Laser prostatectomy versus transurethral resection of prostate in the treatment of benign prostatic hyperplasia

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ABSTRACT

Objectives: To assess the effectiveness of laser-prostatectomy compared with transurethral resection of prostate (TURP).

Methods: This randomized clinical trial with one year follow-up, was conducted on 87 patients with benign prostatic hyperplasia (BPH) at Shohada-e-Tajrish Hospital, Tehran, Iran, from 1999 to 2003. Fifty-two patients underwent TURP and 35 patients were treated by non-contact laser prostatectomy using ND: YAG laser at 40-60 watt power and 13000-29000 jules energy settings.

Results: Comparing variables of urinary maximum flow and residue, changes of urine volume and severity of symptoms during consequent periods of 3, 6 and 12 months after the operation in 3 groups revealed that differences in maximum urinary flow changes were significant only in the sixth month (p<0.05). Also, changes in the severity of symptoms before and after the operation showed more decrease in the TURP group during all 3 periods of follow-up (p=0.01). In the laser prostatectomy group duration of operation (p=0.01), amount of fluid used during the operation (p<0.001) and duration of bed rest (p<0.001) were less than those of the TURP group.

Conclusion: Laser prostatectomy can decrease duration of operation, duration of bed rest and pathogenesis following the operation in patients. Although changes in the severity of symptoms are more pronounced in TURP patients, changes in urodynamic indexes are similar in both groups.

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Increasing life expectancy has resulted in an increase in the number of men with urinary complaints referred to medial centers, due to benign prostatic hyperplasia (BPH). More than 30% of men over 65 yrs-old have either irritative or obstructive urinary problems, as their chief complaints.[1] Until 80 years of age, one out of every 4 men would undergo treatment for ameliorating signs and symptoms of obstruction of urinary tract caused by prostate hyperplasia.[2] A number of these patients are treated by drug therapy (such as with α-blockers), but most of them will need surgical treatment.[3] In the recent decades, transurethral resection of prostate (TURP) has been known as the basic method of treatment of BPH. During 1994, nearly 400,000 TURP operations, costing as much as 5 billion US dollars, were performed around the world.[4] Although TURP is an established method for amelioration of lower urinary tract symptoms of BPH, it has its own limitations. Mortality rate during the 30 day period following the operation is approximately 0.23% that increases up to 28% in a 12-month follow-up. On the other hand, morbidity rate following TURP operation is approximately 18%,[5] which decreases to 12%.[6] This rate of mortality and morbidity has prompted efforts to find a new method with equal efficacy and less complication and mortality.

The first report of using laser in treatment of BPH dates back to 1992.[7] Since then, various techniques for laser prostatectomy, including contact, non-contact and interstitial are used, of which contact laser technique has had the higher rate of success and satisfaction.[8] While coagulation of prostatic tissues using Neodymium–Yttrium–Garnet (Nd:YAG) laser through urethra is the most common technique applied, with excellent homeostasis, little morbidity, and decrease in patients complaints due to obstruction of urethra and finally improvement of their quality of life.[9-14] However, there are few studies in the form of clinical trials and long-term follow-ups that can reveal the effectiveness of laser prostatectomy versus TURP. The present study was performed to assess the efficacy of laser prostatectomy, using Nd:YAG laser, in the treatment of BPH in comparison with TURP.

Methods. This clinical trial was carried out on patients with BPH referred to the clinic of urology at Shohada-e-Tajrish Hospital, Tehran, Iran, from 1999 to 2003. In clinical selection study, men over 50 years with complaints regarding difficulties in urination or urinary retention were determined and registered according to the American Urological Association scoring system.[15] On the basis of the prostate, patients scoring 20 or more with estimated weight of 30-50 grams and adenomatous consistency without nodularity and asymmetry in digital rectal exam (DRE) were included in the study. Patients with a history of laser therapy, TURP or open surgical operation on prostate, and also those with incontinence or very severe irritative symptoms were excluded. Patients with hematuria underwent intravenous pyelography (IVP) to determine the origin of their problem and exclude those whose problem was not due to BPH. On the basis of laboratory findings, all patients with stricture of urethra in verruca due to causes other than BPH (such as tumor or stone) were also excluded.

Following selection of patients and obtaining their informed consent, they were randomly divided into 2 groups of TURP and laser prostatectomy (simple randomization). Determination of severity of symptoms and investigation of uroflometric indexes, including maximum urinary flow rate (Qmax), urinary residue and volume were carried out prior to the operation.

The operations were performed under general or caudal anesthesia. The patients were operated on using a Storz cystoscope with a 24F sheath and 30º lens in lithotomy position for TURP. Laser prostatectomy was carried out with noncontact method using a Nd:YAG laser (Dornier company) at 40-60 watts power that its beam was coupled into a side focus fiber with right angle (90º) firing (Fibertome Medilas 1060). The amount of energy used was between 13000 to 29000 jules, and the duration of operations was between 15 to 40 minutes (Av. 28 min). In order to destroy the prostatic tissue, it was painted until complete whitening (coagulation) of all visible parts by irradiating with the laser beam for 30 to 60 seconds in each point from cervix vesicae (Verruca) to side lobes with one centimeter margins in each side. In case of existence of a medical lobe, the same method was used on 2 points of its surface.

Recall of patients was carried out at 3, 6, and 12 months following the operation and severity of symptoms and maximum urinary flow, residue and volume were assessed and recorded in each case.

These data were analyzed using the Statistical Package for Social Sciences 10.05 statistical software package. Quantitative data are shown as mean ± SD and qualitative ones as percentage of prevalence. In this study, in order to determine the presence of statistical difference, Chi square and Wilcoxon test were used. The level of significance was set at 0.05 ($\alpha = 0.05$).

Results. This study included 87 patients with BPH, which 52 of them underwent TURP and the remaining 35 underwent laser prostatectomy. **Table 1** shows the patients characteristics divided into 2 groups. As shown in this table, there was no significant difference between these groups in terms of average of age, prostate weight, severity of symptoms according to AUA scoring system, maximum of urinary flow (Qmax) and urinary residue before operation ($p>0.05$).

The average duration of operation was 28.5 minutes in laser prostatectomy group, which shows significant decrease ($p=0.01$) compared with 34 minutes in TURP group. The same is true for the amount of fluid used during the operation and duration of hospitalization. In other words, laser prostatectomy has decreased both the amount of fluid used ($p=0.01$) and duration of hospitalization compared with TURP. **Tables 2, 3, & 4**, show the findings of follow ups 3 , 6 and 12 months after operation. Generally, variables of maximum urinary flow rate (Qmax) urinary residue, variations of urinary volume and severity of symptoms were assessed and recorded during 3 periods, and their changes were assessed pre and post-operatively. The changes in Qmax only in the sixth month after operation in TURP had a significant increase ($p<0.05$), compared with laser prostatectomy group. However, this comparison in the third and twelfth months after operation revealed no significant difference ($p>0.05$). Furthermore, a mild increase in variation in urinary residue was observed in TURP group, compared with laser prostatectomy group, but no significant difference was observed in follow-up periods ($p>0.05$). Variations in urinary volume were recorded in all 3 periods of follow-up, but

Table 1 - Characteristics of patients in transurethral resection of prostate (TURP) and laser prostatectomy groups, before and during the operation.

Variables	TURP N=52	Laser N=35
Age (year)	64.5 ± 7.3	69.6 ± 8.5
Prostate volume (gr)	37.5 ± 8	32.8 ± 7.8
Symptom score	23.4 ± 6	22.7 ± 4.6
Urinary flow rates (Qmax) (ml/s)	6.5 ± 5.9	5.6 ± 5.2
Residual urinary volumes (ml)	173 ± 113.4	153 ± 120.8
Operation time (minute)	34 ± 12*	28.5 ± 6.3
Irrigation fluid volume (lit)	16.6 ± 7.6**	6.4 ± 1.9
Hospital stay (day)	4.2 ± 9.5**	1.6 ± 1.4

*$p=0.01$; **$p=0.001$

no significant difference was observed between the 2 groups (p>0.05). Variations in pre and post-operative severity of symptoms in TURP group, in comparison with laser prostatectomy group, during the 3 periods of follow-up, showed significant decrease (p=0.01).

Discussion. Numerous reports on the effects of laser prostatectomy have been published, but the important fact is that there are few reports that compare the effects of laser prostatectomy with TURP in a prospective study and long term follow-ups. The present study is the result of a one year follow-up of patients with BPH that compares the outcome of non-contact laser prostatectomy with that of TURP. The results showed that laser prostatectomy can decrease the duration of operation and amount of fluid used and duration of hospitalization, in comparison with TURP, which results in decrease in pathogenesis and complications of this method.

Laser prostatectomy is performed in 3 ways. First, through interstitial laser ablation using a quartz fiber, which is fixed inside the tissue of prostate. In this method, due to slow necrosis and degeneration of the tissue during a period of several weeks, application of catheters for a long period following operation would be necessary. The second method, called side fire laser prostatectomy, is a non-contact one that, using an optical fiber irradiating the surface of the tissue, will cause in-depth coagulation and vaporization of it. The third method is contact laser prostatectomy, which uses an optical fiber with a rounded black head. In this method, irradiation of the fiber's end with a laser beam generates heat that upon transfer to the prostate tissue will coagulate and evaporate it.

Like TURP, non-contact laser prostatectomy can ameliorate the patients' symptoms. A systematic review by Hoffman et al[16] showed that non-contact laser prostatectomy, decreases the severity of symptoms of patients during a 12 month period by 59% on the average (7.7-19.3), while this decrease in TURP is 63% (7.1-19.3). The maximum urinary flow rate in

Table 2 - Variations in Qmax, urinary residue and volume, and severity of symptoms before and 3 months after transurethral resection of prostate (TURP) and laser prostatectomy.

Groups	Qmax (ml/s)	Residue (ml)	Urine volume changes (ml)	Severity of symptoms
TURP	1.7 ± 6.3	25.3 ± -104.3	25.4 ± 61	1.22 ± -13.3
Laser prostatectomy	4.2 ± 0.8	18.8 ± -87.5	23.7 ± 49.6	1.20 ± -9.3
P-value	Not significant	Not significant.	Not significant	p=0.01

Table 3 - Variations in Qmax, urinary residue and volume, and severity of symptoms before and 6 months after transurethral resection of prostate (TURP) and laser prostatectomy.

Groups	Qmax (ml/s)	Residue (ml)	Urine volume changes (ml)	Severity of symptoms
TURP	8.8 ± 1.4	30.5 ± -63.5	24.9 ± 89.5	1 ± -14.4
Laser prostatectomy	6.1 ± 0.8	33.7 ± -62.9	24.5 ± 74.7	1.11 ± -11.3
P-value	p=0.03	Not significant	Not significant	p=0.01

Table 4 - Variations in Qmax, urinary residue and volume, and severity of symptoms before and 12 months after transurethral resection of prostate (TURP) and laser prostatectomy.

Groups	Qmax (ml/s)	Residue (ml)	Urine volume changes (ml)	Severity of symptoms
TURP	2.5 ± 10	29.4 ± -158	39 ± 94.3	1.4 ± -17.3
Laser prostatectomy	10.7 ± 1.4	34.4 ± -121	39 ± 112.3	1.3 ± -12.8
P-value	Not significant	Not significant	Not significant	p=0.01

patients who underwent TURP was improved more than that of laser prostatectomy patients. Hoffman showed, in his systematic study, the Qmax in TURP group has increased by 96% (9.8-19.2 ml/s), while in laser prostatectomy group this increase is approximately 56% (10.1-15.8 ml/s). Although in this study, the mean of variations in Qmax in TURP group was more than laser prostatectomy group in all 3 periods of follow-up, this difference was not statistically significant.[17-18]

Cowles et al[12] reported the results of a one year follow-up study on effectiveness of non-contact laser prostatectomy using Nd:YAG laser compared with TURP. In this study, the mean difference in scores of patients' complaints in TURP group was 2.4 units less than that of laser prostatectomy group, but no significant difference was observed during a 6-month follow–up between Qmax of these patients. The results of the study by Sengor et al[17] showed no significant difference in the decrease of severity of symptoms and increase of Qmax during the 6-month period following the operation.

In a study by Keoghane et al[18] contact laser prostatectomy was compared with TURP. In this study, 72 patients were treated with contact laser and 76 with TURP. Findings suggested a significant increase in Qmax following TURP, compared with laser prostatectomy, but in a one year follow-up no significant difference was observed. Amount of bleeding during the operation and also blood transfusion in laser group was significantly less than TURP group.

Tukhane et al[19] also studied and compared the effects of contact laser prostatectomy and TURP in treatment of BPH. In this study, 25 patients in each group were assessed in terms of various aspects of uroflometry and urodynamics. During 3 and 6 month periods of follow-up, no significant difference was observed in Qmax, detrusor pressure during Qmax or urinary residue between the 2 groups. The results are similar to those of the present study. In the present study, the results relating to uroflometric indices of the TURP group were a little higher than those of the laser prostatectomy group, but this difference was not statistically significant.

All techniques of laser prostatectomy (interstitial, non-contact and contact) are performed in saline solution, which can protect patients against transurethral resection syndrome (TURS).

In another study by Melik et al[20] 50 patients underwent TURP, 45 patients with laser prostatectomy and 46 patients with electrovaporization. In this study, patients were assessed in terms of uroflometric and urodynamic indexes and the results of a 6 month follow-up revealed no significant difference in the improvement of theses indices between these groups.

Although in the present study, the severity of symptoms in patients of TURP group, compared with those who underwent contact laser prostatectomy, has shown more decrease, such a difference in urodynamic indices (including Qmax, residue and volume) is not significant. One of the significant variables indicated in other studies is the necessity to report operations due to recurrence of symptoms. Some studies show that recurrence of symptoms after laser prostatectomy is up to 6%, while it is close to zero for TURP.[21] In the present study, no patient had respect operation due to recurrence of symptoms, but it remains to become clear in long term follow-ups.

Finally, it can be said that non-contact laser prostatectomy, compared with TURP, decreases the duration of operation and hospitalization. Although, variations in severity of symptoms are more in TURP group, urodynamic indices in both groups have no significant difference.

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