Evaluation of transurethral vaporization of the prostate using plasmakinetic energy (Preliminary study)

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Abstract: Objectives: This study designed to assess efficacy and safety of plasmakinetic vaporization of the prostate for symptomatic prostatic obstruction (small and medium size prostate). **Patients and methods:** we enrolled 50 patients, from Al-Azhar University Hospitals. They subjected to full history taking, clinical examination, laboratory and radiological investigations before and after plasmakinetic vaporization of the prostate. **Results:** Uroflow Q-max at preoperative intervention ranged from 5.60 to 14.70 ml/sec with a mean of 9.50±2.56. Afte the intervention, it ranged from 15.0 to 21.0 ml/sec with a mean of 17.98±1.67; and there was significant increase after vaporization in comparison to values before vaporization P<0.001. No significant difference was found between pre and postoperative values of sodium or hemoglobin concentrations P-value 0.09 (N.S) & 0.083 (N.S) respectively, and no patients needed blood transfusion. Operative time ranged from 25 to 60.0 minutes with a mean of 48.68±10.41 minutes. Duration of hospital stay ranged from 3 to 4 days with a mean of 3.82±0.38 days. Urethral catheter duration ranged from 2 to 3 days with a mean of 2.21 ± 0.41 days. Postoperative complications were in the form of re-hospitalized for secondary hemorrhage in 2 cases (4.0%) and re-hospitalization for acute retention in 1 case (2.0%). Thus, the overall complication rate was 6.0%. Quality of life (QoL) score before intervention ranged from 3 to 6 with a mean of 4.70±0.73; while after intervention, it ranged from 0 to 3 with a mean of 1.70 ±0.64 and there was a significant decrease after intervention in comparison to the values before intervention P<0.001. IPPS score before intervention ranged from 16 to 30 with a mean of 22.75±4.01. After intervention, it ranged from 2 to 12 with a mean of 7.59±4.13 and there was a significant decrease after intervention P<0.001. **Conclusion:** Plasmakinetic vaporization of the prostate provides a reasonable, safe and effective procedure for the treatment of benign prostatic hyperplasia. The Minor drawback of this technique is highly cost among traditional technique**.**
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1. Introduction

Transurethral resection of the prostate (TURP) had being accepted as a gold standard therapeutic modality for patients obstructive symptoms induced by benign prostatic hyperplasia (BPH). The TURP associated with morbidity rates of 18%, these include bleeding, transurethral resection (TUR) syndrome, bladder neck stricture formation and sexual dysfunction **[1].** Prolonged catheterization, use of monopolar energy and longer training **[2].** The considerable morbidity rate associated with TURP has led to the development of several less invasive technologies to relieve prostatic obstruction, e.g., transurethral laser vaporization of the prostate, Plasmakinetic vaporization of the prostate [**3**].

Plasmakinetic vaporization of the prostate (PKVP) using bipolar electro-surgical technology has less morbidity and seemingly comparable results to TURP in the early and short-term follow- up [4]. PKVP creates an ionized plasma corona in a saline solution that vaporizes prostatic tissue and washes it away in an irrigant flow. The saline environment eliminates the risk of glycine absorption and associated complications **[5].** PKVP can achieve similar results to TURP in improving the peak urinary flow rate (Q_{max}) and symptom scores in the short-term [6]**.**

Aim of the work

The aim of this study is to assess the efficacy and safety of plasmakinetic vaporization of the prostate for symptomatic prostatic obstruction (small and medium size prostate).

2. Patients and methods

This study is a prospective trial. It carried out at Al-Azhar University Hospitals, during the period from January 2011 to January 2013. It includes 50 patients complaining of BPH symtoms.

Inclusion criteria:

Patients older than 50 years, failed medical therapy with α-blocker, and Persistence or progression of voiding symptoms.

Exclusion criteria:

Neurogenic bladder; Prostate cancer; Stricture urethra; Total prostatic size more than 50 cc; and previous prostate surgery.

A complete clinical history with special concern of the international prostate symptom score (IPSS), a

quality of life score (QoL). Particular stress made about the history of possible ailments that might symptomatically simulate BPH, on the intake of medications that interfere with vesical or sphincter function and concerning previous prostatic, vesical or urethral operations.

Complete physical examination included full general examination, laboratory investigations (Routine laboratory investigations as CBC, blood sugar, liver functions, renal function tests and coagulation profile (prothrombin time and concentration, INR, specific laboratory investigations as complete urinalysis, urine culture and sensitivity tests in some cases as well as PSA estimation) and imaging **studies (plain UT), abdominopelvic US, TRUS) and uroflowmetery.**

Operative procedure:

Cystoscopy (Storz rigid cystoscope, 21 Fr; resectoscope continuous irrigation sheath 26 Fr; cystoscopic lens 30^{o}; visual obturator; Storz Inc, Germany) was performed by one of two physicians (with the patient in the lithotomy position. Urethral and bladder structures inspected conventionally except for the bladder neck, which viewed in a retroflex position. Plasmakinetic transurethral vaporization performed using the PlasmaKinetic™ SuperPulse system, consisting of a PK® generator, a PK resectoscope and a Plasma-Sect® electrode (Autocon|| 400 from Storz). The PKVP device used to systematically vaporize prostatic tissue with the probe maintaining gentle contact with the tissue being vaporized. Power maintained at the default setting (level 5=250W vaporization and level 5=250W coagulation). The prostate lateral lobes vaporized at first after creating the working space from the bladder neck to the verumontanum, the power setting increased to level 6=300W and final level 7=350W to widen the cavity. The middle lobe vaporized after completing the lateral lobe ablation. To control bleeding when it occurred, the coagulation mode setting used, wherein the power reduced to level 6=300W and the laser beam directed around, rather than directly at, the bleeding vessel. Irrigant used to be normal saline (0.9) and saline warmed to 40C. (20 Fr) three-way Foley catheter inserted with irrigation in all cases. K-Y Jell mixed with a corticosteroid at the fixation of the urethral catheter to reduce postoperative irritative symptoms.

Early postoperative evaluation:

All patients observed after operation to check the general condition and to detect early post-operative complications during hospital stay. Then the patients discharged and followed up in the outpatient clinic after removal of the catheter and spontaneous voiding. The following criteria considered during early follow-up period: consciousness and mentality of the patients; color of urine, suprapubic pain; hospital stay and general condition of the patient; perineal pain and/or hematoma. and fever related to the procedure; micturation after catheter removal, difficulty, burning micturation, possible side effects or complications; **Late postoperative evaluation** (after 3 months) international prostatic symptoms score & Quality of life score; abdomino-pelvic US with post voiding residual urine determination (PVR) and uroflowmetry.

Statistical analysis of data:

The collected data organized, tabulated and statistically analyzed using statistical package for social science (SPSS) version 16 software (SPSS Inc, USA). Interpretation of P-value estimated using the **Chi-square test**, $P \leq 0.05$ considered significant.

3. Results

In this work, age ranged from 55 to 75 years with a mean of 61.84±5.16 years. Symptoms of BPH in a form of difficulty in micturation characterized by interrupted stream, and incomplete voiding in 98% of cases. Nocturia was 66%, the frequency was 20%. While retention reported in only 1 case (2.0%). DRE examination revealed that, the prostate was not significantly enlarged in 5 cases (10.0%), mildly enlarged in 9 cases (18.0%) and moderately enlarged in 36 cases (72.0%). Serum creatinine ranged from 0.6 to 1.90 with a mean of 0.89 and standard deviation of ±0.27. Serum glutamic oxaloacetic transaminase (SGOT) ranged from 12 to 69 with a mean of 25.72 and standard deviation of ±14.56 while serum glutamic pyruvic transaminase (SGPT) ranged from 10 to 83 with a mean of 28.20 and standard deviation of ±15.26. Random blood sugar ranged from 82 to 370 with a mean of 121.72 and standard deviation of ±59.39 mg/dl (data not tabulated).

Uroflow Q-max at preoperative intervention ranged from 5.60 to 14.70 ml/sec with a mean of 9.50±2.56, while after the intervention, it ranged from 15.0 to 21.0 ml/sec with a mean of 17.98±1.67; and there was significant increase after vaporization in comparison to values before vaporization P-value<0.001. In addition, preoperative sodium levels ranged from 135 to 142 mEq/dl with a mean of 141.40±3.20; while after TUVP, it ranged from 136 to 143 MEq/dl with a mean of 141.58±2.73 and there was insignificant increase after vaporization in comparison to their values before vaporization P-value 0.09(N.S). Finally, hemoglobin concentration before the intervention ranged from 10.20 to 15.80 g/dl with a mean of 13.83±1.28 gm/dl; while after the intervention, it ranged from 10.10 to 15.50 gm/dl with a mean of 13.75±1.28 g/dl and there was insignificant decrease after the intervention when compared to values before the intervention P –Value 0.083(N.S), in

the duration of patients hospital stay. No patient required blood transfusion. (Table 1).

Regarding operative time, it ranged from 25 to 60.0 minutes with a mean of 48.68±10.41 minutes, while hospital stay duration ranged from 3 to 4 days with a mean of 3.82±0.38 days. Urethral catheter duration ranged from 2 to 3 days with a mean of 2.21 ± 0.41 days (Table 2).

Regarding postoperative complications, it was found in three cases, two of them re-hospitalized for secondary hemorrhage(4.0%) and the other one re-admitted for acute retention of urine(2.0%). Thus, the overall complication rate was 6.0% (Table 3).

As regards Quality of life (QoL) score before intervention, it ranged from 3 to 6 with a mean of 4.70±0.73; while after intervention, it ranged from 0 to 3 with a mean of 1.70 ±0.64 and there was a significant decrease after the intervention in comparison to their values before the intervention P-value<0.001. In addition, IPPS score before the intervention ranged from 16 to 30 with a mean of 22.75±4.01; while after the intervention, it ranged from 2 to 12 with a mean of 7.59±4.13 and there was a significant decrease after the intervention P-value<0.001. Mean post voiding residual urine from 149.8±59.5 mL to 46.9±24.1 mL (*P* value=0.01) and mean prostate volume from 62.8±10.3 mL to 22.7±6.1 mL (*P* value=0.01). There was statistically significant decrease in the mean PSA from 3.03±2.2 ng/mL to 1.2±1.04 ng/mL (P value=0.02), after 3 months. Pus cells in urinalysis before the intervention ranged from 0 to 110 with a mean of 20.44; while after the intervention, it ranged from 0 to 60 with a mean of 6.05 and there was a significant decrease after TUVP (Table 4).

Table (1): Pre- and Post-operative values of Uroflow Q-max, Sodium and Hemoglobin concentrations in study cases

Mean	Preoperative	Postoperative	P-value
Urolfow Q-max	9.50±2.56	17.98±1.67	<0.001
Sodium	141.40±3.20	141.58±2.73	0.09 (N.S)
Hemoglobin	13.83±1.28	13.75±1.28	0.083 (N.S)

(N.S) = **Non statistically significance**

Table (2): Operative time, hospital stay and urethral catheter duration in study cases

	Duration
Operative time	48.68± 10.41 /minutes
Duration of hospital stay	3.82±0.38 /day
Urethral catheter duration	2.21±0.41 /day

Table (3): Complications in studied cases

	N.	%
No complications	47	94.0
Re-hospitalization for secondary hemorrhage	2	4.0
Re-hospitalization for acute retention	1	2.0
Total	50	100.0

Table (4): Pre- and post-operative Quality of life score, IPPS score, Post-voiding residual urine, Prostate volume and PSA in study cases

Mean	Preoperative	Postoperative	P-value
Quality of life score	4.70±0.73	1.70±0.64	<0.001
IPPS score	22.75±4.01	7.59±4.13	<0.001
Residual urine (mL)	149.8±59.5	46.9±24.1	0.01
Prostate vol.(mL)	62.8±10.3	22.7±6.1	0.01
PSA (ng/mL)	3.03±2.2	1.2±1.04	0.02

4. Discussion

The present study designed to assess efficacy and safety of plasmakinetic vaporization of the prostate for symptomatic prostatic obstruction. It has 50 patients, from Al-Azhar University Hospital. They submitted to full history taking, clinical examination, laboratory and radiological investigations before and after plasma kinetic vaporization of the prostate.

In this series, the age of the patients ranged from 55 to 75 years with a mean of 61.84±5.16 years. In a study done by **Hon et al 2006 [7]** the results reported in cases underwent TUVP, their mean age was 66.1 ± 8.5 years and this age is slightly higher than those of the present study and may attributed to different inclusion criteria. By TRUS, the size of the prostate ranged from 25 to 50 with a mean of 39.79 and standard deviation of 8.43. These results were similar to those reported by **Kim et al 2013 [8]** who reported that, the mean prostate volume was 42.9±16.7 ML.

TUR syndrome is the most important complications of TURP that may develop in 2% of patients submitted to TURP as a result of hyponatremia with the use glycine solution that enters the vascular circulation due to open vessels or periprostatic extravasation This risk decreased with bipolar plasmakinetic technology, due to usage of isotonic saline solution for irrigation (2). In our study, the immediate decrease in postoperative serum Na level was statistically insignificant (P=0.09), so TUR syndrome was not an issue in the present study; this was in agree with many previously published studies (4-10).

In our study, the mean size of the prostate was statistically significantly decreased when measured by TRUS after 3 month from PKVP from 62.8±10.3 to 22.7±6.1 (P=0.01). **Poulakis et al. [10]** found that, the mean preoperative prostate volume was 56.2 mL that reduced to 16.8 mL, when estimated at 6 months postoperative. In the study of **Kaya et al. [13]** concluded that mean preoperative prostate volume was 47±7.7 mL that was significantly reduced to 22±6.8 mL after one year using plasmakinetic technology.

In our cases, There was statistically significant decrease in the mean PSA from 3.03±2.2 ng/mL to 1.2±1.04 ng/mL (P value=0.02). **Kupeli et al. [9]** & **Dincel et al. [5]** found that mean serum PSA was much higher 24 hours postoperatively and it returned to baseline or was below the baseline by 6 weeks.

In addition, Quality of life (QoL) score before the intervention ranged from 3 to 6 with a mean of 4.70±0.73. After the intervention, it ranged from 0 to 3 with a mean of 1.70 ±0.64 and there was a significant decrease after the intervention in comparison to their values before the intervention P <0.001. Furthermore, the IPPS score before the intervention ranged from 16 to 30 with a mean of 22.75±4.01. After theintervention, it ranged from 2 to 12 with a mean of 7.59±4.13 and there was a significant decrease after the intervention P<0.001.

The results of the present study are agree with **Poulakis et al.** [10] & **McAllister et al.** [6]. They performed a meta-analysis of 20 randomized, controlled trials comparing transurethral electrovaporization and TURP for symptomatic prostate obstruction. They concluded that Patients undergoing electrovaporization had a shorter catheterization period postoperatively and a shorter hospital stay. Also, they found that electrovaporization techniques were as effective as TURP in 1-year follow-up, but they associated with significantly decreased adverse events, e.g. transfusion rates and clot retention episodes.

As regards operative time, it ranged from 25 to 60.0 minutes with a mean of 48.68±10.41 minutes. These results were agree with **Hon et al. [7]** who reported that, PlasmaKinetic® prostate vaporization resulted in a slightly shorter hospital stay, but there is a deficiency of a histological specimen, which is a limitation.

As regards the duration of hospital stay, it ranged from 3 to 4 days with a mean of 3.82±0.38 days. Urethral catheter duration ranged from 2 to 3 days with a mean of 2.21 ± 0.41 days.

TUR of the prostate using plasmakinetic energy associated with shorter period of catheterization and hospitalization times seems to be a promising treatment alternative to conventional TURP. Studies reported satisfactory results with PKVP, comparable with TURP. [11,12,13]

Regarding postoperative complications, in a form of secondary hemorrhage in 2 cases (4.0%), it was occurring after 10 days postoperative due to infection. Both of them were diabetic and readmitted to control infection and diabetes. And re-hospitalization for acute retention in 1 case (2.0%). Thus, the overall complication rate was 6.0%. These results are agree with **Seki et al. [14]** who conducted Photoselective Vaporization for BPH and reported that, there were no perioperative deaths or cases of systemic complications. Two patients required intervention for postoperative bleeding, which included continuous bladder irrigation and transurethral electric coagulation in one. Dysuria was noted in 18 patients (13.3%) at a median of 5 weeks. There were 3 newly documented cases of urethral stricture for which postoperative intervention required, including balloon dilation in 2 and visual internal urethrostomy (VIU) in 1.

The results of the study revealed that, plasmakinetic vaporization of the prostate provides a reasonable, safe and effective alternative to TURP. These results are agree with [15] who conducted a meta-analysis of the randomized data evaluating photo-selective vaporization of the prostate (PVP) versus TURP found that PVP has a more desirable with better safety perioperative profile.

A potential advantage of TUVP over TURP was the ability to do surgery inspite of coagulation and platelet deficiency agents due to substantially lower

the risk of bleeding.

There are no TUR syndrome complications of PVP because the fluid medium used is saline and not glycine. Also, there are low incidences of clot retention, as low as incidence of blood transfusion. [16]**;** [17].

Conclusion:

TUVP is a safe and effective procedure among minimally invasive surgeries of BPH, but it is more expensive than traditional TURP. So minor drawback of this technique is highly cost among traditional technique**.**

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