

ABSTRACT

External radiation therapy requires a high degree of precision to ensure that the radiation dose is optimally delivered to the tumor target while minimizing exposure to healthy tissue. However, geometric uncertainties resulting from setup errors and the movement of the patient's internal organs can still occur during the radiation therapy process. This study aims to calculate the values of systematic error and random error using the Van Herk Equation to determine the Planning Target Volume (PTV) safety margin in cases of cervical cancer at Dr. Sardjito General Hospital in Yogyakarta. This study employed a retrospective quantitative observational method using data on patient positional shifts obtained from Electronic Portal Imaging Device (EPID) verification. The margin was calculated using the Van Herk equation: $M = 2.5\Sigma + 0.7\sigma$. The results showed that the PTV safety margins along the X, Y, and Z axes were 0.625 cm, 0.369 cm, and 1.266 cm, respectively. The largest margin value on the Z-axis indicates that the anterior-posterior direction has the highest geometric uncertainty, which is thought to be influenced by variations in patient position between fractions, changes in internal anatomy, and the lack of lower extremity immobilization accessories during radiation therapy.

Keywords: Van Herk Equation, Safety Margin, PTV.