AbstractID: 10487 Title: Robotically-Assisted Minimally Invasive Brachytherapy: Dosimetric Aspects

Purpose: To investigate the dosimetric aspects of robotically-assisted minimally invasive brachytherapy.

Materials and Methods: Using the Intuitive Surgical DaVinci S System, the following were inserted into a porcine abdominopelvic cavity through a 12 mm auxiliary port and sutured directly to the pelvic sidewall: three 6-French catheters; the Xoft Axxent delivery system; a prototype minimally invasive applicator (MIA). Plans were generated in Nucletron's treatment planning software for an Ir-192 source and the Xoft 50 kV source. The ability of the prototype MIA to reproducibly position catheters was tested using film dosimetry. Other applicators were designed to allow an en face application of the source, and various catheter arrangements were investigated. For the en face application, the sensitivity of the delivered dose to random deviations from normal incidence of the catheters (≤ 5 degrees) and regular catheter spacing were tested.

Results: All three trials for introducing the catheters were performed with ease by the surgeon. After the apparatus was sutured into place, it maintained a fixed geometry. The dosimetric measurements using GafChromic EBT film showed a uniform distribution of dose. The treatment plan for the en-face arrangement using the Xoft source with 16 catheters at random angles showed a deviation from the planned dose of ≤ 0.39%.

Conclusions: The feasibility of performing robotically-assisted minimally invasive brachytherapy was demonstrated for techniques utilizing both parallel and en face geometries. A customized applicator was designed to deliver a uniform dose to the target. The reproducibility of the device was confirmed with film dosimetry. For the geometries tested, the en face application was found to be insensitive to random deviations of the catheters of up to 5 degrees from normal incidence. These techniques may be used for minimally invasive intra-operative or post-operative brachytherapy procedures using real-time or atlas-based planning.