

Comparison of Photo Selective High Power System 120 - W Green Light Laser Vaporisation Versus Transurethral Resection for Benign Prostate Hyperplasia

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Abstract: ***Background:** To compare the short term outcomes of the efficacy and safety of hps 120 W green - light laser photoselective vaporisation of the prostate (PVP) with transurethral resection of the prostate (TURP) for lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH) in a prospective randomized trial. **Material & methods:** fifty consecutive patients with enlarged prostatic adenomas satisfying the eligibility criteria were randomly assigned for surgical treatment with TURP (n 25) or PVP (n 25). The groups were compared for functional outcome (both subjective and objective parameters), perioperative parameters and complications. Patients were reassessed at 3 and 6 months. P value<0.05 was considered statistically significant. **Results:** The baseline characteristics of the two groups were comparable. Mean age was 68.72years and 66.55 years, mean IPSS score was 18.35 and 19.77, mean prostate volume was 48.62cc and 44.50 cc in Group A and B, respectively. Improvements in IPSS, QOL, prostate volume, Q max and PVRU at 3 months were similar in both groups. PVP is associated with reduced blood loss, transfusion, clot retention, TUR syndrome, capsular perforation, catheterisation time and hospitalisation, but a higher dysuria rate when compared to TURP patients. **Conclusions:** PVP is an effective alternative, holding additional safety benefits. PVP has equivalent IPSS, Qmax, QoL, PVR, IIEF efficacy and fewer complications with additional benefits of lesser perioperative blood loss, lesser transfusion requirements and a shorter catheterization time. Long - term follow - up is necessary to assess the durability of these results.*

Keywords: Greenlight 120 - W HPS. Photoselective vaporization. Transurethral resection of the prostate. Benign prostatic hyperplasia

1. Introduction

Lower urinary symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH) are encountered with increasing frequency in aging men.¹ After 50 years of age 25% to 40% of men need to be treated for this disease.² Transurethral resection of the prostate (TURP) has been used for more than 50 years to treat BPH and is still accepted as the “gold standard”. However; increasingly evidence indicates this invasive procedure is also associated with serious complications. Complications occur in as many as 20% of patients, including need for blood transfusion, along with infections, strictures, bladder - neck stenosis, sexual problems, and urinary retention and incontinence.³ Also, many men find the procedure, subsequent catheterization, and postoperative period painful and limiting from a quality of life point of view, and many are not satisfied with their result.

Photo selective vaporisation of the prostate (PVP) is increasingly being studied as a potential new first line treatment. This technique is generally performed with a 532 nm green laser. It is generated using potassium - titanyl - phosphate (KTP) or lithium triborate crystals (80 W). There followed development of a higher - powered laser operating at 120 - W high - performance system (HPS) plus a new fibre design. The 120 - Watt HPS unit allows more efficient rate of prostatic tissue vaporization, Minimal loss of vaporization efficiency (up to 3 mm from tissue), Beam profile is more collimated, Removes up to 100% more tissue than PV over the same period of time at a setting of 80W&depth of tissue coagulation is 1 - 2 mm.⁴

Photoselective vaporization of the prostate (PVP) with the 80 - W laser has been used, and reports show its safety and efficacy in patients with large prostate size, anticoagulation therapy, or retention [6–10]. The study by Al - Ansari et al [5] proves that the GreenLight HPS 120 - W laser is as effective as TURP both in the reduction of symptoms and in

the increase of urinary flow rate. In this paper, we give the results of a randomized clinical trial performed in our institution to assess the efficacy and side effects of the GreenLight HPS 120 - W laser compared with TURP.

2. Materials and Methods

Study population & design:

A randomized prospective study of 50 consecutive patients who underwent PVP/TURP from April 2021 to March 2022 in our hospital were included in the study. Initial evaluation included detailed clinical history including the IPSS and IIEF5 score, physical examination including digital rectal and focused neurological examination, urinalysis, serum prostate specific antigen (PSA) measurement, prostate volume estimation by transrectal ultrasound (TRUS), postvoid residual urine (PVRU) measurement by abdominal ultrasound and Qmax measurement on uroflowmetry (UFR). TRUS - guided biopsy was carried out in patients with PSA >4 ng/ml, abnormal DRE, and/or suspicious echogenicity on TRUS. Patients were randomly assigned to one of two groups (group A – PVP, group B – TURP) according to the method of surgical treatment: TURP or GreenLight 120 - W HPS PVP based upon following criteria.

Inclusion criteria

- Age > 50 years
- Flow rate < 15 mL/sec
- IPSS > 12
- Gland 30–80 cm³ on TRUS
- Able to give fully informed consent

Exclusion criteria

- Neurogenic bladder
- Known or suspected prostate cancer
- Chronic retention (pvru > 400)
- History of any previous prostatic, bladder neck, or urethral surgery.

Outcome assessment:

Primary outcome (PVP vs. TURP) included Subjective (IPSS, IIEF5) parameters & Objective (Prostate volume, PVRU and Qmax) parameters. Whereas Secondary outcomes included - a) Perioperative parameters: Operative time, whether postoperative irrigation was instituted, Duration of postoperative irrigation, length of catheterization, length of hospital stay postoperatively, postoperative haemoglobin concentration (sample taken on the morning after surgery) b) Complications, if any.

Surgical technique

TURP was done using a 26F continuous flow resectoscope. The lens employed was a 30 - degree lens and the irrigant used was 1.5% Glycine. A standard tungsten cutting wire loop at a setting of 160 W cutting and 80 W coagulation was used. Postoperatively, a three - way 22F Foley catheter on continuous irrigation with saline was used. Irrigation was stopped when deemed appropriate (when the irrigant was rose colored or clearer), usually on the second postoperative morning.

PVP was performed using an 120 W Green - light high - performance (HPS) system laser. A continuous flow 24F laserscope was used. The lens employed was a 30 - degree lens and the irrigant used was 0.9% sodium chloride. The fibre was a 600 micron, 70 degree side firing laser fibre emitting green light at 532 nm. 18 fr foleys Catheters were left *in situ*.

3. Results

General Characteristics

Total 50 patients were included in study. The *General characteristic* of the two groups including mean age, IPSS score, IIEF - 5 score, prostate volume, serum PSA, Qmax, PVRU, and preoperative hemoglobin were similar with no significant differences noted. (Table - 1)

Perioperative

Operative time was comparable in both the groups. The need, amount and duration of postoperative irrigation along with duration of postoperative catheterization were all significantly lesser in PVP Group. Duration of hospital stay was shorter in PVP group. The postoperative hemoglobin percentage was significantly higher in PVP as compared to TURP group. (Table - 2)

Follow Up

In both groups, there was significant improvement in the IPSS score, QOL score, prostate volume, Qmax and PVRU, as compared to the baseline at each of the follow - up visit. IPSS score decreased by 70.17% and 71.26%, QOL score decreased by 61.71% and 62.15%, prostate volume decreased by 41.32% and 56.96%, Qmax increased by 171.52% and 192.89%, PVRU decreased by 83.53% and 85.76% at 6 months in Group A and B, respectively. Between the two groups, there was no significant difference in the IPSS score, QOL score, IIEF - 5 score, prostate volume, Qmax and PVRU at each of the follow - up of 6 week, 3 - 6month. (Table - 3). A significant reduction of postoperative prostate volume values were measured at 3 and 6 months after PVP and TURP, respectively. However, the percentage of the reduction in prostate volume was higher in TURP group but not significant (p value - 1.83).

Complications

Although the overall complication rate did not differ significantly between the two groups, the rate of clot retention and that of blood transfusion was significantly higher in Group B when compared to Group A. Dysuria in the early postoperative period was significantly more common in Group A as compared to Group B [10 in Group A vs.5 in Group B]. Phenazopyridine was prescribed when dysuria was not related to a positive urine culture. The TUR syndrome was not experienced in any patient, whereas 3 patients (8.1%) in TURP group and none in PVP required blood transfusions ($P = 0.001$). During PVP, no intraoperative complication was seen. Acute urinary retention early after the removal of catheter occurred in 4 patients each group and all were managed with subsequent temporary recatheterization. In addition, 2 patients (8%) in TURP group and 1 patients (4%) in PVP group underwent internal urethrotomy because of urethral stricture within the follow - up period. Urinary tract infection documented with

urine culture test was similar in both groups within the follow - up period (20% after TURP and 24% after PVP). No urinary incontinence occurred in both groups (Table 4).

4. Discussion

Transurethral resection of the prostate constitutes almost 25% of all urologic operations. To minimize the morbidity of this procedure, less invasive techniques are currently under evaluation. Among these, one promising surgical technique is photo selective vaporization of the prostate. The KTP laser emits visible green light at a wavelength of 532 nm, which is strongly absorbed by oxyhemoglobin, but hardly at all by water, which prevents the beam from penetrating into deeper tissue layers.¹² Malek *et al.*¹¹ were the first to use a 60W high - power KTP/532 nm laser for the treatment of BPH. In the first study comparing photo selective vaporization of the prostate with standard TURP, Bachmann *et al.*¹³ were able to show that the KTP - Laser is as effective as the TURP with relatively lower morbidity. More advanced generations including the KTP laser (80W), the Green - light high - performance system laser (120W), the Green - light lithium triboride laser (160W) and the Green - light X - ray photoelectron spectroscopy (XPS) laser (180W) systems were then sequentially introduced, raising hopes of treating symptomatic BPH, effectively and safely. GreenLight 120 - W laser PVP is intended to match TURP in efficacy, and available data support its lower side effects [14, 15], although with limited levels of evidence.

As per meta - analysis published by Yan Zhou *et al*¹⁶ in 2016, PVP and TURP provide comparable improvements in functional results including IPSS and Qmax. PVP offers advantages over TURP in terms of intraoperative safety including lower incidence rate of capsule perforation, AUR, and lower transfusion requirement. Because of the small number of studies and without mid - or long - term follow - up, the conclusion should be treated with caution.

Our study has shown that at 6 - months follow - up, efficacy of KTP - PVP is comparable to TURP with no significant differences noted. Our findings revealed that the mean operating time of KTP PVP was comparable to TURP with associated benefit of Relatively shorter catheter removal time and shorter duration of post operative hospital stay. Although our data also demonstrated that TURP is more effective than PVP in terms of the prostatic volume reduction, indicating a more effective tissue removal than laser application. As far as safety is concerned, KTP PVP was associated with significantly less blood loss, clot retention and transfusion rates, even though the overall complication rate did not differ significantly when compared to the TURP group. Dysuria was observed in 40% of PVP pts in early postoperative period. It is primarily caused by coagulation rather than vaporization. TUR syndrome was not seen in either group. An important disadvantage of laser prostatectomy is the lack of tissue obtaining during the operation.

Limitations of our study is short follow up period of 6 months is less to provide any long - term estimation of outcome with respect to the reformation of adenoma and need for reoperation. Another drawback of this study is that

since patients with prostate volumes >80 cc were excluded, the results of this study cannot be extrapolated to BPE patients with larger prostates.

5. Conclusion

Green Light HPS 120 - W laser PVP is an equally efficacious alternative to TURP in the management of LUTS due to BPE with durable results at 6 - month follow - up. It has the added benefits of significantly lesser perioperative blood loss and transfusion requirements; shorter catheterization time & hospital stay. However, further studies with a largenumber of patients and longer follow - up are warranted to access its long - term results.

Financial support and sponsorship: Nil.

Conflicts of interest: There are no conflicts of interest.

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Tables

TABLE 1 : GENERAL CHARACTERISTICS			
	GROUP A (PVP) N = 25	GROUP B (TURP) N =25	P VALUE
Age (years)	62.64 ± 7.07	64.78 ± 7.62	0.554
IPSS score	19.62 ± 2.87	18.88 ± 3.31	0.179
IIEF SCORE	16.88 ± 3.12	16.98 ± 3.22	0.488
PROSTATE VOLUME	49.02 ± 12.90	47.87 ± 13.09	0.129
S. PSA	2.66 ± 1.28	2.60 ± 1.33	0.388
Q MAX (ML/MIN)	7.75 ± 1.68	8.76 ± 1.98	0.078
PVRU	158 ± 60.76	165.80 ± 65.88	0.980
HB % (G/DL)	12.56 ± 1.58	12.76 ± 1.6	0.316

TABLE 2 : PERIOPERATIVE DATA			
	GROUP A (PVP) N = 25	GROUP B (TURP) N =25	P VALUE
Operative time (min)	46 ± 15.2	51 ± 17.2	0.15
Postoperative Hospital stay (days)	1.6 ± 0.52	2.4 ± 0.82	0.03
Number of patients in whom postoperative irrigation instituted	2/25 (8%)	22/25 (88%)	0.003
Duration of irrigation (Hrs)	1.35 ± 1.92	18 ± 14.32	0.001
Duration of catheterization (Hrs)	23.42 ± 2.68	47.23 ± 12.78	0.001
Postoperative hemoglobin% (g/dl)	12.62 ± 1.42	11.22 ± 1.22	0.001

TABLE 3 : FOLLOW UP DATA

	6 WEEKS			3 MONTH - 6 MONTH		
	GROUP A (N = 25) PVP	GROUP B (N = 25) TURP	P VALUE	GROUP A N = 25/ PVP	GROUP B N = 25/ TURP	P VALUE
IPSS	8.42	9.20	0.197	5.46	5.96	0.216
Q MAX	19.76	18.99	0.359	19.67	19.24	0.943
Prostate Volume	25.62	18.62	0.182	24.22	18.20	0.183
PVRU	54.68	52.22	0.122	39.54	47.66	0.101

TABLE 4 : COMPLICATIONS

	GROUP A N = 25 (PVP)	GROUP B N = 25 (TURP)	P VALUE
BLOOD TRANSFUSION	0	4 (16%)	0.025
CLOT RETENTION	0	6 (24%)	0.012
DYSURIA	10 (40%)	5 (20%)	0.026
UTI	5 (20%)	6 (24%)	0.758
URINARY RETENTION	4 (16%)	4 (16%)	1.00
URETHRAL STRICTURE	2 (8%)	3 (12%)	1.00
BLADDER NECK CONTRACTURE	0	0	0.487
TUR SYNDROME	0	1 (4 %)	0.580