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VISUALIZATION OF 3D STRUCTURE OF THE PROSTATIC URETHRA AND HYDRODYNAMIC SIMULATION ARE VALID FOR ESTIMATING LUTS IN BPH PATIENTS.

Hypothesis / aims of study

In ICS 2009, we presented dilation of prostatic urethra measured using cystourethroscopic video image was related to improvement of voiding symptom in patients with LUTS after tamsulosin treatment [1]. In SIU 2010, we also reported hypothesis of mechanism of LUTS in BOO using hydrodynamic simulation of urine stream in the prostatic urethra [2]. The purpose of the study is to verify whether such methods are valid for estimating LUTS and effects of therapeutic modalities in patients with BPH.

Study design, materials and methods

Cystourethroscopic video image was processed in twenty-five patients with BPH before and after administration of alpha1-blocker. Site and extent of dilation of the urethra was compared with voiding symptoms. In determining the site of the prostatic urethra responsible for LUTS, three types of hydrodynamic models of the bladder and the prostatic urethra were prepared using CAD software. The models were designed to simulate the prostatic urethra with or without enlargement of the prostate, and dilation in the urethra. The hydrodynamic energy was calculated using Bernoulli equation: $H=v^2/2g+z+p/\rho g$ (H: hydraulic energy, v: velocity of flow, g: gravity, z: height, p: pressure, ρ: density of water).

Results

The effect of alpha 1-blocker in dilation was prominent at the level of vermontanum in the anterior wall of the prostatic urethra (figure 1, arrow). In the hydrodynamic model of the urethra in BPH, vortex was prominent at the anterior and distal end of the prostatic urethra (Figure 2, B). The vortex disturbed the urine stream in the prostatic urethra and reduced hydraulic energy of the urine stream during passage through the prostatic urethra. The loss of hydraulic energy was recovered in the model together with disappearance of the vortex after slight dilation of the anterior part of the urethra.

Figure 1

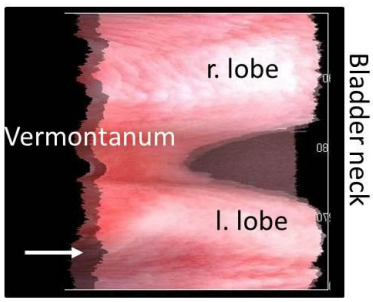
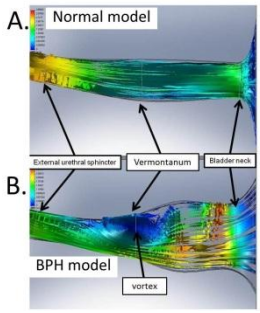


Figure 2



Interpretation of results

The hydraulic model of BPH indicates that vortex occurred at the outlet of enlarged prostatic lobes is considered to be one of factors of deteriorated urination. The effect of alpha 1-blocker in improvement of urination would be attributable to dilation of the anterior part of the prostatic urethra, resulting in re-opening the functional channel of the urethra and reduction of hydraulic energy loss in patients with BPH.

Concluding message

Evaluation of prostatic urethra through cystourethroscopic video image processing would be useful to understand the mechanism of LUTS and efficacy of therapeutic modalities together with analysis of hydrodynamic simulation of urine stream inside the prostatic urethra.

References

1. Neurourol Urodyn, 28: 721-22, 2009.
2. Urology, suppl 3A: s23-24, 2010.

Specify source of funding or grant	**None**
Is this a clinical trial?	**Yes**
Is this study registered in a public clinical trials registry?	**No**
Is this a Randomised Controlled Trial (RCT)?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Ethics Committee of Graduate School of Medicine, Chiba University.**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**