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Recommendations for a Guide to Performing Repeat Analysis for CT Scanning
Submitted by: Sub-committee on CT Repeat Analysis, Physics Resource Committee,
Minnesota Radiological Society

Computed tomography (CT) has been shown to be the source of the majority of radiation dose to the medical patient population. The use of CT scanning has increased dramatically in recent years. Analysis of repeated radiological images is an established method of assisting in reduction of undesired radiation dose to patients. The expansion of this quality control method to include CT scanning is a necessary, although certainly not sufficient, means of reducing unwanted patient dose. However the nature of CT scanning varies significantly from that of radiography and these differences should be taken into account when developing a program for managing repeat exams in CT.

Probably the most significant difference is that CT as practiced today uses volume imaging rather than planar imaging. In early CT practice individual "slices" were obtained one at a time, similar in process to obtaining individual radiographs. In current practice, an entire volume is scanned, often in a single motion, and images are reconstructed sometimes at multiple slice thicknesses using varying image processing techniques. Because of this, the number of images bears no direct relationship to the amount of radiation used. Due to the speed of the scanning process, the most meaningful "unit" of the current CT scanning process has become the CT "series", with one or more series per examination. (For example, an exam of the abdomen may contain one series with contrast and one without.)

Furthermore, the practice of performing CT scans varies widely throughout the medical community, particularly between small and large institutions, both in number and complexity of exam protocols. In order for repeat analysis to be effective, it should be simple, risk-based and standardized to the point where a reasonable rate can be determined within the community.

The following guidelines are recommended for a standardized method of analyzing repeats in CT scanning and the associated radiation dose.

The CT repeat rate should be defined as:

$$\text{CT Repeat Rate} = \text{Total Number of Repeated Series} / \text{Total Number of Series}$$

Implementation: The Technologist records the repeated series (can be multiple per exam). The total number of series may be recorded by technologist or, for larger more complex practices, estimated from knowledge of the practice.

Analysis must occur at least quarterly or when 1,000 series have been done in a quarter.

Certain specialized uses of CT imaging should be exempt because of the nature of usage, complexity of the process or minimal dose to the patient population. Therefore CT repeat analysis is not required for interventional CT or scans that are part of a therapeutic procedure.

Topograms/scouts should be excluded from the analysis based on their extremely low dose compared to a series.

Rather than defining repeat “categories”, the following preliminary list of repeat causes should be used as a guideline in repeat analysis:

Item	Notes/Comments
Artifact	Streaks, rings, blobs, anything the scanner put in the image that is not in the patient.
Scanner malfunction/down	
Incorrect labeling	
Positioning	
Wrong side/ wrong exam	
Insufficient technique	Needed higher mAs. Higher mAs available but not used.
Artifact	Jewelry, etc.
Motion	
Poor circulation time	Contrast never “peaked out” and scan was not diagnostic.
Respiratory gating problem	ECG leads not functioning properly.
Residual contrast	
Wrong injection rate	
Wrong injection site	e.g., right arm instead of left arm.
Infiltrate	
Oral contrast problem	
Injector failure	

Respectfully submitted,

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