Revised 2017 (Resolution 3)*

ACR–SPR–STR PRACTICE PARAMETER FOR THE PERFORMANCE OF PORTABLE (MOBILE UNIT) CHEST 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 in light of 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 the condition of the patient, limitations of available resources, or advances in knowledge or technology subsequent to publication of this document. However, a practitioner who employs an approach substantially different from the guidance in this document 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 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 sole purpose of this document is to assist practitioners in achieving this objective.

I. INTRODUCTION

This practice parameter was revised collaboratively by the American College of Radiology (ACR), the Society for Pediatric Radiology (SPR), and the Society of Thoracic Radiology (STR).

[1] Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing, ___ N.W.2d ___ (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.

Portable chest radiography is the examination of choice for the imaging evaluation of cardiopulmonary diseases in patients under certain circumstances and is appropriate based on medical necessity (eg, critically ill patients), patients with travel risk, acuity of question being asked (eg, support device placement), the assessment for pneumothorax following a chest interventional procedure, patients on ECLS/ECMO or VADS, etc., and in newborns.

(For pediatric considerations, see sections III, IV, V.C, V.E.1, V.E.5, VII.A., and IX.)

II. GOAL

The goal of portable chest radiography is to help determine absence of disease or presence and etiology of disorders that involve the thorax. The portable radiograph may be used to follow abnormalities and to evaluate clinical support devices such as endotracheal tubes, chest tubes, vascular catheters, and CIEDS (cardiac implanted electronic devices). The addition of postprocessing tools that enhance visualization of these devices and foreign objects can be helpful. These are generally vendor specific. Upright portable radiographs can also be performed for free air in the abdomen.

III. INDICATIONS AND CONTRAINDICATIONS [1]

Portable chest radiography should be performed for diagnostic indications or to answer a clinical question [2]. Indications include, but are not limited to:

1. Evaluation of patients with cardiopulmonary signs and/or symptoms following cardiac or thoracic surgery or major trauma, when PA and lateral examinations cannot be performed, and to better evaluate the lung bases when clinically or radiologically indicated
2. Patients with life-support devices
3. Patients who are critically ill or medically unstable
4. Patients who, because of their clinical condition, cannot be transported for standard chest radiography [3-11]
5. Immediate assessment for pneumothorax following an interventional procedure in the chest or abdomen

For the pregnant or potentially pregnant patient, see the ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation [12].

IV. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

A. Physician

See the ACR–SPR Practice Parameter for General Radiography [13].

Additionally, physicians interpreting pediatric portable chest radiographs should also have had documented formal training in pediatric radiology, including interpretation and formal reporting of pediatric chest radiographs.

Physicians whose residency or fellowship training did not include the above may still be considered qualified to interpret pediatric chest radiographs when the following are documented:

1. The physician has supervised and interpreted chest radiographs for at least 2 years.
2. An official interpretation (final report) was generated for each examination.

B. Radiologic Technologist

See the ACR–SPR Practice Parameter for General Radiography [13].

C. Qualified Medical Physicist

See the ACR–SPR Practice Parameter for General Radiography [13].

V. SPECIFICATIONS OF THE EXAMINATION

A. Written request for the examination

The written or electronic request for portable chest 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)

B. The technologist should seek permission of and expect assistance from nursing or other personnel to position unstable patients and adjust or remove support apparatus in the radiographic field.

C. In cooperative adults and older pediatric patients, fully upright portable chest radiographs should be performed at a source-image distance (SID) of 40 to 72 inches, with the optimal distance as close as possible to 72 inches. Infants and young children and comatose or uncooperative patients may be imaged supine or semi-erect with a 40-inch or greater SID. The patient-to-image receptor distance should be minimized. Young or uncooperative children should be immobilized when necessary to assure adequate patient positioning and prevent motion artifact. The examination may be modified by the physician or by a qualified technologist under the direction of a physician, as dictated by the clinical circumstances or the condition of the patient.

D. Radiographic exposure should optimally be performed at peak inspiration for most indications. The radiograph should include the lung apices, the costophrenic sulci, the upper airway, and the upper abdomen. On an optimally penetrated chest radiograph, the retrocardiac vasculature and lower thoracic spine should be visible [14].

E. Technical Factors

1. In adults, without a grid, the kilovoltage should be between 70 and 100 kVp to optimize penetration and limit the effects of scattered radiation. When a grid is used, kilovoltage greater than 100 kVp may be employed [1,15-17]. In newborns, infants, or small children, lower kVp may be used to optimize contrast and decrease the radiation dose. The use of grids should be minimized in children with less than 12- or 14-cm thickness [18].

2. On an optimally exposed chest radiograph, the lung parenchyma is displayed at a mid-gray level.

3. Exposure times should be as short as feasible to reduce motion artifacts.

4. Exposure parameters (including mAs, kVp, distance, and patient position) should be recorded for each image and may be used to optimize subsequent portable radiographs. Digital radiographs should be in accordance with the ACR–AAPM–SIIM Practice Parameter for Digital Radiography [19].

5. For all patients, the radiographic beam should be appropriately collimated to limit radiation exposure outside the area of clinical interest. Inadequate collimation in neonatal intensive care units may increase exposure by a factor of 2 [20]. Therefore, inclusion of the abdomen below the costophrenic sulcus level on neonatal chest radiographs is discouraged. If abdomen radiography is clinically warranted, a separate request including the medical necessity of the examination is required. In that circumstance, the abdomen may be included in a single exposure along with the chest using appropriate collimation and exposure parameters.

6. Shielding during radiography may reduce the minimal amount of external radiation but does not affect internal scatter. However, the use of shielding should not be discouraged because it is an overt acknowledgement to the patient, child, parents, or other caregivers that every attention to minimizing exposure has been addressed [18].

F. The following quality control (QC) procedures should be applied to chest radiography. For more information, please refer to the ACR–SPR Practice Parameter for General Radiography [13]:

1. When the examination is completed, the radiographs should be reviewed by qualified personnel, either a physician or a radiologic technologist [14].

2. Images that are not of diagnostic quality should be repeated as necessary. A repeat-rate program should be part of the QC process [21,22].

VI. DOCUMENTATION AND REPORTING

Images should be compared with prior chest examinations and/or other pertinent examinations that may be available. The date and time of the examination should be included in the official interpretation.

An official interpretation (final report) of the examination should be included in the patient's medical record. Reporting should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings [17,23].

VII. EQUIPMENT SPECIFICATIONS

A. Portable radiographic equipment should have adequate kVp and mA capabilities to produce diagnostic-quality radiographs of most patients (newborn infants to full-size adults) at acceptable exposure times (100 msec for adults and 30 msec for newborns and infants). In some instances, diagnostically adequate radiographic images of morbidly obese patients may not be possible. A battery maintenance procedure, if appropriate, should be part of routine maintenance.

B. An inherent problem in portable chest radiography is correctly identifying support lines and devices, as well as foreign objects. The addition of postprocessing tools that enhance visualization of these structures can be helpful. These are generally vendor specific.

XIII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, registered radiologist assistants, 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 that work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection and application of dose limits) and the principles of proper management of radiation dose to patients (justification, optimization and the use of dose reference levels)

http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1578_web-57265295.pdf

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

Facilities should have and adhere to policies and procedures that require varying ionizing radiation examination protocols (plain radiography, fluoroscopy, interventional radiology, CT) to take into account patient body habitus (such as patient dimensions, weight, or body mass index) to optimize the relationship between minimal radiation dose and adequate image quality. Automated dose reduction technologies available on imaging equipment should be used whenever appropriate. If such technology is not available, appropriate manual techniques should be used.

Additional information regarding patient radiation safety in imaging is available at the Image Gently® for children (www.imagegently.org) and Image Wisely® for adults (www.imagewisely.org) websites. 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 measured and patient radiation dose estimated for representative examinations and types of patients by a Qualified Medical Physicist in accordance with the applicable ACR technical standards. Regular auditing of patient dose indices should be performed by comparing the facility's dose information with national benchmarks, such as the ACR Dose Index Registry, the 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. (ACR Resolution 17 adopted in 2006 – revised in 2009, 2013, Resolution 52).

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 under the heading *Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education* on the ACR website (http://www.acr.org/guidelines).

The lowest possible radiation dose consistent with acceptable diagnostic image quality should be used, particularly in pediatric examinations. Pediatric radiation doses should be determined periodically based on a reasonable sample of examinations. Technical factors should be appropriate for the size of the child and should be determined with consideration of such parameters 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.

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