Quality Assurance and Quality Control of Nuclear Medicine Instruments

Hee-Joung Kim, Ph.D.

Department of Diagnostic Radiology, Yonsei University Research Institute of Radiological Science, Yonsei University

All interpretation of all nuclear medicine procedure is based on the assumption that the performance of the system is reliable and accurate. To provide evidence of reliability and accuracies of the system, a standardized program of Q.A and Q.C is essential.

Quality Assurance (Q.A)

Q.A in nuclear medicine need to put all efforts to be free from all errors and artifacts. This will need to cover all aspects of clinical practice including the preparation and dispensing of radiopharmaceuticals, the protection of patients, staff and the general public against radiation hazards and accidents by the faulty equipment, the scheduling of patients, the setting-up, use and maintenance of electronic instruments, the methodology of the actual procedures, the analysis and interpretation of data, the reporting of results, and the keeping all records. Successful Q.A requires integrated programs. These will include clinical conference, administrative meeting, follow-up studies, technologists' staff meeting, lectures, research meeting, SPECT and PET meeting, radiation safety committee, validation of nuclear medicine results, phantom Q.A. program, and procedure review meeting.

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Instrumentation Quality Control (Q.C)

An important question will be "Why we need Q.C?" The objectives of Q.C in nuclear medicine instrumentation are monitoring, maintaining and characterizing a high standard of performance of nuclear medicine studies. System performance, image quality, and quantitation are regulated by these measurements which range from daily checks of system uniformity and integrity to periodic checks of both the accuracy and precision of nuclear medicine instruments and their corrections.

The types of tests are acceptance testing and recalibration for preventive maintenance as a benchmark. Routine tests include flood field uniformity, spatial resolution, and spatial linearity. These tests generally perform by nuclear medicine technologist and weekly testing is recommended. Resolution and linearity testing may be performed simultaneously with the aid of a flood source and either a parallel-line-equal-space, bar, orthogonal hole or resolution-quadrant phantom. This may be performed extrinsically or intrinsically using a point source or sheet source. Uniformity test in SPECT may be very important, since small changes in extrinsic camera uniformity may be misinterpreted as different levels of activity or artifacts in reconstructed images. These artifacts typically take the form of alternating concentric hot and clod rings which form a bull's eye pattern. Non-routine tests include multiple window spatial registration, maximum count rate (deadtime), sensitivity, SPECT system alignment, center of rotation, phantom evaluation, and protocol optimization in SPECT and PET. At least monthly there should be a full system test using a phantom which can evaluate system uniformity and resolution simultaneously. Resolution phantoms should have a variety of sizes of cold lesions. Data acquisition with clinical parameters and subsequent reconstruction with a variety of filters will allow the user to optimally evaluate parameter selection to provide the most information. Types of Instruments to be tested by standardized Q.C program include dose calibrators, area survey meter, thyroid probe, scintillation well counter, gamma camera, SPECT, and PET.

In the symposium, more detailed measurements and objectives will be discussed. These may provide a guideline to nuclear medicine field to optimize and maintain their instruments for clinical and research applications.

References

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