

AbstractID: 6555 Title: Does the implementation of electron monte carlo simulation based treatment planning have radiobiologically significant ramifications?

Purpose: To quantify differences in dose deposition between three different methodologies determining the dose delivered by electrons in the treatment of breast carcinoma. The quantification is performed using radio-biological models and we determine whether the difference is significant on radio-biological level.

Methods: Twenty patients to be treated with chestwall irradiation are planned in a conventional way using electron fields. The treatments are planned using a pencil beam algorithm, a monte carlo simulation based TPS, and manual hand calcs. Using a dose volumes histogram decomposition technique we calculate tumor control probability for the chest wall, the medial supraclavicular-, and the intra-mammary lymph nodes. Normal tissue complication probabilities are calculated using different models, including Burman-Kutcher effective volume and relative seriality Poisson based models. Endpoints are excess of cardiac mortality risk and radiation pneumonitis.

Results: We find that there is a significant difference for PB based compared to MC-based dose calculation for TCP--values. Both methods are lower than the "ideal" case where we assume homogeneous irradiation of the target structure to the prescribed dose level. The TCP for PB calculation is on average 3% (1SD = 1%) higher than the TCP calculated with a MC-based TPS. Levels of TCP with respect to the ideal case for IM-MS irradiation are 7%, resp. 10% for PB resp. MC. For NTCP an overall decrease is noted although not significant with the data available at the submission time. Cases with an inverse shift in NTCP are found (i.e. NTCP-PB < NTCP-MC).

Conclusions: The outcome predicted from the radio-biological models is dependent on the algorithm used to determine the dose deposition. This implies that the use of patient data to fit radio-biological models needs to be accompanied with the type of dose calculation used. Preferably, all such studies should be performed with a gold standard methodology.