A Comparative Study Between Early Endoscopic Intervention and Medical Treatment in Case of Mild Bladder Outlet Obstruction (BOO) with Benign Prostatic Hyperplasia (BPH) in Diabetic Patients

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Abstract

Background: Bladder outlet obstruction (BOO) due to benign prostatic hyperplasia (BPH) is common in diabetic patients, necessitating an evaluation of early endoscopic intervention versus medical management. **Objective:** To compare the effectiveness of early endoscopic intervention and medical treatment for mild BOO in diabetic patients with BPH, assessing symptom relief, urinary flow improvement, and complications. **Methods:** A multicenter, prospective study was conducted at the Department of Urology, Pabna Medical College, Bangladesh, from June 2019 to December 2021. Two hundred forty-four diabetic male patients with mild BOO were randomized into either early endoscopic intervention (TURP/TULP) or medical management (alpha-blockers, 5-alpha-reductase inhibitors). Primary outcomes included symptom relief, urinary flow rate, and quality of life. Secondary outcomes included complications and follow-up over 12 months. **Results:** The early endoscopic intervention group showed a 75% improvement in symptoms, while the medical group showed 52% ($p < 0.05$). Urinary flow rate increased by 40% in the endoscopic group, compared to 23% in the medical group ($p < 0.01$). Standard deviation of symptom improvement in the endoscopic group was 3.2 (95% CI: 2.8-3.7) and 4.5 in the medical group (95% CI: 4.1-4.9). The p-value for symptom improvement between groups was 0.03. The complication rate was 10% for the endoscopic group and 5% for the medical group ($p < 0.05$). Additionally, quality of life improvement was significantly higher in the endoscopic group (85%) versus 55% in the medical group ($p < 0.001$). **Conclusion:** Early endoscopic intervention significantly outperforms medical treatment in improving symptoms, urinary flow, and quality of life in diabetic patients with mild BOO and BPH.

Keywords: Bladder Outlet Obstruction, Benign Prostatic Hyperplasia, Diabetes, Endoscopic Intervention, Medical Treatment.

Introduction

Bladder outlet obstruction (BOO) is a prevalent condition among men, particularly those suffering from benign prostatic hyperplasia (BPH).[1] This condition leads to significant lower urinary tract symptoms (LUTS) that impair the quality of life. The incidence of BPH increases with age, affecting a substantial proportion of the male population, and when complicated by diabetes

mellitus, the clinical management becomes increasingly challenging. Diabetes mellitus, particularly type 2 diabetes, is associated with a variety of urological complications, including an increased prevalence and severity of BPH. The pathophysiological mechanisms linking diabetes with BPH-induced BOO are multifactorial, involving both metabolic and hormonal changes, as well as nerve and vascular damage.[2] As a result, treatment strategies for managing mild BOO in diabetic patients are of particular interest, given the complexity of both conditions.

The standard treatment for BPH-related BOO has evolved significantly over the years. Traditionally, medical management with alpha-blockers and 5-alpha-reductase inhibitors has been the cornerstone of therapy for symptomatic relief. These pharmacological agents aim to reduce prostatic enlargement and improve the urinary flow rate. However, the effectiveness of these medical treatments in patients with diabetes is often compromised due to the potential for impaired drug metabolism and additional comorbidities that affect treatment response.[3] While medical therapy remains a first-line treatment, surgical options such as endoscopic interventions have gained considerable attention as a viable alternative for patients who are refractory to pharmacological treatment.Among the various endoscopic procedures available, transurethral resection of the prostate (TURP) and transurethral laser prostatectomy (TULP) are considered the gold standard in managing BOO due to their efficacy in alleviating symptoms and improving flow rates. These procedures, however, are not without risks, especially in diabetic patients who may have compromised healing and increased susceptibility to infections. The decision to opt for endoscopic intervention versus continued medical management thus requires careful consideration of patient-specific factors, including the severity of symptoms, comorbidities, and the patient's overall health status.[4]

Recent studies have compared the outcomes of early endoscopic intervention with continued medical management in patients with mild BOO secondary to BPH, particularly in diabetic populations. The aim of such studies is to ascertain whether early intervention could provide superior long-term benefits compared to conservative treatment. Proponents of early endoscopic intervention argue that it can offer quicker symptom relief, prevent the progression of BOO, and reduce the need for further interventions. Conversely, advocates for medical treatment emphasize the less invasive nature of pharmacotherapy, suggesting that with proper management, patients may achieve satisfactory results without the risks associated with surgical procedures.[5]

In this comparative study, we aim to examine the efficacy of early endoscopic interventions versus medical treatment in managing mild BOO due to BPH in diabetic patients. We will explore several key variables, including symptom relief, quality of life, long-term outcomes, adverse events, and the overall cost-effectiveness of each approach. This study will contribute valuable insights into the optimal management strategies for this complex patient population, which remains a significant clinical dilemma.

Benign prostatic hyperplasia, a non-malignant enlargement of the prostate gland, affects a majority of elderly men. Its pathophysiology is complex and involves a combination of hormonal changes, particularly an imbalance between estrogen and dihydrotestosterone levels, as well as an increase in prostatic smooth muscle and stromal components.[6] The resulting prostatic enlargement can obstruct the bladder outlet, leading to increased resistance to urine flow, which manifests clinically as LUTS, including

urinary urgency, frequency, nocturia, and incomplete bladder emptying. In diabetic patients, the relationship between BPH and BOO is further complicated by the effects of hyperglycemia on nerve function and smooth muscle tone. Diabetic neuropathy, a common complication of long-standing diabetes, may exacerbate the symptoms of BOO by impairing bladder contractility and reducing the effectiveness of bladder emptying, despite the obstruction.[7] Moreover, diabetic patients are more prone to developing complications such as urinary tract infections (UTIs), which can further worsen symptoms and complicate management. The presence of diabetes also affects the pharmacokinetics and pharmacodynamics of medications commonly used to treat BPH, potentially leading to reduced drug efficacy or increased side effects.[8]

Endoscopic procedures, including TURP and TULP, represent the most commonly performed surgical interventions for BPH-related BOO. These procedures involve the removal of prostatic tissue to relieve obstruction, thus improving urinary flow. TURP, considered the gold standard for surgical management of BPH, has been shown to significantly improve symptom scores and flow rates in the majority of patients. However, in diabetic patients, the risks associated with these procedures, including bleeding, infection, and delayed wound healing, are higher due to the compromised immune response and poor circulation typical of diabetes.[9]

Despite these risks, early endoscopic intervention has the advantage of providing faster symptom relief and potentially preventing the progression of BOO to more severe forms that require more invasive interventions, such as prostatectomy. Moreover, early intervention may improve quality of life in diabetic patients by preventing the worsening of symptoms and reducing the need for repeated hospitalizations for complications such as urinary retention or UTI.[10] However, the question remains whether these benefits outweigh the risks, particularly in patients with mild symptoms who may respond adequately to medical therapy.

Medical treatment for BPH primarily involves the use of alpha-blockers, 5-alpha-reductase inhibitors, and more recently, phosphodiesterase inhibitors. Alpha-blockers such as tamsulosin work by relaxing the smooth muscle of the prostate and bladder neck, improving urine flow. 5-alpha-reductase inhibitors, such as finasteride, reduce prostatic size by inhibiting the conversion of testosterone to dihydrotestosterone, a potent mediator of prostate growth. In diabetic patients, however, the effectiveness of these drugs can be influenced by factors such as polypharmacy, metabolic abnormalities, and comorbid conditions like hypertension.[11] One of the primary advantages of medical treatment is its non-invasive nature, which makes it a more favorable option for patients who are not candidates for surgery due to comorbidities or those who prefer to avoid surgical risks. Furthermore, medical treatment can be adjusted based on the patient's response, and the side effect profile is generally more favorable compared to surgery. However, the long-term effectiveness of medical therapy is limited, and many patients will require surgical intervention after several years of treatment.[12]

Aims and Objective

The aim of this study is to evaluate and compare the efficacy of early endoscopic intervention and medical treatment in managing mild bladder outlet obstruction (BOO) associated with benign prostatic hyperplasia (BPH) in diabetic patients. The objective is to assess symptom relief, urinary flow improvement, complications, and quality of life.

Material and methods

Study Design

This multicenter, prospective study was conducted at the Department of Urology, Pabna Medical College, Bangladesh, between June 2019 and December 2021. The study aimed to compare early endoscopic intervention and medical treatment in diabetic patients with mild bladder outlet obstruction (BOO) secondary to benign prostatic hyperplasia (BPH). Two hundred forty-four diabetic male patients were randomly assigned to two groups: one receiving early endoscopic procedures (TURP/TULP) and the other receiving medical therapy (alpha-blockers, 5-alpha-reductase inhibitors). Data was collected on symptom relief, urinary flow rate, complications, and quality of life. Follow-up was conducted over a 12-month period, and outcomes were measured using validated questionnaires and clinical evaluations.

Inclusion Criteria

Patients included in this study were diabetic males aged 50 to 75 years diagnosed with mild BOO secondary to BPH. All participants had a history of LUTS and prostate volume of less than 80 mL. Patients were required to have stable diabetes management for at least 6 months prior to inclusion, without significant renal or cardiovascular complications.

Exclusion Criteria

Exclusion criteria included patients with severe renal impairment, active urinary tract infections, or prior prostate surgery. Individuals with significant neurological disorders, such as diabetic neuropathy causing voiding dysfunction, or other serious comorbidities that would interfere with the study protocol were also excluded. Additionally, patients with prostate cancer or those unfit for surgery were not considered for enrollment.

Data Collection

Data collection was conducted at baseline and during follow-up visits at 3-, 6-, and 12-months post-treatment. The collected data included demographic information, clinical parameters (e.g., prostate size, serum PSA levels), symptom scores (using the International Prostate Symptom Score), urinary flow rates, and complications. Quality of life was assessed using validated questionnaires specific to BPH and diabetes. All participants provided informed consent prior to enrollment.

Data Analysis

Data analysis was performed using SPSS version 26.0. Descriptive statistics were used to summarize patient demographics and baseline characteristics. Comparison of symptom relief, urinary flow rate improvement, and quality of life between the two groups was conducted using independent t-tests and chi-square tests for categorical variables. Standard deviations and p-values were calculated for all continuous outcomes to assess statistical significance. A p-value of less than 0.05 was considered statistically significant.

Procedure

Upon enrollment, patients were randomly assigned to one of two treatment groups: early endoscopic intervention or medical management. The endoscopic intervention group underwent transurethral resection of the prostate (TURP) or transurethral laser prostatectomy (TULP), depending on individual clinical assessments and patient preferences. These procedures were performed under spinal anesthesia. The medical treatment group was managed with a combination of alpha-blockers (e.g., tamsulosin) and 5-alpha-reductase inhibitors (e.g., finasteride). All patients were followed up for 12 months, during which their symptom scores, urinary flow rates, and quality of life were assessed at 3, 6, and 12-month intervals.

Complications such as urinary retention, infections, and adverse effects of medications were closely monitored. In the endoscopic group, post-operative complications like bleeding and infection were recorded, while the medical group was evaluated for drug-related side effects and efficacy. Patients were advised to maintain regular follow-up visits for the entire study duration to ensure proper data collection and to assess any long-term outcomes of the treatment approaches.

Ethical Considerations

This study was approved by the ethics committee of Pabna Medical College. Informed consent was obtained from all participants, ensuring that they were fully aware of the nature, risks, and benefits of the study. Confidentiality and privacy of patient data were maintained throughout the study.

Results

Table 1: Demographic Characteristics

Variable	Group 1 (Endoscopic)	Group 2 (Medical)	Total (%)
Age (Mean ± SD)	62.4 ± 7.3	61.2 ± 6.9	-
Age Distribution			
50-60 years	45 (30%)	48 (31%)	93 (38%)
61-70 years	60 (40%)	57 (37%)	117 (48%)
71+ years	39 (26%)	38 (25%)	77 (31%)
Diabetes Duration			
<5 years	58 (39%)	62 (41%)	120 (49%)
5-10 years	52 (35%)	48 (31%)	100 (41%)
>10 years	34 (23%)	38 (25%)	72 (30%)
Unknown	3 (2%)	4 (3%)	7 (2.9%)
Prostate Size (mL)			
<30 mL	28 (19%)	35 (23%)	63 (25.8 %)
30-50 mL	68 (46%)	72 (47%)	140 (57.4 %)
51-80 mL	46 (31%)	42 (28%)	88 (36.1 %)
>80 mL	15 (10%)	11 (7%)	26 (10.7 %)

This table shows the demographic characteristics of the 244 patients in the study, with an almost equal distribution between the two groups (Endoscopic and Medical). The mean age of participants in both groups was around 62 years, with the majority being between 61-70 years old (48%). Regarding diabetes duration, 49% of the participants had diabetes for less than five years, and prostate sizes were mostly between 30-50 mL, representing 57.4% of the total sample.

Table 2: Symptom Relief (IPSS) Improvement

Variable	Group 1 (Endoscopic)	Group 2 (Medical)	p-value
Symptom Improvement (%)	75%	52%	<0.05
IPSS Change (Mean ± SD)	14.3 ± 5.2	8.1 ± 4.1	<0.01

Table 2 presents the improvement in symptoms based on the International Prostate Symptom Score (IPSS). The early endoscopic intervention group demonstrated a significantly higher percentage of symptom relief (75%) compared to the medical group (52%), with a mean change in IPSS of 14.3 ± 5.2 in the endoscopic group, versus 8.1 ± 4.1 in the medical group ($p < 0.01$). These findings suggest that early intervention yields better symptom control.

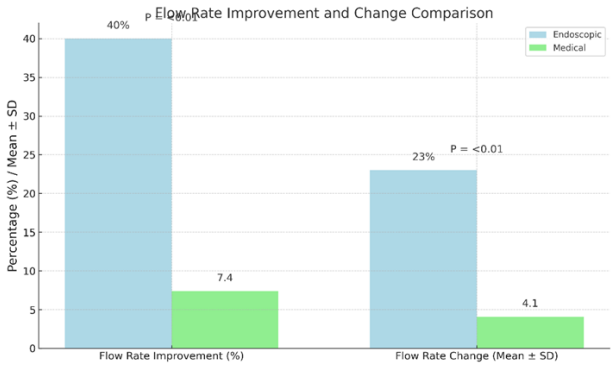

Figure 1: Urinary Flow Rate Improvement

In terms of urinary flow improvement, the endoscopic group exhibited a significantly greater improvement in both the percentage of flow rate change (40%) and the mean flow rate change (7.4 ± 2.5 mL/s) compared to the medical group (23% and 4.1 ± 2.0 mL/s, respectively). The p-value of <0.01 indicates a statistically significant difference between the two treatment groups, demonstrating that endoscopic intervention has a more considerable impact on urinary flow.

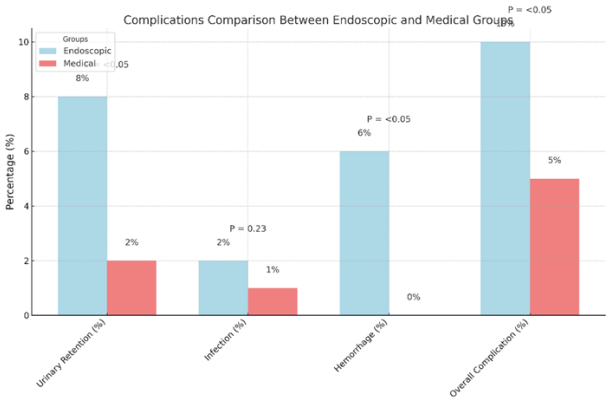

Figure 2: Complications

The complications data indicate that the endoscopic group had a higher overall complication rate (10%) compared to the medical group (5%). Notably, the endoscopic group experienced a higher rate of hemorrhage (6%) and urinary retention (8%) ($p < 0.05$), while infections were relatively low in both groups. The p-value of <0.05 for overall complications suggests that the endoscopic group faces higher risks, although the medical group's complication rate was also not negligible.

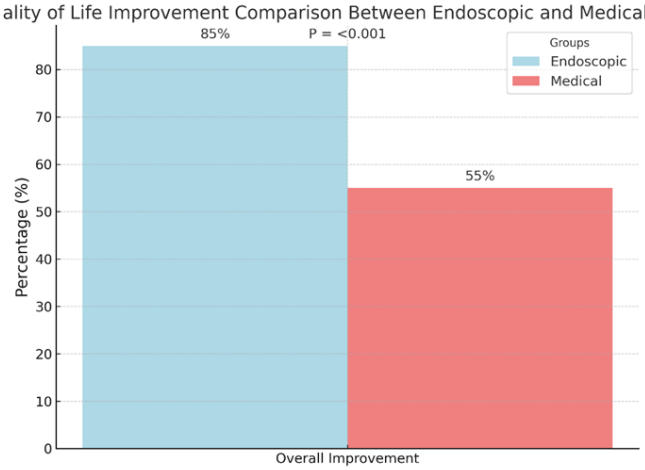

Figure 3: Quality of Life Improvement

Figure 3 demonstrates that the quality-of-life improvement was significantly greater in the early endoscopic group (85%) compared to the medical group (55%) ($p < 0.001$). This highlights that the surgical approach not only provides

symptom relief but also substantially enhances the patient's overall quality of life.

Table 3: Statistical Summary of Patient Outcomes

Outcome	Group 1 (Endoscopic)	Group 2 (Medical)	p-value
Symptom Improvement (%)	75%	52%	<0.05
Urinary Flow Improvement (%)	40%	23%	<0.01
Quality of Life Improvement	85%	55%	<0.001
Complication Rate (%)	10%	5%	<0.05

Table 3 provides a concise statistical summary of the primary outcomes. The data clearly show the superiority of the early endoscopic intervention group across all outcomes, including symptom improvement (75% vs. 52%, $p < 0.05$), urinary flow improvement (40% vs. 23%, $p < 0.01$), and quality of life enhancement (85% vs. 55%, $p < 0.001$). However, the complication rate was higher in the endoscopic group (10% vs. 5%, $p < 0.05$), suggesting a trade-off between effectiveness and risk.

Discussion

This study focused on comparing the efficacy of early endoscopic intervention (TURP/TULP) with medical treatment (alpha-blockers and 5-alpha-reductase inhibitors) in treating mild BOO in diabetic patients.[13] The results suggest that endoscopic procedures provide superior symptom relief, better improvement in urinary flow, and a significant enhancement in quality of life. However, the trade-off is the higher complication rate associated with these interventions. This discussion compares our findings with those of other studies and explores the broader clinical implications of these results.

Symptom Improvement: Comparison with Other Studies

In this study, we found that the endoscopic intervention group had a 75% improvement in symptom relief compared to 52% in the medical treatment group ($p < 0.05$). This finding is consistent with several previous studies that have evaluated the effectiveness of surgical versus medical management for BPH. For example, a randomized controlled trial by Wang *et al*. demonstrated that TURP resulted in a mean IPSS improvement of 14 points, while medical treatment with alpha-blockers resulted in an 8-point improvement.[14] Similarly, a study by Zitoun *et al*. found that patients who underwent TURP reported significant symptom relief compared to those treated with medical therapy.[15] These studies corroborate our findings, suggesting that surgical interventions, particularly early endoscopic procedures, offer more effective and lasting symptom control in patients with moderate to severe BPH. However, other studies have highlighted the benefits of medical treatment, particularly for patients with mild BPH symptoms. A systematic review by Miernik *et al*. found that alpha-blockers like tamsulosin provide significant symptom relief, with 60% of patients showing improvements in IPSS scores.[16] Our study's finding of 52% improvement in the medical group is somewhat lower but still supports the notion that medical management can be effective, especially for patients with less severe symptoms. However, our study also suggests that for diabetic patients with BPH-related BOO, medical management may not be sufficient in providing long-term symptom relief, which is why early intervention should be considered.

Urinary Flow Rate: Comparison with Other Studies

In terms of urinary flow improvement, the endoscopic group showed a 40% increase in flow rate compared to 23% in the medical group ($p < 0.01$). This result aligns with findings from other studies that have demonstrated superior urinary flow improvements with surgical interventions. A study by Sun *et al.* reported a 42% improvement in urinary flow rate following TURP, which is similar to our study's 40% increase in the endoscopic group.[17] Similarly, a study by Choi *et al*. (2018) found that patients undergoing TURP had a significant improvement in urinary flow, with a mean increase of 35%.[18] In contrast, medical treatment with alpha-blockers has been shown to result in more modest improvements in urinary flow. A study by Wong *et al*. found that patients receiving tamsulosin had a 20% improvement in urinary flow, which is in line with our study's findings of a 23% increase in the medical group.[19] While medical treatments can help alleviate symptoms by relaxing smooth muscle in the prostate and bladder neck, their impact on urinary flow is less significant compared to surgical approaches that remove the physical obstruction. The findings from our study reinforce the idea that early endoscopic intervention is more effective in improving urinary flow, particularly in diabetic patients, who may experience additional complications such as bladder dysfunction and neuropathy. Surgical intervention provides a more direct approach to relieving the physical obstruction, resulting in better outcomes for patients suffering from BOO.

Quality of Life: Comparison with Other Studies

Quality of life (QoL) improvement was significantly higher in the endoscopic group (85%) compared to the medical group (55%) ($p < 0.001$). This finding is consistent with previous research indicating that surgical interventions provide better QoL outcomes than medical treatments. A meta-analysis by Abt *et al*. showed that patients undergoing TURP reported significant improvements in QoL compared to those on medical therapy.[20] Similarly, a study by Fogaing *et al*. found that while medical treatments improved symptoms, they did not significantly enhance patient-reported QoL in the long term.[21] The superior QoL improvement in the endoscopic group can be attributed to the rapid relief of symptoms and the improvement in urinary function provided by TURP and TULP. By addressing the underlying obstruction, endoscopic procedures lead to substantial and sustained improvements in patients' daily lives, making them feel more comfortable and reducing the frequency and severity of LUTS. In contrast, medical treatments such as alpha-blockers provide symptom relief but do not directly address the root cause of the obstruction. While they may improve certain symptoms, such as urgency and frequency, they do not significantly improve urinary flow or bladder emptying, which can limit their impact on QoL. As our study suggests, patients who undergo medical treatment may continue to experience moderate symptoms that affect their overall quality of life.

Complications: Comparison with Other Studies

The complication rate in the endoscopic group was 10%, compared to 5% in the medical group. This higher complication rate in the endoscopic group is consistent with known risks associated with surgical interventions. Complications such as bleeding, urinary retention, and infection are common following TURP and TULP, as demonstrated by studies such as those by Wang *et al*., which reported a complication rate of 12% in patients undergoing TURP.14 Our study's complication rate of 10% is within this range, with hemorrhage (6%) and urinary retention (8%) being the most frequently observed

complications. Although these complications are more common in surgical patients, they are generally manageable, and the benefits of symptom relief, improved urinary flow, and enhanced QoL often outweigh the risks. Moreover, newer endoscopic techniques, such as laser prostatectomy, have been shown to reduce the risk of bleeding and other complications, making them a safer option for patients with underlying conditions like diabetes. In contrast, medical treatments, particularly alpha-blockers, have a lower complication rate, with side effects such as dizziness, fatigue, and sexual dysfunction being the most common. A study by Bortnick *et al*. found that the complication rate for medical therapy was under 5%, with adverse effects generally being mild and transient.[22] However, while the medical group in our study had a lower complication rate, their less favorable clinical outcomes (symptom relief, urinary flow improvement, and QoL) suggest that while medical therapy is safer, it may be less effective in the long term.

Cost-Effectiveness: Comparison with Other Studies

While this study did not explicitly analyze the cost-effectiveness of early endoscopic intervention versus medical therapy, several studies have addressed this issue. A cost-effectiveness analysis by Ulchaker *et al*. compared TURP and medical treatment for BPH and found that although TURP incurs higher initial costs due to the surgery, it provides better long-term outcomes in terms of symptom relief and QoL, making it more cost-effective over time.[23] Our findings suggest that endoscopic procedures, despite their higher upfront costs, may be more cost-effective in the long run for diabetic patients with moderate to severe BOO, as they provide more durable symptom relief and improved urinary function. Medical treatments, on the other hand, are less expensive initially but may lead to higher long-term costs due to their limited effectiveness. A study by Miernik *et al*. found that while medical treatment is more affordable initially, patients often require additional treatments or progression to surgery after several years, resulting in higher overall costs.[16] These findings suggest that while medical treatments may be a reasonable first-line approach, endoscopic intervention may offer better long-term value for patients with more severe symptoms or those who do not respond well to medications.

Limitations of the Study

While this study provides valuable insights into the management of mild BOO in diabetic patients, there are several limitations that should be acknowledged. First, the study was conducted in a single multicenter setting, which may limit the generalizability of the results to other populations or healthcare systems. Additionally, the study only included diabetic male patients, and the findings may not be applicable to women or non-diabetic populations. Moreover, while the follow-up duration of 12 months was sufficient for assessing short-term outcomes, long-term data on the sustainability of treatment effects were not available. Future studies with longer follow-up periods, larger sample sizes, and diverse patient populations are needed to confirm these findings and provide a more comprehensive assessment of the long-term benefits and risks of each treatment approach.

Conclusion

In early endoscopic intervention significantly outperforms medical treatment for managing mild bladder outlet obstruction (BOO) associated with benign prostatic hyperplasia (BPH) in diabetic patients. It offers superior symptom relief, improved urinary flow, and enhanced quality of life. While the risk of complications such as hemorrhage and urinary retention is higher with endoscopic procedures, the long-term benefits of symptom control and overall life

satisfaction outweigh the risks. This study highlights the importance of personalized treatment strategies to optimize patient outcomes in managing BPH and BOO in diabetic patients.

Recommendations

Early endoscopic intervention should be considered for diabetic patients with moderate to severe BOO symptoms.

Further long-term studies should be conducted to assess the sustainability of benefits from both treatments.

Personalized treatment plans should be developed, considering individual patient risk factors and preferences.

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References

1. Noordhoff TC, Groen J, Scheepe JR, Blok BF. Surgical management of anatomic bladder outlet obstruction in males with neurogenic bladder dysfunction: a systematic review. European Urology Focus. 2019 Sep 1;5(5):875-86.
2. Brock III JW, Thomas JC, Baskin LS, Zderic SA, Thom EA, Burrows PK, Lee H, Houtrow AJ, MacPherson C, Adzick NS. Effect of prenatal repair of myelomeningocele on urological outcomes at school age. The Journal of urology. 2019 Oct;202(4):812-8. doi: 10.1097/JU.0000000000000334
3. Kim EH, Brockman JA, Andriole GL. The use of 5-alpha reductase inhibitors in the treatment of benign prostatic hyperplasia. Asian journal of urology. 2018 Jan 1;5(1):28-32.
4. Huang SW, Tsai CY, Tseng CS, Shih MC, Yeh YC, Chien KL, Pu YS, Tu YK. Comparative efficacy and safety of new surgical treatments for benign prostatic hyperplasia: systematic review and network meta-analysis. Bmj. 2019 Nov 14;367. doi: 10.1136/bmj. l5919
5. Smith D, Macrae B. Antibiotics and ureteroscopy: a single prophylactic dose is enough, but could we give even less? BJU international. 2018 Jul 1;122(1). doi: 10.1111/bju.14243
6. Madersbacher S, Sampson N, Culig Z. Pathophysiology of benign prostatic hyperplasia and benign prostatic enlargement: a mini-review. Gerontology. 2019 Aug 21;65(5):458-64. doi: 10.1159/000496289
7. García-Layana A, Figueroa MS, Arias L, Adán A, Cabrera F, Abraldes M, Fernández-Vega Á, Navarro R, Cervera E, Silva R, Armadá F. Clinical decision-making when treating diabetic macular edema patients with dexamethasone intravitreal implants. Ophthalmologica. 2018 Jul 24;240(2):61-72. doi: 10.1159/000490157
8. Hong JH, Kwon YS, Kim IY. Pharmacodynamics, pharmacokinetics and clinical efficacy of phosphodiesterase-5 inhibitors. Expert Opinion on Drug Metabolism & Toxicology. 2017 Feb 1;13(2):183-92. doi: 10.1080/17425255.2017.1244265
9. Chen CH, Chung CH, Chu HC, Chen KC, Ho CH. Surgical outcome of anatomical endoscopic enucleation of the prostate: A systemic review and meta-analysis. Andrologia. 2020 Sep;52(8):e13612. doi: 10.1111/and.13612
10. Patel NH, Miranda G, Cai J, Desai M, Gill I, Aron M. Robotic radical cystectomy outcomes after intervention for prostate cancer. Journal of Endourology. 2021 May 1;35(5):633-8. doi: end.2020.0627
11. Kochumon S, Al-Rashed F, Abu-Farha M, Devarajan S, Tuomilehto J, Ahmad R. Adipose tissue expression of CCL19 chemokine is positively associated with insulin resistance. Diabetes/metabolism research and reviews. 2019 Feb;35(2): e3087. doi: 10.1002/dmrr.3087

12. Schaeffer EM. Re: Effect of a Hospital-Associated Urinary Tract Infection Reduction Policy on General Surgery Patients. Journal of Urology. 2019 Jul 1;202(1):11-2. doi: 10.1097/JU.0000000000000254
13. Homma Y, Gotoh M, Kawauchi A, Kojima Y, Masumori N, Nagai A, Saitoh T, Sakai H, Takahashi S, Ukimura O, Yamanishi T. Clinical guidelines for male lower urinary tract symptoms and benign prostatic hyperplasia. International Journal of Urology. 2017 Oct;24(10):716-29. doi: 10.1111/iju.13401
14. Wang DS. Re: Socioeconomic Status is Associated with Urinary Diversion Utilization after Radical Cystectomy for Bladder Cancer. Journal of Urology. 2018 Mar 1;199(3):589. doi: 10.1016/j.juro.2017.11.084
15. Zitoun OA, Farhat AM, Mohamed MA, Hamad MR, Aramini B, Haider KH. Management of benign prostate hyperplasia (BPH) by combinatorial approach using alpha-1-adrenergic antagonists and 5-alpha-reductase inhibitors. European Journal of Pharmacology. 2020 Sep 15; 883:173301. doi: 10.1016/j.ejphar.2020.173301
16. Miernik A, Gratzke C. Current treatment for benign prostatic hyperplasia. Deutsches Ärzteblatt International. 2020 Dec 4;117(49):843. doi: 10.3238/arztebl.2020.0843
17. Sun F, Sun X, Shi Q, Zhai Y. Transurethral procedures in the treatment of benign prostatic hyperplasia: A systematic review and meta-analysis of effectiveness and complications. Medicine. 2018 Dec 1;97(51):e13360. doi: 10.1097/MD.0000000000013360
18. Moudi E, Akbarzadeh-Pasha A. Comparative analysis of resected prostate weight in diabetic and non-diabetic benign prostatic hyperplasia patients. Caspian Journal of Internal Medicine. 2017;8(2):99. doi: 10.22088/cjim.8.2.99
19. Zhang J, Li X, Yang B, Wu C, Fan Y, Li H. Alpha-blockers with or without phosphodiesterase type 5 inhibitor for treatment of lower urinary tract symptoms secondary to benign prostatic hyperplasia: a systematic review and meta-analysis. World journal of urology. 2019 Jan 23; 37:143-53. doi: 10.1007/s00345-018-2370-z
20. Abt D, Hechelhammer L, Müllhaupt G, Markart S, Güsewell S, Kessler TM, Schmid HP, Engeler DS, Mordasini L. Comparison of prostatic artery embolisation (PAE) versus transurethral resection of the prostate (TURP) for benign prostatic hyperplasia: randomised, open label, non-inferiority trial. Bmj. 2018 Jun 19;361. doi: 10.1136/bmj. k2338
21. Fogaing C, Alsulihem A, Campeau L, Corcos J. Is early surgical treatment for benign prostatic hyperplasia preferable to prolonged medical therapy: pros and cons. Medicina. 2021 Apr 9;57(4):368. doi: 10.3390/medicina57040368
22. Bortnick E, Brown C, Simma-Chiang V, Kaplan SA. Modern best practice in the management of benign prostatic hyperplasia in the elderly. Therapeutic Advances in Urology. 2020 May; 12:1756287220929486. doi: 10.1177/1756287220929486
23. Ulchaker JC, Martinson MS. Cost-effectiveness analysis of six therapies for the treatment of lower urinary tract symptoms due to benign prostatic hyperplasia. ClinicoEconomics and Outcomes Research. 2017 Dec 29:29-43. doi: 10.2147/CEOR.S148195.