Diode Laser Ablation of Prostate and Channel Transurethral Resection of Prostate in Patients with Prostate Cancer and Bladder Outlet Obstruction Symptoms

Babak Javanmard, Amin Hasanzadeh Hadad, Mohammad Yaghoobi, Behzad Lotfi

Department of Laser Application in Medical Sciences Research Center, Shohadae Tajrish Hospital, Shahid Beheshti University of Medical Sciences.Tehran, Iran.

Corresponding Author:
Babak Javanmard, MD
Department of laser Application in Medical Sciences, Shohadae Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

Tel: +98 21 22718006
E-mail: drbabakjavanmard@gmail.com

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Purpose: To evaluate the efficacy of diode laser ablation of prostate for treating lower urinary tract symptoms (LUTS) in patients with locally advanced prostate cancer and comparing results with palliative transurethral resection of prostate (pTURP).

Materials and Methods: Thirty-six known cases of locally advanced prostate cancer with a maximum urinary flow rate (Qmax) of 12 mL per second or less and an International Prostate Symptom Score (IPSS) of 20 or more were included in this study. Patients were randomized into two groups. The first group underwent pTURP and for the second group diode laser ablation of prostate was done. In 6 months post-operative follow up, patients were evaluated for IPSS, post void residual (PVR) urine volume, Qmax and possible complications such as urethral stricture or urinary incontinence.

Results: Postoperatively, mean IPSS was 11.1 ± 4.1 in TURP group and 11.7 ± 3.6 in laser group (P = .64). Mean PVR was 18.4 ± 3.5 mL in TURP group and 17.7 ± 6.3 mL in laser group (P = .68). Mean Qmax in TURP and laser groups were measured 20.1 ± 4.5 mL/s and 19.4 ± 2.6 mL/s, respectively (P = .57). While there was a significant improvement in IPSS and Qmax and PVR in both groups, statistical analysis did not show any significant difference postoperatively between pTURP and laser groups.

Conclusion: Diode laser ablation of prostate and pTURP, both improved significantly IPSS, PVR and Qmax. But hospital stay and post-operative catheterization time was less in laser group.

Keywords: laser therapy; prostatectomy; methods; prostatic neoplasms; complications; transurethral resection of prostate; treatment outcome; urinary bladder neck obstruction.

INTRODUCTION

Complications of locally advanced prostate cancer are often overlooked in the treatment of prostate cancer, which can have significant morbidity. Despite advances in early detection and treatment of prostate cancer, as many as 10% of patients present with or develop symptomatic locally advanced prostate cancer.[1] Acute urinary retention is a common complication of a neoplastic prostate. Transurethral resection of prostate (TURP) can offer immediate relief of the obstruction in patients with benign prostatic hyperplasia (BPH).[2] In contrast, palliative TURP (pTURP) (the so-called "channel" TURP), is transurethral resection of prostate tissue in a patient with metastatic or locally advanced and/or previously treated prostate cancer to alleviate obstructive voiding symptoms. Therefore, resection to the depth of the prostatic capsule is not attempted.[3] Although TURP is commonly performed to relieve bladder outlet obstruction (BOO) symptoms in patients with BPH,[4] little known about the outcome of laser ablation of prostate in patients with locally advanced prostate cancer. In this study, diode laser ablation of prostate and pTURP were performed for 36 consecutive patients with locally advanced prostate cancer and refractory urinary retention and preoperative and postoperative results of both procedures were compared.

MATERIALS AND METHODS

In a period of two years, from February 2011 to January 2013, thirty-six patients were included in this study. Inclusion criteria were maximum urinary flow rate (Qmax) of 12 mL per second or less with voided volume of 150 mL or greater and International Prostate Symptom Score (IPSS) of 20 or more, in a patient with locally advanced (stage T3 or T4) prostate carcinoma. External beam radiotherapy with or without adjuvant hormone therapy was the initial treatment for their cancer. Ethical approval for the study was obtained from Medical Ethics Committee of Shahid Beheshti University of Medical Sciences.

Using simple randomization method, patients were divided into two groups. The first group underwent palliative pTURP and for the second group diode laser ablation of prostate was done. Patients had no specific management for lower urinary tract symptoms (LUTS) before the procedure except for α_1- blockers administration. Preoperatively IPSS was determined in all of the patients and cystoscopy was performed to roll out possible urethral stricture. Uroflowmetry was also done. All patients underwent ultrasound study to evaluate kidneys and prostate volume and PVR. Blood tests comprised complete blood count (CBC), serum chemistry, serum prostate specific antigen (PSA) and coagulation tests. Patients with abnormal coagulation tests or those who were using anticoagulant agents and could not stop taking their drugs for a while before surgery were excluded from the study. Urine analysis and urine culture were also attained and appropriate antimicrobial therapy was initiated in patients with a positive urine culture, before the surgery. In all cases prophylactic antibiotics were administered.

A single urologist performed both pTURP and diode laser ablation of prostate. All procedures were performed using spinal anesthesia with standard cardiac monitoring. pTURP was performed using a continuous flow 26 French (F) resectoscope. It was not attempted to remove maximum amount of prostate tissue, but to produce a channel, which would improve urinary flow. Therefore procedure was stopped when it was visually estimated that prostatic fossa was wide enough. Laser therapy was conducted in a side firing technique. A 600 nm, side firing laser fiber was introduced through a 24F continuous flow laser cystoscope. Sterile isotonic saline was used as an irrigant solution. The 980-1470 nm diode laser generator could deliver 50W to 150W energy in continuous mode. We began vaporizing tissue from surface of the median lobe, sweeping the fiber slowly and continuously in a gentle rotation movement in a 5 °'clock to 7 °'clock direction, keeping the fiber in direct contact to the prostatic tissue. When the median lobe was reduced we proceeded to the right lateral lobe, using the same technique and then to the left lateral lobe. The slow continuous motion assured hemostasis and constant reassessing of position. Postoperatively a 20F two-way Foley catheter was placed and no irrigation was needed. The catheter was removed the next day and patients were discharged. In 6-month post-operative follow-up, patients were evaluated for IPSS, PVR, serum creatinine, Qmax and possible complications such as urethral stricture or urinary incontinence.

Statistical Analysis

Continuous data was reported as mean ± SD and dichotomous variables were reported as frequency and percent. Chi-square test was used for statistical analysis of nominal variables and paired *t*-test and independent *t*-test were used for continuous variables. All statistical analysis was done by Statistical Package for the Social Science (SPSS Inc, Chicago, Illinois, USA) version 16.0. *P* value less than .05 was considered statistically significant.

RESULTS

The mean age of patients was 70.8 ± 8.7 years in TURP group and 69.1 ± 6.6 years in laser group (*P* = .51). The mean prostate volume was 45.8 ± 7.2 mL and 43.4 ± 5.5 mL in TURP and laser groups, respectively. The mean PSA before surgery was 27.2 ± 5.5 ng/mL in TURP group and 31.4 ± 7.3 ng/mL in laser group (*P* = .59). Three patients (16.6%) in laser group and 5 (27.7%) in TURP group had mild to moderate hydronephrosis. Mean serum creatinine level for TURP and laser group were 1.81 ± 0.9 mg/dL and 1.65 ± 0.7 mg/dL, respectively. The average time from external beam radiotherapy to pTURP was 31.2 ± 5 months in laser group and 35.5 ± 7.7 months in TURP group (*P* = .56). Preoperative data are shown in **Table**. The mean operation time was 36.8 ± 5.2 minutes and 28.1 ± 4.8 minutes for TURP and laser groups, respectively. Time of surgery was measured from the beginning of laser firing or first bite of TURP to the insertion of Foley catheter. In the TURP group, there was one case of TURP syndrome (5.5%) and one patient needed blood transfusion after the procedure. Neither TURP syndrome nor any need for blood transfusion was observed in laser group. During the first week after the procedure 3 patients (16.6%) needed re-catheterization and a short and mild irrigation because of

obstruction, cause by residual necrotic tissue of prostate in laser group. At 6 months visit after the procedure, one patient from the TURP group and two patients from laser group were lost. Urge incontinence was developed in three patients (17.6%) in TURP group and none was noticed in patients who underwent laser ablation. Postoperatively, mean IPSS was 11.1 ± 4.1 in TURP group and 11.7 ± 3.6 in laser group (P = .64) (**Table**). Mean PVR was 18.4 ± 3.5 mL in TURP group and 17.7 ± 6.3 mL in laser group (P = .68). Mean Qmax in TURP and laser groups were measured 20.1 ± 4.5 mL/s and 19.4 ± 2.6 mL/s, respectively (P = .57). Mean serum creatinine was 1.53 ± 0.5 mg/dL in TURP group and 1.49 ± .06 mg/dL in laser group (P = .73).

DISCUSSION

LUTS are not uncommon in men with prostate cancer. Besides hematuria, BOO with its complications such as urinary retention, a high PVR, bladder stones or hydronephrosis, is the most frequent complication of locally advanced prostate cancer.[5] Today such complications of locally advanced disease are overlooked in the management of prostate cancer. In a series of 478 men with newly diagnosed prostate cancer in pre PSA era, up to 82% presented with obstructive symptoms.[6] A few studies have focused on clinical findings in prostate cancer patients, receiving pTURP for urinary retention and obstructive symptoms. But the role of laser ablation of prostate in such patients as a palliative therapy is not well defined in the literature. TURP has been the gold standard therapy for the relief of BOO for more than 70 years. TURP for BOO due to prostate cancer has been used in clinical practice throughout this time and has been a viable option for prostate cancer obstructing the urethra for several decades.[3] It has been estimated that approximately 25% to 35% of patients on watchful waiting may ultimately require pTURP.[7] In a series of 209 patients who underwent radiotherapy for stage C prostate cancer, 17 patients required subsequent pTURP for local progression of the disease.[8]

Marszalek and colleagues[9] reviewed the outcome of pTURP, performed for 89 patients with locally advanced prostate cancer. The mean interval between the diagnosis and pTURP was 1.5 years. Indications for surgery in their study included: refractory urinary retention (30%), severe BOO with PVR of > 100 mL (43%) and bladder stones, hematuria and hydronephrosis in 9% of patients. Eighth patients (9%) needed blood transfusion after the procedure and in follow up, after 11 months, a repeat TURP was necessary in 22 patients (25%). They concluded that pTURP is a fairly safe procedure, although the pre and post-operative mortality was significantly higher (2%) than for contemporary series of BPH (< 0.25%). Crain and colleagues[10] performed 24 pTURP in 19 patients with locally advanced prostate cancer. The initial therapy for all of them was radiotherapy or hormone therapy. The average time from prostate cancer diagnosis to pTURP was 44.7 months. After the procedure IPSS was significantly reduced but no significant improvement in Qmax was observed. Of patients in this study 24% required repeat procedures for bleeding or obstruction and 21% ultimately required long term bladder drainage via a Foley catheter or suprapubic tube. Thomas and colleagues[11] randomized 22 patients presenting with acute urinary retention secondary to locally advanced prostate cancer into two groups. Ten patients underwent pTURP and bilateral orchiectomy and 12 patients underwent bilateral orchiectomy alone. Four patients treated by pTURP had difficulties in voiding and one of them underwent further TURP. While only 2 patients in orchiectomy group needed TURP and symptoms subsided in the rest. They recommended that initial pTURP should not be carried out and this procedure should be reserved for patients who cannot void two months after initiation of hormone therapy.

There has been many documentation of the absorption of irrigating solutions into the circulatory system after TURP.[12,13] Therefore, at the time of a prostate resection, cancer cells may be free to infuse under pressure into open lymphatic and venous channels, thereby enhancing the dissemination of tumor cells potentially capable of metastasizing. Several studies since then have raised the possibility that palliative TURP contributes to metastatic spread of disease via tumor spillage and hematologic dissemination.[14,15] However, Babaian and Archer[16] retrospectively reviewed data of 285 patients with clinical stage C adenocarcinoma of prostate and studied the impact of TURP on dissemination of cancer and found no association between TURP and progression of cancer.

Our experience with diode laser for treating BPH, has demonstrated successful results. Therefore we decided to study its efficacy for treating obstructive symptoms in patients with locally advanced prostate cancer and comparing the results with pTURP. Any innovative laser therapy of prostate must stand up to comparison with 80W potassium titanyl phosphate (KTP) laser.[1] An advantage of diode laser compared to KTP laser is its less dependency to good blood perfusion. Strong absorption of the wavelength in diode laser by hemoglobin and water allows a tissue penetration of 2-3 mm so that heat is concentrated in a small volume of tissue and cells are lysed by rapid vaporization of their cellular water. Due to probable prior radiotherapy or administrated finasteride in patients with prostate cancer and urinary obstruction, a reduced perfusion in prostate tissue is expected in such patients compared to BPH. Because the procedure is performed with isotonic solution, laser vaporization of the prostate is an attractive option when compared with standard TURP because of the lack of absorption of hypotonic fluid and the potential cardiac and pulmonary complications.[1] The coagulation effect of diode laser leads to a minimum hemorrhage and theoretically, prevents possible dissemination of the cancer cells. Hajdinjak[17] used diode laser to treat patients with LUTS. Four patients in the study were known cases of prostate cancer. After one month of follow up, all patients could urinate freely without difficulty. Kumar[18] described the use of KTP laser to vaporize urethral obstructive prostate cancer. Eight patients with locally advanced prostate cancer with a mean PSA of 10 ng/mL, underwent potassium titanyl phosphate laser vaporization of the prostate. Catheter drainage was discontinued 24 hours after the procedure. No patients required continuous bladder irrigation and none required replacement of the

Table. Preoperative and post-operative data of study subjects.*

Variables	pTURP			Diode Laser		
	Preoperative	Postoperative	*P* Value	Preoperative	Postoperative	*P* Value
IPSS	28.3 ± 5.6	11.1 ± 4.1	.001	29.5 ± 4.1	11.7 ± 3.6	.001
PVR, mL	68.1 ± 23.9	18.4 ± 3.5	.001	60.1 ± 18.9	17.7 ± 6.3	.001
Qmax, mL/s	8.8 ± 1.8	20.1 ± 4.5	.001	9.5 ± 0.9	19.4 ± 2.6	.001
Serum creatinine, mg/dL	1.81 ± 0.9	1.53 ± 0.5	.2	1.65 ± 0.7	1.49 ± 0.06	.4

Abbreviations: IPSS, International Prostate Symptom Score; SD, 2 standard deviation; PVR, post void residual urine volume; pTURP, palliative transurethral resection of prostate; Qmax, maximum urinary flow rate.
* Data are presented as mean ± SD.

catheter. Transrectal ultrasound was performed before and after the procedure, revealing a 51% average reduction in prostate volume. No patients required transfusion, needed to be readmitted, or developed incontinence.

CONCLUSION

Treatment of patients with locally advanced prostate cancer and refractory urinary retention by pTURP and diode laser ablation of prostate shows successful results. Diode laser seems to be a promising option for patients with significant urethral obstruction secondary to locally advanced prostate cancer.

CONFLICT OF INTEREST

None declared.

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