RECONSTRUCTION OF THREE DIMENSIONAL STRUCTURE OF THE URETHRA FROM ENDOSCOPIC VIDEO IMAGE

Hypothesis / aims of study
Recently, depiction of three dimensional (3D) structure of the urethra is attempted using CT\(^1\), MRI\(^2\) or ultrasound\(^3\) to diagnose urethral diseases. Since endoscopy is common in urological practice, and the image contains much information about color and shape of the urethra, we developed novel method to extract 3D information of the urethra from the video image.

Study design, materials and methods
We made software that runs on Windows PC. The software is designed to calculate distance between the object and the endoscope by intensity of each pixel of the image. Before clinical trial, endoscopic image using irregular “dummy” pipe was processed and estimated its relevance. During examination or TUR, the urethra was observed using cystourethroscope pulled through slowly. The video image of the urethra was recorded, captured to PC, and processed using the software later.

Results
Opened image of “dummy” pipe is created automatically in every trial. Relevancy of 3D structure is confirmed using “dummy”. In 9 of 39 video files of male urethra, opened 3D image was processed successfully (figures). Additionally, an opened 3D picture of whole length of the urethra can be processed in four female patients. Failure of processing image was attributable to inadequate maneuvering of the scope or to opaque view by bleeding.

Interpretation of results
Processing the 3D image of the urethra from the endoscopic video image indicates feasibility of acquiring 3D coordinates of the urethral channel using conventional endoscope. The processed 3D image would adjust to hydraulic model for calculating local resistance of urinary stream.

Concluding message
Processing an opened 3D image is achieved in an automated and real-time mode. This method will provide novel diagnostic tool for evaluating obstructive function of lower urinary tract and bladder function further.

References