New 3D imaging can help reduce the number of men needing surgery for prostate cancer

Fewer men could soon need to go under the surgeon’s knife for prostate cancer, thanks to the use of 3D images to help perform non-invasive treatment. Leading doctors in the field of prostate cancer are now trialling software and equipment developed by Israeli company INSIGHTEC together with the German research institute Fraunhofer MEVIS and Mediri, a German SME. The partners hope approval from the U.S. Food and Drugs Agency could soon follow the first successful trials of the prototype.

“The beauty of this treatment is that it’s non-invasive: you don’t have to open up the body,” says Tobias Preusser, a mathematician who helped developed the software as part of EUREKA project PTPS.

The software release helps doctors perform Magnetic Resonance-guided High-intensity Focused Ultrasound treatment. Doctors direct an ultrasound beam at tumours, using heat generated at the beam focus to destroy tumour tissue, guided by images on a screen. Until now, the images used in equipment on the market were 2D, but the partners have managed to achieve a more realistic 3D display by anatomy and procedure imaging.

Clearer images help doctors avoid damaging organs and muscles close to the prostate such as the bladder, the rectum, the sphincter or nerve muscles. “If any of those areas are damaged there can be a real loss of quality of life such as incontinency or impotence,” says Preusser. Men undergoing surgery like a radical prostatectomy currently face a 30-90 percent risk of impotence and a 20-70 percent of incontinence. Those risks would be reduced by high-intensity focused ultrasound since the use of 3D display of the anatomy would enable physicians to target the soundwave at the tumorous tissue, normally only slightly heating the surrounding tissue, not damaging it.

“These 3D images allow the doctor to perform the procedure quicker and improve its accuracy” says Preusser.

It was over a lunch at a U.S. conference eight years ago that Preusser and contacts from INSIGHTEC decided to begin the project. They were discussing ways to improve the experiences of prostate cancer patients. INSIGHTEC was already using MR guided High Intensity Focused Ultrasound for treating other cancers. High-Intensity Focused Ultrasound had been successfully used to treat more than 20,000 men with prostate cancer in Europe over the last 10 years, but the partners felt they could make the treatment safer and more effective if they produced and sold better supporting software, transforming it into a more standard treatment.

Fraunhofer would draw on its expertise in image processing, using machine learning and classic image processing. The partners approached Mediri, which had developed Automated Quality Assessment (AQUA) – a system that helps to detect organ motion in real-time and recognise sub-standard images while they are being acquired in order to correct them.

The researchers used a combination of machine learning and classic image processing to develop the software, with mathematicians on the project coming up with state-of-the-art algorithms to ensure the software could identify sensitive organs around the prostate. Image clarity is particularly key since the shape of the prostate often changes during treatment.

INSIGHTEC is marketing the system as ExAblate 2100 – a transrectal ultrasound transducer, which would be mounted on a patient table of the MR scanner. The MR images are displayed and linked to the ExAblate 2100 system. In the EU, more than 350,000 men per year are newly diagnosed with prostate cancer, meaning a product to cut procedure time and potential treatment side effects is likely to interest patients and health systems worldwide. “This system allows the doctor to perform the procedure quicker and improve its accuracy” says Preusser.