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Does the prostate internal architecture on transrectal ultrasound predict future prostate growth? A 15-year longitudinal community-based study of benign prostatic hyperplasia in Japan

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Introduction

- There are few data about the natural history of lower urinary tract symptoms suggestive of benign prostatic hyperplasia (LUTS/BPH) in Japan.
- From 1992 to 1993, we performed a cross-sectional community-based study of men aged 40 to 79 who lived in Shimamaki-mura, Japan, to clarify the prevalence of LUTS/BPH.
- In the study, we determined the internal prostate architecture on transrectal ultrasound (TRUS) and hypothesized that the architecture could predict the future natural history of prostatic growth[1].

Objective

- To confirm the hypothesis that the internal architecture of the prostate on TRUS determines future prostate growth, we conducted a longitudinal community-based study from February 2007 to January 2008, 15 years after the first survey.

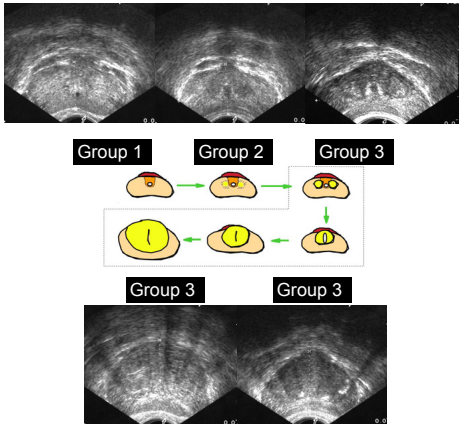

Figure 1 - Transrectal ultrasound images of prostates. These images and schematic illustrations show internal architectures of prostates that shift from group 1 to group 3.

Subjects and Methods

- In the initial cross-sectional community-based study, 319 men aged 40 to 79 at that time participated (46.7% response rate).
- In 287 of the 319, prostate volume and the internal architecture of the prostate on TRUS were determined, and they were eligible for the current study.
- Internal prostate architecture at the initial survey was categorized into 3 groups by one of us (N. M.) (Figure 1).

Group 1; Transition zone not visible
Group 2; Transition zone visible but the border not clearly delineated
Group 3; Transition zone visible with a clear border

- We sent all subjects invitations to the study by mail. We informed participants of the current study and got their consent.
- TRUS was performed by one of the authors (F. F.), using a Bruel & Kjaer transrectal ultrasonograph with a type 8551 (7.0MHz) endosonic multiplane transducer.
- No interrate difference in calculation of prostate volume was observed using a phantom model.
- The internal architecture of the prostate was studied by two of us (F. F. and N. M.).
- The prostate volumes were calculated with the same method as in the initial survey.

Prostate volume = (π/6) × anteroposterior diameter × transverse diameter × longitudinal diameter

- Changes in prostate volume among the 3 groups were analyzed by repeated ANOVA followed by the Tukey HSD test for multicomparison.

Results

- The present status of 287 participants in the initial study was as follows.
  - Alive 164 (57.1%)
  - Dead 90 (31.4%)
  - Moved 33 (11.5%)
- Of the 164 men still living in Shimamaki-mura, 120 (73%) participated in the current study. Nineteen of them were excluded from analysis because of prostate surgery, a history of prostate cancer or taking anti-androgen drugs during the 15 years between the studies.
- Finally, 101 men were eligible for the current study.

Age	No.	No. Current internal architecture (%)		
		Group 1	Group2	Group 3
50-59	16	5 (31.3%)	5 (31.3%)	6 (37.5%)
60-69	31	9 (29.0%)	5 (16.1%)	17 (54.8%)
70-79	32	6 (18.8%)	6 (18.8%)	20(62.5%)
80-94	22	3 (13.6%)	1 (4.5%)	18 (81.8%)

- Of 50 prostates in group 1, 29 (58%) had shifted to higher groups, but most prostates (96%) in group 3 remained in the same group (Table 1).
- Among the three groups, the largest prostate volume was observed in group 3 (Table 1).
- Annual prostate percent increases were 3.2% and 3.4% for prostate volumes of less than 20ml and 20ml or more, respectively. However, there was no significance (p=0.78, Mann-Whitney U test).
- The change of prostate volume in group 3 was significantly larger than those of the other groups (p<0.05) (Table 1 and Figure 2).
- Over the 15 years, 12 participants underwent prostate surgery consisting of transurethral resection of the prostate (TURP) in 1, 1 and 10 participants in group 1, 2 and 3, respectively.

Discussion

- This longitudinal community-based study demonstrated that the groups of prostate based on internal architecture on TRUS tended to become larger with age.
- The proportion of group 3 in each age category increased as the age increased.
- Basically, the change of internal architecture was one-way.
- In groups 2 and 3, there were two cases whose group changed to group 1. This might have been due to incorrect determination in the initial survey.
- Although most of the prostates increased in size in the 15 years (Figure 2), the change of the prostate volume in group 1 was small.
- In contrast, group 3 showed large changes in prostate volume and a large standard deviation with variability.
- Rhodes et al. reported that larger prostates at baseline tended to have a greater annual percentage increase in prostate size[2]. However, our results were not consistent with theirs because of the small sample size.
- The growth of prostate volume in group 3 was significantly larger than in the others. Thus, determination of the internal architecture of the prostate at diagnosis may be useful for estimating whether the prostate volume will increase in the future.
- Had the 12 participants who underwent TURP not undergone surgery, the prostate volume in group 3 would have been larger because most of them were in group 3.

Conclusions

- This is the first study that demonstrates longitudinal changes in prostate volume according to the internal prostate architecture.
- This longitudinal study confirms the hypothesis derived from the cross-sectional study that the group 3 prostate has the potential to grow in the future.

References

1. Masumori N, et al. Age –related differences in internal prostatic architecture on transrectal ultrasonography: results of a community based survey in Japan. J Urol 157, 1718, 1996
2. Rhodes T, et al. Longitudinal prostate growth rates during 5 years in randomly selected community men 40 to 79 years old. J Urol 161, 1174, 1999.

Previous group category	Group 1			Group 2			Group 3		
No	50			23			28		
Current median age (range)	65.5 (53-90)			70 (57-83)			80.0 (59-94)		
Current prostate volume (ml) (mean ± SD)	22.1 ± 6.6			26.0 ± 8.3			39.1 ± 16.4		
Change in prostate volume (ml) (mean ± SD)	5.1 ± 4.7			7.9 ± 7.4			17.2 ± 13.0		
Present group category	**Group 1**	**Group 2**	**Group 3**	**Group 1**	**Group 2**	**Group 3**	**Group 1**	**Group2**	**Group3**
No	21	13	16	1	4	18	1	0	27
Current prostate volume (ml) (mean ± SD)	19.2±5.1	21.9±4.7	26.1±7.8		19.0±1.5	28.5±7.3			40.2±15.8
Change in prostate volume (ml) (mean ± SD)	2.5±4.3	5.9±3.0	8.0±4.5		3.3±1.7	9.6±7.2			17.8±12.8

Table 1- Baseline and present characteristics of subjects by group categories.

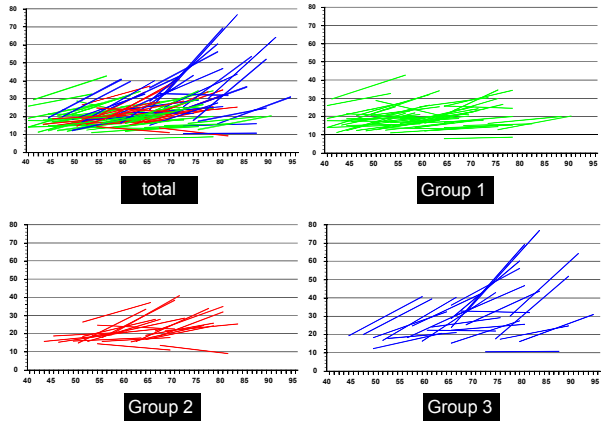

Figure 2 – Graphs show changes in prostate volume by group categories.