A feasibility study of utilising a cadaveric training model for novel robotic bladder cancer brachytherapy techniques

Ashmi Patel, Chimdubem Wisdom Orakwue, Devin Olek, Jonathan C.A. Guzman, Kelvin Lim, Ramiro Pino, Bin S. Teh, Brian Butler, Raj Satkunasivam and Andrew Farach

What was the motivation for initiating this study?

The optimal dose and fractionation for high-dose-rate (HDR) brachytherapy for muscle-invasive bladder cancer (MIBC) are unknown. The motivation for this study was to develop our institutional technique for the delivery of robot-assisted HDR brachytherapy for MIBC in anticipation of an investigator-initiated bladder preservation trial. Through collaboration with the Houston Methodist Institute for Technology, Innovation, and Education (MITIE), we were able to perform the procedure in a simulated, sterile, surgical environment and troubleshoot potential and unrealised obstacles in an end-to-end test that utilised a cadaveric model.

What were the main challenges during the work?

The most significant challenges were related to the cost of training time at MITIE and to obtaining an appropriate cadaver for the simulated procedure. Thanks to support from Golfers Against Cancer and Plato's Cave Innovation Project, we were able to perform this study. In addition, the previously published techniques for partial bladder brachytherapy involve the use of commercially available curved-needle applicators, which are not compatible with our after-loader. We were able to test and refine augmented, straight applicator catheters while avoiding kinking, which could obstruct the after-loader dummy wire or source delivery. Further generalisability will be limited by the cost and scarcity of such training facilities.

What are the most important findings of your study?

The most important finding was the realisation that our approach would be useful in the development of future novel brachytherapy techniques for MIBC and other malignancies. The utilisation of training environments such as that offered at MITIE enables collaboration with and training of multiple medical subspecialists in a simulated and non-stressful environment. A collaborative network of such facilities would enable the accelerated advancement of surgical and image-guided brachytherapy techniques and improve generalisability through the use of hands-on, facilitated training.

What are the implications of this research?

- we have developed a novel approach in terms of robot-assisted HDR brachytherapy for MIBC using our after-loader system;
- it is the first step on a path toward the establishment of HDR brachytherapy as a standard for bladder preservation;
- it serves as a model for innovation in brachytherapy techniques, indications, and education; and
- it has provided a framework for future support in brachytherapy-focused innovation and training grants.

Andrew Farach, MD
Director of brachytherapy
Associate professor
Institute for Academic Medicine & Weill Cornell Medical College
Department of Radiation Oncology
Houston Methodist Hospital
Houston, Texas, USA