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Impact of Benign Prostatic Hyperplasia Medications on Post Void Residual Volume: A Retrospective Study

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ABSTRACT

Introduction: A Benign Obstructive Uropathy (BPH) is a commonly observed cause of Bladder Outlet Obstruction (BOO) among old males. A clinical concern associated with this condition in the form of associated complications such as recurrent urinary tract infection, acute urinary retention and post renal failure.
The Post Void Residual volume (PVR) is considered as a good prognostic tool in ways of diagnosis and follow up the patients with BPH. Hence, this retrospective cross-sectional study aims to evaluate the efficacy of various BPH medications in the reduction of PVR. Accordingly, data were gathered from medical records of patients treated in Salmaniya Medical Complex in the Kingdom of Bahrain over two years. The result offers an insight into the value of various medical therapy in treatment of high PVR.
Methodology: In this study we collected data retrospectively from urology clinics from August 2022 to August 2024. The study included men aged 40 years old and older who were diagnosed with bladder outlet obstruction secondary to BPH at Salmaniya Medical Complex in the Kingdom of Bahrain. BPH was confirmed through combination of clinical symptoms as well as utilizing the International Prostate Symptom Score (IPSS) along with radiological assessment via trans-abdominal ultrasound demonstrating an enlarged prostate volume more than 25 ml. However, the study excluded patients who had incomplete medical records, previous surgical interventions, and presence of concomitant urological conditions that could compromise bladder function or patients receiving BPH treatment at facilities other than Salmaniya Medical Complex.
Result: A total of 220 patients' data were collected in the study. However, 19 patients were excluded from the study due to excluding criteria. Moreover, the patients divided into two groups; group with Alpha-Blockers treatment "group A": total of 101 Patients in this treatment group presented a mean baseline for PVR of 90 ± 25 ml which decreased to 65 ± 20 ml in the 12 month, resulting a mean reduction of 25 ml. On the other hand, the group with Combination Therapy "group B": total of 100 patients demonstrated the most significant improvement, with a mean baseline for PVR of 90 ± 35 ml, that reduced to 50 ± 15 mL at 12 months, resulting in a mean reduction of 40 ml. In addition, patients with a higher baseline of PVR (>100 ml) presented with more significant improvements in both treatment manners. Although, in combination therapy group, patients with a baseline PVR greater than 100 ml achieved an average reduction of 45 ml, in alpha-blockers group all baseline PVR levels consistently

reduced. Accordingly, in combination therapy group the treatment was particularly effective for patients with prostate sizes exceeding 40 ml.
Conclusion: This study highlights the significance of BPH medications in improving patient condition, mainly focusing on PVR treatment. It emphasizes that this treatment should be adapted for specific characters and preferences of the patients. However, more prospective studies are needed to not only confirm the efficacy of the medical treatment, but also to study the long-term efficacy of these medications on patient health and quality of life.

Keywords: Benign prostatic hyperplasia, post void residual volume, Alpha blockers, 5 Alpha reductase inhibitors, Bladder outlet obstruction.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is one of the most common causes of Bladder Outlet Obstruction (BOO) among men. Clinically proven it is the most common benign tumor in males where its prevalence increases with aging, reaching 80% at the age of 80 years old, this is due to glandular epithelial tissue and smooth muscle proliferation in the transition zone of the prostate [1,2].

Lower Urinary Tract Symptoms (LUTS) are usually associated with various etiologies including urinary tract infection, detrusor under activity, bladder stones, bladder cancer, and most commonly bladder outlet obstruction, thus including storage symptoms (Urgency, frequency, nocturia, and urgency incontinence) and voiding symptoms (hesitancy, intermittent stream, straining to void, prolonged micturition, feeling of incomplete emptying, and dribbling) [1,2].

In way to diagnose men with BOO due to BPH it is essential to take a detailed history of the nature of their symptoms to rule out other possible factors as some medical conditions (such as cardiovascular diseases and diabetes mellitus), medications; for example, diuretics medications, lifestyle and dietary habits that may contribute to his presenting symptoms. Physical examination in form of digital rectal examination (DRE) where it can estimate the prostate size, presence of nodules, and texture of prostate. Moreover, investigations usually include laboratory (baseline urinary function test, urine analysis and PSA) and imaging (ultra-sound prostate transabdominal or transrectal), that used to estimate the prostate volume and check Post Void Residual volume (PVR) which is the amount of urine remaining in the bladder after micturition [3,4].

The commonly accepted range of PVR is 0-50 ml. However, an increased amount of PVR (>90) signifies the improper emptying of the bladder, which may be associated with bladder outlet obstruction or detrusor underactivity [5]. This issue warrants medical attention toward the early interventions as it may lead to urinary retention, formation of bladder stones, recurrent urinary tract infection and may lead to post renal injury in some circumstances [6].

Accordingly, after establishing the diagnosis of BOO due to BPH the initial treatment depends on International Prostate Symptoms Score (IPSS) that includes lifestyle modification in non-bothersome symptoms and medical and/or surgical interventions according to the symptom severity, the medical therapy includes alpha blockers which help in the relaxation of smooth muscles fiber in the bladder neck and prostate which significantly improve the voiding symptoms but it has not effect on the prostate size [7,8]. The advantages found in 5-alpha reductase inhibitors medications as they help to shrink the prostate size, and they are recommended for men with prostate volume more than 40 ml as well as they promote a long-term effect. Moreover, the combination of these two medications provides a synergetic effect that effectively treats the LUTS and provides a long-term effect, the term used as dual therapy [1,3,6].

The aim of this study is to evaluate the impact of BPH medications on postvoid residual volume which will help improve our standing and management of patients with BPH.

MATERIALS & METHODS

In this study we collected the data retrospectively from 4 urology clinics in Salmaniya Medical Complex in the Kingdom of Bahrain from August 2022 to August 2024.

This study is a retrospective study, by which data was collected from the daily urology outpatient clinics in Salmaniya Medical Complex in the Kingdom of Bahrain. Each clinic has been selected randomly from each day. The participants' information and records were sourced from the electronic medical records system (i-Seha database) from each urology clinic according to inclusion and exclusion criteria. Moreover, all patients' information and data were confidential. To achieve a proper sample size, we considered the confidence interval 95%, margin of error 5%, population proportion 50%, and population size 500. Hence, 218 measurements were needed to have a confidence level of 95% that the real value is within ±5% of the measured value. However, we chose 220 participants from urology clinics. This method helped reduce bias in selecting the sample among the four clinics.

The study included male patients aged 40 years old and above, who were diagnosed of BPH confirmed through combination of clinical symptoms as well as utilizing the International Prostate Symptom Score (IPSS) *figure3 in appendices* along with radiological assessment via trans-abdominal ultrasound demonstrating an enlarged prostate volume more than 25 ml. Furthermore, in our clinics all patients undergoing transabdominal ultrasound prostate are also investigated for Post void Residual (PVR) volume in ml. The Follow-up plan for PVR measurements were also recorded 6- and 12-months after starting of treatment. In addition, the ultrasound device used was a GE LOGIQ E9 ultrasound machine (General Electric, Boston, MA) using a curvilinear 5-7.5 Hz transducer probe and all measurements were conducted by a senior radiologist.

Exclusion Criteria

In this study we excluded patients who had incomplete medical records, previous surgical interventions for BPH, such as transurethral resection of the prostate (TURP), holmium laser enucleation of the prostate (HOLEP), prostatectomy, or bladder neck incision and patients with the presence of concomitant urological conditions that could compromise bladder function, such as detrusor inactivity. Moreover, the patients who are receiving BPH treatment at facilities other than Salmaniya Medical Complex.

STATISTICAL ANALYSIS

The statistical analysis was conducted to examine the type of medication and PVR among two different groups. The collected data was analyzed by the Statistical Package for Social Sciences (SPSS) software version 26.0. Categorical variable (type of medication) was compared against the continuous variable (PVR) to determine the effect of different medication on the PVR outcome. In addition, descriptive statistical analysis was used to summarize the data including the mean and standard deviation (SD) of PVR for both groups. Moreover, *t*-test used to compare the PVR mean in both groups, and a *P* value of <0.05 was considered statistically significant.

RESULT

The study included 220 patients. However, 19 patients were excluded due to not meeting the inclusion criteria, as 11 patients previously had surgical intervention for benign prostatic hyperplasia (BPH). 5 patients received treatment in another healthcare facility, and 3 patients were found to have incomplete medical records. Accordingly, the total 201 patients were divided into two groups, group A (Alpha-Blockers treatment) with 101 patients, and

group B (Combination Therapy) with 100 patients.

Our sample showed that the mean age of patients was 60.3 years old with the highest age 84 years old and lowest age 48 years old. The patients had varying degrees of lower urinary tract symptoms, where the majority patients 134 (67%) had predominant irritative voiding symptoms, while 67 patients (33%) had predominantly storage symptoms, as demonstrated by Figure 1.

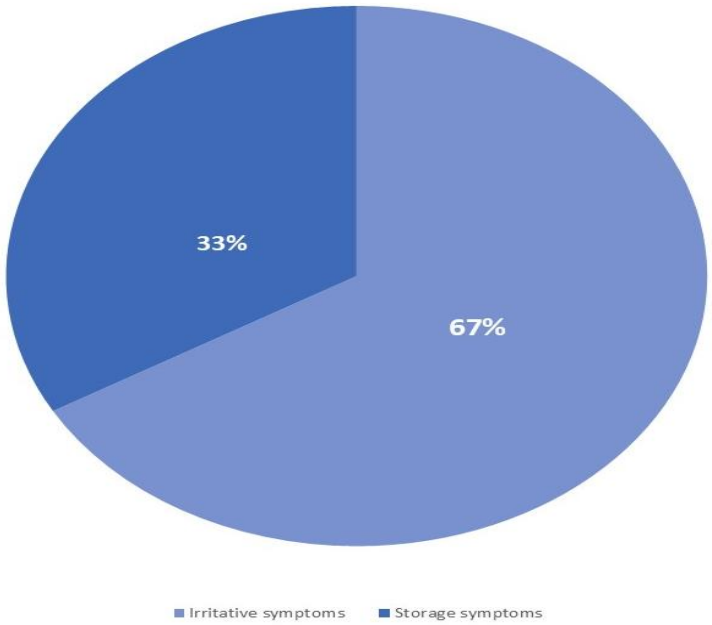

Figure 1: Comparison of the number of patients with main symptoms at presentation.

Furthermore, the mean prostate volume was 30.5 ml in 60% of the patients with maximum volume of 95 ml and minimum 25 ml. Moreover, the average PSA level measured was 3.2 g/l and maximum level 12 µg/l.

Moreover, the participant's baseline post-void residual (PVR) volumes ranged from 90 to 180 ml, with a mean value of 90 ml. The PVR reduction by treatment manner in the study differed in both groups. In group A with Alpha-Blockers treatment, 101 patients presented a mean baseline for PVR of 90 ± 25 ml which decreased to 65 ± 20 ml in the 12th month, resulting in a mean reduction of 25 ml (*p*-value = 0.03). While in group B with Combination Therapy, 100 patients presented a significant improvement, with a mean baseline for PVR of 90 ± 35 ml, that reduced to 50 ± 15 mL in 12 months, resulting in a mean reduction of 40 ml (*p*-value = 0.01). Hence, *t*-test was used to compare the PVR mean in both groups, table 1 presents in detail the comparison in the improvement pre and post medication in both groups.

Table 1 PVR (mL/s) Reduction After Medication in Groip A and B

Group	**Baseline PVR Mean**	**12 Months PVR Mean Post Medication**	**The Difference in PVR Mean**	***p*-value**
Group A	90 ± 25	65 ± 20	25	0.03
Group B	90 ± 35	50 ± 15	40	0.01

p-value < 0.05 is considered significant.

Significance Key:

- $p < 0.05$ = Significant (S)
- $p \geq 0.05$ = Non-significant (NS)

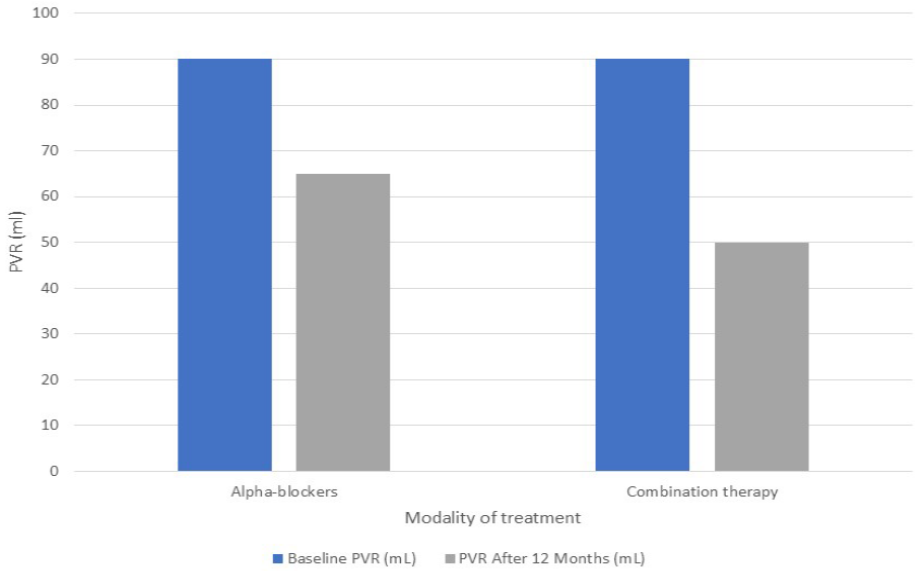

Figure 2: Comparison of PVR reduction by treatment modality

In addition, patients with a higher baseline of PVR (>100 ml) presented with more significant improvements in both treatment manners. Although, in combination therapy group, patients with a baseline PVR greater than 100 ml achieved an average reduction of 45 ml, in alpha-blockers group all baseline PVR levels consistently reduced. Accordingly, in combination therapy group the treatment was particularly effective for patients with prostate sizes exceeding 40 ml.

DISCUSSION

The post-void residual volume (PVR) is a good screening tool in men with BOO which can provide an understanding of patient bladder function capacity. Hence, the possible symptoms and complications might be associated with high PVR [5]. It can be measured using urethral catheterization as a known gold standard, but it can lead to false results of prolonged time of urination and PVR measurement, moreover, it is an invasive procedure [9,10].

Within our clinical settings, the routine measurement of PVR done by trans-abdominal US by radiologist, which is supported by a study conducted by Mittal M, et al, 2023 [11] and Thekumpadam Puthenveetil R, et al, 2015 [12] that concluded the effect of ultra-sound abdomen in diagnosis and monitoring the response of treatment in BPH patients.

Although it is known that BPH is the most common cause of BOO which may lead to significant morbidities and complications, it is encouraging the clinicians to determine the significance of PVR in such patients to provide the needed treatment. Hence, medical treatment is the standard of initial treatment in symptomatic patients, and we aimed to study the impact of commonly used BPH medications (including Alpha-blockers and Dual therapy) on PVR. Additionally, we found that PVR is significantly improved after initiation of the therapy in terms of PVR measurement and symptom improvement. Moreover, we found that the most improvement is with higher PVR and bigger prostate size, who started on dual therapy. Notably, the initiation of dual therapy poses some challenges in terms of medication side effects and cost effectiveness. This concept is well established in the MTOP trial which concluded that dual therapy has been shown to be more effective than monotherapy or placebo [13].

Moreover, Yoosuf BT, et al, 2024 conducted a study that assessed the alpha blockers as monotherapy and analysis revealed an overall improvement of PVR, IPSS score and maximum urinary flow rate (Q-max) [14]. In view of this result another prospective cohort study conducted by Bagus I, et al, 2024 showed improvement of PVR and Q-max started after one month from initiation of

therapy and maximum after three months [15]. These results were conducted on prospective manners which insight more accuracy than that in our study, as we studied the efficacy of therapy after 6 and 12 months that might be affected by patient conduction of therapy or additional medications were given during the observational period.

Kim JH, et al, 2018 [16] proved the effectiveness of 5 alpha reductase inhibitor in improvement of PVR with an average follow up 21.8 months.

Interestingly, none of these studies addressed the potential effect of dual therapy as in our study.

Limitations

This study has some limitations such as the small number of candidates in retrospective design that does not allow for proper follow up of the patients, as the patients may have taken additional medications during the period of observation.

Moreover, the period of assessment is long, hence, new symptoms may develop during this period. In addition, due to ultrasound being the modality of choice for imaging and follow up, a limitation is expected in this study since not all patients were imaged by the same radiologist which can introduce operator variability in reports and affect data outcomes.

While other studies suggest for secondary PVR assessment in measurement of PVR by trans-abdominal US to enhance the accuracy of the assessment like a study conducted by M S, F S, 2021 [17] and in another study by Karayas, 2019 [4]. Which is differ than our practice.

CONCLUSION

This study highlights the significance of BPH medications in improving patient condition, mainly focusing on PVR treatment. It emphasizes that this treatment should be adapted for specific characters and preferences of the patients. However, more prospective studies are needed to not only confirm the efficacy of the medical treatment, but also to study the long-term efficacy of these medications on patient health and quality of life.

Declaration by Authors

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Conflict of Interest: The authors declare no conflict of interest.

Appendices

International Prostate Symptom Score (I-PSS)

In the past month:	Not at All	Less than 1 in 5 times	Less than Half the Time	About Half the Time	More than Half the Time	Almost Always	Your Score
1. Incomplete Emptying How often have you had the sensation of not emptying your bladder?	0	1	2	3	4	5	
2. Frequency How often have you had to urinate less than every two hours?	0	1	2	3	4	5	
3. Intermittency How often have you found you stopped and started again several times when you urinated?	0	1	2	3	4	5	
4. Urgency How often have you found it difficult to postpone urination?	0	1	2	3	4	5	
5. Weak Stream How often have you had a weak urinary stream?	0	1	2	3	4	5	
6. Straining How often have you had to strain to start urination?	0	1	2	3	4	5	
	None	1 time	2 times	3 times	4 times	5 times	
7. Nocturia How many times did you typically get up at night to urinate?	0	1	2	3	4	5	
Total I-PSS Score							
Score:	1-7 Mild		8-19 Moderate		20-35 Severe		

The first seven questions of the I-PSS are from the American Urological Association (AUA) Symptom Index

Quality of Life Due to Urinary Symptoms

	Delighted	Pleased	Mostly Satisfied	Mixed	Mostly Dissatisfied	Unhappy	Terrible
If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?	**0**	**1**	**2**	**3**	**4**	**5**	**6**

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