

The American College of Radiology, with more than 30,000 members, is the principal organization of radiologists, radiation oncologists, and clinical medical physicists in the United States. The College is a nonprofit professional society whose primary purposes are to advance the science of radiology, improve radiologic services to the patient, study the socioeconomic aspects of the practice of radiology, and encourage continuing education for radiologists, radiation oncologists, medical physicists, and persons practicing in allied professional fields.

The American College of Radiology will periodically define new practice guidelines and technical standards for radiologic practice to help advance the science of radiology and to improve the quality of service to patients throughout the United States. Existing practice guidelines and technical standards will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

Each practice guideline and technical standard, representing a policy statement by the College, has undergone a thorough consensus process in which it has been subjected to extensive review, requiring the approval of the Commission on Quality and Safety as well as the ACR Board of Chancellors, the ACR Council Steering Committee, and the ACR Council. The practice guidelines and technical standards recognize that the safe and effective use of diagnostic and therapeutic radiology requires specific training, skills, and techniques, as described in each document. Reproduction or modification of the published practice guideline and technical standard by those entities not providing these services is not authorized.

2001 (Res. 10)  
Amended 2002 (Res. 2)  
Revised 2006 (Res. 14,16g,17,34,35,36)  
Effective 10/01/06

## **ACR PRACTICE GUIDELINE FOR PERFORMING AND INTERPRETING DIAGNOSTIC COMPUTED TOMOGRAPHY (CT)**

### **PREAMBLE**

These guidelines are an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. They are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care. For these reasons and those set forth below, the American College of Radiology cautions against the use of these guidelines in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the guidelines, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the guidelines when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations on available resources, or advances in knowledge or technology subsequent to publication of the guidelines. However, a practitioner who employs an approach substantially different from these guidelines is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and

complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. Therefore, it should be recognized that adherence to these guidelines will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these guidelines is to assist practitioners in achieving this objective.

### **I. INTRODUCTION**

Computed tomography (CT) is a radiologic modality that provides clinical information in the detection, differentiation, and demarcation of disease. CT is the primary diagnostic modality for a variety of presenting problems and is widely accepted as a supplement to other imaging techniques.

CT is a form of medical imaging that involves the exposure of patients to ionizing radiation. It should only be performed under the supervision of a physician with the necessary training in radiation protection to optimize examination safety. Radiation physicists and trained technical staff must be available.

CT examinations should be performed only for a valid medical reason and with the minimum exposure that provides the image quality necessary for adequate diagnostic information.

This guideline applies to all CT examinations performed in all settings.

(For pediatric considerations see Section VII.)

## II. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

Physicians who supervise and interpret CT examinations should be licensed medical practitioners who have a thorough understanding of the indications for CT as well as a familiarity with the basic physical principles and limitations of the technology of computed tomography imaging. They should be familiar with alternative and complementary imaging and diagnostic procedures and should be capable of correlating the results of these with CT findings. The physicians should have a thorough understanding of CT technology and instrumentation as well as radiation safety. Physicians responsible for CT examinations should be able to demonstrate familiarity with the anatomy, physiology, and pathophysiology of those organs or anatomic areas that are being examined. These physicians should provide evidence of training and requisite competence needed to perform CT examinations successfully.

### A. Physician

All examinations must be performed under the supervision of and interpreted by a physician who has the following qualifications:

1. Certification in Radiology or Diagnostic Radiology by the American Board of Radiology, American Osteopathic Board of Radiology, the Royal College of Physicians and Surgeons of Canada, or Le College des Medecins du Quebec, and involvement with the supervision, interpretation, and reporting of 300 CT examinations in the past 36 months.<sup>1</sup>

or

Completion of an Accreditation Council for Graduate Medical Education (ACGME) approved diagnostic radiology residency program or an American Osteopathic Association (AOA) approved diagnostic radiology residency program and involvement with the supervision, interpretation, and reporting of 500 CT examinations in the past 36 months.<sup>1</sup>

or

Physicians not board certified in radiology or not trained in a diagnostic radiology residency program who assume these responsibilities for CT imaging exclusively in a specific anatomical

area should meet the following criteria: completion of an ACGME approved residency program in the specialty practiced plus 200 hours of Category I CME in the performance and interpretation of CT in the subspecialty where CT reading occurs; and supervision, interpretation, and reporting of 500 cases during the past 36 months in a supervised situation.

and

2. The physician shall have documented training in the physics of diagnostic radiology. Additionally, the physician must demonstrate training in the principles of radiation protection, the hazards of radiation exposure to both patients and radiologic personnel, and appropriate monitoring requirements.

and

3. The physician should be thoroughly acquainted with the many morphologic and pathophysiologic manifestations and artifacts demonstrated on CT. Additionally, supervising physicians should have appropriate knowledge of alternative imaging methods, including the use of and indications for general radiography and specialized studies such as angiography, ultrasonography, magnetic resonance imaging, and nuclear medicine studies.

and

4. The physician should be familiar with patient preparation for the examination. The physician must have had training in the recognition and treatment of adverse effects of contrast materials used for these studies.<sup>2</sup>

and

5. The physician shall have the responsibility for reviewing all indications for the examination; specifying the use, dosage, and rate of administration of contrast agents;<sup>2</sup> specifying the imaging technique, including appropriate windowing and leveling; interpreting images; generating official interpretations (final reports); and maintaining the quality of the images and the interpretations.

### Maintenance of Competence

All physicians performing CT examinations should demonstrate evidence of continuing competence in the interpretation and reporting of those examinations. If competence is assured primarily based on continuing experience, a minimum of 100 examinations per year is recommended in order to maintain the physician's skills. Because a physician's practice or location may preclude this method, continued competency can also be assured through monitoring and evaluation that indicates

<sup>1</sup>Completion of an accredited radiology residency in the past 24 months will be presumed to be satisfactory experience for the reporting and interpreting requirement.

<sup>2</sup>See the [ACR Practice Guideline for the Use of Intravascular Contrast Media](#).

acceptable technical success, accuracy of interpretation, and appropriateness of evaluation.

#### Continuing Medical Education

The physician's continuing education should be in accordance with the [ACR Practice Guideline for Continuing Medical Education \(CME\)](#) and should include CME in CT as is appropriate to the physician's practice needs.

#### B. Qualified Medical Physicist

A Qualified Medical Physicist is an individual who is competent to practice independently one or more of the subfields in medical physics. The ACR considers certification and continuing education in the appropriate subfield(s) to demonstrate that an individual is competent to practice one or more of the subfield(s) in medical physics and to be a Qualified Medical Physicist. The ACR recommends that the individual be certified in the appropriate subfield(s) by the American Board of Radiology (ABR) or for MRI, by the American Board of Medical Physics (ABMP) in magnetic resonance imaging physics.

The appropriate subfields of medical physics for computed tomography are Radiological Physics and Diagnostic Radiological Physics.

A medical physicist's continuing education should be in accordance with the [ACR Practice Guideline for Continuing Medical Education \(CME\)](#), 2006 (Res. 16g)

#### C. Radiologist Assistant

A radiologist assistant is an advanced level radiographer who is certified and registered as a radiologist assistant by the American Registry of Radiologic Technologists (ARRT) after having successfully completed an advanced academic program encompassing an ACR/ASRT (American Society of Radiologic Technologists) radiologist assistant curriculum and a radiologist-directed clinical preceptorship. Under radiologist supervision, the radiologist assistant may perform patient assessment, patient management and selected examinations as delineated in the Joint Policy Statement of the ACR and the ASRT titled "Radiologist Assistant: Roles and Responsibilities" and as allowed by state law. The radiologist assistant transmits to the supervising radiologists those observations that have a bearing on diagnosis. Performance of diagnostic interpretations remains outside the scope of practice of the radiologist assistant. 2006 (Res. 34)

#### D. Radiologic Technologist

The technologist should have the responsibility for patient comfort, preparing and positioning the patient for the CT

examination, monitoring the patient during the examination, and obtaining the CT data in a manner prescribed by the supervising physician. If intravenous contrast material is to be administered, qualifications for technologists performing intravenous injections should be in compliance with current ACR policy statements<sup>3,4</sup> and existing operating procedures or manuals at the imaging facility. The technologist should also perform the regular quality control testing of the CT system under the supervision of a medical physicist.

Technologists performing CT examinations should be certified by the American Registry of Radiologic Technologists (ARRT) or have an unrestricted state license with documented training and experience in CT.

### III. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for a CT examination should provide sufficient information to demonstrate the medical necessity of the examination and allow for the proper performance and interpretation of the examination.

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). The provision of additional information regarding the specific reason for the examination or a provisional diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the examination.

The request for the examination must be originated by a physician or other appropriately licensed health care provider. The accompanying clinical information should be provided by a physician or other appropriately licensed health care provider familiar with the patient's clinical problem or question and consistent with the state scope of practice requirements. 2006 (Res. 35)

Images should be labeled with the following: a) patient identification, b) facility identification, c) examination

---

<sup>3</sup>See the [ACR Practice Guideline for the Use of Intravascular Contrast Media](#).

<sup>4</sup>The American College of Radiology approves of the injection of contrast material and diagnostic levels of radiopharmaceuticals by certified and/or licensed radiologic technologists and radiologic nurses under the direction of a radiologist or his or her physician designee who is personally and immediately available, if the practice is in compliance with institutional and state regulations. There must be prior written approval by the medical director of the radiology department/service of such individuals; such approval process having followed established policies and procedures, and the radiologic technologists and radiologic nurses who have been so approved maintain documentation of continuing medical education related to the materials being injected and to the procedures being performed. 1987, 1997 (Res. 1-H)

date, and d) the side (right or left) of the anatomic site imaged.

#### **IV. DOCUMENTATION**

High-quality patient care requires adequate documentation. There should be a permanent record of the CT examination and its interpretation. Images of all appropriate areas, both normal and abnormal, should be recorded in a suitable archival format. An official interpretation (final report) of the CT findings should be included in the patient's medical record regardless of where the study is performed. Retention of the CT examination should be consistent both with clinical need and with relevant legal and local health care facility requirements.

Reporting should be in accordance with the [ACR Practice Guideline for Communication of Diagnostic Imaging Findings](#).

#### **V. EQUIPMENT SPECIFICATIONS**

See the various anatomic CT procedure guidelines or standards for definitive equipment specifications.

#### **VI. RADIATION SAFETY IN IMAGING**

Radiologists, radiologic technologists, and all supervising physicians have a responsibility to minimize radiation dose to individual patients, to staff, and to society as a whole, while maintaining the necessary diagnostic image quality. This is the concept "As Low As Reasonably Achievable (ALARA)."

Facilities, in consultation with the medical physicist, should have in place and should adhere to policies and procedures, in accordance with ALARA, to vary examination protocols to take into account patient body habitus, such as height and/or weight, body mass index or lateral width. The dose reduction devices that are available on imaging equipment should be active or manual techniques should be used to moderate the exposure while maintaining the necessary diagnostic image quality. Patient radiation doses should be periodically measured by a medical physicist in accordance with the appropriate ACR Technical Standard. 2006 (Res. 17)

#### **VII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION CONCERNS**

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education Concerns

elsewhere in the ACR Practice Guidelines and Technical Standards book.

A comprehensive CT quality control program should be documented and maintained at the CT facility. The program should help to minimize radiation risk to the patient, facility personnel, and the public, and to maximize the quality of diagnostic information. CT facility personnel must adhere to radiation safety regulations when inside the scanner room. Overall program responsibility should remain with the physician, but specific program implementation should be supervised by the medical physicist in compliance with local and state regulations as well as manufacturer specifications. The facility should maintain a record of quality control tests, frequency of performance, and description of procedures, as well as a list of individuals or groups performing each test. Moreover, the parameters of technique, equipment testing, and acceptability of limits for each test should also be maintained, along with sample records for each test. Quantitative dose determination should be conducted periodically, in addition to equipment performance monitoring.

The supervising physician should review all practices and policies at least annually. Policies with respect to contrast and sedation must be administered in accordance with institutional policy as well as state and federal regulations. A physician should be available on-site whenever intravenous or intrathecal contrast or intravenous sedation is administered.

An appropriately equipped emergency cart must be immediately available to treat adverse reactions associated with administered medications. The cart should be monitored for inventory and drug expiration dates on a regular basis and comply with institutional policies.

The lowest possible radiation dose consistent with acceptable diagnostic image quality should be used, particularly in pediatric examinations. Radiation doses should be determined periodically based on a reasonable sample of pediatric examinations. Technical factors should be appropriate for the size and the age of the child and should be determined with consideration of parameters such as characteristics of the imaging system, organs in the radiation field, lead shielding, etc. Guidelines concerning effective pediatric technical factors are published in the radiological literature.

All imaging facilities should have policies and procedures to reasonably attempt to identify pregnant patients prior to the performance of any diagnostic examination involving ionizing radiation. If the patient is known to be pregnant, the potential radiation risks to the fetus and clinical benefits of the procedure should be considered before proceeding with the study. 1995, 2005 (Res. 1a)

Equipment performance monitoring should be in accordance with the [ACR Technical Standard for Diagnostic Medical Physics Performance Monitoring of Computed Tomography \(CT\) Equipment](#).

## ACKNOWLEDGEMENTS

This guideline was revised according to the process described in the ACR Practice Guidelines and Technical Standards book by the ACR Commission on Body Imaging.

Principal Reviewer: Lincoln Berland, MD

### Commission on Body Imaging

N. Reed Dunnick, MD, Chair  
Lincoln L. Berland, MD  
Jeffrey J. Brown, MD  
Ella A. Kazerooni, MD  
B J Manaster, MD, PhD  
Geoffrey Rubin, MD  
Meghan E. Blake, MD

### Comments Reconciliation Committee

Paul A. Larson, MD, Co-Chair  
Lawrence A. Liebscher, MD, Co-Chair  
Lincoln L. Berland, MD  
Jeffrey J. Brown, MD  
N. Reed Dunnick, MD  
Mary C. Frates, MD  
Gretchen A. Gooding, MD  
Ella A. Kazerooni, MD  
Peter H.B. McCreight, MD  
Carol M. Rumack, MD  
Richard A. Suss, MD  
Julie K. Timins, MD  
Jeffrey C. Weinreb, MD  
Gary J. Whitman, MD

## REFERENCES

1. Brenner DJ, Elliston CD, Hall EJ, et al. Estimated risks of radiation-induced fatal cancer from pediatric CT. *AJR* 2001;176:289-296.
2. Cody DD, Moxley DM, Krugh KT, et al. Strategies for formulating appropriate MDCT techniques when imaging the chest, abdomen, and pelvis in pediatric patients. *AJR* 2004;182:849-859.
3. Donnelly LF, Emery KH, Brody AS, et al. Minimizing radiation dose for pediatric body applications of single-detector helical CT: strategies at a large children's hospital. *AJR* 2001;176:303-306.
4. Frush DP, Donnelly LF, Rosen NS. Computed tomography and radiation risks; what pediatric healthcare providers should know. *Pediatrics* 2003; 112:951-957.
5. McNitt-Gray MF. AAPM/RSNA physics tutorial for residents: topics in CT. *RadioGraphics* 2002;22:1541-1553.
6. Paterson A, Frush DP, Donnelly LF. Helical CT of the body: are settings adjusted for pediatric patients? *AJR* 2001;176:297-301.
7. Suess C, Chen X. Dose optimization in pediatric CT: current technology and future innovations. *Pediatr Radiol* 2002;32:729-734.