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

The American College of Radiology, with more than 40,000 members, is the principal organization of radiologists, radiation oncologists, and clinical medical physicists in the United States. The College is a nonprofit professional society whose primary purposes are to advance the science of radiology, improve radiologic services to the patient, study the socioeconomic aspects of the practice of radiology, and encourage continuing education for radiologists, radiation oncologists, medical physicists, and persons practicing in allied professional fields.

The American College of Radiology will periodically define new practice parameters 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 parameters and technical standards will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

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.

PREAMBLE

This document is an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. Practice Parameters and Technical Standards are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care[1]. For these reasons and those set forth below, the American College of Radiology and our collaborating medical specialty societies caution against the use of these documents in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the practitioner considering 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 variables such as the condition of the patient, limitations of available resources, or advances in knowledge or technology after publication of this document. However, a practitioner who employs an approach substantially different from the guidance in this document may consider documenting in the patient record information sufficient to explain the approach taken.

The practice of medicine involves the science, and 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 purpose of this document is to assist practitioners in achieving this objective.

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1 *Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing, 831 N.W.2d 826 (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 may include an evaluation of swallowing, esophageal morphology and motility, evaluation of the gastroesophageal (GE) junction and assessment for GE reflux (GER). It can also include quantification of esophageal emptying (timed barium swallow [TBS]). An upper gastrointestinal (GI) series is the radiologic contrast examination of the esophagus, 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, odynophagia, and atypical chest pain
    b. Symptomatic or suspected GER [2-4,7,8,10,11], including chronic cough
    c. Suspected foreign body in the esophagus
    d. Suspected aspiration pneumonia
    e. Suspected esophageal motility abnormality including achalasia
    f. Suspected esophageal perforation
    g. Suspected hiatal hernia
    h. Suspected Zenker diverticulum or esophageal diverticulum
    i. Postoperative pharyngoesophageal evaluation after pharyngeal, laryngeal, or cervical esophageal surgery
    j. Postoperative evaluation after thoracic esophageal surgery

2. The esophagram helps diagnose and evaluate diverse conditions including, but not limited to:
    a. Suspected or known motility disorders [2,4,7,8,10]. The examination could include a TBS [14-16], particularly useful for evaluating achalasia 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. Hiatal hernia
    h. Postoperative imaging such as to assess for leak, fistula, or stricture

II. INDICATIONS AND CONTRAINDICATIONS

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. Weight gain or flattening of weight loss curve after bariatric surgery

j. Suspected gastric or duodenal perforation or postoperative leak
k. Evaluation of postoperative anatomy
l. Suspected gastric outlet or duodenal obstruction, including suspected SMA syndrome

2. The upper GI examination is useful for diagnosis and evaluation of 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, including postoperative complications [17,18]
    j. Gastric or duodenal masses [9,12]

Esophagrams and upper GI examinations are useful to evaluate the anatomy in postsurgical patients and to detect 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/bronchial fistula is suspected, thin barium, iso-osmolar nonionic or low-osmolar contrast should be considered. (See section IV C.5.) 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]. Ideally, images should be obtained in various positions such as prone, supine, and decubitus to evaluate all of the surfaces of the esophagus, stomach, and/or duodenum. The examination can be modified to accommodate patient condition and positioning limitations.

For the pregnant or potentially pregnant patient, see the ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Patients with Ionizing Radiation [20].

II. INDICATIONS AND CONTRAINDICATIONS

C. Contraindications

Relevant patient history should be obtained before the procedure to determine the appropriate type of procedure and contrast medium, noting in particular barium or iodinated contrast sensitivity. If patient history or condition indicates that a double contrast study would be inappropriate or not feasible, a single-contrast examination can be performed. In patients in whom a leak might be present, water-soluble contrast should be used initially (please see section B). At times, for evaluation of the stomach and duodenum, contrast can be introduced via a nasogastric or gastrostomy tube.

III. QUALIFICATIONS OF PERSONNEL

For qualifications of physicians, medical physicists, radiologist assistants, and radiologic technologists, see the ACR–AAPM–SIIM-SPR Practice Parameter for Digital 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)

IV. SPECIFICATIONS OF THE EXAMINATION

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.

IV. SPECIFICATIONS OF THE EXAMINATION

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 can be useful, particularly in postsurgical patients for delineation of staple lines and other surgically related material, for detection of extraluminal gas, or for evidence of bowel obstruction.

IV. SPECIFICATIONS OF THE EXAMINATION

C. Examination Technique

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 and video fluoroscopy recordings 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, as well as fluoroscopic evaluation of motility. Evaluation of motility 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. Although barium is the preferred agent, in selected instances such as suspected leak, water-soluble contrast material is appropriate.
b. With the patient in the semiprone position (RAO), using single, small swallows, esophageal motility should be assessed. Two to five separate swallows of barium should be observed, with each swallow separated by 25–30 seconds [22]. Esophageal emptying in the upright position should also be documented.
c. Fluoroscopic assessment for GER should be performed. This may include patient motion, Valsalva maneuver, leg raise, and water siphon test [23].
d. In addition to thoracic esophageal views, the examination can include frontal and lateral rapid sequence images or video recording for evaluating the pharynx and cervical esophagus during swallowing. (See also the ACR–SPR Practice Parameter for the Performance of the Modified Barium Swallow [24].)
e. For a patient with solid food dysphagia, a barium tablet and/or other solid food bolus should be given whenever possible, and passage should be observed with the patient in an upright position [7,25,26]. Water or barium may be given to assist passage. If a significant stricture is present, the fluoroscopist should exercise care in deciding whether to administer the barium tablet. Any symptoms the patient experiences from ingesting the tablet or solid material should be reported. Care should be taken not to bias or lead the

patient. Before starting the examination, many fluoroscopists will ask the patient to report any symptoms experienced during the examination.

f. For a patient with liquid dysphagia, the fluoroscopist could consider starting the examination with a TBS. Liquid dysphagia can indicate 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. Gastroenterologists and esophageal surgeons may request the timed study before and after treatment. Once the barium has emptied from the esophagus, a motility examination can be performed to confirm the presence or absence of dysmotility.

g. The quality control indicators specific to this study are:
    1. Fluoroscopic observation of the entire esophagus while distended with barium, with appropriate spot images to document normal and abnormal findings.
    2. Sufficient radiographic technique to penetrate the barium-filled esophagus on images.
    3. Visualization of the GE junction to exclude local pathology.
    4. Evaluation of the entire esophagus during single swallows to assess esophageal motility.
    5. In patients with liquid dysphagia or in patients with a suspected motility disorder, esophageal emptying could be assessed with TBS.
    6. In cases with a sizable volume of laryngeal penetration/aspiration, consider terminating the examination and suggesting a modified barium swallow.

IV. SPECIFICATIONS OF THE EXAMINATION

C. Examination Technique

2. Double-contrast (biphasic) esophagram [27]

a. An effervescent agent that releases carbon dioxide into the lumen of the esophagus and stomach should be administered to provide distention

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 or prone-oblique position. Appropriate spot images should be obtained as described previously.

d. Fluoroscopic assessment for GER should be performed (see above).

e. The examination can include rapid sequence imaging or video recording for evaluating the pharynx and cervical esophagus during swallowing.

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 [7,25,26]. Water or barium should be given to assist passage. Symptoms should be reported.

g. For a patient with liquid dysphagia or suspected achalasia, one should consider beginning with a swallow of low-density barium before performing a double contrast (biphasic) esophagram. The effervescent agent and high-density barium could precipitate regurgitation/aspiration in the setting of achalasia.

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.

IV. SPECIFICATIONS OF THE EXAMINATION

C. Examination Technique

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, the examination generally begins with several swallows of barium in the upright or semi-upright position allowing an initial assessment of esophagogastric morphology and contrast transit. Some fluoroscopists use lead gloves, spoon, or paddle and then palpate the stomach to facilitate detection of mucosal abnormalities.

b. After the upright portion of the examination, the patient is placed in a horizontal position. Most fluoroscopists position the patient prone/prone oblique and place a paddle beneath the epigastric area, allowing for compression of the stomach between the compressing device and the spine. Insufflation of the paddle balloon will compress the stomach and duodenum, facilitating identification of mucosal abnormalities.

c. 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. Sufficient spot images should be obtained to adequately document normal and abnormal findings. At the end of the examination, large FOV radiographs or fluoroscopically guided spot views generally include frontal (PA), oblique, and lateral positions.

d. 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.

IV. SPECIFICATIONS OF THE EXAMINATION

C. Examination Technique

4. Double-contrast (biphasic) upper GI examination [28]

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, large FOV radiographs or fluoroscopically guided spot views images can be obtained as part of the routine protocol (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.

IV. SPECIFICATIONS OF THE EXAMINATION

C. Examination Technique

5. Water-soluble contrast examination

Water-soluble contrast may be preferred to barium when there is concern for bowel perforation.

If the patient is at risk for aspiration, iso-osmolar nonionic or low-osmolar contrast agents are recommended. However, in patients with possible esophageal perforation who are at risk for aspiration, or if there is possible connection to the airway, some fluoroscopists prefer to use barium. There has been no proven harm related to the presence of extraluminal 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 before the study.
b. Fluoroscopic observation and spot films 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, a single-contrast barium examination may provide additional diagnostic information [17,18,29]. 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.
e. At the end of the examination, large FOV radiographs or fluoroscopically guided spot views images can be obtained as part of the routine protocol (see above).

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 fluoroscopist.
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 [30].

VI. EQUIPMENT SPECIFICATIONS

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 [32,33].

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, or adverse reaction to contrast agents.

VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, non-physician radiology providers**,** 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 who work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection, application of dose constraints and limits) and the principles of proper management of radiation dose to patients (justification, optimization including the use of dose reference levels). https://www-

pub.iaea.org/MTCD/Publications/PDF/PUB1775_web.pdf

Nationally developed guidelines, such as the ACR's Appropriateness Criteria®, should be used to help choose the most appropriate imaging procedures to prevent unnecessary radiation exposure.

Facilities should have and adhere to policies and procedures that require ionizing radiation examination protocols (radiography, fluoroscopy, interventional radiology, CT) to vary according to diagnostic requirements and patient body habitus to optimize the relationship between appropriate radiation dose and adequate image quality. Automated dose reduction technologies available on imaging equipment should be used, except when inappropriate for a specific exam. If such technology is not available, appropriate manual techniques should be used.

Additional information regarding patient radiation safety in imaging is available from the following websites – Image Gently® for children (www.imagegently.org) and Image Wisely® for adults (www.imagewisely.org). 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 periodically measured by a Qualified Medical Physicist in accordance with the applicable ACR Technical Standards. Monitoring or regular review of dose indices from patient imaging should be performed by comparing the facility's dose information with national benchmarks, such as the ACR Dose Index Registry and relevant publications relying on its data, applicable ACR Practice Parameters, 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; 2006, 2009, amended 2013, revised 2023 (Res. 2d).

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).

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Writing Committee – members represent their societies in the initial and final revision of this practice parameter

ACR
DiSantis, David MD, Chair
Carucci, Laura R MD
Gerson, Rachel MD
Megibow, Alec MD
Scholz, Francis MD
Turner, Mary MD
Wolf, Ellen MD
Zarzour, Jessica MD

Committee on Abdominal Imaging – Body Imaging
(ACR Committee responsible for sponsoring the draft through the process)

Yeh, Benjamin MD, Chair
Brook, Olga R MD
Fidler, Jeff L MD
Furlan, Alessandro MD
Kim, David H MD
Moreno, Courtney Coursey MD
Wasnik, Ashish P MD
Yeghiayan, Paula MD
Arora, Sandeep S MBBS
Carucci, Laura R MD
Fung, Alice MD
Houshmand, Sina MD
Liau, Joy MD, PhD
Turner, Mary MD
Wolf, Ellen MD

Larson, David B MBA, MD, Chair, Commission on Quality and Safety
Rosenkrantz, Andrew MD, Chair, Commission on Body Imaging

Comments Reconciliation Committee

Gerson, Rachel MD - CSC, Chair
Brook, Olga R MD
Crummy, Timothy MD, MHA - CSC
Larson, David B MBA, MD
Rosenkrantz, Andrew MD
Schoppe, Kurt MD - CSC
Wolf, Ellen MD
Zarzour, Jessica MD
Winsor, Kimberly MD - CSC, Co-Chair
Carucci, Laura R MD
DiSantis, David MD
Megibow, Alec MD
Scholz, Francis MD
Turner, Mary MD
Yeh, Benjamin MD

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