

The Contribution of Endorectal Magnetic Resonance Imaging for the Diagnosis of Prostate Cancer

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Prostate cancer is a major public health problem. It is the most common cancer in men and the second leading cause of cancer related death. The incidence in the United States in 2012 was estimated to be 241 470 new cases and 28 170 deaths associated with this cancer.

Although a health problem internationally, diagnosis of prostate cancer has remained virtually unchanged and is still based on three probes: digital rectal examination, PSA determination and systematic biopsy, all three with a low diagnosis accuracy.

The increased use of PSA testing for prostate cancer diagnosis has led to an increased of men scheduled for prostate biopsy in the last decade, which is associated with increased diagnosis of indolent prostate cancer, increasing costs, and biopsy-related complications. Up to 80% of newly diagnosed prostate cancer patients will have localized disease, low PSA serum levels and low risk for tumor recurrence.

systematic biopsy can miss up to 35% of cancers in the first session, especially if the tumors are located at the apex or the anterior portion of the prostate. Furthermore almost half of the cases need to be histologically upgraded after radical prostatectomy.

Over the last years new focal therapy methods emerged for PCa treatment such as high intensity focused ultrasound, cryotherapy, focal laser ablation, intensity-modulated radiation therapy, radio frequency and others. These relatively new therapeutic methods come as an alternative option to existing treatment modalities such as active surveillance, radical prostatectomy or radiotherapy. These therapeutic alternatives are based exclusively on the biopsy results.

Due to the large number of cases of prostate cancer, inefficient methods of diagnosis and the emergence of new minimally invasive treatment options, important efforts were made in recent years to improve diagnostic methods and substantial increase sensitivity and specificity in the detection, characterization and staging of prostate cancer. Among imaging techniques, multiparametric endorectal MRI examination demonstrated great potential in the diagnosis of prostate cancer.

The aim of this thesis was to evaluate the importance of endorectal MRI in the detection, characterization and staging of prostate cancer. The main results are summarized in three chapters. Although the results are promising, further prospective studies are needed to validate this technique.

The first study aimed to compare between two evolving imaging methods, namely endorectal MRI (T2-weighted sequence only) and real-time elastography for detecting prostate cancer. These are two modern techniques, with very promising results, which to date have not been compared, giving similar detection rates in our study.

The second study aimed at analyzing endorectal MRI examination in terms of diagnostic performance and the influence of this technique on subsequent treatment. The study included patients in our population, especially those at high risk of recurrence. For this study endorectal MRI was introduced and applied for the first time in our country, proving its effectiveness in the male patient group in Romania, with a high rate of diagnosis and influence therapeutic decision.

The objective of the third study was to analyze a new ratio proposed by our group for characterizing prostate cancer aggressiveness and comparing it with the absolute values of the ADC (the principal method for the assessment of cancer aggressiveness of prostate cancer). This paper has demonstrated that absolute ADC values are influenced by background changes of the prostate. The study proposes a new technique to estimate cancer aggressiveness by calculating a ratio between the benign and malignant tissue. It shows superior results to absolute ADC values. From the point of view of the author, the introduction of this report is the main contribution to the accurate analysis of multiparametric MRI in the evaluation of prostate cancer.

The main conclusions of this thesis are:

1. Prostate multiparametric MRI provides anatomical, cellular, molecular, and microvascular information and is currently the imaging method of choice used to investigate exact prostate cancer
2. This method has the ability to detect, stage and perhaps the most important consideration, to guide the biopsy needle not only to the tumor but to the most aggressive part of the tumor
3. Wide application of endorectal MRI will reduce the number of biopsies performed, increase the diagnosis rate of relevant cancers and decrease the rate of indolent cancer diagnosis, thereby reducing cost, postbiopsy complication and overtreatment of patients
4. Performing endorectal MRI pre and post biopsy will weigh decisive in choosing the best therapy option for the patient

Keywords: endorectal MRI, prostate cancer, multiparametric MRI, diffusion, ADC maps, aggressiveness