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Park S J[1], Kim Y H[2], Lee H K[1], Yi B H[1], Hong H S[1]
1. *Department of Radiology, Soonchunhyang University Hospital Bucheon,* ***2.*** *Department of Urology, Soonchunhyang University Hospital Bucheon*

A VARIETY OF VASCULAR CHANGES IN THE URINARY BLADDER DURING URODYNAMIC STUDY IN WOMEN WITH VARIOUS TYPES OF LONG-STANDING URINARY SYMPTOMS: PRELIMINARY STUDY USING 3-DIMENSIONAL COLOR AND POWER DOPPLER SONOGRAPHY

Hypothesis / aims of study
The urinary bladder undergoes repeated cycles of filling, contraction and emptying during which substantial variations in bladder perfusion and oxygenation may occur. How can we measure blood flow to the bladder during these cycles of filling, contraction and emptying? We aimed to establish a correlation between intravesical pressure and bladder blood flow during urodynamic study(UDS) by using color or power Doppler sonography in women with longstanding urologic symptoms.
Study design, materials and methods
Nineteen women with various urinary symptoms were included in this study. They complained long-standing urinary symptoms (n=15); including urinary incontinence (n=15), urinary urgency (n=5), frequency (n=8). Some patients suffer loss of voiding sense (n=3), and ESRD (n=1). We obtained multiphasic three-dimensional (3-D) volume data with color/power Doppler of bladder using 4-7MHz 3D-volume curved-array transducer of Accuvix XQ (Medison, Seoul, Korea) during UDS. 3-Ddata includes during filling, during voiding sense combined with/without elevation of intravesical pressure on UDS and during urgent voiding. We reconstructed continuous axial-images with 1mm-slice thickness by MultiSlice View and evaluated vascular flow change of the bladder wall. 3-D data includes during filling, during voiding sense combined with/without elevation of intravesical pressure on UDS and during urgent voiding. We reconstructed continuous multislice axial-images with 1mm-slice thickness by 3D extended imagingTM and evaluated gross blood flow change to the bladder wall. And also we assessed quantitative analysis of blood flow by using of vascular index (VI), flow index (FI), and vascular flow index (VFI) in region of interest (ROI). We created ROI in the urinary bladder wall at entering vesical artery, fitting the individual.

Results
Supplying blood vessels of the bladder were seen in 4/19 (21.1%) during filling stage. There were 32 times of voiding sense in 16 patients during UDS. We obtained color or power Doppler 3-D volume data at that time and 3-D volume data during void in five patients. Flow signals were seen in 23/32 (71.9%) during voiding sense, and 4/5 (80%) during void. This study provides additional evidence for increasing blood flow with increasing distension. Assessing the spatial distribution of blood flow in the microcirculation represents a particularly challenging problem for imaging technologies. The use of VI, FI, VFI enables to perform accurate measurements of the microvascular density of the urinary bladder, as semiquantitative methods.

Interpretation of results
Some investigators have reported that bladder wall perfusion decreases during passive distention of the bladder. However a recent report found an increase in blood flow during distention. To investigate this problem, we measured blood flow to the bladder during UDS using 3-D volume data of color and power Doppler ultrasound with simultaneous measurement of intravesical pressure during UDS. The flow spectra deduced from the bladder wall vessels showed evidence of low resistance. Further an evidence of an increase in blood flow during distention of the bladder was the detection of flow signal in the supplying blood vessels of the bladder, although not quantifiable. As a result of the blurring of the color Doppler signals, measuring the diameter of the individual vessel yields no precise information about the corresponding flow rate.
Concluding message
Blood flow in the bladder tends to increase during urinary urgency. 3-D color/power Doppler sonography is a feasible method for assessing blood flow change in bladder wall during UDS.

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Was the Declaration of Helsinki followed?	**Yes**
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