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SGH-NTU ROBOT IMPROVES DIAGNOSIS AND TREATMENT OF PROSTATE CANCER

The Singapore General Hospital and Nanyang Technological University (NTU) have jointly developed a Prostate Robotic System that will improve the diagnosis and treatment of prostate cancer, the fifth most common cancer in Singaporean men.

The Prostate Robotic System is a robotic biopsy and potential radioactive seed treatment delivery system designed by a group of professors and students from NTU's School of Mechanical and Production Engineering, in collaboration with clinicians at SGH's Department of Urology. The 15-member SGH-NTU team is jointly led by Dr Christopher Cheng, Head of Department of Urology, SGH and Associate Professor Ng Wan Sing from NTU's School of Mechanical and Production Engineering.

The Prostate Robotic System can be used to define cancerous areas in the prostate and guide biopsy protocols. This improves upon present diagnosis methods for prostate cancer, which is difficult to detect due to the location and behaviour of the prostate gland. The system has potential use in the localised treatment of prostate cancer by placing radioactive seeds into cancerous areas in the prostate.

Using the Prostate Robotic System to diagnose prostate cancer

With the Robotic System, ultrasound images obtained will be used to generate a three-dimensional computerized model of the prostate. The 3-D model can then be rotated and magnified, allowing the urologist to obtain a comprehensive perspective of the prostate and hence better define biopsy sampling areas.

Based on the selected biopsy areas, the Robotic System will recommend suitable needle trajectories (pathways) in order to arrive at the defined positions. These planned trajectories can be computer-simulated, allowing the urologist to review the planned procedure before giving the go-ahead for the robot to perform the actual biopsy. By making it possible to accurately place a needle according to a biopsy protocol, the Robotic System is expected to significantly increase the reliability of prostate biopsy for cancer detection.

Initial clinical trials conducted at SGH's Urology Department have shown that the Robotic System achieved a consistent accuracy of $\pm 1.5\text{mm}$ from the intended biopsy spot, a significant improvement over current manual methods.

In cases where multiple areas in a prostate are suspected to be cancerous, the Robotic System requires only a single puncture point to perform multiple biopsies unlike current methods which require multiple punctures. This results in less damage to healthy tissue, less pain and trauma for the patient, and a faster recovery time.

Using the Prostate Robotic System in prostate cancer treatment

In addition to applications in prostate cancer diagnosis, the Prostate Robotic System can also be used in localised radioactive treatment of prostate cancer. The system can accurately place radioactive particles ("seeds") into cancerous areas in the prostate. This will allow an improved distribution of radiotherapy for the prostate and hence maximise treatment effects on cancerous cells, while reducing damage to normal, healthy cells.

Synergy of engineering and surgical skills

The SGH-NTU team are excited that the Prostate Robotic System will improve the detection rate for prostate cancer and increase patients' chances of recovery.

Says Asst Prof Louis Phee, a professor from NTU and a team member, "This robotic system is a good example of how robots and machines can help surgeons and medical doctors improve medical diagnoses and treatment. With robots, surgical procedures could be performed more accurately, take less time and minimize damage to healthy tissue for the benefit of the patient."

Dr Christopher Cheng adds, "The Prostate Robotic System is the result of close R&D collaboration between clinicians and engineers. The system harnesses the latest technologies in robotics, for improvement of the diagnosis and treatment of prostate cancer. We believe that the system is one of the first robotic systems in the world to be applied for prostate cancer management."

Says Assoc Prof Ng, "It is rewarding and satisfying to see engineers and clinicians work in close partnership to build better cancer detection and treatment tools to benefit mankind."

The SGH-NTU team started developing this system in mid-2001, leveraging on SGH's clinical knowledge of the disease and NTU's engineering expertise in robotics technology. Funding of some half a million dollars came from the National Medical Research Council and SingHealth.

The team has filed a provisional US patent for the Prostate Robotic System and plans to have the system commercially available within the next five years. In the meantime, the team has embarked on further enhancement on the Robotic System and plans to incorporate a new method of guidance for even more accurate biopsies. The team members are hopeful of obtaining additional funding and are currently seeking possible development partnerships with medical instrumentation companies.

Media contacts

Mr Ng Aik Kiat
Asst Manager
Corporate Communications
Nanyang Technological University
Tel: 6790 6772, 9191 4836
Email: akng@ntu.edu.sg

Ms Junaidah Hameed
Executive
Corporate Communications
Singapore General Hospital
Tel: 6321 3553 Fax: 6224 9778
Email: gcojah@sgh.com.sg

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