

ABSTRACT

Volume measurement in SPECT/CT imaging is an important aspect of quantitative nuclear medicine analysis. However, volume measurement results are still influenced by system spatial resolution, radiopharmaceutical distribution, and the subjectivity of Region of Interest (ROI) segmentation. This study aims to measure Tc-99m volume in a syringe using the GE NM/CT 670 SPECT/CT modality with the ROI per-slice method, calculate the error value compared to the actual volume, and evaluate the Center of Rotation (COR) value as part of the system quality control. The study was conducted using a 5 mL syringe with volume variations of 1 mL, 3 mL, and 5 mL filled with Tc-99m radiopharmaceutical diluted with saline. Image acquisition was performed using the GE NM/CT 670 SPECT/CT modality. Volume measurements were manually performed using the ROI per-slice method on CT and SPECT images through Xeleris software. In addition, activity measurements were carried out using a dose calibrator and Tc-99m decay correction based on image acquisition time. Quality control testing was performed through Center of Rotation (COR) evaluation using a 1 mCi Tc-99m point source with an LEHR collimator. The results showed that both CT and SPECT volume measurements produced overestimated values compared to the actual syringe volume. CT volume measurements were 1.8777725 mL, 3.5247725 mL, and 4.475475 mL, while SPECT volume measurements were 4.1329775 mL, 8.448035 mL, and 11.2702475 mL for the actual volumes of 1 mL, 3 mL, and 5 mL, respectively. CT error values were 88%, 17%, and 10%, whereas SPECT error values were 313%, 182%, and 125%. COR test results showed that all Delta X and Delta Y values were below the system tolerance limit of 0.55 mm, indicating that the system was suitable for image acquisition. Therefore, this study demonstrates that ROI per-slice volume measurement on CT images provides results closer to the actual volume compared to SPECT images, although both modalities still produce volume overestimation.

Keywords: SPECT/CT, Tc-99m, ROI, syringe volume, volume error, Center of Rotation