RESEARCH ARTICLE

Role of prostate ultrasonography to predict the efficacy of bipolar prostatectomy in benign prostatic hyperplasia

Ali Ibrahim Ali Yuosef, Ahmed Zeid, Eslam Shokry Abdel Maksoud, Tarek Mohammed Abdel Baky, Hossam ElDeen Abdel Hameed Nabeeh

Abstract

Objective: To evaluate the role of prostatic ultrasonography in predicting the clinical outcomes of bipolar transurethral resection of the prostate.

Method: The prospective study was conducted at the Urology Department, Kafrelsheikh University Hospital, Cairo, Egypt from December 2018 to June 2019, and comprised male patients complaining of lower urinary tract symptoms due to benign prostatic hyperplasia. The patients were subjected to pelvi-abdominal and transrectal ultrasonography and values were noted for the international prostate symptom score, uroflowmetry, post-void residual urine volume, ejaculatory domain, and the erectile function domain of the international index of erectile function. The safety of the procedure was assessed using the modified Clavien classification of complications. This was followed by cystourethroscopy under spinal anaesthesia, and then by bipolar resection of the prostate by a single experienced urologist. Operating time, length of hospitalisation, intraoperative and postoperative complications, catheterization time, and changes in haemoglobin levels were recorded. All evaluations were done at baseline and postoperatively at 1, 3 and 6 months. Data was analysed using SPSS 21.

Results: There were 109 male patients with mean age 65.53±6.27 years, mean body mass index 24.6±1.7kg/m^2. Mean total prostate volume at baseline was 86.32±43.61gm (range: 30-195m). There was a significant decrease postoperatively ($p<0.001$). This was associated with a concomitant improvement of international prostate symptoms score, uroflowmetry and post-void residual urine volume over six-month follow-up ($p<0.001$). Overall, 63(57.8%) subjects were sexually active, and there was no significant difference in the international index of erectile function score at baseline and postoperatively ($p>0.05$).

Conclusion: Prostate ultrasonography can be used as a single investigating tool to evaluate the clinical outcomes after bipolar transurethral resection of the prostate.

Keywords: Transurethral resection, Prostate, Prostatic hyperplasia, Erectile, Urinary tract, Ultrasonography, Pelvis.

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Introduction

Lower urinary tract symptoms (LUTs) caused by benign prostatic hyperplasia (BPH) can affect daily activities and may lead to serious outcomes.[1] PH prevalence of BPH has been reported in 5-10% men in the fourth decade of life to >90% in men aged >85 years.[2] Bladder outlet obstruction results from various functional and anatomical factors, such as mechanical compression of the prostatic urethra by an enlarged prostate, increased prostate urethral angle, and increased smooth muscle tone in the prostatic urethra.[3] Several methods have been used to evaluate BPH subjectively by international prostate symptom score (IPSS), and objectively by ultrasonography for the estimation of prostate volume, uroflowmetry and post-void residual urine volume (PVR).[4]

Department of Urology, Kafrelsheikh University, Egypt.

Corrospondience: Ahmed ElSayed Ibrahim Zeid

email: doctor.zeid91@gmail

By the mid-1980s, Transrectal ultrasonography (TRUS) had become a standard diagnostic tool for urologists and radiologists. The first description of prostate volume using TRUS was by Watanabe et al. who reported accurate results.[5]

According to the European Association of Urology (EAU) guidelines, transurethral resection of the prostate (TURP) is the current surgical standard procedure for men with prostate size 30-80ml.[6] However, monopolar TURP is still associated with a risk of haemorrhage, particularly in patients with larger prostates or bleeding disorders. There is also a risk of trans-urethral resection (TUR) syndrome.[7]

The most significant improvement of TURP is the incorporation of bipolar technology. The electric current completes the circuit without passing through the patient. This allows the saline solution to be used for irrigation during resection instead of electrolyte-free solutions, thereby eliminating hyponatraemia and TUR syndrome with excellent haemostasis.[8]

The current study was planned to evaluate the role of prostatic ultrasonography in predicting the clinical outcomes of bipolar TURP.

Patients and Methods

The prospective study was conducted at the Urology Department, Kafrelsheikh University Hospital, Cairo, Egypt. After approval from the institutional ethics review committee, The sample was raised using a consecutive non-probability sampling technique from patients attending the outpatient clinic and met the inclusion criteria during the period from December 2018 to June 2019. Inclusion criteria included patients with symptomatic BPH requiring surgery owing to urinary retention, failed medical therapy, urinary bladder stones, obstructed uroflowmetry, and IPSS >19. Patients with neurogenic bladder, previous prostatic or urethral surgery, prostate cancer, significant co-morbidities, like liver failure and congestive heart failure, and patients unable or unwilling to comply with follow-up schedule were excluded. Informed consent was obtained from all the subjects.

Detailed medical history was obtained from the patients who were evaluated preoperatively using IPSS[9], ultrasonography, uroflowmetry and laboratory investigations, including urine analysis, urine culture, serum electrolytes, kidney function, complete blood count (CBC) and prostate-specific antigen (PSA). The sexual function, including erection and ejaculation, were assessed using IIEF score.[10]

Pelvi-abdominal ultrasonography and TRUS were carried out. Prostate volumes, both total and transition zone (TZ), and PVR were estimated using TRUS and abdominal ultrasonography, respectively. Also, urinary bladder wall thickness and diverticulae were estimated through pelvi-abdominal ultrasonography.

This was followed by cystourethroscopy under spinal anaesthesia, and then by bipolar resection of the prostate by a single experienced urologist under saline irrigation and a 22-F or 24-F three-way Foley catheter fixation.

Operating time, length of hospitalisation, intraoperative and postoperative complications, catheterisation time, and changes in haemoglobin (Hb) levels were recorded.

The patients were followed for 6 months. All baseline evaluations were repeated at 1, 3 and 6 months, except TRUS which was done only at 3 and 6 months due to the painful manipulation of the rectal probe.

Data was analysed using SPSS 21. Data normality was checked using Kolmogorov-Smirnov test. Numeric variables with normal distribution were analysed using parametric student's t-tests, while Mann-Whitney U test was used to evaluate numerical variables with skewed distribution. Categorical variables were analysed using chi-square or Fisher's exact test, as appropriate. P<0.05 was considered statistically significant.

Results

There were 109 male patients with mean age 65.53±6.27 years, mean body mass index 24.6±1.7kg/m^2 (Table 1).

Mean total prostate volume at baseline was 86.32±43.61gm (range: 30-195m). There was a significant decrease postoperatively (p<0.001). This was associated with a concomitant improvement of IPSS, uroflowmetry and PVR volume over six-month follow-up (p<0.001). Overall, 63(57.8%) subjects were sexually active, and there was no significant difference in the IIEF score at baseline and postoperatively (Table 2).

The mean operative time was 63.05±20.5 minutes. Patients were catheterised for 4.86±1.84 days. Mean hospital stay was 2.13±0.53 days.

Blood transfusions were required in 3(2.8%) patients. Preoperative Hb was 13.27±1.67g/dL, while postoperative Hb was 12.02±1.58 g/dL after 24h (p=0.37) (Table 3). TUR syndrome did not occur in any of the patients.

Table-1: Demographic data and baseline characteristics (n=109).

	Mean ± SD
Age (year)	65.53 ± 6.27
47 – 83	
BMI (kg/m^2)	24.61 ± 1.77
20.5 – 27.7	
PSA (ng/mL)	4.03 ± 3
0.13 – 20	
	n (%)
Sexual history:	
Sexual active	63 (57.8%)
Sexual inactive	46 (42.2%)
Complaint:	
Obstructive LUTS	57 (52.3)
Urine retention	17 (15.6)
Obstructive and irritative LUTS	35 (32.1)
DRE:	
Mild	24 (22.0)
Moderate	41 (37.6)
Marked	44 (40.4)
Anal tone:	
Intact	109 (100)
ASA score:	
1	82 (75.2)
2	23 (21.1)
3	4 (3.7)

BMI: Body mass index, PSA: Prostate-specific antigen, DRE: Digital rectal examination, LUTs: Lower urinary tract symptoms, ASA: American Society of Anesthesiology, SD: Standard deviation.

Table-2: Procedure outcomes

Variable (Mean± SD)	Preoperative	1 month	3 month	6 months	*p-value*
Prostate volume total	86.32 ±43.61	43.24±17.09	29.17± 9.42	23.67 ± 6.03	<0.001
(TRUS) TZ	47.52 ± 25.84				
IPSS	25.68 ± 2.67	9.17± 4.32	5.19 ± 4.53	4.87± 3.30	<0.001
QOL (Median)	6(4 – 6)	2(1 – 4)	1(0 – 4)	0(0 – 5)	<0.001
PVR (Median)	100 (10-660)	35(10-180)	20(10-170)	15(10-150)	<0.001
Q max	8.94 ± 2.70	16.14± 3.58	18.20± 4.54	19.77 ± 5.22	<0.001
IIEF-15	32.79 ± 6.64	----------	33.60 ± 8.3	34.75 ±9.93	0.9 0.6 (3m) (6m)
Ejaculatory function (Median)	19	----------	3	5	<0.001
Haemoglobin (g/dl)	13.57 ± 1.62	12.02± 1.58 (After24hours)	----------	----------	0.37
Haematocrit (%)	39.79 ± 4.99	36.06 ± 4.73 (After24hours)	----------	----------	0.39
Sodium level (Na)	138.53 ± 4.77	136.46±3.42 (After24hours)	----------	----------	0.33
PSA (ng/dl)	4.04 ± 3.0	----------	----------	2.16± 1.33	<0.001

TRUS: Trans-rectal ultrasound, TZ: Transitional zone, IPSS: International prostate symptoms score, QOL: Quality of life, PVR: Post-voiding residual, Q-max: Maximum urinary flow, IIEF-5: 5-item International index of erectile function, PSA: Prostate-specific antigen, SD: SD: Standard deviation.

Table-3: Operative data and complications (n=109).

			n (%)
ACystoscopy:			
Diverticulum			10 (9.2%)
High bladder neck			26 (23.9%)
Trabeculations			57 (52.3%)
Trilobar			16 (14.7%)
Blood transfusion:			
No			106 (97.2)
Packed RBCs			3 (2.8)
			Mean ± SD
Operative time (minutes)			63.06 ± 20.53
20 – 95			
intraoperative saline Irrigation (litres)			21.05± 6.17
7 – 35			
Length of hospital stay (days)			2.14 ± 0.54
2 – 5			
Catheterization days			4.86 ± 1.84
2 – 7			
Clavian Grading	**Graded complications**	**n (%)**	**Management**
I	Fever	1 (0.9%)	Fomentations + antipyretics
II	• Anaemia	3 (2.8%)	• Blood transfusion
	• Meatal stenosis	2 (1.8%)	• Meatotomy
	• Urethral stricture	2 (1.8%)	• DVIU
	• Failed trial of voiding (clot retention)	9 (8.3%)	• Recatheterization
IV a	Ischaemic stroke	1 (0.9%)	• (ICU admission)

RBC: Red blood cells, DVIU: Direct visual internal urethrotomy, ICU: Intensive care unit, SD: Standard deviation.

Discussion

According to the EAU guidelines, the gold standard approaches for surgical treatment of BPH are monopolar TURP for patients when the prostate size ranges 30-80cc, and open prostatectomy or holmium laser enucleation (HoLEP) or bipolar TURP for patients with prostate size >80cc.[11] Bipolar TURP is associated with a high success rate reflected by substantial improvements in symptom scores, urinary flow rate, PVR, and low retreatment on long-term follow-up. Bipolar electrosurgical technology is a new modality where the current flows from the loop (the active electrode) to the loop tube and the resectoscope itself.[12] In the current study, 109 patients underwent bipolar TURP using saline irrigation with a good success rate postoperatively.

The correlation between prostate volume and many variables of BPH has been evaluated using different investigations, like ultrasonography and cystourethroscopy. Green et al. concluded that TRUS provided an accurate measurement of the prostate volume and could be used to evaluate the response to therapy for patients with BPH.[13] In the current study, TRUS as used to evaluate the preoperative and postoperative prostate volume. We also detected that pelvi-abdominal ultrasonography is essential for the assessment of PVR and urinary bladder changes.

The efficacy of bipolar TURP was measured in the current study on the basis of residual prostatic tissue volume, maximum urinary flow (Q-max), IPSS and PVR compared to

the baseline values. The residual tissue, measured by ultrasonography at 1, 3 and 6 months post-TURP provided a good estimate of the clinical result. The correlation of the residual tissue with all outcome variables suggested that the smaller the residual tissue, the greater the improvement in the outcome variables. The explanation is that the better clinical result after TURP correlates significantly with the completeness of resection of the obstructing adenoma, and the maximum effect was obtained at 6 months.

In the cuurent study, the reported progressive decrease in the estimated residual prostate volume was associated with a dramatic improvement in IPSS, Q-max and PVR over 6 months of follow-up.

Our findings are in agreement with literature.[14-16]

Hastak et al. suggested that normal prostate tissue, which is compressed by the enlarged adenoma, is released after resecting the adenoma and occupies part of the resection cavity.[17] The same observation was reported in the current study, explaining the residual tissue at 6 months, despite resection of the enlarged adenoma of TZ.

Suspected mechanisms in erectile dysfunction (ED) following TURP are thermal and/or chemical injuries of the erectile nerves traveling just beneath the prostatic capsule, and may be due to the psychological effects post-TURP.[18-21] IIEF score showed no change at 3 and 6 months postoperatively compared to baseline scores. For the ejaculatory function, the study reported a significant decrease at 3, 6 months of follow-up.

The mean operative time in the current study was higher than what was reported by Bogdan et al.[22] The longer operative time was because of a considerable number of patients who presented with a larger prostate adenoma size. The mean catheterization time and mean hospital stay were also longer than Tefekli et al. and de Sio et al.[23,24]

Three patients (2.8%) in the current study needed blood transfusion post-surgery, while published studies where the transfusion rate in Bipolhave reported 3.4%.[25,26] Bogdan et al. reported that 5.9% patients needed recatheterisation.[21] while in the current study, recatheterisation was done in 8.3% patients due to clot retention.

The limitation of the current study is its small sample size because the sample size was not calculated. This can influence the power of the study.

Conclusion

Pelvi-abdominal and transrectal ultrasonography as a single non-invasive imaging tool was found to be effective in predicting the clinical outcomes of bipolar prostatectomy.

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