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Summary of PhD thesis:

“The use of advanced techniques of ultrasound examination in the diagnosis of some urological diseases”

Promotor:

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Ultrasonography is a non-invasive method of imaging organs and tissues. It has been used in medicine since 1950s. The classic grayscale examination has, over time, been supplemented with advanced imaging methods such as: ultrasound examinations utilizing the Doppler effect (for the assessment of vascular flow), elastography (for the assessment of tissue stiffness), imaging with the use of contrast agents (for the assessment of vascular flow and tissue blood supply) and also three-dimensional ultrasound (3D USG) imaging which saves a 3D images during its acquisition and which enables later analysis on the screen and does not required the patient's presence.

The aim of my dissertation was:

- firstly, to evaluate the use of ultrasound elastography to increase the sensitivity and specificity of imaging of prostate cancer foci (the review article),
- secondly, to evaluate the use of shear wave elastography (SWE) in the study of the urethral sphincter complex as a prognostic value of urinary incontinence in patients after radical prostatectomy (the original article),
- thirdly, to assess the use of three-dimensional ultrasound (3D USG) in the diagnosis of Peyronie's disease including its comparison with two-dimensional ultrasound (2D USG) (the original article).

In the first study, the advantages of transrectal elastography were analyzed in the diagnosis of prostate cancer based on available publications. In the second study, the stiffness of the urethral sphincter complex using shear wave elastography was evaluated and correlated with the severity of urinary incontinence after radical prostatectomy. In the third

study, the findings of three-dimensional ultrasound (3D USG) were compared with the two-dimensional ultrasound (2D USG) findings in patients with Peyronie's disease.

The ultrasound elastography can improve the diagnosis of prostate cancer by performing targeted biopsy from areas of increased stiffness. Moreover, it can reduce the number of biopsy cores needed to diagnose prostate cancer. In the second study, statistical analysis revealed that higher than average urethral sphincter complex stiffness correlates with a better urinary continence. The group which underwent the post-prostatectomy pelvic floor muscle rehabilitation had statistically significant higher stiffness of the urethral sphincter complex compared with the group without rehabilitation. In the third study, the 3D ultrasound enabled the visualization of the entire plaque in the coronal plane of plaque showing its precise size and shape. The opportunity to perform a detailed analysis of the acquired images using a generated digital cube reduced the average duration of the acquisition. Shorter time of 3D USG acquisition when compared with 2D USG examination reduces the time of troublesome and uncomfortable examination for the patient.

The studies have showed that elastography is a valuable method in the diagnosis of the prostate cancer, thus enabling targeted biopsy. The shear wave elastography is a valuable method in the evaluation of the urethral sphincter complex after prostatectomy. The 3D USG seems to be a valuable complement to 2D USG for patients with Peyronie's disease because it enables the assessment of the shape of the plaque in the coronal plane and offers shorter time of acquisition.