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# Effect of Silodosin versus Tamsulosin in the Treatment of Lower Urinary Tract Symptoms Associated with Benign Prostatic Hyperplasia: Review Article

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## ABSTRACT

**Background:** In this research, the efficacy of silodosin as well as tamsulosin in treating lower urinary tract symptoms (LUTS) caused by benign prostatic hyperplasia (BPH). LUTS is a big clinical problem for men with BPH, the most frequent progressing illness in older men. BPH has a considerable influence on quality of life. The impacts of growth factors, estrogens, and androgens on prostate enlargement and the onset of symptoms are the primary foci of this investigation into the pathophysiology of BPH. Two regularly used drugs include tamsulosin, a selective α1A & α1D-blocker and silodosin, a highly selective α1A-adrenergic receptor antagonist. The smooth muscles in the prostate in addition to bladder neck are relaxed by the combined action of the two drugs, which helps to reduce pain and increase urine flow. However, silodosin's higher selectivity for the α1A receptor offers the advantage of fewer cardiovascular side effects, making it particularly suitable for patients with cardiovascular comorbidities. **Objective:** This review article aimed to assess the efficiency of silodosin and tamsulosin in the treatment of LUTS that are linked to BPH. **Methods:** We searched Google Scholar, Science Direct, PubMed and other online databases for LUTS, BPH, Silodosin and Tamsulosin. The authors also reviewed references from pertinent literature, however only the most recent or comprehensive studies from 1983 to 2011 were included. Documents in languages other than English were disqualified due to lack of translation-related sources. Papers such as unpublished manuscripts, oral presentations, conference abstracts, and dissertations that were not part of larger scientific studies were excluded. **Conclusion:** The study assessed clinical outcomes such as symptom relief, post-void residual volume reduction, and adverse events. Results indicated that both medications effectively alleviate LUTS, but silodosin demonstrated a better safety profile concerning cardiovascular effects. Common side effects involved dizziness, nasal congestion, and retrograde ejaculation, with silodosin showing a lower incidence of hypotension contrasted with tamsulosin. In conclusion, while both silodosin and tamsulosin are effective in managing LUTS associated with BPH, silodosin's superior selectivity and lower risk of cardiovascular complications make it a preferred option for certain patient populations. Tailoring treatment based on individual patient profiles can enhance therapeutic outcomes and quality of life.

**Keywords**: LUTS; BPH; Silodosin; Tamsulosin.

## INTRODUCTION

BPH is the most prevalent progressive disorder in males and has a strong relationship with the individual's age. It often presents after the age of forty and affects over ninety percent of males over 85 years old. Pharmacological management of LUTs in BPH is predominantly achieved through the use of α-blockers and 5-α reductase inhibitors. The preferable therapy, as recommended by all international guidelines, is undeniable: α-blockers. In a study conducted in 19 European countries, a total of 11.6 million prescriptions were written, with 11% to 41% of them being for α-blockers. The percentage of prescriptions for 5-α reductase inhibitors varied across countries, ranging from 2% to 20% [(1)].

Therefore, the objective of this research was to assess the efficiency of silodosin and tamsulosin in the treatment of LUTS that are linked to BPH.

### Anatomical consideration of prostate:

Ejaculation relies on the generation of prostatic fluid by the prostate, an organ in the male reproductive system. This fluid is crucial for the transportation of sperm. Located directly below the bladder's base, the apex is on the underside and the base is on top. With an anterior, posterior, and lateral surface, a typical adult prostate is three centimeters long, four centimeters wide, and two centimeters deep, like a pyramid. It weighs 22 g [(2)].


**Figure (1):** Sagittal section through male genital system and bladder [(2)].

### Microscopic anatomy:

Clinical features of the prostate include a palpable central sulcus between the two lateral lobes and a middle lobe that, in instances of benign prostatic hyperplasia, can extend into the bladder. The histological description of these lobes in a normal prostate is impossible, however they are typically associated with pathologic enlargement of the prostate. The peripheral zone, central zone, transition zone, as well as periurethral gland region are the four distinct regions into which the glandular prostate is divided. The thra and/or the ejaculatory ducts define or center each of these four distinct regions (Figure 2) [(3)].



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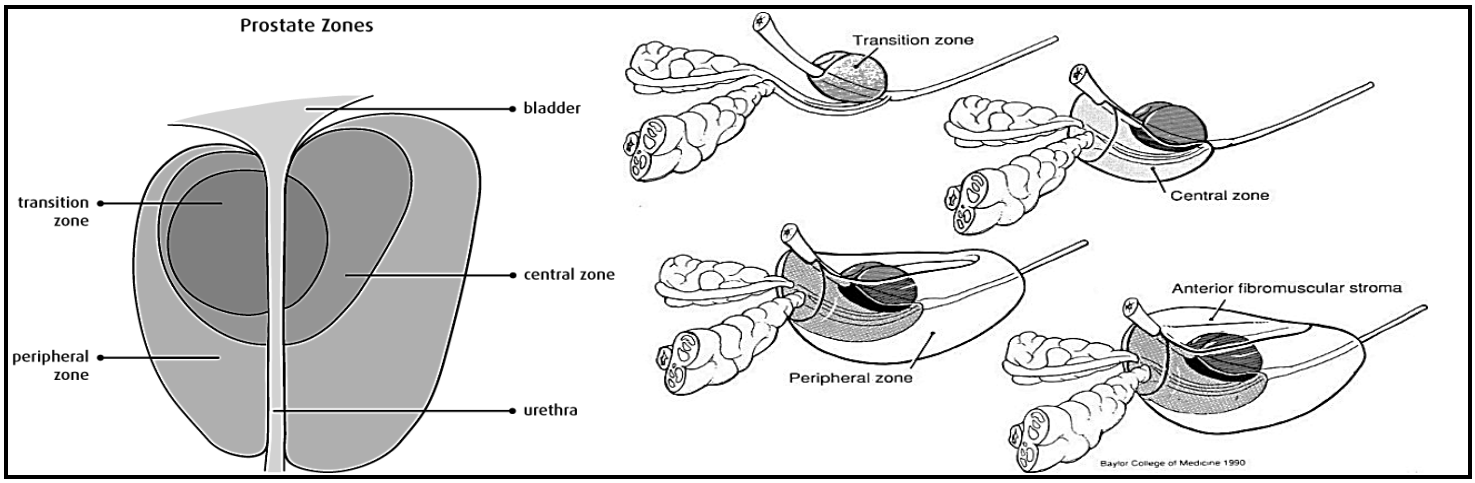


**Figure (2):** Prostate zonal anatomy: The urethra is encompassed by the transition zone next to the ejaculatory ducts. The central zone, located under the bladder base, encircles the ejaculatory channels. A significant portion of the apical, posterior & lateral portions of the prostate are comprised of the peripheral zone at the prostate. From the neck of the bladder to the striated urethral sphincter, the anterior fibromuscular stroma **(**AFMS) is the tissue that spreads across the body [(3)].

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**Anterior fibromuscular stroma (AFMS):**

The AFMS comprises approximately 25% of the prostate volume, the non-glandular tissue of the prostate being almost exclusively composed of it. The prostate's anterior surface is concealed from anterior view by a dense layer of tissue that envelops it. The prostate's glandular parts and urethra are hidden by this. Its primary component is smooth muscle, and it attaches to the anterior bladder wall's detrusor fibers [(4)].

**Arterial supply:**

The internal iliac system includes the hypogastric artery and its branch and the inferior vesical artery, which are major arteries that provide blood to the prostate. From the inferior vesical artery, two main arterial branches are created to nourish the prostate. There are two main branches that originate from the prostate: the urethral artery and the capsular artery [(5)] (Figure 3).

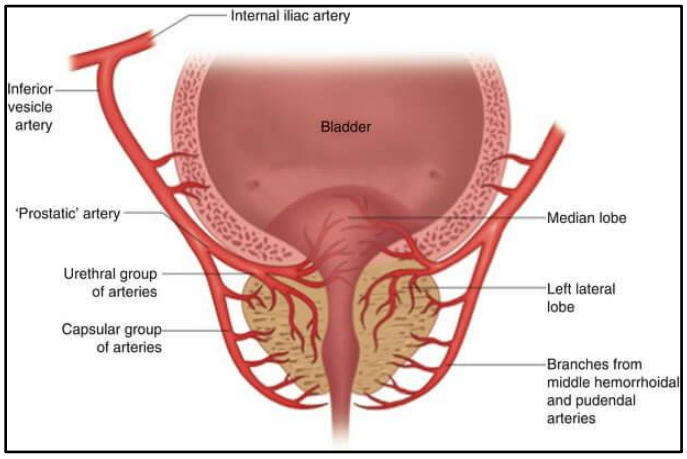


**Figure (3):** Prostate arterial supply [(5)].

**Venous drainage:**

The prostatic venous plexus, which is situated between the lateral prostatic fascia and the true fibrous capsule of the prostate, is responsible for venous drainage. It is a component of the dorsal venous complex (Santorini plexus) that extends along the puboprostatic ligaments. The dorsal venous complex ultimately discharges into the internal iliac vein [(6)].

**Lymphatic drainage:**

There is a wide-meshed subcapsular plexus and a rich lymphatic plexus that envelops the prostate organ. The periprostatic subcapsular network is the conduit through which the prostate lymphatics drain. This system gives rise to three separate sets of ducts: The anterior duct, which leaves the cranial gland and goes to the outside iliac nodes, the posterior duct that leaves the caudal gland and goes to the outside and sub-aortic sacral nodes of the promontory and the lateral duct, which leaves the hypogastric nodes [(6)].

**Nerves supply:**

The pelvic plexus is situated posterior and lateral to the apex of the seminal vesicle and is composed of the sympathetic thoracolumbar fibers (T10-¬L2) and the parasympathetic visceral efferent preganglionic sacral fibers (S2-S4), which are transmitted through the presacral and hypogastric neural plexuses [(6)].

**Benign prostatic hyperplasia**

**Definition:** One of the pathologic processes that can lead to LUTS in older men is prostate enlargement, which is also called BPH. The enlargement of the prostate is a benign condition. The histological hallmark of BPH is an

enlargement of stromal and epithelial cells in the prostate's periurethral area. It is only during fetal development that new epithelial organs are usually seen [7].

**The role of androgens:**

The presence of testicular androgens during the formation of the prostate, puberty, and aging is essential for the development of BPH, however androgens themselves do not cause BPH. Patients with hereditary disorders that limit androgen production or activity, or those who have been castrated before puberty, are not prone to benign prostatic hyperplasia (BPH). To produce dihydrotestosterone (DHT), the principal androgen in the prostate, the nuclear membrane-bound enzyme steroid 5α-reductase transforms testosterone hormone [8].

**Role of estrogens:**

The function of estrogens in the etiology of BPH is still unclear. Intraprostatic estrogen levels are elevated in males with benign prostatic hyperplasia, while serum estrogen concentrations rise in men as they age. Patients with greater volumes of BPH generally demonstrate increased estradiol levels in their peripheral circulation. In human BPH, the concentrations of classic high-affinity estrogen receptors are relatively low; however, there may be an adequate quantity to induce biologic activity [9].

**Regulation of Programmed Cell Death:**

Apoptosis, or programmed cell suicide, is a physiological mechanism that is indispensable for the preservation of normal glandular homeostasis **[10]** .

**Stromal-epithelial interaction:**

Substantial evidence indicates that the proliferation of epithelial cells is partially controlled by stromal cell excretory proteins, namely the extracellular matrix. Consequently, BPH may stem from a dysfunction in a stromal component that ordinarily suppresses cell proliferation, leading to the absence of a standard inhibitory mechanism for proliferation. Simultaneously, this anomaly may induce stromal cell proliferation through an autocrine mechanism [7].

**Growth factors:**

Growth factors are small peptide compounds that can stimulate or inhibit the processes of cellular proliferation and differentiation. Growth factors can stimulate or repress these processes. For the purpose of inducing BPH, the balance among cell proliferation and cell death may be disturbed as a result of interactions among growth factors and steroid hormones [10].

**Genetic and Familial Factors:**

Evidence indicates that benign prostatic hyperplasia is attributable to a heritable genetic component exhibiting an autosomal dominant inheritance pattern. In roughly 50% of males under 60 who undergo prostatectomy for benign prostatic hyperplasia, the condition is attributable to an inheritable variant of the illness. On the contrary, when it comes to males over the age of sixty who have a prostatectomy for BPH, around nine percent blame family risk. The concordance rate of BPH is greater in monozygotic twins than it is in dizygotic twins [10].

**Alpha adrenergic receptors (α-AR):**

Pharmaceutical drugs targeting adrenergic receptors (ARs) are commonly utilized in clinical practice. In order to effectively treat illnesses involving angina, hypertension, congestive heart failure, LUTS caused by benign prostatic obstruction (BPO), acute and chronic pain, adverse responses to anesthesia, and asthma, it is crucial to modulate ARs [11] .

**Types of receptors in bladder, urethra and prostate (Figure 4):**

α1-adrenoceptors exhibit little expression and of limited functional significance in the detrusor muscle. Bladder outlet resistance is increased, particularly in older men with bigger prostates, due to the increased expression of the α1A subtype of α1-adrenoceptors, which helps constrict the bladder neck, urethra, and prostate. To alleviate symptoms of benign prostatic hyperplasia, α1-Adrenoceptor agonists are necessary; however, the receptors located within and outside of the prostate may aid their therapeutic effects. The bladder, urethra, and prostate contain α2-Adrenoceptors, particularly the α2A subtype. In certain animals (not humans), they help restrict neurotransmitter release before the junction and provide the urethra a little contractile force. Their whole role in the lower urinary tract after the junction is mainly unknown. The presence of β-adrenoceptors allows the smooth muscles of the prostate, urethra, and bladder to relax. It is currently difficult to distinguish between different receptor subtypes based on their protein and functional characteristics using the available approaches. However, it is evident that the β3- and β2-subtypes play significant roles in the human bladder as well as urethra, correspondingly. In addition, β3-adrenoceptor agonists are among the possible drug choices for overactive bladder control. The bladder primarily contains M1, M2 (80%), and M3 (20%) cholinergic receptor classes, but only M3 cholinergic receptors are responsible for the parasympathetic detrusor contraction (muscarinic receptors). The bladder's M3 receptors are primarily located in smooth muscles and glands (Figure 4) [12].

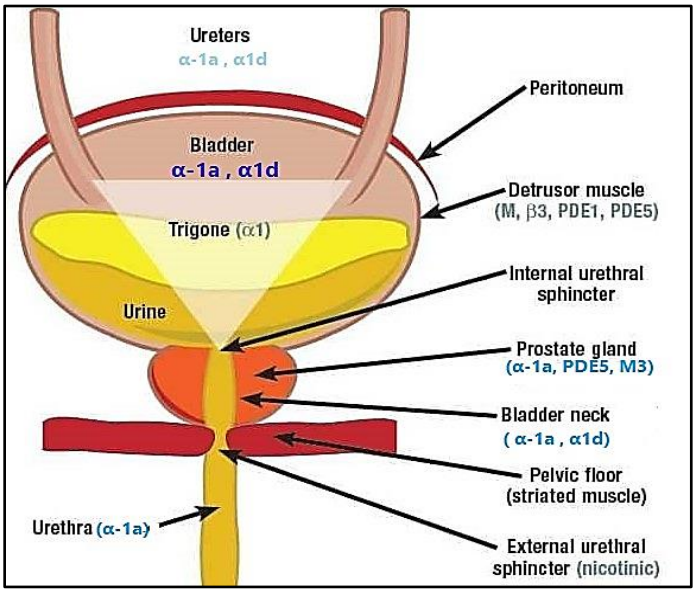


**Figure (4):** Distribution of alpha receptors in the urinary bladder, urethra and prostate [12].

**Pathophysiology of BPH:**

Benign prostatic hyperplasia refers to an enlarged prostate, characterized by aberrant proliferation of prostate cells, or voiding dysfunction resulting from an obstruction of the bladder outlet owing to prostate enlargement. Histological examination of BPH demonstrates heightened cell proliferation in both the stromal and epithelial layers of the prostate. The prostate transition zone and periurethral regions are locations of benign prostatic hyperplasia [13].

**Assessment of male LUTS /BPH:**

LUTS associated with BPH are among the most prevalent complaints among older males. Age and the prevalence of LUTS are correlated, with estimates varying based on the definitions and cohorts examined**.**

**Diagnostic tests for BPH are classified into 2 categories**

**Medical history:**

Additional measures should be implemented to verify that there are alternative causes of LUTS beyond BPH. The recommendations for male LUTS or BPH show how important it is to evaluate the patient's medical history. Potential causes of LUTS and other related medical disorders (such as renal illness, diabetes mellitus or insipidus, heart failure, and other neurological diseases) can be identified by a focused medical history [14].

**Symptom scores:**

In the last 20 years, symptom ratings have established as the gold standard for evaluating male LUTS. The use of symptom score questionnaires that have been validated is supported by the current recommendations for male LUTS and/or BPH. Approximately fifteen when it comes to tracking therapy progress and changes in symptoms, every single one of the existing surveys is quite sensitive [15].

**Physical examination:**

The digital rectal examination (DRE) and neurological examination are critical components of the BPH assessment process. The physical examination of patients with BPH is considered the cornerstone by DRE. DRE provides valuable information regarding the prostate's size, consistency, and anatomy [16].

**Prostate-specific antigen (PSA):**

Individuals who have BPH seldom have serum PSA readings that are higher than 4 ng/mL. Among the 696 individuals who were diagnosed with BPH, fifty percent of the participants had a PSA level that was higher than four ng/mL [17] .

**Creatinine measurement:**

The assessment of upper urinary tract function is the minimum requirement. The reason for this is that BPH has the potential to result in hydroureteronephrosis and renal failure, despite the fact that the risk has been exaggerated in the past [18].

**Urine analysis:**

There is a significant incidence of UTI/LUTS, which becomes worse when there is a UTI, in accordance with numerous criteria for the initial examination of those with LUTS, which is a sign of BPH [19].

**Uroflowmetry (Q max):**

A non-invasive urodynamic test that evaluates the lower urinary tract's outlet function and the bladder is the urine flow rate evaluation. Qmax, or maximal urine flow rate, and flow pattern are important factors. You should empty a minimum of 150 ml of urine [20].

**Post-void residual urine:**

Normal post-void residual urine is less than 50 ml and can be quantified through pelvi-abdominal ultrasound or catheterization. Obstruction or detrusor underactivity may induce elevated post-void residual urine volumes. The prediction of patients at risk of acute urine retention (AUR) may be facilitated by the surveillance of changes in post-void residual urine. This is a critical aspect of the management of patients who are prescribed anticholinergic medications [21].

**Pressure-flow study:**

Urodynamics evaluation by Pressure-Flow studies (PFS) is useful if there is a plan for an invasive treatment or if surgical treatment has failed. PFS are the primary objective and basis for detecting bladder outlet obstruction (BOO). During voiding, BOO involves a decrease in urinary flow rate and an increase in detrusor

pressure. Detrusor underactivity, which is defined as a decreased urinary flow rate in conjunction with an attenuated detrusor pressure during voiding, must be distinguished from BOO/BPO [18].

**Treatment of BPH**

***Watchful waiting:***

Watchful waiting is an acceptable treatment for men with mild to moderate symptoms of benign prostatic hyperplasia and for men with moderate to severe symptoms who have not yet experienced medical consequences as a result of their condition. Behavioral strategies, including the avoidance of caffeinated or carbonated beverages, the reduction of alcohol intake, and the reduction of evening fluid intake, may be beneficial for the relief of symptoms. At different intervals, patients are subjectively evaluated using a symptom score and a measure of distress [22].

***Medical treatment:***

The two basic categories of drugs that are utilized for the treatment of benign prostatic hyperplasia are α-adrenergic receptor blockers, which encompass doxazosin, terazosin, alfuzosin, & tamsulosin, and 5-α reductase inhibitors, which encompass finasteride and dutasteride that are used to treat the condition. When it comes to the smooth muscles of the prostate, as well as the prostatic urethra and the bladder neck, blockers of α-adrenergic receptors have the potential to relax them [23].

***Surgical treatment***

**Minimally invasive therapy:**

Heat and destruction of prostate tissue surrounding the prostatic urethra is the goal of minimally invasive treatment for BPH. Theoretically, a decrease in bladder outlet blockage and clinical relief in LUTS result from the regression or shedding of this tissue [24].

**Transurethral microwave therapy:**

A urethral catheter is used to administer heat to the prostate during transurethral microwave therapy (TUMT). To prevent harm to these structures, it is common to perform simultaneous chilling of the rectal and urethral surfaces [25].

**Transurethral needle ablation:**

Transurethral needle ablation (TUNA) is a clinical procedure that involves the heating of prostatic tissue using radiofrequency (RF) radiation. At the apex of a TUNA device, two 18-gauge needles are used to administer the RF energy. The appearance of this device is reminiscent of a rigid cystoscope [24].

**Surgery**

**Transurethral resection procedure (TURP):**

Due to its proven long-term effectiveness in clinical studies, TURP has become the surgical therapy of choice for BPH. The TURP begins with the insertion of a working sheath into the urethra. After that, the working element with the electrified loop is inserted via this sheath to cut the prostate and cauterize the bleeding area. According to the AUA guidelines, after more than a decade of treatment, symptom ratings can be lowered by around 15 points with TURP. Over the course of sixteen months following surgery, there was an 8 ml/s average change in urine flow rates [24].

**Open prostatectomy:**

Patients whose prostates are extremely big (> 90 $cm^3$) are the target audience for this procedure. Complete excision of the prostate adenoma under direct view is one of the advantages of open prostatectomy. Another advantage is the lack of the threat of TURP syndrome. Under either spinal or general anesthesia, an open prostatectomy can be done using either a retropubic or suprapubic technique [26].

***Laser procedures:***

The components that are intended to be performed by this intervention are the coagulation of prostate tissue, the vaporization of prostate tissue, and the removal of prostate tissue.

**Laser vaporization of the prostate:**

As long as a right-angle laser fiber is utilized, it is possible to perform transurethral laser ablation of the prostate using either holmium or potassium-titanyl-phosphate (KTP) lasers. For the purpose of carrying out the procedure, either spinal or general anesthesia could be applied [27].

**Ethical considerations:** All the procedures of the research were permitted by The Ethics Committee of Faculty of Medicine, Urology Department, Suez Canal University. Administrative consents required have been taken. The objective of this research was to conduct research on humans in accordance with the Declaration of Helsinki, the ethical norm established by the World Medical Association.

**DECLARATIONS**

**Consent for publication:** Each author has granted permission for the work to be submitted.

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**Availability of data and material:** Available

**Conflicts of interest:** None

**Competing interests:** None.

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