Outcome of Transurethral Vaporisation of Prostate in Small Volume Prostate: A prospective observational study

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ABSTRACT

Background

Benign Enlargement of Prostate is common in aging men. Transurethral vaporisation of prostate is one modality of minimal invasive management of benign enlargement of prostate. This study assesses the efficacy and safety of transurethral vaporisation of prostate in small volume prostate.

Objective

To assess the efficacy and safety of bipolar plasma vaporisation of small volume prostate (Prostate Volume less than 40 grams).

Method

A total of 40 patients with prostate volume less than 40 grams and indications for operative management of benign enlargement of prostate were included. Patients with prior prostate surgery, urethral stricture surgery, presence of vesical calculus, urethral stricture and neurogenic bladder were excluded. Preoperative prostate size was assessed by transrectal ultrasonography. Comparison of preoperative and postoperative hemoglobin, sodium, international prostate symptom score and maximum flow rate was done. Perioperative complications were documented.

Result

The mean age of patients was 66.88 ± 9.09 years and the mean size of prostate was 32.52 ± 4.66 grams. Significant improvement in IPSS (preoperative 22, postoperative 9) and Qmax (preoperative 8.4 ml/min, postoperative 18.5 ml/min) was noted. There was significant drop in hemoglobin ($p < 0.001$) but no patients required blood transfusion. There was significant drop in sodium ($p < 0.001$) but no patients developed transurethral resection syndrome. Most complications were Clavien grade I. Two patients required recatheterization and all were catheter free on follow up. Two patients developed urethral stricture.

Conclusion

Bipolar transurethral vaporisation of Prostate is effective and safe treatment option for prostate volume less than 40 grams.

KEY WORDS

Bipolar plasma vaporisation, Lower urinary tract symptoms, Prostate symptoms

INTRODUCTION

Benign Enlargement of Prostate (BEP) is a common problem in older men presenting with lower urinary tract symptoms (LUTS). Significant proportion of those with BEP on medical management require surgical intervention. Although transurethral resection of prostate is regarded as efficacious management of BEP, anatomic enucleation of prostate is gaining popularity recently.[1]

Bipolar transurethral vaporisation of the prostate (B-TUVP) introduced in the late 1990s utilized a bipolar electrode and a high- frequency generator to create a plasma effect able to vaporise prostatic tissue.[2] Contemporary bipolar vaporisation electrode utilizes a hemispherical, mushroom shaped electrode and provides a bloodless field.[2,3] TUVP has been shown to be an effective modality for surgical management of BEP.[4-7] The benefits of TUVP includes shorter learning curve and need of only a vaporisation electrode in addition to the equipment needed in TURP. Studies regarding large volume prostates treated by vaporisation have shown similar efficacy to TURP, however in view of limited literature in small volume prostates treated by bipolar plasma vaporisation, we conducted a observational study to assess the safety and efficacy of bipolar plasma vaporisation of small volume prostate (less than 40 gm).

METHODS

This prospective observational study was conducted in patients undergoing TUVP from April 2023 to April 2024 in the Department of Urology of Bir Hospital, Kathmandu, Nepal. Ethical clearance was obtained from the Institutional Review Board of the National Academy of Medical Sciences, Kathmandu, Nepal (Ref. no. 782/2079/80). Informed written consent was obtained from all patients.

All patients > 40 years of age with moderate- severe LUTS due to prostate volume less than 40 grams with moderate-severe LUTS not responding to medication, recurrent gross hematuria due to BEP, recurrent UTI (urinary tract infection), recurrent AUR (acute urinary retention), renal impairment secondary to BEP and upper tract changes secondary to BEP were included in the study.

Patients with a history of prostate surgery, prostate cancer, bladder cancer, urethral stricture surgery, the concurrent presence of urinary bladder stone, urethral stricture and neurogenic bladder were excluded. Any patient suspected of carcinoma prostate due to suspicious digital rectal examination (DRE), abnormal ultrasonogram findings like hypoechoic lesions in prostate or persistently raised PSA level (PSA > 4 ng/ml, repeated two weeks apart) underwent prostate biopsy and were included only if the biopsy was negative for malignancy.

Sample size of 40 was calculated estimating re-intervention rate post TUVP to be 2.4% and with 95% confidence interval and using the following formula.[2]

$n=z^2p(1-p)/d^2$ (where n = sample size, z= 1.96 for 95% confidence interval, p= reintervention rate post TUVP)

$=(1.96)^2 \times 0.024 \times (1-0.024) / (0.05)^2$

$=36$

When allowed for 10% dropout, sample size was calculated to be 40.

Patients were assessed preoperatively including digital rectal examination and brief neurological examination. The patient's age, body mass index (BMI), complete blood count, serum electrolytes, serum creatinine and prostate-specific antigen (PSA) level were recorded.

Transrectal ultrasound was done to assess prostate size and transabdominal ultrasound was done to assess the upper tract. Patients not under per urethral foley catheter underwent uroflowmetry to assess the maximum flow rate (Qmax). Patients taking antiplatelet agent were asked to continue the medication.

Patients with a positive urine culture were treated with appropriate antibiotics for seven days, following which urine culture was repeated. Patients with repeat culture positivity were admitted and treated with an injectable antibiotic for three days prior to surgery. All the surgeries were done under spinal anesthesia by two experienced urologists. All patients received prophylactic Ceftriaxone one gm at the time of anesthesia.

Perioperative parameters such as duration of surgery, change in hemoglobin level, duration of post-operative Foley catheterization, the need for post-operative Foley recatheterization and complications were recorded.

Patients with prostate size less than 40 grams and with indications to undergo surgery underwent bipolar transurethral vaporisation of prostate. Olympus bipolar generator ESG-400 (Olympus Winter &Ibe GmbH, Hamburg, Germany) with the following settings, cutting: 240 W; coagulation: 120 W. 26 French rotating continuous flow bipolar resectoscope and a "button-type" vaporisation electrode (Olympus Winter & Ibe GmbH, Hamburg, Germany) was used for vaporisation. 0.9% normal saline was used as the irrigant solution.

After insertion of the cystoscope and careful inspection of the prostate and bladder, the ureteral orifices were identified. Vaporisation was initiated at the bladder neck to ablate the median lobe of the prostate. The procedure was continued at the lateral lobes. Finally, the anterior part of the prostate and the apical region were vaporized until the visualization of urinary bladder from the verumontanum.

Operative duration was defined as the time from initiation of vaporisation to placement of 22F foley catheter at the end of the procedure. The volume of normal saline used was noted in litres. The post operative duration of catheterization was noted in hours.

Post-operative hemoglobin level and electrolytes were assessed immediately and 24 hours after the operation. Change in hemoglobin and sodium level was calculated as the difference between preoperative and postoperative value. Complications were classified as per the modified Clavien classification system.[8]

Patients were assessed at two weeks for hematuria and urinary tract infection. Qmax, IPSS and complications were reassessed at three months follow up. Urethral stricture was suspected in case of reduced flow with prolonged plateau in uroflowmetry, and further investigated with urethrocystoscopy and retrograde urethrogram and voiding cystourethrogram.

Data was collected in a proforma, and data analysis was done using SPSS for Mac V. 26 (SPSS Inc, Chicago, IL, USA). General characteristics of the participants were presented using frequency, percentage, mean and standard deviation. Preoperative and postoperative continuous data were compared by paired t-test and chi-square test. A p-value of < 0.05 was considered statistically significant.

RESULTS

Total of 46 patients underwent Bipolar TUVP during this period. Total of 40 patients were included in the final analysis after exclusion of 6 patients (2- urethral stricture, 1- concomitant cystolithotripsy, 3- lost to follow up). The patient characteristics and preoperative baseline parameters are shown in table 1.

Table 1. General Characteristics of the study participants (pre-operative) (n= 40)

Characteristics	Number	Percentages (%)
Age (Years)		
Mean (± SD)	66.88 (±9.09)	
Patient under antiplatelet agent	5	12
Comorbidities	10	25
Prostate volume (grams)		
Mean (±SD)	32.52 (±4.66)	
IPSS score		
Mean (±SD)	22.18 (±3.54)	
PSA (ng/ml)		
Mean (±SD)	1.89(± 0.9)	
Preop Qmax (ml/min)		
Mean (±SD)	8.38(±1.66)	
Preop Hb (gm/dl)		
Mean (±SD)	13.73 (±1.56)	
Preop Na (meq/l)		
Mean (±SD)	139.15(±2.84)	

IPSS- International Prostate Symptom Score, PSA- Prostate Specific Antigen, Hb- hemoglobin, Na- sodium, n= number, ng/ml – nanograms/milliliter, ml/min- milliliters/minute, gm/dl-grams/deciliter, meq/l- milliequivalents/liter

The perioperative characteristics are shown in table 2.

Table 2. Perioperative characteristics of study population (n=40)

Characteristics	Mean± SD
1. Duration of operation in minutes (Mean±SD)	60.5 ± 16.20
2.Irrigation fluid volume in litres (Mean±SD)	9.53 ± 1.91
3.Catheterization duration in hours (Mean±SD)	40.93 ± 3.88
4. Postoperative Hemoglobin in gm/dl (Mean±SD)	13.36 ± 1.50
5.Postoperative Sodium in meq/l (Mean±SD)	137 ± 2.75

gm/dl-grams/decilitre, meq/l- milliequivalents/litre

As depicted in table 3, no patient developed TUR syndrome and blood transfusion was not required in patients. Most of the complications were Clavien grade I and II. None of the patients developed serious complications. Acute urinary retention requiring recatheterization was observed in two patients, both had successful trial without catheter after one week. Four patients had storage symptoms at two weeks follow up but none required any intervention. Two patients presented at 1 month with reduced flow and were found to have proximal bulbar stricture requiring direct vision internal urethrotomy (DVIU).

Table 3. Complications in study population (n=5)

Grade	Complications	Number	Percentages (%)
I	Fever	1	2.5%
	Acute retention after Foley removal	2	5%
II	Fever with signs of bacteremia	2	5%
	Blood transfusion	0	0
III	UB clot	0	0
IV	TUR syndrome	0	0

UB : Urinary bladder , TUR: Transurethral Resection

As shown in table 4, there was significant improvement in postoperative IPSS score (22.18±3.54 vs 8.63 ± 1.73, p-value < 0.001) and maximum flow rate of patients (8.38 ± 1.66 vs 18.47 ± 3.47, p-value < 0.001). Even though the drop in hemoglobin level (13.73 ± 1.56 vs 13.36 ± 1.50) and sodium level (139.15 ± 2.84 vs 137 ± 2.75) were statistically significant (p value < 0.001 for both parameters), it was not clinically significant as none of the patients required blood transfusion, and none developed features of transurethral resection syndrome.

Table 4. Preoperative and Postoperative Comparison in study population (n=40)

Characteristics	Preoperative	Postoperative	p- value
1. IPSS score (Mean±SD)	22.18 ±3.54	8.63 ±1.73	<0.001
2.Hemoglobin in gm/dl (Mean±SD)	13.73 ±1.56	13.36±1.50	<0.001
3. Na in meq/l (Mean±SD)	139.15±2.84	137±2.75	<0.001
4. Qmax in ml/min (Mean±SD)	8.38±1.66	18.47 ±3.47	<0.001

IPSS – International Prostate Symptom Score, Hb- Hemoglobin, Na- Sodium, Qmax- Maximum flow rate

DISCUSSION

Bipolar Transurethral Vaporisation of the prostate (TUVP) is a accepted modality of treatment of Prostate size more than 40 grams.[9] Fukazawa et al. have shown the efficacy of TUVP, even in prostate size > 100 grams.[10] TUVP doesn't require extra instruments compared to TURP and has a shorter learning curve compared with enucleation procedures. Our study done in prostate size less than 40 grams showed significant postoperative improvements in IPSS and Qmax.

Various studies involving different sized prostates have demonstrated significant improvement Qmax post TUVP.[2,5,6,11,12] Our study also has shown significant improvement in Qmax. Similar improvement in Qmax was noted by Kim et al., who compared TUVP with laser enucleation in small volume prostates (Prostate volume less than 40 grams).[12]

The patients undergoing TUVP reported significant improvement in IPSS in our study. At three months follow up, the patients had IPSS score of 8.6, which was similar to other studies.[1,11-13]

Systematic review by Wiratama et al. has also shown similar improvement in IPSS and Qmax in people undergoing TURP and TUVP, showing similar efficacy between the modalities.[7]

Kaplan and Te had initially described TUVP to have low incidence of postoperative morbidity in terms of catheterization time, recatheterization rate and postoperative irritative symptoms which is similar in our study.[14]

Bleeding is one of the most important complications of prostate surgery. The incidence of bleeding requiring blood transfusion after endoscopic prostatectomy ranges from 0.4-7.1%, and the rates are decreasing with developing technology.[15] Plasma vaporisation electrode generates a thin layer of highly ionized particles, allowing it to glide over the tissue and vaporize a limited layer of prostate cells and the bleeding is reduced as a result of concomitant vaporisation and coagulation.[16]

In our study, even though postoperative Hb (mean change: 0.37 gm%, p value < 0.001) and change in postoperative Na (mean change 2.14, p value < 0.001) were statistically significant, these changes were not clinically significant as there were no cases requiring blood transfusion and none had TUR syndrome. About 12% of the cases were under antiplatelet agent during the surgery but none had post op hemorrhagic complications thus indicating safety of bipolar vaporisation. There was no postprocedure clot retention or need of transfusion in such cases similar to study by Kranzbuhler et al. thus showing that TUVP is a safe procedure even in patients who are taking antiplatelet agents.[3] The absence of postoperative bleeding even in patients taking antiplatelet agent may be attributed to the excellent coagulation achieved by plasma vaporisation.

A common complication post transurethral vaporisation of the prostate is transient dysuria and this is thought to be due to because of the tissue necrosis. In our study , four patients (10%) had storage symptoms lasting for more than two weeks but requiring no further intervention, which is similar to the analysis by Bucuras et al.[2] Current studies have however suggested that the necrosis zone of transurethral vaporisation is comparable to that of bipolar TURP.[17]

Urethral stricture is a established complication after transurethral surgery of the prostate. The reasons for stricture are multifactorial and may be attributed to the resectoscope sheath size, duration of surgery and whether a pure bipolar system is used or a quasi-bipolar system is used for the surgery.[18] The urethral stricture rate after transurethral resection of prostate varies from 1.7-11%.[19] Two patients (5%) treated in our study developed urethral stricture, which is comparable to that after TURP. The reasons for urethral stricture in our study may be attributed to the use of larger resectoscope sheath size (26 Fr) and also to the quasi-bipolar system used whereby it is suspected that there is some current leakage via the resectoscope sheath.[20,21] As there are many confounding variables at play for development of urethral stricture after transurethral surgery, attributing it to one cause is difficult, however the current leak in a quasi-bipolar system may be a important factor in our study.

Abdelwahab et al. had found that bipolar vaporisation had increased stricture rates , increased postoperative irritative symptoms and postoperative hematuria when compared with bipolar TURP 20. The study however was conducted in patients with prostate volume > 40 grams (mean weight 58 grams) and had a longer operative time (mean operative time of 81 ± 15 minutes).

Even though our study is not a comparative study, the complication rate is low and comparable to TUVP arm of various studies comparing TUVP.[22-24]

Limitation of TUVP is absence of tissue specimen for histopathology, thus having the possibility of missing prostate cancer diagnosis.[4,25]

Limitations of our study is that it is a single centre study with a small sample size and a short term follow up of three months. Post operative sexual effects and prostate size were also not evaluated.

A randomised study to compare between TUVP and TURP in small volume prostate (prostate size less than 40 grams) with a long term follow up may add valuable evidence on the long term safety and efficacy of the TUV

CONCLUSION

Bipolar Transurethral Vaporisation of small volume prostate (prostate size less than 40 grams) is a safe and effective procedure for those patients with benign enlargement of prostate requiring surgical intervention. However, a study with a large sample size and a longer follow up will further establish longterm efficacy of the procedure.

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