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PROSPECTIVE STUDY TO ESTABLISH CORRELATION BETWEEN MAXIMUM RISE IN RECTAL TEMPERATURE AND MINIMUM EFFECTIVE POWER FOR VAPOURIZATION DURING TUEVP IN BPH AND ITS EFFECT ON POST OPERATIVE RESULTS

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ABSTRACT

BACKGROUND: Out of the Various Surgical Management Techniques For Benign Prostatic Hyperplasia, Transurethral Electrovapourization of Prostate is a Minimal invasive procedure comparable to Transurethral Resection of Prostate which removes prostatic tissue by using High Vapourization Power, combining the effects of Vapourization and Dessication.

The Study Aims to Establish the Co-relation between the Maximum Rise in Rectal Temperature and Minimum Effective Power for Vapourization used during TUEVP and its Effect on Post Operative Results, thus helping us to have an idea about the effect of lateral thermal damage at high energy levels during TUEVP.

METHODS: The Prospective Study was Conducted on 60 Patients of Benign Prostatic Hyperplasia at SGMH, New Delhi. Continous Rectal temperature monitoring was done during TUEVP and Maximum Rise in Rectal temperature was noted at different Vapourization Powers. Patients post operative results were assessed on basis of IPSS and QOL index and complications if any were noted with a follow up of 3 months . Results were compared with the Vapourization power (150-300 Watt) used along with Maximum Rise in Rectal Temperature.

RESULTS: The Mean of Maximum Rise in Rectal Temperature was .5°C at 160 MEPV, 1.005°C at 180 MEPV, .4°C at 190 MEPV and 1.52°C at 200 MEPV. At MEPV of 220 , 240 ,260 and 280 Watts, the Mean of Maximum Rise in Rectal Temperature was 2.2°, 2.4° , 2.55°and 2.8° Celsius, respectively.

At 160 MEPV, there was no complications. At 180 MEPV, 96.87% had no complications while 3.12% of patients had Clot retention. At 190 and 200 MEPV, there were no complications. At 220 MEPV, 25% patients had Clot retention. At 240 MEPV 66.67% had no complications while 33.33% of patients had Clot Retention. At 260 MEPV, 50% of patients had Retrograde ejaculation .At 280 MEPV only 1 patient was operated which developed Clot retention (100%).

CONCLUSION: This study had established that there was a significant direct correlation between Minimum Effective Power for Vapourization and Rectal Temperature During TUEVP and no siginificant difference in IPSS improvement, QOL improvement and Complications rate.

It showed that at all MEPV Levels, TUEVP was equally efficacious and safe. Only very minor complications occurred which mostly could be tackled immediately.

KEYWORDS : Transurethral Electrovapourization of Prostate, Benign Prostatic Hyperplasia, Rectal Temperature, Minimum Effective Power for Vapourization(MEPV)

INTRODUCTION

Benign Prostatic Hyperplasia is a common urological problem in elderly men which histologically, is characterized by an increased number of epithelial and stromal cells in the periurethral area of the prostate and thus correctly referred to as Hyperplasia[1].

As the world population ages, the incidence and prevalence of BPH and LUTS have increased with a constellation of signs and symptoms that develop in the male population having a significant impact on the health of older men and health-care costs.[2,3,4]

The treatment of benign prostatic hyperplasia (BPH) has undergone tremendous re-evaluation over the last decade. Transurethral Electrovapourization of Prostate is a modification of the existing transurethral technology, and is most recent promising alternative to TURP which is brought about by combining the concepts of vapourization and dessication.[5,6,7]

By using high frequency cutting current , synchronous vapourization and coagulation of prostatic tissue is obtained. The use of high power levels has raised concerns about the possible damage to adjacent tissues due to elevated tissue temperatures in proximity to the electrode. Interstitial temperature changes during TUEVP are transient and highly localized.[8,9]

This prospective study was done to establish correlation between Mean of Maximum Rise in Rectal Temperature (MRRT) at a particular Voltage and Minimal Effective Power for Vapourization (MEPV) used during TUEVP in BPH and its effect on post-operative results.

The results were assessed in view of overall patient satisfaction (as assessed by improvement in symptoms based on International Prostate Symptom Scoring together with evaluation of Quality Of Life), patient safety (in terms of incidence of complications such as hemorrhage, urinary retention, extravasation of urine, TUR syndrome, urinary tract infection, incontinence, sexual dysfunction, retrograde ejaculation, urethral stricture, bladder neck contracture) and procedural efficacy (as assessed by improvement in uroflowmetric parameters).

METHODS

A prospective study was conducted on patients diagnosed with Benign Prostatic Hyperplasia in the Surgery department of Sanjay Gandhi Memorial Hospital, Govt. of NCT of Delhi. Sixty patients of symptomatic BPH who were candidates for operative treatment with prostate weighing seventy grams or less were included in the study. The study was conducted during a period of two years starting from December 2015 till December 2017. Clearance from institutional Ethics committee was obtained before the study was started. An informed, bilingual consent was obtained from each patient who were included in to the study.

Sample size was calculated by setting significance level at 5% and power at 80%. All the outcomes are in terms of mean plus minus standard deviation so for sample size calculation we used the formula[10]

$N = 1.96^2 \times 4SD^2/d^2$

Where,
N = Minimum number of cases to be included.
SD = Standard deviation of the measure being estimated.(9.4)
d = Desired width of confidence interval (d=5)

By substituting the above values in the formula we get N as 54.3 and adding an attrition rate of 10%, the total number of cases comes out to be approximately 60.

So, the sample size for this study was 60.

A detailed history of lower urinary tract symptoms (LUTS) was taken in men with presumptive BPH. History to exclude differential diagnosis and preoperative increased rectal temperature such as urinary tract infection, urethral strictures, bladder stones, neurogenic bladder,fever due to any cause 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).

TUEVP was done using a standard 26 F continuous flow Richard Wolf Resectoscope (Figure2) and a grooved roller ball electrode(Figure3) with electric power between 150-300 Watt for cutting and 60 Watt for coagulation using Bowa Arc electric current generator and continuously irrigating with 1.5% glycine. The procedure was started at a particular desired Electric Vapourization power between 180 watt and 300 watt.

Rectal temperature was measured continuously during the whole procedure using Mextech PM10 Digital Thermometer(Figure4) and was noted at three points during the procedure. Firstly, pre-operatively after spinal or general anesthesia (T1), secondly, after resectocope insertion and two minutes of irrigation (T2), and lastly, the Maximum rectal temperature reached during vapourization in each patient undergoing TUEVP(T3). The rectal temperature was monitored continuously during the entire TUEVP procedure and the Maximum Rectal Temperature reached for each patient during TUEVP was noted along with the Minimal Effective Power for Vapourization(MEPV) used in that patient. The Maximum rise in rectal temperature was noted which was the difference between Maximum Rectal temperature and Rectal temperature 2 minutes after irrigation. On conclusion of the Study, Mean of all Maximum Rise in Rectal Temperatures in various patients at a particular Minimum Effective Power for Vapourzation was obtained and compared.

RESULTS

The mean age of the study group was 63.37 ± 6.88 years. Mean Pre-operative Prostate size was 51.27 ± 6.28 grams. Mean Pre-operative Postvoid Residual Urine volume was 165.71 ± 30.51 ml. Mean Rectal Temperature Before Starting Irrigation (T1) was 36.57 (± 0.2499) ^{o}C. Mean of Maximum Rectal Temperature Reached (T3) was 37.78 (± 0.8990)^{o}C. The distribution of the study group according to Minimum Effective Power for Vapourization and Maximum Rise in Rectal Temperature is shown in table 1and chart 1.

A Rise in Mean of all Maximum Rise in Rectal Temperature at a particular Vapourization power on increasing Minimum Effective power for Vapourization (MEPV) ia seen as is shown in table 2 and chart 2.

Distribution of the study group according to Minimum Effective Power for Vapourization and Percentage improvement in IPSS and QOL at 3 Months postoperatively is shown in table no.3,4 and chart no 3,4.

This study has shown that, 91.67% of patients hadcno complications, 6.67% of patients had Clot Retention and 1.67% of patients had Retrograde Ejaculation as shown in table 5.

At MEPV less than 220 watts, only 1 patient had developed clot retention while at MPV more than equal to 220 watts, 3 patients had clot retention and 1 patient had Retrograde Ejaculation.(Table no 5).

DISCUSSION

The correlation between MEPV and Maximum Rise in Rectal Temperature as shown in table 1 chart 1 was statistically significant with Correlation Co-efficient of .671 And p value <.05, being statistically significant.

This suggests that as there occurs a Rise in Vapourization Power , a Rise in Rectal temperature was noted.

Also, the correlation coefficient between Mean of all Maximum Rise in Rectal temperatures at a particular Minimum effective Vapourization power ,as shown in table no 2 and chart 2 was .962 with p value <.05 , suggesting a rise in Mean Rectal Temperature with Rise in Vapourization Power.

In a study by Reis RB, Te AE, Cologna Aj et al[11] Interstitial thermometry in men undergoing electrovapourization of prostate was done. Interstitial temperature during TUEVP in both the prostate and surrounding tissue of 18 men were noted. These 18 men undergoing TUEVP had three interstitial thermocouple probes placed under ulstrasound guidance. Probes were positioned in the rectal wall and at the 5 and 7 o'clock position of the prostate capsule. A fourth probe was placed within 1mm area of vapourization to determine “lesion” temperature. Temperature was measured at baseline and at 15-minute intervals as TUEVP was performed utilizing the Vaportrode at 240 to 280 watts with a Valley Lab Force 40 Generator.

A temperature variability of 1.9 degrees C was seen. The temperature within 0.5 mm of the area of vaporization was >100 degrees Celsius. These results were independent of the temperature of the irrigating solution.

In a study by Larson TR et al [12] to determine the detailed pattern of prostatic interstitial temperature change during rollerball electrovapourization and loop electrosurgery in patients with benign prostatic hyperplasia ,4 patients with symptomatic BPH were subjected to rollerball electrovapourization on one side of the prostate as well as contralateral loop electrosurgery,while continous temperature readings were recorded by help of fibreoptic thermosensors using thermal mapping technique. Marked mean temperature increase occurred at 1 to 2 mm from both the rollerball (30.8 degrees C,95% confidence interval[Cl]27.8 to 33.8 degrees C) and loop(34.8 degrees C,95% confidence interval [CI]24.0 to 45.6 degrees C), and temperatures at this distance were significantly higher than those at greater distances(P <0.05).

No significant statistical co-relation could be established between the Rise in Vapourization power and occurrence of complications, due to limited number of data and follow up period.

In a study by A Tizzani et al[13] on Immunohistochemical evaluation of the safety of Transurethral Electrovapourization of Prostate and its clinical results. TUEVP was performed on 177 patients, 83.9% of sexually active men reported the occurrence of retrograde ejaculation while 12 patients complained of postoperative impotence. Urinary retention following TUEVP was observed which was explained on the basis of Urethral oedema due to Thermal damage. In view of occurence of these complications, the study suggested that the possibility of neuronal damage following TUEVP, could not be ruled out.

CONCLUSION

This Study was mainly undertaken to compare and correlate the Minimum Effective Vapourization Power with Maximum Rise in Rectal temperature and Complication rate during Transurethral Electrovapourization of Prostate in patients with Benign Prostatic Hyperplasia.

This study had established that there was a significant direct correlation between Minimum Effective Vapourization Power and Rectal Temperature and no siginificant difference in IPSS improvement, QOL improvement and Complications rate.

It showed that at all MEPV Levels, TUEVP was equally efficacious and safe. Only very minor complications occurred mostly which mostly could be tackled immediately.

But this study is not without limitations. Since this is a novel study, the study results could not be compared with the other studies. But this study had brought out important facts and also attracts the attention of other researchers for further research.

ACKNOWLEDGEMENTS: None

DECLARATIONS

Funding: None

Conflict of interest: None

Ethical approval: Approved

Abbreviations:

BPH – Benign Prostatic Hyperplaisa , TUEVP – Transurethral Electrovapourization of Prostate

MEPV – Minimum Effective Power For Vapourization

Figure 1: Transurethral Electro Vaporization of Prostate (TUEVP) being done

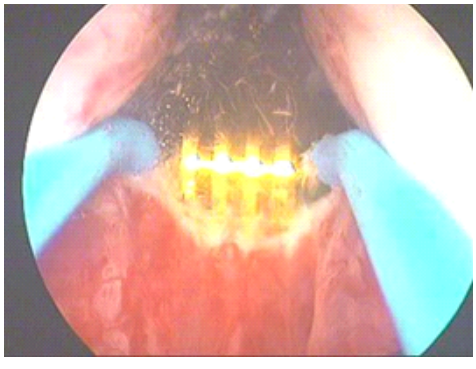

Figure 2: Resectoscope with 5 mm telescope

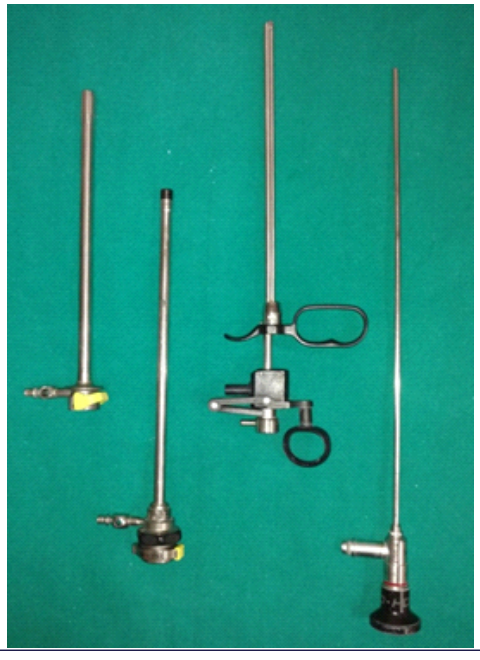

Figure 3: A roller ball electrode used for TransUrethral Vaporisation of Prostate.

Figure 4: Mextech Pm-10 Digital Thermometer Used for Continous Rectal Temperature Monitoring

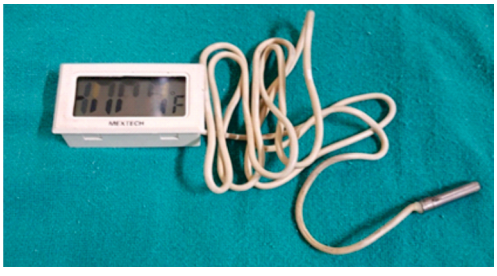

Table 1.Distribution of the study groups according to Minimum Effective power for Vapourization and Maximum Rise in Rectal Temperature (T3-T2)

MEPV (In watts)	Max. rise in rectal temperature(T3-T2) (In Degree Celsius)						Total
	Less than. 5 ^{0}C	.5 –1.0 C	1.0 –1.5 ^{0}C	1.5 –2.0 ^{0} C	2.0-2.5 ^{0} C	2.5-3.0 C	
160	3 (75.0%)	1 (25.0%)	0	0	0	0	4 (100.0)
180	11 (34. 37%)	8 (25%)	5 (15.6%)	8 (25%)	0	0	32 (100.0)
190	1 (100%)	0	0	0	0	0	1 (100.0)
200	0	3 (23.1%)	3 (23.1%)	6 (46.2%)	1 (7.7%)	0	13 (100.0)
220	0	0	0	1 (25.0%)	3 (75.0%)	0	4 (100.0)
240	0	0	0	0	2 (66.7%)	1 (33.3%)	3 (100.0)
260	0	0	0	0	1 (50%)	1 (50%)	2 (100.0)
280	0	0	0	0	0	1 (100%)	1 (100.0)
Total	15 (25.0%)	12 (20%)	8 (13.3%)	15 (25%)	7 (11.7%)	3 (5%)	60 (100.0)

r=0.671, P value=0.000, Sig

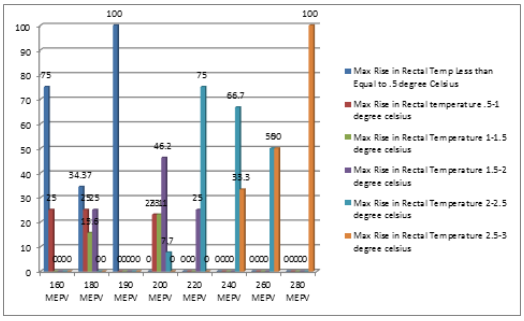

Chart 1. Distribution of the study groups according to Minimum Effective power for Vapourization and Maximum Rise in Rectal Temperature (T3-T2)

Table 2.Distribution of the study groups according to Mean of Maximum Rise in Rectal Temperature at a particular Minimum Effective Power for vapourization

Minimum Effective Power For vapourization (In Watts)	Number of Patients Operated	Mean Of Maximum Rise in rectal Temperature (In Celsius)
160	4	.5°
180	32	1.003°
190	1	.4°
200	13	1.52°
220	4	2.2°
240	3	2.4°
260	2	2.55°
280	1	2.8°

r = .962 ; p value = 0.000, Sig.

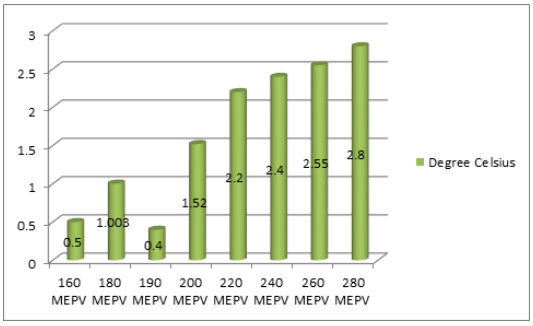

Chart 2.Distribution of the study groups according to Mean of Maximum Rise in Rectal Temperature at a particular Minimum Effective Power for vapourization

Table 3.Distribution of study group according to Minimum Effective Power for Vapourization and Percentage IPSS improvement At 3 months

MEPV (In watts)	%IPSS Improvement			Total
	70-80 percent	80-90 percent	90-100 percent	
160	1 (25.0%)	3 (75.0%)	0	4 (100.0)
180	1 (3.12%)	25 (78.12%)	6(18.75%)	32 (100.0)
190	0	1 (100.0%)	0	1 (100.0)
200	4 (30.76%)	5 (38.46%)	4 (30.76%)	13 (100.0)
220	1 (25.0%)	3 (75.0%)	0	4 (100.0)
240	0	3 (100.0%)	0	3 (100.0)
260	0	1 (50.0%)	1(50.0%)	2(100.0)
280	1 (100.0%)	0	0	1(100.0)
Total	8 (13.33)	41 (68.33)	11 (18.33)	60 (100)

χ2=20.859, df=4, p-value= 0.105, NS

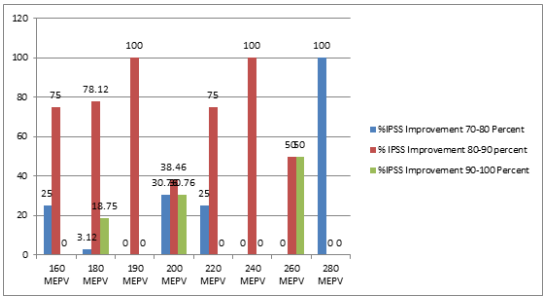

Chart 3.Distribution of study group according to Minimum Effective Power for Vapourization and Percentage IPSS improvement At 3 months

Table 4.Distribution of study group according to Minimum Effective Power for Vapourization and Percentage Quality of Life Improvement At 3 Months

MEPV (In watts)	% QOL improvement				Total
	75	80	83.3	100	
160	2 (50.0%)	0	0	2 (50.0%)	4 (100.0)
180	3 (9.37%)	11(34.4%)	12(37.5%)	6 (18.8%)	32 (100.0)
190	0	0	1 (100%)	0	1 (100.0)
200	4 (30.8%)	6 (46.2%)	0	3 (23.1%)	13 (100.0)
220	2 (50.0%)	0	0	2 (50.0%)	4 (100.0)
240	0	1 (33.3%)	2 (66.7%)	0	3 (100.0)
260	0	0	0	2 (100%)	2 (100.0)
280	1(100%)	0	0	0	1(100.0)
Total	12 (20%)	18(30.0%)	15 (25%)	15(25.0%)	60 (100.0)

χ2=36.109, df=21, p-value=0.021, Sig

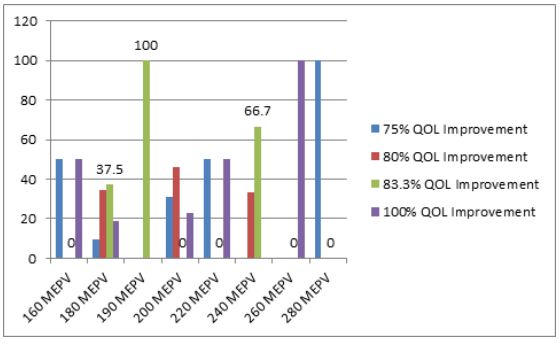

Chart 4. Distribution of study group according to Minimum Effective Power for Vapourization and Percentage Quality of Life Improvement At 3 Months

Table 5.Distribution of study group according to Minimum Effective power for vapourization and Complications

MEPV (In watts)	Complications				Total
	Nil	Clot retention	Urinary Tract Infection	Retrograde ejaculation	
160	4 (100.0%)	0	0	0	4 (100.0)
180	31(96.87%)	1(3.12%)	0	0	32 (100.0)
190	1(100%)	0	0	0	1 (100.0%)
200	13(100%)	0	0	0	13(100.0%)
220	3 (75.0%)	1(25.0%)	0	0	4 (100.0%)
240	2(66.67%)	1(33.33%)	0	0	3 (100.0%)
260	1 (50.0%)	0	0	1(50.0%)	2 (100.0%)
280	0	1(100%)	0	0	1(100.0%)
Total	55(91.67%)	4(6.67%)	0	1 (1.67%)	60(100.0%)

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