

MRI guided prostate cancer focal ablation using HIFU by means of image to image registration

L. Dickinson, Y. Hu, H. Ahmed, C. Allen, A. Kirkham, M. Emberton, D. Barratt

Department of Urology, University College Hospitals, London NHS Foundation Trust, London, United Kingdom

Introduction: Multi-parametric (mp) MRI could be used to define the morphometry (location and limits) of a prostate tumour in order to allow greater precision in targeting focal therapies. This has hitherto not been possible so an anatomical zone has been declared the therapeutic target, with potentially large discrepancies between tumour and target volumes. We report on the use of tumour morphometry to inform the planning and conduct of therapy. The cases described are derived from a prospective Phase II multi-centre study of focal therapy using HIFU.

Methods: Non-rigid image registration software, developed in our institution, was used to transfer data on the location and limits of the index lesion as defined by mpMRI. Manual contouring of the prostate capsule and MR-visible lesion (histologically confirmed) was performed pre-operatively. A deformable patient-specific computer model capturing the location of the target lesion was registered to a 3D TRUS volume. Treatment volume could be added but not subtracted following registration, in order that cancer ablation was not compromised.

Results: MRI-TRUS registration was performed on 17 patients with MR visible lesions. The MRI-contoured lesion was visualised on the 3D TRUS images and compared with a prior manually-defined therapy plan. Two minor registration errors were attributed to temporary and correctable computer software issues. Time for registration took a mean 7 minutes (range 4 –16 minutes). Additional tissue was treated due to image-registration in 10/17 cases with a mean additional ablation time of 50 seconds (range 9 – 90 secs).

Conclusions: We have demonstrated that non-rigid MR-US registration is feasible, efficient and can locate lesions on ultrasound with potential for improved accuracy of focal treatments.