

蒙地卡羅方法模擬直線加速器照射胸腔假體劑量分布

張國平、洪尚和、簡聿皇、黃瑞京

慈濟技術學院 放射醫學科學研究所、安泰醫院 放射腫瘤科、花蓮門諾醫院 放射腫瘤科、花蓮國軍總醫院 放射診斷科

摘要

我們以軟木、壓克力、石膏以及聚苯乙烯自行組合一個胸腔假體。經過直線加速器 (Varian 21EX) 6MV 光子照射假體之後的深度劑量分布以 Gafchromic-EBT 底片測量，作為參考標準。同時，以 BEAMnrc 程式模擬直線加速器機頭以及在記錄平面下粒子的相空間資料 (phase space data)。接著自製假體的材質物理成分在蒙地卡羅程式中建立截面積之後，以 DOSXYZnrc 程式模擬假體的劑量分布。蒙地卡羅模擬的結果與量測值以及醫院使用的治療計畫 (TPS) 三者做一比較。結果發現，蒙地卡羅計算值與量測值較為接近，TPS 計算結果在肺區域有明顯偏差，尤其是在小照野，主要是因為 TPS 在回散射以及多重散射的物理現象無法像蒙地卡羅方法可以準確模擬。

關鍵字：直線加速器、胸腔、假體、蒙地卡羅模擬、劑量分布

Monte Carlo simulation for the dosimetry distribution of a chest phantom irradiated by LINAC

Kwo-Ping Chang 、 Shang-Ho Hung 、 Yu-Huang Chie 、 Ruey-Jing Huang

Institute of Radiological Sciences and Department of Medical Imaging and Radiological 、 Sciences, Tzu Chi College of Technology, Taiwan 、

Department of Radiation Therapy, Antai Hospital, Taiwan 、 Department of Radiation Therapy, Mennonite Christian Hospital, Taiwan 、

Department of Radiology, Hualien Armed Forces General Hospital

Abstract

We used the cork, acrylic, gypsum and polystyrene to compose a chest phantom. The depth dose distribution of the phantom irradiated by LINAC (Varian 21EX; 6MV) was measured by Gafchromic-EBT film and referred to as a standard. BEAMnrc code was used to simulate the LINAC head as well as the phase space data at the scoring plane. After the cross sections have been established with the physical properties of the materials of phantom, DOSXYZnrc code was used to simulation the dose distribution. The results of Monte Carlo simulation were compared with those of measurements and those of TPS. It was found Monte Carlo calculated data were in agreement with those of measurement. TPS results gave a significant deviation, especially for the small field size. That is because that the TPS algorithm can't reflect the back-scattering and multi-scattering phenomena, which can be accurately simulated by Monte Carlo simulation.

Keywords : LINAC, chest, phantom, Monte Carlo simulation, dose distribution