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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 2006 (Resolution 44,17,35)\*

## **ACR PRACTICE GUIDELINE FOR THE PERFORMANCE OF PEDIATRIC FLUOROSCOPIC CONTRAST ENEMA EXAMINATIONS**

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### **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 of 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 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**

Examination of the pediatric colon by contrast fluoroscopically guided enema is a proven and useful technique. This guideline was developed to guide physicians in the performance of contrast enema examinations for evaluating the colon in pediatric patients.

### **II. INDICATIONS AND CONTRAINDICATIONS**

Specific pediatric indications for contrast enema include diagnosis and treatment of intussusception, meconium ileus, and diagnosis of Hirschsprung's disease. Indications include, but are not limited to, evaluation for signs and symptoms including abdominal pain, diarrhea, gastrointestinal bleeding, weight loss, inflammatory disease of the bowel, malrotation,<sup>1</sup> postoperative conditions of the colon, lower intestinal obstruction, familial diseases involving the colon, and in diagnosing disease states that intrinsically and extrinsically affect the colon.

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<sup>1</sup>The preferred technique for detection of malrotation is an upper GI series. If that is inconclusive, a contrast enema may be employed.

Contraindications for contrast enema evaluations include evidence of colonic perforation, ischemic colon, toxic megacolon, hypovolemic shock, peritonitis, or unstable clinical condition.

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 OF PERSONNEL

See the [Practice Guideline for General Radiography](#).

#### A. Physician

In addition to the qualifications listed under the general radiography guideline the physician should have training in performing fluoroscopic examinations on infants and children. The physician shall have documented training and understanding of the value of contrast enema examinations relative to other medical imaging procedures (general radiography, fluoroscopy, CT, ultrasound, MRI, and nuclear medicine) in order to choose the imaging procedure most appropriate to evaluate the patient's clinical signs and symptoms.

The physician shall also have documented training in the principles of radiation protection, the hazards of radiation exposure to both patient and radiologic personnel, radiation monitoring requirements, and keeping radiation exposure as low as reasonably achievable (ALARA).

#### B. Radiologic Technologist

In addition to the qualifications listed under the general radiography guideline the radiologic technologist should have training in performing fluoroscopic examinations<sup>2</sup>

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<sup>2</sup> The American College of Radiology approves of the practice of certified and/or licensed radiologic technologists performing fluoroscopy in a facility or department as a positioning or localizing procedure only, and then only if monitored by a supervising physician who is personally and immediately available\*. There must be a written policy or process for the positioning or localizing procedure that is approved by the medical director of the facility or department/service and that includes written authority or policies and processes for designating radiologic technologists who may perform such procedures. (ACR Resolution 26, 1987 – revised in 2007, Resolution 12-m)

\*For the purposes of this guideline, “personally and immediately available” is defined in manner of the “personal supervision” provision of CMS—a physician must be in attendance in the room during the performance of the procedure. Program Memorandum Carriers, DHHS, HCFA, Transmittal B-01-28, April 19, 2001.

on infants and children. The technologist should be skilled in the performance of contrast enema examinations, including patient positioning, contrast administration, use of gonadal shielding, and methods of applying safe effective physical restraint. Familiarity with the specific equipment is necessary to keep radiation exposure to patient and staff ALARA.

### IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for a pediatric contrast enema 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's scope of practice requirements. (ACR Resolution 35, adopted in 2006)

The contrast enema examination should be performed only for an appropriate clinical indication. A qualified imaging physician, as described in section III. A, who is familiar with the anomalies and diseases of the pediatric gastrointestinal tract should be available to help the clinician decide the most appropriate way to evaluate the child's problem(s).

Digital pulsed and last image features of fluoroscopy reduce radiation dose and should be used when available. Fluoroscopy times should be minimized and recorded.

#### A. Conventional Diagnostic Contrast Enema

The following examination protocols are general guidelines. The procedure should be tailored to the individual patient's needs, based on clinical circumstances and the age and condition of the patient. The imaging physician exercises professional judgment in the choice of contrast media, based on the clinical setting and his/her professional training and experience.

Single-contrast examination is performed unless there are specific indications for a double-contrast study.

The child should be prepared for either procedure with an explanation appropriate to the developmental stage. Immobilization of the infant or young child may be helpful to facilitate performance of the procedure, minimize radiation exposure to the child and the personnel and stabilize the child's position during the procedure. Appropriate gonadal shielding and beam filtration should be used when possible. A preliminary film may be obtained if indicated.

Rectal catheterization should be performed or monitored by those with experience in pediatric rectal catheterization.

1. Single-contrast examination
  - a. Examination preparation  
Preparation for a single-contrast study may involve restriction of oral intake prior to the study. Cleansing of the colon is appropriate in children when mucosal evaluation is necessary.
  - b. Examination technique
    - i. Unless required by the study, the smallest possible catheter permitting adequate contrast flow is used. The use of a balloon or cuff is at the discretion of the physician.
    - ii. Rectal administration of a sufficient volume of contrast agent (air, barium and/or water-soluble contrast) is used to provide colonic distension. The patient is then turned to visualize the flexures and entire colon. Filling of the entire colon is confirmed by reflux into small bowel, filling of the appendix or conclusive identification of the ileocecal valve. Filling of the entire colon may not be necessary or desirable, as in cases of marked colonic dilatation or Hirschsprung's disease (section IV.C).
    - iii. High kVp technique is preferred.
    - iv. Images should be obtained of the rectum in the lateral projection. Images of the cecum should be obtained to document its position.
    - v. Large format images should include a frontal view and (if indicated) lateral view, including the rectum.
    - vi. A postevacuation image may also be obtained and, if needed, delayed postevacuation images and/or lateral rectal views.
2. Double-contrast examination
  - a. Colon preparation

Colon preparation is important to obtain an adequate examination. However, it may be contraindicated in patients with suspected active colitis or active bleeding. The preparation should consist of any effective combination of dietary restriction, hydration, laxatives (in a dose appropriate for body weight), and cleansing enemas. If there is concern for water intoxication, saline enemas should be used.

- b. Examination technique
  - i. High-density (100% weight/volume) barium suspension should be used.
  - ii. High kVp technique is preferred.
  - iii. Barium is instilled per rectum to the splenic flexure under fluoroscopic guidance. The patient is turned on the right side to promote barium coating of the right colon. The patient is then elevated to empty the rectum and coat the cecum. Air is instilled slowly. If good coating is not initially achieved, the patient should be rotated as needed to coat the mucosa, including the cecum.
  - iv. Fluoroscopic images may be obtained immediately or after large format images, to evaluate and document the presence or absence of abnormalities.
  - v. Images may include a cross-table lateral rectum with the patient prone, frontal supine, frontal prone, and both decubitus views. Supplemental views such as upright and oblique views may be obtained.

## B. Intussusception

1. Examination preparation  
No bowel preparation is indicated. A physician member of the surgical department should be available in case of emergency. Contraindications for examination include free intraperitoneal air, peritonitis, and hypovolemic shock.
2. Examination preliminaries  
Sonography may be obtained to assist in the diagnosis of intussusception prior to the enema and aid in image-guided reduction. Preliminary supine and upright or cross-table lateral or left lateral decubitus images of the abdomen should be obtained to identify free peritoneal air, which would be a contraindication to the examination. The patient should receive intravenous fluids prior to the enema if there is evidence of significant dehydration. As large a rectal catheter

as the patient can reasonably tolerate should be used.

If an air enema for pneumatic reduction of an intussusception is performed, the equipment used should include a manometer to measure insufflation pressure and a filtration system to protect any reusable portions of the equipment. An appropriate gauge needle should be available for paracentesis if a tension pneumoperitoneum develops during a pneumatic reduction technique.

### 3. Examination technique

#### a. Pneumatic reduction

- i. Air, CO<sub>2</sub>, or O<sub>2</sub> may be employed for a fluoroscopically guided diagnostic and therapeutic enema for intussusception.
- ii. See b. ii, below.
- iii. The pressure must be monitored as the gaseous contrast is insufflated into the colon. The pressure chosen depends on patient size and clinical circumstances. The recommended range is 80 to 120 mm Hg. The number of images should be kept to a minimum to limit the radiation dose. Intermittent fluoroscopy should be performed to identify an intus-susception, normal filling of the colon and small bowel, or a pneumoperitoneum. The pressure may fluctuate and be higher during insufflation or when the patient is crying, straining, or performing a Valsalva maneuver. The length of time spent on a continuous reduction attempt or intermittent filling is at the discretion of the individual physician. If the intussusception is reduced, air should be allowed to fill the distal small bowel, when possible. The physician should search for a residual filling defect to suggest a lead point or incomplete reduction of the intus-susception. If a tension pneumoperitoneum occurs, paracentesis should be performed immediately in the midline supraumbilical location.
- iv. Large format or fluoroscopic imaging, or sonography, of the abdomen may be performed at the completion of air sufflation. This may identify spontaneous reduction of a previously irreducible intussusception or reintus-susception of a previously reduced intussusception. Documentation of the absence of pneumoperitoneum as a complication of the procedure is accomplished by radiography.

#### b. Hydrostatic reduction

- i. Barium or dilute water-soluble contrast media (approximately 90 to 150 mgI/mL, for example, diatrizoate diluted with an equal volume of water or iohalamate diluted with an equal volume of water) may be employed for fluoroscopically guided diagnostic and therapeutic enema for intussusception.
- ii. The rectum should be catheterized with a soft catheter, and the catheter should be securely taped to the patient's buttocks. The buttocks should be firmly taped to provide as tight a seal as possible. A balloon may be inflated in the rectum as needed to maintain a closed system during reduction of an intussusception.
- iii. The colon should be filled by infusion. Images should be kept to a minimum to limit the radiation dose. If an intussusception is encountered and reduction is incomplete, the hydrostatic pressure should be continued. A continuous hydrostatic reduction or a filling/refilling technique can be used. The height of the infusion bag, the duration of each attempted reduction, and the number of attempts are at the discretion of the physician. If the intussusception is reduced, contrast should be allowed to fill the distal small bowel, when possible. The physician should search for a residual filling defect in the contrast column to detect a possible lead point or incomplete reduction of the intussusception. The contrast should then be drained or evacuation allowed.
- iv. Large format or fluoroscopic images, or sonography, of the abdomen may be performed at the completion of filling and after evacuation or gravity drainage of the colon; this may identify spontaneous reduction of a previously irreducible intussusception or reintus-susception of a previously reduced intussusception.

### C. Hirschsprung's Disease

#### 1. Examination preparation

Unless contraindicated by the clinical condition, a patient 1 year of age or older may have oral intake limited for 3 hours prior to the examination. There should be no bowel preparation prior to the enema, including no oral or rectal cleansing medications, and preferably

no recent digital examination. If the patient has had a recent rectal biopsy, the type and the time interval since the biopsy should be considered prior to scheduling the enema.

2. Examination preliminaries  
Preliminary images of the abdomen can be helpful in evaluating the amount of stool in the colon, the presence of obstruction, and abnormalities of the spine, and in planning the extent of the contrast enema.
3. Examination technique
  - a. Barium or water soluble contrasts are the routine contrast media employed for the evaluation of childhood Hirschsprung's disease. In the neonate or infant a 90 to 150 mgI/mL solution of water-soluble contrast media may be preferred. In the neonate or infant, low-osmolality contrast media such as ioversol diluted with an equal volume of sterile water and iopamidol diluted with an equal volume of sterile water are examples. In the infant, dilute high-osmolality contrast media such as diatrizoate diluted with an equal volume of water and iothalamate diluted with an equal volume of water are examples.
  - b. The rectum should be catheterized with a soft catheter, with the tip just inside the rectum. The caliber of the catheter should be small for the patient's size in order to avoid effacing a transition zone. No balloon or retention device should be inflated in the rectum during the course of the examination.
  - c. The examination should be performed under fluoroscopic guidance with positioning to adequately demonstrate the transition zone if present. Typically, the child is imaged initially in the lateral position when the rectum and sigmoid colon first fill with contrast.
  - d. The colon should be gravity-filled with contrast. The extent of filling depends on the fluoroscopic findings. If the colon is markedly dilated, or if the transition zone is demonstrated, it is desirable to avoid complete colonic filling, to prevent possible barium impaction, water intoxication, or, when water-soluble iodinated agents are used, electrolyte disturbances.
  - e. Large format or fluoroscopic images of the abdomen should be obtained following colonic filling. Following catheter removal, post-evacuation views in the frontal and lateral projections may assist in evaluation for a transition zone.

#### D. Meconium Ileus or Distal Intestinal Obstruction Syndrome of the Neonate

1. Examination preparation  
Surgical evaluation should precede attempted nonoperative management of uncomplicated meconium ileus. Contraindications to the performance of a therapeutic enema include clinical or radiologic evidence of complicated meconium ileus, including perforation and pseudocyst formation. These may be manifested clinically by a palpable abdominal mass, discoloration of the abdominal wall, and signs of peritonitis, and radiographically by intraperitoneal calcifications (with or without mass effect) or free intraperitoneal air.
2. Examination preliminaries  
Supine and left lateral decubitus or cross-table lateral views are evaluated for evidence of complicated meconium ileus or other etiologies of neonatal bowel obstruction requiring operative intervention. If the images remain compatible with a diagnosis of uncomplicated meconium ileus, a diagnostic contrast enema usually employing a water-soluble agent is performed to diagnose simple meconium ileus and exclude other causes of distal intestinal obstruction. If the diagnosis of meconium ileus is made by the contrast enema, the examination may proceed to a therapeutic contrast enema.
3. Therapeutic enema technique
  - a. A wide variety and concentration of water-soluble contrast media have been recommended for therapeutic enema for meconium ileus, including ionic and nonionic water-soluble contrast media diluted to a 90 to 150 mgI/mL solution. Examples include ioversol, diluted with an equal volume of sterile water; iopamidol, diluted with an equal volume of sterile water; diatrizoate, diluted with an equal volume of sterile water; and iothalamate, diluted with an equal volume of sterile water.
  - b. An appropriately sized catheter is placed in the rectum and the buttocks are firmly taped.
  - c. Under fluoroscopic control, contrast material is preferably infused via gravity until it reaches the dilated small-bowel or until significant resistance is met.
  - d. The duration and number of attempts and the intervals between attempts to reflux contrast material into the meconium-filled ileum are left to the discretion of the physician. In general, repeated attempts at

therapeutic enema for meconium elimination and bowel decompression are useful as long as the infant remains well under continued surgical and radiologic evaluation. The neonate should be kept warm and dry and should be carefully monitored for dehydration. Immediate postprocedural large format or fluoroscopic images should be obtained. Follow-up abdominal radiographs should be obtained as needed.

- e. Fluid shifts created by intraluminal hyperosmolar contrast and systemic absorption of hyperosmolar contrast may lead to dehydration and hypovolemic shock. Continued clinical surveillance and communication with the health care team are essential.

E. The following steps are suggested for a quality control program:

1. Correlation of radiologic, endoscopic, and pathologic findings where available.
2. Correlation of radiologic and pathologic diagnosis of Hirschsprung's disease.
3. Monitoring the reduction rate and complication rate of enema for intussusception.

## V. DOCUMENTATION

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 Guideline for Communication of Diagnostic Imaging Findings](#).

## VI. EQUIPMENT SPECIFICATIONS

Examinations should be performed with fluoroscopic image intensification and radiographic equipment meeting all applicable federal and state radiation standards. Equipment should provide diagnostic fluoroscopic image quality and recording (film, video, or digital) capability. Equipment capable of producing kilovoltage greater than 100 kVp should be available. Equipment necessary to compress and isolate regions of the colon for spot filming should be readily available.

Facilities should have the ability to deliver supplemental oxygen, to suction the oral cavity and upper respiratory tract, and to respond to life-threatening emergencies.

## 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 or manual techniques should be used to moderate the exposure while maintaining the necessary diagnostic image quality. Periodically, radiation exposures should be measured and patient radiation doses estimated by a medical physicist in accordance with the appropriate ACR Technical Standard. (ACR Resolution 17, adopted in 2006 – revised in 2009, Resolution 11)

## 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 elsewhere in the ACR Practice Guidelines and Technical Standards book.

The lowest possible radiation dose consistent with acceptable diagnostic image quality should be used particularly in pediatric examinations. Technical factors should be appropriate for the size and the age of the child and should be determined with consideration of parameters such as characteristics of the imaging system, organs in the radiation field, lead shielding, etc. Guidelines concerning effective pediatric technical factors are published in the radiologic literature.

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

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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.

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