

AGE RELATED VOLUME OF CADAVER-PROSTATES IN BANGLADESH

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Abstract

Pathological changes in the prostate gland occur commonly with advancing age including inflammation, atrophy, hyperplasia and carcinoma and a change in volume is also evident. Estimation of volume of prostate may be useful in a variety of clinical settings. A cross-sectional descriptive study was designed to see the changes in volume of the prostate with advancing age and done in the Department of Anatomy, Dhaka Medical College, Dhaka from August 2006 to June 2007. The study was performed on 70 post-mortem human prostates collected from the unclaimed dead bodies that were under examination in the Department of Forensic Medicine, Dhaka Medical College, Dhaka. The samples were divided into three age groups; group A (10-20 years), group B (21-40 years) and group C (41-70 years). Volume of the sample was measured by using the ellipsoid formula. The mean \pm SD volume of prostate was 7.68 ± 3.64 cm³ in group A, 10.61 ± 3.99 cm³ in group B and 15.40 ± 6.31 cm³ in group C. Mean difference in volume between group A and group C, group B and group C were statistically significant ($p < 0.001$). Statistically significant positive correlation was found between age and volume of prostate ($r = + 0.579$, $p < 0.001$).

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Introduction

The prostate is partly glandular; partly fibro muscular organ.¹ It is the largest accessory sex gland in the male reproductive system.² It produces a thin milky fluid containing citric acid and acid phosphatase that is added to the seminal fluid at the time of ejaculation.³ Pathological process in prostate gland occurs commonly in association with aging and includes inflammation, atrophy, hyperplasia and carcinoma.⁴ Estimation of volume of prostate may be useful in a variety of clinical settings. For example, a precise estimate of the amount of BPH would help to determine the appropriate therapy as well as assist in the interpretation of serum prostate specific antigen (PSA) levels for the presence of cancer. Also the decrease in prostate mass after hormonal manipulation or radiation therapy can be used as an indicator of therapeutic efficacy.⁵ Also for PSA density determination accurate volume measurement is necessary.⁶ The effect of prostate volume on biopsy outcome was assessed and noted that there was an

inverse relationship between the size of the gland and prostate cancer. When the gland size was less than 40 ml, 17 had prostate cancer and when more than 40 ml, only 7 were found to have prostate cancer.⁷ The changes in prostate size i.e. volume are highly variable among aging men. Although benign prostatic hyperplasia with an increase in volume is very common, a considerable portion of aging men have a stable or decreasing prostate size.⁸ With the above perspectives, the volume of the prostate was thought to be of great value for diagnosis and treatment of various diseases of the prostate. As data on the volume of the prostate in Bangladeshi males are scarce, this study was conducted, albeit on cadavers, to achieve the same.

Materials & Methods

Human prostate samples were collected from unclaimed dead bodies which were under examination

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in the Department of Forensic Medicine of Dhaka Medical College, Dhaka from August 2006 to April 2007. After legal formalities, the samples were collected from the medico-legal cases within 24-36 hours of death prior to signs of putrefaction. During collection, appropriate age and cause of death were noted from the morgue's record book. The samples were brought to the Department of Anatomy, Dhaka Medical College, Dhaka. The samples were tagged immediately, which was bearing a code number for subsequent identification. Soon after collection, each sample was gently washed in tap water on a dissection tray. Blood and blood clots were removed as far as possible. The samples were fixed in 10% formol saline solution and divided into three groups (Table 1), according to Begum (1991).⁹ This research work was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka.

Measurement of volume:

Volume of the prostate was measured by applying ellipsoid formula which requires measurement of three prostatic dimensions. Dimensions were first determined in the axial plane by measuring the transverse and antero-posterior dimensions at the estimated point of widest transverse dimension. The longitudinal dimension was measured in the sagittal plane. The ellipsoid volume formula¹⁰ was then applied as follows:

$$\text{Volume} = \text{height} \times \text{width} \times \text{length} \times 0.52$$

The volumes were expressed in mean with standard deviation (SD) and comparison among the different age groups was made using ANOVA. The correlation coefficient was used to determine the association between age and volume of prostate. The SPSS version 11.0 was used.

Results

The mean \pm SD volume of prostate was 7.68 ± 3.64 cm³ in group A, 10.61 ± 3.99 cm³ in group B and 15.40 ± 6.31 cm³ in group C. The highest mean \pm SD was in group C and lowest in group A. Mean difference in volume between group A and group C, group B and group C were statistically significant ($p < 0.001$). Statistically the difference between group A and group B was not significant (Table 1). Positive correlation was present between age and volume of

Table 1: Volumes of prostate according to age group

Age group	n	Volume (in cm ³) mean \pm SD*
10-20 (A)	9	7.68 \pm 3.64 (4.37 14.82)
21-40 (B)	32	10.61 \pm 3.99 (4.68 19.97)
41-70 (C)	29	15.40 \pm 6.31 (2.57 26.43)

* Comparison of groups using ANOVA: A vs B, $p = \text{ns}$; A vs C, $p < 0.001$; Parenthesis indicates ranges

prostate which was also statistically significant ($r = +0.579$, $p < 0.001$; Fig 1).

Discussion

Moore¹¹ studied 129 individuals aged between 20 to 90 years. He found that the volume of prostate was 10.22 ± 1.09 cm³, 11.72 ± 0.799 cm³, 10.88 ± 0.788 cm³, 12.03 ± 0.804 cm³, 12.06 ± 1.01 cm³, 11.94 ± 1.11 cm³ and 13.70 ± 1.39 cm³ in 3rd, 4th, 5th, 6th, 7th, 8th and 9th decades respectively. This finding was compatible with the present study. Jakobsen, Torp-Padersen and Juul¹² examined patients between 30 and 50 years and observed their mean prostate volume between 23.9 to 25.7 ml. Gearhart *et al.*¹³ observed that the mean prostatic volume was 20.7 ± 8.2 cm³. Benaim *et al.*¹⁴ studied a series of 100 men aged 40-80 years and found the prostatic volume ranged from 22.1 to 41.5 ml. Chicharro-Molero *et al.*¹⁵ observed 1104

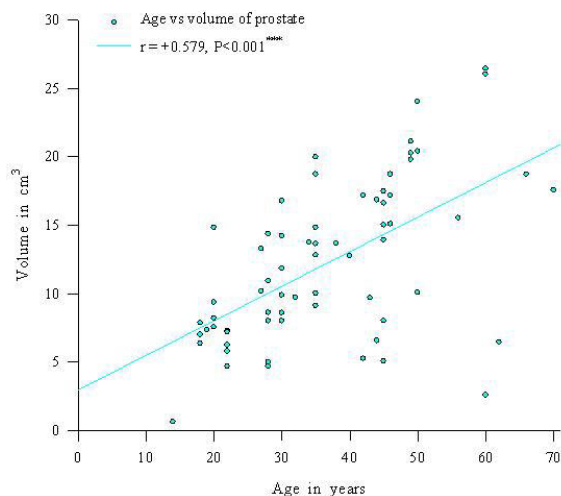


Fig 2 : Scatter diagram showing relationship between age and volume of prostate

men older than 40 years in a Spanish community and found the volume ranged from 23.4 to 41.9 ml. Zackrisson, Hugosson and Aus¹⁶ found that prostatic volume was $19.2 \pm 4 \text{ cm}^3$ in men aged 20-29 years and $35 \pm 12.5 \text{ cm}^3$ for men aged 60-69 years. Overland *et al.*¹⁷ studied 611 Norwegian men aged 60-69 years and found the volume ranging from 26.5 to 31 ml. Loeba *et al.*⁸ studied serial pelvic magnetic resonance imaging performed in 278 men without prostate cancer and found that the median age was 58 years and median prostate size was 28 cm^3 at study entry. At a median follow up of 4.3 years prostate size increased in 61.9% and remained stable or decreased in 38.1% of men. The median rate of volume change was 0.6 cm^3 per year (range: 9.9 to 62.1 cm^3), corresponding to a median growth rate of 2.5% per year (range: 29.2 to 176.4%). During follow up 64.6% of men with an initial prostate size less than 40 cm^3 had prostate growth compared to only 50.9% of men with an initial prostate size of 40 cm^3 or greater. These findings¹²⁻¹⁷ were also of a higher value than that of the present study. The discrepancy may be due to the fact that the present study was conducted on the formalin fixed viscera of the cadaver subjects resulting in a shrinkage and giving a lower value; whereas, the higher prostate volume reported by others were undertaken either by imaging or after excision of living bodies. Another important point may be that most of the study samples were collected from the autopsied bodies of road traffic accidents causing a massive blood loss, hypovolumic shock, reduced tissue perfusion and volume reduction. Moreover, racial variation may contribute to the smaller size of the prostate. Compared with the developed or western people Bangladeshis have a lower body mass index and likely to have lower sized body organs including that of the prostate.

Conclusion

The present study showed the volume of the prostate according to the age group. It revealed – more is the age larger is the volume. The age group only over 40 years had a significantly larger prostate, indicating a significant increase in prostate size only in the aging male Bangladeshi population. Further studies may be undertaken in living humans with a view – a) to determine the prostate volume of different age group; b) to delineate the age when the prostate starts increasing in size and c) to identify the risk factors related to enlarged prostate both benign and malignant.

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