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## AGING AND PROSTATE HEALTH: AN ULTRASONIC EXPLORATION OF URETHRAL CHANGES IN BENIGN PROSTATIC HYPERPLASIA

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## ABSTRACT

**Background**: BPH, also known as benign prostatic hypertrophy, is a pathological disorder characterized by the uncontrolled growth of the prostate's cellular components. Sonographic Evaluation of Prostate Size and its Correlation with Age and post micturition residual volume (PMRV) in Patients with Benign Prostatic Hyperplasia Benign prostatic hyperplasia is a common health problem affecting men older than 50 years.

**Objective:** To determine the frequency of prostatic urethral changes in benign prostate hyperplasia patients and to evaluate the association between benign prostate hyperplasia with age.

**Methodology:** This study was approved by the Clinical Research Ethics Committee of Institute of Paramedical Sciences, Khyber Medical University, and Peshawar. Cross sectional descriptive study conducted at DHQ Hospital Batkhela district Malakand KPK using non-probability convenient Sampling techniques. The study included all the patients referred to ultrasound scan with lower urinary tract symptoms (LUTS). After informed consent data was collected through pre- structured questionnaire proforma and analyzed on SPSS version 20.

**Results:** Sample size calculated is 188 using 95% confidence level and 5% level of significance. There is significant Correlation between prostate sizes with age that is Prostate size tends to increase with age. The most common age group was 60–69 years, accounting for 28% of the cases and most frequently observed prostate gland size ranged between 30 g to 39 g, seen in 42.0% of the cases.

**Conclusion**: prostate size increase with increase in age and their no correlation between post void residual volume and prostate size.

#### **INTRODUCTION**

Benign prostatic hyperplasia (BPH) is an increase in the size of prostate gland. (1). The prostate gland is a small organ located before the rectum and below the bladder. Its main job is to discharge an alkaline substance that makes up 70% of the seminal volume and lubricates and feeds the sperm. There were 94 million BPH cases reported globally in 2019, up to 51.1 million cases in 2000. This shows that 70.5% get (2). More people worldwide suffer from BPH than from all other male genitourinary illnesses put together. The prevalence of BPH ranges from 22.8 to 29.6% across an individual's lifespan.(1). Benign Prostatic Hyperplasia is considered the frequent reason of lower urinary tract symptoms in men aged 40 years and older. (Daher and others, 2023). Fifteen to sixty percent of males over forty suffer from LUTS, a group of persistent urinary diseases. Frequency, urgency, nocturia, trouble starting to urinate, feeling that the bladder is not completely emptying, decreased stream force, and stream interruption are some of the specific symptoms linked to the LUTS complex. BPH is the most frequent cause of male LUTS. In the past, BPH was the standard definition and cause of persistent urine problems in elderly men. BPH is a challenging outcome measure for population studies for at least two reasons. First, there are numerous definitions of BPH, such as histologic examination of prostate tissue, radiographic measurements of prostate enlargement, decreased urine flow rates, history of prostate noncancerous surgery, BPH identified by a physician, and urinary symptoms. It is challenging to validate BPH across study populations due to heterogeneity in its definition. Second, BPH rules out detrusor instability and interstitial cystitis as additional possible causes of urinary symptoms in older men.(3) Bladder outlet obstruction (BOO) is caused by the prostate physically compressing the urethra due to the growth of stromal and prostatic epithelial cells. Additionally, this resulted in Lower Urinary Tract symptoms (LUTS), which include urge incontinence and frequency as well as signs of irritable or obstructive voiding (hesitancy, straining, thin stream, sense of incomplete emptying)(4). Based on our research, we deduce that BPH is linked to anatomical changes in the posterior urethra, including greater posterior urethral elevation, as indicated by a rise in the posterior urethral angle (PUA), and lengthening of the posterior urethra. Postvoid residual urine volume rises, PUA falls, prostatic volume falls, the posterior urethra shortens, and uroflowmetric parameters improve following TURP(5) . Prostate malignancy is the commonest cancer in men and the second-leading cause of death in men after lung cancer. At early stages, prostatic cancer is usually asymptomatic and late diagnosis is common and it is associated with high morbidity and mortality. One of the

tests that has always been used for early detection and screening of prostate cancer is measuring the serum level of PSA, which despite all the limitations of its sensitivity and specificity, is the most commonly used method along with the physical examination(6). BPH involves two primary phases of progression, pathological and clinical. The pathological phase of BPH is subdivided into microscopic BPH. and macroscopic Microscopic BPH includes enhanced proliferation/hyperplasia of either epithelial or stromal cells that may lead to abnormal enlargement of the prostate gland (i.e. macroscopic BPH). Normal prostatic glands contain a luminal epithelial layer surrounded by a monolayer of basal cells, while pseudostratification leading to two or more layers of basal nuclei causing a papillary-like configuration is evident in microscopic BPH. If macroscopic BPH develops, a subset of men with enlarged prostates will present with symptomatic dysuria, resulting in the clinical phase of BPH(2). Benign prostatic hyperplasia gets worse with age. Ten percent of men in their 30s, twenty percent in their 40s, fifty to sixty percent in their 60s, and eighty to ninety percent in their 70s and beyond are affected by the condition. An enlarged prostate is thought to affect 64% of men between the ages of 40 and 70(7). According to the report, most BPH patients were between the ages of 60 and 70. Additionally, the histological prevalence of BPH is 10% in men aged 30 to 40, 20% in men aged 40 to 60, and 80% to 90% in men aged 70 and 80(Dahiya and Dharmarajan 2023). Numerous risk factors, including metabolic syndrome, obesity, inflammation, sex hormone levels, and others, have been found to increase the prevalence of BPH(4).Bladder calculi, renal failure, infection, incontinence, retention, and hematuria are among the side effects of BPH (8). PSA levels, prostate region ultrasonography (USG), and symptoms are the main tests utilized to make the diagnosis. The American Urological Association (AUA) scale's International Prostate Symptom Score (IPSS) is mostly used for symptom diagnosis and scoring. Additional diagnostic methods include urine culture testing, digital rectal examination, prostate magnetic resonance imaging, uroflowmetry, cystoscopy, and others. One study found that the accuracy rate of trans abdominal ultrasonography for benign lesions was 91.66%(9). Medical combination therapy (CT), minimally invasive surgical therapies (MISTs), and invasive surgical procedures are among the available therapeutic options for men with moderate-to-severe LUTS-BPH (10) In the past, TURP has been the gold standard for treating BPH, and it has helped patients achieve clinical improvements in their LUTS. The main disadvantage of TURP is that it might lead to problems, particularly sexual dysfunction and bleeding(11). One of the urological conditions that affect older men the most frequently is

benign prostatic hyperplasia (BPH). For BPH, transurethral resection of the prostate (TURP) has become the gold standard surgical technique. [1, 3] Open prostatectomy (OP) is the surgical option for larger glands, while TURP is the standard surgical procedure for small and medium-sized prostates (80–100 g) that are not responsive to medication.(12)

**Materials and Methods:** This descriptive cross-sectional study was conducted at the Radiology Department of DHQ Hospital Batkhela, KPK. Ethical approval was obtained from Khyber Medical University and the hospital's ethics committee. A total of 185 male patients aged 20–90 years presenting with LUTS suggestive of BPH were included using non-probability convenience sampling. Patients with a history of prostatectomy, catheterization, or neurological disorders were excluded. Data were collected using a semi-structured questionnaire covering informed consent, demographics, clinical symptoms, and sonographic findings. Transabdominal ultrasound (Mindray system) was used to assess prostate size and related parameters. Data were analyzed using SPSS version 20. Descriptive statistics and Chi-square tests were applied to evaluate associations, particularly between age and prostate size.

**Results:** A total of 188 males aged 20–90 years participated, mostly in the 60–69 age group as shown in figure: 1. Key urinary symptoms included: 59% reported incomplete bladder emptying as shown in figure:2, 43.6% had a weak urine stream, 69.1% had dysuria, 21.8% experienced hematuria, and 21.3% reported painful urination. Most could postpone urination (63.8%) and had a normal urine stream (51.1%) as shown in table: 1.



Fig: 1: Age category of the participant

#### sensation of not emptying your bladder?



Figure: 2. Sensation of not emptying bladder

Variables		Frequency
Sensation of not	YES	111
emptying UB	NO	76
Frequency Of	Up to 3 times	92
urine In 2 hours	3-6 times	76
	>6 times	20
Urine postpone	Cannot postpone	16
	Postpone for few Minutes	51
	Properly Postpone	120
	Sometimes cannot postpone	82
Urine stream	Sometimes few stream	82
	Normal stream	96
	Sometimes weak stream	9
Burning and	Burning	130
itching	itching	1
sensation	Both Burning and	8
	itching	
	none	49
Hematuria	YES	41
	NO	144
	Sometimes	1
Painful	During urination	40
urination	After urination	5
	None	142

#### **Tabel.1: characteristic of participants**

Ultrasound assessment showed that most participants (52.1%) had a pre-void urinary bladder volume between 50–150ml, while 38.3% had volumes between 150–500ml. The majority had prostate sizes between 30–39gm (40%), followed by 40–49gm (23.9%), indicating a high prevalence of prostate enlargement. Regarding prostatic urethral diameter, 85.6% of participants had a normal 4mm diameter, while 13.8% had a diameter less than 4mm. Bladder wall thickness was normal (3mm) in 91.5% of participants, with only 8.5% showing thickening. Post-void residual volume was completely empty in 60.1% of cases, and 17% had less than 50ml residual urine, suggesting that most participants could effectively empty their bladder despite prostate enlargement as shown in tabel.2. Correlation of prostate size with age shows moderate increase in prostate size with an increase in age ( $x^2 = 84.4$  p value =0.000) which show significant correlation shown in table.3

S.NO	variables	Column1	Frequency	percentage
1	Pre-void	0 ml	10	5.3
		<50ml	6	3.2
		50-150ml	98	52.1
		150-500	72	38.3
2	Prostate size	20-29gm	38	20.2
		30-39gm	79	42
		40-49gm	45	23.9
		50-59gm	12	6.4
		60-69gm	8	4.3
		70-79gm	4	2.1
		80-89gm	1	0.5
		90+gm	1	0.5
3	Prostatic urethral diameter	4mm	161	85.6
		<4mm	26	13.8
4	UB wall thickness	3mm	172	91.5
		>3mm	16	8.5

5	Post void volume	Empty	113	60.1
		<50ml	32	17
		50-150ml	29	15.4
		150-200	14	7.4

Table. 2: Ultrasound assessment of the participants



Figure.3: Cluster chart showing positive correlation between age & prostate size

Table.3 Correlations between age and prostate size					
		Age continue	prostate size		
			continue		
age	Pearson Correlation	1	.431**		
	Sig. (2-tailed)		<.001		
	Ν	188	188		
prostate size	Pearson Correlation	.431**	1		
	Sig. (2-tailed)	<.001			
	N	188	188		
**. Correlation is significant at the 0.01 level (2-tailed).					

#### **Discussion:**

Ultrasound is considered the modality of choice for evaluating prostate size due to its non-invasive nature, wide availability, and cost-effectiveness. It plays a significant role in the diagnosis of various prostate conditions. Transabdominal ultrasound, in particular, provides reliable results in detecting and assessing benign prostatic hyperplasia (BPH). According to a 2020 study by Parsons et al., BPH affects over 70% of males in the United States who are 60 to 69 years old, and the prevalence increases to nearly 80% among men who are 70 years of age or beyond. Age-related hormonal changes, specifically the impact of dihydrotestosterone (DHT) and a relative decrease in testosterone levels, are responsible for this notable increase, which promotes the growth of prostatic tissue (3). In 2023, Obeagu et al. conducted another study that found Benign Prostatic Hyperplasia (BPH) to be a progressive disorder that grows more common as people age. About 10 percent of men in their 30s, 20 percent in their 40s, 50 to 60 percent in their 60s, and 80 to 90 percent of males 70 years of age and beyond are affected. This consistent increase emphasizes how closely prostate growth and age are related. According to reports, 64% of males in Ghana between the ages of 40 and 70 have an enlarged prostate, indicating a high prevalence of BPH in the populace. Lower urinary tract symptoms (LUTS), which include nocturia (rising up

in the middle of the night to urinate), urgency, increased frequency, incontinence, weak urine stream, and a feeling of incomplete bladder emptying, are the main symptoms of BPH. Because these symptoms have a major impact on everyday activities and quality of life, men frequently seek medical attention for them. It has been demonstrated that nocturia, in particular, impairs the quality of sleep, resulting in exhaustion and a decrease in energy or vitality throughout the day. For many men, the first sign of an enlarged prostate is the development of LUTS. All things considered, the growing incidence of BPH and its accompanying symptoms with aging highlights the necessity of early detection, greater public awareness, and better access to urological care, especially in areas like Ghana where the illness is prevalent and may go undiagnosed(7). The Pascal study also confirmed prior research showing that Benign Prostatic Hyperplasia (BPH) is a non-cancerous enlargement of the prostate gland that occurs more frequently in elderly men. Because it worsens over time and produces discomfort through lower urinary tract symptoms (LUTS), it is regarded as a debilitating disorder. (Pascal et al 2021). According to Ijaz et al. (2022), BPH is a hormone-dependent condition and is therefore seen as a common occurrence in the elderly male population (8). Similarly, Olweny et al. came to the conclusion that Benign Prostatic Hyperplasia is a progressive illness that frequently causes lower urinary tract symptoms (LUTS), especially in older men. Up to 20% of men between the ages of 30 and 79 in the US are thought to suffer from LUTS as a result of BPH (13). Our study also has similar finding that age is significant factor for the development of BPH. According to a 2023 study by Ma Dong et al., Benign Prostatic Hyperplasia frequently results in the development of Lower Urinary Tract Symptoms (LUTS), which are divided into irritative symptoms like frequency, urgency, and urge incontinence and obstructive symptoms like hesitancy, straining, weak urinary stream, and a feeling of incomplete emptying. A higher incidence of BPH has been linked to a number of risk factors, such as aging, obesity, metabolic syndrome, hormonal imbalances, and chronic inflammation. These elements could play a role in the development and course of prostatic enlargement. Sleep is also essential for maintaining the central nervous system and regaining bodily function. However, LUTS, especially nocturia, can interfere with sleep, causing weariness and a decline in general health and well-being. This creates a vicious cycle in which BPH affects not just urine function but also general health and quality of life. (4). Bukunmi et al has predicted that Benign Prostatic BPH, urethral stricture, and prostatic carcinoma are recognized as the leading causes of Lower Urinary Tract Symptoms (LUTS) in men (1). Similarly our study is supporting the results of MA and Dong et al about the LUTS like hematuria, urine stream,

urinary frequency, urinary postponed and painful urination.

**Conclusion:** Benign Prostatic Hyperplasia (BPH) is a significant age-related condition, with its occurrence rising substantially as men grow older. Among the various diagnostic methods available, ultrasound stands out as a safe, noninvasive, and widely accessible tool for evaluating prostate size. Unlike imaging techniques that involve ionizing radiation, ultrasound offers a radiation-free alternative, making it particularly suitable for routine assessment and long-term monitoring of prostate enlargement. Its ease of use and diagnostic reliability make it an essential modality in the early detection and management of BPH.

## **Recommendations and limitations**

Our study is limited in finding the exact mechanism by which age increases the prevalence of BPH so we recommend that a study should be conducted that correlates hormonal changes with BPH development.

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