

## Value of magnetic resonance imaging for the local staging of prostate cancer at 3 T

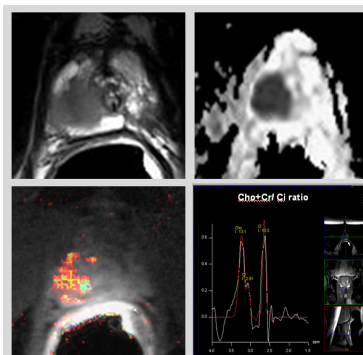
Josephin Otto<sup>1</sup>, Gregor Thörmer<sup>1</sup>, Matthias Seiwerts<sup>1</sup>, Jochen Fuchs<sup>1</sup>, Nikita Garnov<sup>1</sup>, Lars-Christian Horn<sup>2</sup>, Harald Busse<sup>1</sup>, Thomas Kahn<sup>1</sup>, and Michael Moche<sup>1</sup>  
<sup>1</sup>Department of Diagnostic and Interventional Radiology, University Hospital, Leipzig, Saxony, Germany, <sup>2</sup>Institute of Pathology, University Hospital, Leipzig, Saxony, Germany

### Introduction/ Purpose

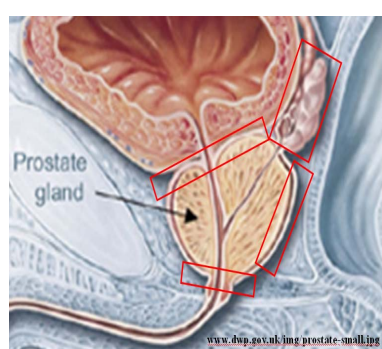
Prostate cancer (PCa) is characterized by a high incidence but relatively low mortality. From 1970 to 2000, the 5-year survival rate reported for the UK had increased from 31% to 77% [1]. Disease prediction and therapeutical decision of histopathologically confirmed PCa are commonly obtained by nomograms [2], which have a relatively low predictive value. This may result in inaccurate local staging with incorrect risk stratification for patients with PCa [3, 4]. Better definition of cancer location and extension are especially important for patients selected for nerve-sparing surgery [5]. Therefore, there is a need for a diagnostic tool that can reliably differentiate organ confinement from extracapsular extension of PCa. So far, only a limited number of studies have assessed the value of a state-of-the-art, endorectal 3-T prostate MRI for the local staging of prostate cancer. The purpose of this work was to evaluate the diagnostic accuracy of multiparametric MRI at 3 T for local staging of PCa.

### Materials and Methods

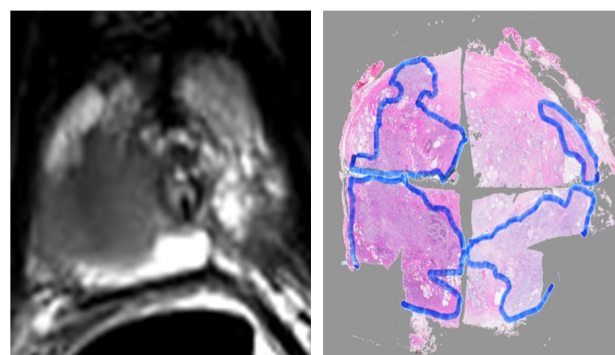
This study was approved by the institutional review board and written informed consent was obtained from all patients. Prior to radical prostatectomy, 38 patients with biopsy-proven PCa underwent a multiparametric MRI examination at 3 T using a combination of a pelvic phased-array coil and an endorectal coil (ERC). The MRI protocol included T2-weighted fast spin-echo imaging in three views as well as diffusion-weighted MRI, dynamic contrast-enhanced MRI and MR spectroscopic imaging in para-axial views (Fig. 1). Two readers with eight and three years experience in abdominal and genitourinary MRI used established MRI criteria for extracapsular extension (ECE) and seminal vesicle invasion (SVI) to determine the extent of local disease [6]. The analysis focussed on six regions (left and right apical, dorsolateral and basal, Fig. 2) that have the highest incidence of ECE [9]. The standard of reference was provided by histopathological analysis of intra-surgical frozen sections in these six regions and the later analysis of the prostatectomy specimen (Fig. 3). Tumor foci were reported with respect to their location (apex, midgland, base), lateral position (left, right), TNM classification and Gleason Score (GS). Sensitivity, specificity and accuracy of ECE and SVI detection were calculated per region as well as per patient.



**Figure 1:** Multiparametric 3-T endorectal MRI examination of a 61-y.o. patient with stage T3a disease in the right midprostate. PSA and GS were 16 ng/mL and 8(4+4), respectively.



**Figure 2:** Schematic longitudinal cross section of prostate gland illustrating six major regions for extracapsular extension (base, midgland, apex) and seminal vesicles.



**Figure 3:** Para-axial T2-weighted MR image (left) and corresponding histopathological sections (right). Tumor foci were marked (in blue) by an experienced pathologist. An independent supervisor used well-established criteria from the literature to define ECE and SVI in all MR images and mapped all findings (left) with histopathological results (right).

### Results and Discussion

Patients in our group were 53-75 (mean 65) years old. Median PSA level and median postoperative GS were 13.5 ng/mL (range 3.7-56 ng/mL) and 6.9 (range 6-9), respectively. ECE was present in 10 of 37 patients and in 15 of 222 individual regions. Sensitivity, specificity, and accuracy for ECE detection by the more/less experienced reader were 93/67%, 92/95% and 92/93% per patient and 90/80%, 74/82% and 78/82% per region, respectively. The corresponding values for the detection of SVI in 5 of 37 patients were 80/100%, 96/99% and 95/97% for the more/less experienced reader, respectively. Differences between both readers were not significant.

### Conclusion

The high specificities and relatively high sensitivities suggest that 3-T MRI with an endorectal coil is a suitable diagnostic tool for the local staging of prostate cancer.

### Acknowledgements

Grant support under BMBF 13N10360 is also greatly acknowledged.

### References

- [1] Coleman MP, Babb P, Damiecki P, et al. The Stationery Office; Series SMPS 1999; 61.
- [2] Partin AW, Mangold LA, Lamm DM, et al. Urology. 2001; 58:843-8.
- [3] Bhojani N, Ahyai S, Graefen M, et al. European Journal of Surgical Oncology (EJSO). 2009; 35:123-8.
- [4] Hoeks CMA, Barentsz JO, Hambrock T, et al. Radiology. 2011; 261: 46-66.
- [5] Seinfeld AD. Radiology. 1992; 184:593-8.
- [6] Fütterer JJ, Heijmink SW, Scheenen TW et al. Radiology. 2006; 238:184-91.
- [9] Wirth M, Weißbach L, Ackermann R, et al. Urological Society of Germany (DGU): <http://www.aeqz.de/mdb/downloads/dguurologie/prostatakarzinom-lang.pdf>