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Guide in Performing Repeat Analysis for Computed Tomography (CT) Imaging

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 according to [NCRP Report No. 160](#). Analysis of repeated radiological images is an established method in assisting with reduction of undesired radiation dose to the patient. The expansion of this quality control method to include CT scanning is a necessary, although certainly not sufficient, means of reducing unwanted patient dose. The nature of CT scanning varies significantly from radiography and these differences should be taken into account when developing a program for managing repeat examinations 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 a potential to have one or more series per examination (e.g. abdomen pelvis may contain an initial series with contrast and a separate series containing delays of just the pelvic region).

The practice of performing CT imaging 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 all institutions.

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:

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

OR

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

Implementation: The technologist records each of the repeated series within the examination (can be multiple per exam). The total number of series will be recorded by technologist for each examination performed or for larger institutions, it may be less complex to record examinations repeated and divide the repeated examinations into the total amount examinations performed. Topogram/scout images should be excluded from the analysis based on their extremely low dose compared to a series or examination.

In addition to documenting repeated imaging, an analysis of the examination must be performed on a quarterly basis and reviewed on your annual review of your program.

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, contrast leakage, jewelry, 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.
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 concern	
Injector failure	
Contrast sensitivity	