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Effectiveness and Safety of Photoselective Vaporization of the Prostate with the 120 W HPS Greenlight Laser in Benign Prostatic Hyperplasia Patients Taking Oral Anticoagulants

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Purpose: To examine the effectiveness and safety of photoselective vaporization of the prostate (PVP) with the 120 W high-performance system (HPS) Greenlight laser procedure in benign prostatic hyperplasia (BPH) patients taking oral anticoagulant medications.

Materials and Methods: This study was conducted on BPH patients taking oral anticoagulant medications form March 2009 to December 2010. Group I consisted of patients who stopped oral anticoagulant medications before surgery (n=30), and group II consisted of patients who continued oral anticoagulant medications before surgery (n=30). PVP applying the 120 W HPS Greenlight laser was done, and followed up for 12 weeks. Follow-up variables were International Prostate Symptom Score (IPSS), maximum urinary flow rate (Qmax), postvoid residual urine volume (PVR), and hemoglobin level change.

Results: At 12 weeks after surgery, we confirmed the improvement in the IPSS score of Group I compared with preoperative scores. The quality of life (QoL) score, Qmax and PVR were also improved. respectively, both of which were significantly improved. In Group II, similarly, the total IPSS score, the voiding symptom score, and the storage symptom score were improved in comparison with the preoperative scores. The QoL score, Qmax and the PVR were improved in comparison with the preoperative scores. During the 12-week follow-up period, no major postsurgical complications requiring transfusion, rehospitalization, etc. were observed.

Conclusions: The 120 W HPS Greenlight laser PVP procedure can be performed effectively and safely in BPH patients, even those who cannot stop oral anticoagulant medications despite requiring surgery.

Key Words: *Anticoagulants; Laser therapy; Prostatic hyperplasia*

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INTRODUCTION

With the aging of society, the absolute number of patients undergoing surgery after a diagnosis of benign prostatic hyperplasia (BPH) is on the increase, which could be considered to be associated with the increase in the absolute number of BPH patients [1]. With the development of medications, the ratio of patients requiring surgical treatment for BPH decreased [1]. Nonetheless, surgery should be performed for bladder outlet obstruction patients who are not responsive to medication. Transurethral resection of the prostate (TURP) has a high success rate, and we can anticipate immediate improvement of urinary symptoms.

In addition, owing to developments in surgical techniques as well improvements in the pre- and postoperative management of patients, the postoperative mortality rate

has decreased to nearly 0% [2]. However, the rate of postoperative complications after transurethral prostatectomy is 20%, which is still high [3-6], and the postoperative morbidity rate reaches 6.9-14%. In addition, it has been reported that the rate of urinary retention due to bleeding and clots within 1 month after surgery is 9.5-18% [7-9], the frequency of transfusion is 2-7.1%, and the rate of reoperation due to bleeding reaches 3-5% [2]. Because of such postoperative bleeding complications, TURP should be performed very carefully, especially in patients prone to bleeding.

As a result of the ongoing prolongation of life expectancy as well as the aging of the population, the number of patients with cardiac diseases such as atrial fibrillation, thrombosis, and prosthetic valves is on the rise. To prevent thrombus and infarction in such patients, anticoagulant agents are prescribed in many cases. The surgery risk is high when conventional TURP is performed in such patients [10]. Thus, consensus on the selection of appropriate surgical methods for such patients has not yet been reached [11].

The 120 W high-performance system (HPS) Greenlight laser minimizes bleeding by photoselective vaporization by use of a specific wavelength of 532 nm. In particular, it has been reported that with photoselective vaporization with a high-power laser system, the vaporization period is short and operator's convenience is increased [12]. Such characteristics of a laser, together with the ability of conventional TURP to remove the prostate, could make it safe to perform transurethral prostatectomy in patients prone to bleeding. Particularly, for older patients with cardiovascular diseases for whom the administration of oral anticoagulant medications cannot be stopped, surgery should be performed very carefully because of the risk of bleeding. Hence, surgery applying a laser may be safer in such patients. In the present study, therefore, we assessed the effectiveness and safety of 120 W HPS Greenlight laser photoselective vaporization of the prostate (PVP) in patients taking oral anticoagulant medications.

MATERIALS AND METHODS

From March 2009 to December 2010, a retrospective, randomized study was performed. The study was conducted on 60 patients who visited the department of urology for lower urinary tract symptoms, diagnosed as BPH, and were prescribed anticoagulant medications such as aspirin and clopidogrel and warfarin because of previous myocardial infarction and arrhythmia and cerebral vascular accident. Operative indications were cases with persistent symptoms despite appropriate treatment with alpha-blockers alone or in combination with 5-alpha reductase inhibitors for a minimum of 3 months, cases who avoided medications because of concerns about side effects, cases with severe bladder outlet obstruction diagnosed by urodynamic study (UDS), and cases with persistent hematuria originating from the prostate, bladder stones, or persistent urinary infection. These patients were divided into two groups: one group consisted of patients who stopped taking oral anticoagulant medications before 120 W HPS Greenlight laser PVP (Group I, n=30). Another group consisted of patients with ongoing oral anticoagulant medications who also underwent 120 W HPS Greenlight laser PVP (Group II, n=30). The follow-up period was 3 months after surgery.

Preoperative history taking, physical examination, complete blood cell count (CBC), digital rectal examination (DRE), transrectal ultrasonography (TRUS), prostate-specific antigen (PSA) test, maximum urinary flow rate (Qmax), postvoid residual urine volume (PVR), the International Prostate Symptom Score (IPSS), voiding diary, and UDS were performed in all patients.

Patients with prostate-specific antigen higher than 4.0 ng/ml, low echo lesions in TRUS, or palpated nodules in DRE were examined by TRUS-guided biopsy to exclude prostate cancer. One patient was confirmed to have prostate cancer, and during conservative treatment, his lower urinary symptoms became severe, and thus surgery was performed for palliative purposes. To assess the risk of bleeding during the operation, we checked the hemoglobin test at postoperative day 1. Postoperative follow-up variables were IPSS, Qmax, and PVR, and these variables were assessed 12 weeks after the operation.

For statistical analysis, we used SPSS ver. 18.0 (SPSS Inc., Chicago, IL, USA). For the comparison of the preoperative and postoperative results of each group, the Mann Whitney U-test was done. For the comparison of preoperative and postoperative results within a group, the Kruskall Wallis test was done. p-values less than 0.05 were considered to be statistically significant.

RESULTS

The mean age of the patients in Group I was 67.1±5.8 years and that in Group II was 71.3±5.8 years. Regarding the IPSS assessed before surgery, the total score of Group I was 22.4±3.6 points and that of Group II was 21.6±7.0 points. The voiding symptom score of Group I was 11.7±3.6 points and that of Group II was 10.4±2.7 points. The symptom score of Group I was 10.1±2.9 points and that of Group II was 9.4±2.4 points. The quality of life (QoL) indexes of Group I and Group II were 4.4±0.7 points and 4.4±1.1 points, respectively.

The Qmax of Group I was 8.6±4.2 ml/s and that of Group II was 6.9±1.3 ml/s. The PVR of Group I was 52.9±67.9 ml and that of Group II was 67.5±101.8 ml.

The prostate size measured before surgery by TRUS of Group I was 38.9±8.9 ml and that of Group II was 34.1±5.1 ml. The prostate-specific antigen of Group I was 3.4±3.4 ng/ml and that of Group II was 3.5±3.0 ng/ml. The prothrombin time international normalized ratio (PT INR) of Group I was 1.1±0.27 and that of Group II was 0.99±0.08. On the basis of these results, it was confirmed that the preoperative condition of the two groups was not significantly different (Table 1).

TABLE 1. Preoperative baseline patient characteristics

	Group I		Group II		p-value
	Mean±SD	Range	Mean±SD	Range	
Age (yr)	67.1±5.8	56-75	71.3±5.8	58-79	0.093
PSA (ng/ml)	3.4±3.4	0.7-21.0	3.5±3.0	0.4-9.7	0.312
Transrectal US (ml)	38.9±8.9	25.0-50.5	34.1±5.1	27.0-42.9	0.837
PVR (ml)	52.9±67.9	5-240	67.5±101.8	20-220	0.293
IPSS-sum	22.4±3.6	16-28	21.6±7.0	14-29	0.162
QoL score	4.4±0.7	4-6	4.4±1.1	3-6	0.317
PT INR	1.1±0.27	0.95-1.77	0.99±0.08	0.86-1.13	0.261

SD: standard deviation, PSA: prostate-specific antigen, US: ultrasonography, PVR: postvoid residual urine volume, IPSS: International Prostate Symptom Score, QoL: quality of life, PT INR: prothrombin time international normalized ratio

TABLE 2. Intraoperative and perioperative patient characteristics

	Group I	Group II	p-value
Operation time (min)	24.9±12.4	16.9±6.1	0.628
Total applied energy (J)	81,445.9±24,542.2	78,582.7±31,448.9	0.390
Hb (mg/dl)	0.6±0.53	0.5±0.49	0.886

Hb: hemoglobin change

TABLE 3. Postoperative follow-up parameters (Qmax, PVR) of Group I and Group II

	Group I		Group II	
	Qmax	PVR (ml)	Qmax	PVR (ml)
Preoperation	8.6±4.2	52.9±67.9	6.9±1.3	67.5±101.8
Postoperation	24.2±7.8	4.6±9.2	14.0±4.5	9.2±19.1
Perioperative change	15.6±5.2	48.3±52.8	7.1±3.8	58.3±112.4
p-value		0.004	0.016	0.047

PVR: postvoid residual urine volume, Qmax: maximum urinary flow rate

The operation times of Group I and the Group II were 24.9±12.4 min and 16.9±6.1 min, respectively. The average energy consumed during surgery was 81,445.9±24,542.2 J in Group I and 78,582.7±31,448.9 J in Group II. Thus, the amount energy delivered during surgery and the operation time of the two groups were not significantly different. During surgery, no complications developed, and Foley catheters were removed 1 day after surgery in all patients.

Changes in the hemoglobin value were assessed by CBC performed before and after surgery. No significant changes in hemoglobin between before and after surgery were detected in the group that ceased taking anticoagulant drugs or in the group who continuously took anticoagulant agents ($p < 0.05$) (Table 2).

At 12 weeks after surgery, the IPSS of each group was assessed compared with the preoperative values. In Group I, the total score was 6.2±3.2 points, the voiding symptom score was 2.6±3.3 points, and the storage symptom score was 3.6±2.0 points, which were improved in comparison with the scores before surgery. The QoL score was 1.8±0.8 points, and it was also improved in comparison with the preoperative score. Qmax and PVR after surgery were 24.2±7.8 ml/s and 4.6±9.2 ml, respectively, which were improved in comparison with the preoperative scores (Table 3). In Group II, similarly, the IPSS total score was 11.4±5.9 points, the voiding symptom score was 4.8±4.0 points, and the storage symptom score was 4.1±4.2 points, which were improved in comparison with the preoperative scores. The QoL score was 2.1±1.4 points, and it was confirmed to be improved. Qmax was 14.0±4.5 ml/s and PVR was 9.2±19.1 ml, which were also improved in comparison with the preoperative score (Table 3).

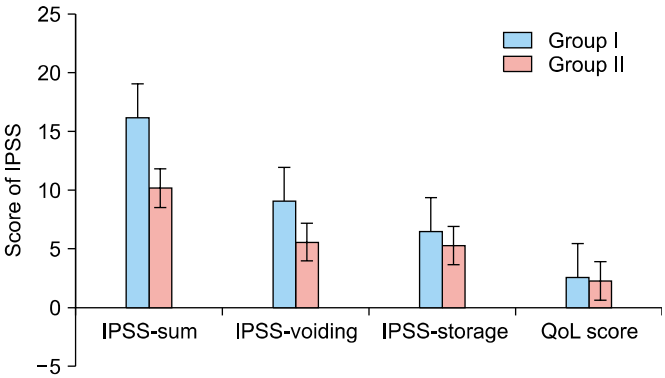

FIG. 1. The change in perioperative IPSS parameters of Group I and Group II. IPSS: International Prostate Symptom Score, QoL: quality of life.

The changes in perioperative IPSS parameters of Group I and Group II were not significantly different (Fig. 1). During 12 weeks of follow-up, none of patients in the two groups developed hematuria, impotence, urethral stricture, infection, or other complications.

DISCUSSION

With the development of medicines, human life expectancy

is prolonged; consequently, the elderly population group is on the increase. Generally, with aging, the possibility of developing cerebral and cardiovascular diseases is increased, and the number of patients taking anticoagulant medications to prevent these diseases is also on the rise. The increase in the number of patients developing geriatric diseases can be confirmed by the increase in the number of BPH patients in the urological field [1].

In such aging patients, regardless of forms or purposes, the interruption of anticoagulants may increase the risk of thrombus, and thus attention should be paid to this point [11]. In TURP for general geriatric patients, the incidence of deep vein thrombosis reaches 6.8-10% [10]; thus, more comprehensive attention is required.

To reduce such risk in patients taking anticoagulants, we usually stop oral administration of anticoagulant agents for 3 to 4 days before surgery, and heparin is injected intravenously. Because the onset and reactive time of the heparin family is short, we can easily control it [13,14]. Despite such efforts, we can find reports of transfusion or rehospitalization after conventional TURP because of bleeding tendency. Chakravarti and MacDermott reported that for 11 patients under oral anticoagulant therapy, unfractionated heparin was injected intravenously from 2 days before surgery. After conventional TURP, one patient required transfusion and persistent hematuria occurred in 27% patients, although mild, and some patients required rehospitalization [13]. Dotan et al reported that in 20 patients receiving warfarin medication, LMW-heparin was administered before surgery. After conventional TURP, 20% of patients required transfusion, and in 10% of cases, a Foley catheter was indwelled again because of persistent hematuria or bleeding [15].

Preoperative anticoagulant medication reduces the level of risk for thrombus or infarction. On the other hand, it was observed that the bleeding tendency during and after the operation is maintained. In addition, in the elderly group, complications due to deep vein thrombosis may develop in approximately 6.8% to 10% of surgical patients, and thus the decision to use anticoagulants for prostate surgery is hard [10,16].

In this condition, 120 W HPS Greenlight laser PVP is drawing attention recently as a minimally invasive surgery that could replace conventional TURP [17,18]. In particular, we suggested it as a new option for patients receiving anticoagulant agents who require TURP.

In the urology field, after KTP laser TURP, the effectiveness and techniques of laser surgery have rapidly improved [19]. According to recent studies, laser PVP is one of the minimally invasive surgeries that have replaced conventional TURP [20].

PVP has the ability of conventional TURP to remove prostate tissues and the safety of a laser [21,22]. In short-term studies, the effectiveness and side effects were not greatly different from those of transurethral prostatectomy. There is no difference between PVP and conventional TURP in symptom improvement or reoperation risks. In particular, the risk of reoperation because of bleeding tendency is lower [23-28]. In addition, we can find many reports with good results, showing application in a large prostate that requires open surgery [27,29] or in a poor prognostic patient with a preoperative history of frequent retention [30].

As shown by our results, for patients taking oral anticoagulant therapy, PVP is a safe and effective procedure. This is because thrombus formation could be prevented by the continuous administration of anticoagulants, and bleeding and other complications could be prevented by PVP with a laser.

The purpose of surgery for the prostate is to improve urinary symptoms and to prevent complications caused by acute and chronic urinary retention. In our study conducted on the initial 60 cases of a high-risk group of patients, for 30 patients, the operation was performed after interrupting anticoagulant therapy, and for the remaining 30 patients, surgery was performed while maintaining anticoagulant therapy. Between these the two groups, there were no significant differences in preoperative variables such as age, IPSS, PSA, or the size of the prostate. Also, there were no significant differences in mean operation time or intraoperative energy consumption.

After surgery, no acute complications such as bleeding or urinary retention were observed in either group. In regard to postoperative urinary symptoms, the Qmax of the two groups was improved from 8.6 ml/s to 24.2 ml/s and from 6.9 ml/s to 14.1 ml/s, respectively. The PVR of the two groups was significantly improved from 52.9 ml to 4.6 ml and from 67.5 ml to 9.2 ml, respectively. In both groups, the objective index of all urinary symptoms was significantly improved in comparison with before the operation.

In addition, the preoperative and postoperative IPSS of the two groups was 22.4 points and 6.2 points, and 21.6 points and 11.4 points, respectively. We confirmed that there was significant statistical improvement. We also confirmed that the average IPSS voiding symptom score significantly improved from 11.7 points to 2.6 points and from 10.4 points to 4.8 points. The average IPSS storage symptom score of the two groups significantly improved from 10.1 points to 3.6 points and from 9.4 points to 4.1 points, respectively. The QoL score of group I improved from 4.4 points to 1.8 points and that of group II improved from 4.4 points to 2.1 points. The improvements in this subjective index were also shown to be statistically significant. The postoperative change in hemoglobin in group I and group II was 0.6 mg/dl and 0.5 mg/dl, respectively. There was no significant intergroup (group I/II) difference and no significant intragroup (pre/post operation) difference either. These results support the conclusion that the 120 W HPS Greenlight laser PVP procedure is safe, even in high-risk patients taking anticoagulant therapy.

In the comparison of the two groups, it appeared that in the group maintained on anticoagulant therapy, operation time was shorter and the average energy consumed during surgery was less than in the group in which anticoagulant

therapy was interrupted, which could be thought to be due to the surgeon's concerns for bleeding. Nonetheless, these differences were not statistically significant.

Besides the improvement of postoperative urinary symptoms, the complication rate is also an important variable. In our study, the long-term, follow-up observation is currently ongoing, but to date, none of the patients have presented with urethral stricture or bladder neck stricture. Long-term follow-up observation for stricture is required in the future.

The 120 W HPS Greenlight PVP method may minimize bleeding and the consequent risk for transfusion, especially for patients with lower urinary tract symptoms and bleeding tendency. This report is considered to be valuable because it is the first study in Korea showing that 120 W HPS Greenlight laser PVP can be performed safely and effectively in BPH patients who require maintenance of oral anticoagulants. Long-term follow-up observation on a larger number of patients is required and is planned.

CONCLUSIONS

For BPH patients taking anticoagulant medications for the treatment or prevention of cardiac or cerebral diseases who require surgical BPH treatments, 120 W HPS Greenlight laser PVP is considered to be an effective and safe surgical method. On the basis of our experiences, we suggest that 120 W HPS Greenlight PVP be considered the standard procedure for such patients with a high risk of bleeding, while maintaining anticoagulant therapy.

Conflicts of Interest

The authors have nothing to disclose.

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