

CT Dose Reduction in Abdominal CT Scanning

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Purpose and Rationale

This project focuses on identifying variation in radiation dose for abdominal CT scanning and developing an approach to reducing variation and dose.

Much attention has been focused on efforts to reduce dose in CT scanning. In general, doses for abdominal scanning are higher than for scanning of the chest or head. This makes the abdomen an appropriate target for dose reduction efforts.

Several regional and national quality metrics now include collection and reporting of radiation dose.

Project Resources:

1. CT Dose Reduction and Dose Management Tools: Overview of Available Options. McCollough CH, Brusewitz RT, Kofler JM. *Radiographics* 2006; 26: 503-512
2. Dose Reduction and Compliance with Pediatric CT Protocols Adapted to Patient Size, Clinical Indication, and Number of Prior Studies. Singh S, Kalra MK, Moore MA, Shailam R, Liu B, Toth TL, Grant E, Westra SJ. *Radiology* 2009; 252: 200-208
3. ACR National Radiology Data Registry (NRDR): Dose Index Registry. <http://nrdr.acr.org>

Project Measures

Metric 1

Numerator: # of cases in which CT dose is recorded
Denominator: total # of CT scans performed

Metric 2

Dose Length Product (DLP), averaged across cases measured
Standard Deviation for DLP, across cases measured

Baseline Data Collection

Make a plan for selecting cases. For example, you might want to select a specific indication (e.g., suspected appendicitis) or a group of indications that might have similar CT scanning protocols (e.g., suspected diverticulitis, abdominal pain, etc.).

Identify a data collection strategy, including the time period for collecting cases and the total number of cases to be collected. Ideally, consecutive cases meeting the selection criteria (e.g., indication) will be collected until the desired target number of cases has been collected. An alternative strategy might be to collect the first 5 or 10 cases in consecutive days, or on a specific day of the week.

The number required will vary based on the patient demographics of your practice. A reasonable target would be to end up with approximately 100 cases per indication (if more than one indication is included).

Data Analysis

The goal is to identify the percentage of cases in which radiation dose information is collected, as well as the average dose and an indication of the variation in dose among patients.

The next step should be to identify outliers (either high or low), by identifying those cases in which CT dose is more than 2 standard deviations above or below the mean. These cases should be further investigated. Things to consider in this investigation would be patient weight, BMI, scan range (to assess for over scanning), the presence of metal implants, patient centering in the gantry, etc.

Factors Potentially Influencing Performance

After analyzing the data, identify metrics where there is room for improvement. Reflect on your setting and practice and identify factors that may have influenced your results. Potential contributors may include:

1. Protocols that have not been optimized to reduce dose (e.g., appropriate mA and KvP settings, slices too thin, etc.).
2. Technologists failing to follow the protocols.
3. Excessive scan range, e.g., including the chest when abdomen is requested, unnecessary additional scan acquisitions.
4. Physician or technologist selecting the incorrect protocol.
5. Equipment factors, e.g., manufacturer, # detector rows, dose reduction algorithms.

Intervention

Team members, including radiologists, technologists and where possible radiation physicists, should meet to review the data and discuss possible strategies to reduce dose and unnecessary variance. This might include careful review of root causes for high outlier doses, as well as possibly image quality for low outlier doses.

Post Intervention Data Collection

Using the same data collection strategy as for Baseline Data Collection, collect a similar number of cases and repeat the data analysis (Metrics 1 and 2, as described above). Review the Post Intervention Data with your project team and compare to Baseline Data. Discuss the effect of specific strategies employed. Develop plan for ongoing dose monitoring.