Quality control in the imaging unit – part 1: instrumentation, gamma camera – planar, SPECT

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One important aspect of any quality assurance (QA) program is continuous quality improvement. This implies a commitment by the staff to perform daily control of all nuclear medicine equipments in the department. First in the chain is radionuclide calibrator. Most efficient in nuclear medicine is when optimum activity is used. Radionuclide calibrators are composite system: ionization chamber (IC) + electrometer. Batch production may introduce differences between system and jeopardize calibration traceability. Users containers and volumes may bear no relation and correction factors may not be available. Electrometers may not operate in logical/straightforward mode. Integrating times may compromise precision of single readings. Was the suppliers original calibration traceable? Dose calibrators are often black-boxes with little useful data on mode operation. (1)

The purpose of quality control (QC) is to detect changes in the performance of a gamma camera system that may adversely affect the interpretation of clinical studies. Clearly, there are a large number of factors that contribute to the final image quality, including uniformity, resolution (both intrinsic and energy), collimation and the hard copy device. In addition, for certain types of studies, other factors such as count rate capability come into play. With the addition of tomographic imaging, comes an additional suite of parameters that can influence the clinical images - these include system center of rotation, gantry and collimator hole alignment, rotational stability of the detector head and the integrity of the reconstruction algorithms. On a day-to-day basis, there is a limited amount of time that can be reasonably devoted to system QC. Hence the main goal of a QC program should be to monitor those parameters that are a) most sensitive to changes in system performance and b) most likely to impact clinical studies. This review will focus on some of the more critical areas in the quality control of gamma camera systems. (2)

QC of Planar Imaging Systems:

Quality control for planar systems is based on measurement of system uniformity

and resolution on a daily and weekly basis respectively. Additional, but less frequently performed QC measurements include checks of collimator integrity, multiple window spatial registration and for some systems, whole body(WB) uniformity. (3)

QC of SPECT Systems:

While it is well recognized that tomographic systems are more complex than

planar systems, the disparity in complexity between the two modes of operation has increased in recent years with the advent of multi-detector systems. It is likely to further increase as new advances such as scatter correction, attenuation correction and coincidence imaging move from the research environment into routine clinical use. Comprehensive quality control in a modern tomographic gamma camera and computer system may involve the performance of a large number of sophisticated tests of system function, many of which require specialized test equipment and are beyond the capabilities of most small laboratories. (3)

References

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