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The American College of Radiology will periodically define new practice guidelines and technical standards for radiologic practice to help advance the science of radiology and to improve the quality of service to patients throughout the United States. Existing practice guidelines and technical standards will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

Each practice guideline 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, requiring the approval of the Commission on Quality and Safety as well as the ACR Board of Chancellors, the ACR Council Steering Committee, and the ACR Council. The practice guidelines 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 guideline and technical standard by those entities not providing these services is not authorized.

Revised 2008 (Res. 32)*

PRACTICE GUIDELINE FOR THE PERFORMANCE OF PEDIATRIC CONTRAST EXAMINATIONS OF THE SMALL BOWEL

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 on 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

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

The examination of the small bowel by 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
7. Sepsis

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. Intramural hemorrhage with possible intussusception
6. Ischemic bowel
7. Suspected small bowel obstruction
8. Small bowel trauma
9. Follow-up of known small bowel disease
10. Suspected recurrent diaphragmatic hernia

Some indications for 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), documentation of the position of the small bowel and fluoroscopic assessment of cecal mobility may confirm the diagnosis.

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 leakage or extravasations, 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, enteroclysis, capsule endoscopy, ultrasound, computerized tomography (CT), CT enterography, CT enteroclysis, magnetic resonance (MR) enterography, and/or MR enteroclysis.

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

For the physician, medical physicist, radiologist assistant, and radiologic technologist qualifications see the [Practice Guideline 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 as pertains to the performance of contrast small bowel examinations. Physicians 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 3-12 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 (e.g., suspected malrotation of volvulus) fasting may not be required.

C. Examination Preliminaries

Preliminary 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. 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. 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 cheek with a small syringe may be successful. The syringe should have a luer-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 enteric tube may need to be placed for contrast administration.

The amount and type of contrast media 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. An iodine-containing contrast medium may be given to assess the integrity of small bowel, to diagnose necrotizing enterocolitis, or malrotation, and in selected critically ill patients. When a small bowel study is performed with iodine-containing contrast media, low osmolality contrast is preferred. Iso-osmolar contrast media are desirable in critically ill premature neonates and infants to avoid serum electrolyte shifts. 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 media administered will vary based on patient size, anatomy and pathology. Typical volumes range from 30-75 ml in infants to 480 ml in older teens and can be adjusted based on individual needs of the patient and discretion of the performing radiologist. The radiologist may choose to administer additional contrast media at any time during the small bowel 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 patient's 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 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.

Enteroclysis is indicated less frequently in children than in adults. In older children or adolescents, enteroclysis should be performed in accordance with the [ACR Practice Guideline 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 Guideline for Communication of Diagnostic Imaging Findings](#).

VI. EQUIPMENT SPECIFICATIONS

Examinations shall 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 (radiographs, 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 parameters and fluoroscopic time should be recorded so as to allow monitoring and review of radiation dose for the procedure.

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, 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; if not, manual techniques should be used to moderate the exposure while maintaining the necessary diagnostic image quality. Patient radiation doses should be periodically measured by a medical physicist in accordance with the appropriate ACR Technical Standard. (ACR Resolution 17, adopted in 2006)

VIII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION CONCERNS

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

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

ACKNOWLEDGEMENTS

This guideline was revised according to the process described in the ACR Practice Guidelines and Technical Standards book by the Guidelines and Standards Committees of the Commissions on Pediatric Radiology and General, Small, and Rural Practice in collaboration with the Society for Pediatric Radiology (SPR).

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*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

1998 (Resolution 37)

Revised 2003 (Resolution 9)

Amended 2006 (Resolution 17, 35)

Amended 2007 (Resolution 12m)

Revised 2008 (Resolution 32)