Revised 2021 (Resolution 39)*

ACR–SAR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF ABDOMINAL RADIOGRAPHY

PREAMBLE

This document is an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. Practice Parameters and Technical Standards are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care[1]. For these reasons and those set forth below, the American College of Radiology and our collaborating medical specialty societies caution against the use of these documents 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 practitioner considering all the circumstances presented. Thus, an approach that differs from the guidance in this document, 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 this document when, in the reasonable judgment of the practitioner, such course of action is indicated by variables such as the condition of the patient, limitations of available resources, or advances in knowledge or technology after publication of this document. However, a practitioner who employs an approach substantially different from the guidance in this document may consider documenting in the patient record information sufficient to explain the approach taken.

The practice of medicine involves the science, and 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 the guidance in this document 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 purpose of this document is to assist practitioners in achieving this objective.

[1] Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing 831 N.W.2d 826 (Iowa 2013) Iowa Supreme Court refuses to find that the *ACR Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures* (Revised 2008) sets a national standard for who may perform fluoroscopic procedures in light of the standard's stated purpose that ACR standards are educational tools and not intended to establish a legal standard of care. See also, Stanley v. McCarver, 63 P.3d 1076 (Ariz. App. 2003) where in a concurring opinion the Court stated that "published standards or guidelines of specialty medical organizations are useful in determining the duty owed or the standard of care applicable in a given situation" even though ACR standards themselves do not establish the standard of care.

I. INTRODUCTION

This practice parameter was developed collaboratively by the American College of Radiology (ACR), Society of Pediatric Radiology (SPR), and the Society of Abdominal Radiology (SAR).

The role of plain radiography in the evaluation of intra-abdominal disease has been largely supplanted by other imaging modalities, such as computed tomography (CT), ultrasound, nuclear medicine, and magnetic resonance imaging (MRI) [1-5]. However, the abdominal radiograph is still a frequently obtained examination. It continues to play an important role in a number of clinical conditions, which are enumerated in the following section.

Abdominal radiography consists of views in supine and/or horizontal beam (upright, decubitus, or cross-table lateral) projections. Additional views in other projections or patient positions are occasionally necessary to supplement the basic views. In some clinical situations, a single image is appropriate. The examination may be performed with portable equipment when clinically appropriate. Abdominal radiography should be performed only for a valid medical reason and with the minimum radiation dose necessary to achieve a diagnostic study. Adherence to the following practice parameter will maximize the diagnostic yield of abdominal radiography.

(For pediatric considerations, see Sections II and IV.B.)

II. INDICATIONS/CONTRAINDICATIONS

Indications for abdominal radiography include, but are not limited to:

1. Evaluation and follow-up of abdominal distension, bowel obstruction, nonobstructive ileus**,** or possible toxic megacolon [1,5-13]
2. Evaluation for pneumatosis and pneumoperitoneum [6,7,9,14]
3. Evaluation of ingested or other introduced foreign bodies**,** including ingested magnets, retained surgical foreign bodies, suspected retained video endoscopy capsule, or localization of a patency capsule [15-21]
4. Evaluation and follow-up of intra-abdominal calculi **(**urinary tract or pancreatic duct calculi**)**, including assessment of lithotripsy and postendoscopy patients [9,22-24]
5. Evaluation of the placement of medical devices, such as gastrointestinal tubes or stents (drainage tubes, feeding tubes, and pancreaticobiliary stents), nephroureteral stents and catheters, vascular stents and catheters [25,26]
6. Evaluation of unstable patients after blunt trauma to the abdomen [27]
7. Evaluation of a palpable mass in an infant or child[2] [28-33]
8. A scout radiograph prior to a planned fluoroscopic examination [40-42] or to evaluate for retained high-density contrast material from an earlier examination
9. Constipation, especially assessment of fecal load in children[3] [34-36]
10. Evaluation for necrotizing enterocolitis, particularly in the premature newborn[4] [37]
11. Evaluation of congenital gastrointestinal abnormalities [38,39]
12. Evaluation of colon transit time using the simplified radiodense marker colon transit test

There are no absolute contraindications to abdominal radiography. Pregnancy is a relative contraindication to abdominal radiography because the uterus is within the primary beam for almost all examinations. If diagnostically appropriate, ultrasound or MRI should be considered as an alternative imaging modality. For the pregnant or potentially pregnant patient, see the ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Patients with Ionizing Radiation [40].

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the ACR–AAPM–SIIM–SPR Practice Parameter for Digital Radiography [41].

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[2] Ultrasound may be helpful in evaluation, to be followed by MRI if ultrasound is inconclusive

[3] However, recent studies suggest abdominal radiographs are of limited value in the child with constipation and potentially the adult

[4] Ultrasound may be helpful in evaluation.

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for abdominal radiography 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 – revised in 2016, Resolution 12-b)

Appropriate clinical history and the reason for the examination should be provided by the requesting provider or their authorized agent.

A. Patient Selection and Preparation

No prior preparation of the patient is usually required for abdominal radiography. External and artifactual densities outside the patient should be removed whenever possible. Immobilization of the patient may occasionally be required.

B. Examination Technique

1. Technical factors

   In adults, abdominal radiography is usually performed on a 35 × 43 cm (14 × 17 in) image receptor. For children, the image size should be adjusted to the size of the patient. When the patient can cooperate, the radiograph is exposed at end expiration. Low kVp technique (60-75 kVp) is preferable [9,42], although kVp should be appropriate to patient size and clinical indication. In patients with obesity, increasing beam energy may be necessary to obtain acceptable image quality and also to decrease patient dose, which can be substantially higher than in patients who are lean [43]. The exposure time should be kept as short as practical to minimize motion artifact. This may be difficult to achieve when using portable radiography in larger adult patients. A grid (moving or stationary) is desirable for adults and larger pediatric patients. Proper collimation is required for all patients. Current scientific evidence indicates that routine use of gonadal shielding for diagnostic x-ray imaging should be discontinued [44].

2. Examination components

   The abdominal radiography examination typically consists of views in supine anteroposterior (AP) and/or horizontal beam (upright, decubitus, or cross-table lateral) projections. Some institutions also use an upright posteroanterior (PA) or AP chest radiograph as part of an abdominal series to evaluate for pneumoperitoneum or causes of referred abdominal pain. In some instances, a combination of a supine abdominal radiograph and an upright chest radiograph with elimination of a horizontal beam view of the abdomen may be performed without loss of significant diagnostic information [45-47]. A single supine view of the abdomen may be diagnostic in many cases, particularly in follow-up, while minimizing radiation exposure to both the chest and abdomen [48]. A prone cross-table lateral view of the rectum can be helpful in the evaluation when there is concern for distal colonic obstruction in a neonate.

   a. The supine radiograph is obtained in the AP projection and should include the area from just above the hemidiaphragms superiorly to the ischial tuberosities inferiorly. Both flanks should be included. The image receptor is centered at the level of the iliac crest with the central ray perpendicular to it.

Every attempt should be made to perform the examination on one image, particularly in children, with the inferior collimation ending at the symphysis, excluding the upper femurs and the male gonads. In large patients, more than one radiograph may be needed to encompass the entire abdomen.

b. The upright, decubitus, or cross-table lateral projection is obtained with the x-ray beam parallel to the floor and perpendicular to the image receptor to optimize the visualization of small amounts of pneumoperitoneum and to assess the distribution and configuration of air-fluid levels. Most institutions prefer the upright projection for adults and older children when the patient's condition permits. The lateral decubitus position is also used when the patient cannot be placed upright; this position is especially useful for neonates, infants, and young children who are unable to stand or cooperate. This position is also most useful to evaluate the right lower quadrant, and it has been found to be particularly helpful in pediatric patients suspected of having intussusception [49]. The left lateral decubitus position is preferred to the right lateral decubitus position, as pneumoperitoneum is more readily detected adjacent to the liver. When possible, the patient should be placed in the upright or decubitus position for at least 5 minutes before exposing the radiograph to allow free air to accumulate in the elevated part of the peritoneal cavity. Obtaining an upright chest radiograph after the patient has been placed in the left lateral decubitus position for several minutes may enhance detection of a small pneumoperitoneum [50].

    i. The upright radiograph may be obtained in the AP or PA projection. The image receptor is centered 5 cm (2 in) above the iliac crest in the adult patient. The AP projection will provide better visualization of the kidneys, but the PA projection will reduce gonadal dose. The most superior part of the diaphragm must be included on the upright view, and in larger patients a second image, centered lower, may be needed to encompass the entire abdomen.

    ii. For the left lateral decubitus view, the most superior part of the right side of the abdomen must be included on the radiograph, and it should include the area from the right hemidiaphragm to the pelvis, with the center of the film or receptor at or above the iliac crest. If the patient cannot be placed on the left side, the right lateral decubitus position may be used as an alternative; in such cases, the most superior part of the left side of the abdomen must be demonstrated, including the hemidiaphragm.

    iii. The cross-table lateral projection is seldom used for adults and older children, except for critically ill patients when an upright or decubitus view cannot be obtained. However, for neonates, many institutions use this projection rather than a decubitus view because it does not require repositioning the patient. This projection is also used to exclude malpositioning of vascular catheters, such as femoral central venous catheters and lower-extremity peripherally inserted central catheters **(**PICCs) into the spinal vessels.

c. When abdominal radiography is performed for urinary tract calculi, an upright projection is typically not obtained. Occasionally, oblique or other views may be appropriate [51]. However, CT or ultrasound may be considered in these cases. When performed for localization of pancreatic duct stone burden prelithotripsy, oblique views are added to the supine view.

d. Additional projections of the entire abdomen or coned views of a selected portion of the abdomen to provide improved detail in an area of concern may be used occasionally to supplement the standard examination. Oblique and lateral views may be helpful to localize foreign bodies or calcifications and to assess for calcification and aneurysms of the abdominal aorta. In infants and children, cross-table lateral prone views may be used to demonstrate the distribution of bowel gas and evaluate conditions such as anorectal malformation to determine the distance from the gas-filled rectal pouch to a radiopaque marker placed in the expected location of the anus**.**

e. In selected patients, a limited examination not including the entire abdomen or consisting of an upright radiograph only may be acceptable. Examples include checking the position of medical devices,

following up known localized abnormalities, and evaluating for pneumoperitoneum following a medical or surgical procedure.

C. Radiographic Quality Control

1. A qualified physician or technologist should review all radiographs for positioning and diagnostic quality before the patient is released. Repeat radiographs should be performed when necessary for diagnostic quality.

2. All radiographic studies should be permanently labeled with patient identification and the date of the examination. The time of the examination should be included if relevant, especially when more than one examination is performed on the same date. The right or left side of the patient should be indicated on the radiograph.

V. DOCUMENTATION

Reporting should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings [52].

An official interpretation (final report) of the examination should be included in the patient's medical record. Whenever possible, new studies should be compared with prior abdominal examinations and/or other pertinent studies that may be available.

VI. EQUIPMENT SPECIFICATIONS

Equipment monitoring should be in accordance with the ACR-AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Radiographic Equipment [53] and the ACR–AAPM–SIIM–SPR Practice Parameter for Digital Radiography [41].

VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, non-physician radiology providers**,** radiologic technologists, and all supervising physicians have a responsibility for safety in the workplace by keeping radiation exposure to staff, and to society as a whole, "as low as reasonably achievable" (ALARA) and to assure that radiation doses to individual patients are appropriate, taking into account the possible risk from radiation exposure and the diagnostic image quality necessary to achieve the clinical objective. All personnel who work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection, application of dose constraints and limits) and the principles of proper management of radiation dose to patients (justification, optimization including the use of dose reference levels). https://www-pub.iaea.org/MTCD/Publications/PDF/PUB1775_web.pdf

Nationally developed guidelines, such as the ACR's Appropriateness Criteria®, should be used to help choose the most appropriate imaging procedures to prevent unnecessary radiation exposure.

Facilities should have and adhere to policies and procedures that require ionizing radiation examination protocols (radiography, fluoroscopy, interventional radiology, CT) to vary according to diagnostic requirements and patient body habitus to optimize the relationship between appropriate radiation dose and adequate image quality. Automated dose reduction technologies available on imaging equipment should be used, except when inappropriate for a specific exam. If such technology is not available, appropriate manual techniques should be used.

Additional information regarding patient radiation safety in imaging is available from the following websites – Image Gently® for children (www.imagegently.org) and Image Wisely® for adults (www.imagewisely.org). These advocacy and awareness campaigns provide free educational materials for all stakeholders involved in imaging (patients, technologists, referring providers, medical physicists, and radiologists).

Radiation exposures or other dose indices should be periodically measured by a Qualified Medical Physicist in accordance with the applicable ACR Technical Standards. Monitoring or regular review of dose indices from patient imaging should be performed by comparing the facility's dose information with national benchmarks, such as the ACR Dose Index Registry and relevant publications relying on its data, applicable ACR Practice Parameters, NCRP Report No. 172, Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States or the Conference of Radiation Control Program Director's National Evaluation of X-ray Trends; 2006, 2009, amended 2013, revised 2023 (Res. 2d).

VIII. 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 under the heading *ACR Position Statement on Quality Control & Improvement, Safety, Infection Control, and Patient Education* on the ACR website (https://www.acr.org/Advocacy-and-Economics/ACR-Position-Statements/Quality-Control-and-Improvement).

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