ABSTRACT

Breast cancer is one of the leading causes of cancer-related deaths among women worldwide, making it essential to develop therapies capable of delivering an optimal radiation dose distribution. The objective of this study is to evaluate and analyze the effect of variations in virtual bolus thickness on dose distribution in breast cancer using Intensity-Modulated Radiation Therapy (IMRT) and to determine the optimal bolus thickness. CT image data from five breast cancer patients were planned using the Eclipse Treatment Planning System (TPS) with 6 MV IMRT, a total dose of 5000 cGy, and boluses made of plasticine with a density of 1.2 g/cm³ and a CTValue of 299, as used at Indriati Solo Baru Hospital. The range of virtual bolus thicknesses used was 0 cm to 1.5 cm in 0.1 cm intervals. The dosimetric parameters analyzed included 95% PTV coverage, 107% PTV coverage, hotspots, the Homogeneity Index (HI), the Conformity Index (CI), skin dose, and doses to Organs at Risk (OARs). The optimal thickness was determined by identifying the range that met all clinical criteria for all five patients. The study results showed that without a bolus, most patients experienced underdose in the PTV and hotspots exceeding clinical limits. Adding a bolus increased the surface dose and improved dose distribution; however, excessive thickness caused a decrease in PTV coverage due to beam attenuation. A virtual bolus thickness of 0.4–0.6 cm yielded the most optimal and consistent results, with PTV coverage of 95%–107%, no hotspots, a Homogeneity Index (HI) of approximately 0.088–0.148, a Conformity Index (CI) of approximately 0.958–0.990, and skin doses within safe limits without exceeding OAR dose limits. A virtual bolus thickness of 0.4–0.6 cm is recommended to achieve a balance between therapeutic efficacy in breast cancer.

Keywords *: Virtual Bolus, IMRT, Breast Cancer, PTV Coverage, Skin Dose, Hotspot, Homogeneity Index, Conformity Index*