

INTI SARI

Analisis Dosis Terapi Kanker Hati dengan *Proton Therapy* Menggunakan Program PHITS V3.31

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Penelitian mengenai analisis dosis jaringan kanker dan *Organ at Risk* (OARs) serta waktu optimal *Proton Beam Therapy* (PBT) dalam suatu penanganan kasus kanker hati berjenis *Hepatocellular Carcinoma* (HCC) stadium BI berdasarkan sistem staging *Italian Liver Cancer* (ITA.LI.CA) telah berhasil dilakukan. Simulasi penyinaran PBT dilakukan untuk menghitung dosis pada jaringan kanker dan organ sehat di sekitarnya serta waktu optimal untuk membunuh sel kanker dengan tetap meminimalisir kerusakan jaringan sehat di sekitarnya. Keseluruhan simulasi ini menggunakan program *Particle Heavy Transport Code System* (PHITS) versi 3.31. Pada penelitian ini telah berhasil dimodelkan geometri kanker dan OARs berbasis komputasional fantom dari *Oak Ridge National Laboratory* (ORNL) *Medical Internal Radiation Dose* (MIRD). Rentang energi berkas proton yang didapatkan yaitu sebesar 109 MeV – 171 MeV pada kedalaman kanker. Hasil dosis yang didapatkan berturut-turut di *Gross Tumor Volume* (GTV), *Clinical Target Volume* (CTV), *Planning Target Volume* (PTV), dan OARs khususnya kulit adalah 67,8 GyE; 67,1 GyE; 60,6 GyE; dan 1,959 GyE dengan waktu penyinaran sebesar 221 s.

Kata Kunci : PBT, kanker hati, dosis radiasi, OARs, dan PHITS

ABSTRACT

Dose Analysis of Liver Cancer Therapy with Proton Therapy using *Particle Heavy Ion Transport code System V3.31 Program*

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The research on the analysis of radiation dosage to cancerous tissues and Organs at Risk (OARs), as well as the optimization of Proton Beam Therapy (PBT) dosage timing in the treatment of Hepatocellular Carcinoma (HCC) stage BI based on the Italian Liver Cancer (ITA.LI.CA) staging system has been successfully conducted. PBT irradiation simulations were performed to calculate the dosage in cancerous tissues and surrounding healthy organs, along with the optimization of dosage timing to eliminate cancer cells while minimizing damage to surrounding healthy tissues. The entire simulation utilized the Particle Heavy Transport Code System (PHITS) version 3.31. In this research, the computational phantom-based geometry of cancer and OARs was successfully modeled using the Oak Ridge National Laboratory (ORNL) Medical Internal Radiation Dose (MIRD) phantom. The obtained range of energy for the proton beam is 109 MeV to 171 MeV at the cancer depth. The obtained doses in Gross Tumor Volume (GTV), Clinical Target Volume (CTV), Planning Target Volume (PTV), and OARs, particularly the skin, were 67,8 Gy; 67,1 GyE; 60,6 GyE; and 1.959 GyE, respectively, with an irradiation time of 221 seconds.

Keywords: PBT, liver cancer, radiation dosage, OARs, and PHITS.