

**PP-05****Improved prostate cancer localization with DCE-MRI dispersion imaging**S. Turco<sup>1</sup>, K. Kompatsiari<sup>1</sup>, J.J. de la Rosette<sup>2</sup>, H. Wijkstra<sup>1,2</sup>, M. Mischi<sup>1</sup><sup>1</sup>*Eindhoven University of Technology, Eindhoven, The Netherlands*<sup>2</sup>*Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands*

**Introduction:** Current clinical diagnosis of prostate cancer (PCa) still relies on repeated systematic biopsies, hampering the efficient and timely use of the available focal therapies. This has spurred the need for imaging methods able to provide a timely localization and reliable delineation of prostate cancer. Based on the established link between cancer growth and angiogenesis<sup>[1,2]</sup>, several contrast enhanced imaging modalities have been proposed to investigate the structural and functional changes in tumor microvasculature, mainly represented by an increased microvascular permeability and density.

In dynamic contrast enhanced MRI (DCE-MRI), the adopted gadolinium-based contrast leaks across the vascular walls into the extravascular space, providing an opportunity for investigating permeability. To this end, time-concentration curves (TCCs) obtained from MRI dynamic scans are fitted by a model (Tofts et al.)<sup>[3]</sup> describing the contrast medium distribution kinetic between the intravascular and extravascular space, and parameters reflecting permeability and leakage rate are estimated.

Under the hypothesis that increased blood supply demands translates into increased microvascular density (MVD), many authors have investigated blood perfusion as a potential marker of angiogenesis. However, in tumor angiogenic vasculature lack of vasomotor control and increase in arteriovenous shunts cause a low flow resistance, while the high tortuosity and increased interstitial pressure may lead to a decreased perfusion. As a result, characterization of the microvascular architecture by perfusion quantification may be unreliable.

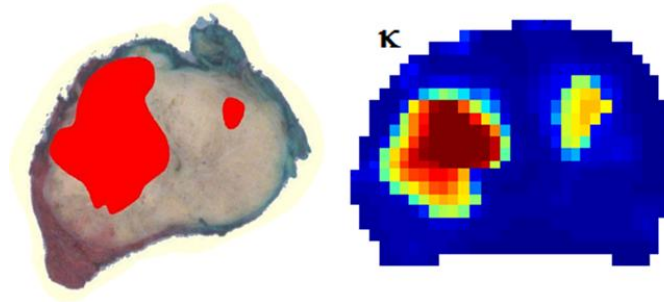
Recently, a new DCE-US method has been introduced that characterizes the microvascular architecture by assessment of the dispersion kinetics of an intravascular contrast agent<sup>[4]</sup>.

**Methods:** Based on the promising results of this method, which seem to overcome the limitations of perfusion imaging, in this work we investigate for the first time the feasibility of dispersion imaging with DCE-MRI by combining it with the Tofts extravasation model. The resulting model is fitted to the measured TCCs to obtain the simultaneous estimation of two parametric maps representing the microvascular architecture (dispersion parameter,  $\kappa$ ) and permeability (leakage parameter,  $\kappa_{ep}$ ).

**Results:** A preliminary validation was carried out by performing DCE-MRI (Magnetom Avanto, 1.5 T, Siemens) on 7 patients referred for radical prostatectomy at the Academic Medical Center, University of Amsterdam (The Netherlands), and comparing the imaging results with the histological analysis. Classification (pixel level) by the dispersion parameter  $\kappa$  was accurate, providing sensitivity=82.6, specificity=89.5, and ROC area=0.91.

**Conclusions:** The obtained results are promising, encouraging further research on this new method for localization of prostate cancer and, more in general, of any type of cancer where angiogenesis is involved.

**References:**<sup>1</sup> Russo, G., et al., *BJU International*, 2012. **110**(11c): p.E794-E808.<sup>2</sup> Camerliet, P., *Nature*, 2005. **438**(15): p.932-936.<sup>3</sup> Tofts, P.S., et al., *JMRI*, 1999. **10**(3): p.223-232.<sup>4</sup> Kuenen, M.P.J., et al., *IEEE Trans Med Im*, 2011. **30**(8): p.1493-1502.



**Figure 1: Histology results compared to the corresponding map of the dispersion parameter  $\kappa$ .**