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Transurethral Detachment Prostatectomy Using a Tissue Morcellator for Large Benign Prostatic Hyperplasia

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Abstract

Objective: Transurethral enucleation of the prostate (TUE) is designed for complete removal of the prostate lobes. On the basis of TUE and holmium laser enucleation of the prostate, we developed a new technique of transurethral detachment prostatectomy (TUDP) using a tissue morcellator.

Materials and Methods: In TUDP, enucleation is performed with a prostate-detaching blade and the tip of a resectoscope, followed by removal of the tissue with a morcellator. This study reports our experience with TUDP in which the weight of retrieved tissue was greater than 30 g in 76 patients with benign prostate hyperplasia.

Results: The mean preoperative total prostate and adenoma volumes were 70.7 and 47.4 mL, respectively. The mean times required for enucleation, morcellation, and total operation time were 28.5, 14.4, and 66.3 minutes, respectively. The mean weight of removed prostate tissue was 61.1 g. The mean decreases in the levels hemoglobin and serum sodium were 1.73 mg/dL and 2.41 mEq/dL, respectively. The mean preoperative maximum flow rate (Qmax), International Prostate Symptom Score (IPSS), and quality of life score (QOL) improved from 9.8 mL/sec, 20.2, and 4.9, to 22.3 mL/sec, 3.1 and 1.2, respectively. Complications included mild morcellator-induced mucosal injury in 2 patients (2.6%), nausea in 4 patients (5.2%), transient urinary retention in 2 patients (2.6%), transient urge incontinence in 5 patients (6.4%), and urethral stricture in 2 patients (2.6%). The mean prostate volume and serum prostate-specific antigen level measured 6 months postoperatively in 46 patients were 10.68 mL and 0.89 ng/mL, respectively.

Conclusions: TUDP is effective for complete removal of large prostate lobes in patients with large benign prostate hyperplasia and is associated with lower perioperative morbidity.
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Key words: prostate, benign prostatic hyperplasia, prostatectomy, transurethral resection of the prostate, transurethral detachment prostatectomy

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Introduction

Complications associated with transurethral resection of the prostate (TURP) for benign prostatic hyperplasia (BPH) are due to difficulties in complete removal of the adenoma and to bladder neck contraction[1,2]. In 1983, Hiraoka et al[3–5] introduced the procedure of transurethral enucleation (TUE) of the prostate which uses a prostate-detaching blade and the tip of resectoscope. TUE was the first successful method of endoscopic enucleation of the prostate lobes. For large BPH, TURP is associated with major problems, which include high reoperation rate due to incomplete removal of the prostate lobes, TUR syndrome and excessive blood loss[1,2,6]. In holmium laser enucleation of the prostate (HoLEP), the prostate lobes are released into the urinary bladder following enucleation with a holmium laser, instead of a prostate-detaching blade and the tip of the resectoscope, and then removed with a tissue morcellator[7–17]. For large BPH, HoLEP is useful because it causes little blood loss and only minor changes in serum sodium levels. In 2007, Hiraoka et al[18] reported the new technique of transurethral detaching prostatectomy with tissue morcellation (TUDP) as a development of TUE. TUDP involves complete detachment of the prostate lobes with a prostate-detaching blade and the tip of the resectoscope instead of the expensive holmium laser system. The prostate lobes released into the urinary bladder are also retrieved with a tissue morcellator. TUDP is a development of TUE and is similar to HoLEP. In the present study, we report our experience with TUDP and a tissue morcellator for large BPH with more than 30 g of retrieved tissue.

Materials and Methods

From April 2004 through September 2006, 76 cases of BPH were treated with TUDP with the weight of retrieved tissue being more than 30 g (**Table 1**). Patients who were examined rectally and suspected to have prostate carcinoma or those with high levels of prostate-specific antigen (PSA) underwent prostate needle biopsy; patients found to have prostate carcinoma were excluded from this study.

Preoperatively, the volumes of the entire prostate and adenoma were measured with transrectal ultrasonic tomography (volume = length × width × height × 0.52), and the serum PSA level was measured with the Tandem method. We also measured the International Prostate Symptom Score (IPSS), quality-of-life (QOL) score, and urinary flow rate before surgery and 6 months after surgery. In all patients, serum sodium, hematocrit, and hemoglobin were measured before and after surgery. All harvested tissues were examined histopathologically. We used the following instruments in the present study: a 26-Fr continuous irrigation resectoscope (Olympus Co., Tokyo), Hiraoka's prostate-detaching blade (**Fig. 1a**). (Olympus), a 26-Fr Storz nephroscope (Deutsheland), and a Lumenis Versa Cut Morcellator (Israel) (**Fig. 1b**). The prostate-detaching blade is attached to the resectoscope instead of the cutting loop and can be moved forwards and backwards and in a loop. Normal saline was used at the time of morcellation. The first step of enucleation was a circular incision on the urethral mucosa along Nesbit sign and the verumontanum with needle electrode (**Fig. 2a and b**). The second step included detachment of the apical region and the entire prostate lobe bilaterally. The process began by inserting the prostate detaching blade through the circular incision line at the 5 o'clock to 7 o'clock positions under digital guidance into the rectum to establish a cleavage plane (**Fig. 2c**). Next, the resectoscope tip was inserted into the cleavage plane, and the detachment area was extended to the lateral and forward sides with the tip. During detachment, the detaching blade was changed to the loop, and hemostasis was achieved with the loop. The third step involved detachment of the bladder neck with the exclusion of the lower region. The anterior side was detached. Next, the detached segment was extended to both sides (**Fig. 2d**). In the fourth step, multiple deep incisions were made with a needle electrode on the surface of the prostate lobes (**Fig. 2e**). In the fifth step, the lower region of the bladder neck was divided by resection and detachment, or the middle

Table 1 Characteristics of 76 cases

Characteristics	Range	Mean ± SD
Age, years	54 − 88	68 ± 7.34
IPSS score	4 − 35	20.19 ± 7.90
QOL score	1 − 6	4.87 ± 1.00
Total PSA (ng/mL)	2.3 − 34	9.73 ± 7.00
Adenoma volume (mL)	14 − 160	47.37 ± 26.41
Total prostate volume (mL)	24 − 224	70.66 ± 32.34
Qmax (mL/sec)	3 − 23	9.77 ± 4.54
Qaverage (mL/sec)	2 − 14	4.57 ± 2.22

IPSS: International Prostate Symptom Score QOL: quality of life

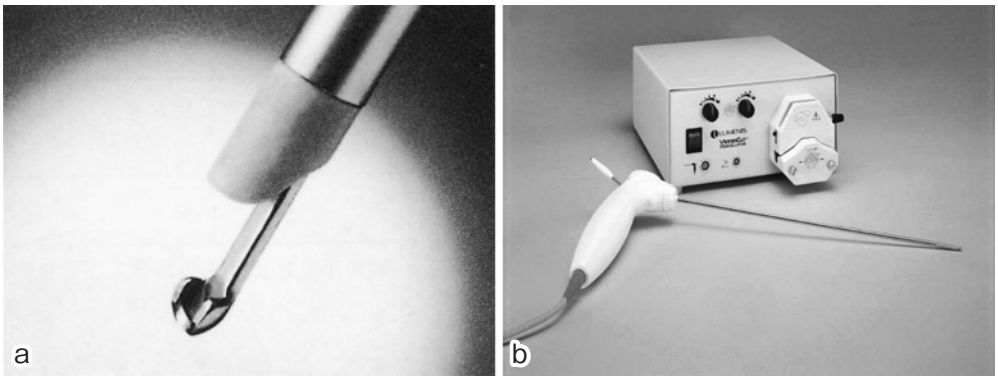

Fig. 1 **a**: Hiraoka's prostate detaching blade. **b**: Lumenis Versa Cut Morcellator.

lobe was resected with the loop. With these steps, the prostate lobes were dropped into the bladder **(Fig. 2f)**. In the final step, the nephroscope was inserted, and the detached prostate lobes were removed with a morcellator under normal saline irrigation **(Fig. 2g)**[18].

Results

Before surgery, the mean IPSS score, QOL score, and serum PSA level were 20.2, 4.9, and 9.7 ng/mL, respectively. The mean volumes of the entire prostate and the adenoma were 70.7 mL and 47.4 mL, respectively **(Table 1)**. The mean enucleation time, morcellation time, and total operation time were 28.5 minutes, 14.4 minutes and 66.3 minutes, respectively **(Table 2)**. The mean weight of all removed tissue was 61.1 g (range, 30.5–206.5). After prostatectomy, the mean decrease in serum sodium was 2.41 mEq/L, and mean decrease in hemoglobin was 1.73 g/dL. The mean IPSS, QOL score, PSA level, and total prostate volume 6 months after surgery were 3.1, 1.2, 0.89 ng/mL, and 10.7 mL, respectively **(Table 3)**.

Mucosal bladder injury occurred in 2 patients during morcellation. Postoperative complications included nausea in 4 patients and transient urinary retention in 2 patients. Two patients had transient urge incontinence, and 2 patients required urethral balloon dilatation for urethral stricture after discharge from the hospital **(Table 4)**.

Discussion

The reported mean enucleation time is 94.7 to 95.8 minutes with HoLEP[12,15] but was significantly less with TUDP in the present study (28.5 minutes, **Table 5)**. The enucleation time and TUDP operation time were shorter than with HoLEP. The enucleation technique with the prostate-detaching blade and the tip of the sheath is easy, because the tip of the sheath is dull and can be moved forward and laterally to the left and right sides in a manner similar to the index finger at open prostatectomy.

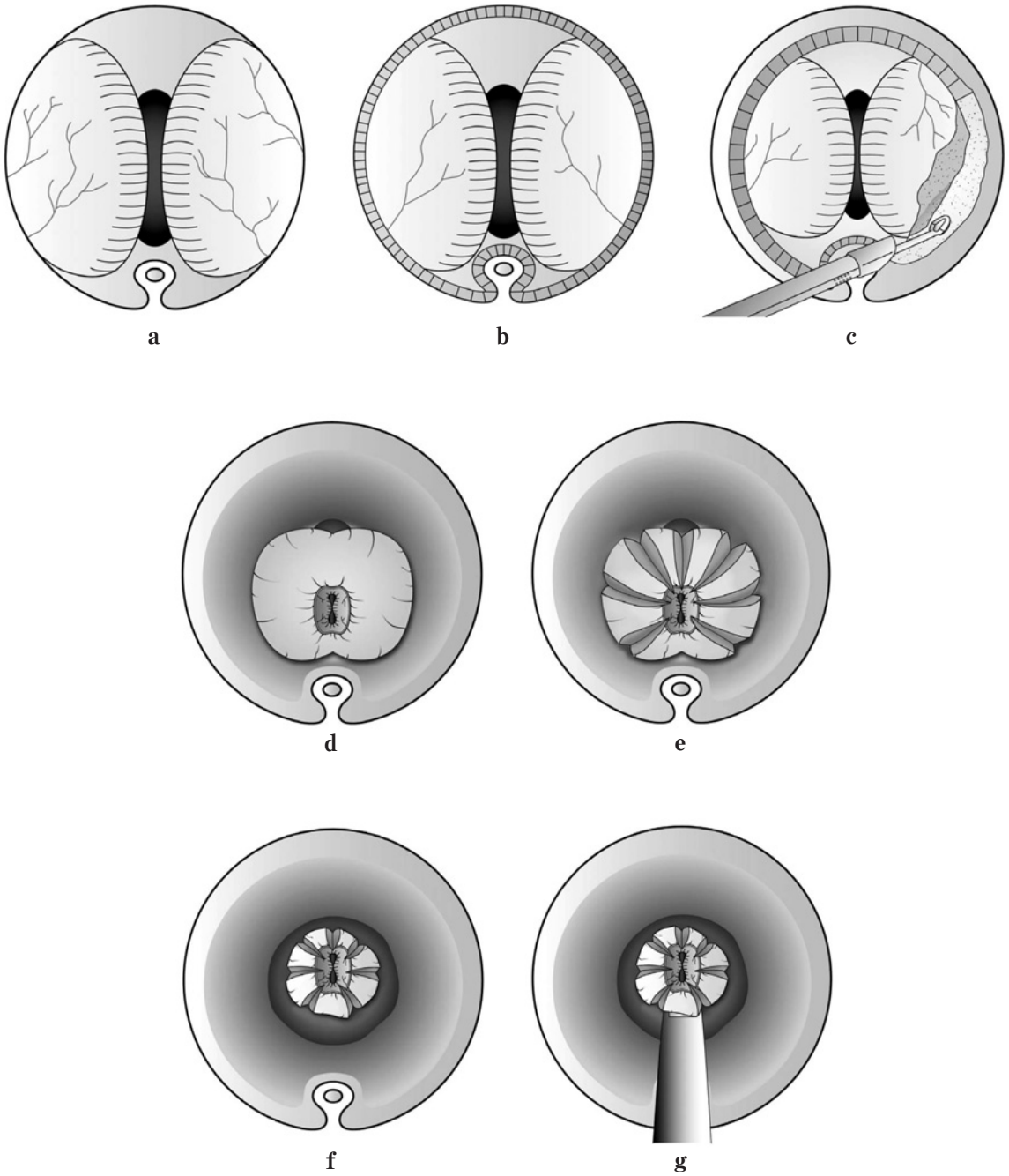

Fig. 2 **a**: Schema of posterior urethra with BPH. **b**: Circular incision on urethral mucosa along verumontanum and Nesbit sign with needle electrod. **c**: Detachment of prostate lobes by inserting prostate detaching blade. **d**: Detachment of whole prostate lobes by tip of the resectscope. **e**: Deep multiple incisions into prostate lobes with needle electrode. **f**: Dropped prostate lobes into bladder. **g**: Removal of prostate lobes by morcellator. (Hiraoka Y et al: Urol Int 2007; 79: 50-54)

On the other hand, HoLEP requires skill, a longer operation time, and expensive laser equipment, and laser fibers.

Prostate volume was calculated by subtracting the volume of excised tissue from the total prostate volume. The prostate volume was 9.59 to 10.64 mL with TUDP[18], 16.6 to 36.31 mL with open prostatectomy[7,16], 12.7 to 45.3 mL with TURP[8–10,13,17,19] and 21.1 to 53.95 mL with HoLEP[7–10,12–17]. On the other hand, prostate volume after surgery was 8.9 to 11.0 mL with TUE[3,5], 9.6 to 10.7 mL with TUDP[18], 46.6 mL with TURP[9,11], and 21.8 to 30.8 mL with HoLEP[9,11,12,14]. Prostate volume and prostate volume after surgery were smallest with TUDP, suggesting that the

Table 2 Perioperative data

Operative data	Range	Mean ± SD
Enucleation time (min)	2.6 − 52.3	28.48 ± 13.31
Morcellation time (min)	2.36 − 32.59	14.38 ± 14.45
Total operation time (min)	22.3 − 117.08	66.31 ± 22.25
Retrieved weight (g)	30.5 − 206.5	61.07 ± 30.97
Ht decrease (%)	0.8 − 12.1	5.56 ± 2.62
Na decrease (mEq/L)	− 3 − 15	2.41 ± 3.78
Hb decrease (g/dL)	0.3 − 3.83	1.73 ± 0.83

Ht: hematocrit Na: serum sodium Hb: haemoglobin

Table 3 Data at six months post-operative

Characteristics	Range	Mean ± SD	*p* value
IPSS score	0 − 9	3.12 ± 2.25	< 0.0001
QOL score	0 − 6	1.22 ± 1.70	< 0.0001
Qmax (mL/sec)	8 − 50	22.28 ± 9.84	< 0.0001
Qaverage (mL/sec)	3 − 29.9	12.05 ± 5.49	< 0.0001
Total PSA (ng/mL)	0.2 − 3.3	0.89 ± 0.69	< 0.0001
Total prostate volume (mL)	3.21 − 19.34	10.68 ± 4.04	< 0.0001

Table 4 Peri and postoperative complications

Characteristics	No. (%)
Nausea	4 (5.2)
Bladder mucosal injury	2 (2.6)
Transitory urge incontinence	5 (6.5)
Aarly acute urinaly retention	2 (2.6)
Urethral stricture	2 (2.6)

adenoma could be removed more completely with TUE and TUDP than with other methods.

The decrease in hemoglobin after surgery is greatest with open prostatectomy, followed by that with TURP, and is least with TUDP and HoLEP (**Table 5**). The decrease in serum sodium after surgery was greater with TURP than with HoLEP or TUDP.

There were no differences between the surgical techniques with respect to Qmax, IPSS score, and QOL score. On the other hand, the PSA level after surgery was 0.6 to 0.8 ng/mL with TUE[5] and 0.8 to 0.9 ng/mL with TUDP[18]. Serum PSA levels after TUE and TUDP may represent the excretion of PSA from the external gland because the adenoma is completely removed with these procedures. In this regard, the normal serum PSA level in elderly men without BPH is less than 1.5 ng/mL.

In our study, the decrease in serum sodium with TUDP was 2.41 mg/dL. None of our patients had typical TUR syndrome, but nausea was recognized in 4 patients. A new bipolar resectscope, which is similar to TUR in saline, is currently available from Olympus Co. and can be used for resection under saline irrigation[20]. TUDP using TUR in saline is performed to prevent falls in serum sodium levels.

The use of morcellator for large adenomas is reported to be associated with intraoperative complications, such as bladder mucosal injury and bladder wall perforation by morcellator blade malfunction (**Table 6**). Thus, morcellation might be associated with more frequent complications than is enucleation, emphasizing the need for practice in handling the morcellator. In our technique, we make multiple deep incisions on the surface of the prostate lobes with a needle electrode before dropping the prostate into the bladder. These incisions are useful for preventing morcellator blade malfunction (**Fig. 2 f**). Although postdischarge complications, such as urethral stricture and urge incontinence, are recognized with all techniques, irritative symptoms are more common with HoLEP (cite a reference here).

Table 5 Operative data of each methods

References	Methods (n)	TRUS prostate volume (mL)	Total removed weight (g)	Remaining prostate vol.	Prostate vol. after surgery	Operation time (min)	Enucleation time (min)	Hb drop (mg/dL)	Sodium drop (mmol/L)	Peak flow (mi/s)		IPSS s		QOL s		PSA	
										Preop	Postop	Preop	Postop	Preop	Postop	Preop	Postop
Kuntz 2002	HoLEP (n = 60)	114.6	83.9	30.7		135.9		1.9	1.4	3.8	29.9	22.1	2.4				
	Open (n = 60)	113	96.4	16.6		90.6		2.8	0.9	3.6	27	21	2.8				
Kuntz 2004	HoLEP (100)	53.5	32.4	21.1		94.6		1.3	1.1	4.9		22.1					
	TURP (100)	49.9	37.2	12.7		73.8		1.8	1.8	5.9		21.4					
Tan 2003	HoLEP (n = 31)	77.8	40.4	37.4	28.4	62.1				8.4	26.4	26	6	4.8	1.6		
	TURP (n = 30)	70	24.7	45.3	46.6	61.2				8.3	20.8	23.7	4.8	4.7	1.5		
Gupta 2006	HoLEP (n = 50)	57.9	17.2	40.7		75.4		0.83	3.05	5.15	23.1	23.4	5.2	5.15			
	TURP (n = 50)	59.8	24.8	35		64.1		1.1	3.19	4.5	20.7	23.3	6.1	4.5			
Wilson 2006	HoLEP (n = 30)	77.8			28.4					8.4	21.3	26	6	4.8	1.6	8.7	1.2
	TURP (n = 30)	70			46.6					8.3	18.9	23.7	4.8	4.7	1.5	5.2	2.3
Bachmann 2005	TURP (n = 37)	48.9	21.9	27		49.4		1.7	4.3	6.9	19.1	17.3	4.8	3.4	1.1	3.3	
Matlaga 2006	HoLEP (n = 86)	170.2	140.2	30	30.8		94.7	2.1	4.3	9.1	22.9	19.6	6.4			9.82	0.96
Gilling 1999	HoLEP (n = 60)	44.3	7.9	36.4		41.5				8.9	23.9	21.9	3.8				
	TURP (n = 60)	44.6	14.5	29.1		25.3				9.1	22.4	23	5				
Kuo 2003	HoLEP (n = 108)	163.8	120.6 (> 75.3)	43.2	21.8	166.8						20.3	3.8			9.5	0.6
Elzayat 2006	HoLEP (n = 225)	126.4	86.5	39.9			95.8	0.83	1	8	26.4	18.9		3.7	0.82	9	0.91
Naspro 2006	HoLEP (n = 41)	113.27	59.33	53.94		72.09		2.12								6.33	
	Open (n = 39)	124.21	87.9	36.31		58.31		3.15								6.99	
Gupta 2005	HoLEP (n = 50)	59.8	17.2	42.6		75.4		0.83	3.05	23.1		23.4	5.2	5.15			
	TURP (n = 50)	57.9	24.8	33.1		64.1		1.1	3.19	20.7		23.3	6.1	4.5			
Shimizu 2005	TUE (n = 64)	37.4	20.1	17.3	8.9												
Hiraoka 2007	TUDP (n = 46)	47.75	37.11	10.64	9.56	54.28	20.4	1.65	1.56	9.93	18.25	18.88	5.62	4.83	1.48	6.11	0.8
Present study	TUDP (n = 76)	70.66	61.07	9.59	10.68	66.31	28.48	1.73	2.41	9.77	22.28	20.19	3.12	4.87	1.22	9.73	0.89

Table 6 Complications of TURP, HoLEP and TUDP

References	Kuntz		Tan		Gupta		Wilson		Gupta		Gilling		Bachmann	Elzayat	Hiraoka	Present study
Methods No. (%)	HoLEP	TURP	HoLEP	TURP	HoLEP	TURP	HoLEP	TURP	HoLEP	TURP	HoLEP	TURP	TURP	HoLEP	TUDP	TUDP
Complications Intra-operative																
Blood transfusion	0	2 (2)	0	1 (3)	0	1 (2)	0	1 (3)		1 (2)	0	4 (6.5)		3 (1.3)	1 (2)	0
Serum hemoglobine <10mg/dL													8 (21.6)			
Hyponatoraemia						1 (2)				1 (2)						
Capsular perforation					1 (2)				1 (2)				1 (2.7)			
Morcellator blade malfunction														7 (3.1)		
Open cystotomy														3 (1.3)		
Bladder mucosal injury					2 (4)				2 (4)					2 (0.7)		2 (2.6)
Post-operative																
Clot retention													2 (5.4)	1 (0.4)		
Secondary arterial coagulation	1 (1)	2 (2)						2 (7)			1 (1.6)	4 (6.6)			0	0
Reoperation			0	2 (6)				2 (7)								
Nausea																4 (5.2)
Recatherization	0	5 (5)	5 (17)	4 (13)	2 (4)	3 (6)	5 (17)	4 (13)	2 (4)	3 (6)	5 (8.2)	8 (13.1)	1 (2.7)			
Urinary retention													1 (2.7)			2 (2.6)
Deep vein thrombosis											0	1 (1.6)				
Death											1 (1.6)	1 (1.6)				
Fever					1 (2)	1 (2)										
Post-discharge																
Secondary apical resection	1 (1)	3 (3)														
Urethal stricture	3 (3.2)	1 (1)	1 (3)	2 (6)	1 (2)	2 (4)	1 (3)	3 (10)	1 (2)	2 (4)	6 (10)	6 (10)	1 (2.7)	3 (1.3)	2 (4)	2 (2.6)
Bladder neck contracture	3 (3.2)	1 (1)														
Urge incontinence														2 (0.7)		5 (6.5)
Stress incontinence	1 (1.1)	1 (1)			1 (2)	1 (2)			1 (2)	1 (2)				16 (7.1)		
Incontinence					1 (2)	1 (2)										
Urinary tract infection			0	2 (6)				2 (7)					4 (10.8)	4 (1.7)		
Irritative symptoms					5 (10)	1 (2)			5 (10)	1 (2)				21 (9.3)		

Conclusion

TUDP is a practical method for the complete removal of the prostate lobes in patients with large BPH and is associated with low perioperative morbidity.

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