractivity on the outcomes of transurethral surgery in patients with male bladder outlet obstruction: a systematic review and meta-analysis. World J Urol. 2019 Mar;37(3):529-538. DOI: 10.1007/s00345-018-2402-8

[6] Abelson B, Majerus S, Sun D, Gill BC, Versi E, Damaser MS. Ambulatory urodynamic monitoring: state of the art andfuture directions. Nat Rev Urol. 2019 May; 16(5):291-301. DOI: 10.1038/s41585-019-0175-5

[7] Suhani, Gupta S, Gupta A, Saha S, Mahapatra L, Srivastava U. Outcome of surgery for benign prostatic hyperplasia-is itpredictable? J Clin Diagn Res. 2013 Dec;7(12):2859-62. DOI: 10.7860/jcdr/2013/7606.3888

[8] Foo KT. What is a disease? What is the disease clinical benign prostatic hyperplasia(BPH)? World J Urol. 2019 Jul;37(7):1293-1296. DOI: 10.1007/s00345-019-02691-0

[9] Devlin CM, Simms MS, Maitland NJ. Benign Prostatic Hyperplasia- What do we know? BJU Int. 2021 Apr;127(4):389-399. DOI: 10.1111/bju.15229

[10] Rahman F, Putra IB, Mochtar CA, Rasyid N. Adherence of Indonesian urologists to practiceguidelines for the Management of benign prostatic hyperplasia. Prostate Int. 2019 Mar;7(1):35-40. DOI: 10.1016/j.prnil.2018.01.003

[11] Foster HE, Dahm P, Kohler TS, Lerner LB, Parsons JK, Wilt TJ, Surgical ManagementOf Lower Urinary Tract Symptoms Attributed To Benign Prostatic Hyperplasia: Aua Guideline Amendment 2019. J Urol. 2019 Sep;202(3):592-598. DOI: 10.1097/ju.0000000000000319

[12] Demirbas A, Gunseren KO, Bagcioglu M, Yucel MO. A Prediction Model of Operation Efficacy Using Protruding Prostate Lobe Volume in Patients Who Are Candidates for Transurethral Resection of Prostate. Urol Int. 2019;103(2):172-179. DOI: 10.1159/000501175