IPSA vs. geometry based optimization in dose distribution calculation in accelerated partial breast irradiation

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Purpose: Comparison of the dosimetric data of breast treatment plans calculated with IPSA and geometry based optimization method.

Material and methods: In our study we analyzed dosimetric data in a group of HDR breast treatment plans calculated by Nucletron Oncentra Brachy treatment planning system and realized in the Center of Oncology – Institute in Gliwice, Poland. Two different manners of dose calculations were used to compute a pair of alternative dose distributions for each patient. Treatment plans created with the IPSA (Inverse Planning Simulated Annealing) algorithm and geometry based optimization were compared in respect to dosimetric parameters, conformity index (COIN) and homogeneity index.

Results: In geometrically optimized plans mean PTV volume covered by 100% isodose was 88%, while in IPSA plans PTV100 was 87%. Mean DHI index was 0.56 and 0.55 for IPSA plans and geometrical plans, respectively. COIN for geometrical plans was equal to 0.58 and was higher than for IPSA plans (0.53). Maximal dwell times registered for the group of IPSA plans were significantly higher when compared to the geometrical plans. Mean relative difference between maximal dwell times for IPSA and geometrical plans was 73%.

Conclusions: Dose distributions calculated with the help of the IPSA algorithm and geometry based optimization method are comparable in respect to dosimetric parameters and quality indices. However, dosimetric data were collected based on the DVHs which translated spatial information into simple graph. Comparison of the maximal dwell times in both group of plans revealed that dwell time gradient is higher in IPSA plans. It may increases the risk of hot points in a treated volume. In a geometry based optimization dwell times were smoothly distributed along the active length. The risk of the single, large overdose area formation inside the treated volume is lower.

cancer IB and IIA.