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Lower Maximum Watt Factor does not Associate Postoperatively with Lower Maximum Urinary Flow Rate

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Abstract **Original Research Article**

Objective: Collect preoperative and postoperative urodynamic parameters and clinical data from patients with benign prostatic hyperplasia (BPH), compare changes in urodynamic parameters before and after transurethral resection of the prostate (TURP), and explore the predictive value of the maximum Watt factor (WFmax) for postoperative parameters, aiming to provide a basis for clinical decision-making. ***Methods:*** Clinical data and pre- and postoperative urodynamic parameters were reviewed from patients with BPH underwent TURP in the department of urology at Shaoyang Central Hospital and The Second Affiliated Hospital of Guilin Medical University between June 2019 and June 2024. All patients underwent preoperative sonography videourodynamic studies (SVUDS), and maximum Watt factor (WFmax) and maximum urinary flow rate (Qmax) were reviewed. Recruited patients were stratified into two groups: group A, in which WFmax＞7w/m^2, and group B, in which WFmax ≤ 7w/m^2. Pre- and postoperative Qmax were compared between two groups. *Results:* 90 patients were enrolled into this study, WFmax＞7w/m^2 were found in 54 (60%) patients and recruited into the group of normal detrusor contractility (group A), and the remining 36 (40%) patients, in which WFmax ≤ 7w/m^2, were considered to have a impaired detrusor contractility (group B). All patients had a markedly improvement of Qmax, increased from 5.0 (2.7,6.6) to 13.9(10.0, 18.0) ml/s ($p < 0.01$), after TURP. Nevertheless, no significant difference of postoperative Qmax was found between patients with impaired (14.9±6.8ml/s) and normal (15.5±7.3ml/s) detrusor contractility (P=0.052), even though patients with impaired detrusor had a lower preoperative Qmax (4.7±2.1ml/s) compared to normal detrusor (5.5±2.3ml/s) (P=0,045). ***Conclusion:*** All patients underwent BPH showed a significant improvement of Qmax after TURP regardless of preoperative detrusor contractility. Lower preoperative WFmax was not associated with lower postoperative Qmax even though a higher preoperative Qmax was found in patients with normal detrusor contractility compared to impaired detrusor if 7w/m^2 of WFmax was considered the cut-off between impaired and normal detrusor contractility.

Keywords: Maximum Watt factor, benign prostate hyperplasia; detrusor contractility; transurethral resection of the prostate; sonography videourodynamic studies.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is the most common reproductive system disease in elderly men, with its incidence increasing year by year with age. Evidence show that the incidence is approximately 20% in men aged 51–60, 50% in men aged 61–70, and as high as 83% in men aged 81–90 [1]. The pathogenesis of BPH involves histological sex hormone disorders leading to glandular or fibrous hyperplasia, anatomical enlargement of the prostate volume (BPE), and bladder outlet obstruction (BOO) in urodynamic studies. Clinically, it mainly manifests as lower urinary tract symptoms (LUTS), such as urinary frequency, urgency, and dysuria. Treatments options for BPH include regular monitoring, drug therapy, and surgical intervention. Regular monitoring and drug therapy are primarily suitable for patients in the early stages of the disease, those with mild LUTS, or those who cannot tolerate surgery. Surgical treatment is indicated for patients whose daily life was damaged by LUTS or those who

develop complications such as renal insufficiency due to prolonged obstruction.

Currently, transurethral resection of the prostate (TURP) is the "golden standard" of surgical approach for BPH patients with severe LUTS 2. Although most patients had experienced significant symptom relief after surgery, some still show little improvement. Detrusor underactivity (DU) is defined as the lack enough contractility or/and contractile time to expel completely the urine of bladder through urinary urethra, which has been reported to be regarded as one of main causes contributed to unsatisfaction of BPH patients underwent surgery for elimination of BOO. Urodynamic studies (UDS) has been regarded as the "golden standard" for diagnosis of BOO and/or DU, and maximum watt factor (WFmax) generated automatically by software of UDS has currently been considered a numerical parameter representing detrusor contractility. Although there has been not a consensus over the WFmax of cut-off for definition of DU, less than 7w/m^2 of WFmax has been regarded as a urodynamic diagnosis of DU by some experts.

Given maximum urinary flow rates (Qmax) has long been used to postoperatively evaluate the prognosis of BPH-related treatments, the association between preoperative WFmax and postoperative Qmax in patients with BPH underwent TURP was explored in this study.

PARTIPANTS AND METHODS

Participants

We retrospectively collected clinical data from patients diagnosed with BPH underwent TURP in the department of urology at Shaoyang Central Hospital and The Second Affiliated Hospital of Guilin Medical University between June 2019 and June 2024. All patients underwent preoperative sonography videourodynamic studies (SVUDS). Postoperative Qmax was recorded one month after discharge. A total of 90 eligible cases were recruited in this study.

Methods

The SVUDS combined an ultrasound scan with multichannel UDS (Aquarius XT, Laborie, USA) and could synchronously integrate urodynamic measurement values with sonographic images sequences by Aquarius XT own software (UDS.V14, Laborie, USA), and conducted strictly following the International Continence Society (ICS) Good Urodynamic Practice (GUP) guidelines. The preoperative parameters included WFmax and preoperative Qmax.

Statistical Methods

Statistical analysis was performed using SPSS 25.0 software. Normality tests analysis were conducted on all data. Inter-group comparisons were performed using ANOVA or Kruskal-Wallis H test, while intra-group comparisons used paired t-test or Wilcoxon signed-rank test. The significance level for all tests was set at α=0.05.

RESULTS

This study included a total of 90 patients with ages ranging from 52 to 89 years, WFmax＞7w/m^2 were found in 54 (60%) patients and recruited into the group of normal detrusor contractility (group A), and the remining 36 (40%) patients, in which WFmax ≤ 7w/m^2, were considered to have a impaired detrusor contractility (group B). All patients had a markedly improvement of Qmax, increased from 5.0 (2.7,6.6) to 13.9(10.0, 18.0) ml/s ($p < 0.01$), after TURP(table 1). Regardless of WFmax, either patients with normal detrusor contractility or impaired detrusor presented significantly increased Qmax after TURP(all $p < 0.01$) (table 2).

Nevertheless, no significant difference of postoperative Qmax was found between patients with impaired (14.9±6.8 ml/s) and normal (15.5±7.3ml/s) detrusor contractility (P=0.052), even though patients with impaired detrusor had a lower preoperative Qmax (4.7±2.1ml/s) compared to normal detrusor(5.5±2.3ml/s) (P=0.045) (table 2).

Table 1: Comparison bewteen Pre- and postoperative Qmax

	Preoperative	postoperative	P
Qmax（ml/s）	5.0（2.7,6.6）	13.9（10.0,18.0）	＜0.01

Table 2: Intergroup and Intragroup Comparisons of Qmax Before and After Surgery Across WFmax Subgroups

Groups	Preoperative Qmax (ml/s)	Postoperative Qmax (ml/s)	*P*
A (n=54)	5.5±2.3	15.5±7.3	＜0.01
B (n=36)	4.7±2.1	14.9±6.8	＜0.01
P	0.045	0.052	-

DISCUSSION

There has been noted that the failure incidence of treatments for patients with benign prostate obstruction (BPO) complicated by detrusor underactivity (DU) is higher than without DU. Insufficient understanding of surgical indications by clinicians may lead to unsatisfaction of patients for treatments, which not only affects patients' quality of life but may also exacerbate doctor-patient conflicts. Although various international guidelines have clarified indications and contraindications of surgical approaches for BPH,

decision-making of a patient underwent surgical treatments has yet depended on the severity of their LUTS and the presence of complications due to BPH in real world. Factors such as patients' self-assessment of symptoms and complications may drive them to opt for surgery, yet the postoperative outcomes for these patients often fail to meet the expectations outlined in the guidelines. Therefore, there has been always an urgent need of an prognostic method based on accurate clinical indicators to assist doctors in determining whether a patient is suitable for BPO-elimination surgery.

With emergence of UDS, there has been a consensus that urodynamically diagnosed DU to some extent play a key role in postoperative evaluation for patients with BPH. Mauricio *et al.*, 3 reported that if BPO is combined with DU before surgery, the rates of postoperative LUTS relief is low, and urinary retention may even occur. Although some invasive approaches have been reported to be explored its possibility of replacing invasive urodynamic methods, UDS has yet been considered the gold standard for assessment of detrusor contractility 4.

Among various invasive urodynamic parameters for evaluation of detrusor contractility, including WFmax, bladder contractility index (BCI), and the LinPURR nomogram, continuous variables of WFmax and BCI facilitated both more clinically accessible compared to the other. However, a controversy persists regarding the urodynamic cutoff of DU. Although calculation simplicity of BCI make it wide application, WFmax has once been regarded as a more precise indicator than BCI in DU assessment supported by Griffiths research 5. Given few reports over application of WFmax in prognostic assessment of BPH, this study adopted less than 7w/m^2 of WFmax to defined DU to explore the prognostic effect of WFmax in patients underwent TURP.

Nevertheless, ongoing debate surrounds the diagnostic criteria and cutoff value of WFmax in DU diagnosis 4. Oelke 6 and Rollema 7 adopted WFmax <10 w/m² as the diagnostic threshold for DU and utilized this criterion to subgroup patients. Therefore. 7 w/m² of WFmax was defined as the cutoff of diagnosis for DU which may contribute to no significant difference of postoperative Qmax found between normal and impaired detrusor contractility in this study. It was suggested that a lower cutoff of WFmax for diagnosis of DU should be explored to find a suitable one presenting more efficacy in prognostic differentiation.

BPH, as a typical chronic disease, predominantly affects men aged 40 and above. With exacerbation of global aging, the incidence of BPH has been on the rise. Epidemiological data at 2010 indicates that BPH patients account for 6.05% of the male population 8. TURP remains the “golden standard” of surgical option for severe LUTS caused by BPH. However, clinical observations reveal that some patients experience insignificant improvement of postoperative symptom or remain large post-voiding residual (PVR), even acute urinary retention (AUR). To date, there has been not a consensus on the impact of DU on outcomes of BPH patients receiving surgical approaches 910. Thomas 11 conducted a follow-up study of 224 patients undergoing TURP, showing no significant postoperative improvement in DU patients compared to non-surgical controls. However, all patients with BPH show a significant improvement in postoperative Qmax compared to preoperative regardless of detrusor contractility in this study. It was indicated that improvement of postoperative Qmax may insignificantly be attributed to amelioration of symptoms after surgery for BPO. Therefore, more noninvasive and invasive parameters should be considered in evaluation of prognostic effect on BPH treatments.

To dates, UDS has yet served as the gold standard for differential diagnosis and evaluation of detrusor contractility. WFmax, proposed by Griffiths 12, offers clinically superior efficacy, which integrated detrusor contraction velocity and strength, on assessing detrusor contractility compared to BCI, which introduced by Abrams 13, defines DU as BCI <100. Although more clinical application of BCI due to the simplicity of its generation, the susceptibility to an abrupt change of abdominal pressure during voiding often failed to correctly observe detrusor contractility.

Several limitations of the present study should be carefully noted. Firstly, relatively small size of this study should be considered. Secondly, different cutoff of WFmax for diagnosis of DU may lead to variability of prognostic effect on postoperative urodynamic parameters. Finally, good compliance to practice guidelines of ICS plays a key role in generation of WFmax correctly representing detrusor contractility, due to which not all of WFmax value can precisely mirror the truth of it in this study.

CONCLUSIONS

All patients underwent BPH showed a significant improvement of Qmax after TURP regardless of preoperative detrusor contractility. Lower preoperative WFmax was not associated with lower postoperative Qmax even though a higher preoperative Qmax was found in patients with normal detrusor contractility compared to impaired detrusor if 7w/m^2 of Wfmax was considered the cut-off between impaired and normal detrusor contractility. It was suggested that lower cutoff value of Wfmax may be more eligible to differentiate poor prognosis for BPH patients.

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Competing interests: The author reports no conflicts of interest in this work.

Data availability

The data that support the findings of this study are not openly available due to reasons of sensitivity and privacy protection and are available from the corresponding author upon reasonable request. Data is located in controlled access data storage at The Second Affiliated Hospital of Guilin Medical University and The Shaoyang Central Hospital.

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