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Each practice parameter 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 and approval. The practice parameters 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 parameter and technical standard by those entities not providing these services is not authorized.

Revised 2013 (Resolution 27)*

ACR–SPR PRACTICE PARAMETER FOR THE PERFORMANCE OF PEDIATRIC CONTRAST EXAMINATIONS OF THE SMALL BOWEL

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 care¹. 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).

Imaging of the small bowel with the use of contrast media administered orally, or through a nasogastric, gastrostomy, or jejunostomy tube, or by enteroclysis, is a proven and useful procedure. Examinations are typically performed when specific signs and/or symptoms of an anatomic or functional abnormality of the small bowel are present. The goal of this procedure is to establish the presence or absence and the nature of disease by a diagnostic quality study with the minimum radiation dose necessary.

II. INDICATIONS

Many of the indications for a small bowel examination are the same for both pediatric and adult patients.

A. Signs and symptoms for which a small bowel examination may be indicated in children include, but are not limited to:

1. Abdominal pain
2. Vomiting
3. Diarrhea
4. Unexplained fever
5. Weight loss
6. Failure to thrive

B. Medical conditions for which a small bowel examination is useful in diagnosis and evaluation include, but are not limited to:

1. Inflammatory bowel disease
2. Unexplained gastrointestinal bleeding or anemia
3. Malabsorption
4. Suspected enteric fistulae
5. Suspected small bowel obstruction
6. Small bowel trauma
7. Congenital anomaly such as an omphalomesenteric duct remnant
8. Polyposis syndromes such as Cowden or Peutz-Jeghers
9. Follow-up of known small bowel disease
10. Evaluation of postoperative anatomy

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 upper gastrointestinal (GI), documentation of the position of the small bowel and fluoroscopic assessment of cecal position/mobility may help to clarify a potential diagnosis of malrotation.

In patients who have undergone abdominal surgery for congenital or acquired abnormalities, contrast small bowel examination is useful in documenting postoperative small bowel anatomy, including assessment of anastomoses; detection of leak, strictures, and adhesions; and determination of the length and caliber of residual small bowel.

In determining the appropriateness of contrast small bowel examination for a specific patient, alternate methods might be considered, such as endoscopy [1], capsule endoscopy, ultrasound [2], computerized tomography (CT) [3], CT enterography [4], CT enteroclysis [4,5], magnetic resonance (MR) with or without enterography [6,7], and/or MR enteroclysis [8]. A small bowel examination with intraluminal contrast can be performed as a unique study or in conjunction with an upper GI series.

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](#).

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

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

In addition, personnel 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 pediatric 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 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. (ACR Resolution 35, adopted in 2006)

A. Patient Selection

A qualified radiologist who is familiar with the normal anatomy, anatomic variations, anomalies, and diseases of the pediatric gastrointestinal tract should be available to help the clinician decide which test is best to evaluate the child’s 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.

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 should be considered in patient scheduling and study design.

B. Patient Preparation

The patient should have nothing by mouth or via nasogastric, gastrostomy, or 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: 2 hours for neonates and infants under 3 months of age, 3 hours for infants 3 to 12 months of age, and 4 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

Preliminary abdominal images may be helpful, particularly in the presence of acute abdominal symptoms. Preliminary images should be assessed for calcifications; skeletal abnormalities; anomalies of situs; bowel gas pattern, including assessment for bowel wall thickening; extraluminal gas, including pneumoperitoneum; evidence of prior surgery; organomegaly; mass or mass effect; catheters; and monitoring electrodes. 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.

D. Examination Technique

The following examination technique may be modified by the radiologist as warranted by clinical circumstances and the condition of the patient.

A barium preparation or other contrast media should be delivered in a manner that is appropriate for the patient's age [9]. 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 [10]. Alternatively, the neonate or infant may be fed contrast from a baby bottle with 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 tube, feeding tube, or jejunostomy tube, 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 tip to prevent accidental injury to the child. However, if the child of any age is unable to take sufficient contrast by mouth, an appropriate sized enteric tube may need to be placed for contrast administration.

The amount and type of contrast given are 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 gastrointestinal 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 [9]. Hyperosmolar iodinated contrast media should not be given by mouth in patients who are at risk for aspiration.

Hyperosmolar contrast is also discouraged for small bowel studies due to possible electrolyte shifts that may lead to loss of intravascular volume and dilution of the intraluminal contrast media, thus limiting the diagnostic capabilities of the examination.

The volume of contrast administered will vary based on patient size, anatomy and pathology. Typical volumes range from 30 to 75 ml in infants 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 gastrointestinal tract is insufficient for diagnosis.

Appropriate images of any abnormality, or representative images when no abnormality is found, should be obtained. When focal small bowel disease is suspected, intermittent fluoroscopy with compression is recommended to assess all accessible small bowel loops, including the terminal ileum. Fluoroscopy may also be useful in assessing diffuse small bowel disease (e.g., malabsorption).

The timing of images to assess the progress of the contrast through the small bowel to the colon should be individualized to the bowel transit time and the disease process suspected. The number of images obtained will vary depending on the small bowel transit time. Images may be obtained at 15 minutes, 30 minutes, and 1 hour after contrast administration. If contrast has not reached the colon by 1 hour, additional images may be obtained every 30 minutes until contrast reaches the colon. Alternatively, the study may be terminated when contrast

reaches an ostomy or a point of complete obstruction, or demonstrates a perforation or other finding requiring surgical intervention [11,12].

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](#), with appropriate adjustment for injected volumes.

Immobilization devices may be helpful in patient positioning. These devices may help limit repeat exposures and unnecessary radiation dose to patients, parents, technologists, and other personnel.

The following quality control measures should be applied to small bowel contrast examinations whenever possible.

1. When the examinations are completed, images should be checked by the radiologist before the patient is released.
2. An attempt should be made to resolve questionable radiologic findings before the patient leaves. If necessary, additional imaging should be performed.
3. Radiologic, endoscopic, and pathologic findings should be correlated when available.

V. DOCUMENTATION

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

VI. EQUIPMENT SPECIFICATIONS

Examinations must be performed with fluoroscopic and radiographic equipment meeting all applicable federal and state radiation standards. The equipment should be 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. Equipment necessary to compress and isolate accessible regions of the small bowel should be readily available. 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 procedures, such as last image-hold, image-capture, and video recording are also recommended. Imaging practice parameters and fluoroscopic time should be recorded so as to allow monitoring and review of radiation dose for the procedure [13,14].

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. 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 (<http://www.acr.org/guidelines>).

Equipment performance monitoring should be in accordance with the [ACR-AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Fluoroscopic Equipment](#).

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