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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 2019 (Resolution 9)*

ACR–SAR PRACTICE PARAMETER FOR THE PERFORMANCE OF EXCRETORY UROGRAPHY

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 care¹. 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 in light of 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 the condition of the patient, limitations of available resources, or advances in knowledge or technology subsequent to publication of this document. However, a practitioner who employs an approach substantially different from the guidance in this document 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 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 sole purpose of this document 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

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.

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 before and 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. It has now been almost completely supplanted by cross-sectional imaging techniques, particularly computed tomography CT urography in adults and MR urography in children. Occasionally, EU is still performed for imaging of the urinary tract. Typically, an EU includes one 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” and “intravenous pyelography” 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 ultrasound (US), CT, nuclear medicine, and MR imaging 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 MR imaging 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 before and after contrast medium administration. Such limited studies may reduce the patient’s radiation burden compared with repetitive CT studies.

EU should not be used to assess the kidneys for parenchymal lesions, as it has only 67% sensitivity in detecting renal masses ≤ 3 cm in diameter [6]. Without tomography, the sensitivity is even lower. Because 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 [8-11].

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 (with a minimal number of radiographs obtained). In general, low-dose CT or MR is preferable to a limited EU [12].

For additional information concerning the performance of imaging studies requiring contrast media injections or ionizing radiation 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](#) [13].

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the [ACR–SPR Practice Parameter for General Radiography](#) [14].

The interpreting physician should have 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 MR imaging.

The interpreting physician must also:

1. Be familiar with the disease processes for which the patient is being evaluated and 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 media.
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 EU 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). The provision of 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 Selection and Preparation

Appropriate history should be obtained and a preprocedure screening should be performed by personnel familiar with the various risk factors, preparation, and premedication strategies [8,9,15,16]. Patients should be evaluated for factors predisposing them to adverse reactions to iodinated contrast media. Appropriate precautions should be taken in any patient in whom risk factors are identified.

Substantially decreased renal function is another relative contraindication to EU because patients with poor renal function may not be able to excrete the administered contrast material at a sufficient rate or amounts to obtain a diagnostic examination.

B. Injection of Iodinated Contrast Media

Care and preparation of IV access sites are the responsibility of the health care professional who injects the contrast medium. The contrast medium used for the study may vary with the institution.

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 media.² 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 [9,10,17,18]. 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 yet limit radiation exposure.

1. Preliminary image(s) should be evaluated prior to the injection of contrast media to check patient positioning and technique and to assess for radiopaque urinary tract calculi. The obtained image should include the abdomen from just above the kidneys to a level below the symphysis pubis [5,15,19,20]. When indicated, an additional image centered over the kidneys should be obtained to assess for renal calculi, in addition to an 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) [5,19,20]. When indicated, nephrotomograms are necessary to optimize 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 US in detecting a small renal mass.
3. 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, ostomies, or trauma, as well as in other clinical situations.
4. When indicated, the addition of oblique images of the abdomen may be useful for optimal assessment of the entire collecting systems and ureters. Prone images may assist in opacification of dilated ureters [21]. An additional radiograph with the patient upright can be obtained in patients with suspected urinary tract obstruction; such an image is sensitive for detecting low-grade obstruction.
5. Images centered over the pelvis may be obtained for assessment of a full 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.

² See the ACR–SPR Practice Parameter for the Use of Intravascular Contrast Media.

V. DOCUMENTATION

Reporting should be in accordance with the [ACR Practice Parameter for Communication of Diagnostic Imaging Findings](#) [22].

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)

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 (<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 Radiographic Equipment](#) [23].

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REFERENCES

1. Eikefjord EN, Thorsen F, Rorvik J. Comparison of effective radiation doses in patients undergoing unenhanced MDCT and excretory urography for acute flank pain. *AJR Am J Roentgenol.* 2007;188(4):934-939.
2. Kawashima A, Vrtiska TJ, LeRoy AJ, Hartman RP, McCollough CH, King BF, Jr. CT urography. *Radiographics.* 2004;24 Suppl 1:S35-54; discussion S55-38.
3. Nawfel RD, Judy PF, Schleipman AR, Silverman SG. Patient radiation dose at CT urography and conventional urography. *Radiology.* 2004;232(1):126-132.
4. Zahringer M, Hesselmann V, Schulte O, et al. Reducing the radiation dose during excretory urography: flat-panel silicon x-ray detector versus computed radiography. *AJR Am J Roentgenol.* 2003;181(4):931-937.

5. Dyer RB, Chen MY, Zagoria RJ. Intravenous urography: technique and interpretation. *Radiographics*. 2001;21(4):799-821; discussion 822-794.
6. Amendola MA, Bree RL, Pollack HM, et al. Small renal cell carcinomas: resolving a diagnostic dilemma. *Radiology*. 1988;166(3):637-641.
7. Curry NS, Schabel SI, Betsill WL, Jr. Small renal neoplasms: diagnostic imaging, pathologic features, and clinical course. *Radiology*. 1986;158(1):113-117.
8. American College of Radiology. ACR Manual on Contrast Media. 2017; Version 10.3: Available at: https://www.acr.org/-/media/ACR/Files/Clinical-Resources/Contrast_Media.pdf. Accessed January 9, 2018.
9. Ellis JH. Radiographic iodinated contrast media: adverse reactions, premedication, and other considerations. In *New Techniques in Uroradiology*. Morcos S, Cohan RH eds. . Taylor and Francis Group, New York, NY. 2006.
10. Hunt CH, Hartman RP, Hesley GK. Frequency and severity of adverse effects of iodinated and gadolinium contrast materials: retrospective review of 456,930 doses. *AJR Am J Roentgenol*. 2009;193(4):1124-1127.
11. Davenport MS, Cohan RH, Ellis JH. Contrast media controversies in 2015: imaging patients with renal impairment or risk of contrast reaction. *AJR Am J Roentgenol*. 2015;204(6):1174-1181.
12. Woodfield CA, Lazarus E, Chen KC, Mayo-Smith WW. Abdominal pain in pregnancy: diagnoses and imaging unique to pregnancy--review. *AJR Am J Roentgenol*. 2010;194(6 Suppl):WS14-30.
13. American College of Radiology. ACR-SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation. 2018; Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/Pregnant-Pts.pdf>. Accessed January 8, 2018.
14. American College of Radiology. ACR-AAPM Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures. 2013; Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/MgmtFluoroProc.pdf>. Accessed August 17, 2018.
15. Jansson M, Geijer H, Andersson T. Bowel preparation for excretory urography is not necessary: a randomized trial. *Br J Radiol*. 2007;80(956):617-624.
16. Katzberg RW. Urography into the 21st century: new contrast media, renal handling, imaging characteristics, and nephrotoxicity. *Radiology*. 1997;204(2):297-312.
17. Wang CL, Cohan RH, Ellis JH, Adusumilli S, Dunnick NR. Frequency, management, and outcome of extravasation of nonionic iodinated contrast medium in 69,657 intravenous injections. *Radiology*. 2007;243(1):80-87.
18. Wang CL, Cohan RH, Ellis JH, Caoili EM, Wang G, Francis IR. Frequency, outcome, and appropriateness of treatment of nonionic iodinated contrast media reactions. *AJR Am J Roentgenol*. 2008;191(2):409-415.
19. Hattery RR, Williamson B, Jr., Hartman GW, LeRoy AJ, Witten DM. Intravenous urographic technique. *Radiology*. 1988;167(3):593-599.
20. Segal AJ. Optimizing urography. *World J Urol*. 1998;16(1):3-8.
21. Kowalchuk RM, Banner MP, Ramchandani P, Forman HP. Efficacy of prone positioning during intravenous urography in patients with hematuria or urothelial tumor but no obstruction. *Acad Radiol*. 1998;5(6):415-422.
22. American College of Radiology. ACR Practice Parameter for Communication of Diagnostic Imaging Findings. 2014; Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/CommunicationDiag.pdf>. Accessed January 8, 2018.
23. American College of Radiology. ACR-AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring or Radiographic Equipment. 2016; Available at: <https://www.acr.org/-/media/ACR/Files/Practice-Parameters/RadEquip.pdf>. Accessed January 8, 2018.

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