Revised 2018 (Resolution 4)*

ACR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF A CONTRAST SMALL BOWEL EXAMINATION

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.

[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.

I. INTRODUCTION

This practice parameter was revised by the American College of Radiology (ACR) in collaboration with the Society for Pediatric Radiology (SPR).

Radiographic examination of the small bowel after oral ingestion of contrast is a proven and useful procedure. The purpose is to establish the presence or absence of a disease and its nature by opacifying the small bowel with contrast and taking sequential images. The goal is to obtain a diagnostic-quality study visualizing the small bowel with the minimum radiation dose necessary. Peroral pneumocolon is an adjunct technique that involves retrograde insufflation of air into the terminal ileum via a rectal tube.

Computed Tomography (CT) is often selected as the imaging examination of choice for patients with suspected small bowel obstruction since it does not rely on contrast reaching the site of obstruction to allow identification of its location and is considerably quicker than contrast small bowel series [1]. A small bowel examination with water-soluble contrast has been suggested as a predictor of nonoperative resolution of small bowel obstruction [2] and as a therapeutic agent in these patients [3]. While advocated by many surgeons, water-soluble contrast small bowel "examinations" are not effective in treating prolonged postoperative ileus [4]. For some indications, such as inflammatory bowel disease and suspected (formerly known as obscure) bleeding [5], the contrast small bowel examination has been largely supplanted by CT enterography (CTE) or MR enterography (MRE) [6-10] and is no longer the examination of choice.

In some situations, enteroclysis may also be chosen over the contrast small bowel examination to provide better bowel distention and mucosal detail. Enteroclysis is indicated less frequently in children than in adults. In older children or adolescents, enteroclysis should be performed in accordance with the ACR–SAR Practice Parameter for the Performance of an Enteroclysis Examination in Adults [11], with appropriate adjustment for injected volumes.

II. INDICATIONS

A. Indications for contrast small bowel examinations include, but are not limited to:

1. Diverticula
2. Evaluation for an asymptomatic stricture prior to capsule enteroscopy
3. Evaluation for presence of primary or secondary neoplasm(s)
4. Evaluation of congenital bowel anomaly
5. Evaluation of postsurgical anatomy
6. Evaluation of suspected enteric fistula
7. Extraluminal tethering
8. History of small bowel disease
9. Inflammatory bowel disease (see above, re: CTE/MRE)
10. Known or suspected small bowel stricture or obstruction (see above, re: CT)
11. Malabsorption
12. Polyposis syndrome such as Cowden or Peutz-Jeghers
13. Protein-losing enteropathy
14. Suspected small bowel bleeding or iron deficiency anemia
15. Possible small bowel stricture or obstruction (see above, re: CT)
16. Enteric fistula
17. Possible postoperative leak

B. Pertinent symptoms serving as indications for a contrast small bowel examination include, but are not limited to:

1. Abdominal pain
2. Diarrhea
3. Abdominal masses
4. Unexplained fever

5. Vomiting
6. Failure to thrive or weight loss

Pediatric Patients Special Considerations:
Some indications for contrast small bowel examinations, such as failure to thrive, are unique to the pediatric population. In patients with suspected malrotation and an unclear duodenal-jejunal junction (ligament of Treitz) on the upper gastrointestinal (GI), documentation of the position of the small bowel may help to clarify a potential diagnosis of malrotation.

In determining the appropriateness of a contrast small bowel examination for a specific pediatric patient, alternate methods might be considered that may not require ionizing radiation, such as ultrasound and MRI.

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].

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

For physician, Qualified Medical Physicist, registered radiologist assistant, and radiologic technologist qualifications, see the ACR–SPR Practice Parameter for General Radiography [13].

In addition, personnel participating in the care of pediatric patients should have knowledge and experience in dealing with the pediatric patient population, including methods of safe effective physical immobilization when needed, and in the use of enteric catheters in performing contrast small bowel examinations. Physicians, registered radiologist assistants, and technologists should also be cognizant of the specific methods of radiation reduction appropriate to pediatric patients of various ages and sizes.

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for a contrast small bowel 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 is 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. (ACR Resolution 35, adopted in 2006 – revised in 2016, Resolution 12-b)

A. Patient Selection

A qualified radiologist should be available to help the clinician decide which test is best to evaluate the clinical problem(s). The radiologist and the patient's health care provider should consult when necessary to determine the examination and examination technique appropriate for the individual patient.

B. Patient Preparation

The adult patient should be instructed to refrain from taking anything by mouth after midnight the night before the procedure. Some institutions require a bowel preparation in order to reduce excessive right-sided colonic feces that can impair normal small bowel motility. Patients may generally take scheduled medications on the morning of the examination. Examinations may be performed with shorter fasting times as clinically indicated. If a peroral pneumocolon is planned, a bowel preparation to remove any intraluminal particulate material should be performed [14].

The pediatric patient should have nothing by mouth or via nasogastric, gastrostomy, or other enterostomy tube prior to the examination. The length of the fast depends on the patient's age, the examination, and the clinical circumstances. Suggested regimens are as follows:

1. Two hours for neonates and infants under 3 months of age
2. Three hours for infants 3 to 12 months of age
3. Four hours or more for all other children

These regimens may be modified depending on the needs of the patient as assessed by the performing radiologist. For emergent indications, fasting may not be required.

C. Examination Preliminaries

Horizontal beam imaging should be performed if there is any suspicion of pneumoperitoneum or if the patient has an underlying condition that might predispose to bowel perforation.

Pertinent prior studies and/or reports, if available, should be reviewed when appropriate.

Medical history should be reviewed to determine whether the protocol should be modified to meet specific needs, such as dosing of medication or clinical monitoring. Concurrent medical conditions as well as allergies should be considered in patient scheduling and study design.

D. Examination Technique

To produce a diagnostic-quality examination, the physician should tailor the contrast small bowel examination procedure to the individual patient, as warranted by clinical circumstances and the condition of the patient.

1. Contrast selection and administration

    a. For adult patients, oral ingestion of a minimum of 16 ounces of a well-suspended barium preparation, with additional barium ingestion as needed to maintain uniform distension of all barium-opacified small bowel loops. This is best accomplished by maintaining a barium-filled stomach for the duration of the procedure. Because of dilution and absorption, the use of water-soluble contrast media is not the preferred method for small bowel contrast examination and imaging. However, water-soluble contrast is sometimes preferred by referring physicians if there is suspicion of bowel leak or obstruction; if used, an isosmotic water-soluble contrast will minimize the dilution effect caused by hyperosmotic contrast agents.

    b. For children:
        i. Type of contrast: The type of contrast given is determined by the child's age and the indications for the study. Barium is the preferred contrast medium for most studies. A barium sulfate suspension of 45% weight/weight (70% weight/volume) is commonly used. Barium should be avoided when there is a possible perforation of the GI tract. When a small bowel study is performed with iodine-containing contrast media, low or iso-osmolar contrast is preferred. Use of iso-osmolar contrast media is particularly important in critically ill premature neonates and infants to avoid serum electrolyte shifts [15]. Hyperosmolar iodinated contrast media should not be given by mouth in patients who are at risk for aspiration.
        ii. Volume of contrast: The volume of contrast administered will vary based on patient age, size, anatomy, and pathology. Typical volumes range from 30 to 75 ml in infants and to 480 ml in older teens and can be adjusted based on individual needs of the patient and the discretion of the performing radiologist. The radiologist may choose to administer additional contrast at any time during the study if images or fluoroscopy suggest that the quantity of contrast present in the GI tract is insufficient for diagnosis.

        iii. Delivery of contrast: Contrast medium should be delivered in a manner that is appropriate for the patient's age [15]. Flavoring agents may be added. For neonates and infants, a device consisting

of a feeding tube or orogastric tube passed through a nipple may be used to deliver the contrast into the mouth [16]. Alternatively, the neonate or infant may be fed contrast from a baby bottle with a nipple. Older infants able to bottle feed themselves may be allowed to do so. The barium suspension may be given by straw or taken directly from a cup by an older child. A nasogastric tube, gastrostomy, or jejunostomy, if present, may be used as appropriate. If the infant or child does not voluntarily take contrast, administration of contrast into the mouth with a small syringe may be successful. The syringe should have a Luer lock-type or catheter-type tip to prevent accidental injury to the mouth. However, if the child of any age is unable to take sufficient contrast by mouth, an appropriately sized enteric tube may need to be placed for contrast administration.

2. The procedure in adult and pediatric patients should include:

   a. Preliminary (scout) supine radiograph of abdomen as indicated.

   b. Intermittent fluoroscopy with patient rotation with palpation or compression (known as rotation and palpation) of all accessible small bowel loops, including the terminal ileum, with appropriate images to demonstrate any abnormality. The timing of fluoroscopy depends upon the examination indication, patient condition, and transit time. Palpation is performed with a lead-gloved hand, compression paddle, or spoon. Even with rotation and palpation, separation of small bowel loops in the pelvis may not be possible. Sometimes these loops can be separated when the patient is placed in the prone position and a paddle with an inflatable balloon is placed under the patient's pelvis. When the balloon is inflated, the loops are displaced superiorly out of the pelvis. (In addition to obtaining compression images after the small bowel is opacified, in certain cases, if needed, images utilizing compression may be obtained before the contrast reaches the colon in order to better assess early detectable small bowel abnormalities.)

   c. After obtaining preliminary images of the abdomen, intermittent, serial large-format overhead images of the abdomen are obtained in the supine or prone position when possible, each labeled with its individual time of acquisition. These overhead images are obtained as the contrast progresses through the small bowel to the colon and allow documentation of transit time. Subsequent timing of the overhead images should be dependent upon the examination indication, patient condition, and transit time.

   d. Alternatively, the study may be terminated when contrast reaches an ostomy or a point of complete obstruction, demonstrates a perforation, or other finding requiring surgical intervention [17,18]. In cases of presumed partial obstruction, especially in small children with very little intra-abdominal fat in which the bowel loops significantly overlap and are asymmetrically dilated, it is important to follow the proximal end of the contrast bolus until it has cleared from the small bowel and into the colon. If there is a partial obstruction of the small bowel, it is on these images that one might see residual contrast at a transition point from dilated bowel above a partial obstruction to decompressed bowel just distal to it.

   e. If peroral pneumocolon is needed to better visualize the terminal ileum, the patient is then placed in the lateral decubitus position on the fluoroscopy table. Pneumocolon is achieved by introducing a flexible enema catheter tip connected to a hand-held bulb insufflator into the rectum and insufflating room air. Room air is introduced in a retrograde manner under intermittent fluoroscopic guidance until the right colon is filled with air. Air should be insufflated until it fills the terminal ileum or to patient tolerance. The patient can be placed in the prone position to encourage reflux of gas into the terminal ileum [19]. If air does not enter the terminal ileum despite right colonic distension, postevacuation examinations may show that it has entered the ileum. This technique is usually not performed on children.

3. The following quality control indicators should be applied to all contrast small bowel examinations:

    a. When examinations are completed, patients should be held in the fluoroscopic area until the physician has reviewed all images.

    b. An attempt should be made to resolve questionable radiographic findings before the patient leaves. Repeat fluoroscopy of segments in question or special maneuvers, such as per oral pneumocolon, should be performed as necessary, but again, should not be performed in children.

V. DOCUMENTATION

Reporting should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings [20].

VI. EQUIPMENT SPECIFICATIONS

Examinations should be performed with fluoroscopic image intensification and radiographic equipment that meets all applicable federal and state radiation standards.

The equipment should be appropriately calibrated for low dose/adequate image quality and maintained by qualified staff, such as a medical physicist, and able to optimally image a full range of patients, extending from a preterm infant to a very large adult. The equipment should provide diagnostic fluoroscopic image quality and recording capability (images, video, or digital). It should be capable of producing kilovoltages greater than 100 kVp. The equipment ideally should be capable of pulsed fluoroscopy, and this should be used throughout the examination, with adjustment of frame rate as required during the procedure. Other dose-reduction techniques, such as last image hold/capture, saving of fluoroscopy clips, and video recording, are also recommended. Imaging practice parameters such as air KERMA (mGy) or dose-area product (mGy-cm2) and fluoroscopic time should be recorded so as to allow monitoring and review of radiation dose for the procedure [21,22]. One should utilize these dose-saving techniques as appropriate, remembering that low dose comes at the cost of reduced image quality; last image hold/capture images and fluoroscopy clips are of lower resolution, with higher quantum mottle; if one requires higher resolution, such as to exclude subtle leak or other more subtle abnormalities, digital spot images or an overhead radiograph should be used as needed.

Equipment necessary to compress and isolate accessible regions of the small bowel should be readily available.

Facilities should have the ability to deliver supplemental oxygen, to suction the oral cavity and the upper respiratory tract, and to respond to life-threatening emergencies that may accompany aspiration, allergic reaction to contrast agents, or reflux. If examinations of children are performed, available resuscitation equipment should be adequate to meet the needs of the full range of patients, extending from a preterm infant to a very large adult.

VII. 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).

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 *Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education* on the ACR website (https://www.acr.org/Clinical-Resources/Practice-Parameters-and-Technical-Standards).

Equipment performance monitoring should be in accordance with the ACR–AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Fluoroscopic Equipment and the ACR–AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Radiographic Equipment .

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