ABSTRACT

RESEARCH PAPER: MAMMOSITE BRACHYTHERAPY DOSIMETRY – EFFECT OF CONTRAST AND AIR INTERFACE ON SKIN DOSE

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High-dose-rate (HDR) brachytherapy an accepted and effective internal radiation therapy procedure used to treat a number of malignant neoplasms. A common procedure is the use of HDR brachytherapy sources and applicators to treat limited stage breast cancer. In breast cancer, this method of adjuvant treatment is used to kill residual cancer cells surrounding the lumpectomy cavity following surgery. The technique is known as accelerated partial breast irradiation or simply as APBI. This is done by inserting a balloon catheter into the cavity that is inflated with saline as well as a medium of radiographic contrast. Then, the radioactive isotope is positioned into the center of the balloon using an HDR unit to deliver the prescribed dose to a volume surrounding the balloon. The purpose of the contrast is to improve CT image quality and balloon visibility for treatment planning procedures. Most of the currently available treatment planning systems (TPS) for brachytherapy including Nucletron Oncentra, estimate dose using proprietary algorithms which use a pre-calculated dose metric derived from a Ir-192 positioned...
in a water phantom, and do not take variations in attenuation into account due to inhomogeneities, such as various types of tissues. This may lead to several questions; do these TPS estimate absorbed dose correctly within the target tissue? What are the effects on breast-air interface within the target volume? Does a radiographic contrast medium in the balloon alter the dose distribution calculated by TPS? These uncertainties and doses, which are predicted by the treatment planning systems, can be quantified by measurement in a tissue equivalent patient phantom using a PN junction commercial diode detector and electrometer.

In this investigation we propose to use a cubical water phantom and Mammosite® single lumen balloon system to measure effects on breast-air interface, the diode detector will be placed on the phantom wall simulating the tissue air interface. Measured data will then be compared by predictions from the Oncentra TPS for the same geometry. The results of this investigation may help quantify uncertainties in the predicted versus actual skin dose for patient being treated with this technique. This in turn could allow clinicians predictive power regarding potential excessive skin dose that may result in toxicity.