Received: 17 November 2025 | Accepted: 19 December 2025

DOI: 10.1002/bco2.70156

ORIGINAL ARTICLE

BJUI COMPASS

Outcomes of Aquablation in BPH with bladder stones: Analysis of the ICARUS database

Joshua D. Cabral[1] | Margaret Gannon[1] | Gregory Raster[1] | David J. Nusbaum[1] | David Bouhadana[2] | Adel Arezki[2] | Aalya Hamouda[2] | Anouk Leathead[3] | Ilan Ohana[4] | Rosie Foucault[5] | Iman Sadri[2] | Jeffrey A. Sioufi[2] | Nick Lee[3] | Tarek Benzouak[2] | Liam Murad[2] | Nicholas J. Corsi[6] | John Klein[7] | Inderjit Singh[7] | James Kearns[1,8] | Cecilia Chang[8] | Juan Justo Quintas[9,10,11] | Kevin C. Zorn[12] | Tiago Rodrigues[13] | Shawn H. Marhamati[7] | Brian T. Helfand[1,8] | Alexander P. Glaser[1,8]

[1]Department of Surgery, Division of Urology, University of Chicago, Chicago, Illinois, USA

[2]Department of Surgery, Division of Urology, McGill University, Montreal, Quebec, Canada

[3]Department of Surgery, Division of Urology, University of Montreal, Montreal, Quebec, Canada

[4]Department of Surgery, Division of Urology, University Laval, Quebec City, Quebec, Canada

[5]Department of Surgery, Division of Urology, University of Sherbrooke, Sherbrooke, Quebec, Canada

[6]Department of Urology, University of Texas Southwestern Medical Center, Dallas, Texas, USA

[7]Potomac Urology Center, National Harbor, Maryland, USA

[8]Department of Surgery, Division of Urology, Endeavor Health, Evanston, Illinois, USA

[9]ROC Clinic, Madrid, Spain

[10]Department of Urology, HM Hospitales, Madrid, Spain

[11]HM Hospitals Faculty of Health Sciences, Camilo José Cela University, Madrid, Spain

[12]BPH Canada, Prostate Surgical Institute, Montreal, Quebec, Canada

[13]Department of Surgery, Division of Urology, Hospital Cruz Vermelha, Lisbon, Portugal

Correspondence
Alexander Glaser, 2180 Pfingsten Road, Suite 3000, Glenview IL 60026, USA.
Email: aglaser@northshore.org

Abstract

Objective: The purpose of this study is investigate the clinical outcomes of men with benign prostatic hyperplasia (BPH) and bladder stones treated concomitantly with Aquablation and bladder stone removal in an international, multi-institutional cohort.

Patients and Methods: We performed a retrospective analysis of men who underwent Aquablation between 2018 and 2024. Patients were divided into two cohorts: men with bladder stones and those without. Outcomes assessed included baseline demographics and variables (medication use, prostate volume, prior BPH surgery), operative characteristics (OR time, transfusion requirement, complications), and functional outcomes were measured by the International Prostate Symptom Score (IPSS), peak urinary flow rate (Q_{max}) and PVR at regular intervals over 24 months.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.
© 2026 The Author(s). *BJUI Compass* published by John Wiley & Sons Ltd on behalf of BJU International Company.

Results: A total of 1885 men were analysed, including 60 men with bladder stones and 1825 without. Patients with bladder stones had higher rates of prior BPH surgery (15% vs. 5.5%, $p = 0.015$) and pre-operative urinary retention (28.3% vs. 14.8%, $p = 0.004$) as well as larger prostate volumes (98.6 ml vs. 77 ml, $p < 0.0001$). Total operative time was longer in the bladder stone group (76.5 mins vs. 55.0 mins, $p < 0.001$), but there were no significant differences in Aquablation time or bleeding complications including transfusions. There was also no difference in improvements in IPSS, Q_{max} and PVR post-operatively.

Conclusion: This study demonstrates that Aquablation is safe and effective in the management of BPH regardless of concomitant bladder stone treatment.

KEYWORDS
Aquablation, bladder stones, BPH, cystolitholapaxy, Medicare

1 | INTRODUCTION

Benign prostatic hyperplasia (BPH) is a common condition among ageing men which consequently can result in bladder outlet obstruction (BOO) and subsequent lower urinary tract symptoms (LUTS).[1–3] The prevalence of LUTS/BPH increases with age with approximately 80% of men aged 70 years or older being affected.[4,5] With disease progression, worsening symptoms can have a profound impact on quality of life (QoL), mental health and health-care expenditure.[6–10] These negative impacts can be exacerbated by additional complications of BOO, such as urinary retention, renal insufficiency, recurrent urinary tract infections and/or bladder stones. Bladder stones most often result from urinary stasis secondary to BOO and incomplete voiding.[11] The presence of these stones can be associated with urinary infections, irritative voiding symptoms, haematuria and pain.[12] In addition, bladder stones may be a harbinger for severe BOO, and it is unknown if surgical relief of BPH is always associated with similar clinical outcomes to men without stones. Bladder stones are typically managed with endoscopic cystolitholapaxy, often using holmium: YAG or thulium fibre laser fragmentation along with concomitant BPH surgery as men who do not undergo bladder stone removal are at much higher risk of recurrent bladder stones and subsequent BPH surgeries.[13] This is reflected in current American Urological Association (AUA) guidelines that recommend surgical treatment of BPH in men with recurrent bladder stones.[14]

Aquablation (PROCEPT BioRobotics) is an image-guided, robotically executed surgical procedure utilising high-velocity water jet technology and has emerged as an effective treatment for BPH. Pivotal randomised controlled trials have demonstrated that Aquablation is both a safe and effective therapy with durable outcomes, significant improvement in functional outcomes and preservation of sexual function.[15–21]

Despite this growing evidence base, there is little published regarding its use in men with concomitant bladder stones, a subgroup that may present distinct perioperative and functional considerations. In part, because of this lack of evidence, Medicare coverage determinations currently restrict the use of Aquablation in the presence of bladder stones, thus limiting utilisation of Aquablation in otherwise ideal patients who desire BPH treatment with Aquablation.[22] This study aimed to investigate the efficacy, safety and clinical outcomes of Aquablation in men with BPH and concurrent bladder stones in a large multi-institutional retrospective cohort.

2 | METHODS

2.1 | Study design and population

This retrospective cohort study analysed men who underwent Aquablation for BPH between 2018 and 2024 at one of four sites in the International Collaborative Aquablation Research Urology Society (ICARUS) database. Male patients diagnosed with symptomatic LUTS/BPH who underwent Aquablation were included in the study. Study participants were divided into two cohorts: men with bladder stones undergoing concomitant cystolitholapaxy (stone group) and those without (non-stone group). Patients with unknown or unspecified bladder stone status were excluded from this analysis ($N = 259$). This study was approved by the institutional review board (IRB; EH20-122).

2.2 | Clinical variables and outcomes

Baseline data collected included demographic information (age, comorbidities), pre-operative medication use (e.g. alpha-blockers, 5-alpha-reductase inhibitors, daily phosphodiesterase 5 inhibitors, anticoagulation), serum prostate specific antigen (PSA) values, serum prostate health index (PHI) values, prostate volume and history of prior BPH surgeries. Pre-operative characteristics included maximum urinary flow rate (Q_{max}), post-void residual volume (PVR) and patient-related outcomes, including the International Prostate Symptom Score (IPSS), IPSS quality of life (QoL) and Sexual Health Inventory for Men (SHIM).

Study outcomes were assessed at baseline and at regular intervals post-operatively. Functional outcomes were assessed using the IPSS, SHIM, uroflowmetry and PVR. Additionally, operative and peri-operative outcomes were collected including total operative time, total Aquablation time, transfusion requirements, takebacks for cystoscopy with clot evacuation and other surgical complications as classified on the Clavien–Dindo scale. Additionally, stone characteristics such as stone size, number of stones, stone diameter, method of

TABLE 1 Demographics and baseline variables.

	No bladder stones ($N = 1825$)		Men with bladder stones ($N = 60$)		
	N		*N*		*p*-value
Age, years (mean, SD)	1825	68.98 (8.03)	60	70.75 (7.57)	0.09
Diabetes mellitus type 2 (*n*, %)	579	90 (15.54)	38	8 (21.05)	0.37
Coronary artery disease (*n*, %)	261	36 (13.79)	16	4 (25.00)	0.26
Anxiety/depression (*n*, %)	579	102 (17.62)	36	5 (13.89)	0.57
Obstructive sleep apnoea (*n*, %)	479	111 (23.17)	31	8 (25.81)	0.74
Family history of BPH (*n*, %)	375	116 (30.93)	22	5 (22.73)	0.42
HbA1c (median, IQR)	213	5.60 (5.40–6.00)	11	5.70 (5.40–6.10)	0.64
PSA (median, IQR)	1447	3.65 (1.91–6.46)	55	4.55 (2.86–6.93)	0.05
Prostate Health Index (median, IQR)	405	30.79 (23.59–41.09)	28	32.26 (26.01–44.92)	0.33
Baseline medication use (*n*, %)					
Alpha adrenergic antagonist	732	536 (73.22)	48	32 (66.67)	0.32
5ARI	732	147 (20.08)	48	10 (20.83)	0.90
Daily PDE5-i	640	94 (14.69)	43	8 (18.60)	0.49
Anticholinergic or β3 agonist	732	34 (4.64)	48	2 (4.17)	1.00
Prostate volume, cc (median, IQR)	1809	77.00 (55.50–107.65)	60	98.57 (79.00–141.50)	<0.0001
Median lobe (*n*, %)	1688	1122 (66.47)	53	33 (62.26)	0.52
Intravesical prostatic protrusion (*n*, %)					
Small (<5 mm)	592	138 (23.31)	23	7 (30.43)	0.30
Moderate (5–10)		102 (17.23)		6 (26.09)	
Large (>10 mm)		352 (59.46)		10 (43.48)	
Anticoagulation, any (*n*, %)	661	175 (26.48)	45	14 (31.11)	0.50
Aspirin 81 mg (*n*, %)	490	75 (15.31)	35	8 (22.86)	0.24
Other antiplatelet agent (e.g. clopidogrel, prasugrel) (*n*, %)	490	19 (3.88)	35	0 (0.00)	0.63
Direct oral anticoagulant or warfarin (*n*, %)	490	56 (11.43)	35	6 (17.14)	0.28
Prior BPH surgery (*n*, %)					
No	1821	1721 (94.51)	60	51 (85.00)	0.015
Prostate artery embolisation		6 (0.33)		0 (0.00)	
Photoevaporation of prostate		19 (1.04)		3 (5.00)	
Robotic simple prostatectomy		3 (0.16)		0 (0.00)	
Water vapour thermotherapy (Rezum)		23 (1.26)		0 (0.00)	
Transurethral incision of prostate (TUIP)		1 (0.05)		0 (0.00)	
Transurethral microwave thermotherapy (TUMT)		2 (0.11)		0 (0.00)	
Transurethral resection of prostate (TURP)		20 (1.10)		2 (3.33)	
Prostatic urethral lift (Urolift)		25 (1.37)		4 (6.67)	
Robotic waterjet therapy (Aquablation)		1 (0.05)		0 (0.00)	
Q_{max}, ml/s (median, IQR)	911	8.50 (5.40–12.60)	18	6.00 (5.00–8.80)	0.06
PVR, ml (median, IQR)	1351	106.00 (41.00–219.00)	50	112.00 (38.00–321.00)	0.38
Urinary retention requiring catheter or CIC (*n*, %)	1822	269 (14.76)	60	17 (28.33)	0.004
Baseline PROs					
IPSS (mean, SD)	1594	20.40 (7.65)	51	19.43 (7.88)	0.37
QOL (median, IQR)	546	4.00 (3.00–5.00)	37	4.00 (3.00–5.00)	0.50
SHIM (mean, SD)	886	14.33 (8.15)	38	14.21 (8.31)	0.93

removal and stone composition were recorded. Systematic use of the Male Sexual Health Questionnaire assessing Ejaculatory Dysfunction (MSHQ–EjD) was limited in the ICARUS database; therefore, ejaculatory function was also categorically recorded by sites as normal antegrade ejaculation, antegrade ejaculation with reduced volume, and retrograde ejaculation.

2.3 | Statistical analysis

Statistical analyses were performed to compare the characteristics between men with and without bladder stones. Continuous variables were expressed as means with standard deviations (SD) or medians with interquartile ranges (IQR), as appropriate. Comparisons between groups were performed using *t*-tests or Mann–Whitney *U* tests for continuous variables and chi-square tests for categorical variables. Missing data were handled with pairwise deletion. Statistical significance was defined as a p-value < 0.05. Statistical analysis was performed with SAS v9.4 (SAS Institute, Cary, NC) and R v4.3.2.

3 | RESULTS

3.1 | Patient characteristics

The analysis included 1885 men who underwent Aquablation from 2018 to 2024. Of those men, 60 (3.2%) patients had bladder stones and 1825 did not. Table 1 displays the baseline characteristics of the two groups.

Patients with bladder stones had significantly larger prostate volumes (99 ml vs. 77 ml, $p < 0.0001$), were more likely to have previously undergone BPH surgery (15% vs. 5.5%, $p = 0.015$) and were more likely to be in pre-operative urinary retention (28.3% vs. 14.8%, $p = 0.004$). Men with bladder stones also tended to have higher serum PSA values compared to those without stones (median PSA 4.55 vs. 3.65 ng/ml, $p = 0.05$). Baseline urinary symptoms and erectile function were similar between groups (Table 1).

3.2 | Operative outcomes

Table 2 demonstrates the comparison of intra-operative details between the two groups. As expected, the group that underwent concomitant bladder stone treatment had a longer total operative time (76 vs. 55 min, $p < 0.0001$). However, the two groups had no significant differences in the Aquablation-specific BPH treatment time, transfusion rates, complications or 30-day readmissions.

3.3 | Functional outcomes

Over the 24-month follow-up period, both groups displayed similar and notable improvements in IPSS (Figure 1). IPSS improved similarly from baseline 19.4 vs. 20.4 ($p = 0.37$) to 9.85 vs. 9.74 ($p = 0.91$) at 3 months post-operatively, and 6.46 vs. 7.13 ($p = 0.70$) at 24 months in the bladder stone and non-stone groups, respectively. There was a significant difference in IPSS measured 4–8 months post-operatively (5.54 ± 3.81 [$n = 26$, bladder stones] vs. 7.48 ± 5.72 [$n = 632$, no

TABLE 2 Operative characteristics.

	No bladder stones ($N = 1825$)		Men with bladder stones ($N = 60$)		p-value
Total OR time, min, (median, IQR)	1784	55.00 (43.00–70.00)	60	76.50 (58.50–108.00)	<0.0001
Aquablation time, min, (median, IQR)	538	6.98 (5.20–8.47)	35	7.03 (6.27–8.68)	0.24
Takeback for cystoscopy/clot evacuation (*n*, %)	1825	38 (2.08)	60	1 (1.67)	1.00
Blood transfusion (*n*, %)	1825	12 (0.66)	60	2 (3.33)	0.07
30-day readmission (*n*, %)	1510	16 (1.06)	42	0 (0.00)	1.00
Clavien–Dindo complications (*n*, %)					
Clavien 0	1735	1517 (87.44)	51	42 (82.35)	0.11
Clavien I		148 (8.53)		4 (7.84)	
Clavien II		19 (1.10)		3 (5.88)	
Clavien IIIa		6 (0.35)		0 (0.00)	
Clavien IIIb		44 (2.54)		2 (3.92)	
Clavien V		1 (0.06)		0 (0.00)	
Stone characteristics					
Stone size, mm (median, IQR)		/		10 (5–20)	
Number of bladder stones (median, IQR)		/		1.5 (1–4)	
Aggregate stone diameter, mm × N, (median, IQR)		/		22.5 (10.0–38.8)	
Stones treated with laser lithotripsy, %		/		70% ($N = 42$)	
Stones treated with extraction/removal, %		/		30% ($N = 18$)	
30-day UTI rate				5%	



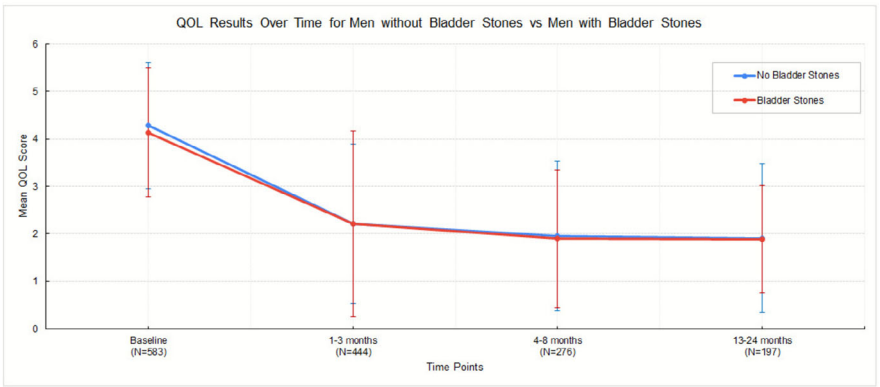


FIGURE 1 Improvement in IPSS and IPSS QoL after Aquablation in men with and without concomitant treatment of bladder stones. IPSS, International Prostate Symptom Score; IPSS QoL, International Prostate Symptom Score quality of life.

TABLE 3 Post-operative variables (data collected 1–3 months post-op).

	No bladder stones ($N = 1825$)		Men with bladder stones ($N = 60$)		*p*-value
Post-op Q_{max}, ml/s (median, IQR)	627	19.3 (14.6–26.0)	8	19.5 (16.8–24.6)	0.78
Post-op change in Q_{max} from baseline, ml/s (median, IQR)	474	10.9 (6.2–17.9)	8	12.35 (10.9–17.2)	0.41
% change in Q_{max}	474	142% (62%–278%)	8	245% (179%–329%)	0.13
Postop PVR, ml (median, IQR)	1491	24 (6–65)	50	18 (3–50)	0.18
Postop change in PVR, ml (median, IQR)	1207	−145.57 (236.56)	44	−178.75 (282.79)	0.25
% change in PVR	1165	−80% (−97–49%)	44	−89% (−99%–40%	0.31
Post-op SHIM (mean, SD)	650	13.43 (8.79)	34	13.65 (9.63)	0.89
Post-op change in SHIM from baseline	543	−0.10 (5.27)	29	−1.72 (4.60)	0.10
% change in SHIM	540	−24.50 (164.24)	29	−15.21 (35.09)	<0.0001
Post-op retrograde ejaculation (*n*, %)					
No	514	415 (80.74%)	18	17 (94.44%)	0.52
Reduced or decreased ejaculate		46 (8.95%)		0 (0.00%)	
Yes		53 (10.31%)		1 (5.56%)	
Postop PSA, ng/ml (median, IQR)	636	2.05 (1–3.56)	19	3.320 (1.87–4.57)	0.017
Postop change in PSA from baseline (median, IQR)	571	−1.60 (−3.70–0.37)	19	−2.38 (−4.12–0.95)	0.15
% change in PSA	571	−44% (−69–16%)	19	−42% (−63–19%)	0.81
Postop Prostate Health Index (median, IQR)	267	25.96 (18.80–36.05)	17	24.69 (16.67–33.04)	0.54
Postop change in Prostate Health Index from baseline (median, IQR)	204	−4.04 (−11.52–1.68)	15	−3.90 (−12.83–0.91)	0.82
% change in Prostate Health Index (median, IQR)	204	−13% (−32%–7%)	15	−15% (−36–3%)	0.64

bladder stones], $p = 0.004$), but there were no other significant differences at any other timepoints. Both groups also reported similar improvements in IPSS and QoL scores over the follow-up period.

Both groups also had similar post-operative Q_{max} (19.3 vs. 19.5, $p = 0.78$) and post-operative PVR (24 ml vs 18 ml, $p = 0.18$) (Table 3). Post-operative PSA was slightly higher in the bladder stone group

(3.32 vs 2.05, $p = 0.017$), but there was no difference in change in PSA from baseline, percent change in PSA from baseline, or in post-operative Prostate Health Index between groups. Furthermore, no differences were observed in post-operative SHIM scores between groups, and absolute changes from baseline were similar. Also of importance, there was no difference in the rate of men who reported ejaculatory dysfunction between groups.

4 | DISCUSSION

The current treatment landscape for the surgical management of BPH is changing, with newer techniques, such as Aquablation, becoming more utilised. As these procedures become more prevalent, their utilisation and application in well-selected patients are important. Men who form bladder stones may have a higher degree or more severe and chronic form of BOO related to BPH that results in urinary stasis and stone formation.[23] Furthermore, BOO may be associated with structural changes in the bladder which diminish detrusor function over the long term.[24] The current study demonstrates that Aquablation is a safe and effective treatment when performed concomitantly with laser endoscopic cystolitholapaxy for the treatment of bladder stones. In this analysis, men with bladder stones who are treated with Aquablation and concomitant bladder stone removal have similar perioperative safety and functional outcomes to those without stones who undergo Aquablation.

Current Medicare local coverage determinations preclude the use of Aquablation in the presence of bladder stones, thus necessitating patients who are insured by Medicare and interested in this procedure to either explore alternative treatment options or undergo multiple anaesthetics and staged procedures. This government policy negates shared decision making and could force men with larger prostates to undergo alternative procedures, such as transurethral resection of the prostate (TURP), simple prostatectomy or holmium laser enucleation of the prostate (HoLEP), which have higher risks of sexual dysfunction and stress urinary incontinence compared to Aquablation.[25,26] In part because of this government-imposed restriction, limited data on concomitant treatment of bladder stones with Aquablation is available. Our current study demonstrates that Aquablation is safe and effective in treating BPH in men with bladder stones and that, over a 24-month-follow-up period, the presence of bladder stones did not impact long-term functional outcomes.

Our findings are analogous to other studies on concomitant treatment of bladder stones. Romero-Otero et al. showed that concomitant laser cystolitholapaxy at the time of HoLEP increased total operative time by an average of 17 min; however, no differences were noted in enucleation time, morcellation time or post-operative functional outcomes.[22] Similarly, in our study, concomitant treatment of bladder stones increased total operative time by an average of 21.5 min, but Aquablation time, overall complication rates, transfusion requirements and long-term functional outcomes were similar between the two cohorts.

There are several limitations to this study. The retrospective nature of the study limits the ability to establish causality and may be subject to biases. Patients with bladder stones had larger prostate volumes and were more likely to have undergone prior BPH procedures. Follow-up was not standardised and thus variable in this real-world cohort which led to inconsistencies in cohort follow-up for functional outcomes, and not all patients completed 24-month follow-up. Furthermore, the relatively small sample size of the bladder stone group ($N = 60$) may limit the statistical power to detect true differences between the groups. As in any large, real-world, retrospective study, missing data are inevitable. Non-random missing data could have introduced bias and may therefore limit the generalisability of our findings. Finally, 24-month follow-up may be insufficient to assess long-term complications and the need for retreatment; long-term retreatment rates are better assessed through national databases not linked to individual institutions.

5 | CONCLUSION

In conclusion, while the presence of bladder stones can extend total procedural time, this study demonstrates that Aquablation is a safe and effective treatment option in the management of BPH including men with bladder stones. There was no increase in transfusions or perioperative complications with concomitant treatment of bladder stones, and both cohorts demonstrated durable improvements in functional outcomes over 24 months. Based on these findings, federal health-care policies should consider eliminating restrictions on concurrent bladder stone treatment during Aquablation, aligning with existing coverage determinations for all other BPH procedures, such as prostatic urethral lift, water vapour thermotherapy, photoselective vaporisation of the prostate, TURP and laser enucleation.

AUTHOR CONTRIBUTIONS

Joshua D. Cabral: Writing—original draft. **Margaret Gannon:** Writing—original draft. **Gregory Raster:** Writing—original draft. **David J. Nusbaum:** Writing—original draft. **David Bouhadana:** Writing—review and editing. **Adel Arezki:** Writing—review and editing. **Aalya Hamouda:** Writing—review and editing. **Anouk Leathead:** Writing—review and editing. **Ilan Ohana:** Writing—review and editing. **Rosie Foucault:** Writing—review and editing. **Iman Sadri:** Writing—review and editing. **Jeffrey A. Sioufi:** Writing—review and editing. **Nick Lee:** Writing—review and editing. **Tarek Benzouak:** Writing—review and editing. **Liam Murad:** Writing—review and editing. **Nicholas J. Corsi:** Writing—review and editing. **John Klein:** Data collection or management. **Inderjit Singh:** Data collection or management. **James Kearns:** Data collection or management. **Cecilia Chang:** Formal analysis; visualization. **Juan Justo Quintas:** Data collection or management; protocol/project development. **Kevin C. Zorn:** Conceptualization; supervision; writing—review and editing; data collection or management; protocol/project development. **Tiago Rodrigues:** Data collection or management; protocol/project development. **Shawn H. Marhamati:** Writing—review and editing; data collection or

management; protocol/project development. **Brian T. Helfand:** Writing—review and editing; data collection or management; protocol/project development. **Alexander P. Glaser:** Project administration; supervision; conceptualization; writing—review and editing; data collection or management; protocol/project development.

ACKNOWLEDGEMENTS

The authors would like to express their gratitude to the study participants as well as the clinical and research staff at the participating sites within ICARUS who contributed to the collection and management of data.

CONFLICT OF INTEREST STATEMENT

Alexander Glaser reports a relationship with PROCEPT BioRobotics Corporation that includes consulting or advisory, speaking and lecture fees, and travel reimbursement. Alexander Glaser reports a relationship with Emano Metrics that includes board membership and equity or stocks. Inderjit Singh reports a relationship with PROCEPT BioRobotics Corporation that includes consulting or advisory. James Kearns reports a relationship with PROCEPT BioRobotics Corporation that includes consulting or advisory, speaking and lecture fees, and travel reimbursement. Justo Quintas reports a relationship with PROCEPT BioRobotics Corporation that includes consulting or advisory. Kevin Zorn reports a relationship with PROCEPT BioRobotics Corporation that includes consulting or advisory, speaking and lecture fees, and travel reimbursement. Shawn Marhamati reports a relationship with PROCEPT BioRobotics Corporation that includes consulting or advisory. Brian Helfand reports a relationship with PROCEPT BioRobotics Corporation that includes consulting or advisory, speaking and lecture fees, and travel reimbursement. Other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

ORCID

David Bouhadana https://orcid.org/0000-0003-3716-3447
Anouk Leathead https://orcid.org/0009-0003-3761-492X
Rosie Foucault https://orcid.org/0009-0000-1796-4592
Nick Lee https://orcid.org/0000-0002-7166-0503
James Kearns https://orcid.org/0000-0002-5416-4671
Juan Justo Quintas https://orcid.org/0009-0005-3363-1452
Kevin C. Zorn https://orcid.org/0000-0003-3651-6669
Tiago Rodrigues https://orcid.org/0000-0001-9497-206X
Brian T. Helfand https://orcid.org/0000-0002-7707-3318
Alexander P. Glaser https://orcid.org/0000-0003-1781-9023

REFERENCES

1. Auffenberg GB, Helfand BT, McVary KT. Established medical therapy for benign prostatic hyperplasia. Urol Clin North Am. 2009;36(4):443–59.
2. Egan KB. The epidemiology of benign prostatic hyperplasia associated with lower urinary tract symptoms: prevalence and incident rates. Urol Clin. 2016;43(3):289–97. https://doi.org/10.1016/j.ucl.2016.04.001
3. Murad L, Bouhadana D, Nguyen DD, Chughtai B, Zorn KC, Bhojani N, et al. Treating LUTS in men with benign prostatic obstruction: a review article. Drugs Aging. 2023;40(9):815–36. https://doi.org/10.1007/s40266-023-01054-0
4. Maserejian NN, Chen S, Chiu GR, Wager CG, Kupelian V, Araujo AB, et al. Incidence of lower urinary tract symptoms in a population-based study of men and women. Urology. 2013 Sep 1;82(3):560–4. https://doi.org/10.1016/j.urology.2013.05.009
5. Litman HJ, McKinlay JB. The future magnitude of urological symptoms in the USA: projections using the Boston Area Community Health survey. BJU Int. 2007;100(4):820–5.
6. Gong ZC, Wu ZL, Wen YA, et al. Sexual dysfunction in patients with urinary bladder stones but no bladder outlet obstruction. Front Med. 2021;8:704360.
7. Girman CJ, Jacobsen SJ, Tsukamoto T, Richard F, Garraway WM, Sagnier PP, et al. Health-related quality of life associated with lower urinary tract symptoms in four countries. Urology. 1998 Mar 1;51(3):428–36. https://doi.org/10.1016/S0090-4295(97)00717-6
8. Girman CJ, Jacobsen SJ, Rhodes T, Guess HA, Roberts RO, Lieber MM. Association of health-related quality of life and benign prostatic enlargement. Eur Urol. 1999;35(4):277–84.
9. Pinto JDO, He HG, Chan SWC, Toh PC, Esuvaranathan K, Wang W. Health-related quality of life and psychological well-being in patients with benign prostatic hyperplasia. J Clin Nurs. 2015;24(3–4):511–22. https://doi.org/10.1111/jocn.12636
10. Saigal CS, Joyce G. Economic costs of benign prostatic hyperplasia in the private sector. J Urol [Internet]. 2005;173:1309–13. https://doi.org/10.1097/01.ju.0000152318.79184.6f
11. Shah HN. Benign prostate hyperplasia and bladder stones: an update. Curr Bladder Dysfunct Rep. 2013 Sep 1;8(3):250–60. https://doi.org/10.1007/s11884-013-0196-5
12. Jung JH, Park J, Kim WT, Kim HW, Kim HJ, Hong S, et al. The association of benign prostatic hyperplasia with lower urinary tract stones in adult men: a retrospective multicenter study. Asian J Urol. 2018 Apr 1;5(2):118–21. https://doi.org/10.1016/j.ajur.2017.06.008
13. Chapelle C, Lavallée E, Vallée M, Descazeaud A. Bicentric retrospective study comparing the postoperative outcomes of patients treated surgically for bladder stones with or without concomitant surgery for BPH. World J Urol. 2024 Jan 8;42(1):13. https://doi.org/10.1007/s00345-023-04699-z
14. Sandhu JS, Bixler BR, Dahm P, et al. Management of lower urinary tract symptoms attributed to benign prostatic hyperplasia (BPH): AUA guideline amendment 2023. J Urol [Internet]. [cited 2025 Jan 27]. https://doi.org/10.1097/JU.0000000000003698
15. Suarez-Ibarrola R, Bach T, Hein S, Cocci A, Russo GI, Herrmann TRW, et al. Efficacy and safety of aquablation of the prostate for patients with symptomatic benign prostatic enlargement: a systematic review. World J Urol. 2020 May 1;38(5):1147–63. https://doi.org/10.1007/s00345-019-02959-5
16. Gilling P, Barber N, Bidair M, Anderson P, Sutton M, Aho T, et al. WATER: A double-blind, randomized, controlled trial of Aquablation® vs transurethral resection of the prostate in benign prostatic hyperplasia. J Urol [Internet]. 2018;199:1252–61. https://doi.org/10.1016/j.juro.2017.12.065
17. Sanchez DE, Ghoreifi A, Storino Ramacciotti L, Cai J, Maas M, Venkat A, et al. The safety and feasibility of aquablation in patients with previous surgery for benign prostatic hyperplasia. J Endourol. 2025 Jan;39(1):50–5. https://doi.org/10.1089/end.2024.0370
18. Desai M, Bidair M, Zorn KC, Trainer A, Arther A, Kramolowsky E, et al. Aquablation for benign prostatic hyperplasia in large prostates (80–150 mL): 6-month results from the WATER II trial. BJU Int. 2019 Aug;124(2):321–8. https://doi.org/10.1111/bju.14703
19. Oumedjbeur K, Corsi NJ, Bouhadana D, Ibrahim A, Nguyen DD, Matta I, et al. Aquablation versus TURP: 5-year outcomes of the

WATER randomized clinical trial for prostate volumes 50–80 mL. Can J Urol. 2023;30(5):11650–8.
20. Gilling P, Barber N, Bidair M, Anderson P, Sutton M, Aho T, et al. Two-year outcomes after Aquablation compared to TURP: efficacy and ejaculatory improvements sustained [Internet]. Adis Journals. 2019 [cited 2025 Sep 13];78631 Bytes. https://adisjournals.figshare.com/articles/Two-Year_Outcomes_after_Aquablation_Compared_to_TURP_Efficacy_and_Ejaculatory_Improvements_Sustained/7937555
21. Labban M, Mansour M, Abdallah N, Jaafar R, Wazzan W, Bulbul M, et al. Aquablation for benign prostatic obstruction: single center technique evolution and experience. Investig Clin Urol. 2021;62(2):210–6. https://doi.org/10.4111/icu.20200249
22. Romero-Otero J, García González L, García-Gómez B, Alonso-Isa M, García-Rojo E, Gil-Moradillo J, et al. Analysis of holmium laser enucleation of the prostate in a high-volume center: the impact of concomitant holmium laser cystolitholapaxy. J Endourol. 2019 Jul;33(7):564–9. https://doi.org/10.1089/end.2019.0019
23. Maresca G, Mc Clinton S, Swami S, El-Mokadem I, Donaldson JF. Do men with bladder stones benefit from treatment of benign prostatic obstruction? BJU Int. 2022 Nov;130(5):619–27. https://doi.org/10.1111/bju.15761
24. Lee HY, Wang CS, Juan YS. Detrusor underactivity in men with bladder outlet obstruction. Biomedicine. 2022 Nov 17;10(11):2954. https://doi.org/10.3390/biomedicines10112954
25. Placer J, Salvador C, Planas J, Trilla E, Lorente D, Celma A, et al. Effects of holmium laser enucleation of the prostate on sexual function. J Endourol. 2015 Mar;29(3):332–9. https://doi.org/10.1089/end.2014.0502
26. Leong JY, Patel AS, Ramasamy R. Minimizing sexual dysfunction in BPH surgery. Curr Sex Health Rep. 2019 Sep;11(3):190–200. https://doi.org/10.1007/s11930-019-00210-1

How to cite this article: Cabral JD, Gannon M, Raster G, Nusbaum DJ, Bouhadana D, Arezki A, et al. Outcomes of Aquablation in BPH with bladder stones: Analysis of the ICARUS database. BJUI Compass. 2026;7(2):e70156. https://doi.org/10.1002/bco2.70156