Handout - CT QA & QC

Purpose

Outcome 4: Identify QC requirements and QA data for computed tomography (CT).

Objective 4.1: Distinguish between the principles of quality control and quality assurance.

Quality Assurance in CT is designed to monitor and test radiation equipment and related components using administrative methodologies that ensure proper monitoring, evaluation, and corrective actions are properly performed. The owner is responsible for implementing a QA program, which provides guidelines that ensure:

- ***Information Quality*** – all diagnostic information produced can provide an accurate clinical assessment
- ***Clinical Efficiency*** – all steps leading to accurate diagnosis and intervention are taken, and information to the patient (or their physicians) is made available in a timely fashion
- ***Patient Dose*** – the imaging exam(s) are performed under A.L.A.R.A. guidelines.

Administrative procedures include:

- *Responsibility*
  - Of implementing and maintaining the QA program
- *Record Keeping*
  - Information collected must be clearly documented and readily available for evaluation
- *Evaluation of Data*
  - Recorded data should be evaluated immediately
- *Limits of Acceptability of Data*
  - Upper and lower limits of acceptability of recorded data must be determined and documented
- *Testing Frequency*
  - Must consider the cost of testing, disruption to the operation of the facility, and the maintenance of quality
  - Should be adjusted if equipment exhibits significant changes (i.e. acceptable limits are not met, equipment usage increases, after service to any part, etc.)
- *Corrective Actions*
  - Must establish repair and calibration procedures to deal with issues

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Quality Control in CT is an essential component of a radiation protection program, based on dose optimization principles. All QC programs should involve three fundamental steps:

1. *Acceptance testing*
    - Used to set baseline values and acceptance limits on operational performance of the equipment
    - Verifies compliance
    - Items under evaluation for acceptance testing include: Identification, Visual and Functional tests, Performance evaluation of the x-ray generator and image receptor(s)
2. *Routine performance evaluation*
    - Monitoring the components of a CT scanner that affect dose and image quality
3. *Error correction*
    - *Deals with the evaluation of the results of the QC tests*
    - *If the scanner fails to meet the acceptance limits established, then the scanner should be serviced to ensure acceptance limits are met*

CT equipment is extremely complex, and is composed of many different mechanical and electronic parts. Image quality may degrade so slowly, that the effects may go unnoticed. Likewise, as equipment ages, image quality may decrease (compared to installation). Comparing current QC data with past data can help identify when the scanner is not performing optimally. This will assist in determining the extent of the problem(s), and how best to address the issue(s).

Basic mandates of QC:

- *QC must be performed on a regular periodic basis*
    - Testing frequency should be such that the CT scanner is always operating correctly, with minimal disruption to patient throughput
- *Prompt interpretation of the measurements*
    - To determine if the equipment is operating within the specified guidelines, and/or if remedial action is required
- *Effective bookkeeping*
    - Measurements must be accurately recorded for the lifetime of the scanner

Considerations when completing QC tests:

- *Technique* – selection is dependent on the type of CT scanner, and the test being performed
    - Many variables can be selected, therefore it is best practice to use two representative techniques (that are frequently used on patients)
        - Typically a head and a body technique
    - The technique should remain the same from day to day for the same test

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        - Effectiveness of alternate tests may require setting a different technique
- *Test priority & frequency* – Complexity of the test typically dictates how often it should be performed
    - *Testing frequency should be adjusted as required*
- *Acceptable limits* – typically set by regulatory bodies (aka. Health Canada; outlined in the Safety Code 35)
    - Acceptable vs. Achievable
        - Importance of assessing changes between past and present measurements

There are several CT QC phantoms available to use for testing (some are included with the CT scanner while others are available commercially). Their intended purpose is to demonstrate to patients and personnel operating the CT facility the safety and effectiveness of their CT imaging services.

References

Seeram, E. (2016). *Computed Tomography: Physical Principles, Clinical Applications, and Quality Control* (4th ed.). Elsevier.

Safety Code 35: Safety Procedures for the Installation, Use and Control of X-ray Equipment in Large Medical Radiological Facilities - Canada.ca
https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/radiation/safety-code-35-safety-procedures-installation-use-control-equipment-large-medical-radiological-facilities-safety-code.html

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