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Absorbed dose assessment due to proton and neutron particles in tumoral and healthy tissues of liver in proton-therapy using Monte Carlo method

S Z Moayedian[1], A Karimian[2], and M H Alamatsaz[1]

1. Department of Physics, Isfahan University of Technology, Isfahan, Iran
2. Department of Biomedical Engineering, Faculty of Engineering, University of Isfahan, Isfahan, Iran

E-mail: karimian@eng.ui.ac.ir

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Abstract

Proton therapy is one of the best methods of treatment for liver cancer. In this research, the main parts of proton therapy system, with passive scattering nozzle, including range-modulating wheel, energy-compensated contoured scatterer and collimators were simulated. Then the proton absorbed dose in healthy and tumoral tissues was calculated by simulating the proton therapy of liver tumors. Furthermore the secondary neutron dose, that increases the risk of secondary cancers, was calculated. For this purpose, the neutron equivalent absorbed dose in tumor and healthy tissues were calculated. Furthermore, the MIRD phantom was located in front of the output of the proton therapy system. By simulating the proton therapy for tumor in depth of 11 cm in the liver with mean source energy of 200 MeV, the absorbed dose of proton in tumor estimated as 3.32×10^{-12} Gy/particle that is 7.26 times more than proton dose in healthy parts of liver. This ratio showed that tumor absorbs the maximum dose, while the healthy tissue absorbs the minimum dose. In the next step, the same procedure was done with mean source energy of 180 MeV for tumor in depth of 6 Cm. According to the results, the proton absorbed dose in tumor was 1.94×10^{-12} Gy/particle that is 9 times more than proton absorbed dose in healthy tissue. Also the maximum neutron equivalent absorbed dose in healthy tissue is of the order of 10^{-14} Sv that can be ignorable in comparison with proton treatment effects of proton therapy.

keywords: proton therapy, liver cancer, dosimetry

For full article, refer to the Persian section