DEPARTMENT OF HEALTH

DIRECTORATE: RADIATION CONTROL

GUIDELINES

FDA Public Health Notification: Reducing Radiation Risk from Computed Tomography for Pediatric and Small Adult Patients - 2 November 2001

(You are encouraged to copy and distribute this information)

Background

The individual risk from the radiation associated with a CT scan is quite small compared to the benefits that accurate diagnosis and treatment can provide. Still, unnecessary radiation exposure during medical procedures should be avoided. This is particularly important when the patient is a child, since children exposed to radiation are at a relatively greater risk than adults.

1 The American College of Radiology has noted, "Because they have more rapidly dividing cells than adults and have longer life expectancy, the odds that children will develop cancers from x-ray radiation may be significantly higher than adults."

2 It has been estimated by the National Research Council's Committee on the Biological Effects of Ionizing Radiation that children less than 10 years of age are several times more sensitive to radiation than middle-aged adults.

3 Unnecessary radiation maybe delivered when CT scanner parameters are not appropriately adjusted for patient size.

4 When a CT scan is performed on a child or small adult with the same technique factors that are used for a typically sized adult, the small patient receives a significantly larger effective dose than the full-sized patient. To compound the problem, the overexposure of children or small adults during CT procedures can easily go unrecognized. In conventional x-ray procedures, medical personnel can tell if the patient has been overexposed because the resulting film is overexposed, producing a dark image.

5 But with CT, there is no obvious evidence that the patient has been overexposed because the quality of the image may not be compromised. Several recent articles stress that it is important to use the lowest radiation dose necessary to provide an image from which an accurate diagnosis can be made, and that significant dose reductions can be achieved without compromising clinical efficacy. (see references 2, 5, 6, 7, 8, 9, 10)

RECOMMENDATIONS

Here are the steps we are recommending. They are not new. Indeed, many facilities are already taking measures to protect children and other small patients from unnecessary exposure during CT procedures. (see references 11, 12, 13)

1. Optimize CT Settings. Based on patient weight or diameter and anatomic region of interest, evaluate whether your CT operating conditions are optimally balanced between image quality and radiation exposure. To reduce dose while maintaining diagnostic image quality:

   - Reduce tube current. With all other factors held constant, patient radiation dose is directly proportional to x-ray tube current. For example, a 50 percent reduction in tube current results in a 50 percent decrease in radiation dose (see reference 9).

- Develop and use a chart or table of tube-current settings based on patient weight or diameter and anatomical region of interest. See reference 9 for an example of tube current settings based on patient weight and anatomical region of interest (i.e., chest, pelvis or abdomen) for a single-detector helical-scanning CT unit. The diameter of the patient may be a better predictor of the tube-current required than body weight because patient diameter better correlates with the x-ray beam attenuation in the patient. The scanner manufacturer can help in developing this chart or table.

- Increase table increment (axial scanning) or pitch (helical scanning). If the pitch is increased, the amount of radiation needed to cover the anatomical area of interest is decreased (see references 2 14). One study showed that increasing the pitch from 1:1 to 1.5:1 decreased the radiation dose by 33 percent without loss of diagnostic information (see reference 15). Consult your facility's medical physicist, who can advise you on optimal tube-current and pitch settings for diagnostic requirements. You can also contact the manufacturer of the CT scanner for recommendations specific to your model.

Note that some newer CT scanners may automatically suggest or implement an increase in mA if pitch is increased. For these models, increasing the pitch may not result in a lower radiation dose. Contact the CT scanner's manufacturer for recommendations on your model's automatic current adjustment features.

2. Reduce the number of multiple scans with contrast material. Often, CT scans are done before, during, and after injection of IV contrast material. When medically appropriate, multiple exposures may be reduced by eliminating pre-contrast images (i.e., unchanged images) (see reference 9).

3. Eliminate inappropriate referrals for CT. In some cases, conventional radiography, sonography, or magnetic resonance imaging (MRI) can be just as effective as CT, and with lower radiation exposure. Most conventional x-ray units deliver less ionizing radiation than CT systems, and sonography and MRI systems deliver no x-ray radiation at all. It is important to triage these examinations to eliminate inappropriate referrals or to utilize procedures with less or no ionizing radiation (see reference 9).

References

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15. A. Vade et al., "Evaluation of Image Quality Using 1:1 Pitch and 1.5:1 Pitch Helical CT in Children: A Comparative Study." Pediatr Radiol Vol. 26, pp. 891-893, 1996.

Getting more information

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