Age-stratified mean values of prostate volume in a community-based population of healthy Korean men

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Authors: S.-Y. Chung, H. S. Kim, S. Kang, J. Kang, H. Seo; Seoul/KR  
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Aims and objectives

Previous autopsy studies have suggested the average weight of the normal prostate was 21 grams. Asians were thought to have more smaller gland volumes.

Prostate size measured by transrectal ultrasonography (TRUS) has shown good agreement with surgically defined prostate size.

However, in practice, the prevalence of TRUS measured prostate volume below 20cc was scarce in otherwise healthy Korean men.

The purpose of this study was to find out the age-stratified reference of mean values, standard deviation and percentile curve of prostate volume in community based population of healthy Korean men.
Methods and materials

Cross-sectional analysis of prostate volume determined by transrectal ultrasound (TRUS) was done in 11,633 healthy Korean men visiting Seoul National University Gangnam Healthcare Center for their annual checkup.

During the year from 2003 to 2012, a total of 165,639 men visited our center for their annual checkup. A total of 15,875 TRUS was performed in men who willingly choose to take the checkup package that included PSA and TRUS. Foreigners (n=117), repeated follow-up studies (n=4,088), and men with history of radical prostatectomy/transurethral surgery/bladder or prostate cancer (n=37) were excluded.

Prostate volume was calculated using prolapse ellipsoid volume equation.

Mean prostate volume and standard deviation of each age decade group were calculated. The age-standardized mean prostate volume of Korean men age 40 and over was calculated.

Age stratified prevalence of prostate volume over 20cc, 25cc, and 30cc was also calculated.

Prostate volume distribution of each age decade group was compared using kernel density curve (R graphics, ggplot2).

Prostate-volume for age percentiles were drawn. Data were grouped by 1 year interval and 3rd, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 97th percentile estimates were plotted at the midpoint of each group. Age group with less than 100 men were excluded for evaluation due to small size. Statistical smoothing were applied to the irregular observed percentile points. Several regression lines were applied and the regression line with the best fit, defined as the regression line with the correlation coefficient R-squared closest to 1.0 was chosen.
METHODS

165,639
Total health check-up during 2003~2012.12 at HCS

15,875 TRUS
Performed by Radiologist

Excluded
Repeated study (n=4,088)
previous op Hx (n=37)
Foreigners (n=117)

Cross Sectional Analysis

11,633 men
Study population

mean age ±SD
54.6±8.8
Age range
18~93

Fig. 1

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Results

The analysis is based on results of transrectal ultrasound of 11,633 Korean men (Age mean ± SD 54.6 ±8.8yrs, range 18-93) during 2003-2012. This is a single center cross-sectional study (Fig.1).

Mean prostate volume and standard deviation of each age decade group are shown in Fig 2. The mean prostate volume continously increased from 19.8cc at 3rd decade to 40.1cc at 9th decade. The mean prostate volume of Korean men age 40 and over was 30.4cc after age-standardization. The standard deviation also increased with age.

In Korean men age below 30s, the density curve forms almost a normal distrubution bell curve with the peak near 20cc (Fig.3). As men ages, average prostate volume increased, shown as right shifting of the peak in Fig 3. The tall thin shaped bell curve becomes more shorter and broader, indicating broader distribution of prostate volume, probably due to increased proportion of men having benign prostatic hyperplasia as they get older.

The age stratified(by each decade) percentage of prostate volume over 20cc was 38% in Korean men below 30, and upto 92% in men at age 50-59 (Fig. 4). Prostate volume over 25cc and 30cc were 24%, 10% at age under 30 upto 83% and 69% at 8th decade, respectively.

Age and prostate volume had linear regression relationship(p<0.0001) with low pearson coefficient of 0.345 (Fig.5). According to the regression line, as Korean men ages, prostate volume will increase by 0.4cc per year.

Prostate-volume for age percentiles from age 39 to 70 are shown in Fig 6. From 3rd to 50th percentile, linear regression line showed the best fit, but for 75th and above percentiles, exponential regression line was the best fit. This may be due to the increased percentage of BPH developing in older age groups as we have previously seen in the density curve. Using this graph, we can see that by age 40, 75% will have PV over 20cc and by age 55, 90% of men will have PV over 20cc. The result correlates with Fig 4, where the blue line represents the raw data of prostate volume over 20cc in each age decade.
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Cross Sectional
Analysis

11,633 men
Study population

mean age ±SD
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Age range
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Fig. 1

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<table>
<thead>
<tr>
<th>Age</th>
<th>N</th>
<th>Mean±SD</th>
<th>Range</th>
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<td>21</td>
<td>19.8±6.2cc</td>
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<td>476</td>
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<td>70-79</td>
<td>612</td>
<td>38.1±16.9cc</td>
<td>12.7-152</td>
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<td>80 and over</td>
<td>46</td>
<td>40.1±21.9cc</td>
<td>5.2-120</td>
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<td>11633</td>
<td>30.5±10.3cc</td>
<td>5.2-152</td>
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<tr>
<td>Age standardization (2008) 40 and over</td>
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<td>30.4cc</td>
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**Fig. 2:** Age-stratified mean values and standard deviation of prostate volume in community based population of Korean men

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RESULTS

Age and Prostate volume

Fig. 3: Comparison of prostate volume distribution by age decade

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Fig. 4: Age stratified percentage of prostate volume over 20cc, 25cc, and 30cc in healthy Korean men

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RESULTS

Age and Prostate volume

Linear regression Analysis
Pearson: 0.345 (p < 0.0001)
PV = 8.53 + 0.4cc x Age(year)

Fig. 5

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Fig. 6: Prostate volume-for-age percentiles; Age 39 to 70

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Conclusion

Age-stratified mean prostate volume values and the influence of aging hereon should be considered in determining threshold for prostate enlargement in Korean men.
References


