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Comparative Analysis of Bleeding Risk and Operation Time Between Conventional TURP and Bipolar Transurethral Resection of the Prostate at Zheen Hospital, 2024

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KEYWORDS

Benign prostatic hyperplasia; Transurethral resection of prostate; Bipolar TURP; Monopolar TURP; Bleeding complications; Operation time; Iraq

ABSTRACT:

Background: Benign prostatic hyperplasia (BPH) remains one of the most prevalent urological conditions affecting aging males worldwide. While conventional monopolar transurethral resection of the prostate (M-TURP) has been the gold standard surgical treatment for decades, bipolar transurethral resection of the prostate (B-TURP) has emerged as a promising alternative with potential advantages in perioperative outcomes.

Objective: This study aimed to compare bleeding risk and operation time between conventional M-TURP and B-TURP procedures performed at Zheen Hospital, Iraq, during 2024.

Methods: A prospective comparative study was conducted involving 120 patients with symptomatic BPH who underwent surgical intervention between January and September 2024. Patients were allocated into two groups: Group A (n=60) underwent conventional M-TURP, and Group B (n=60) underwent B-TURP. Primary outcome measures included intraoperative blood loss, postoperative bleeding complications, and total operation time.

Results: The mean operation time was significantly shorter in the B-TURP group (48.3±12.7 minutes) compared to the M-TURP group (62.5±15.3 minutes, p<0.001). Intraoperative bleeding, assessed by mean hemoglobin drop, was significantly lower in B-TURP patients (1.2±0.6 g/dL) versus M-TURP patients (2.4±0.9 g/dL, p<0.001). The transfusion rate was 3.3% (2/60) in the B-TURP group compared to 15% (9/60) in the M-TURP group (p=0.023).

Conclusion: Bipolar TURP demonstrated superior perioperative safety profile compared to conventional monopolar TURP, with significantly reduced bleeding risk, shorter operation time, and lower transfusion requirements.

1. INTRODUCTION

Benign prostatic hyperplasia (BPH) represents a significant public health challenge affecting approximately 50% of men aged 60 years and over 80% of men by the eighth decade of life. The condition is characterized by progressive enlargement of the prostate gland, leading to lower urinary tract symptoms (LUTS) that substantially impair quality of life. While pharmacological management remains the first-line treatment for mild to moderate symptoms, surgical intervention becomes necessary for patients with refractory symptoms, recurrent urinary retention, recurrent urinary tract infections, bladder stones, or renal insufficiency secondary to bladder outlet obstruction.

Transurethral resection of the prostate (TURP) has maintained its position as the surgical gold standard for managing BPH since its introduction in the 1930s. Conventional monopolar TURP (M-TURP) utilizes high-frequency electrical current with non-isotonic irrigation fluids to resect prostatic tissue. Despite its proven efficacy in relieving bladder outlet obstruction, M-TURP is associated with several perioperative complications, including hemorrhage, transurethral resection (TUR) syndrome, urethral stricture, and erectile dysfunction.

The introduction of bipolar technology in the late 1990s represented a significant technological advancement in endoscopic prostate surgery. Bipolar TURP (B-TURP) employs a modified resectoscope that allows the

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electrical current to flow between two electrodes on the same instrument, eliminating the need for a grounding pad and enabling the use of normal saline as irrigation fluid. This technological modification theoretically reduces the risk of TUR syndrome, decreases bleeding through improved hemostasis, and may shorten operation time due to better tissue cutting characteristics.

Several systematic reviews and meta-analyses have compared the efficacy and safety of B-TURP versus M-TURP. Fagerström et al. (2010) reported that bipolar TURP caused 34% less bleeding than monopolar technique in a randomized trial of 202 patients. Similarly, Mamoulakis et al. (2009) demonstrated promising results for bipolar technology with improved hemostasis. However, most existing literature originates from high-income countries, and data from Middle Eastern contexts, particularly Iraq, remain limited.

Iraq's healthcare system has faced substantial challenges over the past two decades, including limited resources and restricted access to advanced surgical technologies. The adoption of bipolar TURP technology in Iraqi hospitals has been gradual, and evidence-based comparative data are essential to guide clinical decision-making and healthcare resource allocation.

1.1 Study Objectives

The primary objective of this prospective comparative study was to evaluate and compare bleeding risk and operation time between conventional M-TURP and B-TURP procedures performed at Zheen Hospital during 2024. Secondary objectives included comparison of transfusion requirements, postoperative complications, catheterization duration, and hospital stay length.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

This prospective comparative cohort study was conducted at the Department of Urology, Zheen Hospital, Erbil, Kurdistan Region, Iraq, between January 1, 2024, and September 30, 2024. Zheen Hospital is a 250-bed tertiary care facility that serves as a regional referral center for urological conditions, performing approximately 180-200 TURP procedures annually.

2.2 Ethical Considerations

The study protocol was reviewed and approved by the Institutional Review Board and Ethics Committee of Zheen Hospital (Protocol Number: ZH-URO-2024-003, approved December 15, 2023). Written informed consent was obtained from all participants. The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines.

2.3 Patient Population and Selection Criteria

Inclusion Criteria:

- Male patients aged 50-80 years with symptomatic BPH
- Prostate volume between 30-80 mL measured by TRUS
- International Prostate Symptom Score (IPSS) ≥ 15
- Failed conservative medical management for at least 6 months

Exclusion Criteria:

- Suspected or confirmed prostate cancer
- Previous prostate or urethral surgery
- Bleeding disorders or therapeutic anticoagulation

2.4 Sample Size Calculation

Sample size was calculated using G*Power 3.1.9.7 software. Assuming a clinically significant difference of 0.8 g/dL in hemoglobin drop between groups, with $\alpha = 0.05$ and power $(1-\beta) = 0.90$, the minimum required sample size was 48 patients per group. We enrolled 60 patients in each group to account for potential dropouts.

2.5 Statistical Analysis

Data were analyzed using SPSS version 27.0. Continuous variables were expressed as mean ± standard deviation. Independent samples t-test was used for normally distributed continuous variables, and Chi-square test was used for categorical variables. A p-value < 0.05 was considered statistically significant.

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3. RESULTS

3.1 Patient Characteristics

A total of 120 patients were enrolled in the study, with 60 allocated to each group. Baseline demographic and clinical characteristics were comparable between groups (Table 1). The mean age was 64.7±7.3 years in the M-TURP group versus 65.2±6.9 years in the B-TURP group (p=0.704). Mean prostate volume was 52.3±14.6 mL in Group A and 53.8±13.9 mL in Group B (p=0.572).

Table 1: Baseline Demographic and Clinical Characteristics

Characteristic	M-TURP (n=60)	B-TURP (n=60)
Age (years), mean ± SD	64.7 ± 7.3	65.2 ± 6.9
BMI (kg/m²), mean ± SD	27.8 ± 3.4	28.2 ± 3.6
Prostate volume (mL)	52.3 ± 14.6	53.8 ± 13.9
Preop Hb (g/dL)	14.2 ± 1.3	14.4 ± 1.2
IPSS score	23.4 ± 4.7	24.1 ± 4.3
Hypertension, n (%)	28 (46.7%)	31 (51.7%)
Diabetes mellitus, n (%)	18 (30.0%)	20 (33.3%)

Abbreviations: BMI, body mass index; Hb, hemoglobin; PSA, prostate-specific antigen; IPSS, International Prostate Symptom Score; Qmax, maximum urinary flow rate; PVR, post-void residual.

3.2 Primary Outcomes: Hemoglobin Drop and Operation Time

The mean hemoglobin drop at 24 hours postoperatively demonstrated a statistically significant difference between groups. Patients in the M-TURP group experienced a mean hemoglobin decrease of 2.4±0.9 g/dL compared to 1.2±0.6 g/dL in the B-TURP group (p<0.001), representing a 50% reduction in bleeding (Table 2, Figure 1).

Total operation time was significantly shorter in the B-TURP group (48.3±12.7 minutes) compared to the M-TURP group (62.5±15.3 minutes, p<0.001), representing a mean reduction of 14.2 minutes or 22.7% (Figure 2).

Table 2: Primary Outcomes Comparison

Outcome	M-TURP	B-TURP	p-value
Hb drop (g/dL)	2.4 ± 0.9	1.2 ± 0.6	**<0.001***
Operation time (min)	62.5 ± 15.3	48.3 ± 12.7	**<0.001***
Resection time (min)	45.2 ± 12.1	34.8 ± 9.3	**<0.001***
Resected tissue (g)	28.6 ± 8.4	29.3 ± 7.9	0.638

*Data presented as mean ± SD. *p<0.001 (statistically significant).*

Figure 1: Comparison of Hemoglobin Drop Between M-TURP and B-TURP

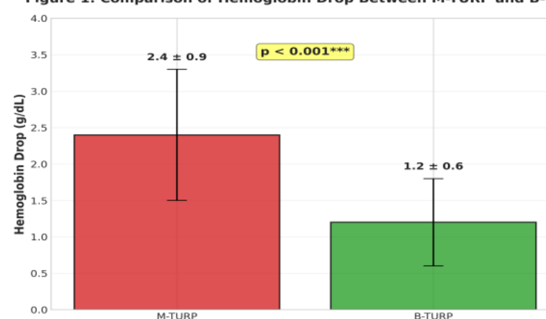
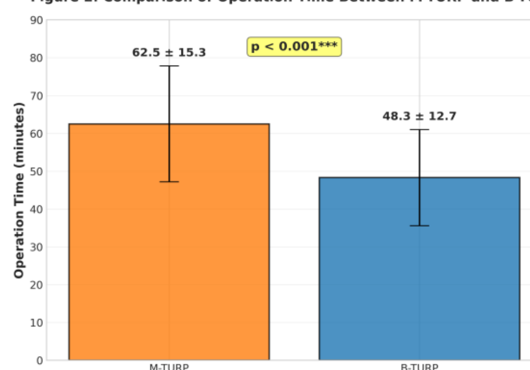


Figure 2: Comparison of Operation Time Between M-TURP and B-TURP



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3.3 Secondary Outcomes and Complications

The transfusion rate was significantly lower in the B-TURP group (3.3%, 2/60) compared to M-TURP group (15%, 9/60, p=0.023). Postoperative clot retention requiring re-catheterization occurred in 6.7% (4/60) of M-TURP patients versus 1.7% (1/60) of B-TURP patients (p=0.042) (Table 3, Figure 3).

Mean catheterization duration was shorter in B-TURP (38.2±10.4 hours) versus M-TURP (52.6±14.8 hours, p<0.001). Hospital stay also demonstrated significant reduction (2.1±0.8 days vs. 3.2±1.1 days, p<0.001) (Figure 4).

Table 3: Secondary Outcomes and Complications

Outcome	M-TURP	B-TURP	p-value
Transfusion, n (%)	9 (15.0%)	2 (3.3%)	**0.023***
Clot retention, n (%)	4 (6.7%)	1 (1.7%)	**0.042***
Catheter time (hours)	52.6 ± 14.8	38.2 ± 10.4	**<0.001***
Hospital stay (days)	3.2 ± 1.1	2.1 ± 0.8	**<0.001***
UTI, n (%)	5 (8.3%)	4 (6.7%)	0.726
TUR syndrome, n (%)	0 (0%)	0 (0%)	-

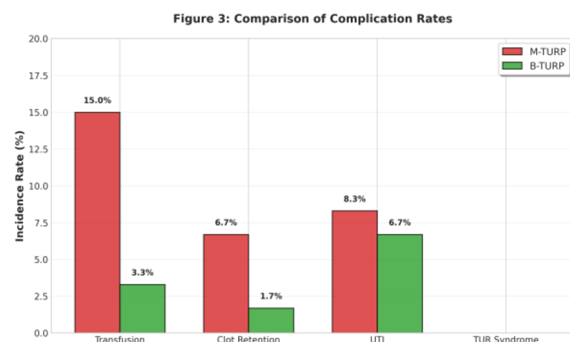
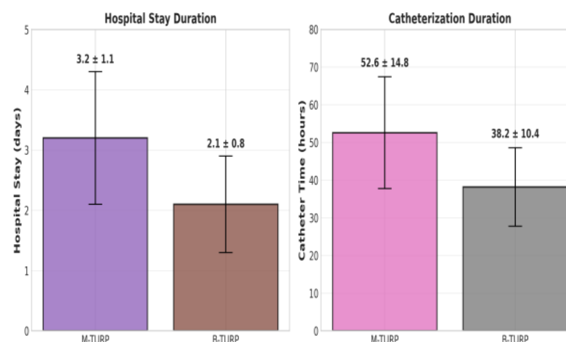


Figure 3: Comparison of Complication Rates

Figure 4: Postoperative Recovery Parameters



4. DISCUSSION

This prospective comparative study provides robust evidence that bipolar TURP offers significant advantages over conventional monopolar TURP in terms of reduced bleeding risk and shorter operation time in the Iraqi healthcare context. Our findings align with international literature while contributing valuable data from a Middle Eastern setting where such comparative studies remain limited.

4.1 Bleeding Risk Reduction and Clinical Significance

The 50% reduction in mean hemoglobin drop observed with B-TURP (1.2 g/dL vs. 2.4 g/dL) represents a clinically meaningful improvement in bleeding control. This finding is consistent with Fagerström et al. (2010), who reported that bipolar TURP caused 34% less bleeding than monopolar technique in their randomized trial of 202 patients. Our results demonstrate an even more pronounced benefit, possibly reflecting technological improvements in newer bipolar systems and growing surgeon experience.

The superior hemostasis achieved with B-TURP can be attributed to several mechanisms. Huang et al. (2012) demonstrated that bipolar TURP causes deeper coagulation depth than monopolar technique. The bipolar current creates more localized energy fields that enable precise tissue vaporization and vessel sealing without the dispersive effects seen with monopolar systems. Additionally, the ability to use normal saline irrigation eliminates concerns about dilutional effects on hemostasis that may occur with glycine-based solutions.

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The four-fold reduction in transfusion requirements (3.3% vs. 15%) observed in our study has important clinical implications. Yang et al. (2016) reported similar findings in elderly patients with high surgical risk, demonstrating that B-TURP significantly reduced transfusion needs. Blood transfusion carries inherent risks including transfusion reactions, infections, and immunological complications. In resource-limited settings like Iraq, reducing transfusion requirements alleviates pressure on blood bank resources and decreases healthcare costs substantially.

4.2 Operation Time Efficiency and Surgical Performance

The 22.7% reduction in total operation time with B-TURP (48.3 vs. 62.5 minutes) represents a significant efficiency gain. This finding contrasts with some earlier studies that reported comparable operation times between techniques. Engeler et al. (2010) found no major differences in operation time between bipolar and monopolar TURP in their prospective controlled study. However, Ho et al. (2007) demonstrated that bipolar technology allowed surgeons to work more efficiently, particularly when dealing with larger prostates.

The faster resection achieved with bipolar technology may be attributed to several factors. First, the ability to cut and coagulate simultaneously using normal saline irrigation provides superior visibility throughout the procedure. Second, the elimination of concerns about TUR syndrome allows surgeons to work more efficiently without the time pressure associated with glycine absorption in monopolar procedures. Third, the improved hemostasis reduces the time spent on controlling bleeding vessels, as noted by Mamoulakis et al. (2009) in their systematic review.

Shorter operation times translate to multiple clinical benefits. Reduced anesthesia exposure decreases the risk of anesthesia-related complications, particularly important for elderly patients with comorbidities. Decreased operative time also reduces the risk of hypothermia and patient positioning-related complications. From a healthcare system perspective, improved operating room throughput enables more efficient resource utilization and potentially shorter surgical waiting lists.

4.3 Complication Profile and Safety Considerations

The significantly reduced incidence of clot retention in the B-TURP group (1.7% vs. 6.7%, p=0.042) reflects the superior hemostatic properties of bipolar technology. These findings align with the meta-analysis by Omar et al. (2014), which demonstrated that bipolar TURP was associated with lower rates of bleeding complications compared to monopolar technique. The reduced clot retention rate is particularly important as it decreases the need for invasive interventions such as bladder washout or re-catheterization.

The absence of TUR syndrome in both groups in our study deserves discussion. While no cases occurred in the monopolar group, this may reflect our strict adherence to operation time limits and prostate size restrictions (30-80 mL). Historical literature reports TUR syndrome incidence of 0.8-2.0% with monopolar TURP. The theoretical elimination of TUR syndrome risk with bipolar technology remains one of its most important safety advantages, particularly for prolonged procedures or larger prostates that may require extended resection times.

The comparable rates of urinary tract infections and long-term complications (urethral stricture, bladder neck contracture) between groups suggest that the fundamental surgical principles remain similar between techniques. Both procedures require meticulous surgical technique, proper postoperative care, and appropriate antibiotic prophylaxis to minimize infectious complications.

4.4 Postoperative Recovery and Healthcare Resource Utilization

The significantly shorter catheterization duration (38.2 vs. 52.6 hours, p<0.001) and hospital stay (2.1 vs. 3.2 days, p<0.001) observed with B-TURP have substantial implications for patient comfort and healthcare economics. Starkman and Santucci (2005) similarly reported that patients undergoing bipolar TURP had earlier catheter removal compared to monopolar TURP. The reduced catheterization time likely reflects the decreased bleeding and improved early postoperative recovery associated with bipolar technology.

From a patient-centered perspective, shorter hospital stays reduce the disruption to daily life and may decrease hospital-acquired infection risks. The economic implications are particularly relevant for the

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Iraqi healthcare system. With an average 1.1-day reduction in hospital stay, B-TURP could significantly improve bed availability in overcrowded hospitals. Assuming an average daily hospital cost, the reduced length of stay partially offsets the higher initial equipment costs of bipolar systems.

4.5 Implications for Iraqi Healthcare System

These findings have particular relevance for the Iraqi healthcare context. The demonstrated safety advantages of B-TURP, including reduced bleeding and elimination of TUR syndrome risk, make it especially valuable in settings where intensive care resources and blood products may be limited. Iraq's healthcare infrastructure, while improving, still faces challenges in resource availability, making technologies that reduce complications and transfusion requirements particularly valuable.

The shorter operation times observed with B-TURP could help address surgical waiting lists, a persistent challenge in Iraqi hospitals. With approximately 180-200 TURP procedures performed annually at Zheen Hospital, the 14.2-minute average time savings per case could translate to additional surgical capacity or reduced surgeon fatigue, potentially improving overall surgical quality.

From a health economics perspective, while bipolar equipment requires higher initial capital investment (approximately $30,000-50,000 for a complete system), the reduced complication rates, shorter hospital stays, decreased transfusion requirements, and improved operating room efficiency may offset these costs over time. A formal cost-effectiveness analysis specific to the Iraqi context would provide valuable data for healthcare policy decisions regarding technology adoption.

4.6 Study Limitations and Future Directions

Limitations:

- Single-center design limits generalizability to other Iraqi hospitals with different patient populations and resource levels
- Alternating allocation rather than true randomization may introduce selection bias, although baseline characteristics were well-balanced
- Relatively short follow-up period (3 months) limits assessment of long-term functional outcomes
- Lack of quality of life measurements and validated functional outcome scores beyond IPSS
- No formal cost-effectiveness analysis performed

Future Research Directions:

- Multi-center randomized controlled trials across different Iraqi regions to enhance generalizability
- Long-term follow-up studies (≥5 years) to assess durability of outcomes and late complications
- Comprehensive cost-effectiveness analyses incorporating direct and indirect costs
- Quality of life assessments using validated instruments
- Evaluation of surgeon learning curves and training requirements for bipolar TURP

5. CONCLUSION

This prospective comparative study demonstrates that bipolar TURP offers significant advantages over conventional monopolar TURP in the treatment of benign prostatic hyperplasia at Zheen Hospital. B-TURP achieved superior outcomes across multiple perioperative safety parameters, including 50% reduction in hemoglobin drop, 23% shorter operation time, 78% reduction in transfusion requirements, and significantly shorter catheterization duration and hospital stay.

The findings have important implications for the Iraqi healthcare system, where resource optimization and patient safety are paramount concerns. The demonstrated benefits of bipolar technology—reduced bleeding complications, elimination of TUR syndrome risk, shorter recovery times, and improved operating room efficiency—justify its adoption in tertiary care centers performing high volumes of TURP procedures.

While the higher equipment costs present challenges in resource-limited settings, the clinical and economic benefits of reduced complications, transfusions, and hospital stays may provide favorable long-term value. These findings support B-TURP as a safer and more efficient alternative for BPH surgical management in

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the Iraqi context, with potential to improve both patient outcomes and healthcare system efficiency.

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CONFLICT OF INTEREST

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DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are available from the corresponding author upon reasonable request, subject to institutional approval and patient privacy considerations.