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Evaluation of the Incidence of Benign Prostatic Hyperplasia in Obese Patients Using Transabdominal Ultrasound

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Abstract **Original Research Article**

Objective: To evaluate the incidence of benign prostatic hyperplasia in obese patients. ***Method:*** A cross-sectional study with 113 men aged 40 years and above without any prostatic pathology were recruited. The study population was categorized into 3 BMI groups (healthy, overweight and obese) and 2 WC groups (<90 cm and >90 cm). A <0.05 p-value was considered significant. ***Result:*** The mean prostate volume was 45.86±13.01ml, mean BMI was 28.97±3.63kg/m^2 and mean waist circumference was 93.73±7.04cm. The incidence of BPH was found to be highest in men with BMI > 30 kg/m^2 and WC > 90 cm. Positive significant relationship between BMI and WC was found with PV. ***Conclusion:*** Central obesity is an important and independent risk factor of BPH and thus it increases the risk of developing BPH significantly. The greater a man's obesity, the greater his chance of developing BPH.

Keywords: Benign Prostatic Hyperplasia, Prostate Volume, Waist circumference, Ultrasound, Obesity, BMI, BPH, WC, PV, TAUS, LUTS.

INTRODUCTION

The benign, unregulated enlargement of the prostate gland is Benign Prostatic Hyperplasia (BPH) [1, 2]. The increase in the size of prostate gland is common and appears due to the failure of prostate tissue to undergo apoptosis with advancing age in men [2]. Men in their fifth decade are more prone to BPH [3, 4]. The diagnosis of BPH is thus presumptively based on the size of the prostate [5]. It is observed that this neoplasm occurs commonly in men [6, 7] and BPH is strictly an age-related phenomenon in older and obese patients having 40 years of age and above [8]. Advancing age leads to higher chances of developing BPH and this may lead to Lower Urinary Tract Symptoms (LUTS) [9]. LUTS is a set of symptoms that involves storage and voiding disturbances. These include symptoms like urgency, urinary frequency, dysuria, nocturia, hesitancy, poor stream, post-void dribbling, and overflow incontinence [9]. These occur as a result of prostate enlargement, mostly in the transition zone of prostate that surrounds the urethra [9, 10]. This enlargement puts stress on the urethra, raising the outlet resistance contributing to LUTS [10, 11]. These symptoms range from mild to severe depending upon the severity of BPH [10, 11]. The larger the size of the prostate, the more severe will be LUTS(10, 11). Although BPH is not fetal, yet it can lead to LUTS which can negatively affect the quality of life [10]. In a study, it was observed that the prevalence of BPH in 30 years of age was 10%, in 40 years of age was 20%, in 60 years of age was 60% to 70%, and in men of age 80 to 90 years was 90% [8]. The cause of BPH remains unclear [12, 13]. However, recent studies have indicated that along with the factors like age, androgen activity and family history, other factors, like obesity, diet and smoking may also play important role in BPH development [13]. The overall prevalence of BPH in Pakistan is noted to be 10.3% [14].

According to World Health Organization, Obesity is the excessive accumulation of abnormal fat in the body that presents a health risk [15]. Obesity adversely affects almost every physiological function of the body and thus proves to be a public health threat [15]. The obesity has alarmingly doubled worldwide

since 1980 such that now nearly one-third of the world population is classified as obese [15]. Globally obesity has increased from 7% to 12.5% in 2015 [15]. A study by WHO describes the rate of obesity in Pakistan which was estimated to be 4.8% in 2017 [16].

Obesity is the major determinant that influences the volume of the prostate gland in BPH patients [17]. BMI is used to define obesity in which 18.5-22.9 is considered normal and 25> is considered obese(18, 19). In a study, it was observed that at each increase of 1kg/m^2 BMI, there was an increase of about 0.41mL in prostate volume [13]. Sonographic assessment of prostatic volume is helpful in the selection of the method of treatment [20]. According to the sonographic measures of the prostate, The normal prostate volume is approximately <25ml [20]. In patients with BPH, the volume of the prostate is >30ml [20]. It is evident that prostate of obese men are greater in volume than the normal-weighted men [21]. Abdominal obesity is associated with increased prostate volume because of greater adiposity [22, 23]. Bodyweight, waist circumference, and BMI have been noted to have effect on prostate volume [24].

The prostatic volume can be measured by using several types of imaging modalities such as ultrasound, Computed Tomography(CT) and Magnetic Resonance Imaging(MRI) [24]. But ultrasound has been in clinical use for about 50 years and is of significant importance [24]. Prostate volume can be measured by ultrasound which is of various types like Transabdominal (TAUS), Transrectal (TRUS) and Transperineal (TPUS) [24]. According to American Institute of Ultrasound & Medicine guidelines, TAUS is preferred frequently as it is non-invasive, simple, basic and economical investigation [24]. Transabdominal ultrasound is used to determine the prostate size and amount of urine present in the bladder after urination (post residual volume, PMRV) [20]. The use of ultrasound in the detection of BPH has helped us by promoting its diagnosis, enhancing surgery qualification and selection of better treatment method [20].

The obesity in male population is increasing rapidly and promoting to benign prostatic hyperplasia. This study will cause an awareness to maintain BMI among aged and obese men. It will also suggest them to maintain healthy lifestyle of balanced diet and exercise.

MATERIALS AND METHOD

This cross-sectional study was completed over a period of 4 months (from October 10, 2020 to February 13, 2021) with sample size of 113. Eligible participants underwent sonographic examination at Social Security Hospital, Gujranwala and Rashid Khokhar Diagnostic Centre, Gujranwala. Male patients of age 40 years and above with BPH were included in this study. Patients with the history of bladder stone, urinary tract infection, confirmed prostate cancer, acute or chronic prostatitis, neurogenic bladder dysfunction, history of TURP or other surgical intervention associated with BPH were excluded from this study.

In this study, the participants were classified into four groups according to WHO classification for BMI, Healthy (>18.9 to 25.0 kg/m²), Overweight (>25.0 to 29.9 kg/m²), Obese (≥30.0 kg/m²). They were also classified according to WHO Criteria of Asia-Pacific obesity for WC: normal waist circumference (<90 cm) and central obesity (> 90 cm).

Individuals aged 40 years and above were selected. Each participant gave their informed consent and the height, weight, BMI, and WC of each participant were recorded. Normal standard anthropometric methods were used to calculate height and weight after which BMI was calculated by using weight/height^2 formula and expressed in kilogram per square meter.

The waist circumference (WC) of subjects was measured in centimeter (cm) between the lower rib margin and the iliac crest while they stand with their feet together and breathing quietly. Transabdominal sonography of prostate volume was performed after taking a clinical history and demographic details (age, height, weight, and waist circumference).

In order to measure prostate volume (PV), Mindray (DP-5) and Toshiba (Aplio 300) ultrasound machine with 3.5MHz curvilinear transducer was used. Participants were examined in supine position. For better assessment transducer was angled inferiorly under symphysis pubis. With a full bladder, the transverse sections were obtained by angling the transducer at 15° towards the feet. The frozen images of prostate were taken in order to measure its length, transverse and anteroposterior diameters.

Fig-1: This figure shows the elevated prostate volume of 58.48ml in an obese patient who was diagnosed with BPH using TAUS. Normal prostate volume should be <30ml.

STATISTICAL ANALYSIS

In order to collect samples, non-probability convenience sampling technique was used in this study. In order to calculate sample size, prevalence at 8%,

bound of error at 0.05% and confidence level of 95% was kept.

$$n = \frac{z^2 P (1-P)}{B^2}$$

n = number of samples

z = standard error of mean (1.96)

P= 8%

B= absolute precision (0.05)

Data analysis was done by using SPSS 20 version. Mean and standard deviation was taken. Frequencies and percentages were taken for the categorical variables. The P-value of <0.05 was considered significant.

RESULTS

The subjects that participated in this study were of age 40 years and above with BPH. The mean age, height and weight of the participants was found to be 60.85±10.32 years, 1.74±.10 m and 87.46±12.82 kg respectively in this study (Table 1).

Table-1: Descriptive stats for total participants

Characteristics	Total Participants N=113 Mean, Standard deviation
Age (years)	60.85±10.32
Height (m)	1.74±.10
Weight (kg)	87.46±12.82
BMI	28.97±3.63
WC (cm)	93.73±7.04
PV (ml)	45.86±13.01

The mean BMI of the participants in this study was 28.97±3.63 kg/m^2. The BMI distribution of these participants was 15, 41 and 57 in healthy, overweight and obese men (Table 2 and Figure 1).

Table-2: Frequency of subjects according to their BMI

BMI (kg/m^2)	Frequency (N)	Percentage (%)
Normal	15	13.3
Over weight	41	50.4
Obese	57	36.3
Total	113	100

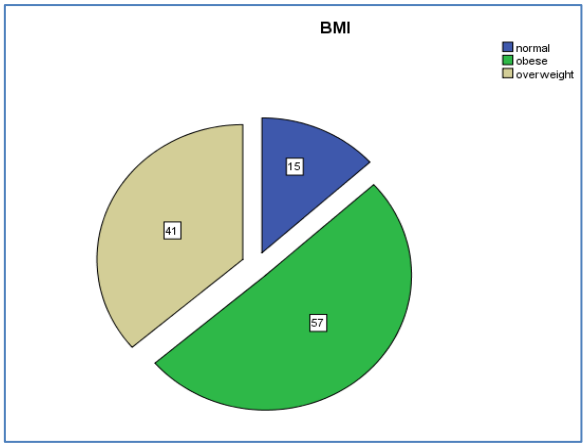

Fig-1: Pi chart representing the frequency of subjects according to their BMI

The mean WC in the studied population was 93.73±7.04 cm. The distribution of 113 subjects was as follows: 23 in <90 cm and 90 in >90 cm (Table 3 and Figure 2). It was noted that all subjects with BMI >30kg/m^2 (obese) had the WC of >90cm (Table 4).

Table -3: Frequency of subjects according to their WC

Waist circumference (cm)	Frequency (N)	Percentage (%)
<90 cm	23	20.4
>90 cm	90	79.6
Total	113	100

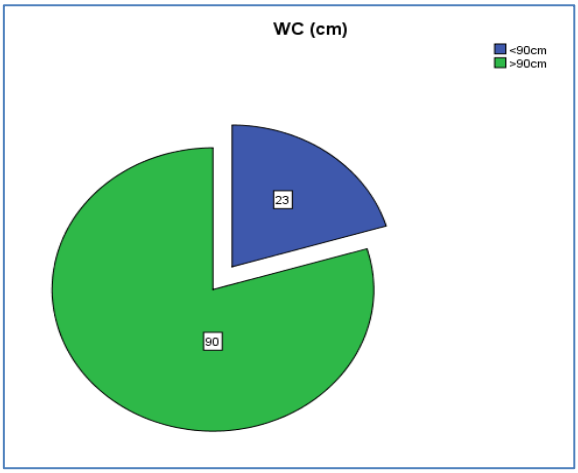

Fig-2: Pi-chart representing the frequency of subjects according to their WC

Table-4: Crosstabulation of BMI and WC

			WC (cm)		Total
			<90cm	>90cm	
BMI	normal	Count	12	3	15
		% within BMI	80.0%	20.0%	100.0%
	obese	Count	0	57	57
		% within BMI	0.0%	100.0%	100.0%
	overweight	Count	11	30	41
		% within BMI	26.8%	73.2%	100.0%
Total		Count	23	90	113
		% within BMI	20.4%	79.6%	100.0%

The mean of PV in the studied population was found to be 45.86±13.01 ml. The maximum and minimum value for PV was 30ml and 80ml respectively (Table 4). Increased frequency of BPH among obese men was noted as compared to normal and overweight (Table 5).

Table-5: Descriptive Stats for PV

	N	Range	Maximum	Minimum	Mean	Std. Deviation
Prostatic Volume	113	50.00	30.00	80.00	45.8628	13.01411

A relation between PV and age BMI, WC was examined in this study. Positive relation between PV with BMI and WC was noted suggesting the positive relation between PV and obesity. Positive relationship between PV with age (p=0.029), with BMI (p=0.0159) and with WC (p=0.001) was noted (Table 5).

Table-6: p-value analysis of prostate volume with anthropometric measures

Anthropometric measurements	p-value
Age	0.029
BMI	0.0159
WC	0.001

P-value <0.05 is significant

DISCUSSION

In this study, men aged 40 years and without any prostatic pathology were recruited. There are many risk factors that influence the risk of developing BPH which includes ageing, steroid hormones, genetics, alcohol, smoking, and metabolic syndrome, such as obesity, cardiovascular disease and dyslipidemias. In this cross-sectional study, the mean of the BMI and WC of the studied population was 28.97±3.63 kg/m^2 and 93.73±7.04 cm respectively. It was observed that the risk of developing BPH was increased in the patients who had increased BMI and WC. Obese men, in particular, were at an elevated risk of developing BPH. The frequency was found to higher in the obese group than the other BMI groups which constitutes 50.4% and that of central obese group (WC greater than 90cm) was 79.6% of the sample size. There was positive significance between PV and BMI and WC which was 0.0159 and 0.001 respectively.

There are many studies that have suggested that BMI and WC are the prevalent causes of BPH. A study by S.Lee and H.G Min in South Korea was held to examine effect of obesity in promoting BPH. It was found that men with high BMI and WC were positively associated with PV and central obesity is an important and independent risk factor of BPH [25]. A study by Iffat Raza showed that increased BMI and WC contribute in unregulated prostatic growth. The PV was found to have positive correlation with BMI and WC. However, PV was found to be much higher in patients with WC greater than 90cm suggesting that central obesity is an independent risk factor that contributes in the development of BPH [17].

A study performed by Yue L in China showed the correlation between BMI, age, PV, IPSS and quality of life. It was observed that increasing BMI leads to decreased quality of life but PV increased with increasing BMI [26]. According to a study by J. Kellogg Parsons, obesity has a significant relationship to lack of physical exercise. Increased physical exercise is linked to a lower risk of BPH, adding to the findings of a correlation between obesity and BPH. Furthermore, this finding suggests that lifestyle changes can alter the natural course of BPH [27].

In this study, it is observed that obesity is a risk factor of BPH and is found to increase the risk of developing larger prostatic volume than non-obese men. This increase in volume of prostate gland in obese men increases their chances and severity of experiencing urinary symptoms. This enlargement of prostate gland can have detrimental effect on an individual's quality of life.

CONCLUSION

Central obesity is an important and independent risk factor of BPH and thus it increases the risk of developing BPH significantly. It was concluded that the incidence of BPH was found to be highest in men of BMI >30kg/m^2 and lowest in men of BMI <23 kg/m^2. BPH was found to be highest in men of WC of >90 cm and lowest in men of WC <90 cm in this study. A positive significant relation is found between PV and BMI and WC. Increase in the obesity, increases the risk of developing BPH and also increases its severity which leads to LUTS which causes a negative impact on the quality of life of that individual. Thus, it is important to maintain a healthy BMI among elderly and obese men by adopting a healthier lifestyle with balanced diet and exercise.

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