Prostate cancer is the most common cancer in men, yet the prostate is the only solid organ in the body that doesn’t undergo targeted biopsies. At Smilow Cancer Hospital, that practice is changing. New technology and expertise now make it possible to visualize a prostate tumor within the gland, improving its detection, location, and staging.

Until now, the standard of care for prostate cancer has been to do a random biopsy of the prostate following an elevated prostate-specific antigen (PSA) test or abnormal digital rectal exam. Using ultrasound to locate the prostate, 12 random cores are taken from various areas within the gland. Sampling is random because until now it has not been possible to visualize cancer within the prostate. Aside from the lack of visual data, another problem with this method is that the cores may not be evenly distributed, making it easy to miss small lesions. In about a third of negative biopsies, prostate cancer is found on subsequent biopsies. Even if low-grade cancer is found, doctors can’t be sure it’s limited to the affected cores.

Smilow Cancer Hospital offers the only program in Connecticut that uses a novel technique to perform targeted biopsies of the prostate. The high-tech approach uses MRI combined with the Artemis device, a 3D robotic imaging system, to locate and biopsy areas in the prostate. This technique has been shown to have a much higher cancer detection rate than standard biopsy; preliminary data at Yale show that it reduces the chances of missing cancer from 30 percent to just three percent. “The device allows doctors to more effectively stratify men as to whether or not they need treatment and whether or not they have cancer,” said Preston Sprenkle, MD, Assistant Professor of Urology, who has used it to perform 90 targeted biopsies so far.

The technique brings together expertise in urology, pathology, radiology, and engineering. The first step in the process is a multiparametric MRI that uses three different measurements to locate potentially cancerous areas in the prostate gland. A radiologist outlines problematic areas or tumors and ranks them by suspicion level: low, moderate, or high. Back in the clinic, Dr. Sprenkle performs the biopsy with the Artemis device, which combines real-time ultrasound with the MRI image to create a 3D model of the prostate gland. The 12 cores plus any additional areas of suspected cancer are sampled using a mechanical arm to guide the biopsy. “With Artemis, the 3D model of the prostate, and the computer-generated biopsy pattern, it allows us to look at the entire prostate and make sure we are evenly distributing biopsies so it’s much less likely that we will miss a tumor, even if it’s not visible on the MRI,” Dr. Sprenkle explained.

For men on active surveillance – those with low risk disease who do not currently need treatment – the Artemis system provides some assurance that the low grade disease that has been detected is all that’s there. For those who have had negative biopsies but PSA levels that continue to rise, targeted biopsies can help find hard to spot lesions, especially those at the front of the gland that are more difficult to reach. “We can identify cancer that has been missed on the conventional biopsy,” said Peter Schulam, MD, PhD, Chairman of Urology and Clinical Program Leader of the Prostate and Urologic Cancers Program. Artemis also lends precision to repeat biopsies because it allows the physician to locate the exact spot sampled in earlier procedures.

A Novel Technique for Honing in on Prostate Cancer
Dr. Schulam arrived at Yale in 2012 from UCLA and built on his experience there with targeted biopsies to create Yale’s program a year ago. Biomedical engineer Richard Fan, PhD, who also arrived from UCLA, lends technological and rapid response support in calibrating the delicate equipment. “Embedding an engineer as part of the team is novel,” he said. “It allows for cutting-edge clinical practices that drive engineering research and development and vice versa.” Dr. Fan is part of a group of radiologists, pathologists, and oncologists that meets monthly to review findings and plan multidisciplinary research.

The team is initiating research studies of long-term active surveillance that will be asked by the Artemis system’s ability to precisely biopsy the same tumor repeatedly. They are also beginning to look at high-risk patients, such as those with BRCA2 mutations, which are associated with a higher risk of aggressive prostate cancer, to determine if MRI can help identify disease even in the absence of an elevated PSA or abnormal exam. In these cases, earlier detection might be able to save lives. In biopsied tissue, they are looking at genetic factors in prostate cancer that may predict progression for men on active surveillance. “Ideally if we can identify men who have a low rate of progression, we can safely treat as few men as possible,” Dr. Sprenkle said.

Targeted biopsies are the first step toward reaching the ultimate goal of being able to rely on MRI to detect prostate cancer, in much the same way that mammograms are used to detect breast cancer. In the meantime, they are a vast improvement over conventional biopsies. “I think it’s really the future of where medicine is going,” Dr. Schulam said.

Eric Bowles was 16 when he noticed what he thought was a canker sore on the side of his tongue. Over the next month the sore gradually grew, but only bothered him if directly touched. During routine x-rays at the dentist’s office, Eric asked them to be careful since he had a spot on his tongue that was sensitive. The dentist took one look and called an oral surgeon who met with Eric the next day and performed a biopsy of the lesion. Everyone was shocked when the diagnosis came back as squamous cell carcinoma of the tongue.