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ACR PRACTICE PARAMETER FOR THE PERFORMANCE OF ESOPHAGRAMS AND UPPER GASTROINTESTINAL EXAMINATIONS IN ADULTS

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 physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the practice parameters, 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 practice parameters 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 practice parameters. However, a practitioner who employs an approach substantially different from these practice parameters 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 practice parameters 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 practice parameters 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

An esophagram is the radiologic examination of the esophagus guided by fluoroscopy. It includes an evaluation of swallowing, esophageal emptying, when using the timed barium swallow (TBS), esophageal morphology and motility, evaluation of the gastroesophageal (GE) junction, and assessment for gastroesophageal reflux (GER). An upper gastrointestinal (GI) series is the radiologic contrast examination of the esophagus (identical to the routine esophagram), stomach, and duodenum guided by fluoroscopy.

Single-contrast and double-contrast (biphasic) examinations are proven and useful procedures for evaluating the esophagus and the upper GI tract [1-13]. Their goal is to establish the presence or absence, nature, and extent of disease with a diagnostic-quality study, using the minimum radiation dose necessary. The following practice parameters are for performing these examinations in adult patients.

II. INDICATIONS AND CONTRAINDICATIONS

A. Indications for an esophagram

1. Pertinent history and symptoms for an esophagram include, but are not limited to:
   a. Dysphagia and atypical chest pain
   b. Symptomatic or suspected GER [2-4,7,8,10,11]
   c. Suspected foreign body in the esophagus

2. The esophagram helps diagnose and evaluate many conditions including, but not limited to:
   a. Suspected or known motility disorders [2,4,7,8,10]. The examination should include a TBS [14-16] in most patients with a suspected or known motility disorder, especially achalasia, to assess esophageal emptying. This is most effective in assessing treatment, especially achalasia treated with Botox, pneumatic dilation, Heller myotomy, and per oral endoscopic myotomy. As such, it should be performed both before and after intervention.
   b. Esophagitis [2-4,7,8,10,11]
   c. Strictures [2-4,7,8,10]
   d. Suspected esophageal perforation [7,17,18]
   e. Neoplasms [3,4,7,8,10]
   f. Esophageal obstruction [2-4,7,8,10]
   g. Postoperative assessment: to assess for leak or abnormal connection to bowel, such as a fistula as well as treatment of achalasia or other severe motility disorders

B. Indications for upper GI examination

1. History and symptoms for an upper GI examination include, but are not limited to:
   a. Symptomatic or suspected GER (ie, dysphagia, chest pain, heartburn, or regurgitation) [2-4,7,8,10,11]
   b. Abdominal pain
   c. Epigastric distress or discomfort
   d. Dyspepsia
   e. Nausea
   f. Vomiting
   g. Anemia
   h. Weight loss
   i. Gastric band slippage

2. The upper GI examination helps diagnose and evaluate many conditions, including, but not limited to:
   a. Suspected or known gastritis or duodenitis [13]
   b. Peptic ulcer disease [1,5,6,12,13]
   c. Hiatal hernia [7,8]
   d. Varices [12]

e. Suspected perforation [17,18]
f. Neoplasms [7,9]
g. Gastric outlet obstruction [12]
h. Preoperative anatomical evaluation, such as prior to bariatric surgery
i. Postoperative assessment [17,18]
j. Gastric or duodenal masses [9,12]

Esophagrams and upper GI examinations may aid in the evaluation of anatomy in postsurgical patients for detecting spontaneous, posttraumatic, or postsurgical leaks from the esophagus, stomach, or duodenum. In general, if a leak or perforation is clinically suspected, water-soluble contrast should be used for the initial evaluation. If aspiration or esophageal-tracheal or bronchial fistula is suspected, thin barium, iso-osmolar nonionic or low-osmolar contrast should be considered. (See section IV C.5.) Extravasation of thin barium in the mediastinum or pleural space does not cause complications [19]. Additionally, if a leak is suspected and not identified with water-soluble contrast, barium should be administered [17,19]. If a leak is suspected, obtaining images in the prone, supine, and both lateral decubitus positions is suggested to evaluate the various surfaces of the esophagus and/or duodenum.

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 [20].

C. Contraindications

Patients who have undergone recent esophageal or gastric surgery or recent trauma, or who are unable to cooperate with the examination, are not candidates for a double-contrast examination. Relevant patient history should be obtained prior to the procedure to determine the appropriate type of procedure and contrast medium. In these instances, assuming that the patient can cooperate, a single-contrast examination should be performed. At times, for evaluation of the stomach, contrast can be introduced via a nasogastric (NG) tube if patient is unable to swallow.

III. QUALIFICATIONS OF PERSONNEL

For qualifications of physicians, medical physicists, radiologist assistants, and radiologic technologists, see the ACR–SPR Practice Parameter for General Radiography [21].

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for an esophagram and upper GI 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 – revised in 2016, Resolution 12-b)

A. Patient Preparation

For a routine esophagram, the patient should be instructed to refrain from taking anything by mouth for a minimum of 2 hours before the procedure. For an upper GI examination, the patient should be instructed to refrain from taking anything by mouth after midnight the night before or at least 6 hours before the procedure. Examinations may be performed with shorter fasting times as clinically indicated. Patients may generally take scheduled medications on the morning of the examination with a small cup of water.

B. Examination Preliminaries

An appropriate medical history should be available, including the findings of laboratory tests and imaging and the results of endoscopic and surgical procedures as applicable.

A preliminary ("scout") image of the abdomen is often useful, particularly in postsurgical patients for delineation of staple lines. A preliminary image of the chest may be obtained prior to an esophagram, particularly if there is history of prior intervention (stent, surgery, or endoscopic treatment).

C. Examination Technique

The physician should tailor the examination procedure to the individual patient, as warranted by clinical circumstances and the condition of the patient to produce a diagnostic-quality examination. Images should be taken with an appropriate field of view, manually collimated as much as possible, so that radiation exposure to the patient is limited.

1. Single-contrast esophagram

    a. Using a low-density (60% weight per volume [weight/volume]) barium suspension, the anatomic structure and motility of the entire esophagus should be evaluated fluoroscopically. Appropriate spot images should be obtained to document normal and abnormal findings. The examination should include barium-distended and, when appropriate, collapsed mucosal relief views of the esophagus, including fluoroscopic evaluation of motility. This is optimally performed with the patient in the prone or the prone right anterior oblique (RAO) position, depending on the patient's condition and the presence of risk factors, such as the potential for aspiration. Specific, appropriate small field-of-view (FOV) images of the esophagogastric junction should also be included.
    b. With the patient in the semiprone position (RAO), using single, small swallows, esophageal motility should be assessed. Four to five separate swallows of barium should be observed, with each swallow separated by 25 to 30 seconds [22].
    c. Fluoroscopic assessment for GER should be performed. This may include patient motion, Valsalva maneuver, leg raise, and water siphon test.
    d. If the patient has symptoms suggesting oropharyngeal or swallowing dysfunction, then rapid sequence images or video recording for evaluating the pharynx and cervical esophagus should be considered. (See also the ACR–SPR Practice Parameter for the Performance of the Modified Barium Swallow [21].)
    e. For a patient with solid food dysphagia, a barium tablet or other solid food bolus should be given whenever possible, and passage should be observed with the patient in an upright position [7]. Water or barium may be given to assist passage. Any symptoms the patient experiences from ingesting the solid material should be reported. Care should be taken to not bias or lead the patient. Before starting the examination, many experienced fluoroscopists will ask the patient to report any symptoms experienced during the examination. In some patients where the dysphagia is only to a specific food (bolus-specific dysphagia), the patients should be requested to bring the offending food during the examination; otherwise, a re-evaluation with the specific food should be recommended. If the patient has achalasia, the barium tablet will obstruct at the lower esophageal sphincter.
    f. For a patient with liquid dysphagia, one should strongly consider starting the examination with TBS. Liquid dysphagia is almost always caused by a severe motility disorder, such as/most often achalasia. If the patient has achalasia, flooding the poorly emptying esophagus with gas-producing crystals and high-density barium may compromise the remainder of the examination. Furthermore, most gastroenterologists and esophageal surgeons request the timed study for assessing the effect of treatment. Once the barium has emptied from the esophagus, a motility examination can be performed to confirm the presence or absence of dysmotility.
    g. At the end of the fluoroscopic examination, "overhead" images can be obtained as part of the routine protocol when using non–remote control fluoroscopic units (conventional table side control). (Overhead images are taken while the patient is drinking low-density barium in the RAO position.)

h. The quality control indicators specific to this study are:
    i. Fluoroscopic observation of the entire esophagus while distended with barium, with appropriate spot images to document normal and abnormal findings.
    ii. Sufficient radiographic technique to penetrate the barium-filled esophagus on images.
    iii. Visualization of the GE junction to exclude local pathology.
    iv. Evaluation of the entire esophagus during single swallows to assess esophageal motility.
    v. In patients with liquid dysphagia or in patients with a suspected dysmotility disorder, esophageal emptying should be assessed with TBS.
    vi. In cases with penetration or frank aspiration, the study should be terminated and a modified barium swallow study suggested.

2. Double-contrast (biphasic) esophagram

a. An effervescent agent that releases carbon dioxide into the lumen of the stomach should be administered to provide distention if the patient can tolerate this agent.
b. Fluoroscopic observation of the esophagus and gastric cardia should be performed in double contrast using a high-density (210%-250% weight/volume) barium suspension with the patient in an upright oblique position. Appropriate spot images should be taken to document normal and abnormal findings.
c. Fluoroscopic observation of esophageal motility and the distended esophagus should be performed using the single-contrast technique while the patient is drinking barium and is in a prone-oblique position. Appropriate spot images should be obtained as described previously.
d. Fluoroscopic assessment for GER should be performed (see above).
e. If the patient has symptoms suggesting a swallowing function abnormality, then rapid sequence imaging or video recording for evaluating the pharynx and cervical esophagus should be considered.
f. For a patient with solid food dysphagia, a barium tablet or other solid food bolus may be given whenever possible, and passage should be observed with the patient in an upright position [7]. Water or barium may be given to assist passage. Symptoms should be reported.
g. For a patient with liquid dysphagia, one should strongly consider not performing a double-contrast (biphasic) esophagram and start the examination with a TBS (see above). If the effervescent agent and high-density barium is given to a patient with achalasia, the patient may aspirate or immediately regurgitate the ingested agents as the esophagus is often partially or completely filled with foam, saliva, fluid, and/or food. Furthermore, once these agents are ingested, any subsequent examination that day will be hampered.
h. The quality control indicators specific to this study are as follows:
    i. Fluoroscopic observation of the entire esophagus by both single-contrast and double-contrast techniques, with appropriate spot images to document normal and abnormal findings.
    ii. A double-contrast view of the gastric cardia and fundus to exclude pathologic conditions in this adjacent anatomic region.
    iii. Sufficient radiographic technique to penetrate the barium-filled esophagus.

3. Single-contrast upper GI examination

a. Fluoroscopic assessment of the morphology and function of the entire esophagus, stomach, and duodenum should be performed. Although the protocol for a single-contrast examination may be tailored to the specific indication, it is best to start the patient in the upright position. The stomach should be palpated after the patient has ingested two or three swallows of barium. Palpation can be achieved with a lead-gloved hand, paddle, or spoon. This process can identify mucosal abnormalities, including ulcers and masses. The patient should be rotated, keeping the portion of the stomach palpated overlying the spine, allowing for compression of the stomach between the compressing device or gloved hand and the spine. After palpation and rotation, more barium should be ingested to distend the stomach to assess for contour abnormalities and extrinsic masses. After this portion of the examination, the patient is placed in the horizontal position, where other portions of the stomach are assessed. Suggested views include barium-distended and, when appropriate, collapsed mucosal relief views of the esophagus, as well as barium-distended, mucosal relief, and/or compression views of the stomach and duodenum. Many

fluoroscopists place the patient in the prone position, placing a paddle underneath the epigastric area. Insufflation of the paddle balloon will compress the stomach and facilitate identification of mucosal abnormalities. At the end of the examination, it is important to examine the gastric fundus in both the barium-filled, as well as gas-filled views. Gas-filled views are facilitated by placing the patient right side down/left side up in the horizontal, or 45° erect positions. Sometimes, maximum gas distension is achieved with the patient totally upright. A sufficient number of spot images should be obtained to adequately document normal and abnormal findings. Suggested views include barium-distended and, when appropriate, collapsed mucosal relief views of the esophagus as well as barium-distended, mucosal relief, and/or compression views of the stomach and duodenum. At the end of the examination, overhead images can be obtained as part of the routine protocol when using non–remote control fluoroscopic units. (Overhead images are taken posterioranterior (PA), RAO, and right lateral positions).

b. The quality control indicators specific to this study are radiographic technique and graded compression that permit radiographic penetration of the barium suspension in the areas being examined.

4. Double-contrast (biphasic) upper GI examination

   a. A hypotonic agent may be used to induce gastric and duodenal hypotonia.
   b. An effervescent agent that releases carbon dioxide into the lumen of the stomach should be administered to provide distention.
   c. After ingestion of high-density barium, fluoroscopy should be used to visualize all segments of the esophagus, stomach, and duodenum in double contrast. Appropriate spot images should be obtained to document normal and abnormal findings.
   d. Fluoroscopy may be used to evaluate the esophagus, stomach, and duodenum after ingestion of low-density barium without and with palpation and rotation (see above). Additional spot images may be used to document normal and abnormal findings. Manual or mechanical compression of the accessible portions of the stomach and duodenum may be used.
   e. At the end of the examination, overhead images can be obtained as part of the routine protocol when using non–remote control fluoroscopic units (see above).
   f. The quality control indicators specific to this study are:
      i. Adequate barium coating of the esophagus, stomach, and duodenum.
      ii. Adequate gaseous distention of the esophagus, stomach, and duodenum. Double-contrast views may be supplemented by prone and/or upright compression views of the stomach and the duodenum. If quality control indicators demonstrate that adequate barium coating of the stomach and duodenum cannot be achieved, compression views should be included in the examination to display as much anatomy and pathology as possible.

5. Water-soluble contrast examination

   Water-soluble contrast may be preferred to barium when there is concern for subdiaphragmatic bowel perforation into the peritoneal cavity and in the patients who are not at risk for aspiration when there is concern for tracheoesophageal communication.

   If the patient is at risk for aspiration, iso-osmolar nonionic, or low-osmolar contrast agents are recommended for use by many. However, in patients with possible esophageal perforation who are at risk for aspiration, barium is used by some, as there has been no proven harm related to the presence of extravasated barium within the mediastinum.

   a. Water-soluble contrast in concentration sufficient for fluoroscopic and plain radiographic visualization should be used. Risks of aspiration should be considered prior to the study.
   b. Fluoroscopic observation of the esophagus, stomach, and duodenum should be performed, with specific attention to any areas of suspected leakage.
   c. If no leak is identified or the study is inconclusive in patients with possible esophageal leak, a single-contrast barium examination may provide additional diagnostic information [17,18]. In addition, prone, supine, and both lateral decubitus positioning of the patient may be helpful to detect a leak.

d. Appropriate spot images should be taken to document normal and abnormal findings. At the end of the examination, overhead images can be obtained as part of the routine protocol when using non–remote control fluoroscopic units.

6. Portable technique

Portable technique may be used only when the patient is too unstable for examination in the fluoroscopy suite and when portable technique will not compromise examination accuracy:

a. The images must be reviewed by the radiologist prior to using the tube. It is important to obtain a plain radiograph before injecting the contrast. After contrast injection, some sites obtain both a frontal and a cross-table lateral image of the abdomen, which provide orthogonal images for detection of potential leak(s) and determine the tube position. Good-quality, portable, cross-table lateral images, without a Bucky grid, are a challenge for a technologist. Dedicated initial evaluation in the fluoroscopy suite should be encouraged assuming that the patient is medically stable for such an examination.
b. If the portable examination does not provide adequate diagnostic accuracy or confidence level, the patient should be brought to the fluoroscopy suite for a targeted problem-solving examination.

7. The following quality control indicators should be applied to all esophagram and upper GI examinations:
   a. When examinations are completed, patients should be held in the fluoroscopic area until the images have been reviewed by the physician.
   b. An attempt should be made to resolve questionable radiologic findings before the patient leaves. If necessary, repeat targeted fluoroscopy should be performed for problem solving.
   c. Radiologic, endoscopic, and pathologic findings should be correlated whenever feasible.

V. DOCUMENTATION

Reporting should be in accordance with the ACR Practice Parameter for Communication of Diagnostic Imaging Findings [23].

It is recommended that radiation dose data be recorded for all fluoroscopy procedures in accordance with the ACR–AAPM Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures [24]. If patient dose information from an automated dosimetry system is not available, the fluoroscopic exposure time and the number of acquired spot images should be recorded in the patient's medical record.

VI. EQUIPMENT SPECIFICATIONS

Examinations must be performed with fluoroscopic and radiographic equipment meeting all applicable federal, state, and local radiation standards. The equipment should provide diagnostic fluoroscopic image quality and recording capability (digital image, video, or both). The equipment should be capable of producing kilovoltage greater than 100 kVp. Equipment necessary to compress and isolate accessible regions of the stomach and duodenum 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.

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/Advocacy-and-Economics/ACR-Position-Statements/Quality-Control-and-Improvement).

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 [25,26].

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