MONOPOLAR VERSUS BIPOLAR TRANSURETHRAL RESECTION OF THE PROSTATE: A PROSPECTIVE RANDOMIZED TRIAL COMPARING BLEEDING COMPLICATIONS

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Abstract

Objective: To compare standard monopolar transurethral resection of the prostate (TURP) and bipolar transurethral resection of the prostate for bleeding complications.

Materials and methods From January 2012 and February 2013, a total of 60 patients with symptomatic benign prostatic hyperplasia who are indicated for surgery were randomized into two groups. The first group was managed by monopolar TURP, and the second group was managed by bipolar TURP. The primary end points of the study were the occurrence of intra operative and postoperative bleeding complications and the changes in the preoperative and immediate postoperative serum hemoglobin (Hb) and hematocrite levels.

Results: Patient demographic profiles were similar in both groups. Mean resection time and mean weight of resected prostate tissue were comparable for both groups. There was no significant difference in incidence of intra operative and post operative bleeding or blood transfusion between both groups. The overall reduction in hemoglobin was 10.7% in monopolar group and 9.1% in bipolar group while the overall reduction in hematocrite value was 6.3% in monopolar group and 2.7% in bipolar group with no statistical difference between the two groups. Similarly, there was no statistically significant difference between incidence of clot retention, intra operative and post operative irrigation volume which are also considered as criteria to evaluate blood loss in TURP.

Conclusion: Bipolar and monopolar TURP are both effective and safe techniques for the surgical treatment of BPH. We did not find significant differences in outcome between bipolar TURP and monopolar TURP with regard to blood loss and bleeding complications.

Introduction

In elderly men, benign prostatic hyperplasia (BPH) related lower urinary tract symptoms (LUTS) are common. They can impact daily activity and quality of life, and may lead to serious outcomes (1). Many therapeutic options are available today to manage these bothersome symptoms. Based on symptom severity and BPH-related complications, an individualized decision between watchful waiting, pharmacological therapy, minimally invasive therapy, transurethral resection of the prostate (TURP) and open prostatectomy can be made (2). According to the European Association of Urology guidelines, monopolar TURP is the current surgical standard procedure for men with prostate sizes of 30-80 mL and bothersome moderate-to-severe LUTS secondary of benign prostatic obstruction (BPO). Its high success rate is reflected in the reported substantial improvements in symptom scores, urinary flow rates and PVR, and its low re-treatment rate on long-term follow up (3).

However, monopolar TURP is still associated with a risk of hemorrhage, particularly in patients with larger prostates or bleeding disorders, or who are undergoing anticoagulation therapy. There is also a risk of the TUR syndrome, a rare but potentially life threatening complication due to the resorption of nonconductive hypo-osmolar irrigation fluid resulting in water toxicity and electrolyte abnormalities (3). Therefore, several technologies have been developed in the last years to minimize the perioperative morbidity of TURP (4). The most significant improvement of TURP was the incorporation of bipolar technology. With bipolar technologies, the electric current completes the circuit without passing through the patient. This allows saline solution to be used for irrigation during resection instead of electrolyte-free solutions and, thereby, completely eliminating hyponatremia and TUR syndrome (5). However, there is controversy in the literature regarding haemostatic advantages of bipolar TURP when compared with the standard monopolar TURP (6). Therefore, we perform this prospective randomized study to compare between the safety profile of the standard monopolar and bipolar TURP regarding bleeding complications.

Materials and methods

From January 2012 and February 2013, a total of 60 patients with symptomatic BPH with indication for surgery were randomized into two equal groups that were managed by either monopolar or bipolar TURP.

The primary end points of the study were the occurrence of bleeding complications and the changes in the preoperative and immediate postoperative serum hemoglobin (Hb) and hematocrite levels.

Inclusion criteria were symptomatic BPH that required surgery (due to failed medical therapy or urinary retention) and a TRUS-estimated prostatic weight of 30–100 gm. Exclusion criteria were patient with significant co morbidities, neurogenic bladder, urethral stricture, prostate cancer, bladder stones and chronic renal impairment. The study was approved by our institution's ethics committee, and informed consent was obtained from all patients. The diagnostic evaluation included IPSS, digital rectal examination, complete laboratory tests, abdominal ultrasound, TRUS and uroflowmetry. All operations were performed under spinal anesthesia with glycine 5% solution as the irrigant during monopolar TURP and saline solution as an irrigant during bipolar TURP. All patients were treated postoperatively with continuous bladder irrigation until urine became clear and a hemoglobin and hematocrite levels were determined immediately after surgery. Removal of the catheter was done after complete clearance of urine and PVRU was measured to ensure proper emptying before discharge. Any complications as intra operative bleeding, (TUR) syndrome, clot retention were documented.

Monopolar TURP was performed with a 26Fr Karl Storz continuous flow resectoscope and a standard loop electrode for TURP (8 mm diameter, Storz) using the electrosurgical unit (Valleylab Force EZ, Boulder, CO, USA) set at 140 W (cutting mode) and 40 W (coagulation mode). Bipolar resection was performed with a 26Fr Karl Storz continuous flow resectoscope and a Storz bipolar electrode using the electrosurgical device (EMED ES- Vision., EMED, NY, USA) set at 350W (cutting mode) and 120 W (coagulation mode).

The results were analyzed with the use of descriptive statistics paired t test and chi-square test to compare the continuous variables and categorical data. Significant differences were considered at $p < 0.05$ (Statistical Package for the Social Sciences, version 10.1; SPSS Inc, Chicago, IL, USA).

Results

All cases had histopathology as BPH. As shown in table (1), preoperative patient characteristics and preoperative laboratory data were comparable between both groups.

Table (1): preoperative patient data

Variable	Monopolar (n=30)		Bipolar (n=30)		p-value	Significance
	Mean	SD	Mean	SD		
Age (years)	65.5	8.03	67.8	5.3	0.2	NS
IPSS score	26.9	5.9	28.2	4.1	0.2	NS
PVRU (ml)	237.9	295.8	246.6	186.8	0.9	NS
Qmax(ml/sec)	7.2	10.5	9.3	4.2	0.6	NS
Gland size(gm)	59.2	12.6	61.7	16.4	0.5	NS
Adenoma (gm)	39.7	9.4	41.6	9.9	0.4	NS
Hb (gm/dl)	13.2	1.4	13.1	1.8	0.9	NS
Hematocite %	38.4	3.9	37.5	5.3	0.5	NS
S.Creatinine (mg/dl)	1.1	0.4	1.1	0.3	0.5	NS
Na (mEq/L)	140.4	3.3	138.4	4.6	0.06	NS
K (mEq/L)	4.1	0.5	3.8	0.7	0.06	NS
PC%	89.9	10.5	91.9	8.9	0.4	NS
PSA (ng/ml)	3.9	2.9	3.9	2.2	0.9	NS

NS = nonsignificant.

Intraoperative parameters are shown in table (2). The resection time and weight of resected prostate tissue were similar for both groups. In monopolar group, five cases had intra operative bleeding. Of those five cases, three needed blood transfusion during the operation (one blood unit) due to decline in hemoglobin below 9 gm/dl. On the other hand, intra operative bleeding occurred only in two cases in bipolar group and

they needed blood transfusion intra operatively (one blood unit). There was no statistically significant difference between the two groups regarding incidence of intra operative bleeding and blood transfusion. TUR syndrome occurred in two cases in monopolar group whereas no case developed TUR syndrome in bipolar group.

Table (2): Perioperative patient data

Variables	**Monopolar**		**Bipolar**		**p-value**	**Sig.**
	Mean	**SD**	**Mean**	**SD**		
Resected prostate weight (gm)	31.8	8.1	33.8	9.4	0.4	NS
Resection time (minute)	71.3	37.6	63	16.8	0.3	NS
	No.	**%**	**No.**	**%**		
Intra-operative bleeding	5	17.2%	2	6.7%	0.3	NS
Blood transfusion	3	10%	2	6.7%	0.9	NS
Volume of intra operative irrigation fluid (Liter)	21.8	7.8	22	6.7	0.2	NS
TUR syndrome	2	6.7%	0	0%	0.2	NS

NS = nonsignificant.

Early postoperative parameters are shown in table (2). One case in monopolar group had severe bleeding 3 hours postoperatively. One unit of blood was transfused to the patient due to decline of hemoglobin to 9 gm/dl. No case had post operative bleeding in bipolar group. There was no statistically significant difference regarding Clot retention, postoperative irrigation amount, catheterization time and hospitalization.

Variables	**Monopolar**		**Bipolar**		**p-value**	**Sig.**
	Mean	**SD**	**Mean**	**SD**		
Post operative bleeding and transfusion	1	3.3%	0	0%	0.2	NS
Clot retention	3	10%	0	0%	0.2	NS

Volume of post operative irrigation fluid (Liter)	5.5	2.7	4.5	2.6	0.2	NS
Catheterization time (day)	2.7	0.7	2.4	0.6	0.08	NS
Hospitalization (day)	3.8	0.8	3.5	0.6	0.1	NS

NS = nonsignificant.

Table (3) summarizes the mean values for hemoglobin and hematocrite before and immediately after surgery in both groups. The overall reduction in hemoglobin was 10.7% in monopolar group and 9.1% in bipolar group. The overall reduction in hematocrite value was 6.3% in monopolar group and 2.7% in bipolar group. In each group, there was a statistically significant difference between preoperative and postoperative hemoglobin and hematocrite value (p-value <0.05).

Table (3): Mean hemoglobin and hematocrite values before and immediately after surgery in both groups

Group	Hemoglobin and hematocrite	Preoperative Mean ± SD	Postoperative mean ± SD	Change %	P value	Significance
Monopolar	Hemoglobin (gm/dl)	13.1±1.8	11.7±1.9	-10.7%	<0.001	S
	Hematocrite (%)	38.4±3.9	36±4.3	-6.3%	<0.001	S
Bipolar	Hemoglobin (gm/dl)	13.2 ± 1.4	12 ± 1.2	-9.1%	<0.001	S
	Hematocrite (%)	37.5±5.3	36.5±5.6	-2.7%	0.01	S

S = significant.

There was also no statistical significant difference between monopolar and bipolar group regarding postoperative hemoglobin and hematocrite (p-value >0.05) as shown in table (4)

Table (4): Comparison between postoperative Hb and hematocrite in the two groups

	Monopolar Mean ± SD	Bipolar Mean ± SD	P value	Sig.

Postoperative Hemoglobin (gm/dl)	11.7±1.9	12 ± 1.2	0.4	NS
Postoperative hematocrite (%)	36±4.3	36.5±5.6	0.6	NS

NS = nonsignificant.

Discussion

For 8 decades, monopolar transurethral resection of the prostate (TURP) has been considered the cornerstone of surgical management for BPO, due to the procedure's outstanding, well-documented, long-term treatment efficacy. Similar data on durability for any other instrumental BPO treatment are lacking, and the evidence supports the notion that ''TURP is here to stay'' (7). Nevertheless, TURP is still associated with complications, such as transurethral resection (TUR) syndrome, bleeding, and urethral strictures (4). In recent years, newer endoscopic techniques and technologies have been largely developed in an attempt to reduce these complications, the most important of which are bipolar electrosurgical therapy. Since its introduction, bipolar TURP has gained increasing popularity among urologists and is advocated by some to replace monopolar TURP as the treatment of choice (8). However, before any of these modalities can be promoted as the new gold standard, comparison with conventional monopolar TURP is mandatory.

Bleeding is the most common intra operative and immediate postoperative complication of TURP, and it is particularly bothersome to the urologist as well as to the patient if it necessitates blood transfusion, reoperation, or clot evacuation. It may also lead to shock-related complications, such as acute myocardial infarction. Furthermore, bleeding may prolong irrigation and catheterization time, and ultimately duration of hospital stay, which may lead to financial burden for the patient (9). Massive intra operative bleeding also impairs visibility in the surgical area and makes it difficult to identify anatomical landmarks. The reduced blood loss in bipolar TURP would alleviate these problems and reduce the stress for the surgeon caused by profuse bleeding, especially when teaching. The smaller hemorrhage should make education in TURP easier and more comfortable for doctors in training (10).

The haemostatic capacity of bipolar TURP has been reported to be superior to the traditional monopolar TURP in a number of ex vivo studies. This better haemostatic capacity was mainly attributed to the different electro physical behavior of the bipolar current compared to its monopolar counterpart leading to a different effect on tissues and blood vessels from that of the monopolar current (11).

Investigators and researchers have attributed this better haemostatic capacity of the bipolar current to 3 reasons. The first advantage is the Cut and seal effect of the plasma corona which enables concomitant (simultaneous) haemostasis during resection. When retraction of the loop is done at the appropriate speed, sufficient thermal energy remains on the tissue to enable coagulation (sealing) of capillary bleeders (12). The second advantage is the Small depth of penetration with reduced localized tissue damage, preventing charring and damage to underlying blood vessels that may subsequently slough off or open due to patient movement (6). Finally, Intraoperative monopolar coagulation zones were reported to be lower than bipolar ones, signifying that bipolar TURP might have better haemostatic efficacy (13).

Nevertheless, and in spite of these advantages, there is an ongoing debate in the literature on the question of whether these characteristics of bipolar resection may induce less severe bleeding during and after TURP. In most studies evaluating bleeding incidence, the decline in hemoglobin level, hematocrite value and incidence of blood transfusion was measured as criteria to compare bleeding between monopolar and bipolar TURP (6).

Some RCTs comparing bipolar resection with monopolar TURP demonstrated that blood loss and blood transfusion were significantly less in the bipolar group (9, 14, 15, 16). On the contrary, two recent meta-analyses suggested a similar blood loss for monopolar and bipolar TURP (17, 18). This was supported by Reich (2009) who reported his personal experience with multiple bipolar devices and was not able to confirm superior haemostasis with bipolar TURP (19). In a recent paper done by Stucki et al (2015) focusing on bleeding complications, the authors failed to demonstrate an advantage of bipolar technique regarding bleeding (8). There was no significant difference for bleeding tendency also in three recent Trials (2, 12, 20).

These data are confirmed by our study as it failed to show differences in bleeding tendency between the two groups. Hemoglobin and hematocrite levels decreased similarly and clot retention or transfusion rates did not differ significantly. Similarly, there was no statistically significant difference between intra operative and post operative irrigation volume which are also considered as criteria to evaluate blood loss in TURP. However, the higher incidence of blood transfusion in our study (10% in monopolar group and 6.7% in bipolar group) compared with the reported incidence (2.9%) in the literature (3) and the higher incidence of clot retention (10%) compared with the reported incidence (2% - 5%) in the literature (17) can be explained by high incidence of pre operative catheterization (50%) and pre operative UTI infection in our study (60%) which may be responsible for increased bleeding because of a congested gland (4).

In a trial extensively investigating bleeding in TURP, Fagerström et al (2009) criticized measuring hemoglobin and blood transfusion rate as an indicator of bleeding and claimed that these methods provide only an indirect gross estimate of the hemorrhage and do not quantify the actual amount of blood lost. They also stated that blood transfusion is a less precise measure of blood loss, as the 'transfusion trigger' hemoglobin level involves a subjective evaluation of health status. They suggested that the 'Low Hemoglobin' photometer (HemoCue system) is an accurate and objective way of measuring the Hb concentration of the irrigating fluid, which is easily transformed into an estimate of the amount of blood lost (10). The reliability of the HemoCue system for measuring blood loss during TURP was also confirmed in other studies (21, 22). The photometer is a small device which can be conveniently carried into the operating theatre. The Hb concentration was obtained from the irrigation fluid collected during TURP. To prevent coagulation, 15 000 IU of heparin was added to every 10 L container of returned irrigant at the operation and blood loss was calculated according to the following formula:
Hemoglobin concentration in the irrigation fluid (g/L) × irrigant volume (L) ÷ preoperative blood hemoglobin concentration (g/L). He recorded significantly higher blood loss in the monopolar group (350 ml) compared to the bipolar group (235 ml), and concluded that bipolar TURP reduced the overall perioperative and total surgical bleeding by

34% (10). Similar results also were reported by Bhansali et al (2009) where the blood was significantly less in bipolar TURP (mean 195.97 mL) compared with that of conventional TURP (mean 361.52 mL) which means that blood loss in the bipolar group was only 54% that of the conventional TURP group (9) . Application of this method on a wider scale in the future may give us a conclusive answer regarding the exact amount of intra operative bleeding.

Finally, there was no statistically significant difference between monopolar and bipolar group regarding catheterization time and hospital stay. Some studies reported shorter catheterization and hospitalization with bipolar TURP due to the decreased bleeding occurring with bipolar TURP leading to decreased post operative irrigation and consequently decreased hospital stay. In our study, we did not emphasize these postoperative clinical outcomes. The clinical decision for removal of urinary catheter and hospital discharge is markedly affected by subjective factors; having prior knowledge of the treatment rendered could lead to bias. As such, for studies that emphasized these clinical outcomes, the assessor and patients must be blinded to the treatment modality rendered (12).

The two major limitations of this study are the small number of patients studied and the different levels of experience of the surgeons at our teaching hospitals. These limitations greatly affect the interpretation of our findings. The use of statistics to determine the clinical relevance of our findings is premature at this stage and, therefore, they must be viewed with caution. A larger pool of patients will definitely provide a more accurate picture.

Conclusion

Bipolar and monopolar TURP are both effective and safe techniques for the surgical treatment of BPH. We did not find significant differences in outcome between bipolar TURP and monopolar TURP with regard to blood loss and bleeding complications.

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