

ABSTRACT

Planar sensitivity is a quality control parameter that plays a role in the internal dosimetry quantification process. In clinical practice, variations in the distance between the source of the radionuclide and the collimator are inevitable due to variations in the patient's anatomy. Based on the inverse square law theory, the number of counts detected by detectors decreases as the distance of the source to the surface of the collimator increases, potentially affecting the planar sensitivity value. This study aims to analyze the variation in the distance of the I-131 source to the planar sensitivity of SPECT both without and with scatter correction (dual energy window). Testing was performed using the SPECT/CT GE Discovery NM/CT 670, HEGP collimator, and I-131 1 mCi source. Image acquisition was carried out at a distance variation of (10 ± 0.5) cm - (15 ± 0.5) cm with an energy window emission of $364 \text{ keV} \pm 10\%$ and an energy window scatter of $297 \text{ keV} \pm 10\%$. The values obtained were analyzed for their deviation from the standard distance (10 ± 0.5) cm based on the GE and IAEA HHS No.6 manufacturer's guidelines to evaluate the stability of the system. The planar sensitivity of SPECT without scatter correction was obtained of 46.8776-45.3143 cps/MBq and with a scatter correction of 34.2073-33.5365 cps/MBq. The value obtained decreased as the distance increased due to the decrease in geometric efficiency and the contribution of the penetration of the collimator septa. Although it decreases linearly the value of the planar sensitivity deviation of the distance variation to the standard distance (10 ± 0.5) cm meets the tolerance $\leq 5\%$. Thus, the distance variation in the range used in this study did not have a significant effect on the stability of the planar sensitivity of the SPECT.

Keywords: Sensitivity, scatter, SPECT, distance