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Original Article

Morphological Variations of Weight & Volume of Prostate

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ABSTRACT

CONTEXT: *The prostate is a walnut sized fibromuscular glandular organ at the base of the urinary bladder. Prostate is the site of frequent medical problems affecting elderly men, benign prostatic hyperplasia (BPH), carcinoma prostate and prostatities. In order to plan appropriate treatment strategies of prostatic disease, studies on human prostate are expected to helpful for the urologist, pathologist and sonologist for diagnosis of disease.* ***OBJECTIVES****: The objective of this study was to observe the morphological variarions of post mortem human prostate.* ***MATERIALS AND METHODS:*** *The present study was carried out on 60 (sixty) human prostate collected from dead body those were under went post mortem examination of different age groups in Bangladeshi people and collected by consecutive, convenient and exhaustive sampling technique. All the specimens were studied macroscopically by careful dissection. A descriptive study was done in the department of Anatomy in collaboration of Forensic Medicine, Sylhet MAG Osmani Medical College, Sylhet from January 2015 to December 2015. The mean weight and volume of the prostates were 20.32 (SD ± 6.34) gm & 22.12 (SD ± 9.30) cm³. In this study, the weight and volume of prostates found significant positive correlation with age.* ***RESULTS****: The weight of the prostate ranged from 7.80 gm to 31.30 gm with the mean 20.32 (SD ± 6.34) gm. The mean weight of the prostate were 11.29 gm (SD ± 2.60) (range 7.80-14.9 gm) in the age group of 10 to 20 years; 18.81 gm (SD ± 2.93) (range 14.40-24.80 gm) in the age group of 21 to 40 years and 27.08 gm (SD ± 2.73) (range 19.20-31.30 gm) in the age group of 41 to 70 years. The difference among the groups were statistically significant (F=6.755; p=0.011). The volume of the prostate ranged from 2.79 cm³ to 36.41 cm³ with the mean 22.12 (SD ± 9.30) cm³. The mean volume of prostate were 12.04 cm³ (SD ± 7.90) (range 2.79-26.73 cm³) in the age group of 10 to 20 years; 21.42 cm³ (SD ± 7.31) (range 11.34-33.98cm³) in the age group of 21 to 40 years and 28.33 cm³ (SD ± 7.42) (range 12.23-36.41 cm³) in the age group of 41 to 70 years. The difference among the groups were statistically significant (F=4.021; P=0.003).* ***CONCLUSION:*** *In the present study weight and volume of the prostates had found significant positive correlation with age.*

Key words: Prostate, Morphology, Weight, Volume.

INTRODUCTION

The prostate gland is a compact, encapsulated, pyramidal, fibro-muscular and glandular organ. It is located immediately inferior to the neck of urinary bladder, which surrounds the prostatic urethra.[1,2] It is a major accessory sex gland. It secretes thin milky fluids that constitute 30% of the semen and contains calcium, citrate ion, phosphate ion a clotting enzyme and profibrinolysin.[3] Prostatic fluid plays an important role in sperm activation, motility and viability.[4] The slightly alkaline characteristic of the prostatic fluid may be quite important for successful fertilization of the ovum.[5] From a morbid anatomical perspective, the glandular tissue may be subdivided into three distinct zones, peripheral (70% by volume), central (25% by volume), and transitional (5% by volume). The prostate is surrounded by a fibrous capsule. It is approximately 3 cm long, 4 cm wide, 2 cm in

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antero-posteriorly and weighs about 8 grams in youth.[6]

The prostate is traversed by the urethra and ejaculatory ducts and contains the prostatic utricle. The urethra travels vertically downwards through the prostate to emerge just anterior to the apex of the gland.[7] The prostatic part of the urethra consists of two segments, the proximal segment and distal segment. It is 3-4 cm in length. The proximal segment extends from the bladder neck to the superior aspect of the colliculus seminalis that is verumontanum. The dominant anatomical feature of this region is the preprostatic sphincter which extends from the base of the verumontanum to the bladder neck.[8] Contraction of the preprostatic sphincter serves to prevent the retrograde flow of ejaculation through the proximal urethra into the bladder.[7] A similar sphincter of striated muscle exists along the urethra distal to the verumontanum.[8] The proximal segment is linked anteriorly at 35° angles to the distal segment at the level of the verumontanum. A midline ridge, the urethral crest, projects into the lumen causing it to appear crescentic in transverse section from the posterior wall throughout most of the length of the prostatic urethra. The shallow depression on either side of the crest is termed the prostatic sinus, the floor of which is perforated by 15-20 prostatic ducts.[9] An elevation, the verumontanum lies at the middle of the length of the urethral crest, contains slit like orifices on each side of prostatic utricle. On both side of this orifice are the two openings of the ejaculatory ducts.[7] The prostatic utricle is a cul-de-sac, 6 mm long which runs upwards and backwards within the substance of the prostate behind the median lobe.[7] The duct of the seminal vesicle joins with the terminal expansion of the vas deferens (ampula of vas deferens) to form the ejaculatory duct. It traverse the central zone of the prostate to terminate at the verumontanum.[10] The zonal anatomy of the human prostate is clinically important because carcinomas arise mostly in the peripheral zone whereas benign prostatic hyperplasia (BPH) affects the transitional zone. The central zone surrounding the ejaculatory ducts is rarely involved in any diseases.[6] Incidence of prostatic disease increasing day by day in Bangladesh. Surgical method can be planned by the clear knowledge about size of the prostate. Prostatic androgenic activity can be assessed by observing weight of the prostate where as treatment options can be preferred by estimation of volume of the prostate. The mean transition zone volume had a higher increase rate with age than the mean total prostate volume, indicating that the enlargement of the transition zone contributed the most to the increase in total prostate volume. The growth curve equations for prostate width, height and length were also positively associated with increasing age.[11] Prostate related clinical conditions such as benign prostatic hyperplasia and prostatic cancer are frequent in our country. So in our opinion, study is not sufficient to acquire a proper knowledge about the normal gross anatomy of prostate in our country. It is observed by reviewing the existing literatures that significant variations are found among the different age group. So far it is known, still we have few published work on morphological variations of prostate between different age groups among Bangladeshi populations.

MATERIALS AND METHODS

In this descriptive study, sixty human prostates were collected from the unclaimed dead bodies by consecutive, convenient and exhaustive sampling technique and autopsy was done in the Department of Forensic Medicine in Sylhet M.A.G Osmani Medical College, Sylhet during the period from January 2015 to December 2015 meeting the inclusion criteria that, dead bodies autopsy was done within 36 hours of death and exclusion criteria of considerable sign of decomposition and

preserved in the department of Anatomy, Sylhet MAG Osmani Medical College for measurement. Particulars of dead bodies were collected from police inquest report and chalan.

Dead body was kept in supine position on the mortuary table. A longitudinal midline incision was made from the tip of the xiphoid process to the upper border of the symphysis pubis encircling the umbilicus.

Then a transverse incision was made from the xiphoid process to mid axillary line in both side. Another incision was made from the symphysis pubis to the anterior superior iliac spine along with inguinal line in both side. Then skin and superficial fascia were retracted laterally. After cutting the rectus sheath and parietal peritoneum, abdomen was opened. The entire thoracic and abdominal cavities were found exposed, following routine post-mortem examination by the forensic experts. Then urinary bladder was identified. In case of any distended urinary bladder, it was evacuated with a penile catheter in place by squeezing the urinary bladder. Then the apex of the bladder was detached completely from the anterior abdominal-wall by cutting through the median umbilical ligament with peritoneal fold and medial umbilical folds over two obliterated umbilical arteries. Both sides of the urinary bladder were made free by cutting the lateral false ligaments and posterior false ligaments with a scissor.

Fingers were pushed downwards between the bladder and the pubis till the resistance of the puboprostatic ligament was faced. This ligament was incised by the scalpel.

Then the urinary bladder along with the prostate were pushed posteriorly. Fingers were insinuated and carried away round the side of bladder and the prostate to detach them from surrounding loose areolar tissue upto the medial margin of the levator ani.

The ureters, the ducti deferentia and the seminal vesicles were traced on either side upto their termination into the urinary bladder and prostate. These were cut with the scissors at a distance from their respective organ of termination. The urinary bladder and prostate were pulled anteriorly by cutting posteriorly the reflected peritoneal folds.

Fingers were insinuated posterior to the prostate to detach it from the rectum. Fascia of Denonvilliers was separated by pulling and cutting it with the scissors. Finally the prostate was found wedged between the medial margins of levator-ani muscle and resting firmly on the fascia of the superior surface of the urogenital diaphragm.

Figure 1: Measurement of weight of the Prostate

Next, the prostate was separated by cutting through the tissues distal to its apex. In this way the prostate along with the urinary bladder, ureters, seminal vesicles and a portion of the ducti deferentia were taken out of the pelvic cavity. The prostate was washed and cleaned thoroughly and carefully. The surface of the prostate was dried with blotting paper. Then it was weighed by means of an analytical

balance (Mega digital scale, made in China) and expressed in grams.

Figure 2: Measurement of volume of the Prostate

Volume of the prostate was measured by using water displacement method. A bucket was filled with water with side channel and placed on a dissection tray. Then the examined prostate was immersed in the water as a result some water was displaced and come out through the side channel which was collected in graduated cylinder marked in milliliter. The obtained number is the volume of the prostate that is expressed in milliliter.

Prior to the commencement of the study, approval of the research protocol was obtained from the Ethical Committee of Sylhet M.A.G Osmani medical college, Sylhet and analyzed with the help of SPSS (Statistical Package for Social Sciences) Version 21.0. Quantitative data were expressed as mean and standard deviation; and comparison was done by unpaired 't' test between two groups and ANOVA test among three groups. A probability value (p) of less than 0.05 were considered statistical significant.

RESULTS

Table I shows the weight of the prostate ranged from 7.80 gm to 31.30 gm with the mean 20.32 (SD ± 6.34) gm. The mean weight of the prostate were 11.29 gm (SD ± 2.60) (range 7.80-14.9 gm) in the age group of 10 to 20 years; 18.81 gm (SD ± 2.93) (range 14.40-24.80 gm) in the age group of 21 to 40 years and 27.08 gm (SD ± 2.73) (range 19.20-31.30 gm) in the age group of 41 to 70 years. The difference among the groups were statistically significant (F=6.755; p=0.011). Figure 3 also shows correlation between age and weight of prostate (n=60)

Table-I: Distribution of weight of prostate by different age group(n=60)

Age group	Weight of prostate (gm)		
	Range	Mean	Standard deviation
Group-A (n=11)	7.80-14.9	11.29	± 2.60
Group-B (n=28)	14.40-24.80	18.81	± 2.93
Group-C (n=21)	19.20-31.30	27.08	± 2.73
*p-value		*p=0.011	

Group-A: 10 to 20 years;
Group-B: 21 to 40 years;
Group-C: 41 to 70 years.
*One way ANOVA test was applied to analyze the data

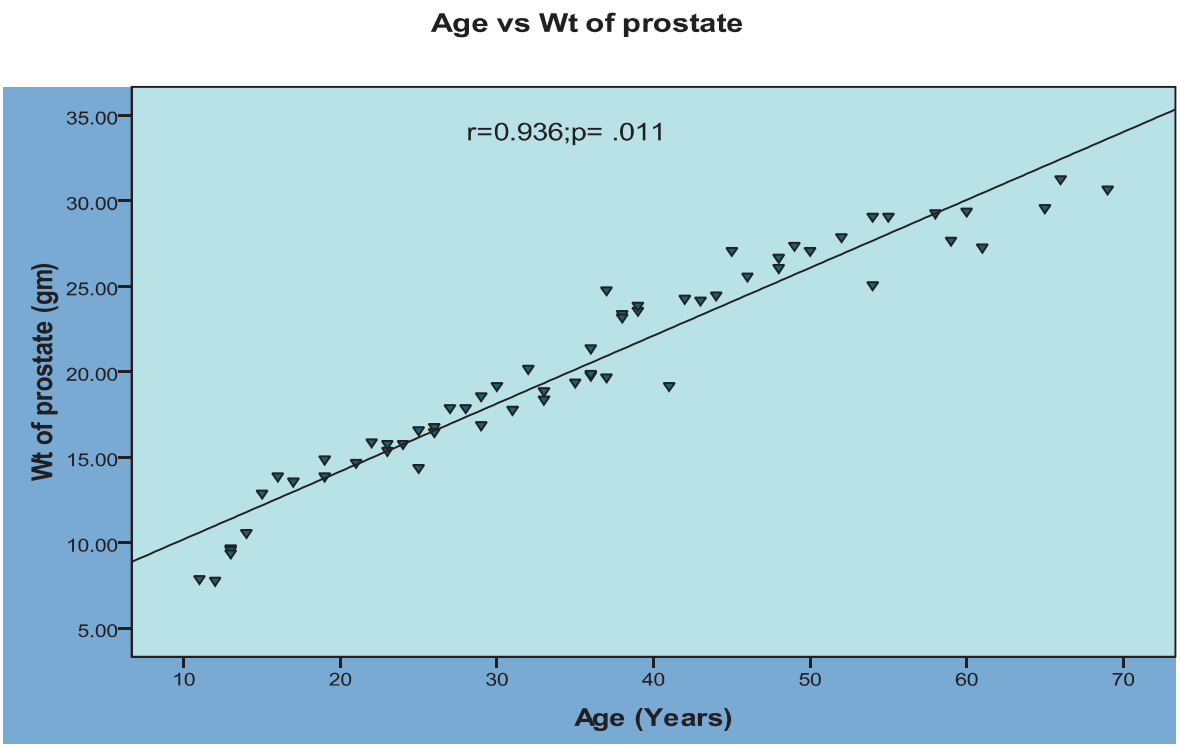

Figure 3: Scatter diagram showing correlation between age and weight of prostate (n=60)

Table II shows the volume of the prostate ranged from 2.79 cm^3 to 36.41 cm^3 with the mean 22.12 (SD ± 9.30) cm^3. The mean volume of prostate were 12.04 cm^3 (SD ± 7.90) (range 2.79-26.73 cm^3) in the age group of 10 to 20 years; 21.42 cm^3 (SD ± 7.31) (range 11.34-33.98cm^3) in the age group of 21 to 40 years and 28.33 cm^3 (SD ± 7.42) (range 12.23-36.41 cm^3) in the age group of 41 to 70 years. The difference among the groups were statistically significant (F=4.021; p=0.003). And the figure 4 also shows correlation between age and volume of prostate (n=60).

Table-II: Distribution of volume of prostate by different age group (n=60)

Age group	volume of prostate (cm^3)		
	Range	Mean	Standard deviation
Group-A (n=11)	2.79-26.73	12.04	± 7.90
Group-B (n=28)	11.34-33.98	21.42	± 7.31
Group-C (n=21)	12.23-36.41	28.33	± 7.42
*p-value		*p=0.003	

Group-A: 10 to 20 years; Group-B: 21 to 40 years; Group-C: 41 to 70 years.
*One way ANOVA test was applied to analyze the data.

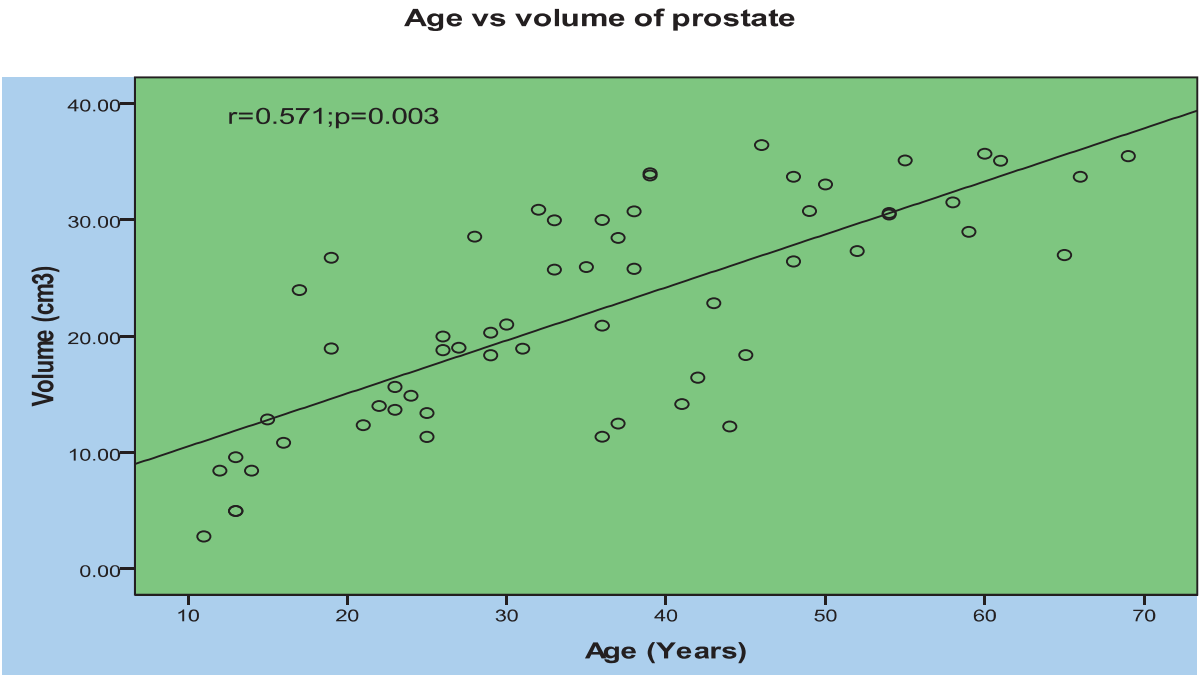

Figure 4: Scatter diagram showing correlation between age and volume of prostate (n=60).

DISCUSSION

In the present study the weight of the prostate ranged from 7.80 gm to 31.30 gm with the mean 20.32 (SD ± 6.34) gm. This result was consistent with the study of Kumar et al[12] that the mean weight of the prostate was 20 gm and with the study of Roehborn and Mc Connell[13] that the mean weight of the prostate was 18 gm. Ahmed[14] found that the weight of the prostate was ranged from 11.89 gm to 25.88 gm.

This study found that the volume of the prostate ranged from 2.79 cm^3 to 36.41 cm^3 with the mean 22.12 (SD ± 9.30) cm^3. Moore[15] found that volume ranged from 10.22 cm^3 to 13.70 cm^3. Ahmed[15] found that volume of the prostate ranged from 7.68 cm^3 to 15.40 cm^3. All these findings are compatible with study of Gearhart[16], they found that the mean prostatic volume was 20.7 cm^3. Nwadike et al[17] found that the mean and standard deviation for prostate volume were 26.6±7.576 cm^3. All these findings are lower than the present study.

CONCLUSION

In the present study weight and volume of the prostates have shown significant positive correlation with age. This is why we can tell the weight of the prostate gland is an excellent surrogate for prostate volume.

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