ORIGINAL PAPER

One-month postoperative α-blocker therapy reduces morbidity and increases patients' satisfaction and well--being following water jet aquablation for treating benign prostatic obstruction: a randomized prospective trial

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Introduction The study aimed to evaluate whether continuing α-blocker therapy for one month after aquablation improves early clinical outcomes in patients undergoing surgery for benign prostatic obstruction (BPO).

Material and methods This prospective, single-center study enrolled 240 consecutive patients with symptomatic BPO who underwent aquablation between 2023 and 2025. Patients were divided into two cohorts: cohort A (n = 120) discontinued BPH medications postoperatively, while cohort B (n = 120) continued α-blocker therapy for one month. Functional, sexual, and safety outcomes were assessed at 3, 6, and 12 months using validated tools (IPSS, QoL, VAS, IIEF, MSHQ-EjD-SF, SF-ICIQ). Statistical analysis was used to compare symptom scores, complication rates, and retreatment frequencies between groups.

Results Both cohorts experienced significant symptom improvement following aquablation. However, cohort B showed superior early outcomes, including a greater reduction in irritative symptoms (p = 0.014 at 3 months; p = 0.02 at 12 months), lower VAS pain scores, and fewer postoperative complications (22.5% vs 30.8%, p = 0.15), with nonsignificantly lower rates of moderate (Grade II) complications in cohort B. Sexual function remained stable in both groups, with cohort B demonstrating improved ejaculatory function scores at all time points. No increase in adverse events was observed with continued use of α-blockers.

Conclusions Short-term continuation of α-blocker therapy following aquablation enhances early postoperative recovery, reduces complications, and improves patient-reported well-being without compromising sexual or functional outcomes. Routine one-month α-blocker therapy is a valuable adjunct in aquablation postoperative care.

Key Words: aquablation ‹› benign prostatic hyperplasia ‹› bladder outlet obstruction ‹› α-blocker

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a common condition that leads to prostatic enlargement and lower urinary tract symptoms (LUTS). It affects approximately 50% of men aged 60 and older and up to 80% of men aged 80 and older [1]. Treatment for BPH ranges from conservative approaches such as watchful waiting to various medical and surgical interventions. Medical therapies include α-1

selective adrenergic receptor antagonists (AB), often combined with 5α-reductase inhibitors (5-ARIs), phosphodiesterase type 5 inhibitors, and phytotherapy [2]. Surgical options are considered for patients who continue to experience persistent symptoms despite medical treatment. Surgery may also be necessary in cases of urinary retention, significant hematuria, bladder stone formation, recurrent urinary tract infections, or upper urinary tract deterioration [3]. In recent years, minimally invasive surgical approaches have gained popularity due to their technical simplicity and potential for outpatient management [4]. Aquablation (AquaBeam System, PROCEPT BioRobotics, Inc., USA), which received FDA approval in December 2017, is a robotically assisted, surgeon-guided procedure that utilizes high-pressure water jet technology combined with real-time ultrasonography [5]. It has a short learning curve, offers rapid tissue resection, and is effective for small and large prostates. Early studies have demonstrated that aquablation provides non-inferior symptom relief compared to transurethral resection of the prostate (TURP) [6].

Following aquablation, residual "fluffy" tissue often remains in the surgical bed [7]. This tissue appears loose and soft, resulting from the water-shearing effect, the healing process, or fragmented prostate tissue. During early postoperative cystoscopic monitoring, signs of tissue reorganization are typically observed, with "fluffy tissue" gradually becoming more organized and dense as healing progresses. We have performed cystoscopy examinations in aquablation patients in our services and noticed that sloughing of the fluffy tissue usually occurs during the first postoperative month. We therefore suggest that α-blocker medical therapy, one month after aquablation, may help alleviate persistent symptoms and improve patient outcomes, particularly for those who experience bothersome symptoms after surgery.

MATERIAL AND METHODS

This was a prospective, single-center study conducted from the initiation of aquablation implementation at our department (2023–2025). All patients were followed prospectively from the first case of aquablation performed at our institution.

Patients were divided into two chronologically determined historical cohorts, reflecting a change in departmental postoperative management. During the first 120 consecutive aquablation procedures (cohort A), all BPH medications were discontinued immediately after catheter removal. As part of the early learning curve, the department adopted a standardized postoperative protocol in which the next 120 consecutive patients (cohort B) continued α-blocker therapy for one month after surgery. Thus, while data collection was fully prospective, cohort allocation was based on temporal sequence rather than randomization. Postoperative continuation in cohort B consisted primarily of α-blockers, most commonly tamsulosin 0.4 mg once daily (>80% of patients), with silodosin 8 mg or alfuzosin 10 mg used in the remainder. Postoperative continuation in cohort B consisted primarily of α-blockers, most commonly tamsulosin 0.4 mg once daily (>80% of patients). A minority of patients continued their chronic preoperative α-blocker (silodosin or alfuzosin) to avoid unnecessary medication switching. A small number of patients also continued long-term 5-α reductase inhibitor therapy (finasteride or dutasteride); no new 5-ARI prescriptions were initiated postoperatively. Medication adherence was assessed at each follow-up visit through patient self-report. All enrolled patients met the inclusion criteria, which included BPO, an International Prostate Symptom Score (IPSS) >8, a maximum flow rate (Q_{max}) <10 ml/s, and clinically confirmed prostate enlargement. Exclusion criteria included LUTS due to conditions unrelated to BPO.

A comprehensive urological examination was performed on all patients, including a digital rectal examination, upper and lower urinary tract ultrasound (with prostate volume evaluation), and assessment of subjective measures such as the International Prostate Symptom Score (IPSS), Quality of Life (QoL), irritative score, Short Form Incontinence Questionnaire-Urinary Incontinence (SF-ICIQ) Score, the International Index of Erectile Function (IIEF) Score, and the Male Sexual Health Questionnaire for Ejaculatory Dysfunction Short Form (MSHQ-EjD-SF) to evaluate ejaculatory dysfunction. Objective measures included Q_{max} (ml/s) and post-void residual (PVR; ml), which were monitored throughout the study. Additionally, demographic parameters such as age, body mass index (BMI), comorbidities, and use of anticoagulants or antiplatelet medications were recorded. Surgical details, including total surgical time (in minutes, defined as the time from the start of the procedure until the placement of the catheter after intervention), hemoglobin drop (g/dl), and treatment-related adverse events, were graded according to the Clavien–Dindo classification. Patients were monitored at three, six, and twelve months after surgery, with annual follow-ups thereafter.

Statistical analysis

Statistical analysis was performed using Prism 9 for macOS (version 9.5.0). Continuous variables were expressed as means ± standard deviations (SD), and categorical variables as frequencies and percentages. Between-group comparisons were made using t-tests or Mann-Whitney U tests for continuous variables and chi-square or Fisher's exact tests for categorical variables. Changes over time were analyzed using repeated-measures ANOVA or mixed-effects models. A p-value <0.05 was considered statistically significant.

A CONSORT flow diagram summarizing patient enrollment, chronological cohort allocation, follow-up completion, and inclusion in the final analysis is presented in Figure 1.

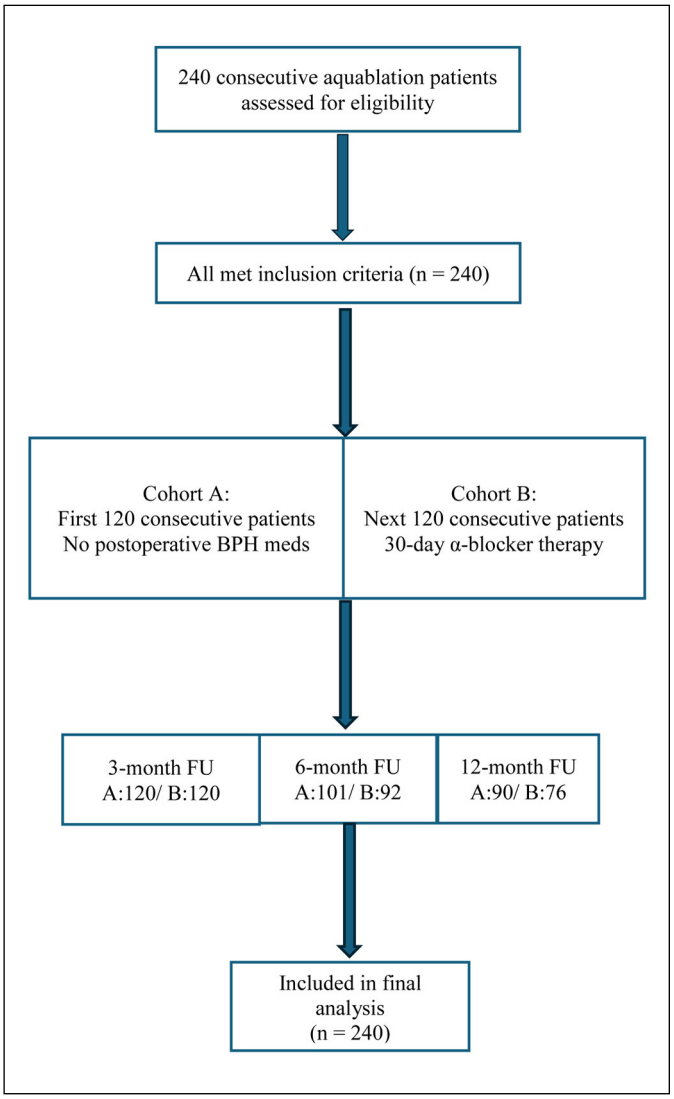

Figure 1. *CONSORT flow diagram of patient enrollment, cohort allocation, follow-up, and analysis.*

Bioethical standards

The study adhered to the principles outlined in the Declaration of Helsinki and received approval from the Shaare Zedek Medical Center Institutional Review Board (IRB number: SZMC-0058-25).

RESULTS

Baseline demographics

A total of 240 consecutive patients undergoing aquablation were enrolled in the study. All patients met the eligibility criteria and were divided into two cohorts of 120 each. Follow-up assessments were conducted at 3, 6, and 12 months and annually. In cohort A, follow-up was completed for 120, 101, and 90 patients at 3, 6, and 12 months, respectively. Six patients died from causes unrelated to the aquablation procedure. In cohort B, the follow-up duration was smaller, as data collection is still ongoing, with 120, 92, and 76 patients completing follow-up at 3, 6, and 12 months, respectively.

Table 1 summarizes baseline characteristics. There were no significant differences between cohorts

Table 1. *Baseline characteristics*

Variable	Cohort I (n = 120)	Cohort II (n = 120)	p-value
Age ±SD, years	73.4 ±8.1	70.3 ±8.1	**0.004**
BMI (kg/m^2), ±SD	26.6 ±3.9	27.9 ±4.1	**0.018**
Prostate volume (cm^3), ±SD	91.4 ±34.9	95.7 ±40.8	0.384
Median lobe present, n (%)	45 (37.5)	48 (40)	>0.999
Prior catheter n (%) Urethral catheter Clean intermittent catheterization	47 (39.1) 44 (36.6) 3 (2.5)	37 (30.8) 27 (22.5) 1 (0.8)	0.15
Prior prostate surgery, n (%)	4 (3.3%)	1 (0.83)	>0.999
Antithrombotic use, n (%) Anticoagulation Aspirin	18 (15) 35 (29.1)	7 (5.8) 41 (34.1)	>0.999
BPH medication use n (%) α-blocker 5-ARI α-blocker/5-ARI	 71 (59.1) 4 (3.3) 17 (14.1)	 88 (73.3) 12 (10) 14 (11.6)	 **0.028** 0.067 0.700
Baseline Questionnaires IPSS score, mean ±SD IPSS QoL score, mean ±SD Irritative score, mean ±SD SF-IIEF-5, mean ±SD MSHQ-EjD, mean ±SD	 24.3 ±6 5 ±1.1 10 ±3.9 19.8 ±7.8 8.8 ±4	 25.1 ±5.8 5.3 ±1.4 10.8 ±3.5 18.2 ±10.4 9.2 ±4.8	 0.821 0.630 >0.999 0.329 0.072

5-ARI – 5α-reductase inhibitor; BMI – body mass index; BPH – benign prostatic hyperplasia; IPSS – International Prostate Symptom Score; MSHQ-EjD – Male Sexual Health Questionnaire Short Form; QoL – Quality of Life; SD – standard deviation; SF-IIEF – Short Form International Index of Erectile Function

regarding prostate volume, presence of a median lobe, prior prostate surgery, or use of antithrombotic medications. However, patients in cohort A were significantly older than those in cohort B (mean age 73.4 vs 70.3 years, p = 0.004). α-blocker use at the time of surgery was significantly higher in cohort B (73.3%) compared to cohort A (59.1%, p = 0.028), while no significant differences were observed in 5-ARI or combination therapy use (p = 0.067 and p = 0.700, respectively). The rate of prior urinary catheterization was similar between cohorts (p = 0.15). In cohort A, 44 (36.6%) patients required indwelling catheters, and 3 (2.5%) used clean intermittent catheterization (CIC), primarily for acute urinary retention (35.8%) and a few for chronic retention (2.5%). In cohort B, 27 (22.5%) patients required indwelling catheters, and 1 (0.83%) patient used CIC, with 29.1% experiencing acute retention and only one case of chronic retention.

Urinary functional outcome

Both cohorts presented with severe lower urinary tract symptoms (LUTS), as indicated by a median IPSS score of 24.3 ±6 in cohort A and 25.1 ±5.8 in cohort B (p = 0.821). The median IPSS quality of life (QoL) subscore was 5 in both cohorts. Both groups demonstrated clinical improvement sustained throughout the year; however, the most pronounced difference occurred at 3 months postoperatively, where cohort B showed a greater reduction in IPSS (16.1 vs 18.6 points, p = 0.054). The QoL subscore improved similarly in both cohorts, with no significant difference during the follow-up period (p = 0.286).

The most notable differences between cohorts were observed in irritative symptom scores and Visual Analogue Scale (VAS) assessments. At 3 months, the reduction in irritative symptoms was significantly greater in cohort B (3.9 vs 2.7, p = 0.014), a difference that persisted at 12 months (1.2 vs 2.8, p = 0.02), indicating a sustained advantage in symptom relief in cohort B. Likewise, VAS scores favored cohort B, with significantly lower values at both 3 months (0.1 vs 0.9, p = 0.013) and 12 months (0.1 vs 0.4, p = 0.01).

35.8% of patients in cohort A reported urgency urinary incontinence at baseline, which decreased to 22.5% at 3 months, 12.5% at 6 months, and 10.8% at 12 months. Among those reporting leakage, the mean SF-ICIQ score improved from 6.4 at baseline to 4.4 at 3 months and remained stable throughout the year (average change of -2.0 points). In cohort B, 27.5% reported urgency urinary incontinence at baseline, decreasing to 15.8% at 3 and 6 months and further decreasing to 8.3% at 12 months. Their SF-ICIQ score improved from 6.3 to 4.6 at 3 months, 4.4 at 6 months, and 4.1 at 12 months (a total improvement of –1.7 to –2.2 points).

Regarding objective voiding parameters, both Q_{max} and PVR improved in both cohorts; however, the improvement was more pronounced in cohort B over time.

Sexual functional outcome

In both cohorts, erectile function (EF-IIEF) and ejaculatory function (MSHQ-EjD) scores were assessed at baseline and 3, 6, and 12 months postoperatively.

At baseline, EF-IIEF scores were comparable between the two cohorts (cohort A 19.8 ± 7.8, cohort B 18.2 ±10.4; p = 0.329). Over time, both cohorts demonstrated stability in EF scores. At 3 months, cohort A showed a mean change of Δ19.6, while cohort B showed Δ20.3 (p = 0.529). Similar non-

Table 2. *Clinical outcomes*

Parameter	Cohort A			Cohort B			p-value		
	3 M	6 M	12 M	3 M	6 M	12 M	3 M	6 M	12 M
IPSS	8.2 ±7.1	5.8 ±5.7	5.8 ±5.9	6.5 ±6.5	5.2 ±5.3	5.2 ±4.9	0.054	0.399	0.392
IPSS QoL	1.4 ±1.5	1.3 ±2	1.1 ±1.5	1.2 ±1.4	1.1 ±1.2	0.8 ±1.5	0.286	0.348	0.122
Irritative	3.9 ±4.2	2.7 ±3.6	2.8 ±3.6	2.7 ±3.3	2.1 ±2.8	1.2 ±1.8	**0.014**	0.150	**0.02**
VAS	0.9 ±0.2	0.3 ±0.5	0.4 ±0.1	0.1 ±0.4	0.2 ±0.9	0.1 ±0	**0.013**	0.288	**0.01**
Q_{max} (cc/s)	14.5 ±8.3	13.8 ±7	19.2 ±7.2	15 ±6.2	17.8 ±5.4	19.2 ±4.3	0.597	**0.032**	1.0
PVR	183.2 ±86.4	169 ±94.3	142.3 ±123	176 ±82.4	171 ±23.1	182.6 ±35.2	0.509	0.821	**0.000**
EF-IIEF	19.6 ± 8.7	16.6 ±11.4	15.5 ±8.9	20.3 ±8.5	17.2 ±10	16.9 ±2.5	0.529	0.665	0.098
MSHQ-EjD-SF	9 ± 6	9.4 ±6.6	12 ±4.9	7.3 ±5.5	7 ±5.5	7 ±2.3	**0.023**	**0.002**	**0.000**

EF-IIEF – Short Form International Index of Erectile Function; IPSS – International Prostate Symptom Score; MSHQ-EjD SF – Male Sexual Health Questionnaire Short Form; PVR – post-void residual; QoL – Quality of Life; VAS – Visual Analogue Scale

significant differences were observed at 6 months (cohort A: 16.6, cohort B: 17.2; p = 0.665) and 12 months (cohort A: 14.8, cohort B: 16.9; p = 0.098). In contrast, ejaculatory function showed a consistent and significant advantage for cohort B. While baseline MSHQ-EjD-SF scores were similar (cohort A: 8.8 ±4.0; cohort B: 9.2 ±4.8; p = 0.072), cohort B outperformed cohort A at all postoperative timepoints. At 3 months, scores were 7.3 vs 9.0 (p = 0.023); at 6 months, 7.0 vs 9.4 (p = 0.002); and at 12 months, 7.0 vs 12.0 (p <0.001), highlighting a significant and sustained difference favoring cohort B.

Safety and retreatment rate

The overall complication rate is summarized in Table 3. A total of 37 patients (30.8%) in cohort A and 27 patients (22.5%) in cohort B experienced postoperative complications (p = 0.15). The most frequent events were Clavien–Dindo II complications, particularly blood transfusions, which occurred in 18 patients (15.0%) in cohort A and 11 patients (9.2%) in cohort B. Urinary tract infections were reported in 3 patients (2.5%) and 2 patients (1.7%), respectively. Grade I complications included urinary retention (6 vs 4 cases) and hematuria (4 vs 3 cases). Grade III complications were uncommon in both groups. They consisted primarily of reinterventions, such as suprapubic catheter insertion (3 cases in cohort A), fulguration for postoperative bleeding (1 case vs 5 cases), and isolated procedures, including meatoplasty (1 case in cohort A) and cardiac catheterization (1 case in cohort B). Grade III complications were uncommon in both groups and consisted primarily of reinterventions, such as suprapubic catheter insertion (3 cases in cohort A), endoscopic fulguration for postoperative bleeding, which was performed in a moderate number of patients in both cohorts (1 case in cohort A and 5 cases in cohort B), and isolated procedures, including meatoplasty (1 case in cohort A) and cardiac catheterization (1 case in cohort B). No grade IV complications were observed. It should be emphasized that several bleeding events required a return to the operating room for endoscopic fulguration, and these were appropriately classified as Clavien–Dindo Grade III complications. All transfusions were administered in the postoperative period and were therefore graded as Clavien–Dindo II events.

Table 3. *Postoperative complications stratified by Clavien-Dindo grade*

	Cohort A (n = 120)	Cohort B (n = 120)	p-value
Clavien–Dindo score			
Grade I	10 (8.3)	8 (6.7)	0.62
Grade II	22(18.3)	13 (10.8)	0.09
Grade III	5 (4.2)	6 (5)	0.76
Grade IV	0	0	–
Total	37 (30.8)	27 (22.5)	0.15

Overall, although the difference in complication rates did not reach statistical significance, cohort B demonstrated fewer transfusions and catheter-related events, consistent with a lower burden of moderate (grade II) postoperative complications. In addition, five patients (4.1%) in cohort A required re-initiation of α-blocker therapy at the three-month follow-up, which was later discontinued; in contrast, no patients in cohort B required α-blockers beyond one month (p = 0.06). Surgical retreatment was significantly less frequent in cohort B, with only 4 patients (3.3%) requiring an additional TURP compared to 9 patients (7.5%) in cohort A (p = 0.041). Collectively, these findings suggest that short-term continuation of BPH medications after aquablation may reduce the need for transfusion, catheter-related interventions, and surgical retreatment, thereby lowering the overall postoperative burden.

DISCUSSION

Residual devitalized tissue following aquablation is commonly observed during early postoperative cystoscopy and may contribute to irritative symptoms during the healing phase; our findings provide further insight into how short-term continuation of BPH medications may modulate this early postoperative course.

Our findings have supported our hypothesis. There were statistically significant differences in the procedural safety and retreatment rates with or without BPH medication after aquablation; however, functional and sexual results remained similar regardless of the use of BPH medication, except for irritative and VAS scores.

Clinical outcomes in both groups were similar, as shown by Q_{max} (cohort A 7.8–15.4 compared to cohort B 6.9–19.2, p = 0.062) and IPSS scores (cohort A 24.3–5.8 compared to cohort B 25.1–5.2, p = 0.17). The scores were comparable to those from other studies of aquablation; IPSS dropped from 22.9 to 8.4, and Q_{max} increased from 8.7 to 18.2 ml/s [9]. The rate of dysuria reported in other clinical studies is generally low, likely due to the absence of cautery or laser energy use, as noted by Bhojani et al. [10]. In contrast, our trial included

the use of cautery for hemostasis. When comparing cohorts, we observed overall superior outcomes associated with the continued use of BPH medication. Specifically, cohort B exhibited a greater and more sustained reduction in irritative symptoms than cohort A. Despite having slightly higher baseline irritative scores, cohort B demonstrated a more rapid decline, reaching a mean score of 1.2 at 12 months, compared to 2.8 in cohort A.

Additionally, VAS scores were consistently lower in cohort B, suggesting that short-term continuation of medical therapy following aquablation may enhance early symptom relief. This observation may be attributed to ongoing anti-inflammatory and stabilizing effects of BPH medications, particularly α-blockers and 5-α-reductase inhibitors, during the early postoperative healing phase. These agents can reduce smooth muscle tone, alleviate bladder irritation, and mitigate inflammation of residual "fluffy" tissue, which may otherwise contribute to urgency, frequency, and discomfort. Thus, maintaining pharmacologic therapy for a limited period after aquablation may promote faster symptom resolution and improved patient comfort, as reflected in the superior early outcomes seen in cohort B.

The ejaculatory function was similar between the groups, with over 80% of patients maintaining antegrade ejaculation. It should be mentioned that we have recommended avoiding sexual intercourse for the month following surgery; therefore, use of α-blocker therapy did not cause any ejaculatory disturbance. This rate is slightly lower than the 90% reported in the WATER trial, which focused on aquablation in small to moderate-sized prostates [10]. Since preserving sexual quality of life, particularly antegrade ejaculation, is a key concern for many patients, the higher likelihood of maintaining ejaculation represents a meaningful advantage over traditional surgical techniques such as TURP (10–35%) and holmium laser enucleation of the prostate (HoLEP) (20–30%) [11, 12].

Finally, the safety of the procedure showed differences between the cohorts. Short-term urinary retention after the procedure was more common in cohort A. Although statistical significance was not established, the odds ratio was 1.82 times higher in cohort A compared to cohort B ($p = 0.220$). The difference might be explained by the improved detrusor contractility, reduced post-operative inflammation, and edema at the prostatic fossa. This combination likely contributed to better early postoperative bladder function in cohort B.

Bleeding events within the first postoperative month were more frequently observed in cohort A (18 vs 13 cases, $p = 0.336$), with a proportion of patients requiring a return to the operating room for endoscopic fulguration, classified as Clavien-Dindo grade III complications. All transfusions occurred postoperatively and were classified as grade II events. The overall bleeding profile likely results from multiple factors, including the early learning curve with aquablation, the presence of residual devitalized tissue during initial healing, and variability in patient comorbidities such as the use of antithrombotic therapy. However, this study was not designed to determine cause and effect. Although BPH medications might theoretically affect tissue stability or inflammation, their specific impact on bleeding risk cannot be firmly concluded from these data.

A key strength of this study is its prospective design, which evaluates the short-term continuation of BPH medications following aquablation and their impact on functional, safety, and patient-reported outcomes. The study included a relatively large sample size ($n = 240$), balanced cohort sizes, and consistent follow-up at 3, 6, and 12 months. The use of validated urological and sexual health questionnaires (IPSS, QoL, VAS, SF-ICIQ, IIEF, MSHQ-EjD-SF) allowed a comprehensive assessment across multiple domains.

Nonetheless, several limitations must be acknowledged. Most importantly, the use of chronological cohorts rather than randomization introduces potential time-related bias, including improvements in surgical efficiency, postoperative management, and familiarity with aquablation over time. Consecutive enrollment minimized selection bias, and all procedures were performed by the same surgical team using standardized operative and postoperative protocols; however, this cannot fully substitute for randomization, and the causal inference that continuation of BPH medications improves outcomes must therefore be interpreted with caution. The single-center design may further limit generalizability to broader populations and practice settings. Although most baseline characteristics were comparable, cohort A was significantly older than cohort B, which may have increased the risk of complications and slowed recovery. In addition, a higher proportion of patients in cohort B were already receiving α-blocker therapy preoperatively, which could have produced a "carry-over effect" that partially accounted for their superior relief of irritative symptoms and lower complication rates. Thus, while our findings support a potential benefit of short-term continuation of BPH medications, they should be interpreted with caution given these baseline imbalances. The follow-up period was limited to 12 months, precluding evaluation

of long-term retreatment rates, symptom recurrence, or re-initiation of medical therapy. Nevertheless, prospective follow-up of this cohort is ongoing, and updated long-term results will be analyzed and reported in the future. Future multicenter randomized controlled trials are warranted to validate our findings.

CONCLUSIONS

Short-term continuation of BPH medications after aquablation was associated with improved early symptom relief and lower complication and retreatment rates. While long-term functional and sexual outcomes were similar, ongoing medical therapy may enhance early recovery. Routine prescription of α-blocker therapy may be considered as part of the aquablation armamentarium, although further multicenter studies are needed to confirm the benefits.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

FUNDING

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ETHICS APPROVAL STATEMENT

The study was approved by the Shaare Zedek Medical Center Institutional Review Board (IRB number: SZMC-0058-25).

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