

Original Article

Benign Prostatic Hyperplasia: Using the Urodynamic Study's Decision, Who will Benefit from Surgical Intervention?

Ali Nammour^{1*}, Louai Naddaf¹, Aiman Harfoush¹

¹Department of Surgery, Faculty of Medicine at Tishreen University in Lattakia, Syria.

*Corresponding Author : alinammour1932002@gmail.com

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Abstract - Background: Benign prostatic hyperplasia (BPH) with LUTS represents the fourth most common disease in the male population over 50 years of age. When there is an obstruction at the level of the lower urinary tract accompanied by benign prostatic hyperplasia, surgical intervention is often the most applied option despite the rate of accompanying complications that may occur. To ensure better results, appropriate indications for surgical intervention should be chosen, especially since BPH may not be the lesion causing the symptoms that the patient suffers from. Objective: To determine the diagnostic value of urinary flow study in selecting BPH patients who will undergo prostatectomy. Patients and methods: A randomized controlled clinical study, including all BPH patients attending the Department of Urology at Tishreen University Hospital in Lattakia and who will undergo surgery to remove an enlarged prostate in the time period between 2022 to 2024. They were randomly divided into two groups: Group A (traditional investigations followed by surgical intervention to remove enlarged prostate) and Group B (conventional investigations followed by urine flow studies). Results: The research sample included 55 patients, distributed into two groups: Group A (27 patients) and Group B (28 patients). The average age was 67.78 years, the average value for IPSS was 21.74, the average value for prostate volume was 45.85 cc, and the average value for urinary residual was 157.09. As for the results of the urine flow study for group B patients, the average value of the Maximum flow rate was 10.2 ml/second, the detrusor pressure was 8.12 cm H₂O, and the detrusor pressure at Q_{max} was 60.07 cm H₂O, the BCI was 113.3 and the BOOI was 41cm H₂O. Based on these results, 20 patients from group B were referred for surgery, and the remaining patients were referred for neurological treatment. Conclusion: Urodynamic study contributes to determining the indication for surgical intervention in patients with BPH by accurately determining the cause of the urinary symptoms that the patient suffers from.

Keywords - Urodynamic study, Surgical intervention, Benign prostatic hyperplasia.

1. Introduction

The management of Benign Prostatic Hyperplasia (BPH) often reaches a point where surgical intervention is considered to treat Lower Urinary Tract Symptoms (LUTS) in aging men. To optimize surgical outcomes, the judicious use of urodynamic studies is necessary to pinpoint patients who are likely to benefit from surgery [1]. Urodynamic tests such as pressure-flow studies can help unravel the functional impairments in urinary flow and bladder contractility, making them a critical component of the pre-operative evaluation [2,3].

While the primary objective of BPH treatment is symptomatic relief, urodynamic assessments contribute substantially to discerning the efficacy of interventions, particularly when surgical options are considered for patients with Q_{max} greater than 10mL/s [1]. Although there is debate on the necessity of routine pre-operative urodynamic testing

within the urological community, urodynamics cannot be entirely disregarded when considering invasive therapeutic modalities or when the clinical picture is ambiguous [2]. Urodynamic studies not only reinforce the diagnostic process but also have projected prognostic value, predicting surgical outcomes and postoperative satisfaction for BPH patients [3].

Some argue that medical indications for BPH are determinable without specific urodynamic studies, indicating a possibility to circumvent them in patient selection and treatment planning [4,5]. Nonetheless, the role of urodynamic evaluation holds significance in the context of BPH, where invasive therapeutic modalities or insufficient information from clinical assessments are present [2]. The urodynamic study reinforces the diagnostic process and holds prognostic value, aiding in predicting surgical outcomes and postoperative satisfaction for BPH patients [3]. Therefore, the role of urodynamic study in setting the surgical indication for



BPH patients is a balance that makes it a significant, albeit selectively employed tool in the surgical management of this condition [1,2,3,7].

2. Patients and Methods

To provide an overview of the approach and methodology for a randomized controlled clinical study of patients with Benign Prostatic Hyperplasia (BPH) at the Department of Urology at Tishreen University Hospital in Lattakia, we can draw upon standardized practices used in similar studies. Here's a proposed structure for the methods section of the study:

2.1. Patients

The study population consisted of all male patients diagnosed with BPH attending the Department of Urology at Tishreen University Hospital from 2022 to 2024. Eligibility criteria for this study included men over the age of 50 with a clinical diagnosis of BPH, verified through both symptomatic assessment and physical examination, who are deemed suitable candidates for surgical intervention.

The exclusion criteria were based on the presence of neurological disorders affecting lower urinary tract function, prior prostate or bladder surgery, prostate or bladder cancer, active urinary tract infections, or inability to provide informed consent.

2.2. Methods

Upon the initial presentation, eligible patients were briefed on the study's objectives, procedures, potential risks, and benefits. After obtaining written informed consent, the enrolled patients were randomly assigned to one of two groups:

Group A: Traditional Investigations and Surgical Intervention. Patients in this group underwent routine pre-operative investigations, which included physical examination, Digital Rectal Examination(DRE), Abdominal Ultrasound, and Cystoscopy. Following the traditional diagnostic assessments, patients proceeded to receive the standard surgical treatment for BPH removal, which was Transurethral Resection of the Prostate (TURP), open prostatectomy, or minimally invasive surgical techniques, based on the clinical discretion of the treating urologist.

Group B: Conventional Investigations and Urodynamic Studies. This group followed the same initial diagnostic process as Group A. Additionally, before surgical intervention, patients in this group also underwent urodynamic testing, including Uroflowmetry and Cystometry, to measure the Maximum urinary flow rate (Qmax), detrusor pressure (Pdet), Pdet at Qmax, the Bladder Contractility Index (BCI) and The Bladder Outlet Obstruction Index (BOOI). The BCI and the BOOI were calculated using these formulas:

$$BCI = Pdet Qmax + 5 Qmax$$

$$BOOI = Pdet Qmax - (2 \times Qmax)$$

Bladder contractility is considered normal if the Bladder Contractility Index (BCI) is between 100 and 150. A BCI exceeding 150 indicates strong contractility, while a value below 100 suggests weak contractility. While the presence of bladder outlet obstruction is identified by a Bladder Outlet Obstruction Index (BOOI) exceeding 40. Conversely, obstruction is considered absent if the BOOI value falls below 20, which can provide quantitative data about bladder outlet obstruction and bladder contractility.

Both groups' preoperative and postoperative symptoms and outcomes were compared using validated questionnaires, such as the International Prostate Symptom Score (IPSS), and objective measure, maximum urinary flow rate (Qmax). Adverse events, surgical complications, and any deviations from standard protocols were recorded throughout the study.

2.3. Randomization

Participants were allocated to their respective groups using a computer-generated randomization sequence to ensure the unbiased distribution of patients.

2.4. Ethical Considerations

The study protocol was reviewed and approved by the Institutional Review Board (IRB) at Tishreen University Hospital. Patient privacy and the confidentiality of medical records were maintained in accordance with the Declaration of Helsinki.

2.5. Statistical Analysis

Data collected from the two groups were analysed using appropriate statistical methods. The primary analysis compared the effectiveness of surgical intervention in both groups. Secondary outcomes will focus on the differences in urinary flow studies and the presence or absence of urodynamic obstruction.

3. Results

The results from the research sample, which included 55 patients, are as follows:

Patients were categorized into two groups. Group A, comprising 27 patients, followed the traditional pathway, which included standard clinical assessments before considering surgical intervention. Group B, with 28 patients, included the additional step of urodynamic studies after conventional investigations and before surgical intervention.

The demographic and clinical profile of the study population revealed the average age of participants to be 67.78 years, which is indicative of the typical age range for BPH

prevalence. The mean International Prostate Symptom Score (IPSS), which is a quantifiable metric used for evaluating the severity of urinary symptoms, was determined to be 21.74. This score suggests moderate to severe LUTS among the study participants.

Furthermore, the average prostate volume was 45.85 cubic centimetres, correlating with an enlarged prostate. The mean value for Post-void Residual Urine (PVR), a marker of voiding efficiency, was 157.09 millilitres, pointing towards significant urinary retention among the individuals evaluated.

Table 1. The demographic and clinical profile of the study population

Demographic/Clinical Feature	Average or Mean Value
Age of Participants	67.78 years
International Prostate Symptom Score (IPSS)	21.74
Prostate Volume	45.85 cc
Post-Void Residual (PVR) Urine	157.09 ml

Table 1 provides average values of the study population that support the decision to consider surgical interventions as a treatment for BPH.

However, well-informed clinical decisions on management strategies for each patient must be personalized based on their unique clinical presentation and interpreted alongside urodynamic studies.

Group B's urodynamic findings regarding the physiological characteristics of the lower urinary tract under study are crucial. The mean maximum flow rate (Qmax) of 10.2 ml/s is typically indicative of an impaired urine stream commonly associated with BPH. Detrusor pressure, reflecting the strength of bladder contractions during filling, averaged 8.12 cmH2O, and Detrusor pressure at Qmax, the strength of bladder contractions during voiding, averaged 60.07 cmH2O, based on the previous urodynamic study results, the BCI and the BOOI were calculated. The average of BCI was 113.3, while the average of BOOI was 41.7 cm H2O.

Table 2. The urodynamic findings from Group B

Urodynamic Parameter	Mean Value
Qmax	10.2 ml/s
Pdet	8.12cm H2O
Pdet @ Qmax	60.07 cm H2O
BCI	113.3
BOOI	41.7 cm H2O

According to the values of these indices, the patients in group B were categorized into three diagnostic groups as follows:

Table 3. The diagnostic results from Group B

The diagnosis	Number of patients	The percentile
BOO due to BPH	20	71.4%
Detrusor overactivity (DO)	3	10.7%
Detrusor underactivity (DU)	5	17.9%

The diagnostic results from Group B are represented in Figure 1.

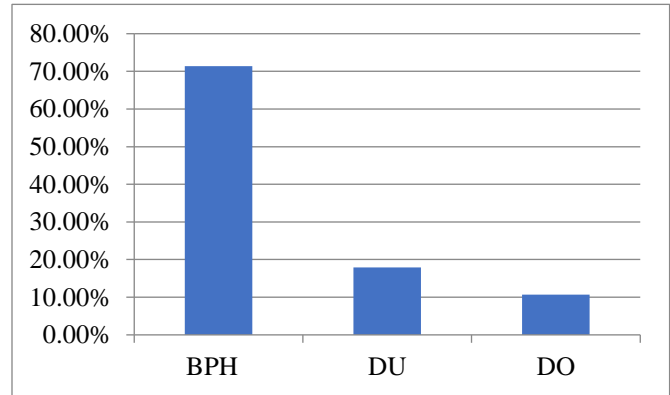


Fig. 1 The diagnostic results from Group B

Within Group B, 20 patients exhibited urodynamic findings suggestive of bladder outlet obstruction(BOO) due to BPH, prompting a recommendation for surgical intervention (Transurethral Resection of the Prostate (TURP) and Simple Prostatectomy) to potentially alleviate the obstruction.

Among the remaining 8 patients, 5 were diagnosed with detrusor underactivity (weak bladder contractions). Their treatment plan involved a combination therapy of an alpha-blocker medication alongside an acetyl cholinesterase inhibitor. The other 3 patients presented with detrusor overactivity (overactive bladder) and were managed with a course of Transcutaneous Tibial Nerve Stimulation (TTNS). The TTNS treatment regimen consisted of one session per week for a duration of 12 weeks.

Patients were followed up and reassessed 3 months post-intervention. The reassessment included calculating the International Prostate Symptom Score (IPSS), measuring the maximum urinary flow rate (Qmax), and evaluating for any post-surgical complications in patients who underwent surgical procedures.

A significant improvement was observed in both IPSS and Qmax values. However, some patients who underwent surgery experienced post-surgical complications such as urinary retention, Urinary Tract Infections (UTIs), and Urinary incontinence.

4. Discussion

This study's findings underscore the value of urodynamic studies in BPH surgical planning, furthering the ongoing discussion in the field.

The research demonstrated that the preoperative urodynamic assessment could significantly impact surgical decision-making. It was found that detailed urodynamic data allowed for better stratification of patients, ensuring that those with clear indications of bladder outlet obstruction were selected for surgery. This is consistent with the study [1], which also performed pre-surgical urodynamic evaluations and found them essential in planning treatment.

The comparability of the urodynamic findings with other modalities of BPH treatment reinforces the importance of urodynamic testing across different treatment pathways [1]. Maximum flow rate, detrusor pressure, detrusor pressure at Qmax, BCI and BOOI measurements provided objective data supporting surgical intervention. It helped predict which patients might benefit the most from procedures like TURP. However, predicting post-surgery outcomes remains difficult, as reported in previous studies [6,9]. Although many patients benefit from surgery following urodynamic assessments, a subset may require alternative or additional neurological treatment [2].

In discussing this study in the context of existing literature, it is necessary to explore how these findings correlate with or diverge from other significant research in the field of urology pertaining to benign prostatic hyperplasia (BPH). The studies by Dou et al. (2015) [10], Bishara et al. (2015) [11], and Yang et al. (2023) [12] provide substantial insights that can be used to frame the discussion.

Starting with the study by Dou et al. (2015), they investigated the efficacy of various urodynamic parameters in diagnosing Bladder Outlet Obstruction (BOO) caused by Benign Prostatic Hyperplasia (BPH). Analyzing data from 156 BPH patients, they assessed the correlation between symptoms, prostate size, and urodynamic indices such as Maximum flow rate (Qmax), Post-void residual urine volume (PVR), Detrusor pressure at maximum flow (PdetQmax), and Bladder Outlet Obstruction Index (BOOI). The study revealed that while commonly used measures like maximum flow rate (Qmax) and Post-void Residual Urine (PVR) are helpful, they alone are not enough to accurately diagnose Bladder Outlet Obstruction (BOO) in BPH patients. Instead, detrusor pressure at maximum flow (PdetQmax) and Bladder Outlet Obstruction Index (BOOI) proved to be more reliable indicators of BOO, with a BOOI threshold of 40 effectively differentiating between obstructed and unobstructed cases [10].

Bishara and colleagues (2015) explored the potential of urodynamic studies to differentiate between urethral strictures and Benign Prostatic Hyperplasia (BPH) as causes of Lower

Urinary Tract Symptoms (LUTS) in men. The study included 57 men with LUTS, who underwent Uroflowmetry and pressure-flow studies to assess various parameters, including Maximum flow rate (Qmax), Voiding pressure, Urethral resistance, and Bladder contractility index. The study found that while certain urodynamic trends were observed – such as higher voiding pressures in stricture patients and detrusor overactivity in BPH patients – there was significant overlap in these measures between the two groups. This means that relying solely on urodynamics wasn't enough to reliably differentiate between urethral strictures and BPH [11].

Furthermore, the work by Yang and colleagues (2023) investigated the influence of preoperative urodynamic parameters on the clinical outcomes of patients with Benign Prostatic Hyperplasia (BPH) who underwent Transurethral Resection of the Prostate (TURP). The study involved 198 BPH patients who underwent urodynamic studies before TURP. Researchers analyzed various urodynamic parameters and their correlation with post-operative improvements in International Prostate Symptom Score (IPSS), Maximum flow rate (Qmax), and Post-void residual urine volume (PVR). The study revealed that certain urodynamic parameters measured before TURP surgery could predict how well patients would do afterwards. Specifically, higher detrusor pressure and bladder outlet obstruction index were linked to better improvements in symptom scores and urinary flow. However, detrusor overactivity before surgery indicated a higher chance of continued storage symptoms even after the procedure [12].

Overall, this study adds to the existing body of literature by reinforcing the utility of urodynamic studies in the preoperative evaluation of BPH patients. While Dou et al. and Bishara et al. endorse the role of urodynamic testing in diagnosing the underlying causes of LUTS, This research further highlights its prognostic value in informing surgical pathways, akin to the predictive insights offered by Yang et al. The results also suggest that, in some cases, patients might benefit from neurological investigation when urodynamic parameters indicate neurogenic influences on bladder function. This holistic approach toward patient evaluation and management helps in maximizing therapeutic efficacy and personalizing treatment for BPH.

In summary, comparing these results with extant studies, it becomes evident that urodynamic testing before BPH surgery offers an additional layer of diagnostic precision that can improve patient outcomes. It provides a clearer picture of bladder function, helps tailor treatments to individual needs, and could potentially forecast the effectiveness of surgical interventions.

These benefits, set against the complexity of BPH and variability in individual patients, suggest urodynamic studies should retain their role as a cornerstone of BPH management, particularly when surgery is being considered.

5. Conclusion

Urodynamic studies have proven to be valuable diagnostic tools in determining surgical indications for patients with BPH. Urodynamic assessments provide clinicians with an accurate and detailed understanding of bladder outlet obstruction and detrusor muscle function, enabling them to distinguish between symptoms caused by BPH and other urological conditions. The integration of preoperative urodynamic assessment in the management of BPH patients can refine the selection criteria for surgical intervention, ensuring that the therapeutic approach is personalized to address the specific cause of the patient's

urinary symptoms. Thus, the incorporation of urodynamic evaluations in the management of BPH is indicative of a patient-centred approach to urological care and is also pivotal in optimizing surgical outcomes and improving overall patient well-being. As supported by this study, combining urodynamic assessments with clinical evaluations is essential in accurately diagnosing and treating BPH patients.

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