The American College of Radiology, with more than 30,000 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.

Revised 2014 (Resolution 14)*
I. INTRODUCTION

This practice parameter has been developed by the American College of Radiology (ACR) and the Society of Abdominal Radiology (SAR) to assist physicians supervising the performance or interpretation of excretory urography (EU). Properly performed EU is a diagnostic radiologic imaging test that can provide information about the kidneys and urinary tract. It is not possible to detect all abnormalities using EU, such as small renal masses or other renal parenchymal abnormalities.

Currently, excretory urography (EU) is as in patients with known or suspected ureteral obstruction or urinary leak.

EU is a radiographic examination in which anatomic and physiologic abnormalities of the urinary tract are detected by obtaining a timed series of images of the abdomen and pelvis after the injection of intravenous (IV) iodinated contrast media. Before the advent of cross-sectional imaging examinations, this examination was, for several decades, the primary imaging method for evaluating the urinary tract. Although largely supplanted by cross-sectional imaging techniques, particularly CT urography (CTU) in adults and MR urography in children, EU still plays an occasional role in imaging the urinary tract. Typically, an excretory urogram includes 1 or more images of the abdomen before an IV contrast medium is administered (referred to as “scout images” or “preliminary images”) and sequential images after contrast medium administration. Tomograms may be obtained when appropriate and technically feasible.

The terms “intravenous urography” (IVU) and “intravenous pyelography” (IVP) are used as synonyms for EU. In this practice parameter, the term “contrast media/medium” refers specifically to water-soluble iodinated contrast media that are administered intravenously.

II. INDICATIONS, CONTRAINDICATIONS, AND CAUTIONS

A. Indications

Relative merits of EU versus other imaging examinations including US, CT, nuclear medicine, and MRI should be considered in selecting the most appropriate test for the specific patient [1-5].

The indications for an EU examination include, but are not limited to, the following:

1. Evaluation of patients with suspected or known ureteral obstruction
2. Assessment of the integrity of the urinary tract following trauma or therapeutic interventions, especially when cross-sectional imaging is inappropriate or unavailable. One example of such an indication is an examination performed in the operating room when a trauma patient is too unstable to undergo cross-sectional imaging prior to surgery.
3. Assessment of the urinary tract for suspected congenital anomaly, when thought to be more appropriate than cross-sectional imaging
4. Assessment of the upper urinary tract (renal collecting systems and ureters) for urothelial lesions that may explain hematuria and for identification of urinary tract abnormalities that may predispose to infection, especially when cross-sectional examinations using US, CT, or MRI are either unavailable or felt to be inappropriate for the clinical circumstance
5. Follow-up of patients with recurrent renal/ureteral calculi, with a limited number of images obtained pre and postcontrast administration. Such limited studies may reduce the patient’s radiation burden compared with repetitive CT studies.

Although EU was used to assess the kidneys for parenchymal lesions and masses in the past, with nephrotomography required for optimal assessment of the parenchyma, EU has only 67% sensitivity in detecting renal masses ≤3 cm in diameter [6], and without tomography the sensitivity is even lower. More than half of small tumors were not visualized or were missed on the initial IVU in one series [7]. Since cross-sectional imaging studies outperform EU in renal parenchymal evaluation [7], they are the study of choice for this indication.
B. Contraindications and Cautions

Issues related to use of intravascular iodinated contrast media administration, including relative contraindications to its use, and when premedication should be considered, are discussed in detail in the ACR Manual on Contrast Media and other publications [8-10].

Pregnancy is a relative contraindication to EU. For the pregnant or potentially pregnant patient presenting with acute abdominal pain, a limited EU may be indicated in special circumstances. A low-dose CT or MR may be preferable to a limited EU [11].

For additional information concerning the performance of imaging studies requiring contrast media injections on the pregnant or potentially pregnant patient, see the ACR Manual on Contrast Media [8] and the ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation.

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the ACR–SPR Practice Parameter for General Radiography.

The interpreting physician should have documented formal training in the performance, interpretation, and reporting of EU and integration of other imaging examinations in the evaluation of the urinary tract, such as US, CT, nuclear medicine, and MRI.

The interpreting physician must also:

1. Be familiar with the disease processes for which the patient is being evaluated and must understand the urographic manifestations of these diseases as well as variants of normal anatomy and congenital anomalies.
2. Have an understanding of and experience in proper imaging technique, image sequencing, and the use of tomography, as well as the volume and concentration of appropriate IV contrast.
3. Be available in person or via electronic connection (remote access to PACS or other teleradiology connection) to monitor the examination and tailor the imaging sequence to answer the clinical question.

A physician must be available to assess and treat the patient in the event of a contrast reaction. The physician should have training in the recognition and treatment of adverse reactions to IV contrast media [8-12].

IV. SPECIFICATIONS OF THE EXAMINATION

The written or electronic request for excretory urography 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).
A. Patient Selection and Preparation

Appropriate history should be obtained and preprocedure screening performed by personnel familiar with the various risk factors, preparation, and premedication strategies [9,14,15]. Patients should be evaluated for factors predisposing them to anaphylactoid or idiosyncratic reactions to iodinated contrast media, possible renal impairment, or other conditions that could increase the chances of an adverse reaction to contrast media.

The physician must be aware of relative contraindications to EU, including a history of prior contrast reactions.

B. Injection of Iodinated Contrast Media

After intravenous access is obtained, the contrast medium is injected. Care and preparation of intravenous access sites are the responsibility of the health care professional who injects the contrast medium. The contrast medium used for the study will vary with the institution; in most cases, the contrast used for other imaging studies such as CT is appropriate for EU as well. The dose of contrast medium instilled will vary with the institution as well, with factors such as patient’s body weight and presence of both kidneys versus a solitary kidney (whether functionally or anatomically solitary) coming into consideration.

The physician or, if state and local regulations permit, the radiologic technologist, registered nurse, or other appropriately credentialed health care practitioner may inject the contrast media2. An appropriately trained individual who is aware of the signs and symptoms of adverse reactions to contrast medium must monitor the patient for the development of these signs and symptoms during the examination [9,10,12,13]. Appropriate personnel must be available to respond promptly to any adverse reactions that might occur.

Appropriate emergency equipment and medications must be immediately available to treat adverse reactions associated with administered medications. The equipment and medications should be monitored for inventory and drug expiration dates on a regular basis. The equipment, medications, and other emergency support must also be appropriate for the range of ages and sizes in the patient population.

C. Image Acquisition: Image acquisition should be tailored to the specific needs of the patient to optimize the examination and limit radiation exposure.

1. Preliminary image(s) should be evaluated prior to the injection of contrast media to check positioning and technique and to assess for radiopaque urinary tract calculi. Imaging should delineate the abdomen from just above the kidneys to a level below the symphysis pubis [5,14,16,17]. An image centered over the kidneys should be obtained to assess for renal calculi, in addition to a 14x17 inch image of the abdomen and pelvis.
2. Postcontrast sequential images should be obtained to evaluate the kidneys, upper collecting systems, ureters, and urinary bladder. These images should be tailored to address the clinical question(s) [5,16,17]. Nephrotomograms are necessary only for renal parenchyma evaluation in a patient who has no recent cross sectional imaging studies, recognizing that EU is not as sensitive as CT, MR or ultrasound in detecting a small renal mass.
3. In some clinical circumstances (eg, pregnancy), a limited examination may be appropriate.
4. Imaging with abdominal compression may be useful in optimally distending and opacifying the collecting systems. The appropriateness of compression should be assessed in individual patients as abdominal compression may be contraindicated in patients with a large abdominal aortic aneurysm, a history of recent abdominal surgery, or trauma, as well as in other clinical situations. Severe flank pain after application of compression may indicate fornix rupture; an image of the abdomen should be obtained immediately and compression released if extravasation is demonstrated.
5. The addition of oblique images of the abdomen is also useful for optimal assessment of the entire collecting systems and ureters. Prone images may assist in opacification of the ureters [18].

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2 See the ACR–SPR Practice Parameter for the Use of Intravascular Contrast Media.
6. Images centered over the pelvis may be obtained for assessment of the bladder for wall irregularities and intraluminal masses. A postvoid image may be useful to assess bladder emptying or facilitate visualization of bladder masses; in some patients bladder masses are more easily seen on a postvoid image.

7. An additional radiograph with the patient upright can be obtained in patients with suspected urinary tract obstruction, as such an image is sensitive for detecting low-grade obstruction. Incomplete drainage of the collecting systems and ureters on an upright radiograph suggests that there is some degree of obstruction.

V. DOCUMENTATION

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

VI. 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).

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VII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education on the ACR website (http://www.acr.org/guidelines).

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

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REFERENCES


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