

## Risk Factors for Delayed Hematuria Following Photoselective Vaporization of the Prostate

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**Purpose:** Photoselective vaporization of the prostate has become an increasingly popular option for the treatment of benign prostatic hyperplasia. However, delayed bleeding has been raised as a potential issue as more cases are performed. We characterize delayed bleeding after photoselective vaporization of the prostate and identify associated risk factors.

**Materials and Methods:** We defined delayed gross hematuria as any complaint of hematuria following hospital discharge, and further stratified it as delayed gross hematuria requiring emergency department evaluation, hospital admission, continuous bladder irrigation, transfusions or reoperation. We performed an explicit chart review of 290 patients who underwent photoselective vaporization of the prostate at a single center from 2002 through 2009. Exposures of interest included age, prostate volume, followup duration, operative factors (watts/joules), and use of oral anticoagulation therapy or 5 $\alpha$ -reductase inhibitors.

**Results:** Delayed gross hematuria occurred in 33.8% of patients during an average followup of 33 months. For 8.5% of patients the bleeding was severe enough to prompt presentation to the emergency department. For 4.8% of patients hospitalization was required and for 4.5% reoperation was required. Multivariate analysis revealed that the odds of bleeding increased with prostate size (OR 1.08, 1.03–1.14), longer followup (OR 1.35, 1.12–1.62) and anticoagulant use (OR 3.35, 1.43–7.83), and decreased with increasing age (OR 0.71, 0.51–0.98) and use of a 5 $\alpha$ -reductase inhibitor (OR 0.41, 0.24–0.73).

**Conclusions:** Delayed hematuria occurs commonly after photoselective vaporization of the prostate but severe hematuria is rare. Larger prostate size, longer followup and use of anticoagulation were associated with a higher risk of delayed gross hematuria while preoperative 5 $\alpha$ -reductase inhibitor use and older age were protective.

**Key Words:** prostate, prostatic hyperplasia, lasers, anticoagulants, urination disorders

PHOTOVAPORIZATION of the prostate has gained popularity for the surgical treatment of lower urinary tract symptoms in men with benign prostatic hyperplasia. The adoption of

PVP has been motivated by numerous factors including decreased perioperative morbidity compared to TURP or simple prostatectomy,<sup>1–4</sup> a relatively gentle learning curve, effectiveness in

### Abbreviations and Acronyms

5ARI = 5 $\alpha$ -reductase inhibitor  
 CBI = continuous bladder irrigation  
 DH = delayed gross hematuria  
 ED = emergency department  
 ER = emergency room  
 PVP = photoselective vaporization of the prostate  
 TRUS = transrectal ultrasound  
 TURP = transurethral resection of the prostate

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the treatment of small and large glands, and the ability to treat patients on oral anticoagulation therapy.<sup>5-9</sup>

Several studies have established that there is decreased intraoperative bleeding during PVP compared to TURP and that good intraoperative hemostasis is possible even when operating on patients who are fully anticoagulated.<sup>2,3,6,8,10</sup> However, there are relatively few data on delayed postoperative bleeding, although this can be a particularly distressing problem for patients and surgeons. Examinations of DH after PVP have focused on the frequency with which it occurs rather than the risk factors associated with its occurrence.<sup>7,11</sup> In this study we provide a broader examination of delayed hematuria after PVP (defined as any complaint of gross hematuria after hospital discharge), including its frequency, and determine if any clinical or patient factors may be associated.

## MATERIALS AND METHODS

This study was approved by the University of Michigan Health Systems Internal Review Board (HUM 00032264). The study population consisted of 334 patients who underwent PVP at a single tertiary care center from October 2002 through February 2009. Patients were prospectively enrolled in a database registry tracking the majority of preoperative and postoperative data. For the purposes of this study the information in this registry was augmented with explicit chart review. Indications for PVP included lower urinary tract symptoms, hematuria, increased post-void residual urine, urinary retention and bladder stones. DH was defined as any complaint of gross hematuria after discharge home. This was then categorized further into the nonexclusive groups of complaints of delayed gross hematuria, associated ED visits, hospital admissions, and need for CBI, transfusion or reoperation. Exposures of interest included age, prostate volume, duration of followup, operative factors (wattage settings and joules applied), use of anticoagulation and 5ARIs. Because prostate volume was one of the exposures of interest, those without a preoperative prostate volume determined by TRUS were excluded from study, leaving 290 cases in our final analysis.

Preoperative patient evaluation included a medical history and physical examination including digital rectal examination and assessment of American Urological Association Symptom Score. Urinalysis, post-void residual urine and prostate specific antigen levels were also obtained.

### Perioperative and Intraoperative Management

For patients on long-term anticoagulation therapy, decisions regarding perioperative management of anticoagulation were made on a case-by-case basis in conjunction with the patient's primary care provider. This resulted in 26 patients having their anticoagulation held perioperatively and 5 patients undergoing treatment while fully anticoagulated. Patients received general or spinal anesthesia. PVP was performed by 1 of 2 surgeons (GJF and

JTW) using the GreenLight™ laser system. The 80 W system was used initially and we transitioned to the 120 W GreenLight HPS® system in 2006 when it was introduced. The GreenLight laser system consists of a side-firing laser fiber inserted into a 23Fr continuous flow cystoscope. Vaporization was typically started at the left lateral lobe, followed by the right lateral lobe, bladder neck, anterior prostate and prostatic apex. Vaporization was stopped when an appropriate TURP-like defect had been created. After the procedure a urethral catheter was placed, typically without traction or CBI.

Patients were given a voiding trial on postoperative day 1. Patients who passed their voiding trial were discharged home without an indwelling catheter. Those unable to void were discharged home with a catheter in place and were scheduled for a repeat voiding trial within the next 2 to 3 days. Anticoagulants that had been held preoperatively were typically started 2 to 3 days after surgery if the urine remained clear. Patients were seen at 1 and 6 months after surgery. Inquiries were made at each visit regarding instances of gross hematuria. Chart review of each case through July 2009 supplemented the database with regard to the incidence of delayed hematuria, hospital admissions, ED visits, CBI, transfusion and reoperation.

### Data Analysis

Univariate and bivariate analyses were performed to evaluate the distribution of key risk factors including age, prostate volume, followup duration, wattage settings, joules applied, use of anticoagulation and 5ARI. Multivariate logistic regression with a primary end point of delayed hematuria, defined as any post-discharge gross hematuria, was performed in a backwards, stepwise manner. Statistical significance was set at 5% and all analysis was performed using SAS®.

## RESULTS

Baseline patient information is summarized in the table. Of the 31 patients on systemic anticoagulation preoperatively 5 (16%) had surgery while fully anticoagulated and the remaining 26 (84%) had anticoagulation held or had bridging with low molecular weight heparin.

Approximately a third of patients experienced DH, with 8.6% requiring an ER visit and 4.8% requiring hospital admission (fig. 1). Of those admitted to the hospital some required CBI, reoperation or transfusion. The majority of delayed gross hema-

### Patient characteristics

Mean age at procedure (SD)	68.7	(9.0)
Mean gm TRUS prostate vol (SD)	76.5	(57.7)
Mean mos followup (SD)	32.9	(18.3)
Mean wattage (SD)	93.8	(18.5)
Mean total joules (SD)	235,080	(129,126)
No. anticoagulant use (%)	31	(10.8)
No. history of 5ARI use (%)	188	(65.0)
No. 5ARI use at surgery (%)	161	(56.5)

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