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Prostate volume reduction following pure transurethral bipolar plasma vaporization and conventional transurethral resection of the prostate: a prospective investigation using transrectal 3D ultrasound volumetry

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Abstract: **PURPOSE** To evaluate and compare postoperative changes in prostate volume and clinical outcome after bipolar plasma vaporization (BPV) and conventional transurethral resection of the prostate (TURP). **PATIENTS AND METHODS** Consecutive series of patients undergoing BPV or TURP were included in this prospective, nonrandomized study. Planimetric volumetry after transrectal three-dimensional ultrasound of the prostate was performed preoperatively and postoperatively after 6 weeks, 6 months and 12 months. Additionally, changes in clinical outcome parameters were assessed and compared between the groups. The reduction ratio and analysis of covariance were used to compare volume changes between BPV and TURP. Multiple regression analysis was performed to assess a possible interaction between preoperative prostate volume and effect of therapy. **RESULTS** A total of 157 patients were included (BPV: n = 68, TURP: n = 89). Median preoperative prostate volume was 43.1 ml in the BPV group and 45.9 ml in the TURP group (p = 0.43). Postoperatively, the prostate volumes decreased significantly in both groups. After catheter removal, the relative residual prostate volume was significantly higher in the BPV group (66.6 vs. 60.8 %; p = 0.02). Thereafter, significant differences were not detectable anymore (12 months: 46.6 vs. 47.1 %; p = 0.82). Regression analysis revealed that tissue ablation after BPV was superior to TURP in prostates <45 ml but inferior in prostates >45 ml. All clinical outcome parameters improved significantly and were not significantly different between the groups. **CONCLUSIONS** Volume reduction and short-term clinical outcome following pure BPV was excellent and comparable to conventional TURP. However, volume reduction seems to be limited in patients with larger prostates.

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after 12 months

A

B

Table 1 - Baseline parameters of all 157 patients (a), Intra and perioperative outcome (b), Postoperative outcome (c), Changes of the investigated follow-up parameters (d)

	BPV (n=68)	TURP (n=89)	p-value
a) Baseline parameters			
Age (y)	66 (48-89)	65 (46-85)	0.12
Prostate volume (ml)	43.1 (17.2-111.1)	45.9 (17.5-128.5)	0.43
PSA (ng/ml)	2.6 (0.3-22.5)	3.5 (0.3-23.5)	0.19
IPSS	16 (2-35)	19 (3-35)	0.14
QoL	4 (0-6)	5 (0-6)	0.22
Qmax (ml/s)	10.1 (3.2-29.3)	9.3 (1.0-30.9)	0.16
Residual volume (ml)	91 (0-1000)	62 (0-1400)	0.3
Indwelling catheter (n)	16 (23.5%)	17 (19.1%)	0.55
ASA score (n)			0.15
I	5 (7.4%)	6 (6.7%)	
II	40 (58.8%)	74 (83.2%)	
III	23 (33.8%)	9 (10.1%)	
Platelet aggregation modifiers (n)	24 (35.3%)	3 (3.4%)	< 0.001
Acetylsalicylic acid (n)	24 (35.3%)	3 (3.4%)	
Clopidrogel (n)	0 (0%)	0 (0%)	
Coumarin (n)	0 (0%)	0 (0%)	
Positive urine culture (n)	27 (39.7%)	20 (22.5%)	0.02
Indwelling catheter (n)	14 (20.6%)	8 (9.0%)	
No catheter (n)	13 (19.1%)	12 (13.5%)	
b) Intra- and peri-operative outcome			

Operative time (min)	77.5 (34-145)	70 (10-165)	0.16
Anesthesia:			
Intubation (n)	54 (79.4%)	68 (76.4%)	0.7
Spinal anesthesia (n)	14 (20.6%)	21 (23.6%)	0.7
Blood transfusion (n)	0	0	n/a
Duration of catheterization (d)	3 (2-13)	3 (2-22)	0.65
Re-catheterization (n)	9 (13.3%)	10 (11.2%)	0.81
Urinary retention (n)	7 (10.3%)	9 (10.1%)	
Residual volume > 300ml (n)	1 (1.5%)	0 (0%)	
Persistent haematuria (n)	1 (1.5%)	0 (0%)	
Stress urinary incontinence (n)	0 (0%)	1 (1.1%)	
c) Post-operative outcome			
Urinary tract infection (6 weeks; n)	12 (17.6%)	2 (2.2%)	0.001
Dysuria (n)			
6 weeks	26 (38.2%)	28 (31.5%)	0.4
6 months	2 (2.9%)	2 (2.2%)	0.99
12 months	3 (4.4%)	3 (3.4%)	0.99
Urethral stricture (n)	3 (4.4%)	3 (3.4%)	0.99
Re-operation (n)	0 (0%)	0 (0%)	n/a
d) Changes of the investigated follow-up parameters			
IPSS			
Preoperative	16 (2-35)	19 (3-35)	0.14
Postoperative	n/a	n/a	
6 weeks	8 (0-29)	8 (0-33)	0.58
6 months	3 (0-24)	4 (0-25)	0.84

12 months	3 (0-20)	4 (0-24)	0.14
QoL			
Preoperative	4 (0-6)	5 (0-6)	0.22
Postoperative	n/a	n/a	
6 weeks	2 (0-6)	2 (0-6)	0.35
6 months	1 (0-4)	1 (0-6)	0.76
12 months	1 (0-4)	1 (0-5)	0.89
Qmax (ml/s)			
Preoperative	10.1 (3.2-29.3)	9.3 (1.0-30.9)	0.16
Postoperative	14.7 (4.0-47.0)	17.0 (5.0-42.4)	0.23
6 weeks	16.6 (2.3-100)	18.8 (4.1-75.6)	0.1
6 months	17.0 (5.6-53.8)	21.4 (4.2-50.0)	0.03
12 months	16.6 (3.3-56.0)	18.6 (4.4-51.4)	0.43
Residual volume (ml)			
Preoperative	91.0 (0-1000)	62.5 (0-1400)	0.3
Postoperative	20.0 (0-900)	20.0 (0-130)	0.73
6 weeks	10.0 (0-240)	12.0 (0-300)	0.28
6 months	6.5 (0-120)	8.8 (0-400)	0.7
12 months	11.0 (0-190)	10.0 (0-300)	0.7
PSA (ng/ml)			
Preoperative	2.6 (0.3-22.5)	3.5 (0.3-23.5)	0.19
Postoperative	n/a	n/a	
6 weeks	1.4 (0.1-6.9)	0.8 (0.1-12.9)	0.02
6 months	1.2 (0.2-6.0)	1.1 (0.2-30)	0.8
12 months	1.1 (0.1-7.2)	1.0 (0.2-24.1)	0.9
<p>Data presented as median (range) or number (percent). PSA = prostate-specific antigen, IPSS = International Prostate Symptom score, QoL = Quality of life, Qmax = maximum urinary flow rate, ASA score = American Society of Anaesthesiology score.</p>			

Table 2 – Post-operative prostate volumes in relation to pre-operative prostate volumes

	Prostate volume		Volume reduction ratio	
	BPV	TURP	Raw ratio [§]	Adjusted ratio [°] (ANCOVA)
Pre-operative	43.1 (17.2-111.1)	45.9 (17.5-128.5)		
Post-operative	26.8 ml (10.3-89.0) ^a 66.6 % ^b	27.6 ml (11.2-90.1) ^a 60.8 % ^b	1.10 (1.02 - 1.18) <i>p</i> =0.019	1.08 (1.01 - 1.16) <i>p</i> =0.032
Six weeks	21.1 ml (7.0-68.6) ^a 52.4 % ^b	24.4 ml (11.3-92.7) ^a 53.7 % ^b	0.98 (0.90 - 1.06) <i>p</i> =0.57	0.97 (0.89 - 1.05) <i>p</i> =0.42
Six months	19.2 ml (5.5-59.2) ^a 48.2 % ^b	20.6 ml (10.1-87.9) ^a 49.0 % ^b	0.98 (0.90 - 1.08) <i>p</i> =0.72	0.98 (0.90 - 1.07) <i>p</i> =0.68
Twelve months	18.3 ml (5.0-59.9) ^a 46.6 % ^b	21.0 ml (8.0-89.0) ^a 47.1 % ^b	0.99 (0.89 - 1.10) <i>p</i> =0.82	0.98 (0.89 - 1.08) <i>p</i> =0.71
^a Median prostate prostate volume (range) ^b Residual prostate volume relative to pre-operative prostate volume in percent [§] Change score in log prostate volume relative to log baseline prostate volume (95%-confidence interval); corresponding <i>p</i> -value (t-Test). [°] Analysis of covariance (ANCOVA) with adjustment for pre-operative prostate volume (95%-confidence interval); corresponding <i>p</i> -value.				