

# Treatment of Benign Prostatic Hyperplasia with Green Light Laser (PVP) vs. Transurethral Resection of the Prostate

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## ABSTRACT

**Introduction:** Benign prostatic hyperplasia (BPH) is a highly prevalent disease afflicting mankind. BPH is the major etiology of lower urinary tract symptoms (LUTS) in men >50 years of age. Transurethral resection of the prostate (TURP) has been the gold standard to treat lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH). we described our institutional prospective study comparing the efficacy and outcomes of Green light laser photovaporisation of prostate (PVP) and transurethral resection of prostate (TURP) for the treatment of benign prostatic hyperplasia (BPH).

**Methods:** Between June 2014 to March 2017, In this prospective, randomized comparative study total 150 patients with BPH were enrolled at our department of Urology. Two study groups were made. Group 1 – patients who underwent Green light PVP. Group 2 – patients who underwent TURP. All data were collected from medical records, which contained the clinical, laboratory tests, uroflowmetry and diagnostic imaging.

**Results:** In present study we have taken total 150 patients, 75 Green light PVP, 38 monopolar TURP and 37 bipolar TURP. In study no significant difference in age distribution. Mean duration of catheterization post operatively was 21.88 hours, 27.97 hours and 28.24 hours, in PVP, monopolar and bipolar TURP respectively. Mean duration of hospital stay in PVP was 25.42 hours which is much shorter than in monopolar TURP (38.55 hours) and in bipolar TURP (38.37 hours). In PVP group no major intraoperative complications were recorded and none of the patients required blood transfusion. There was no

significant difference between PVP, monopolar TURP & bipolar TURP in terms of change in IPSS at 12 months follow up.

**Conclusions:** Green light PVP might be as safe and effective surgical procedure for the treatment of patients with BPH at high risk which gives it an edge over both monopolar and bipolar TURP. In terms of intra operative complications, TUR syndrome, blood transfusion, capsular perforations and clot retention are lower in PVP than TURP. Long-term functional results showed dramatic improvement in both groups with no significant difference between PVP and TURP groups.

**Keywords:** Greenlight Laser Photovaporisation of Prostate (PVP), Transurethral Resection of Prostate (TURP), Benign Prostatic Hyperplasia (BPH).

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## INTRODUCTION

Benign prostatic hyperplasia (BPH) is a highly prevalent disease afflicting mankind. BPH is the major etiology of lower urinary tract symptoms (LUTS) in men >50 years of age. Pharmacologic treatment should be routinely discussed with patients who have moderate-to severe symptoms (IPSS  $\geq 8$ ), bothersome symptoms, or both, with attention to the benefits and risks of various options.1 Surgery is usually needed when patients have not obtained adequate relief from LUTS or PVR using conservative or medical treatments. Transurethral resection of the prostate (TURP) has been the gold standard to treat lower urinary tract symptoms (LUTS) secondary to benign prostatic hyperplasia (BPH). Among new technologies, the potassium-titanyl-phosphate laser, which permits the photoselective vaporization of the prostate (PVP), has the potential to be cost-effective compared to TURP; it appears to

provide similar outcomes and can be performed in an outpatient setting. In our study, we described our institutional prospective study comparing the efficacy and outcomes of Greenlight laser photovaporisation of prostate (PVP) and transurethral resection of prostate (TURP) for the treatment of benign prostatic hyperplasia (BPH).

## AIMS AND OBJECTIVES

1. To prospectively compare outcome of two different surgical modalities of benign prostatic hyperplasia (BPH) Green light laser photovaporisation of prostate (PVP) and transurethral resection of prostate (TURP) including high risk patients.
2. To study complications and their management occurring after PVP and TURP procedures.

**MATERIALS AND METHODS**

In this prospective, randomized comparative study total 150 patients with BPH were enrolled at our department of Urology, between June 2014 to March 2017. Two study groups of patients were made using following criteria:

**Group 1:** Patients (75 out of 150) who underwent Green light HPS Laser Photoselective vaporization of prostate.

**Group 2:** Patients (75 out of 150) who underwent TURP (38 by monopolar TURP or 37 by bipolar TURP).

**Inclusion Criteria**

- Diagnosed with symptomatic/obstructive symptoms secondary to BPH requiring surgical intervention. Had prostate specific antigen (PSA) normal for age group or with a negative TRUS-guided biopsy if PSA is elevated.
- IPSS value > 19
- Peak urinary flow < 15 ml/sec on minimum of 125 ml voided volume
- Willing and able to comply with all follow-up requirements including multiple follow-up visits.

**Exclusion Criteria**

- Neurogenic bladder disorder Urethral strictures
- History of prostate adenocarcinoma or
- Any previous prostatic, bladder neck or urethral surgery.

**Preoperative Work-Up and Procedure**

Patient's history & Physical examination Complete pre anesthetic work up.

USG KUB S.PSA and TRUS-guided biopsy if PSA is elevated.

**Procedure**

Pre-operative advice included

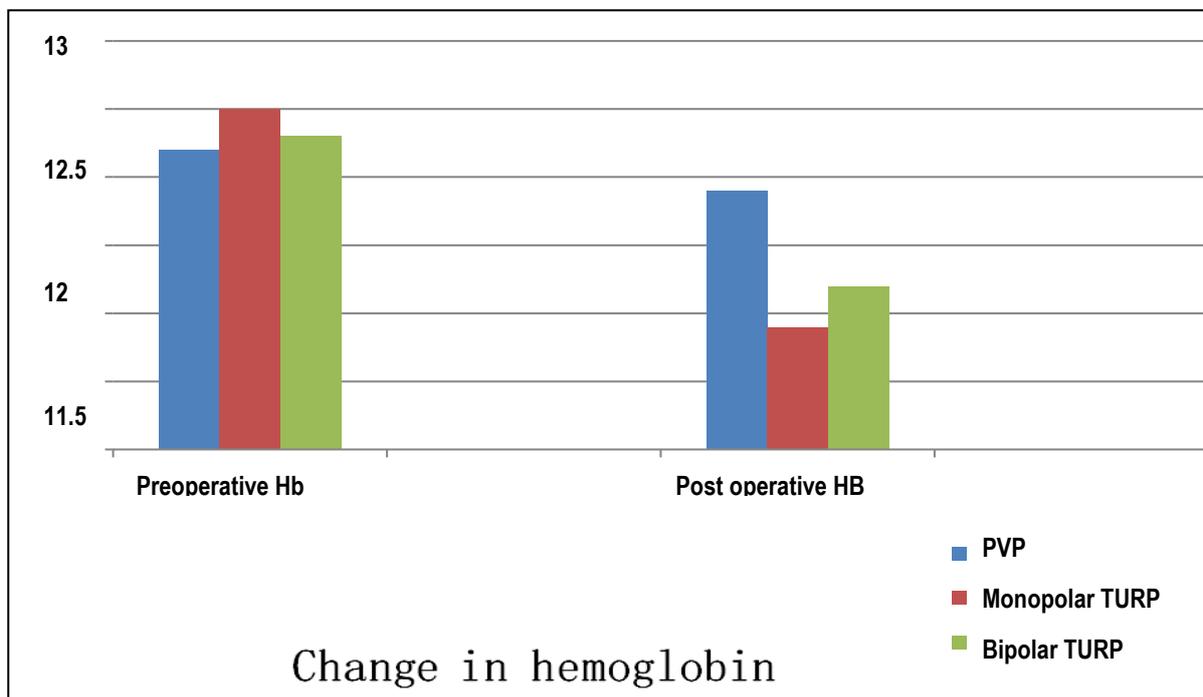
- Nil by mouth 10:00 Pm night before surgery
- Detailed explained informed consent
- Part clean & shave

All patients were given spinal anesthesia 0.5% bupivacaine hydrochloride using a 25 gauge spinal needle at lumbar intervertebral space 2-3. After preliminary cystourethroscopy, PVP, monopolar or bipolar TURP was performed.

A 22 Fr tri-way Foley catheter is kept in all patients. No traction is given for the cases included in the study group. Postoperatively the catheter is irrigated continuously with 0.9% saline solution and stopped once clear effluent is draining. The decision to remove the catheters is based on the color of the catheter effluent, absence of clots, normal vital signs and adequate urine output. Days corresponding to catheter removal and hospital discharge were recorded for each patient. Patients were followed up regularly at one month; three month; six months and one-year interval post-operatively with IPSS scoring, USG KUB, uroflowmetry and post void residual volume assessment.

**Table 1: Distribution of Comorbidities**

Comorbidities	No of patient (PVP)	No of patient (Bipolar TURP)
Ischemic heart disease (IHD)	11(14.66)	2 (5.4%)
Diabetes mellitus (DM)	9 (12%)	3 (8.57%)
Hypertension (HTN)	12 (16%)	12 (32.4%)
DM with HTN	8 (10.66%)	3 (8.57%)
COPD	10 (13.33%)	5 (13.51%)
Parkinsonism	1 (1.33%)	0
HTN with Cerebrovascular accident (CVA)	3 (4%)	1 (2.7%)



**Fig 1: Changes in Haemoglobin gm%**

**OBSERVATIONS AND RESULTS**

In present study we have taken total 150 patients, 75 patients underwent Green light PVP, 38 underwent monopolar TURP and 37 bipolar TURP. Patients in TURP group with comorbidities underwent bipolar TURP. In PVP, 54 out of 75 patients were having comorbidities, and in bipolar TURP, 26 out of 37 patients were having comorbidities.

In our study mean age in PVP was 67.9 years, in monopolar TURP was 64.02 years and in bipolar TURP was 66.15 years. There was not a significant difference in age distribution. In PVP group, average size of prostate gland was 45.9 gm. and in monopolar TURP group, average size of prostate gland was 46.31 gm in bipolar TURP group, average size of prostate gland was 45.21 gm. There was not a significant difference in prostate size. In PVP group, number of patients presenting with retention was 41 and in monopolar TURP group number was 25 and in bipolar TURP group number was 21. In PVP, average IPSS on presentation was 23.55 and in monopolar TURP, average IPSS was 25 and in bipolar TURP, average IPSS was 23.62. There was not a significant difference in average IPSS. In PVP, average maximum flow rate on presentation was 10.6 ml/sec. and in monopolar TURP, average maximum flow rate was 9.2 ml/sec and in bipolar TURP, average maximum flow rate was 11 ml/sec. There was not a significant difference in average maximum flow rate. In PVP, average flow rate on presentation was 5.7 ml/sec. and in TURPs, average flow rate was 4.6 ml/sec. In PVP, average post void residual volume on presentation was 89.85 ml. and in monopolar TURP, average PVR was 70.38 ml and in bipolar TURP, average PVR was 70.38 ml. In PVP, mean operative time was 46.68 min. and in TURPs, mean operative time was 38.55 min. Mean operative time was shorter for TURPs. In PVP, average duration for which PUC kept was 21.88 hours, and in monopolar TURP, average duration for which PUC kept was

27.97 hours, and in bipolar TURP, average duration for which PUC kept was 28.24 hours. Average duration for which PUC kept post operatively was shorter for PVP group. In PVP, average duration of post-operative hospital stay was 25.42 hours, and in monopolar TURP, duration of post-operative hospital stay was 32.89 hours and in bipolar TURP, duration of post-operative hospital stay was 33.46 hours. Average duration for which patient was in hospital post operatively was shorter for PVP group than TURPs.

In PVP, preoperatively hemoglobin was 12.2 gm/dl, which changed to 11.9 gm/dl after the procedure, in monopolar TURP, hemoglobin changed from 12.5 gm/dl to 10.9 gm/dl after TURP while in bipolar TURP, hemoglobin changed from 12.3 gm/dl to 11.2 gm/dl after TURP. Drop in hemoglobin was more in monopolar TURP and bipolar TURP than PVP group.

Complications in PVP and, monopolar TURP and bipolar TURP were measured in terms of TUR syndrome, blood transfusion, clot retention, capsular perforation, transient dysuria, UTI, urethral stricture and bladder neck contracture. TUR syndrome, blood transfusion, stricture urethra and capsular perforation were more in monopolar TURP whereas dysuria was more in PVP group.

Follow up in PVP, monopolar TURP and bipolar TURP were measured in terms of IPSS, Q- max and PVR at 1 month, 3 months, 6 months and 12 months respectively. There was no significant difference in PVP and monopolar TURP on follow up in terms of IPSS, Q-max and PVR.

75 consecutive patients in PVP group were split into three sub groups with 25 consecutive patients in each sub group. The learning curve was assessed using mean operative time in each group. The mean operative time in group III (51 to 75 patients) of PVP was 42.72 min whereas in group I (1 to 25 patients) it was 50.12 min.

**Table 2: Complications rate**

Complications	PVP	Monopolar TURP	Bipolar TURP
TUR Syndrome	0	1 (2.63%)	0
Blood Transfusion	0	2 (5.26%)	1 (2.7%)
Clot Retention	1 (1.33%)	1 (2.63%)	1 (2.7%)
Capsular Perforation	1 (1.33%)	2 (5.26%)	1 (2.7%)
Transient Dysuria	6 (8%)	1 (2.63%)	0
UTI	4 (5.33%)	2 (5.26%)	2 (5.4%)
Stricture urethra	0	1 (2.63%)	0

**Table 3: Impact on IPSS, Q-max, PVR**

Period	PVP			Monopolar TURP			Bipolar TURP		
	IPSS	Q-max (ml/sc)	PVR (ml)	IPSS	Q-max (ml/sc)	PVR (ml)	IPSS	Q-max (ml/sc)	PVR (ml)
1 month	6.25	19.45	36.6	6.07	20	34.73	6.21	19.64	34.4
3 months	6.55	20.15	29.2	6.46	20.2	30.8	6.12	19.8	28.7
6 months	7.07	21.4	26.7	6.17	19.6	26.4	6.80	20.6	24.45
12 months	7.23	20.2	22.2	7.12	19.3	24.2	7.30	21.2	26.50

**Table 4: Prostatic size and operating time**

No of cases	PVP	
	Average Gland size (gm)	Mean operative time (min)
Group I (1 – 25)	46.4	50.12
Group II (25 – 50)	47.2	47.2
Group II (50 – 75)	46	42.72

**DISCUSSION**

The search for an ideal procedure to replace the well-established gold standard of TURP has been elusive. This is in part because TURP is an effective, durable procedure with an acceptable morbidity profile. Many alternative procedures have been proposed and tried with variable success. Bipolar TURP and PVP emerged as an alternative to monopolar TURP; several studies have shown their equivalent efficacy with up to 5 years of follow-up.<sup>5,6,17,18</sup> In our study, we had compared the efficacy of approaches of green light PVP with monopolar TURP and bipolar TURP. Our data support these findings: Efficacy of PVP and

TURP study groups was comparable up to 12-month follow-up. Mean age in PVP group in present study was 67.9 years, in monopolar TURP was 64.02 years and in bipolar TURP was 66.15 years. Mean age in present study is comparable to Kumar et al, Capitan et al and Whelan et al study. The mean IPSS in PVP in present study was 23.55 while in monopolar TURP it was 25 and in bipolar TURP group was 23.62. Mean IPSS in present study is comparable to Capitan et al and Whelan et al study. The mean size of prostate gland in PVP in present study was 45.9 gm while in monopolar TURP was 46.31 gm and in bipolar TURP group was 45.21 gm.

**Table 5: Age, Prostatic size comparison**

Parameter	Present study			Kumar et al <sup>29</sup>			Capitan et al <sup>30</sup>		Whelan et al <sup>31</sup>	
	PVP	Monopolar TURP	Bipolar TURP	PVP	Monopolar TURP	Bipolar TURP	PVP	TURP	PVP	TURP
Mean age (years)	67.9	64.02	66.15	64.58	63.68	62.31	69.8	67.7	67.4	70.8
Prostate gland size (gm)	45.9	46.31	45.21	52.79	52.20	50.26	51.29	53.10	53.8	54.5

The mean pre-operative maximum flow rate (Qmax) in PVP in present study was 10.6 ml/sec while in monopolar TURP was 9.2 ml/sec and in bipolar TURP group was 11 ml/sec. Mean Qmax in present study is comparable to Whelan et al study where Qmax for PVP was 11 and for TURP was 8.8. The mean pre-operative average flow rate in PVP in present study was 5.7 ml/sec while in monopolar TURP was 4.9 ml/sec and in bipolar TURP group was 5.2 ml/sec. Mean average flow rate in present study is comparable to Whelan et al study where average flow rate for PVP was 5.6 ml/sec and for TURP was 4.7 ml/sec.

The mean pre-operative post void residual volume (PVR) in PVP in present study was 89.85 ml while in monopolar TURP was 70.38 ml and in bipolar TURP group was 79.06 ml. Mean PVR in Whelan et al study in PVP was 106.9 ml and in TURP was 68.8 ml which is comparable to the present study. The average number of patient presented with indwelling urethral catheter in present study in PVP group was 41 (54.66%) while in monopolar TURP was 25 (65.78%) and in bipolar TURP group was 21 (56.75%). In the present study, patients with comorbidities like IHD, diabetes,

hypertension, COPD, Cerebro-vascular accident (CVA) were treated with PVP and in TURP group with bipolar TURP. Similar findings were seen in Elgin et al<sup>33</sup> and Jun Fu et al<sup>34</sup> study in which high-risk patients were treated with PVP.

Mean duration of surgery in present study was 46.68 min while in monopolar and bipolar TURP were 38.55 and 38.37 min respectively. The mean operative time is significantly higher in PVP group than in TURP, which is comparable to the study of Capitan et al. Similar finding were seen in Kumar et al, Whelan et al, Al-Ansari et al and Ruszat et al study where duration of surgery is longer in PVP than TURP. Mean duration of catheterization post operatively in present study in PVP was 21.88 hours while in monopolar TURP catheter was kept for 27.97 hours and in bipolar group for 28.24 hours. Average duration of catheterization was much shorter for PVP than monopolar or bipolar TURP, which is comparable to Kumar et al study, which concluded duration of catheterization of PVP was 24.27 hours, in monopolar TURP was 27.97 hours and bipolar TURP was 35.07 hours. Similar findings were found in Capitan et al and Al-Ansari et al study.

**Table 6: Duration of surgery (mins)**

Parameter	Duration of surgery (min)		
	PVP	Monopolar TURP	Bipolar TURP
Present study	46.68	38.55	38.37
Kumar et al	60.03	45.73	46.03
Capitan et al	54.13	48.15	-
Whelan et al	63.0	40.9	-
Al-Ansari et al	89	80	-
Ruszat et al	72	53	-

**Table 7: PUC duration (hours)**

Parameter	Average PUC duration (hours)		
	PVP	Monopolar TURP	Bipolar TURP
Present study	21.88	27.97	28.24
Kumar et al	24.27	36.56	35.07
Capitan et al	23	72	-
Al-Ansari et al	33.6	64.8	-

Mean duration of hospital stay in present study in PVP was 25.42 hours which is much shorter than in monopolar TURP (38.55 hours) and in bipolar TURP (38.37 hours). Findings in present study is comparable to Capitan et al, Whelan et al and Al-Ansari et al study which also show, duration of hospital stay is much shorter in PVP than TURP.

In present study, in PVP group no major intraoperative complications were recorded and none of the patients required blood transfusion. Blood transfusion was required in 2 (5.26%) patients in monopolar TURP and in 1(2.7%) in bipolar group. Similar observations was seen in Kumar et al, Capitan et al and Al-Ansari et al study where blood transfusion was required in 7 (11.66%), 3 (6%) and 12 (20%) cases respectively of monopolar TURP and 1 (1.75%) case of bipolar TURP in Kumar et al study.

Clot retention was observed in 1 (1.33%) patient in PVP, in 1 (2.63%) case of monopolar TURP and in 1 (2.7%) case of bipolar TURP. This was comparable to the study of Kumar et al and Al-Ansari et al. In present study, TUR syndrome was seen in 1 (2.63%) patient of monopolar TURP which was managed with diuretics and fluids and none of the patients of PVP or bipolar

TURP had TUR syndrome. This was comparable to the study of Kumar et al, Capitan et al and Al-Ansari et al where TUR syndrome was seen in 1(1.66%), 2 (4%) and 3 (5%) respectively in monopolar TURP and in none of the case of PVP or bipolar TURP. In present study transient dysuria was seen in significant cases of PVP, 6 (8%), while dysuria was seen only in 1 (2.63%) of monopolar TURP and none in bipolar TURP. Similar observations was seen in Kumar et al and Al-Ansari et al where dysuria was seen in significant number of cases of PVP.

In present study on follow up, urethral stricture was seen in 1(2.63%) case of monopolar TURP who was managed endoscopically by internal urethrotomy and none in PVP or bipolar TURP cases had urethral stricture. These findings are comparable to the study of Capitan et al and Al- Ansari et al.

In present study, drop in hemoglobin in PVP is 0.3 gm/dl, which is much less than monopolar TURP (1.4) or bipolar TURP (1.1). Our observation is comparable to Kumar et al where drop in hemoglobin is 0.74 in PVP, 1.54 in monopolar TURP and 1.48 in bipolar TURP. Similar findings were seen in Capitan et al and Al-Ansari et al study.

**Table 8: Hospital stays (hours)**

Parameter	Duration of hospital stay (hours)		
	PVP	Monopolar TURP	Bipolar TURP
Present study	25.42	38.55	38.37
Capitan et al	38.4	86.4	-
Whelan et al	48	60	-
Al-Ansari et al	80	89	-

**Table 9: Comparison of complications**

Complications	Present study			Kumar et al			Capitan et al		Al-Ansari et al	
	PVP	Monopolar TURP	Bipolar TURP	PVP	Monopolar TURP	Bipolar TURP	PVP	TURP	PVP	TURP
TUR syndrome	0	1 (2.63%)	0	0	1 (1.66%)	0	0	2 (4%)	0	3 (5%)
Blood Transfusion	0	2 (5.26%)	1 (2.7%)	0	7 (11.66%)	1 (1.75%)	0	3 (6%)	0	12 (20%)
Clot Retention	1 (1.33%)	1 (2.63%)	1 (2.7%)	0	6 (10%)	2 (3.50%)	-	-	0	6 (10%)
Capsular Perforation	1 (1.33%)	2 (5.26%)	1 (2.7%)	-	-	-	-	-	0	10 (16.7%)
Transient Dysuria	6 (8%)	1 (2.63%)	0	5 (8.62%)	2 (3.33%)	1 (1.75%)	-	-	56 (93.3%)	19 (31.7%)
UTI	4 (5.33%)	2 (5.26%)	2 (5.4%)	4 (6.89%)	5 (8.33%)	6 (10.52%)	3 (6%)	1 (2%)	-	-
Stricture urethra	0	1 (2.63%)	0	1 (1.72%)	0	1 (1.75%)	0	2 (4%)	4 (7.4%)	2 (3.6%)

**Table 10: Drop in haemoglobin (gm%)**

	Drop in hemoglobin (gm/dl)		
	PVP	Monopolar TURP	Bipolar TURP
Present study	0.3	1.4	1.1
Kumar et al	0.74	1.54	1.48
Capitan et al	0.65	2.3	-
Al-Ansari et al	0.7	2.9	-

**Table 11: Impact on IPSS**

IPSS	Present study			Kumar et al			Capitan et al	
	PVP	Monopolar TURP	Bipolar TURP	PVP	Monopolar TURP	Bipolar TURP	PVP	TURP
1 month	6.25	6.07	6.21	9.84	9.81	9.78	11.88	15.16
3 months	6.55	6.46	6.12	7.40	7.56	7.47	9.6	12.31
6 months	7.07	6.17	6.80	6.96	7.08	7.08	8.31	10.23
12 months	7.23	7.12	7.3	7.01	7.07	6.94	8.11	8.61

**Table 12: Impact on Q-max (ml/sec)**

Qmax (ml/sec)	Present study			Kumar et al			Capitan et al		Lukacs et al <sup>36</sup>	
	PVP	Monopolar TURP	Bipolar TURP	PVP	Monopolar TURP	Bipolar TURP	PVP	TURP	PVP	TURP
1 month	19.45	20	19.64	17.71	17.92	18.07	20.64	18.91	16	14.9
3 months	20.15	20.2	19.8	18.79	19.01	19.27	23.85	21.62	17	15.7
6 months	21.4	19.6	20.6	20.66	20.05	20.48	23.93	22.23	16.3	16.3
12 months	20.2	19.3	21.2	19.58	18.89	19.93	22.53	22.95	16.7	16.8

**Table 13: Impact on PVR (ml)**

PVR (ml)	Present study			Kumar et al			Lukacs et al <sup>36</sup>	
	PVP	Monopolar TURP	Bipolar TURP	PVP	Monopolar TURP	Bipolar TURP	PVP	TURP
1 month	36.6	34.73	34.4	48.01	43.56	48.73	20	13
3 months	29.2	30.8	28.7	37.98	36.73	39.98	10	15
6 months	26.7	26.4	24.45	29.70	26.11	30.38	10	19
12 months	22.2	24.2	26.6	30.78	26.71	31.09	0	7

**FOLLOW UP**

In the present study there was no significant difference between PVP, monopolar TURP and bipolar TURP in terms of change in IPSS at 12 months follow up. Urinary flow rate (maximum flow rate and post void residual volume) improved equally and simultaneously after both treatment modalities. Kumar et al, Capitan et al and Lukacs et al study findings are comparable to the present study.

There was significant decrease in length of operative time in group III (51 to 75 patients) when compared to group I (1 to 25 patients) of PVP patients although mean prostate gland size was comparable in each group. Wheelan et al have seen similar finding that one of the advantages of PVP is the short learning curve, a combination of online modules, observation and mentoring of 5 cases is sufficient for most urologists.<sup>31</sup>

**CONCLUSIONS**

- Green light PVP might be considered as safe and effective surgical procedure for the treatment of patients with BPH at high risk which gives it an edge over both monopolar or bipolar TURP.
- TUR syndrome, blood transfusion, capsular perforations and clot retention are lower in PVP than TURP. Drop in hemoglobin post operatively is significantly lower for PVP. Urethral stricture is more common in TURP than PVP. Learning curve is shorter in PVP.
- Duration of surgery is longer in PVP group but hospital stay are shorter post operatively for PVP than TURP. Long-term functional results showed dramatic improvement in both

groups regarding reduction of IPSS and PVR and improvement of Q-max, with no significant difference between PVP and TURP groups.

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