Revised 2006 (Res. 13,17,35)*

ACR PRACTICE GUIDELINE FOR THE PERFORMANCE OF COMPUTED TOMOGRAPHY (CT) OF THE ABDOMEN AND COMPUTED TOMOGRAPHY (CT) OF THE PELVIS

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 of 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 utilizes ionizing radiation to obtain cross-sectional images (non-helical CT) or volumetric data sets (helical CT). The acquired images may also be reprocessed to produce images in many anatomic planes or in three dimensions to view entire anatomic volumes. Optimal performance of CT requires knowledge of anatomy and pathophysiology, familiarity with the basic physics and techniques of computed tomography, and knowledge of radiation safety. This guideline outlines the principles for performing high-quality diagnostic abdominal CT and/or pelvic CT.

II. INDICATIONS AND CONTRAINDICATIONS

Indications for abdominal CT or pelvic CT examinations include, but are not limited to:

A. Evaluation of abdominal, flank, or pelvic pain.

B. Evaluation of known or suspected abdominal or pelvic masses or fluid collections.

C. Evaluation of primary or metastatic malignancies.

D. Evaluation of abdominal or pelvic inflammatory processes.

E. Assessment of abnormalities of abdominal or pelvic vascular structures.

F. Evaluation of abdominal or pelvic trauma.

G. Clarification of findings from other imaging studies or laboratory abnormalities.

H. Evaluation of known or suspected congenital abnormalities of abdominal or pelvic organs.

I. Guidance for interventional or therapeutic procedures within the abdomen or pelvis.

J. Treatment planning for radiation therapy.

K. Noninvasive angiography of the aorta and its branches. (See the ACR Practice Guideline for the Performance and Interpretation of CT Angiography [CTA].)

There are no absolute contraindications to abdominal CT or pelvic CT examinations. As with all procedures, the relative benefits and risks of the procedure should be evaluated prior to performing unenhanced or contrast-enhanced abdominal CT and/or pelvic CT. Appropriate precautions should be taken to minimize patient risk.

For the pregnant or potentially pregnant patient, see the ACR Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation.

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the ACR Practice Guideline for Performing and Interpreting Computed Tomography (CT).

IV. SPECIFICATIONS OF THE EXAMINATION

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

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). 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's scope of practice requirements. (ACR Resolution 35, adopted in 2006)

A. A CT examination of the abdomen should include transaxial images from the dome of the diaphragm to the upper margin of the sacroiliac joints with 8 mm or less slice thickness. A CT of the pelvis should extend from the iliac crest through the ischial tuberosities with 8 mm or less slice thickness (see section VI). Often, depending on the clinical indication for the study, both the abdomen and pelvis must be examined concurrently. An adequate study may be performed with sequential single-slice technique, with single detector helical technique, or with multidetector scanners. Beam pitch should not routinely exceed 2:1 for helical scanners.

B. In addition to directly acquired axial images, images in coronal, sagittal, or other more complex oblique planes may be constructed from the source-image data to answer specific clinical questions, to aid in disease visualization, or to assist in planning for interventional or surgical procedures. Additionally, the imaging information may be displayed to selectively demonstrate specific structures such as in CT angiography, CT urography, virtual colonography, and/or other applications deemed necessary. Such applications are performed better with data acquired with multidetector CT.

C. Some abdominal and/or pelvic CT examinations may be performed with multiple acquisitions. All acquisitions are best obtained in the same suspended state of respiration if possible. For radiation treatment planning, examinations may be obtained during normal respiration. Scans should be obtained through the entire area of interest. The scan field of view should be optimized for each patient.

D. An intraluminal gastrointestinal contrast agent may be administered orally, rectally or by nasogastric or other tube to provide adequate visualization of the gastrointestinal tract unless medically contraindicated or unnecessary for the clinical indication. This may be a positive contrast agent such as dilute barium, a water soluble iodinated solution, a neutral contrast agent such as water or nonabsorbable agent, or a negative agent such as air or carbon dioxide.

E. Abdominal and/or pelvic CT examinations may be performed after administering intravenous (IV) contrast medium, using appropriate injection techniques. For specific indications, it may be necessary to perform a non-IV contrast enhanced study first. Abnormal findings on an

unenhanced examination may require further evaluation with contrast enhancement or an alternative imaging study if contrast medium is contraindicated.

F. Appropriate window width and level settings should be used to view the visceral organs, the intra-abdominal fat and muscles, the pulmonary parenchyma at the lung bases, and the osseous structures.

G. Although many of the operations of a CT scanner are automated, a number of technical parameters remain operator-dependent. Because these user-determined technical parameters can significantly affect the diagnostic quality of a CT examination, the supervising physician must become familiar with the following:

1. Exposure factors.
2. Collimation.
3. Table increment or pitch.
4. Field of view.
5. Window settings.
6. Reconstruction algorithms.
7. Image reconstruction interval.
8. Detector configuration for multidetector systems.
9. Display slice width for multidetector systems.

H. Optimizing CT examination technique requires the supervising physician to develop an appropriate CT protocol based on careful review of the patient history (to include risk factors that might increase the likelihood of adverse reactions to contrast media) and clinical indications, as well as all relevant imaging studies when available. This optimization process may include determining if CT examination of the abdomen, pelvis, or both is necessary.

I. Protocols may be prepared by region of interest and medical indication. Techniques should be selected that provide image quality consistent with the diagnostic needs of the examination at acceptable radiation dose levels. For each area of interest or indication, the protocol should indicate the following:

1. The volume and type of gastrointestinal contrast media to be administered, the route of administration (oral, rectal, or via nasogastric or other tube), and the time during which it should be delivered.
2. If intravenous contrast media is used, the type, volume, rate of administration, and time delay between administration and scan initiation.
3. Detector configuration.
4. Table increment and pitch.
5. Slice thickness (for multidetector CT).
6. Reconstruction interval.
7. Reconstruction kernel (algorithm).
8. kVp and mAs per slice as appropriate for adult or pediatric patients.
9. Superior and inferior extent of the region of interest to be imaged.
10. Appropriate window width and level settings for hard-copy imaging.

These protocols should be reviewed and updated periodically and dated copies should be available to appropriate physician, technical and administrative personnel at the facility.

V. DOCUMENTATION

Reporting should be in accordance with the ACR Practice Guideline for Communication of Diagnostic Imaging Findings.

VI. EQUIPMENT SPECIFICATIONS

A. Performance Guidelines

To achieve acceptable clinical CT scans of the abdomen and/or pelvis, a CT scanner should meet or exceed the following capabilities:

1. Scan time: ≤ 2 sec.
2. Minimum slice thickness: ≤ 2 mm.
3. Interscan delay: 1 sec, but may be longer if no intravascular contrast used. Limiting spatial resolution: ≥ 8 lp/cm for ≥ 32-cm display field of view (DFOV) and ≥ 10 lp/cm for < 24 cm DFOV.

B. Appropriate emergency equipment and medications must be immediately available to treat adverse reactions associated with administered medications. The equipment and medications should be monitored for inventory and drug expiration dates on a regular basis. The equipment, medications, and other emergency support must also be appropriate for the range of ages and sizes in the patient population.

C. A soft-copy workstation review capability is desirable.

VII. EQUIPMENT QUALITY CONTROL

The quality control program for CT equipment should be designed to minimize patient, personnel, and public radiation risks and to maximize the quality of the diagnostic information. The program should be supervised by a medical physicist. Each imaging facility should have documented policies and procedures that include:

1. A list of tests to be performed and the frequency of performance.
2. A list identifying which individual or group will perform the tests.

3. A written description of the procedure that will be used for each test, including the technique factors to be employed, the equipment to be used for testing, the acceptability limits of each test, and sample records from each test.

VIII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, 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 concept is known as "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. Periodically, radiation exposures should be measured and patient radiation doses estimated by a medical physicist in accordance with the appropriate ACR Technical Standard. (ACR Resolution 17, adopted in 2006 – revised in 2009, Resolution 11)

IX. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION

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 appearing elsewhere in the ACR Practice Guidelines and Technical Standards book.

For specific issues regarding CT quality control, see the ACR Practice Guideline for Performing and Interpreting Computed Tomography (CT).

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 Committee on Abdominal Imaging of the Commission on Body Imaging.

Principal Reviewer: Lincoln L. Berland, MD

Committee on Abdominal Imaging
Lincoln L. Berland, MD, Chair
James Brink, MD
Richard Ehman, MD
G. Scott Gazelle, MD, PhD
Jay Heiken, MD
Charles D. Johnson, MD
Edward Lubat, MD
Alec Megibow, MD
Donald Mitchell, MD
William Shuman, MD
Stuart Silverman, MD
N. Reed Dunnick, MD, Chair, Commission

Comments Reconciliation Committee
Charles E. Mueller, MD, Chair
Ronald E. Cordell, MD
N. Reed Dunnick, MD
Jay Heiken, MD
Paul A. Larson, MD
Stanley P. Laucks, Jr., MD, PhD
Lawrence A. Liebscher, MD

Suggested Reading

1. Flohr TG, Schaller S. Stierstorfer K, et al. Multidetector row CT systems and image-reconstruction techniques. *Radiology* 2005;235:756-773.
2. Gupta AK, Nelson RC, Johnson GA, et al. Optimization of eight-element multidetector row helical CT technology for evaluation of the abdomen. *Radiology* 2003;227:739-745.
3. Hamberg LM, Rhea JT, Hunter GJ, et al. Multidetector row CT: radiation dose characteristics. *Radiology* 2003;226:762-772.
4. O'Malley ME, Halpern E, Mueller PR, et al. Helical CT protocols for the abdomen and pelvis: a survey. *AJR* 2000;175:109-113.
5. Yamashita Y, Komohara Y, Takahashi M, et al. Abdominal helical CT: evaluation of optimal doses of intravenous contrast material—a prospective randomized study. *Radiology* 2000;216:718-723.

---

*Guidelines and standards are published annually with an effective date of October 1 in the year in which amended, revised or approved by the ACR Council. For guidelines and standards published before 1999, the effective date was January 1 following the year in which the guideline or standard was amended, revised, or approved by the ACR Council.

Development Chronology for this Guideline
1995 (Resolution 2)
Amended 1995 (Resolution 24, 53)
Revised 1997 (Resolution 31)
Revised 2001 (Resolution 8)
Revised 2006 (Resolution 13, 17, 35)
Amended 2009 (Resolution 11)