International Surgery Journal
Saini R et al. Int Surg J. 2017 Nov;4(11):3722-3727
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20174894

Original Research Article

A comparative evaluation of Transurethral Electro-Vaporisation of Prostate (TUEVP) versus Transurethral Resection of Prostate (TURP) for Benign Prostatic Hyperplasia (BPH)

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Received: 08 September 2017
Accepted: 28 September 2017

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ABSTRACT

Background: Transurethral Resection of Prostate (TURP) has been gold standard of surgical treatment of BPH but nonetheless it is associated with many complications. Transurethral Electro-Vaporisation of Prostate (TUEVP) is a new promising modality which has similar results and better side effect profile.
Methods: A prospective, randomised, comparative study was conducted on seventy patients with symptomatic BPH in the Surgery department of Sanjay Gandhi Memorial Hospital, Delhi over two years starting from December 2014. These patients were randomly assigned to two groups- A and B using online random number generator. Patients of group A underwent TUEVP and those of group B underwent TURP. Overall patient satisfaction, patient safety, procedural efficacy and operative ease of the surgeon were compared.
Results: Mean operative time (42.1 min in TUEVP and 38.4 min in TURP) and complication rates (14.3% in TUEVP and 11.4% in TURP) were comparable in both groups. Intra-operative bleeding was significantly less (2.9% in TUEVP; 22.9% in TURP) and visual clarity of operative field was significantly better in TUEVP (persistently clear in 97.1% in TUEVP; 77.1% in TURP). The mean catheterisation time (1.14 days in TUEVP and 2.51 days in TURP) and hospitalisation time (2.14 days in TUEVP and 3.1 days in TURP) were significantly shorter in TUEVP.
Conclusions: TUEVP is comparable to TURP in terms of patient satisfaction, safety, operative time and procedural efficacy. TUEVP has shorter duration of catheterisation and hospitalisation and is better than TURP in terms of intra-operative bleeding and operative ease of the surgeon.

Keywords: BPH, TUEVP, TUVP, TURP, TUEVP v/s TURP

INTRODUCTION

Benign Prostatic Hyperplasia (BPH) is one of the most common health problems in elderly men which interferes with the quality of life of the patients.[1-3] The treatment of BPH has continually evolved over time.[4,5] At present, most surgeons accept that a patient of BPH is best treated with Transurethral Resection of Prostate (TURP) as it is associated with best results and a very high patient satisfaction rate but nonetheless it is associated with many complications.[1-3] Efforts are on to minimise these complications and at the same time keep the merits of TURP. One such technique showing such potential is Transurethral Electro-Vaporisation of Prostate (TUEVP).[2,6,7] It is a modification of the existing transurethral technology, is most recent promising alternative to TURP.[8,9] It is based on the principal of using electric current to vaporise and desiccate prostatic tissue. Vaporisation is done using high cutting current (up

to 300 W) and desiccation is done using coagulation current (between 40 W and 70 W).[10-12]

This prospective randomised study was done with an aim of comparing TUEVP to TURP in terms of overall patient satisfaction (as assessed by improvement in symptoms based on International Prostate Symptom Scoring and Quality of Life Index), patient safety (in terms of complication rate), procedural efficacy (as assessed by improvement in uroflowmetric parameters) and operative ease of the surgeon (as assessed by visual clarity of operative field and operative time).

METHODS

A prospective, randomised, comparative study was conducted on patients diagnosed with benign prostatic hyperplasia in the Surgery department of Sanjay Gandhi Memorial Hospital, Govt. of NCT of Delhi. Seventy patients of symptomatic BPH who were candidates for operative treatment with prostate weighing seventy grams or less were included in the study from December 2014 till December 2016. These patients were randomly assigned to two groups- A and B using online random number generator (http://stattrek.com/statistics/random-number-generator.aspx).[13] Patients of group A underwent TUEVP and those of group B underwent TURP. Clearance from institutional ethical committee was obtained before the study was started. An informed bilingual and written consent was obtained from each patient before they were included into the study.

Sample size was calculated by setting significance level at 5% and power at 80%. A difference of improvement in IPSS score more than 15% was taken as clinically significant.[14] All the outcomes were in terms of mean plus minus standard deviation so for sample size calculation we used the formula:[15]

$$N= (Z_{1-\alpha/2}+Z_{1-\beta})^2 (\sigma_1^2+\sigma_2^2)/d^2$$

Where,

- N= minimum number of cases to be included in each group
- $Z_{1-\alpha}$ =1.96: normal deviate corresponding to level of significance i.e. 0.05
- $Z_{1-\beta}$ =0.84: normal deviate corresponding to power of 80%
- σ_1= Standard deviation of group 1 i.e. 20.7
- σ_2= Standard deviation of group 2 i.e. 22.1
- d= μ_1-μ_2 Difference of means of group 1 and group 2 i.e. 15.4
- μ_1= (mean of group 1) and μ_2 (mean of group 2).

Using the values of mean and standard deviation in the above formula, a sample size of 30 patients in each group was thus obtained. A 16% attrition rate was assumed. Thus, sample size was increased to 35 in each group taking attrition into consideration.

A detailed history of lower urinary tract symptoms (LUTS) was taken in men with presumptive BPH. History to exclude differential diagnosis such as urinary tract infection, urethral strictures, bladder stones, neurogenic bladder, and prostate cancer was taken in a predesigned study proforma. IPSS and QOL scoring was done pre-operatively. Complete general physical examination, digital rectal examination and neurological examination was performed on all patients. Ultrasound examination of the abdomen was done to look for prostate size and post void residual urine volume. Uroflowmetry was done to look for maximum flow rate and average flow rate. Serum Prostate Specific Antigen was done. Other investigations for pre-anaesthetic fitness were done. After pre-anaesthetic clearance, the patients were taken up for surgery (Figure 1).

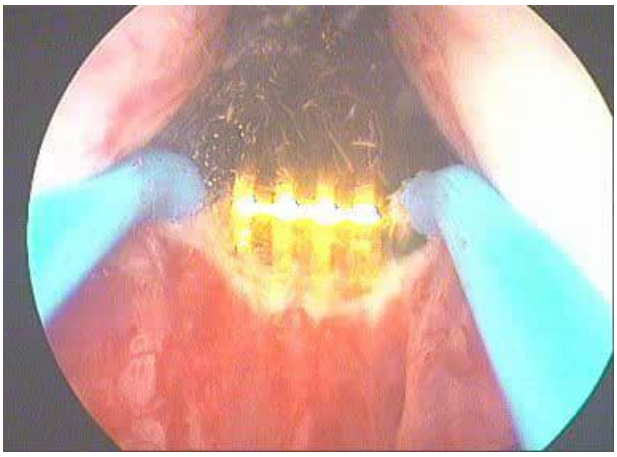

Figure 1: Vaporisation of prostate in trans-urethral electro vaporisation of prostate.

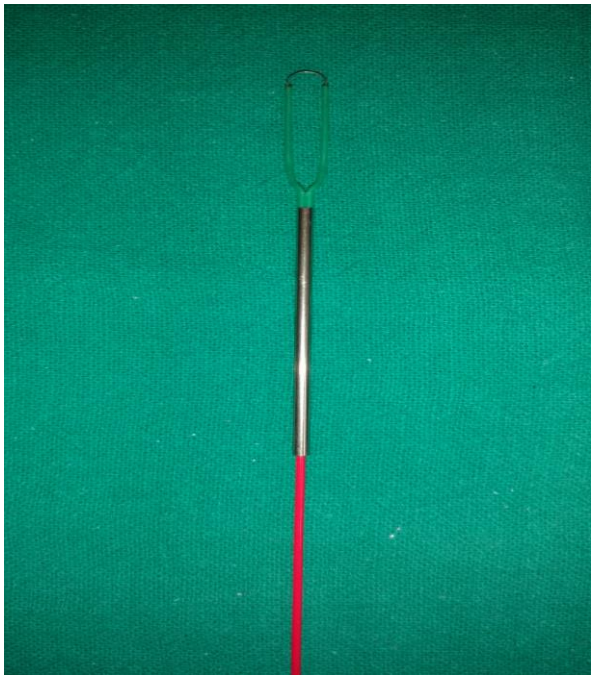

Figure 2: A standard cutting loop electrode used for trans-urethral resection of prostate.

Standard cutting loop electrode was used for TURP (Figure 2) and a roller ball electrode was used for TUEVP (Figure 3). The observations were then compared for the specified parameters.

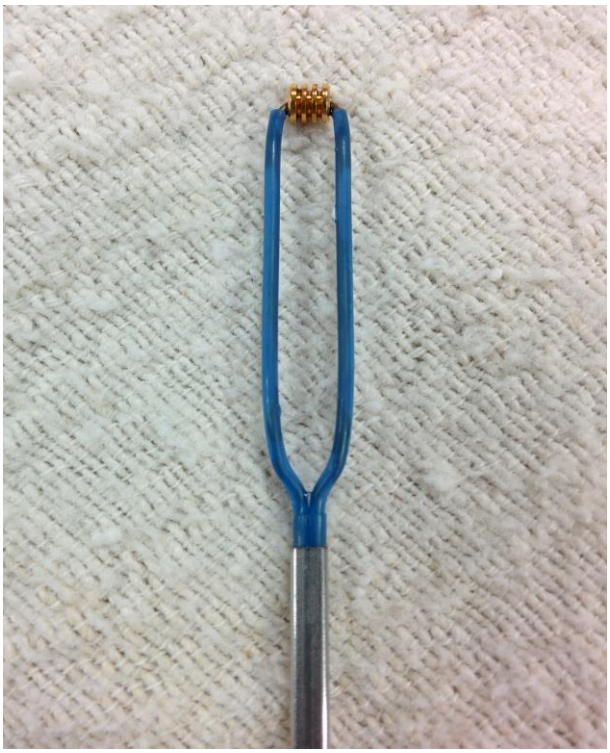

Figure 3: A roller ball electrode used for Trans-Urethral Vaporisation of Prostate.

All data thus obtained was entered in Microsoft Excel spreadsheet. Numerical data was reported as mean±SD and range. Categorical variables were reported as number and percentages. Student's t-test was used to compare numerical variables and the chi-square test or Fischer's exact test were used for categorical variables. Data was processed using Statistical Package for Social Sciences (SPSS version 20.0 for Windows, SPSS inc., IBM, Armonk, NY) statistical software. For all statistical tests, a p value of less than 0.05 was taken to indicate significant difference.

RESULTS

There was no statistically significant difference in both the groups in terms of age wise distribution (mean age 58.86 years in TUEVP; 60.34 years in TURP), mean preoperative prostate size (52.03g in TUEVP and 50.09g in TURP), mean Post Void urine Volume preoperatively (137.6ml in TUEVP and 150.3ml in TUEVP), mean preoperative International Prostate Symptom Score (29.31 in TUEVP and 27.77 in TURP), mean preoperative Quality of Life score (5.06 in TUEVP and 4.57 in TURP), mean preoperative Maximum Flow Rate (8.16ml/s in TUEVP and 7.87ml/s in TURP). Therefore, both the groups had comparable patient profile, thereby making a fair comparison possible.

Mean operative time was comparable in both groups (42.1 min in TUEVP and 38.4 min in TURP). Intra-operative bleeding was significantly less in TUEVP as compared to TURP (Table 1). Visual clarity of operative field was significantly better in TUEVP as compared to TURP (Table 2). The volume of glycine used as an irrigating fluid was significantly less in TUEVP (12.3 litres) as compared to TURP (14.2 litres).

Table 1: Comparison of intra-operative bleeding among study groups.

Bleeding code	TUEVP n (%)	TURP n (%)
No or insignificant bleeding which required application of coagulation current for less than 10 seconds	34 (97.1)	27 (77.1)
Minimal bleeding which required application of coagulation current for more than 10 seconds	1 (2.9)	8 (22.9)
Total	35 (100)	35 (100)

χ^2 Value = 6.248

TUEVP- Transurethral Electro-Vaporisation of Prostate, TURP- Transurethral Resection of Prostate, n- number of patients, %- percentage of patients, χ^2 - Chi Square Value, df- degrees of freedom, Sig- Significant

Table 2: Comparison of visual clarity of operative field among study groups.

Visual clarity of operative field code	TUEVP n (%)	TURP n (%)
Persistently clear	34 (97.1)	27 (77.1)
Transiently obscured vision which required less than 10 seconds to clear	1 (2.9)	6 (17.1)
Persistently obscured vision which required more than 10 seconds to clear	0	2 (5.7)
Total	35 (100)	35 (100)
χ^2 Value = 6.375	df=2	p value=0.041, Sig

TUEVP- Transurethral Electro-Vaporisation of Prostate, TURP- Transurethral Resection of Prostate, n- number of patients, %- percentage of patients, χ^2 - Chi Square Value, df- degrees of freedom, Sig- Significant

The mean duration of catheterisation was significantly shorter in TUEVP (1.14 days) than that in TURP (2.51 days). The mean duration of hospitalisation was also significantly shorter in TUEVP (2.14 days) as compared to TURP (3.1 days).

The complication rates were comparable in both the groups (14.3% in TUEVP and 11.4% in TURP) and there was no statistically significant difference observed. There was no statistically significant difference in mean percentage

improvement in IPSS score among both the groups at 1 week (71.11% in TUEVP and 76.15% in TURP), 1 month (77.1% in TUEVP and 81.26% in TURP), and 3 months (83.67% in TUEVP and 85.67% in TURP) of follow up. The mean improvement in Quality of Life was comparable in both the groups at 1 week (62.43% in TUEVP and 57.14%), 1 month (69.48% in TUEVP and 69.53% in TURP) and 3 months (82.48% in TUEVP and 81.76% in TURP) of follow up. The mean reduction in prostate size at 3 months of follow up was comparable in both the groups (73.5% in TUEVP and 72.35% in TURP). There was no statistically significant difference in the post void residual volume at 3 months of follow up (34.57 ml in TUEVP and 33.14 ml in TURP with a reduction of 78.04% and 80.83% respectively). There was no statistically significant difference in percentage improvement in maximum flow rate (134.47% in TUEVP and 143.57% in TURP) at 3 months of follow up.

DISCUSSION

The mean prostate size preoperatively was comparable in both the groups. It was 52.03 (±6.954) grams in TUEVP and 50.9 (±7.58) grams in TURP. The mean prostatic volume reduced to 13.55 grams in TUEVP and 13.8grams in TURP group. The mean reduction in prostate size at 3 months of follow up was 73.5% in TUEVP and 72.35% in TURP with no statistically significant difference among both groups. In a randomised controlled study on 60 patients, Kupeli et al, found that the mean prostatic volume in TURP decreased from 51.7g to 26.2g, a 49.3% reduction and in TUEVP it decreased from 48.9g to 27.8g, a 43.1% reduction.[16]

Both the groups were comparable in terms of mean IPSS pre-operatively which was 29.31 in TUEVP and 28.77 in TURP. At 1 week of follow up, the mean IPSS in TUEVP was 7.09 (71.11% improvement). The mean IPSS in TURP at 1 week of follow up was 5.62 (76.15% improvement). This difference was not statistically significant. The mean IPSS at 1 month of follow up was 5.46 in TUEVP with a percentage improvement of 77.71% whereas in TURP the mean IPSS at 1 month was 4.43, an 81.26% improvement which was statistically not significant. The mean IPSS after 3 months was comparable in both the groups, being 4.03 in TUEVP with 83.67% improvement and 3.49 in TURP with 85.27% improvement. In a study by Kaplan et al, at 1 year symptom score decreased to 12.8 (66% of patients) and 12.2 (67%).[8] In a study by Verregoso et al, the median IPSS was 19 before the surgery and 5 after the surgery.[17] In a study by Hammadeh et al, both groups showed a comparable decline in the mean IPSS, from 26.5 to 4.4 (TUVP) and from 26.6 to 5.9 (TURP).[18] In a study by Kupeli et al, the IPSS score decreased from 21.6 to 5.2 in TURP 19.4 to 4.1 in TUVP.[16] In a study by McAllister et al, the mean IPSS was 20.7 at baseline, 9.8 after 2 months and 6.9 after 6 months in TURP. In TUEVP group, the mean IPSS was 20.7, 11.8 after 2 months and 8.5 after 6 months.[19]

Quality of Life was comparable in both the groups preoperatively with mean QOL of 5.06 in TUEVP and 4.57 in TURP. At 1 week of follow QOL reduced to 1.83 in TUEVP and 1.89 in TURP. The improvement in QOL after 1 week was 62.43% in TUEVP and 57.14% in TURP, the difference being statistically non-significant. After 1 month of surgery the mean QOL was 1.49 in TUEVP and 1.37 in TURP, with percentage improvement in QOL being 69.48% in TUEVP and 69.53% in TURP. The difference was statistically non-significant. At 3 months of surgery, the mean QOL further improved to 0.86 in TUEVP and 0.83 in TURP with a percentage improvement being 82.48% in TUEVP and 81.76% in TURP. In a study by Verregoso et al, the median QOL before surgery was 4 and after surgery was 2.[17] In a study by McAllister et al, the mean QoL was 4.9 at baseline, 2.3 after 2 months and 1.6 after 6 months in TURP. In TUEVP, the mean QoL was 4.6 at baseline, 2.6 after 2 months and 2 after 6 months.[19]

The post void residual urine volume (PVRV) pre-operatively in TUEVP was 137.6ml and 150.3ml in TURP which was comparable. The mean PVRV assessed at 3 months was 34.57 ml in TUEVP and 33.14 ml in TURP. There was a reduction of 78.04% in TUEVP as compared to 80.83% in TURP. The difference was not statistically significant. In a study by McAllister et al, the PVRV was 171ml at baseline, 78ml after 2 months of follow up and 71ml after 6 months of follow up in TURP cases. In TUEVP group, the mean PVRV was 181ml at baseline, 59 ml after 2 months of follow up and 71ml after 6 months of follow up.[19]

The mean maximum flow rate pre-operatively in TUEVP was 8.16ml/second and 7.87ml/s in TURP which was increased to 17.76ml/s in TUEVP and 17.3ml/s in TURP at 3 months of follow up. The mean percentage improvement being 134.47% in TUEVP and 143.57% in TURP. This difference was not statistically significant. In a study by Kaplan et al, the peak urinary flow increased 9.7ml/s (135%) in TUEVP and 11.3 ml/second (136%) in TURP.[8] In a study by Hammadeh et al, the maximum flow rate increased from 8.6 to 20.8ml/s (TUVP) and 8.6 to 22.8ml/s (TURP) after 1 year.[18] In a study by Verregoso et al, the median maximum flow rate was 8.3 and 22.1ml/s before and after treatment.[17] In a study by Kupeli et al, maximum flow rate increased from 9.2 to 19.2ml/s at 3 months in TURP and from 7.9 to 17.7ml/s in TUEVP.[16]

The mean operative time in TUEVP was 42.1 (±10.4) minutes and in TURP was 38.4 (±7.4) minutes. This difference was not statistically significant. In a study by Kaplan et al, operative time was significantly longer with TUEVP (47.6±17.6 in TUEVP versus 34.6±11.2 minutes in TURP, $p < 0.003$).[8] In a study by Verregoso et al, the mean duration of operation was 45 minutes for TUEVP.[17]

The intra-operative bleeding was compared by dividing the cases into 3 groups - No or insignificant bleeding

(which required application of coagulation current for less than 10 seconds), minimal bleeding (which required application of coagulation current for more than 10 seconds) and significant bleeding (which dropped the haemoglobin percent of patient more than 2 grams per decilitres requiring blood transfusion). None of the patients in either group required blood transfusion. Likewise, the visual clarity of operative field was compared by dividing into 3 groups - persistently clear vision, transiently obscured vision (which required less than 10 seconds to clear) and persistently obscured vision (which required more than 10 seconds to clear). The better visual clarity of operative field in TUEVP may be owed to less bleeding, rapid shrinkage of prostatic tissue due to vaporisation/ fulguration and absence of chips of resected prostate which hamper the vision.

The volume of glycine used as an irrigation fluid was significantly less in TUEVP group (12.3 litres), than in TURP group (14.2 litres). TURP requires more irrigation fluid and with more pressure to clear the operative field. This added to the hospital cost of TURP as compared to TUEVP.

The mean duration of catheterisation in TUEVP was 1.14 days and in TURP was 2.51 days. This difference was statistically significant (p value <0.001). The catheters were placed in situ until urine was visibly clear and patients in TURP group took significantly longer duration for urine to clear as compared to patients in TUEVP group. In a study by Kaplan et al, Catheterisation time was 67.4±13.6 hours in TUEVP versus 12.9±4.6 hours in TURP.[8] In a study by Hammadeh et al, there were significant differences in the mean duration of catheterisation (TUVP 20.9 h, TURP 46.6 h, P<0.001), hospital stay (TUVP 2.2 day, TURP 3.1 days, P<0.001).[18] In a study by Kupeli et al, the mean duration of catheterisation was 4 days in TURP and 2 days in TUEVP.[16]

The mean duration of hospitalisation in TUEVP was 2.14 days and 3.1 days in the TURP which is statistically significant (p value <0.001). In a study by Kaplan et al, the mean duration of hospitalisation was 2.6±0.9 days in TUEVP versus 1.3±0.5 days in TURP cases.[9] In a study by Kupeli et al, the mean hospital stay in TURP cases was 4.5 days and in TUEVP cases the mean hospital stay was 2.5 days.[13]

In TUEVP, about 85.7% had no complications, 2 patients (5.7%) had urinary tract infection which was treated by oral antibiotics, 1 patient (2.9%) complained of impotence who gradually improved over following 2 months without any intervention, 1 patient (2.9%) had retrograde ejaculation and did not improve even after 6 months of follow up and 1 patient (2.9%) had urethral stricture following UTI for which internal optical urethrotomy had to be done after 6 weeks. In TURP, 88.6% had no complications, 2 patients (5.7%) had clot retention in the ward for which repeat catheterisation had to be done, 1 patient (2.9%) had catheter block in the ward for which repeated flushing of the catheter had to be done with saline and 1 patient (2.9%) developed urinary tract infection which responded to oral antibiotics. The overall complication rate was comparable in both groups and there was no statistically significant difference in both the groups in terms of complication rate. In a study by Kaplan et al, there were no major complications in the electro-vaporisation group while in the resection group one patient required transfusion and in one patient TUR syndrome developed[8]. In a study by Hammadeh et al, two patients in each group developed urethral strictures (4%) and two patients in each group required re-operation for residual adenoma (4%); two patients undergoing TURP had a bladder neck stricture (4%).[18] In a study by Kupeli et al, at 3 months postoperatively, 13 patients in the TURP group and 7 patients in the TUVP group had retrograde ejaculation.[16]

CONCLUSION

The present study concluded that TUEVP is comparable to TURP in terms of overall patient satisfaction as assessed by improvement in IPSS and QOL index; patient safety as assessed by complication rate; procedural efficacy as assessed by improvement in uroflowmetric parameters; and operative time. TUEVP is better than TURP in terms of intra-operative bleeding; operative ease of the surgeon as assessed by visual clarity of operative field; catheterisation time and hospitalisation time; and utilises significantly less amount of irrigating fluid as compared to TURP. Thus, on the basis of observations of this study, we recommend TUEVP to be an effective and safe alternative to TURP. It is also a highly cost-effective alternative to other methods of prostatic vaporisation such as laser vaporisation.

However as with any vaporisation method, tissue is not available post TUEVP for subjecting to histopathology. Moreover, this study requires further long term follow up of patients for conclusive evidence to strengthen the above results on rates of complications and recurrence.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Saini R, Saxena K, Makkar GS, Shekhar S, Desai S, Singh S, et al. A comparative evaluation of Transurethral Electro-Vaporisation of Prostate (TUEVP) versus Transurethral Resection of Prostate (TURP) for Benign Prostatic Hyperplasia (BPH). Int Surg J 2017;4:3722-7.