



## Original Article

## A Comparative Study of Perioperative Blood Loss in Monopolar Versus Bipolar Transurethral Resection of the Prostate: Quasi Experimental Study

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## ABSTRACT

Transurethral Resection of the Prostate (TURP) is frequently performed for Benign Prostatic Hyperplasia (BPH), and the choice between monopolar and bipolar diathermy influences blood loss. Minimizing blood loss is crucial for reducing complications and improving recovery, with bipolar diathermy generally offering better hemostasis than monopolar diathermy. **Objective:** To compare perioperative blood loss in monopolar versus bipolar transurethral resection for benign prostatic hyperplasia. **Methods:** Quasi experimental study was conducted at the Department of Urology and Renal Transplantation, DHQ Hospital Gujranwala, from December 11, 2018, to June 11, 2019. Patients were assigned to either Group A, which received monopolar diathermy, or Group B, which received bipolar diathermy, using convenience sampling technique. Each group comprised 40 patients. Hematocrit levels were assessed 24 hours' post-surgery; hematocrit, the proportion of blood volume occupied by red blood cells, serves as an indirect measure of blood loss. Blood loss during surgery was estimated by comparing pre-operative and post-operative hematocrit readings, and the data were analyzed using SPSS version 23. **Results:** Perioperative blood loss was significantly higher in patients who underwent monopolar diathermy compared to those treated with bipolar diathermy (monopolar: 325.22 ml vs. bipolar: 240.0 ml, p-value = 0.0001). Similar findings were observed when stratifying by age and prostate size, indicating that bipolar TURP consistently resulted in less perioperative blood loss. **Conclusions:** A significant reduction in perioperative blood loss with bipolar TURP compared to monopolar TURP in BPH patients. Reduction is clinically relevant, as it may lead to lower morbidity and improved recovery times.

## INTRODUCTION

BPH, also known as benign prostatic hyperplasia, affects elderly men and causes lower urinary tract symptoms due to increase in smooth muscle and epithelial cells in the urinary tract [1, 2]. Men aged 40–50 have a 20% increased risk of developing BPH, men aged 50–60 a 50% increased risk, and men aged 80+ have a 90% increased risk [3]. Goal of therapy is around three features: eradicate the LUTS, hinder disease development, and to decrease complications. Surveillance, medication therapy, and surgical management are all viable options for treating BPH [4]. Moderate to severe LUTS and individuals who have

acquired problems owing to BPH are evaluated for surgical treatment [5]. In view of long-term findings from randomized control studies, transurethral monopolar resection of the prostate has become the gold standard for the surgical care of BPH. The diathermy unit is used endoscopically to remove the inner prostate gland [6]. Retrograde ejaculation, transurethral resection syndrome, peri- and post-operative bleeding, erectile dysfunction and urinary incontinence are among complications that might arise from this procedure despite its usefulness in enhancing urine flow rate, symptom score, and other



metrics [7]. Recently, several minimally invasive techniques have been developed such as photosensitive vaporization, holmium laser enucleation of the prostate, and plasma kinetic bipolar loop resection. These methods seek to minimize the dangers linked to TURP and, although similar to monopolar techniques, they differ in their rates of complications [4]. In the technique called bipolar resection of the prostate gland, a specific resectoscope loop is utilized. This loop comprises both active and return electrodes, and the pattern of current flow that results from its use mitigates the potentially damaging effects of continuous current flow [8]. Normal saline is used as the irrigation fluid in bipolar TURP, offering potential benefits such as reducing TUR syndrome and minimizing blood loss. In contrast, monopolar TURP has historically been associated with severe bleeding, often requiring frequent blood transfusions [9]. Numerous studies have shown that patients undergoing bipolar TURP experience significantly less intraoperative blood loss compared to those receiving monopolar TURP, with findings indicating blood loss of 238.5 ml versus 289.6 ml, and 300.0 ml versus 349.0 ml, respectively [10, 11]. While the introduction highlights the advantages of both techniques, it does not sufficiently emphasize the importance of blood loss as a key outcome measure. Blood loss is critical in surgical procedures, as it directly impacts patient morbidity, recovery time, and overall surgical success; excessive bleeding can lead to complications such as transfusions, longer hospital stays, and heightened postoperative risks [2]. By prioritizing blood loss as an outcome, this study seeks to provide valuable insights into the safety and effectiveness of each technique, which is essential for optimizing surgical strategies and enhancing patient care in the treatment of BPH [7]. Bipolar TURP has gained global popularity as a preferred surgical method for BPH due to its potential for reduced perioperative blood loss. However, a critical gap in the literature exists, as there is currently no data directly comparing blood loss between bipolar and monopolar TURP techniques. This research aims to address this gap by determining whether there is a significant difference in blood loss between the two methods. Establishing this difference could position bipolar TURP as a safer option for patients at higher risk of bleeding with monopolar diathermy. Group A and Group B were selected based on the surgical technique employed: Group A received monopolar diathermy, while Group B received bipolar diathermy. This distinction allowed for a direct comparison of perioperative blood loss between the two techniques, which is critical to understanding the safety and efficacy of each method in the treatment of BPH.

This study hypothesized that bipolar TURP will demonstrate significantly lower perioperative blood loss compared to monopolar TURP.

## METHODS

A quasi-experimental study was conducted at the Department of Urology and Renal Transplantation, DHQ Hospital Gujranwala, from December 11, 2018, to June 11, 2019. Following approval from the Institutional Review Board (IRB) (Reference no: Admn.105/GMC), written informed consent was obtained from all patients. Patient confidentiality was ensured by anonymizing all data and securely storing it in password-protected files. Only authorized personnel had access to the data, and the consent form outlined the voluntary nature of participation and the option to withdraw at any time. A total of 80 male patients, age 55-75 years, with diagnosed Benign Prostatic Hyperplasia (BPH) were enrolled using a 95% confidence level and 80% statistical power, based on an anticipated mean blood loss of  $238.5 \pm 69.43$  ml for bipolar TURP and  $289.6 \pm 89.47$  ml for monopolar TURP using OpenEpi [5]. Group A (monopolar diathermy) and Group B (bipolar diathermy) each consisted of 40 patients. Exclusion criteria were patients with diabetes mellitus (FBS >240), chronic liver disease (ALT & AST >40 IU/L), bleeding disorders (PT, INR > 1.5), and uncontrolled hypertension ( $\geq 140/90$ ). All patients underwent preoperative assessment, including demographic data, a full blood count, urinalysis, and abdominal and pelvic ultrasound to confirm Benign Prostatic Hyperplasia (BPH) symptoms and prostate size (>30 ml). Hematocrit levels were measured preoperatively and 24 hours' post-surgery to estimate blood loss. The hematocrit-based measurement is an indirect blood loss assessment, calculated by comparing the pre- and post-operative hematocrit values. The study's data collection process was standardized, with all researchers using an approved data collection form to ensure consistency. SPSS version 23.0 was used for data analysis, presenting quantitative data on prostate size, blood loss, age, and duration as means and standard deviations. Preoperative blood loss comparisons between groups were conducted using the T-test, with age, duration of BPH, and prostate volume as additional stratification factors. Statistical significance was defined as a p-value of less than 0.05. Ethical considerations were upheld throughout the study, guided by the four principles of ethics: beneficence (maximizing benefits), non-maleficence (minimizing harm), autonomy (respecting patient choices), and justice (ensuring fair treatment). Handling of missing data and potential confounders was addressed through statistical techniques, although further details on these methodologies could enhance clarity.

## RESULTS

Mean age of patients in Group-A and Group-B was  $62.42 \pm 5.27$  and  $62.27 \pm 4.86$  years, respectively. Mean duration of BPH was  $3.28 \pm 1.66$  months for Group A and  $3.70 \pm 1.84$

months for Group B. Comparison of perioperative blood loss describe in Table 1. Group A showed a mean value of 325.22 (SD= 49.56), and the scores ranged from a minimum of 221 to a maximum of 390. In contrast, Group B had a mean value of 240 (SD= 37.36), with scores ranging from 171 to 307. An independent T-test was used to compare blood loss between the groups. Assumptions of normality and homogeneity of variance were confirmed through Shapiro-Wilk and Levene's tests, respectively. A significant difference between the two groups, yielding a t-value of 8.684 and a p-value of 0.0001.

**Table 1:** Comparison of Perioperative Blood Loss (ml) in Both Groups

Group	N (Participants)	Mean Blood Loss Mean ± SD	Minimum (mL)	Maximum (mL)
Monopolar Diathermy	40	325.22 ± 49.56	171	307
Bipolar Diathermy	40	240.0 ± 37.36	221	390

Group-A: Monopolar Diathermy; Group-B; Bipolar Diathermy; N= Number of participant's Independent sample t-test= 8.684; p-value= 0.0001

The comparison of perioperative blood loss (in milliliters) between Group A (Monopolar Diathermy) and Group B (Bipolar Diathermy) is presented, stratified by age in Table 2. For the 55-60 years' age group, Group A recorded a mean blood loss of 317.94 ml with a standard deviation of 60.45, while Group B had a mean of 243.12 ml and a standard deviation of 36.01, resulting in a p-value of 0.000. In the 61-65 years' age group, Group A had a mean of 314.14 ml (SD = 50.02) compared to Group B's mean of 222.44 ml (SD = 38.45), with a p-value of 0.001. For the 66-70 years' age group, Group A recorded a mean blood loss of 337.81 ml (SD = 34.64), while Group B had a mean of 247.20 ml (SD=37.27), again showing a significant difference with a p-value of 0.000. These results indicate that Monopolar Diathermy consistently leads to higher perioperative blood loss across all age groups compared to Bipolar Diathermy.

**Table 2:** Comparison of Perioperative Blood Loss (mL) in both Groups Stratified for Age

Age Group (Years)	Group A Mean ± SD (mL)	Group B Mean ± SD (mL)	P-Value
55-60	317.94 ± 60.45	243.12 ± 36.01	0.000
61-65	314.14 ± 50.02	222.44 ± 38.45	0.001
66-70	337.81 ± 34.64	247.20 ± 37.27	0.000

In the analysis of perioperative blood loss based on the duration of Benign Prostatic Hyperplasia (BPH), the results in table 3 revealed that for patients with BPH duration of 1-3 months, Group A (Monopolar Diathermy) had a mean blood loss of 325.10 ml (SD = 54.14), while Group B (Bipolar Diathermy) had a mean of 238.00 ml (SD = 36.44), with a significant p-value of 0.000. For patients with BPH duration of 4-6 months, Group A recorded a mean of 325.37 ml (SD = 45.45), compared to Group B's mean of 241.81 ml (SD =

38.99), also showed a significant difference with a p-value of 0.000. These findings indicated that monopolar diathermy results in significantly higher perioperative blood loss across both durations of BPH.

**Table 3:** Comparison of Perioperative Blood Loss (mL) in both Groups Stratified for duration of BPH

BPH Duration (Months)	Group A Mean ± SD (mL)	Group B Mean ± SD (mL)	p-Value
1-3	325.10 ± 54.14	238.00 ± 36.44	0.000
4-6	325.37 ± 45.45	241.81 ± 38.99	0.000

The comparison of perioperative blood loss by prostate size further supported these findings in table 4. For patients with prostate sizes of 33-36 mm, Group A had a mean blood loss of 311.66 ml (SD=51.13), while Group B had a mean of 240.06 ml (SD = 39.02), yielding a significant p-value of 0.000. In the 37-40 mm size category, Group A recorded a mean of 343.77 ml (SD = 35.77) compared to Group B's mean of 241.09 ml (SD = 41.82), with a p-value of 0.000. For prostate sizes of 41-45 mm, Group A showed a mean of 325.00 ml (SD = 53.48) against Group B's mean of 239.00 ml (SD = 34.26), again demonstrating significance with a p-value of 0.000. Overall, these results indicated that monopolar diathermy consistently leads to greater perioperative blood loss across all examined prostate sizes.

**Table 4:** Comparison of Perioperative Blood Loss (mL) in both Groups Stratified for Prostate Size

Prostate Size (mm)	Group A Mean ± SD (mL)	Group B Mean ± SD (mL)	p-Value
33-36	311.66 ± 51.13	240.06 ± 39.02	0.000
37-40	343.77 ± 35.77	241.09 ± 41.82	0.000
41-45	325.00 ± 53.48	239.00 ± 34.26	0.000

## DISCUSSION

One of the results of having LUTS or BPO is BPH. Treatment options include radical prostatectomy, observation, drug treatment, and TURP, a minimally invasive therapy. In the field of BPO, the most effective surgical treatment is considered to be monopolar TURP due to its established track record of long-lasting effectiveness. Despite significant technological advancements over the past few decades, concerns still remain over complications such as transurethral resection syndrome, bleeding, and urethral strictures, which have decreased in frequency but are still considered problematic [12, 13]. Mortality and morbidity after TURP have decreased (0.1% and 11.1%, respectively), according to a prospective, large-scale, multicenter observational study [14]. Recent advancements in bipolar technology have significantly improved TURP outcomes. Notably, bipolar TURP can be performed in normal saline, which addresses a major shortcoming of monopolar TURP. This study found a notable increase in perioperative blood loss in patients receiving monopolar diathermy compared to those treated with bipolar diathermy (monopolar: 325.22

vs. bipolar: 240.0, p-value=0.000). Stratification by age and prostate size showed similar findings, indicating that bipolar TURP consistently results in significantly less perioperative blood loss [15]. Several studies corroborate these findings, indicating that monopolar TURP results in greater blood loss [16-18]. Tawfik A *et al.*, demonstrated that bipolar TURP results in less intraoperative blood loss compared to monopolar TURP (238.5 ± 69.43 ml versus 309.62 ± 89.47 ml) [10]. Similarly, Nour and colleagues prospective randomized controlled trial showed less blood loss with bipolar TURP (300.0 ± 2.47 ml versus 349.0 ± 43.5 ml) [11]. These findings suggest that bipolar TURP is linked to significantly reduced blood loss during surgery, attributed to improved hemostasis from the bipolar technique's lack of a returning current [17]. Research by Bashir S and Swami G *et al.*, in an isolated blood-perfused pig kidney model indicated that bipolar devices result in significantly less bleeding (15.16 g/min) compared to monopolar devices (20.78 ± 1.52 g/min) [18]. Additionally, in canine prostates, the coagulation zones were statistically deeper with bipolar devices (237.73 ± 20.12 m) compared to monopolar devices (200.75 ± 19.34 m) [19]. This suggested that bipolar technology is more effective at closing major blood vessels. Furthermore, study demonstrated that bipolar cutting produced a deeper coagulation zone (236.25 ± 36.69 m) compared to monopolar cutting (216.00 ± 42.24 m) [20]. The enhanced coagulation ability of bipolar devices may be linked to a unique cutting method and higher initial power levels. In contrast, conventional monopolar devices primarily generate heat to eliminate tissue, with much of the heat lost as steam, resulting in minimal effective tissue coagulation [21]. The power level for cutting with bipolar devices is set at 175 W, while the coagulation setting is 75 W. The plasma effect is crucial for cutting tissue with bipolar devices. High-frequency energy is transmitted from the active pole to the conductive fluid (NaCl 0.9%), which then returns to the return pole. Charged ions in the fluid facilitate the breaking of bonds in organic compounds [21]. The study adds valuable insight into the benefits of bipolar TURP, but it is important to acknowledge several limitations. Sample size may restrict the generalizability of study findings, and potential confounding factors could influence the outcomes. Biases in patient selection or surgical technique may also affect results. Future research should address these limitations and explore how these findings can impact clinical practice, particularly in optimizing surgical approaches for patients with BPH. By highlighting the advantages of bipolar TURP over monopolar techniques, to better inform clinical decision-making and enhance patient care.

## CONCLUSIONS

In conclusion, this study demonstrated a significant reduction in perioperative blood loss with bipolar TURP compared to monopolar TURP for patients with Benign Prostatic Hyperplasia (BPH). Bipolar diathermy consistently resulted in less blood loss across various stratifications, including age, duration of BPH, and prostate size. This finding suggested that bipolar TURP is a superior option, offering better hemostasis and potentially leading to lower morbidity, faster recovery, and reduced transfusion needs. Future research should explore long-term outcomes and how bipolar TURP impacts complications in diverse patient populations.

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## Authors Contribution

Conceptualization: RNA

Methodology: AM, SI

Formal Analysis: MI

Writing, review and editing: RNA, MZA, SS

All authors have read and agreed to the published version of the manuscript

## Conflicts of Interest

The authors declare no conflict of interest.

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