

## THE 3D-ULTRASOUND ORIENTED ADJUSTMENT FOR SPHINCTERIC URETHRA PRIOR TO DOPPLER ULTRASOUND VIDEOURODYNAMICS -REPEATABILITY OF VELOCITY-FLOW PARAMETERS.

### Hypothesis / aims of study

We had developed a totally noninvasive transperineal urodynamic technique using Doppler ultrasonography. We have been testing the 3D-ultrasound probe orientation for adjustment of sphincteric urethra prior to velocity flow evaluation using Doppler ultrasonography. Moreover repeatability of velocity-flow parameters was compared between two voiding trials with or without 3D aided urethral aiming.

### Study design, materials and methods

Initially 57 patients were considered for transperineal Doppler ultrasound videourodynamic study. Among them 50 patients successfully underwent ultrasound videourodynamics two times. Subjects were divided into two groups according to prostatic volume with more than 30cm<sup>3</sup> (BPE group: n=16) or less (Non BPE group: n=34). For 3D-aided urethral aiming, the anal canal, acting as a median reference point, was set to the midline of the 3D image. After completion of adjustment for urethral aiming, the ultrasound machine (Prosound α6, Hitachi-Aloka Medical Co, Tokyo, Japan) turned from the 3D mode to the Doppler mode. Then the Doppler images were recorded on the computer during voiding and analysed to obtain flow characteristics by an in-house developed specialized software. The spatially averaged flow velocity curves were plotted and shown on the computer screen. The velocities,  $V_1$  at the distal prostatic urethra ( $S_1$ ) and  $V_2$  at the membranous urethra ( $S_2$ ) were obtained. From these data, the velocity ratio ( $VR=V_1/V_2$ ), and the corresponding functional cross-sectional areas  $A_1$  and  $A_2$  were measured from the following formula:  $A=Q_{max}/V$ .

### Results

Without 3D aid, 12% failures in urethral aiming were counted whereas no failure occurred for aiming with 3D aid. There were 6% patients who couldn't hold micturition until completion of 3D aided aiming whereas this increased to 10% for the cases without 3D aid. Good repeatability for Doppler ultrasound urodynamic parameters was confirmed between two voiding trials. It was found that  $A_2$  had better repeatability (Spearman's rho: 0.841) than any other parameters including  $Q_{max}$  (Spearman's rho: 0.820). It was demonstrated that  $V_1$  (52.7cm/s) was higher than  $V_2$  (47.2cm/s) for the BPE group, whereas for non BPE group  $V_2$  (63.4cm/s) was significantly higher than  $V_1$  (36.9cm/s).

### Interpretation of results

The 3D ultrasonography helps to achieve the urethral aiming accurately prior to velocity flow study. Sufficient repeatability of velocity flow parameters was confirmed. We hereby report improvement of robotic manipulator and advancement in imaging technique that allow successful measurement of urethral velocity in all cases using 3D-ultrasound aided adjustment prior to velocity-flow urodynamic study. Current results are consistent with previous findings showing that in non BPE group flow velocity was accelerated through the sphincter, whereas in BPE group flow velocity was reduced through the sphincter.  $A_2$  has better repeatability than  $Q_{max}$ . Therefore,  $A_2$  demonstrates similar value for each patient regardless of voided volume.

### Concluding message

The 3D aided urethral aiming is extremely helpful in conducting noninvasive Doppler ultrasound videourodynamics accurately.

### Disclosures

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