

ABSTRACT

Background: Intrinsic count rate performance verification is mandatory for the acceptance testing of new or majorly repaired SPECT/CT scanners. This testing is essential for ensuring detector stability and linearity. The most critical aspects of this parameter is the detector's dead time phenomenon. The most effective and efficient approach among several recommended methods is dual-source method. **Objectives:** This study aims to measure the dead time constant (τ) of the GE Discovery NM/CT 670 SPECT/CT system using the dual-source method. Moreover, the Input Count Rate (ICR) and Observed Count Rate (OCR) at the 20% count loss threshold are also evaluated. **Methods:** The experiment was conducted at the Department of Nuclear Medicine, RSUP Dr. Kariadi, using two Technetium-99m (Tc^{99m}) sources each with an activity $100 \mu Ci \pm 5\%$ evaluated both individually and simultaneously. Data acquisition was performed intrinsically without a collimator at a geometric distance of 11 cm for 20 seconds. The performance threshold parameters were estimated based on the paralyze mathematical model. **Results:** Simultaneous measurement of the two sources showed that the maximum observed count rates reached 433.22 kcps (Detector 1) and 423.23 kcps (Detector 2), with a count rate linearity efficiency of only 54%–57%. The calculated average dead time constants were 0.84 μ for Detector 1 and 0.85 μs for Detector 2. Projections at the 20% count loss yielded ICR ($R_{20\%}$) values of 264.71 kcps (Detector 1) and 261.83 kcps (Detector 2), with corresponding OCR ($C_{20\%}$) values of 211.77 kcps (Detector 1) and 209.46 kcps (Detector 2). **Conclusion:** The ICR values for both detectors exceeded the minimum threshold of 250 kcps specified by Ge Healthcare. Hence, the SPECT/CT scanner is passed the acceptance test. The obtained OCR values can serve as a practical safety ceiling for count rate monitoring in clinical settings.

Keywords: SPECT/CT, Dead Time, Dual-Source Method, ICR, OCR