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**The role of magnetic resonance imaging in the diagnostic work up of clinical localized prostate cancer: A review**

Umbehr MH *et al*. MRI-staging of localized prostate cancer

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**Abstract**

Imaging plays an increasingly important role in the work up of prostate cancer (PCa) and magnetic resonance imaging (MRI) is generally accepted as the most accurate and promising imaging modality in the local staging of PCa due to its high spatial resolution and excellent soft tissue contrast. The quality and performance of MRI of the prostate has improved dramatically during the last decade. Mainly the combination of morphologic information and functional information on cell density, tissue perfusion or metabolism as provided in multi-parametric prostate MRI (mpMRI) has led to a substantial increase lesion detection and characterization. The correlation between functional parameters as provided by MRI and the aggressiveness of PCa as determined by Gleason Score may help in differentiating clinically significant from indolent PCa non-invasively. Beside these pros, radiologists are confronted with an immense amount of information and standardized acquisition, interpretation and reporting of mpMRI is not yet a reality. Furthermore, prostate MRI availability is still limited to high volume centers in many countries; hence, it is not yet a routine tool in common daily practice. Hence, development of guidelines for standardized acquisition, interpretation and reporting of prostate MRI exams is urgently needed in order to provide useful information to treating clinicians. Preferably multi-centric clinical studies comparing MRI findings to step-section histologic specimens are mandatory during the coming years. Furthermore, simplification of the acquisition must be achieved in order to make this imaging modality applicable for daily use in common uro-radiologic practice.

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# Key words: Localized prostate cancer; Magnetic resonance imaging; Local imaging; Staging; Diagnostic work up

**Core tip:** This review gives an overview about the current strengths and pitfalls of magnetic resonance imaging in the work up of clinical localized prostate cancer as well as suggestions for steps to be done in the future.

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# INTRODUCTION

Imaging plays an increasingly important role in the work up of prostate cancer (PCa). An important mainstay of magnetic resonance imaging (MRI) is the local staging in patients with clinically localized PCa. In these patients, not only the information whether or not the disease is confined to the capsule is crucial but also information on the aggressiveness of the PCa is desired. The latter information is especially important in PCa due to its heterogeneity in terms of histopathology and clinical outcome. Exact characterization of PCa is a prerequisite in order to offer personalized treatment options and minimize the evident problem of over-diagnosis and over-treatment of indolent PCa[[1](#_ENREF_1)]. Furthermore, because of PSA screening - even in opportunistic forms – most PCa are detected while still in a clinically localized stage[[2](#_ENREF_2)]. In the end, a combination of tumor characteristics such as stage and aggressiveness of PCa and patient characteristics such as the age, co-morbidities and preferences of the patient will help decide on the best available (curative) treatment option. Men who suffer from aggressive localized PCa variants – meaning PCa with a GleasonScore ≥ 7 - traditional whole gland approaches such as radical prostatectomy or irradiation of the prostate gland are still considered the gold standard treatment modalities. However, patients suffering from a less aggressive – so called “indolent” - variants of PCa can nowadays be offered less aggressive treatment options which aim at preserving the prostate and thereby minimizing treatment related adverse events. Of these treatment options active surveillance (AS) should be mentioned first. In AS, patients with low risk PCa are closely observed and followed and curative intervention is only suggested in case of disease progression during follow up. AS is considered a safe treatment strategy as long as inclusion criteria are strictly set and respected[[3](#_ENREF_3)]. More recently, focal therapy emerged as another option. However, although short term safety of this approach has been described in the literature[4], long term outcome data are still lacking.

Deciding on the optimal treatment plan for a man suffering from PCa involves knowledge of differentiating limited from extensive tumor burden, organ confined from non-organ confined disease and indolent from aggressive cancer variants. MRI may help in gathering this crucial information and is therefore an important test for urologists and radio-oncologists in order to offer personalized treatment to patients suffering from PCa.

**THE ROLE OF MRI TODAY**

Today, MRI is generally accepted as the most accurate and promising imaging modality in the local staging of PCa[[5](#_ENREF_5)] due to its high spatial resolution and excellent soft tissue contrast. Furthermore, its ability to detect prostate cancer foci in anatomical locations within the prostatic gland which are difficult to sample and therefore often missed by TRUS-Biopsy (*i.e*. the anterior zone) has been shown by Sciarra *et al*[6]. The quality and performance of MRI of the prostate has improved dramatically during the last decade[[5](#_ENREF_5),7-[9](#_ENREF_9)]. Mainly the combination of morphologic/anatomic information and functional information on cell density, tissue perfusion or metabolism as provided in multi-parametric prostate MRI (mpMRI) has led to a substantial increase lesion detection and characterization[[10](#_ENREF_10),[11](#_ENREF_11)]. The correlation between functional parameters as provided by MRI and the aggressiveness of PCa as determined by GleasonScore which has recently been discovered [11-15] may help in differentiating clinically significant from indolent PCa non-invasively.

**THE ROLE OF MRI IN THE FUTURE**

These promising developments have led to great enthusiasm and it is conceivable that the traditional ultrasound guided random prostate biopsy with its well know problem of under-sampling[[16](#_ENREF_16)] might be completely replaced by MRI guided targeted biopsy procedures. Quite possibly overtreatment could be decreased due to the identification of only significant PCa[[17](#_ENREF_17)] while indolent PCa remains undiscovered. However, there are several crucial and yet unsolved problems with MRI in PCa today. As described by Gupta *et al*[[7](#_ENREF_7)] and supported by others[[18](#_ENREF_18)] in mpMRI radiologists are confronted with an immense amount of information and standardized acquisition, interpretation and reporting of mpMRI is not yet a reality. However, standardization is urgently needed in this field, should MRI ever play an as crucial role in PCa work up as prospected by Choyke[[17](#_ENREF_17)]. In this respect, there are currently promising developments[[19](#_ENREF_19),[20](#_ENREF_20)] in progress. Furthermore, prostate MRI availability is still limited to high volume centers in many countries; hence, it is not yet a routine tool in common daily practice. As a consequence, reading prostate MRI correctly isn’t a routine task for most radiologists today but the experience of the radiologist in reading and interpreting prostate MR findings – probably more so than in other exams – is a crucial factor[[21](#_ENREF_21),[22](#_ENREF_22)]. The role and the responsibility of the radiologist will change as urologists and radio-oncologists will most likely base their treatment recommendations much more on MRI-findings than they used to. The quality and reproducibility of reading prostate MRI are important and mandatory prerequisites for a high quality care of patients with PCa.

**NEXT STEPS**

MpMRI has shown to be an important and highly promising imaging modality in the work up of patients with PCa. As its technical potential seems to be far from fully exploited, mpMRI may truly revolutionize management of patients with PCa up and subsequently personalize the treatment of PCa. However, proper interpretation of prostate MRI is still limited to some specialized radiologists and a certain number of prostate MRIs have to be interpreted on a regular basis in order to maintain a high quality of radiologic reports. Development of guidelines for standardized acquisition, interpretation and reporting of prostate MRI exams is urgently needed in order to provide useful information to treating clinicians. In this regard, further and preferably multi-centric clinical studies comparing MRI findings to step-section histologic specimens are mandatory during the coming years. Furthermore, simplification of the acquisition must be achieved in order to make this imaging modality applicable for daily use in common uro-radiologic practice.

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