Three dimensional profilometry
– complex method to evaluate the dimensional pressure distribution in the urethra

Elżbieta ŚWIŚ, Hanna SZWEDA, Wioletta Katarzyna SZEPIENIEC, Paweł GRUSZECKI, Paweł SZYMANOWSKI
Department of Gynecology ang Uroginecology, Faculty of Medicine and Health Sciences of the Andrzej Frycz Modrzewski Kraków University, Scanmed St. Raphael Hospital, Kraków, Poland.

1 Introduction and aim of the study

Urethral profilometry, a feature of urodynamic diagnostics which has been used since the 1970's, is one of several different urethral assessment methods. It involves simultaneous measurement of intravesical and intraurethral pressure both at rest and during exercise. Created as a scientific and research tool, urethral profilometry has numerous limitations in clinical practice and it has also been said that this is not a repetitive study.

One of the main limitations of profilometry is due to the use of traditional catheters where intraurethral pressure is measured along the entire urethra but only at one of the point of its circumference. Because of the anatomical structure of the urethra, the results of dimensional pressure distribution tests can be very different depending on the direction in which the measurement is directed. In patients with lower urinary tract pathology, i.e. after surgery or injury to this area, the pressure distribution is even more varied. Dimensional profilometry allows for a more precise and global assessment of the distribution of pressure in the urethra.

2 Materials and methods

Dimensional profilometry is performed as an element of comprehensive urodynamic diagnostics. We used 5-channel catheters, model 5 PPV-9 with a diameter of 9Fr, four of which are used to measure intraurethral pressure (Pura), and the fifth to measure the pressure in the bladder (Pves). Four Pura measurement channels are arranged radially every 90 degrees at a distance of 6 cm from the Pves channel (Fig. 1) and dedicated software is used for analysis and graphical illustration of the Pico 3000 result. The pilot study initially included a group of 20 patients with various pathologies of the lower urinary tract.

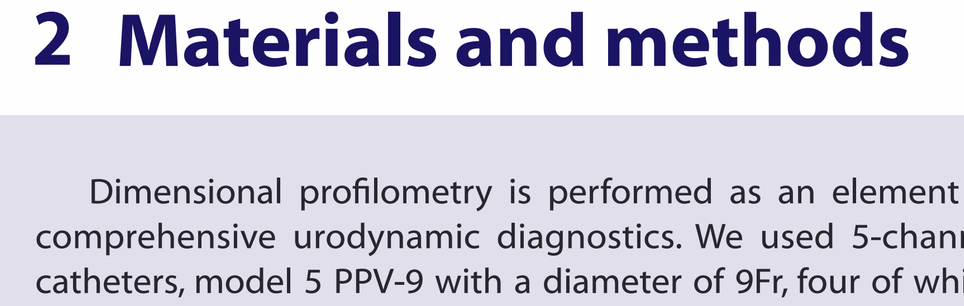


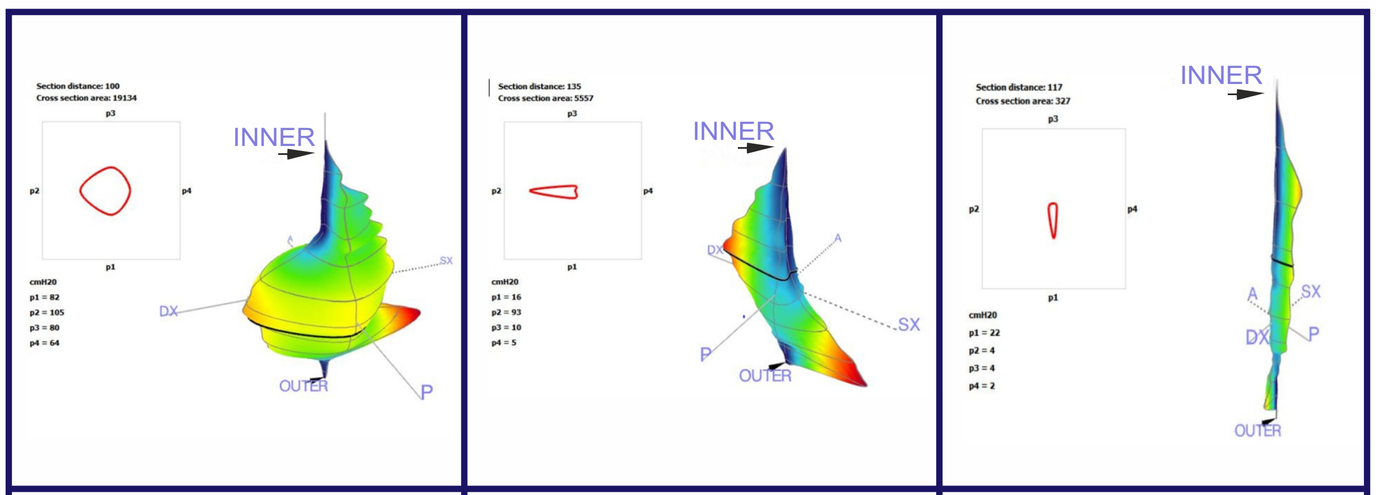
Fig.1 5-channel cathether.

3 Results

Performing a dimensional profilometry test, we obtain images of the pressure distribution in the patient's urethra which are both reliable and easy to analyse. Presented below are pressure distribution images in the urethra depending on the complaints of the subjects.

The software used enables the healthcare provider to view these 3D images at a selected angle, rotate them, and perform numerical analyses of pressure at any chosen point of the urethra. The red mark in the frame illustrates the shape of the urethral section at the level indicated by the black line of the 3D graphics.

Examination time, technique and discomfort experienced by the patient do not differ from those of classical profilometry.



Healthy Patient	Patient after TOT procedure	Intrinsic sphincter deficiency

Fig. 2 Example graphs of dimensional profilometry (INNER-internal urethral meatus, OUTER - external urethral meatus, p1-p4 pressure values corresponding to individual catheter channels, A reading from the P1 catheter - ventrally, Sx (reading from the catheter P2) left side, P reading from the P3 catheter - rectally, DX reading from the P4 catheter - right side.

4 Conclusions

Dimensional profilometry of the urethra allows for a comprehensive assessment of the dimensional pressure distribution in the urethra, and the use of dedicated software results in transparent and easy to analyze three-dimensional images of pressure distribution. No other method or multiple measurements using classical profilometry allow physicians to obtain such complete data concerning urethral pressure distribution. Specifically, this method can be used in the diagnosis of complicated cases of lower urinary tract disorders, and also urethral evaluation in patients after surgery of the lower urinary and genital tract with suspected obstruction in urine outflow at the level of the urethra. Assessment of repeatability, clinical use and implementation in daily clinical practice requires further research on a larger group of patients.