ORIGINAL ARTICLE

Photoselective vaporisation prostatectomy using a GreenLight High Performance System for patients with bleeding tendency

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A video of photoselective vaporisation prostectomy is available at <www.hkmj.org>.

Objectives To report the results of a modified vaporisation incision technique using a GreenLight High Performance System in the treatment of benign prostatic disease in men receiving anticoagulants.

Design Case series.

Setting Regional hospital, Hong Kong.

Patients From January 2007 to April 2010, 48 patients with a bleeding tendency or on oral anticoagulants who underwent photoselective vaporisation prostatectomy with a GreenLight High Performance System in the North District Hospital were studied. Data collected prospectively were analysed to determine perioperative and postoperative outcomes, including uroflowmetry parameters, serum prostate-specific antigen level, prostate volume, and complications at 1, 3, 6, and 12 months post-surgery.

Results The patients' mean age was 76 (standard deviation, 7; range 62-94) years. The mean follow-up period was 13 (standard deviation, 9) months. Thirty-six (75%) patients had urinary retention prior to surgery. Bleeding tendencies were due to receipt of aspirin (n=36), two antiplatelet agents (n=6), warfarin (n=4) and clopidogrel (n=1), and to thrombocytopaenia (n=1). Preoperative transrectal ultrasonography showed a mean prostate size of 58 (standard deviation, 30; range, 18-154) mL. Of the patients, 81% were discharged without a catheter and their mean hospital stay was 3 days. Five patients were readmitted for secondary haemorrhage, two had a drop of more than 10 g/L in their haemoglobin level, but only one received a blood transfusion. Mean uroflowmetry parameters, namely, peak flow rate and residual volume, were 8.7 mL/s and 199 mL preoperatively and 14.7 mL/s and 50 mL 1 year after the operation.

Conclusion With an ageing population in which patients with various co-morbidities receive anticoagulant/antiplatelet therapy, photoselective vaporisation prostatectomy using a GreenLight High Performance System is a safe treatment option.

Key words
Laser therapy; Prostate-specific antigen; Prostatectomy; Prostatic hyperplasia; Treatment outcome

Hong Kong Med J 2012;18:502-6

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New knowledge added by this study

- An alternative to transurethral resection of the prostate has emerged in the form of laser energy.
- Instead of cutting out tissue, the new technique creates the channel by vaporising the tissue using laser energy.
- This procedure is associated with less bleeding and fluid absorption than standard transurethral prostate resection.

Implications for clinical practice or policy

- A new treatment is available for the treatment of benign prostatic hyperplasia.
- Photoselective vaporisation prostatectomy is safe and effective in patients receiving oral anti-coagulants.

Introduction

Transurethral resection of the prostate (TURP) is an established endoscopic procedure for the treatment of an obstructing prostate. With improved techniques, its complication

rate has decreased significantly. Among other complications, rates of blood transfusion are still between 2% and 7%.[1] Bleeding is of particular concern in patients with any bleeding tendency due to disease or drugs. Increasing recourse to the latter create challenges and dilemmas for surgeons. Conventionally, oral anticoagulants or antiplatelet-aggregating agents are discontinued perioperatively often with bridging heparinisation (if indicated). The introduction of photoselective vaporisation of the prostate (PVP) has provided a safe alternative to traditional TURP. Among the earlier generations of PVP lasers, an 80 W potassium-titanyl-phosphate (KTP) laser was the most widely described. Crystals of KTP were used to generate a light beam at a wavelength of 532 nm at 80 W energy, which fell within the visible green light zone of the electromagnetic spectrum; hence the name 'GreenLight' laser. This laser is selectively absorbed by oxyhaemoglobin in the prostate, which allows photovaporisation of the prostate tissue. Haemostasis is achieved by the superficial coagulative effect of the laser beam, thereby significantly reducing intra-operative bleeding. Recourse to blood transfusion is minimal,[1] and both the immediate and sustained improvement in voiding is similar to that achieved by conventional TURP. In addition, use of normal saline as irrigant eliminates the risk of TURP syndrome.

The GreenLight High Performance System (HPS) was introduced in 2006. In contrast to the KTP laser, it uses lithium triborate crystals to generate a laser at the same wavelength at 120 W energy. Its safety and efficacy was demonstrated in males with retention and large prostates who were taking anticoagulants.[2,3] The North District Hospital is one of the pioneer hospitals that introduced GreenLight HPS to the public health care system in Hong Kong. It is an acute general hospital with 600 in-patient beds, serving the population of the New Territories East district. It has a 24-hour accident and emergency service, as well as specialist out-patient, day and community facilities that commenced services in February 1998. Here we evaluated the safety and efficacy of PVP with the GreenLight HPS in patients taking oral anticoagulants, antiplatelet agents, or having other bleeding tendencies.

綠色激光高效能系統替有出血傾向的病人進行經尿道前列腺選擇性激光氣化術

目的 利用綠色激光高效能系統替有前列腺良性疾病並正服用抗凝血劑的病人進行改良了的氣化切割術。本文報告這些病人的術後結果。

設計 病例系列。

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患者 2007年1月至2010年4月期間，於北區醫院接受使用綠色激光高效能系統進行經尿道前列腺選擇性激光氣化術的病人，這些病人均有出血傾向或正服用抗凝血劑。本研究分析前瞻性收集得到的數據來找出病人術中和術後的結果，包括尿流率參數、血清前列腺特定抗原水平、前列腺大小，以及於術後1、3、6和12個月出現的併發症。

結果 病人平均年齡76歲（標準差7歲；介乎62至94歲），平均追蹤期13個月（標準差9個月）。36名病人（75%）術前有尿瀦留。病人有出血傾向的原因有服用阿司匹林（36例）、雙重抗血小板藥物（6例）、華法林（4例）、氯吡格雷（1例）以及血小板減少症（1例）。經直腸超聲檢查顯示術前前列腺的平均大小為58 mL（標準差30 mL；介乎18至154 mL）。病人平均住院時間為3天，其中81%出院時並不需置有導管。5名病人因再度出血而要入院，其中2人的血紅素水平下降多於10 g/L，但只有1人接受輸血。術前和術後一年的尿流率參數有分別：術前尿流速為8.7 mL/s，術後一年上升至14.7 mL/s；術前餘尿量為199 mL，術後一年下降至50 mL。

結論 人口老化，加上有不同共病的病人接受抗凝血劑/抗血小板的治療，利用綠色激光高效能系統替病人進行經尿道前列腺選擇性激光氣化術是一種安全的治療選擇。

Methods

Between January 2007 and April 2010, 48 patients receiving oral anticoagulants, antiplatelet agents, or having a coagulopathy underwent PVP for the treatment of benign prostatic hyperplasia (BPH). Indications for PVP included symptomatic BPH that failed medical treatment or the presence of refractory urinary retention. Patient data were compiled prospectively, and augmented using the territory-wide electronic medical record system. Prior to surgery, the International Prostate Symptom Score (IPSS) questionnaire was filled out, and uroflowmetry parameters, serum level of prostate-specific antigen (PSA), and transrectal ultrasonographic estimate of prostate volume were obtained. Patients with elevated PSA levels of more than 4 ng/mL and an abnormal digital rectal examination were advised to undergo transrectal ultrasound-guided prostate biopsy, and proceed with PVP only after carcinoma of the prostate had been ruled out. Platelet-aggregating inhibitors were continued throughout the perioperative period, while coumarin derivatives were stopped for several days before the operation and a heparin infusion was titrated.

Description of technique

This study is an extension of an earlier report.[4] The procedure was performed using the 120 W HPS side-firing laser (American Medical Systems, Minnetonka

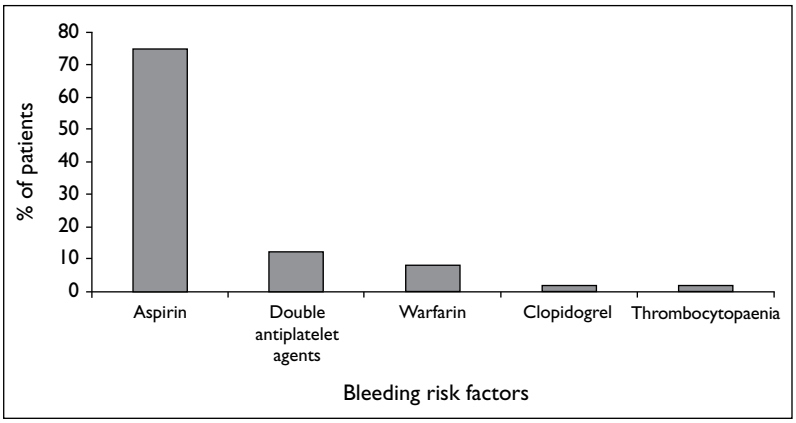

FIG. Types of bleeding risk factors applicable to our study population

[MN], US) through a continuous-irrigation laserscope (Wolf, Germany), using normal saline as the irrigant. We used a modified vaporisation incision technique.[4] The PVP began at 80 W and then power was increased to 120 W. After identifying the ureteric orifices, an incision was made at 5 and 7 o'clock at the bladder neck by a rapid twitching movement of the laser fibre. Laser vaporisation was directed towards the right lobe and the initial channel was developed with a slow and steady stroke from the bladder neck towards the apex. This procedure was repeated on the left side, and the resultant channel allowed even better irrigation flow. Further vaporisation using the 120 W setting was achieved in the lateral and median lobes.

Postoperative bladder irrigation was not routinely adopted. The patients' indwelling catheters were removed on postoperative day 1 after they were weaned off the spinal anaesthetic agent, with the exception of those with fever or persistent gross haematuria. Those who failed to void freely underwent voiding trials at the day service department 2 weeks later. Perioperative parameters—including the operating time, duration of catheterization and hospitalisation, and complications—were documented in accordance with the protocol.

Patients were followed up at a designated prostate clinic at 1, 3, 6, and 12 months after the operation. At each visit, IPSS and uroflowmetry parameters were determined; the serum PSA level was determined at the 3rd and 6th month after the operation, and the prostate volume was assessed by transrectal ultrasound at the 6th and 12th postoperative month.

Results

There were 48 patients with a mean age of 76 (standard deviation, 7; range, 62-94) years; 36 were taking aspirin, 6 were on double antiplatelet agents (aspirin + dipyridamole or clopidogrel), 4 were taking warfarin, and 1 was taking clopidogrel only. The mean follow-up period was 13 (standard deviation, 9) months. One patient had thrombocytopaenia (Fig). Among these patients, 12 (25%) had surgery for severe lower urinary tract symptoms and 36 (75%) for urinary retention.

The mean operating time was 68 (standard deviation, 35; range, 17-170) minutes, and the mean laser energy used was 223 504 J (range, 45 485-487 358 J). One case was converted to monopolar TURP, due to bleeding during the operation. After catheter removal upon discharge, 39 (81%) of the patients were able to void adequately, including 20 who voided successfully on postoperative day 1. The mean postoperative hospital stay was 3 (range, 1-13) days. Those who underwent re-catheterization did so after a voiding trial in the out-patient department. Regarding these patients, 46 (96%) were catheter-free 2 months after the operation; only two experienced refractory urinary retention attributable to hypocontractile bladders (confirmed by urodynamic studies). Their clinical outcomes in terms of prostate volume and uroflowmetry parameters are listed in Table 1.

The adverse events these patients experienced are listed in Table 2. Five patients developed secondary haemorrhages, two of whom had a significant drop in haemoglobin level (>10 g/L). One of the latter was taking warfarin for atrial fibrillation and had a preoperative prostate size of 36 mL. He developed significant secondary haematuria with clot retention 1 month after the operation. His warfarin had been withdrawn 7 days before the operation without bridging heparinisation. As his haemoglobin level had dropped by 30 g/L, he received a blood transfusion and underwent clot evacuation. No other patient had a revision operation within the follow-up period.

Discussion

For bladder outlet obstruction secondary to BPH, TURP has stood the test of time and is considered the 'gold standard' surgical treatment. However, major complications, most notably perioperative blood loss warranting blood transfusion and TURP syndrome, have been reported as frequently as 2-7% and 1%, respectively.[5]

Bleeding is of particular concern in patients who are on antiplatelet/anticoagulant therapy, which is increasingly being used to treat a variety of medical conditions. The benefit of minimising bleeding by withdrawing oral anticoagulants during the perioperative period is offset by the risk of thrombosis, blockage of blood vessels, or embolism. Hence, various minimally invasive techniques for treating the prostate have been developed, including PVP using the KTP laser, in which situation

TABLE 1. Clinical outcome in terms of prostate volume, prostate-specific antigen (PSA), uroflowmetry, and International Prostate Symptom Score (IPSS)

Outcome	Baseline	Postoperative			
		1 Month	3 Months	6 Months	12 Months
IPSS					
Mean ± SD*	21.2 ± 8.7	15.4 ± 9.4	14.3 ± 10.3	12.5 ± 10.0	9.5 ± 6.7
Range	5-34	2-33	0-33	2-33	0-26
Qmax† (mL/s)‡					
Mean ± SD	8.7 ± 5.5	19.5 ± 6.5	16.2 ± 6.2	16.3 ± 6.9	14.7 ± 7.2
Range	4-22.1	10.1-34.1	6.8-28.7	7.1-26.7	6.6-34.2
Post-void residual (mL)‡					
Mean ± SD	199 ± 201	47 ± 45	63 ± 83	70 ± 130	50 ± 45
Range	0-623	0-168	0-377	0-721	0-176
PSA (ng/mL)					
Mean ± SD	5.9 ± 4.5	-	3.3 ± 3.2	3.6 ± 2.9	-
Range	0.48-20	-	0.3-14.3	0.1-11.2	-
Prostate volume (mL)					
Mean ± SD	58 ± 30	-	-	38.3 ± 23.5	42.5 ± 28.7
Range	18-154	-	-	6-99.6	10.3-115

* SD denotes standard deviation
† Qmax was considered valid only if the voided volume was ≥150 mL
‡ Only 10 patients who were not in retention had measurable preoperative flow rate

TABLE 2. Major postoperative complications after photoselective vaporisation of the prostate

Complication	No. of patients
Secondary haemorrhage	5
Blood transfusion*	1
Transient urinary retention	9
Urinary tract infection	3
Urethral stricture	1
Medical complications (atrial fibrillation, chest infection)	2

* One of the five patients who developed secondary haemorrhage

perioperative anticoagulation may be continued or only interrupted very briefly.

Numerous studies have demonstrated PVP to be a safe and effective surgical technique in patients with BPH,[1,6] including those with high cardiopulmonary risks,[7] urinary retention, and large prostates. Although no results from randomised controlled studies are currently available, initial data support its safety profile and short-term efficacy in patients on oral anticoagulants.[2,8]

Ruszat et al[8] reported their experience with 80 W KTP laser therapy on 116 patients at risk of bleeding, including 71 taking aspirin, 36 on coumarin derivatives, and 9 on clopidogrel. Their mean prostate volume was 62 (range, 15-180) mL. None of these patients endured perioperative bleeding warranting blood transfusion, although 11% did develop transient retention treated by catheterization on discharge.

Woo et al[2] illustrated the short-term efficacy of PVP using GreenLight HPS 120 W laser therapy in 67 patients taking anticoagulant therapy. Statistically significant improvements in the IPSS (-62%; P<0.001), maximum flow rate (+128%; P<0.001), post-void residual urine (-79%; P<0.001), and reduction in prostate volume (-51%; P<0.001) were observed during a mean follow-up period of 4 months. The improvements in these parameters were all comparable to those noted in patients not on anticoagulants. Furthermore, Ruszat et al[8] reported a low rate of blood transfusion (1.5%) among patients who underwent PVP, although 8% underwent re-catheterization due to retention.

In the current study, immediate improvement in voiding was observed and sustained for at least 12 months. Similar to other series, the majority of our patients were receiving aspirin before the operation and their oral anticoagulants were continued. Although our patients had a smaller mean prostate volume than that reported in other series, a significantly higher proportion endured urinary retention (75% vs 28-38%).[2,8,9] We did not demonstrate a dramatic improvement in urinary flow, possibly because many of our patients had preoperative retention; however, the majority were nevertheless catheter-free after the procedure.

The most common complication was transient urinary retention. Although approximately 18% of the patients were discharged with a catheter, 96% were able to void without a catheter after 2 months. In our series, the continuation of antiplatelet-aggregating agents did not appear to result in substantial postoperative bleeding, and the rate of blood transfusion was low. Thus, PVP is the procedure of choice for patients on antiplatelet/anticoagulation therapy, in whom withdrawal of the medication could aggravate thromboembolic risk.

One major limitation of this series was the small number of patients. However, our study was unique in having satisfactory results in a population where a significantly high portion of patients were in retention. In addition, for the entire group the improvements were sustained for at least 1 year.

To reduce the morbidity of TURP, various surgical techniques have been developed, including bipolar transurethral resection in saline, in which the risk of TURP syndrome has been minimised.[10,11] However, no definite conclusion can be drawn regarding its haemostatic efficacy. Specifically, the modality has not been studied in high-risk patients, and it would appear premature to extrapolate its use to our patient group.

Conclusion

We have described a modified vaporisation incision technique using a GreenLight HPS 120 W laser for the treatment of BPH, and have demonstrated its favourable safety profile and clinical outcome in patients receiving oral agents that interfere with haemostasis.

References

1. Ruszat R, Seitz M, Wyler SF, et al. Greenlight laser vaporization of the prostate: single-center experience and long-term results after 500 procedures. Eur Urol 2008;64:893-901.
2. Woo H, Reich O, Bachmann A, et al. Outcome of greenlight HPS 120-W laser therapy in specific patient populations: those in retention, on anticoagulants, and with large prostates (≥80 ml). Eur Urol 2008;7(4 Suppl):378S-383S.
3. Saliviero M, Araki M, Culkin DJ, Wong C. Incidence, management, and prevention of perioperative complications of greenlight HPS laser photoselective vaporization prostatectomy: experience in the first 70 patients. J Endourol 2009;23:495-502.
4. Mak SK, Wong MH, Yip SK, Chu WH. Photoselective vaporization prostatectomy with 120 W greenlight HPS on bleeding tendency patients—vaporization incision technique. Journal of Endourology Part B, Videourology. Feb 2010, 24. doi: 10.1089/vid.2009.0060.
5. Rassweiler J, Teber D, Kuntz R, Hofmann R. Complications of transurethral resection of the prostate (TURP)—incidence, management, and prevention. Eur Urol 2006;50:969-79; discussion 980.
6. Hai MA. Photoselective vaporization of prostate: five-year outcomes of entire clinic patient population. Urology 2009;73:807-10.
7. Reich O, Bachmann A, Siebels M, Hofstetter A, Stief CG, Sulser T. High power (80W) potassium-titanyl-phosphate laser vaporization of the prostate in 66 high risk patients. J Urol 2005;173:158-60.
8. Ruszat R, Wyler S, Forster T, et al. Safety and effectiveness of photoselective vaporization of the prostate (PVP) in patients on ongoing oral anticoagulation. Eur Urol 2007;51:1031-8; discussion 1038-41.
9. Sandhu JS, Ng CK, Gonzalez RR, Kaplan SA, Te AE. Photoselective laser vaporization prostatectomy in men receiving anticoagulants. J Endourol 2005;19:1196-8.
10. Ho HS, Yip SK, Lim KB, Fook S, Foo KT, Cheng CW. A prospective randomized study comparing monopolar and bipolar transurethral resection of prostate using transurethral resection in saline (TURIS) system. Eur Urol 2007;52:517-22.
11. Mamoulakis C, Trompetter M, de la Rosette J. Bipolar transurethral resection of the prostate: the 'golden standard' reclaims its leading position. Curr Opin Urol 2009;19:26-32.