Penentuan Dosis Radiasi Linac Menggunakan Aplikasi MCNPX pada Jaringan Lunak Dengan Penyisipan Paru-Paru, Pankreas, dan Tulang Belakang

Abstrak

Dalam proses radioterapi, perlu dilakukan estimasi distribusi dosis yang akan diterima oleh pasien sebelum dilakukan penyinaran, agar terapi radiasi dapat dimanfaatkan secara optimal. Perhitungan dosis radiasi tersebut dapat disimulasikan dengan program MCNPX. Pada penelitian ini, dilakukan perhitungan karakteristik kurva *Percentage Depth Dose* (PDD) dan distribusi dosis serap pada organ pankreas dan tulang belakang, dengan menggunakan simulasi MCNPX pada jenis *phantom* ORNL-MIRD (1996 *version*) yang telah dimodifikasi. *Phantom* nonhomogen disisipkan dengan organ paru-paru pada kedalaman 5,0-14,0 cm, pankreas, dan tulang belakang. Luas lapangan radiasi 10×10 cm^2 dan arah penyinaran radiasi *Anterior-Posterior* (AP). Penelitian dilakukan dengan variasi *Source Surface Distance* (SSD) sebesar 95,0 cm, 97,5 cm, 100 cm, 102,5 cm, dan 105 cm. Hasil penelitian menunjukkan bahwa karakteristik kurva PDD *phantom* homogen mengalami peningkatan hingga kedalaman 2,0 cm untuk seluruh SSD, kemudian mengalami penurunan secara eksponensial. Kurva PDD untuk *phantom* nonhomogen menunjukkan perbedaan pola di daerah sebelum paru-paru, di paru-paru, dan setelah paru-paru. Selanjutnya, distribusi dosis serap terendah untuk organ pankreas dan tulang belakang didapatkan saat menggunakan SSD 105 cm. Temuan ini dapat membantu memaksimalkan kinerja pada proses *Treatment Planning System* (TPS).

Kata kunci: MCNPX, kedalaman maksimum (D_{maks}), *percentage depth dose* (PDD), *source surface distance* (SSD).

Radiation Dose Determination of Linac Using MCNPX Application on Soft Tissue with Insertion of Lungs, Pancreas, and Spine

Abstract

In the process of radiotherapy, it is necessary to estimate the dose distribution that will be received by the patient before irradiation, so that radiation therapy can be used optimally. The radiation dose calculation can be simulated with the MCNPX program. In this study, calculations were performed on the characteristics of the Percentage Depth Dose (PDD) curve and absorbed dose distribution in the pancreas and spine, using MCNPX simulations on the ORNL-MIRD phantom type (1996 version) that has been modified. The nonhomogeneous phantom was inserted with lung organs at depths of 5.0-14.0 cm, pancreas, and spine. The radiation field area was 10×10 cm^2 and the radiation direction was Anterior-Posterior (AP). The study was conducted with variations in the Source Surface Distance (SSD) of 95.0 cm, 97.5 cm, 100 cm, 102.5 cm, and 105 cm. The results showed that the PDD curve characteristics of the homogeneous phantom increased to a depth of 2.0 cm for all SSD, and then decreased exponentially. The PDD curve for the nonhomogeneous phantom showed different patterns in the areas before the lungs, in the lungs, and after the lungs. Furthermore, the lowest absorbed dose distribution for the pancreas and spine organs was obtained when using SSD 105 cm. These findings can help maximize performance in the Treatment Planning System (TPS) process.

Keywords: MCNPX, maximum depth (D_{maks}), *percentage depth dose* (PDD), *source surface distance* (SSD).