This paper describes the clinical performance of prostate cancer in magnetic resonance (MR) imaging at both 1.5 and 3T. Both a literature review and our own results are presented. Additionally potential ways to improve local staging performance and tumor localization with MR imaging will be described.

Prostate cancer is the most frequently diagnosed form of non-cutaneous cancer, affecting an estimated 218,890 new patients and causing approximately 27,050 deaths in the United States in 2007.

The use of high-magnetic field strengths (3T) offers new advantages in prostate cancer imaging. At higher field strength the signal-to-noise ratio is increased. The higher SNR enables to increase temporal resolution in dynamic MR imaging resolution, which will improve differentiation between prostate carcinoma and normal prostate tissue. Initial results show that with a time resolution of one second 10 slices can be obtained with adequate image quality and good signal intensity-time curves. Spectral resolution will be improved at higher field strength, which also may lead to improved differentiation between cancer, prostatitis and BPH.

Prostate cancer lesions demonstrate on T2-weighted MR images a low signal intensity area in a bright normal peripheral zone. The differential diagnosis of low signal intensity areas include besides carcinoma, biopsy-hemorrhage, prostatitis, BPH, effects of hormonal or radiation treatment, scars, calcifications, smooth muscle hyperplasia and fibro muscular hyperplasia. Previous studies using T2-weighted MR imaging obtained an accuracy in a range of 67 to 72% in localizing tumors at 1.5T. The addition of MR spectroscopic imaging and dynamic contrast-enhanced MR imaging showed significant improvement in localization performance in prostate cancer patients compared with T2-weighted MR imaging. It may be anticipated that 3T may result in higher localization accuracies. However, so far there is little scientific evidence that 3T prostate imaging results in improved localization performance.

At 1.5T, a meta-analysis revealed a large variation in local staging performance. With a maximum joint sensitivity and specificity of 71%. In a large prospective study in 82 patients with prostate cancer performed in our hospital showed, that the use of an endorectal-pelvic phased-array coil combination resulted in a significant improvement of anatomic details, staging accuracy and specificity, compared to phased-array imaging. Local staging accuracy, sensitivity and specificity were respectively 83%, 65%, and 98%. Two recent endorectal MR imaging papers performed at 3T demonstrated high sensitivities and specificities for local staging of prostate cancer. Even minimal capsular penetration could be detected.

In conclusion, local staging of the prostate should be performed at 3T using an endorectal coil for obtaining optimal results. The exact role of 3T for tumor localization, although promising, has not been established yet.