



CT Protocol Design and Optimization

Michael F. McNitt-Gray, PhD *David Geffen School of Medicine, UCLA, Los Angeles, CA*

James M. Kofler, Jr. PhD *Mayo Clinic, Rochester, MN*

Protocols, or scan instructions, are the core of every CT examination. All aspects of the exam should be included in the protocol, including patient positioning, nursing instructions, scan parameters, reconstruction/reformatting instructions, and any other information necessary for the imaging team to complete the CT study successfully. Derivation and approval of all components of the protocols should be completed by a team consisting at least of a radiologist, a medical physicist, and a technologist. Representatives from other areas, such as nursing, should also be consulted as necessary. The protocol team should assure that protocols are appropriate for the clinical indication and that the scan parameters, including radiation dose, are tailored to the specific imaging task.

Some general information and philosophies on protocol design and optimization can be found at the following sites:

- Siegle C.L., Kofler J.M., Torkelson J., et al., *CT Protocol Management*. Presented at the Radiological Society of North America, Chicago, IL; 2004.
<http://mayoresearch.mayo.edu/mayo/research/ctcic/upload/ct-protocol-managment.pdf>
- The ACR and American Society of Neuroradiology Statement on CT Protocols and Radiation Dose. Available at:
<http://www.acr.org/SecondaryMainMenuCategories/NewsPublications/FeaturedCategories/CurrentACR/News/archive/ACRASNRStatementonCTProtocols.aspx>. Accessed October 1, 2010.
- American College of Radiology, *CT Accreditation QC Manual: Review of Clinical Protocols*. Not available until 2011.

The following references discuss dose-reducing techniques, including the principles and considerations for optimizing dose using automatic exposure technologies in CT:

- Yu L., Lui X., Leng S., et al., “Radiation Dose Reduction in Computed Tomography: Techniques and Future Perspective,” *Imaging in Medicine*, October 2009.
- McCollough C.H., Primak A.N., Braun N., et al., “Strategies for Reducing Radiation Dose in CT,” *Radiologic Clinics of North America*, January 2009.



- Rego S.L., Yu L., Bruesewitz M.R., et al., *CARE Dose4D CT Automatic Exposure Control System: Physics Principles and Practical Hints*, Presented at the Radiological Society of North America, Chicago, IL, 2007.
- Bruesewitz M.R., Yu L., Vrieze T.J., et al., *Smart mA – Automatic Exposure Control (AEC): Physics Principles and Practical Hints*, Presented at the Radiological Society of North America, Chicago, IL, 2008.

The following references discuss the potential advantages and disadvantages of using in-plane patient shielding in CT, which has been suggested as a means to reduce radiation dose:

- Coursey C., Frush D.P., Yoshizumi T., et al., “Pediatric Chest MDCT Using Tube Current Modulation: Effect on Radiation Dose With Breast Shielding,” *American Journal of Roentgenology*, January 2008.
- Geleijns J., Salvadó Artells M., Veldkamp W.J., et al., “Quantitative Assessment of Selected In-Plane Shielding of Tissues in Computed Tomography Through Evaluation of Absorbed Dose and Image Quality,” *European Radiology*, October 2006.
- Geleijns J., Wang J., McCollough C., “The Use of Breast Shielding for Dose Reduction in Pediatric CT: Arguments Against the Proposition,” *Pediatric Radiology*, August 2010.