Bipolar versus monopolar technique for palliative transurethral prostate resection

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Submitted: 13 January 2010
Accepted: 29 March 2010

Arch Med Sci 2010; 6, 5: 780-786
DOI: 10.5114/aoms.2010.17095

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Abstract

Introduction: The aim was to evaluate the postoperative morbidity and outcome of palliative endoscopic resections for relief of infravesical obstruction in prostate cancer patients with hormone deprivation therapy, and to investigate the added value of bipolar technology over conventional monopolar resections.
Material and methods: A retrospective study was performed on 70 patients with prostate cancer under hormone deprivation therapy undergoing 75 endoscopic procedures, by either monopolar or bipolar technology, between August 2005 and March 2009 at a single institution. The analysis used outpatient, inpatient, and operative records, and observations of electrolyte changes in the serum, postoperative morbidity, and the overall results of palliative endoscopic resections. Preoperative cancer stages and grades were compared with the pathological findings after surgery. Postoperative outcome and complications of conventional monopolar and bipolar technology were compared.
Results: Over a period of 44 months, 34 conventional monopolar resections were performed in 32 patients and 41 bipolar resections in 38 patients. Patients' profiles regarding age, initial cancer stage and grade, resection weight, resection speed, catheterization time, and hospital stay were similar in both groups. No statistically significant difference was observed in sodium drop ($p = 0.802$), clot retention ($p = 0.565$), or urinary retention ($p = 0.292$). The overall success rate in relieving obstruction leading to spontaneous voiding was 77%. While 38% of the patients had a high grade tumour at diagnosis, 79% were found to be high grade after the endoscopic resection ($p < 0.0001$).
Conclusions: Palliative endoscopic transurethral resection is an acceptable and safe adjunctive surgical treatment for voiding disorders in prostate cancer patients. Bipolar technology offers no substantial benefit over conventional monopolar technology.

Key words: prostate, prostate cancer, transurethral resection.

Introduction

Monopolar transurethral resection of the prostate (TURP) is the gold standard for the operative management of benign prostatic hyperplasia (BPH) [1].

New techniques must be compared with the known efficacy of monopolar TURP [2]. The risk of complications such as transurethral resection (TUR) syndrome, bleeding, and clot retention associated with conventional monopolar resections discourages some patients from choosing an endoscopic procedure.

Bipolar resection of the prostate is based on a slightly different technological concept. By incorporating both the active and return poles on the same electrode [3], a conductive fluid medium (normal saline) instead of the conventional nonconductive irrigation fluid (glycine, sorbitol, and mannitol) can be used.

The peri- and postoperative morbidity as well as the final outcome of bipolar resections with the Gyrus PlasmaKinetic and the Olympus TURIS systems was evaluated in several randomized controlled trials [4]. All trials supported the conclusion that bipolar technology provides a similar clinical efficacy compared to that of monopolar transurethral resection of the prostate [4]. The lower risk of peri- and postoperative morbidity regarding TUR syndrome and clot retention however does favour the bipolar technology [5].

We retrospectively evaluated this peri- and postoperative morbidity using both techniques in patients with urinary obstruction due to prostate cancer.

Material and methods

A retrospective analysis of 75 endoscopic procedures in 70 patients for relief of obstructive voiding difficulties and retention due to prostate cancer was performed at a single university institution between August 2005 and March 2009. Outpatient records, inpatient charts, and operative reports were reviewed.

Electrolyte changes, postoperative complications, and clinical outcome were selected as data points of special interest in order to compare the two slightly different pieces of operative equipment, i.e. the monopolar technique (TURP) and bipolar technique (TURIS).

All palliative endoscopic resections were performed by two staff urologists, both familiar with the two types of equipment. A standard Olympus resectoscope and an Olympus UES-40 SurgMaster electrical current generator were used for both techniques. Monopolar TURP was carried out with a standard 24 Fr resectoscope and standard loops using 175 W cutting power and 75 W coagulation power. Bipolar TURIS was performed using a 24 Fr resectoscope with the bipolar electrode set at 270 W for cutting and 75 W for coagulation. All procedures were performed with intermittent glycine 5% (monopolar TURP) or saline 0.9% (bipolar TURIS) irrigation using general or spinal anaesthesia. An average amount of 12 litres/procedure was used.

Both urologists used the same resection technique. Palliative resection was defined as a limited resection to create a channel permitting better urinary flow. In contrast with standard endoscopic resection for BPH, resection to the depth of the prostatic capsule was not attempted. All resected tissue was weighed and submitted to the pathologist for review. At the end of the procedure, a 22 Fr 3-way Foley catheter with a closed drainage system was inserted. All patients were treated postoperatively with continuous saline bladder irrigation until bleeding ended. After discharge, patients were reassessed at three-month intervals.

All statistical tests performed were two-sided and at the 5% level of performance. The two groups were compared using the independent *T*-test. The incidence of complications such as TUR syndrome, clot retention, and urinary retention were determined by Fisher's exact test. The *p*-values obtained were similar to the χ^2 test with continuity correction. SPSS version 17.0 was used to perform the tests.

Results

A total of 70 patients underwent 75 endoscopic procedures between August 2005 and March 2009. Their mean age was 76 ±9 years (range 61 to 93 years). The mean time from cancer diagnosis to endoscopic resection was 56.7 ±52.5 months (range 3 to 210 months). The initial oncological parameters are listed in Table I. In 68 of the 70 patients, the initial diagnosis of prostate cancer was made in our institution. T1 prostate cancer was found in 18%, T2 prostate cancer in 22%, T3 prostate cancer in 53%, and T4 prostate cancer in 7%. Regarding initial grading, 12% had well-differentiated, 50% moderately differentiated, and 38% poorly differentiated prostate cancer. Twenty-two of the 68 men had metastatic disease as documented by plain X-ray and bone scan at the time of diagnosis.

Table I. Initial oncological parameters

Variables	Monopolar TURP *N* (%)	Bipolar TURIS *N* (%)	Total *N* (%)
Stage			
T1	6 (19)	6 (17)	12 (18)
T2	5 (16)	10 (28)	15 (22)
T3	19 (59)	17 (47)	36 (53)
T4	2 (6)	3 (8)	5 (7)
Grade			
2-4	4 (17)	3 (9)	7 (12)
5-7	12 (50)	17 (50)	29 (50)
8-10	8 (33)	14 (41)	22 (38)
Bone metastases	11 (34)	11 (31)	22 (32)

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, N – number

The initial treatments are listed in Table II. Of the 70 patients, 16 (23%) patients received external beam radiation therapy. In 7 patients this was combined with hormonal treatment with luteinizing hormone-releasing hormone during 3 years. Forty-four (63%) patients had hormonal treatment for prostate cancer from the beginning (luteinizing hormone-releasing hormone in 38 patients and bilateral subcapsular orchiectomy in 6 patients). In 10 patients, active surveillance was preferred.

At the time of resection, all patients had urinary retention while under hormonal treatment. PSA values are listed in Table III. Thirty-four palliative resections were carried out in 32 patients by conventional monopolar technique. In 38 patients, 41 bipolar resections in saline were performed. Table IV compares the preoperative and perioperative statistics. Average preoperative prostatic volume measured by transrectal ultrasound was 58.6 ±16.5 g in the conventional monopolar group and 51.0 ±16.8 g in the bipolar group. Table V shows that a vast majority of patients had spinal anaesthesia (91% in the conventional monopolar group, 78% in the bipolar group). Of all perioperative parameters, only longer resection time was statistically significant in the bipolar group (40.0 ±15.2 min vs. 49.1 ±20.5 min) (*P* = 0.03). However, after correction with respect to the weight of resected prostatic tissue, no statistically significant difference in resection speed between the two groups was observed (0.4 ±0.3 g/min vs. 0.4 ±0.3 g/min). Tables VI and VII show the changes in electrolytes before and after resection. No statistically significant changes were observed in haemoglobin, sodium, potassium, or chloride.

Postoperatively there were no cases of TUR syndrome in either group (Table IX). The indwelling catheter was removed after 1.6 ±0.9 days in the conventional monopolar group and 2.0 ±2.5 days in the bipolar group (*p* = 0.342) (Table IV).

Seven palliative resections (9.3%) were complicated with postoperative clot retention, 2 in the conventional monopolar group and 5 in the bipolar resection group (*p* = 0.565) (Table IX).

Palliative endoscopic resection was successful in 77% of the patients. Urinary retention occurred after 5 conventional monopolar resections (15%) and 11 bipolar resections (27%) (*p* = 0.292). A long-term indwelling catheter was necessary for 16 patients (23%) (Table IX).

Patients were discharged from the hospital after respectively 4.6 ±2.2 days in the conventional and 5.8 ±4.6 days in the bipolar group (Table IV).

Postoperative pathological evaluation was available in 66 (94.4%) patients. In 6 procedures there was only benign prostate tissue in the resected parts. Cancer was found in 65 procedures (62 patients) (Table VIII), well-differentiated in 3%

Table II. Initial therapeutic approach to prostate cancer

Variables	Monopolar TURP *N* (%)	Bipolar TURIS *N* (%)	Total *N* (%)
Active surveillance	5 (16)	5 (13)	10 (14)
Radiotherapy	5 (16)	4 (11)	9 (13)
Radiotherapy and 3 years hormonal treatment	2 (6)	5 (13)	7 (10)
Hormonal treatment	20 (62)	24 (63)	44 (63)

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, N – number

Table III. PSA value at diagnosis, before and after endoscopic resection

Variables	Monopolar TURP (± SD)	Bipolar TURIS (± SD)
PSA at diagnosis [ng/ml]	70.35 (±118.43)	78.59 (±220.99)
PSA before endoscopic resection	50.72 (±73.65)	128.16 (±274.80)
PSA after endoscopic resection	93.40 (±179.72)	71.92 (±142.80)

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline

Table IV. Characteristics of two groups

Variables	Monopolar TURP mean (± SD)	Bipolar TURIS mean (± SD)	*p*-value	95% confidence interval
Age [years]	75.7 (±8.3)	75.6 (±8.8)	0.941	(–3.930, 4.230)
Prostate [ml]	58.6 (±16.5)	51.0 (±16.8)	0.517	(–33.976, 18.776)
Operative time [min]	40.0 (±15.2)	49.1 (±20.5)	0.032	(0.785, 17.374)
Resection weight [g]	16.86 (±10.6)	17.30 (±10.3)	0.858	(–5.361, 4.476)
Resection speed [g/min]	0.4 (±0.3)	0.4 (±0.3)	0.992	(–0.159, 0.157)
Catheterization time [days]	1.6 (±0.9)	2.0 (±2.5)	0.342	(–0.464, 1.321)
Hospital stay [days]	4.6 (±2.2)	5.8 (±4.6)	0.179	(–0.543, 2.855)

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, SD – standard deviation

(2 patients), moderately differentiated in 18% (11 patients) and poorly differentiated in 79% (49 patients). While 38% of the patients had a high grade tumour at diagnosis, 79% were found to have high grade prostate cancer at the time of the resection.

Postoperative PSA analysis 3 months after surgery increased from a mean value of 50.72 ng/ml before the surgery to a mean of 93.40 ng/ml in the conventional monopolar group (Table III) (p = 0.372). Over the same period in the bipolar group, there was a PSA decline after surgery from 128.16 ng/ml to 71.92 ng/ml (p = 0.350).

Discussion

Urinary retention is a common complication in patients with locally advanced prostate cancer, with an incidence of 13% to 20% [6-7]. The first step is usually initiation of hormone deprivation treatment in combination with an indwelling catheter [8]. Ultrasonic volume determinations in patients with prostate cancer treated by hormonal deprivation therapy showed a 50% reduction of the gland size in the first month [9], continuing for nine months after orchiectomy. Fleischmann and Catalona reported a 68% response rate after hormonal treatment for urinary retention in 35 patients with advanced prostate cancer [10]. Unfortunately, an indwelling catheter was necessary for 21 to 60 days in 46% of the patients. Thomas *et al*. achieved an 83% success rate in 12 patients after 1 month [8].

Hormonal deprivation therapy is not limited to orchiectomy. Varenhorst and Alund were successful in relieving urethral obstruction by carcinoma of the prostate in 65% of patients treated by orchiectomy, cyproterone acetate, or oestrogens [11].

Hormonally deprived patients with acute or persisting urinary retention are initially helped with a transurethral or suprapubic bladder catheter. Since long-term catheter drainage is hazardous, patients who are fit for surgery are considered ideal candidates for a palliative endoscopic prostate resection. In this study, all patients were already on hormone deprivation therapy when the urinary retention occurred.

Palliative or channel TUR has the advantage of enabling restored micturition but is not free from complications such as stress incontinence and rapid regrowth of obstructive prostate cancer requiring

Table V. Anaesthesia

Variables	Monopolar TURP, *N* (%)	Bipolar TURIS, *N* (%)
Spinal anaesthesia	32 (91)	32 (78)
General anaesthesia	3 (9)	9 (22)

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, N – number

Table VI. Summary of laboratory results

Variables	Preoperation, mean (± SD)	Postoperation, mean (± SD)	Difference
Monopolar TURP			
Haemoglobin [mg/dl]	13.1 (±1.9)	11.9 (±1.7)	–1.2
Sodium [mmol/l]	140.9 (±3.2)	139.2 (±2.7)	–1.7
Potassium [mmol/l]	4.2 (±0.5)	4.1 (±0.4)	–0.1
Chloride [mmol/l]	104.7 (±3.1)	105.1 (±3.2)	+0.5
Bipolar TURIS			
Haemoglobin [mg/dl]	12.8 (±2.0)	11.6 (±2.1)	–1.3
Sodium [mmol/l]	141.9 (±3.0)	140.0 (±2.9)	–1.9
Potassium [mmol/l]	4.1 (±0.4)	4.0 (±0.4)	–0.1
Chloride [mmol/l]	105.1 (±2.9)	105.5 (±2.9)	+0.4

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, SD – standard deviation

Table VII. Chemical and haematological parameters

Variables	Monopolar TURP mean (± SD)	Bipolar TURIS mean (± SD)	*p*-value	95% confidence interval
Haemoglobin [mg/dl]	–1.2 (±0.9)	–1.3 (±1.3)	0.606	(–0.629, 0.369)
Sodium [mmol/l]	–1.7 (±3.1)	–1.9 (±2.6)	0.802	(–1.491, 1.156)
Potassium [mmol/l]	–0.1 (±0.4)	–0.1 (±0.3)	0.331	(–0.086, 0.252)
Chloride [mmol/l]	0.5 (±2.7)	0.4 (±2.5)	0.895	(–1.288, 1.127)

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, SD – standard deviation

Table VIII. Histological data after endoscopic resection

Variables	Monopolar TURP *N* (%)	Bipolar TURIS *N* (%)	Total *N* (%)
Grade			
2-4	1 (3)	1 (3)	2 (3)
5-7	8 (28)	3 (9)	11 (18)
8-10	20 (69)	29 (88)	49 (79)

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, N – number

Table IX. Complications

Variables	Monopolar TURP *N* (%)	Bipolar TURIS *N* (%)	*p*
TUR syndrome	0 (0)	0 (0)	1.000
Clot retention	2 (6)	5 (12)	0.565
Urinary retention	5 (15)	11 (27)	0.292

TURP – transurethral resection of prostate, TURIS – transurethral resection of prostate in saline, TUR – transurethral resection

repeated surgery [12]. Mazur and Thompson report a success rate of 79% [12]. In our study a success rate of 77% was achieved. Palliative endoscopic resection failed in 16 patients (23%), demanding a long-term suprapubic or transurethral catheter as a final solution.

Our re-operation rate was 6%. A factor in re-intervention was a reoccurring obstruction due to ongoing local tumour progression. Crain *et al*. reported 29% of patients requiring additional procedures [13], including surgical intervention for haemorrhage and clot retention. Our incidence of clot retention was 9.3%, but all cases could be managed conservatively.

A potential drawback of palliative endoscopic transurethral resection of a malignant gland is that this is technically more difficult. The prostatic urethra may be rigid and both the verumontanum and external sphincter hard to identify. This leads to a higher risk of incontinence. External radiotherapy that had been applied in some patients causes radiation effects that may contribute to the complication rate.

Palliative endoscopic resections have been criticized by Engelhardt and Riedl [14], as resection and venous propagation of tumour cells may enhance further dissemination of the disease. Such a possible negative impact on progression has been demonstrated in several studies. Fadlon *et al*. detected circulating prostate cancer cells in the serum of patients after prostate manipulations [15]. Clinical observations in patients with high grade cancer or progressive cancer showed higher postoperative rates of metastasis [16-19]. Furthermore, some survival benefit was observed when palliative endoscopic resection was avoided [14]. Therefore, Hübner *et al*. promotes intraprostatic stenting in locally advanced prostate cancer and urinary obstruction [20]. Our personal experience with prostatic stenting is disappointing and corresponds with the results and the high rates of complications reported in the literature [21]. Our goal in hormonal refractory prostate cancer patients is for improved quality of life rather than for quantity of months of survival.

Transurethral resection of the prostate with conventional monopolar loops remains the gold standard for treatment of symptomatic obstructive prostatic hypertrophy [22]. The current passes from the active electrode on the monopolar resectoscope through the patient's body to the return plate. This can provoke deep tissue heating, stimulation of underlying nerves or muscles, burning wounds at the site of the return electrode and malfunction of cardiac pacemakers [23]. The risk of complications such as bleeding and absorption of irrigation fluid with possible TUR syndrome cannot be ignored.

With bipolar systems, one tries to counter the problems associated with conventional monopolar systems by allowing resection in an iso-osmotic saline solution and obviating the use of a return electrode applied to the skin because the active and return electrode are placed on the same axis on the resectoscope.

Many studies have reported the advantages and disadvantages of bipolar resection in BPH patients [24-33]. Our group compared the Olympus TURIS device over conventional monopolar resections in 238 BPH patients [23]. In the bipolar resection group there were only 4 clot retentions (3.4%) and no occurrence of TUR syndrome. But staff members as well as trainees needed more operative time with the bipolar system. We do not discard the importance of the learning curve, but prolonged operative time was also related to specific TURIS characteristics such as the size of the resection loop and smaller endoscopes [33].

To date, no studies have analysed the advantages and disadvantages of bipolar resection in prostate cancer patients. Therefore, we re-analysed our data retrospectively. Two important factors were investigated. Did bipolar resection have a positive influence on the electrolyte balance in this older and debilitated patient group, and was bipolar resection associated with less prostate bleeding after the procedure?

In the present study we did not observe statistically significant changes in the electrolyte balances, although this advantage was clear in BPH patients. Possible explanations for this are the smaller study groups, the shorter operation times in patients with prostate cancer, and the fact that in palliative resections one does not need to go as close to the surgical capsule of the prostate because the creation of a voiding channel is sufficient.

Surprisingly, there was a 12% clot retention rate in the bipolar resection group. However, this is not a statistically significant difference from the conventional monopolar group. Recent experimental work by Qu *et al*. reported significantly better haemostasis with the bipolar technique of the Gyrus PlasmaKinetic system (Gyrus Medical Ltd, UK) in an isolated normal saline perfused porcine kidney [34]. The coagulation depth with bipolar technology is sufficient to seal blood vessels of 125 µm diameter, which is not possible with monopolar devices. Such vessels are only present in 0.1% of benign prostate hyperplastic tissue.

In the majority (79%) of patients undergoing palliative endoscopic resection, the tumour was pathologically upgraded. Potential explanations for this phenomenon are grade progression with time, effects of hormonal deprivation, and achievement of a hormone refractory state. Civantos *et al*. pointed out that prolonged hormonal deprivation induces histological changes in prostate cancer that may be incorrectly interpreted as high-grade disease [35].

In conclusions, urethral obstruction by prostate cancer is initially treated by hormonal deprivation and drained by a suprapubic or urethral catheter. Endoscopic resection is a valuable therapeutic option when hormonal manipulation fails or when there is hormone refractory disease. Effective relief of the obstruction is possible with an acceptable rate of procedure-related side effects. In this specific setting, bipolar technology offers no substantial benefit over conventional monopolar technology.

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