High dose rate (HDR) brachytherapy is a form of radiation therapy cancer treatment that can deliver a high dose of radiation to the target volume (tumor), while minimising dose to surrounding healthy tissue.

HDR brachytherapy treatment can be quite complex, usually requiring computed tomography (CT) data to accurately plan the treatment on a specialised treatment planning system (TPS). A remote afterloader unit is used to drive the radioactive source to dwell (stop) positions in the implanted catheters, specified by the treatment plan. Accurate treatment delivery relies on the source dwell positions occurring in the correct locations relative to the surrounding anatomy.

Routine clinical brachytherapy treatment practice does not involve any verification of the dose delivered to the patient during the treatment itself. Strategies for HDR brachytherapy treatment verification usually consist of detectors to measure the dose at a single point within the treatment volume. A weakness to point dose methods is the difficulty of localisation of the detector in relation to the target volume, making dose comparison with the TPS difficult and questionable. Establishing a routine in-vivo dosimetry protocol for HDR brachytherapy using these detectors is not practical.

This research project intends to investigate an alternative in-vivo dosimetry option for HDR brachytherapy that has not, to the author’s knowledge, been used in brachytherapy before. The aim is to develop a brachytherapy treatment dose verification system that can provide the clinician (and medical physicist) with details about the absolute dose delivered to the entire treatment volume as well as the geometrical distribution of the treatment dose. The measured dose will be compared to the dose calculated by the TPS in order to confirm the planned dose was actually delivered to the patient. The project will also aim to establish a routine in-vivo dosimetry protocol that can be practically applied in the clinic, and potentially be carried across to an ethics approved clinical trial.

For further information, please contact: Dr Michelle Spencer, Coordinator (03) 9925 9697
School of Applied Sciences office (03) 9925 2600

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