عنوان مقاله:

Investigation of LINAC Structural Effects on Photoneutron Specified Parameters Using FLUKA code

محل انتشار:

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خلاصه مقاله:

Introduction: The utilization of high-energy photons in the medical linear accelerator can lead to photoneutron production. This study aimed to evaluate the effect of the physical components of the head, including flattening filter (FF) andmultileaf collimator (MLC), as well as the dependence of therapeutic field size on the photoneutron spectrum, dose, and flux. Material and Methods: The present study reported the simulation of the fundamental linac head components of the Varian Clinac 2100 performing in X-ray mode with 18 MV energy by the FLUKA code. The percentage depth dose and lateral dose profile were measured using a PTW thimble chamber to ensure the simulation reliability. Results: Photoneutron spectrum analysis indicated that neutrons with highest relative biological effectiveness were delivered to the phantom surface, and opening the field from 0×0 to 40×40 shifted the spectrum by 24.545% to the higher energies. The target and the vicinity parts played the most prominent roles in neutron contamination. The relationship between the field size and the photoneutron dose was non-linear, and it reached a peak of 20×20 . Although using small fields formed by the MLC contribute to a lower dose compared to those shaped by the jaws, MLC-equipped machines result in 21.98% higher dose. Moreover, the flattening filter removal unexpectedly increased the isocenter photoneutron dose by 11.63%. This undesirable dose can be up to 2.54 mSv/Gy for the reference field at the isocenter while the out-of-field dose is about 0.5 mSv/Gy for most of the field dimensions. Conclusion: As a result, it is critical to consider this unwanted absorbed dose, which is seriously influenced by the implemented therapeutic conditions.

کلمات کلیدی:

Fast Neutrons, Linac, Monte Carlo, FLUKA