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The Use of Alpha-Adrenergic Blockers as the Drug of Choice for Men with Symptomatic Benign Prostatic Hyperplasia

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Abstract

Background: Benign Prostatic Hyperplasia (BPH) is a common urological condition affecting older men, leading to Lower Urinary Tract Symptoms (LUTS). Alpha-1 adrenergic receptor blockers, such as tamsulosin, are commonly used to treat BPH-related LUTS.

Aim: This study aimed to evaluate the efficacy of oral tamsulosin in managing symptomatic benign prostatic hyperplasia (BPH) and improving urodynamic parameters in men aged ≥50 years while exploring the association between BPH, age, and comorbidities.

Methods: A retrospective analysis was conducted on 51 male patients aged ≥50 years diagnosed with symptomatic BPH and treated with tamsulosin (0.4 mg daily) from January 2021 to December 2023. Descriptive statistics were used to analyze patient demographics, comorbidities, and clinical parameters. Statistical significance was assessed using T-tests.

Results: The study found a significant positive correlation between age prostate size and PSA levels. Additionally, a higher prevalence of BPH was observed in patients with hypertension and diabetes. Tamsulosin treatment resulted in significant improvement in LUTS for 75% of the study participants. Moreover, 3 months of tamsulosin treatment, resulted in statistically significant improvements in peak voided volume (PVR) and maximum flow rate (Qmax) ($p<0.05$), indicating enhanced bladder emptying and improved urine flow. However, the change in detrusor pressure at maximum flow was not statistically significant ($p>0.05$).

Conclusion: This study demonstrates the effectiveness of tamsulosin in managing LUTS associated with BPH, with substantial improvements in PVR and Qmax. Age, hypertension, and diabetes were identified as significant risk factors for BPH. Further research is needed to explore the underlying mechanisms of BPH progression and to identify novel therapeutic strategies.

Keywords: Benign prostatic hyperplasia, Lower urinary tract symptoms, α1-Adrenoceptor blockers, Tamsulosin

Abbreviations: TPW: Total Prostate Weight; OVS: Obstructive Voiding Symptoms; LUTS: Lower Urinary Tract Symptoms; PVR: Post-Void Residual Volume; Qmax: Maximum Urinary Flow Rate

Introduction

The prostate gland is a vital organ of the male reproductive system, playing a crucial role in male fertility (1). It is encapsulated by a thin fibroblastic layer that surrounds the urethra at the neck of the urinary bladder, dividing the prostate into five lobes: anterior, posterior, medial, and two lateral lobes (2). In humans, the prostate is a single gland composed of various histological zones, including the peripheral, central, and transitional zones. Prostate-related issues are commonly associated with three primary conditions: prostatitis, benign prostatic hyperplasia (BPH), and prostate cancer (2,3).

Benign Prostatic Hyperplasia (BPH) is the most prevalent non-malignant condition affecting the prostate, leading to several symptoms collectively referred to as lower urinary tract symptoms (LUTS). The prevalence of

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BPH significantly increases in men over the age of 50, with hormonal changes being major predisposing factors linked to hormonal dysregulation and alterations in prostate morphology (4,5). The proliferation of stromal cells in the periurethral area of the prostate is influenced by various hormones, most notably testosterone. Testosterone, produced in the testes, is converted to dihydrotestosterone (DHT) by the enzyme 5-α-reductase II (6,7). Consequently, any dysfunction of the 5-α-reductase II enzyme can lead to changes in prostate morphology and uncontrolled growth of glandular epithelium, smooth muscle, and connective tissue in the prostatic transition zone (5). This unchecked growth impairs urine flow and can result in bladder outflow obstruction (BOO) as well as LUTS, which can be classified into obstructive (voiding) and irritative symptoms (8,9). Obstructive symptoms include hesitation, poor or irregular stream, straining, and prolonged micturition, while irritative symptoms encompass frequency, urgency, urge incontinence, and nocturia (10).

Other risk factors that may exacerbate BPH include inflammation, characterized by significant infiltration of activated T cells. These T cells release various growth factors that stimulate the growth of stromal and epithelial cells in the prostate, contributing to hyperplasia (10). Advanced age is strongly associated with hormonal dysregulation and androgen abnormalities. Chronic inflammation, often due to hypogonadism and hypoestrogenism, can lead to overexpression of Toll-like receptors (TLRs), which may convert prostatic cells into antigen-presenting cells. This activation of human prostate-associated lymphoid tissue can result in an overproduction of growth factors, ultimately causing prostate remodeling and further enlargement (11). Moreover, BPH is linked to metabolic syndrome, which includes dyslipidemia, insulin resistance, and hypertension (HTN) (12). Additionally, men with elevated glycosylated hemoglobin levels (HbA1c) have shown an increased risk of LUTS. Therefore, proper diagnosis and management of BPH are essential. Management options include surgical procedures such as transurethral resection of the prostate (TURP) and pharmacological treatments like alpha-1 blockers (10).

Therapeutic options for BPH include watchful waiting for mild symptoms that do not interfere with daily activities, pharmacological treatments to reduce prostate size and resist urinary flow, and surgical interventions for severe symptoms and complications, weighed carefully against the risks and benefits of various treatment options (13). Alpha-blockers are a class of antihypertensive medications divided into non-selective alpha-blockers, alpha-1 selective blockers, and alpha-2 selective blockers. Among these, selective alpha-1 adrenergic receptor blockers are the most effective in treating BPH (13). These blockers target alpha receptors in the smooth muscle of the prostate and bladder, alleviating smooth muscle tension, improving urine outflow, and relieving bladder outlet obstruction (14). α1A receptors are predominantly expressed in prostatic stromal smooth muscle cells, regulating smooth muscle tone in the bladder neck, and prostate. Blocking α1A adrenoceptors reduces prostatic tone and improves the dynamic aspects of LUTS. In contrast, α1B receptors, primarily expressed in the smooth muscles of blood vessels, regulate blood pressure through arterial smooth muscle relaxation; thus, blocking α1B receptors leads to arterial and venous dilation. Additionally, α1D receptors are primarily found in the bladder body and dome, facilitating bladder contraction; blocking these receptors alleviates irritative voiding symptoms (15,16).

Tamsulosin is the most commonly used α1 blocker, targeting both α1A and α1D receptors without causing the cardiovascular side effects associated with α1B receptor blockade. The typical adult dose for managing BPH is 0.4 mg taken once daily, as this dosage minimizes blood pressure reduction and orthostatic hypotension symptoms, making Tamsulosin safe for normotensive patients with BPH (13-16). However, Tamsulosin is associated with higher rates of ejaculatory dysfunction due to its predominant effect on α1A receptors distributed in the epididymis, vas deferens, seminal vesicles, prostate, and bladder neck, all of which are involved in the emission phase of ejaculation (13-16).

The findings of this study will provide valuable insights into the efficacy and safety of alpha-1 selective adrenoceptor blockers in improving LUTS and overall quality of life in patients with symptomatic BPH.

Aim

The primary objective of this study was to assess the effectiveness of oral tamsulosin in managing symptoms of benign prostatic hyperplasia (BPH) and improving urodynamic parameters in men aged 50 years or older. Additionally, the study aimed to investigate the relationship between BPH, age, and comorbidities.

Methods

Study design: A retrospective analysis was conducted utilizing electronic medical records from the outpatient department (OPD) of the Urology department at Al-Hawari Hospital.

Study Population and data collection: The study included data from 51 male patients aged ≥50 years diagnosed with symptomatic BPH and Lower Urinary Tract Symptoms (LUTS) suggestive of Bladder Outlet Obstruction (BOO) with or without coexisting comorbidities. All participants were treated with tamsulosin 0.4 mg once daily following standard urological practice. Patient data collected included demographics (age), presence and type of comorbid diseases, prostate size assessed using transrectal ultrasonography (TRUS) and recorded in grams (g), and prostate-specific antigen (PSA) levels measured in nanograms per milliliter (ng/mL). All participants underwent TRUS to determine prostate size, with the

procedure performed by experienced urologists following a standardized protocol. The prostate volume was calculated using the formula for an ellipsoid shape: volume (mL) = length x width x height x 0.52. PSA levels were recorded as part of routine clinical evaluation. The collected data, encompassing demographics, comorbidities, prostate size, and PSA levels, was entered into a Microsoft Excel spreadsheet for further analysis.

Urodynamic parameters

Urodynamic studies were conducted using the Mediwatch Urodynamics system at a private urology clinic in Benghazi Libya, to assess various urodynamic parameters before and after 3 months of tamsulosin treatment. Treatment efficacy was evaluated by a change in the following parameters Maximum Urinary Flow Rate (Qmax), measured to determine the maximum urine flow during voluntary voiding; Post-Void Residual Volume (PVR), assessed using ultrasound to measure urine remaining in the bladder after voiding; and Detrusor Pressure at Maximum Flow, recorded to evaluate the pressure in the bladder during maximum flow; calculated to quantify the degree of bladder outlet obstruction. All assessments were performed by experienced urologists following standardized techniques and protocols recommended by the International Continence Society, ensuring precise measurements for baseline and three months after treatments and reliable data collection for thorough analysis.

Inclusion criteria

- Male patients aged ≥50 years
- Diagnosis of symptomatic BPH and LUTS suggestive of BOO
- Patients not taking any medications known to cause or contribute to obstructive urinary symptoms, such as:
- Antihistamines
- Antidepressants
- Antipsychotics
- Bladder anticholinergics
- Decongestants
- Opioid analgesics

Exclusion criteria

- Patients taking any medications that could potentially cause or exacerbate obstructive urinary symptoms.
- Patients with a history of neurogenic bladder, spinal cord injury, or other neurological conditions that could contribute to LUTS
- Patients with a history of prostate or bladder cancer
- Patients who had undergone any previous prostate or bladder surgery
- Patients with severe comorbidities that could independently affect urinary function (e.g., chronic kidney disease that could complicate urinary function, bilateral hydroureteronephrosis, bladder calculi that could interfere with normal urinary flow, bladder diverticula (pouches that form in the bladder wall) which may affect urinary dynamics, etc.)

Data Analysis

Descriptive statistics were used to analyze the collected data. Quantitative variables, such as age and urodynamic parameters, were expressed as means and standard deviations. Qualitative variables, such as the presence of comorbidities, were represented by frequencies and percentages. Statistical significance (p-value) was calculated using paired T-tests for quantitative variables before and after tamsulosin treatment to assess changes in urodynamic parameters.

Ethical Considerations

This study adhered to ethical research principles and patient confidentiality was maintained. Approval from the institutional review board was obtained before initiating the study.

Results

A total of 51 male patients aged 50 years and older with symptomatic BPH were included in this retrospective study. The demographic characteristics of the study population are summarized in Table 1. The majority of patients (54%) were aged between 61 and 75 years.

Comorbidities

A significant proportion of patients had comorbidities, with hypertension being the most common (28%), followed by a combination of hypertension and diabetes (30%). Diabetes alone was present in 14% of the patients, while 6% had other comorbidities, including COPD, IHD, and bronchial asthma (Figure 1).

Table 1: Prevalence of BPH in each age group.

Age group	Prevalence of BPH in each age group (%)
51-55	**3.92**
56-60	**19.61**
61-65	**21.57**
66-70	**17.65**
71-75	**23.53**
76-80	**9.8**
81-85	**3.92**
Total (n=51)	**Total percentage (100%)**

Age-Related changes in BPH

The prevalence of BPH increased with age, with the highest prevalence observed in the 61-65 and 71-75 age groups with percentages of 21.57% and 23.53%, respectively (Table 1). A significant positive correlation was found between age and both total prostate weight (TPW), and (Table 2) prostate-specific antigen (PSA) levels ($p < 0.05$) (Figure 2).

Prostate size and PSA levels

A significant positive correlation was observed between prostate size and PSA levels ($p<0.05$). This suggests that larger prostate size is associated with higher PSA levels (Figure 3).

BPH symptoms

The most common LUTS reported by patients were obstructive symptoms (OVS) and a combination of OVS and outflow incontinence (Figure 4).

Treatment response

After three months of tamsulosin treatment, 75% of patients reported complete relief of their LUTS, demonstrating the efficacy of α1-adrenoceptor blockers in managing BPH symptoms (Figure 5).

Urodynamic parameter results

Three months of tamsulosin treatment resulted in statistically significant improvements across the following measured urodynamic parameters, as shown in Table 3. The p-values indicate that the changes in PVR and Qmax before and after treatment are statistically significant ($p<0.05$) suggesting enhanced bladder emptying and urine flow, while the change in Detrusor pressure at maximum flow is not statistically significant ($p>0.05$), suggests that longer treatment may be needed to improve bladder compliance and overall bladder function further.

These findings collectively demonstrate the efficacy of tamsulosin in improving various aspects of urinary function in men with symptomatic benign prostatic hyperplasia (BPH).

Discussion

Population aging is generally associated with an increased prevalence of multiple chronic conditions. Our analysis revealed a high frequency of benign prostatic hyperplasia (BPH) development among hypertensive

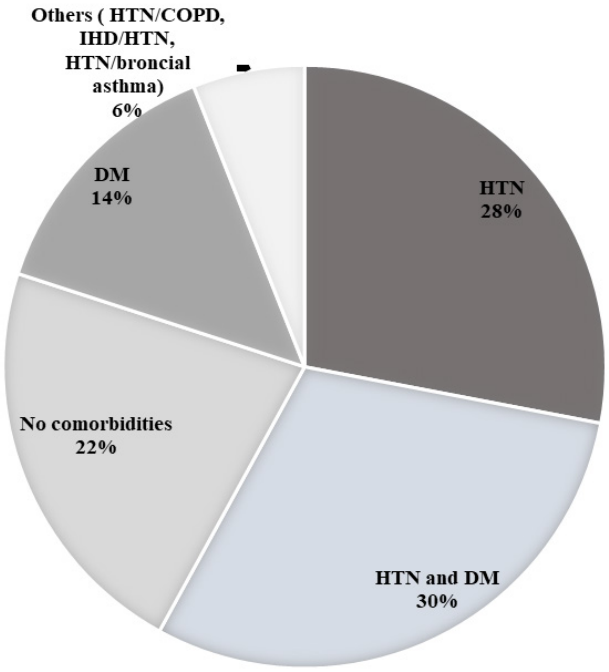

Figure 1: Hypertension and diabetes representing the most common comorbid diseases in BPH patients)

Table 2: Aging-related changes in prostate weight and percentage of increase.

Age	group 1 (51-55)	group 2 (56-60)	group 3 (61-65)	group 4 (66-70)	group 5 (71-75)	group 6 (76-80)	group 7 (81-85)
TPW (gm)	50	58.2	63.09	67.56	72.75	78.2	81.5
Percentage increase in prostate weight (%)	2.22	2.58	2.8	3	3.23	3.47	3.62

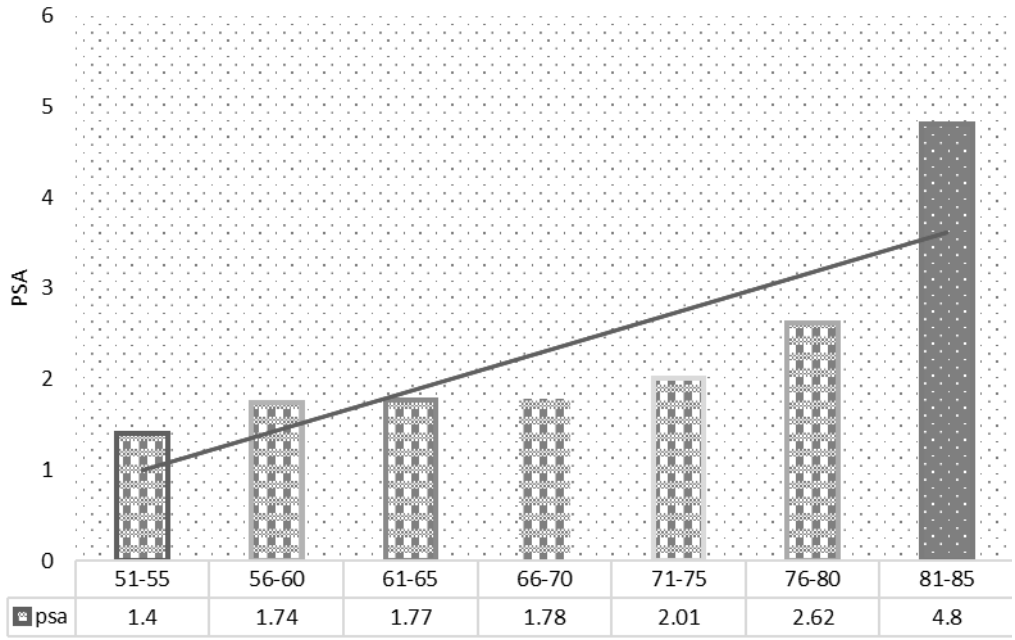

Figure 2: Significant correlation between PSA and age (p-value < 0.001).

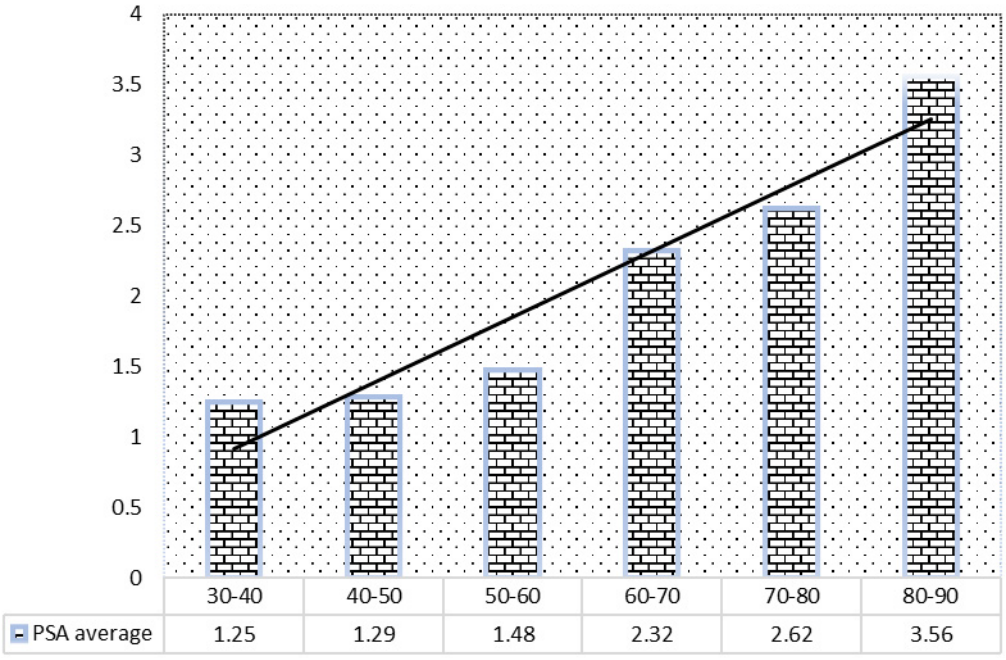

Figure 3: The correlation between PSA and prostate size is statistically significant (p-value < 0.001).

patients, particularly among those concurrently diagnosed with both hypertension and diabetes. These findings are consistent with the study by Michel et al. and Pritam Halder et al. (17), which also identified a significant association between BPH symptoms and various chronic conditions.

Age is a key risk factor for BPH in the aging population. Our data align with findings from Yang Xiong et al. (18), which reported that the majority of cases were observed in the age group of 71-75 years, followed by those aged 61-65 years. Additionally, our study indicated that prostate size typically increases with advancing age. This is in agreement with Zhang et al. (19), who found that prostate size serves as a good predictor for growth rate. Conversely, a study by Elijah A. et al. (20), noted a weak correlation between prostate size (volume) and age.

Serum prostate-specific antigen (PSA) levels vary across different age groups. Our study demonstrated a significant relationship ($p<0.001$) between PSA levels and patient age, corroborating the findings of M.M. Kirollos et al. (2), which indicated a rise in PSA with age. Moreover, our results showed a strong positive correlation between PSA levels and prostate size, consistent with observations

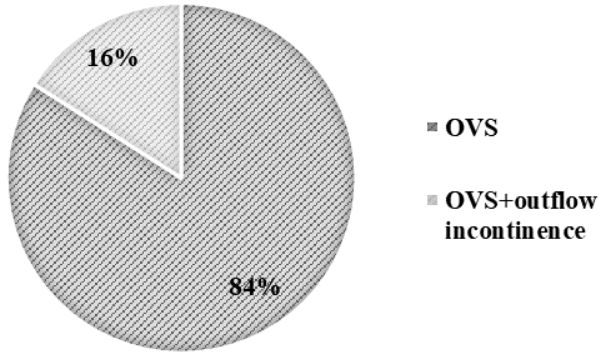

Figure 4: Obstructive voiding symptoms with outflow incontinence presenting the highest presenting symptoms.

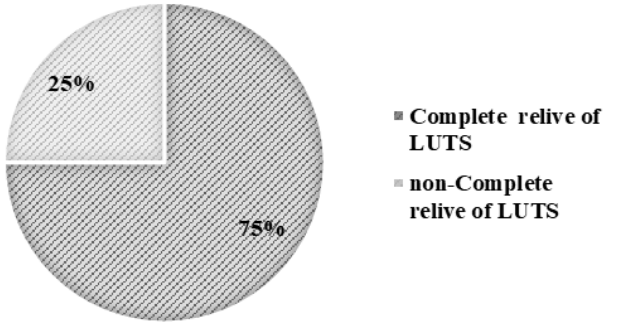

Figure 5: Dramatic symptoms relief after tamsulosin treatment crossing the 75%.

Table 3: Comparison of urodynamic parameters before and after treatment.

Urodynamic parameters	Before Treatment Mean ± SD	After Treatment Mean ± SD	P Value (t test)
PVR (ml)	56.31 ± 44.97	27.8 ±11.8	0.0002
Qmax (ml/s)	6.9 ± 4.6	13.1 ± 6.9	0.0004
Detrusor pressure at maximum flow (cmH20)	66.7 ± 34.6	53.6 ± 26.5	0.0562

made by Das AG et al. (22), who reported a progressive increase in both prostate size and PSA.

Eighty-four percent of BPH patients in our study presented with obstructive voiding symptoms and urinary incontinence, corroborating the findings of Aruna V. Sarma et al. (23), which indicated that obstructive symptoms are the most common presentation, occurring in more than half of men in their 60s and increasing with age. Our results showed that 75% of lower urinary tract symptoms (LUTS) were completely relieved with a daily dose of 0.4 mg tamsulosin throughout 1 to 3 months, demonstrating excellent safety and no development of tolerance. This aligns with findings from Kim KS et al. (24), which highlighted the potential advantages of tamsulosin in treating BPH, including a rapid onset of action and straightforward dosing without the need for adjustments.

The results of this study demonstrate the efficacy of tamsulosin in improving various aspects of urinary function in men with symptomatic benign prostatic hyperplasia (BPH). The statistically significant improvements in peak voided volume (PVR) and maximum flow rate (Qmax) after three months of tamsulosin treatment suggest enhanced bladder emptying and improved urine flow, which are important factors in managing Lower Urinary Tract Symptoms (LUTS) associated with BPH. These results are consistent with previous research by Kaplan et al. (25) and Ren RM et al. (26) found that tamsulosin improved LUTS in men with BPH by increasing the maximum flow rate and reducing the residual volume. However, the change in detrusor pressure at maximum flow after three months of tamsulosin treatment was not statistically significant, suggesting that longer treatment may be needed to improve bladder compliance and overall bladder function further. This finding is consistent with the results of a previous study by Arnold et al. (27), which found that tamsulosin may have a more gradual effect on bladder function over time.

The use of alpha-adrenergic blockers as a first-line treatment for men with symptomatic BPH is particularly noteworthy due to their efficacy in rapidly alleviating Lower Urinary Tract Symptoms (LUTS), improving urinary flow, and enhancing the overall quality of life.

Conclusion

This study demonstrates the efficacy of alpha-adrenergic blockers, specifically tamsulosin, in improving urinary function in men with symptomatic benign prostatic hyperplasia (BPH). The results show that tamsulosin treatment significantly improves peak voided volume (PVR) and maximum flow rate (Qmax) in men with symptomatic BPH, suggesting improved bladder emptying and urine flow. However, the lack of significant change in detrusor pressure at maximum flow after three months of treatment highlights the need for further research to optimize treatment duration and achieve optimal bladder function. Overall, this study supports the use of alpha-adrenergic blockers as a first-line treatment for men with symptomatic BPH.

Limitations

This study acknowledges its retrospective design as a limitation, which may introduce biases inherent to this type of research. Additionally, the relatively small sample size of 51 patients may limit the generalizability of the findings to a broader population. While the subject of using alpha-adrenergic blockers for the management of benign prostatic hyperplasia (BPH) is well-established in urology, this study aimed to provide localized insights into treatment efficacy. We recognize that a more innovative and thorough approach, such as a prospective study design or the inclusion of a control group, could enhance the robustness of the findings. Future research could also explore comparative analyses with other treatment options or incorporate a larger and more diverse patient population to strengthen the conclusions drawn from this study.

Suggestions for Future Research

Prospective Study: Conducting a prospective study could provide stronger evidence for causality and allow for the assessment of additional variables.

Larger Sample Size: A larger sample size would increase the statistical power of the study and improve the generalizability of the findings.

Multicenter Study: A multicenter approach could address the limitations of a single-center study and enhance the external validity of the findings.

Comparison with Other Treatments: Comparing the outcomes of tamsulosin treatment to other BPH medications or surgical interventions could yield valuable insights.

Funding

None

Conflicts of Interest

There are no conflicts of interest.

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