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Aquablation, a safe technique?

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Introduction Prostatic Aquablation has emerged as a minimally invasive treatment for benign prostatic hyperplasia, recognized in the European guidelines. The aim of this study is to evaluate the safety of the procedure in patients treated with this technique at a tertiary care hospital.

Material and methods Complications during hospitalization were evaluated, as well as the reasons for emergency visits and the medium-long-term complications in patients who underwent Aquablation between February 2021 and November 2024. Clinical and laboratory variables were also assessed, along with the type of complication, using the Clavien-Dindo classification system.

Results One hundred and ninety-two patients were operated on with Aquablation in a third-level hospital, between February 2021 and November 2024. Mean age of patients was 68.11 ±11.15 years. Mean prostatic volume was 76.58 ±26.46 ml. During the hospital stay, 30 patients (15.7%) presented some kind of complication. The main complication was haematuria requiring haemostatic resection (7 patients; 23.3%) or evacuation of clots by bladder washings (14 patients, 46.6%). Seven patients required blood transfusions. Two patients (6.66%) presented with acute urinary retention after urinary catheter removal. Additionally, two patients developed urinary tract infection during hospitalization. Two patients presented a rectal perforation. One patient presented a vesical perforation during surgery, and one of them had a false urethral passage. One patient died during hospitalization due to bronchoaspiration in the context of decompensation of multiple myeloma. Out of the total 126 patients who completed at least one year of follow-up, 10.31% (13 patients) required reintervention.

Conclusions Despite being a robotic treatment, Aquablation is not free of serious complications and requires a learning curve. Further studies are needed to properly establish the safety profile of this procedure.

Key Words: Aquablation ‹› benign prostatic hyperplasia ‹› rectal perforation

INTRODUCTION

Innovations in the surgical management of benign prostatic hyperplasia aim to reduce the morbidity of the procedure and shorten the surgical time, while maintaining satisfactory relief of the lower urinary tract symptoms caused by benign prostatic hyperplasia [1]. Aquablation is included in the European Association of Urology (EAU) guidelines as an alternative surgical technique to transurethral resection of the prostate (TURP) for medium volume (30–80 ml) prostates [2]. As presented in WATER I study, Aquablation of the prostate may be an effective and safe approach to the surgical management of lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH), with a substantially lower rate of ejaculatory dysfunction compared to TURP [3].

Patient recruitment was based on their preference for the technique, after explaining the different

treatment options – enucleation, adenomectomy, transurethral resection of the bladder (TURB) – and their advantages and disadvantages.
The main concern with this treatment modality is prostate bleeding after Aquablation, and currently there is no standardised approach for proper haemostasis. This is because Aquablation does not use thermal energy to ablate the prostatic tissue, but instead uses a high-pressure jet of saline solution. In the WATER study the haemostasis methods used were unspecified use of cautery (40%) and balloon tamponade in the prostatic fossa (60%) [4]. Nevertheless, overall adverse events of Aquablation after three years seems to be similar to other BPH treatment modalities [3]
Objective: to evaluate the early and late complications in patients who underwent prostatic Aquablation at a tertiary care hospital, where a learning programme for this technique has been implemented since 2021.

MATERIAL AND METHODS

A retrospective analysis of demographic, clinical and surgical data was performed. Patients were evaluated in urology consultations where they received different treatment options for BPH. Aquablation was considered in cases of medical treatment failure, haematuria of prostatic origin, renal failure due to bladder outlet obstruction or inability to remove urinary catheter. There was no limit to prostate volume and patients could have received previous surgical treatment for BPH. Patients with bladder stones or anticoagulant treatment were excluded. All patients gave written and oral consent, according to the consensus with our Institutional Review Board when preparing the informed consent document.
The following demographical and perioperative items were collected: PSA level, prostatic volume, presence of an indwelling urinary catheter, surgical time (planification, Aquablation, and haemostasis), haemoglobin (Hb) loss, hospital stay, and perioperative complications using the Clavien-Dindo scale. Patients were followed up at least up to 6 months in consultations during which we recorded any complication (recorded with Clavien-Dindo scale), visit to the emergency room, and need for reintervention.
Aquablation was developed using Aquabeam system (PROCEPT BioRobotics) by 3 different surgeons without any previous experience in this surgery. The complete description of the surgical technique was published by Gilling and Barber in 2018 [3]. Aquabeam technology treats an ultrasound-defined area and ablate prostate tissue with a high-pressure water jet. Selective haemostasis is then performed with bipolar energy using a 26 Ch Karl-Storz resectoscope, followed by placement of a 22 Ch bladder catheter with continuous irrigation until haematuria is resolved.
The surgical technique used in our institution followed the manufacturer's recommendations. Notably, in our case we have always performed active resection of the bladder neck: Aquablation + TURP.
Our postoperative protocol consisted of a catheter and continuous bladder lavage based on haematuria. The catheter was removed 48 hours postoperatively if the urine was clear, and then discharged if spontaneous urination occurred.

RESULTS

One hundred and ninety-two patients were operated on with prostatic Aquablation in a third-level hospital, between February 2021 and November 2024. Mean age of patients was 68.11 ±11.15 years old. Only 7.3% of patients were ASA I; meanwhile, 59.4% were ASA II, and 33.3% were ASA III. There was not any patient with ASA IV or superior. Patients who took anticoagulant treatment were excluded, but 15.6% took antiplatelet treatment, which was discontinued before surgery. 24.5% of patients had indwelling urinary catheter. Mean prostatic volume was 76.58 ±26.46 ml. The smallest prostate in this study measured 30 ml and the biggest 183 ml.
Mean surgical time was 46.86 ±11,88 minutes, divided into 19.85 ±6.68 minutes of planification time, 11.99 ±5.51 minutes of prostatic Aquablation, and 14.23 ±6.61 minutes of haemostasis. Mean Hb loss was 1.95 ±1.52 g/dl. Mean hospital stay was 2.51 days, and mean duration of urinary catheterization was 3.43 ±3.35 days. Mean preoperative PSA was 3.32 ±2.67 ng/dl, and after a year it was 2.96 ±2.96 ng/dl. During hospital stay, 30 patients (15.7%) presented some kind of complication.
Of the different pre-surgical characteristics of the patients, only the presence of a permanent urinary catheter was associated with bleeding complications. Among the 47 patients with urinary catheters, 11 (23.4%) had haematuria requiring bladder irrigation or surgery, while this complication was observed in 10 patients (6.9%) of 145 patients without catheters ($p = 0.05$).
The main complications occurring during the postoperative period were Clavien-Dindo 1 and 2 complications, with haematuria resolved with clot evacuation being the most common (14 patients, 7.3%), although 7 of them required a blood transfusion. Other minor complications included were acute urinary retention and urinary tract infection.

In contrast, the major complications were 7 cases of haematuria requiring haemostatic resection and 2 rectal perforations resolved with colostomy. One patient died during hospitalization due to bronchoaspiration in the context of decompensation of multiple myeloma. All complications are detailed in Tables 1 and 2.

One month after the procedure, 30 patients (16.4%) required emergency care, all of them were Clavien-Dindo 1–2, and therefore none was readmitted to hospital. Among these patients, 43.3% were diagnosed with urinary tract infection (UTI) without microbiological confirmation, leading to antibiotic treatment. Additionally, 9 patients (30%) experienced acute urinary retention (AUR). Another 7 patients (23.3%) sought emergency care for haematuria, requiring urinary catheterization to remove clots, and one patient presented symptoms consistent with bladder spasms (Tables 3 and 4).

At the follow-up visit three months after the intervention, only one patient presented a surgery-related complication. This case involved bladder neck sclerosis, which required a bladder neck incision.

Out of the total 126 patients who completed at least one year of follow-up, 10.31% (13 patients) required reintervention. Seven patients underwent TURP or holmium laser enucleation of the prostate (HoLEP for obstructive prostate remnants. Four patients underwent surgery for urethral stricture: one with oral mucosa graft urethroplasty, one with terminal-to-terminal urethroplasty with associated RTP, one with mechanical dilatation, and one with Optilume balloon dilatation. One patient died from sepsis of urinary origin, secondary to AUR with catheterization failure and the need for suprapubic catheter placement (Table 5).

DISCUSSION

This analysis presents our experience with the first 192 cases of Aquablation for the treatment of BPH in a third level public hospital. To our knowledge, this is the first series published in a public setting in Spain and one of the largest cohorts published in this type of surgery.

Using the WATER I study as a reference [3], our cohort represents cases with an overall larger prostate volume (54.10 ±16.30 ml compared to 76.58 ±26.46 ml). At our centre, there is no prostate volume limit when considering this surgical technique for patients, with prostate Aquablation performed on prostates as large as 180 ml. When analysing whether there were more complications in the group of patients with prostates larger than 80 ml,

Table 1. *Postoperative complication*

Complication during hospitalization	Number of patients (% of total)
Haematuria requiring bladder irrigation	14 (7.3%)
Secondary resection for haemostasis	7 (3.7%)
Blood transfusion	7 (3.7%)
Acute urinary retention	2 (1 %)
Urinary tract infection	2 (1%)
Rectal perforation	2 (1%)
False urethral passage	1
Vesical perforation	1
Death due to decompensation of underlying disease	1

Table 2. *Postoperative complication*

Complication during hospitalization	Number of patients (% of total)
Clavien 1	14 (7.3%)
Clavien 2	11 (5.7%)
Clavien 3a	1 (0.5%)
Clavien 3b	9 (4.6%)
Clavien 5	1 (0.5%)

Table 3. *Early complication (first 30 days after surgery)*

Complication 30-day follow-up	Number of patients (% of total)
Urinary tract infection	13 (6.8%)
Acute urinary retention	9 (4.7 %)
Haematuria which needs vesical wash	7 (3.7%)
Bladder spasm	1 (0.5%)

Table 4. *Early complication (first 30 days after surgery)*

Complication 30-day follow-up	Number of patients (% of total)
Clavien 1	21 (10.9%)
Clavien 2	9 (4.7 %)

Table 5. *Reintervention in 1-year follow-up care*

Type of reintervention	Number of patients
TURP/HOLEP/transurethral incision	8
Urethroplasty	2
Urethral dilation	2
Suprapubic catheter placement	1

no statistically significant differences were found. Therefore, we do not consider that this technique should be reserved only for medium-sized prostates. A systematic review published in 2019 [5], concluded that prostate Aquablation is a safe technique, with a complication rate similar to TURP, the most common being haematuria, acute urinary retention, and urinary tract infection. No Clavien-Dindo V complications were recorded in the 445 patients included in the review. In our study, one patient died in the postoperative period due to the decompensation of his underlying disease, multiple myeloma.

In our study, a significant percentage of patients presented Clavien-Dindo 3 complications (4.6%), similar to other studies, where this percentage is around 5.2–12.9% [6]. In this cohort, 7 patients (3.7%) required reoperation due to incoercible macroscopic haematuria. This percentage is similar to Bach's cohort [7], where 4 patients presented gross haematuria requiring surgical review. This study found a mean reduction in Hb of 1.95 ±1.52 g/dl. These results are lower than those presented in a systematic review (2.3 g/dl) that selected prostates bigger than 100 ml [8].

Permanent urinary catheterisation carries a higher risk of bleeding complications due to the inflammatory effect of the catheter on the prostate and bladder mucosa. For this reason, we believe that in patients for whom permanent catheterization is indicated, other surgical techniques that provide better haemostasis should be considered.

During postoperative follow-up, 3.7% of patients required blood transfusion. This percentage is higher than that presented in the WATER II study [9], where only one patient (<1%) required blood transfusion. It is important to emphasise that our results come from a cohort of patients operated by three different surgeons with no previous experience, who had established their own learning curve during the study. We therefore consider that these results could improve once we standardise the surgical technique, mainly haemostasis time.

Among the complications during the early postoperative period, we point out that we observed two rectal perforations, which in both cases prompted the performance of a left emergency colostomy, because the lower third of the rectum was affected. Evaluating the cases, we did not observe any specific characteristic in the patient or the prostate. We cannot assess the pressure that the ultrasound probe applies to the rectum during haemostasis, and we discuss whether this pressure, combined with the coagulation that occurs in a flaccid capsule tissue, after Aquablation, could have been the determining factor in this serious complication. This is an infrequent complication which, although rarely reported in major Aquablation studies, may have an incidence of around 4% in some series [10]. Although it is a rare but potentially serious complication, some centres have modified the surgical technique to enhance safety. Measures such as performing a rectoscopy at the end of the procedure could allow for early detection of this complication [11].

Regarding medium- to long-term complications after surgery, 7 out of 126 patients (5.5%) required another BPH surgery after at least one year of follow-up, and one patient needed a bladder neck incision three months after the initial procedure. This is a higher percentage compared to the 2.6% shown in the literature [1], in patients with a one-year follow-up. We suggest that the lack of limits on prostate size and the learning curves of this technique in our department could have affected the results.

Although classified by some authors as a minimally invasive surgical treatment (MIST), in our personal opinion, Aquablation should not be considered in this way, because it cannot be performed under local anaesthesia with same-day discharge, requiring an admission of at least 24 hours [12].

Urethral strictures are one of the greatest medium-long-term complications after endoscopic procedures [13]. In our cohort, four patients (2%) presented with urethral stricture requiring surgical repair. The stricture location was the bulbar urethra in all cases. Among them, one was treated with endoscopic dilatation with Optilume® balloon, one was treated with pneumatic dilatation, and the two patients left required urethroplasty (one end-to-end urethroplasty and one oral graft urethroplasty). In the WATER study, 3 urethral strictures (2.5%) were reported as Clavien-Dindo grade 3 complications, but data regarding the required treatment were not provided.

Previous studies have presented Aquablation as a procedure with minimal or no learning curve [14]. Nevertheless, following our results we consider that this procedure does in fact have its own learning curve, even though it is a robotic procedure. As shown, one of the biggest problems of this operation is bleeding and marking properly the to-treat zone, avoiding the bladder neck, which could improve post-treatment haemostasis. In our cohort, we used bipolar energy in all patients, but by selecting lower prostate volume, we could be more selective using this energy, potentially increasing the percentage of patients preserving ejaculatory function.

This study presents some limitations. First of all, it is a retrospective observational study with a huge

number of patients, but they were operated by three surgeons with no experience at the beginning of the study. The authors declare no conflicts of interest.

CONCLUSIONS

Aquablation is an innovative surgical technique that can be offered for the treatment of benign prostatic hyperplasia. Despite being a robotic treatment, it is not free of serious complications and requires a learning curve. Further studies are needed to properly establish the safety profile of this procedure.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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ETHICS APPROVAL STATEMENT

The ethical approval was not required.

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