عنوان مقاله:

Dose Calculations for Lung Inhomogeneity in High-Energy Photon Beams and Small Beamlets: A Comparison between XiO and TiGRT Treatment Planning Systems and MCNPX Monte Carlo Code

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خلاصه مقاله:

Introduction Radiotherapy with small fields is used widely in newly developed techniques. Additionally, dose calculation accuracy of treatment planning systems in small fields plays a crucial role in treatment outcome. In the present study, dose calculation accuracy of two commercial treatment planning systems was evaluated against Monte Carlo method. Materials and Methods Siemens Once or linear accelerator was simulated, using MCNPX Monte Carlo code, according to manufacturer's instructions. Three analytical algorithms for dose calculation including full scatter convolution (FSC) in TiGRT, along with convolution and superposition in XiO system were evaluated for a small solid liver tumor. This solid tumor with a diameter of 1.8 cm was evaluated in a thorax phantom, and calculations were performed for different field sizes (1×1, 2×2, 3×3 and4×4 cm2). The results obtained in these treatment planning systems were compared with calculations by MC method (regarded as the most reliable method). Results For FSC and convolution algorithm, comparison with MC calculations indicated dose overestimations of up to 120%and 25% inside the lung and tumor, respectively in 1×1 cm2field size, using an 18 MV photon beam. Regarding superposition, a close agreement was seen with MC simulation in all studied field sizes. Conclusion The obtained results showed that FSC and convolution algorithm significantly overestimated doses of the lung and solid tumor; therefore, significant errors could arise in treatment plans of lung region, thus affecting the treatment outcomes. Therefore, use of MC-based methods and super position is recommended for lung treatments, using small fields and beamlets.

کلمات کلیدی:

Convolution, Mall Beamlet, Monte Carlo, Radiation Therapy, Treatment Planning