O064 / #833
TREATMENT PLAN CHARACTERISTICS FOR A PHASE III MULTI-INSTITUTIONAL RANDOMIZED TRIAL COMPARING IMPT AND IMRT FOR OROPHARYNGEAL CANCER

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The North America multi-center Phase III Randomized Trial of Intensity-Modulated Proton Beam Therapy (IMPT) versus Intensity-Modulated Photon Therapy (IMRT) for the treatment of Oropharyngeal Cancer of the Head and Neck has completed patient enrollment. A total of 226 proton and 171 photon plans were collected from 17 institutions. This report presents the preliminary dosimetry data and treatment plan characteristics, as detailed in Table 1. The mean dose and coverage (D95) of CTVs (high, intermediate, and low) are similar between proton and photon therapies. The volumes receiving 70 Gy and 57 Gy are lower in proton plans than in photon plans, indicating better dose conformity with proton therapy. Proton therapy significantly spares the brain, larynx, oral cavity, esophagus, eye, brainstem, and optical nerve more effectively than photon therapy (Table 1). Photon therapy, marginally better spares the ipsilateral parotid. The majority of proton patients were treated with a 3-beam (61%) technique, while 4-field and 5-field were advanced during the course of the trial, and the majority of photon patients with VMAT (80%) technique while IMRT was the approach during the early phase of the trial. For photon plans, all organ-at-risk (OAR) sparing are either better or no worse with VMAT than with IMRT. For proton plans, nearly all OAR sparing are better or no worse with 5-beam than with 3-beam plans, except for the oral cavity, which spares better in 3-beam. However, the majority of 5-beam plans were planned using scanning beam lines with smaller spot sizes. The average and range of spot sizes for proton plans are 2.25 (0.84, 2.3) cm. Linear regression analysis of OAR dose with respect to spot size indicates that the average doses of ipsilateral-parotid, larynx, submandibular, and maximum doses of the cord positively with spot size (Figure 1). This is the first report of the dosimetric treatment plan characteristics for the multi-center Phase III IMPT vs IMRT trial demonstrating the advancements of radiation therapy technology and techniques in both treatment arms. The work is submitted by authors on behalf of the MD Anderson Phase III OPC IMPT vs IMRT Trial Consortium.

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O065 / #420
DEVELOPMENT OF A SPECT SYSTEM FOR REAL-TIME BORON DISTRIBUTION MONITORING IN BNCT

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Background and Aims: Boron Neutron Capture Therapy (BNCT) is a radiotherapy technique where tumor cells are loaded with ^{10}B-enriched molecules and exposed to thermal neutrons, leading to localized damage through $^{10}B(n,\alpha)^{7}Li$ reactions. The direct correlation between released dose and boron distribution emphasizes the need for boron real-time monitoring to estimate the therapeutic effects. In response, we propose a SPECT (Single Photon Emission Tomography) system consisting of scintillator-based detectors and pinhole collimators. The system aims to detect the 478 keV gamma rays emitted during reactions, to reconstruct three dimensional images of boron distribution for effective dose visualization.

Methods: We characterized a single unit of the final SPECT system (Figure 1). It consisted of a 5x5x2cm^3 $LaBr_3$(Ce + Sr) gamma ray detector with Silicon Photomultipliers and custom electronics, coupled with a lead pinhole collimator (5x5x10 cm^3, 5 mm hole) and cadmium shielding housing. Experimental measurements at the nuclear reactor of Pavia University involved irradiating borated samples (0.5g and 1g of boron powder) with a neutron flux of 2x10^6 n/cm^2/s. The events at 478 keV were calculated with Matlab elaboration. Artificial 1 cm shifts of the vials were introduced, and a dedicated artificial neural network (ANN), with 64 input neurons, one hidden layer and two output neurons for x and y coordinates, was used to reconstruct the gamma ray interaction position in the monolithic crystal.

Results: The acquired spectra (Figure 2, Top) show a distinct BNCT photopeak at 478 keV, well resolved from the adjacent peak at 511 keV. The final values for the events under the 478 keV photopeak are 7.22+-2.00 cps for the 0.5g measurement and 15.50+-2.03 cps for the 1g measurement, showing a linear detector response. The ANN successfully reconstructed the three different positions with a FWHM (Full Width at Half Maximum) of approximately 8 mm, aligning with the collimator-imposed spatial resolution. The 1 cm shifts were clearly detected (Figure 2, Bottom).

Conclusions: The proposed detection unit has successfully demonstrated its capability to quantify and localize the borated vials, confirming the suitability of the final SPECT system with multiple modules. Measurements in the AB-BNCT facility of Nagoya University are foreseen.

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O066 / #384
FIRST COMPARISON AND COMBINATION OF BNCT AND CIRT DOSIMETRY IN A HEAD AND NECK TUMOR USING ISOEFFECTIVE DOSE MODEL.

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