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Revised 2008 (Resolution 13)*

ACR–SIR PRACTICE GUIDELINE FOR SPECIFICATIONS AND PERFORMANCE OF IMAGE-GUIDED PERCUTANEOUS DRAINAGE / ASPIRATION OF ABSCESSES AND FLUID COLLECTIONS (PDAFC) IN ADULTS

PREAMBLE

These guidelines are an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. They are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care. For these reasons and those set forth below, the American College of Radiology cautions against the use of these guidelines in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the guidelines, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the guidelines when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations of available resources, or advances in knowledge or technology subsequent to publication of the guidelines. However, a practitioner who employs an approach substantially different from these guidelines is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to 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 guidelines will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these guidelines is to assist practitioners in achieving this objective.

I. INTRODUCTION

This guideline was revised by the American College of Radiology (ACR) in collaboration with the Society of Interventional Radiology (SIR).

Image-guided percutaneous drainage or aspiration of abscesses and abnormal fluid collections (PDAFC) has become the diagnostic and therapeutic treatment of choice for a wide variety of fluid collections. The procedures have resulted in reduced morbidity and mortality and have helped to reduce length of hospital stay and hospital costs [1-13].

For information on breast interventional procedures, see the [ACR Practice Guideline for the Performance of Stereotactically Guided Breast Interventional Procedures](#) or the [ACR Practice Guideline for the Performance of Ultrasound-Guided Percutaneous Breast Interventional Procedures](#).

The procedures may be performed with ionizing radiation for image guidance, including fluoroscopy or computed tomography (CT), or with nonionizing radiation

modalities, including ultrasound (US) and magnetic resonance imaging (MRI). Optimal performance of PDAFC requires knowledge of anatomy and pathophysiology, familiarity with percutaneous techniques (needle, guide-wire, drainage catheter use, etc.) and knowledge of the advantages and disadvantages of one imaging modality versus another for any particular drainage procedure. As with any invasive therapy, the patient is most likely to benefit when the procedure is performed in an appropriate environment and by qualified physicians. This guideline outlines the specifications and principles for performing high-quality PDAFC.

This guideline is intended to be used in quality improvement programs to assess percutaneous drainage procedures. The most important processes of care are 1) patient selection, 2) performing the procedure, and 3) monitoring the patient. The outcome measures or indicators for these processes are indications, success rates, and complication rates. Outcome measures are assigned threshold levels.

II. DEFINITION

Image-guided percutaneous drainage is defined as the placement of a catheter using image guidance to provide continuous drainage of a fluid collection, using access pathways that may be either transorificial (e.g., transrectal, transvaginal, peroral) or transcutaneous. It includes localization of the collection, and placement and maintenance of the drainage catheter or catheters. It may be performed during a single session or as a staged procedure during multiple sessions.

Image-guided percutaneous aspiration is defined as evacuation or diagnostic sampling of a fluid collection using either a catheter or a needle during a single imaging session, with removal of the catheter or needle immediately after the aspiration.

III. INDICATIONS AND CONTRAINDICATIONS

Because of variability in the presentation of abscesses and fluid collections, the indications for PDAFC must be stated in general terms. The prerequisites for PDAFC are an abnormal fluid collection and one of the following: suspicion that the fluid is infected, need for fluid characterization, or suspicion that the collection is producing symptoms sufficient to warrant drainage. The collection may be detected by physical examination but typically is discovered by an imaging study. Additional studies may be required to confirm the presence or nature of the fluid collection and to evaluate the feasibility of percutaneous aspiration or drainage.

Diagnostic aspiration may be the only means of determining that a fluid collection is infected. For

instance, while fever, leukocytosis, malaise, anorexia, or other systemic symptoms point to an infection, these signs and symptoms may be absent in elderly, very ill, or immunocompromised patients. If material that appears infected is obtained or if the operator suspects the presence of infection, a drainage catheter may then be placed.

Percutaneous drainage or aspiration may be performed in essentially every organ system. The contraindications are relative and depend on the suitability of surgical alternatives. Common relative contraindications include coagulopathy and necrotic tissue requiring surgical debridement.

There is a spectrum of disease complexity. Examples of more complex situations include multiple or multiloculated abscesses, abscess due to Crohn's disease, pancreatic abscesses, drainage route that traverses bowel or pleura, infected clot, and infected tumor [14-21]. Articles have documented curative or partially successful percutaneous drainage in patients with these complex situations. However, one should expect that percutaneous drainage in such cases will have a lower chance of success, be more technically difficult, require longer periods of time for drainage, and have a higher rate of complications. In addition, abscesses in such cases may be more likely to recur. Decisions regarding percutaneous versus surgical drainage of complex collections should be made in concert with other physicians involved in the patient's care. Some have advocated the possibility of draining abscesses using needles alone [22-24]. However, catheter drainage may still be needed in selected cases, and the overall utility of needle drainage of abscesses awaits further study.

Patient follow-up and catheter management are integral to the success of the procedure. The radiologist performing the drainage should ensure that appropriate follow-up is performed and maintained until the catheter is removed.

The indications for PDAFC include, but are not limited to, the presence of an abnormal fluid collection with:

1. Suspicion that the fluid is infected or the result of an abnormal fistulous communication.
2. Need for fluid characterization.
3. Suspicion that the collection is producing symptoms sufficient to warrant drainage.
4. As an adjunctive procedure to facilitate the improved outcome of a subsequent intervention (e.g., paracentesis prior to liver intervention).

Threshold – PDAFC should be done for 1 of the above 4 indications in 98% of the cases.

There are no absolute contraindications. However, there are relative contraindications and, as for all patients

considered for this procedure, the relative benefits and risks of the procedure should be weighed carefully. These relative contraindications should be addressed and corrected or controlled before the procedure, when feasible. The relative contraindications for PDAFC include:

1. Significant coagulopathy that cannot be adequately corrected.
2. Severely compromised cardiopulmonary function or hemodynamic instability.
3. Lack of a safe pathway to the abscess or fluid collection.
4. Inability of the patient to cooperate with, or to be positioned for, the procedure.

For the pregnant or potentially pregnant patient, see the [ACR Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation](#).

IV. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

A. Physician

Image-based diagnosis and treatment planning require integrating the preprocedural imaging findings with the patient's history and physical findings. Therefore, the physician must be clinically informed and understand the specific questions to be answered by PDAFC prior to the procedure in order to plan and perform it safely and effectively.

The physician performing PDAFC must fully appreciate the benefits, alternatives, and risks of the procedures. The physician must have a thorough understanding of imaging anatomy (including congenital and developmental variants), fluoroscopic and ultrasound equipment, radiation safety considerations, and physiologic monitoring equipment and have access to adequate supplies and personnel to perform the procedure safely.

PDAFC procedures must be performed by a physician who has the following qualifications. Performance of the number of cases suggested below is best documented by use of a formal case log submitted by the applicant.

1. Certification in Radiology or Diagnostic Radiology by the American Board of Radiology (ABR), the American Osteopathic Board of Radiology, the Royal College of Physicians and Surgeons of Canada, or the Collège des Médecins du Québec and has performed (with supervision) at least 35 image-guided percutaneous catheter placements with aspiration

and/or drainage procedures, 25 of them as the primary operator.

or

2. Completion of a residency program approved by the Accreditation Council for Graduate Medical Education (ACGME), the Royal College of Physicians and Surgeons of Canada (RCPS), the Collège des Médecins du Québec, or the American Osteopathic Association (AOA) to include a minimum of 3 months experience performing interventional radiology procedures and 6 months of documented formal training in interpreting cross-sectional imaging examinations. This training must include the experience of performing (with supervision) at least 35 image-guided percutaneous catheter placement with aspiration and/or drainage procedures, 25 of them as the primary operator, with outcomes within the quality improvement thresholds of this document.

or

3. Physicians whose residency or fellowship training did not include the above may still be considered qualified to perform percutaneous, catheter placement with aspiration and/or drainage procedures provided that the following can be demonstrated.

The physician must have at least 2 years of interventional radiology experience during which the physician was supervised and during which he/she performed and interpreted at least 35 image-guided percutaneous catheter placement procedures with aspiration and/or drainage, 25 of them as the primary operator, with outcomes within the quality improvement thresholds of this document.

and

4. Physicians meeting any of the qualifications in 1, 2, and 3 above must also have written substantiation that they are familiar with all of the following:
 - a. Indications and contraindications for the procedure.
 - b. Periprocedural and intraprocedural assessment, monitoring, and management of the patient and potential complications.
 - c. Where applicable, pharmacology of moderate sedation medications and recognition and treatment of adverse reactions and complications.
 - d. Imaging systems that may be used for guidance during percutaneous procedures.
 - e. Where applicable, principles of radiation protection, hazards of radiation exposure both to patients and to radiologic personnel, and monitoring requirements.

- f. Where applicable, pharmacology of contrast agents and recognition and treatment of potential adverse reactions.
- g. Percutaneous needle and catheter introduction techniques.
- h. Technical aspects of performing the procedure, including the use of alternative catheter and guide-wire systems.
- i. Anatomy, physiology, and pathophysiology of the structures being considered for PDAFC.

The written substantiation should come from the chief of interventional radiology, the director or chief of body imaging or ultrasound, or the chair of the department of the institution in which the physician will be providing these services. Substantiation could also come from a prior institution in which the physician provided the services, but only at the discretion of the current interventional director or chair who solicits the additional input.

Maintenance of Competence

Physicians must perform a sufficient number of PDAFC procedures to maintain their skills with acceptable success and complication rates as laid out in this guideline. Continued competence should depend on participation in a quality improvement program that monitors these rates.

Continuing Medical Education

The physician's continuing education should be in accordance with the [ACR Practice Guideline for Continuing Medical Education \(CME\)](#).

B. Qualified Medical Physicist

A Qualified Medical Physicist should have the responsibility for overseeing the equipment quality control program and for monitoring fluoroscopy and other cross-sectional imaging studies both upon installation and routinely on an annual basis. Medical physicists assuming these responsibilities should meet the following qualifications:

A Qualified Medical Physicist is an individual who is competent to practice independently in one or more of the subfields in medical physics. The American College of Radiology (ACR) considers certification and continuing education and experience in the appropriate subfield(s) to demonstrate that an individual is competent to practice one or more of the subfields in medical physics and to be a Qualified Medical Physicist. The ACR recommends that the individual be certified in the appropriate subfield(s) by the American Board of Radiology (ABR), the Canadian College of Physics in Medicine, or for MRI, by the

American Board of Medical Physics (ABMP) in magnetic resonance imaging physics.

The appropriate subfields of medical physics for this guideline are Diagnostic Radiological Physics and Radiological Physics.

A Qualified Medical Physicist should meet the [ACR Practice Guideline for Continuing Medical Education \(CME\)](#). (ACR Resolution 17, 1996 – revised in 2008, Resolution 7)

C. Registered Radiologist Assistant

A registered radiologist assistant is an advanced level radiographer who is certified and registered as a radiologist assistant by the American Registry of Radiologic Technologists (ARRT) after having successfully completed an advanced academic program encompassing an ACR/ASRT (American Society of Radiologic Technologists) radiologist assistant curriculum and a radiologist-directed clinical preceptorship. Under radiologist supervision, the radiologist assistant may perform patient assessment, patient management and selected examinations as delineated in the Joint Policy Statement of the ACR and the ASRT titled “Radiologist Assistant: Roles and Responsibilities” [25] and as allowed by state law. The radiologist assistant transmits to the supervising radiologists those observations that have a bearing on diagnosis. Performance of diagnostic interpretations remains outside the scope of practice of the radiologist assistant. (ACR Resolution 34, adopted in 2006)

D. Radiologic Technologist

The technologist, together with the physician and nursing personnel, should have responsibility for patient comfort and safety. The technologist should be able to prepare and position¹ the patient for the image-guided percutaneous procedure and, together with the nurse, monitor the

¹The American College of Radiology approves of the practice of certified and/or licensed radiologic technologists performing fluoroscopy in a facility or department as a positioning or localizing procedure only, and then only if monitored by a supervising physician who is personally and immediately available*. There must be a written policy or process for the positioning or localizing procedure that is approved by the medical director of the facility or department/service and that includes written authority or policies and processes for designating radiologic technologists who may perform such procedures. (ACR Resolution 26, 1987 – revised in 2007, Resolution 12m)

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

patient during the procedure. The technologist should obtain the imaging data in a manner prescribed by the supervising physician. If intravenous contrast material is to be administered, qualifications for technologists performing intravenous injection should be in compliance with the current ACR policy² and the operating procedures or manuals at the facility. The technologist should also perform regular quality control testing of the equipment under supervision of the physicist.

Technologists should be certified by the American Registry of Radiologic Technologists (ARRT) or have an unrestricted state license with documented training and experience in the imaging modality used for the image-guided percutaneous procedure.

E. Diagnostic Medical Sonographer

The sonographer, together with the physician and nursing personnel, should have responsibility for patient comfort and safety. The sonographer should be able to prepare and position the patient for the image-guided percutaneous procedure and, together with the nurse, monitor the patient during the procedure. The sonographer should obtain the imaging data in a manner prescribed by the supervising physician. The sonographer should also perform regular quality control testing of the equipment under supervision of the physicist.

Diagnostic medical sonographers should be certified by the ARRT or by the American Registry for Diagnostic Medical Sonography (ARDMS) or have an unrestricted state license with documented training and experience in the imaging modality used for the image-guided percutaneous procedure.

F. Other Ancillary Personnel

Other ancillary personnel who are qualified and duly licensed or certified under applicable state law may, under supervision by a radiologist or other qualified physician, perform specific interventional fluoroscopic or other image-guided procedures. Supervision by a radiologist or other qualified physician must be direct or personal and must comply with local, state, and federal regulations. Individuals should be credentialed for specific fluoroscopic and other image-guided interventional procedures and should have received formal training in radiation management and/or application of other imaging modalities as appropriate.

G. Nursing Services

Nursing services, when deemed appropriate by the performing physician, are an integral part of the team for preprocedural, intraprocedural, and postprocedural patient management and education and are recommended in monitoring the patient during the procedure.

H. Other Licensed Independent Practitioner

In cases where moderate sedation is used or the patient is critically ill, an experienced licensed provider should be present, whose sole responsibility is monitoring of the patient's vital signs, sedation state, and level of comfort/pain. For moderate sedation, refer to the [ACR–SIR Practice Guideline for Sedation/Analgesia](#).

V. SPECIFICATIONS AND PERFORMANCE OF THE PROCEDURE

A. Imaging Equipment and Facilities

The choice of modality for imaging guidance will depend on the site and characteristics of the collection, the skill and preference of the intervening physician, and the availability of appropriate imaging devices for guidance.

1. The minimum requirements for facilities in which PDAFC is performed include the following:
 - a. When fluoroscopic guidance is used, a high-resolution unit with adequate shielding and collimation is desirable. Ability to perform complex angle (e.g., anteroposterior, lateral, or oblique) fluoroscopy views is often necessary to ensure proper needle placement. Image and written documentation of needle or drainage catheter location is essential. Overhead fluoroscopic tube suites are less desirable because of their increased radiation exposure to personnel during this procedure.
 - b. When appropriate, availability of ultrasound is desirable. Proper transducer frequency is required to direct and monitor needle placement. This is especially true for diagnostic aspiration of fluid collections in the pleural space, peritoneal cavity, etc.
 - c. When appropriate, CT and/or CT fluoroscopic capability is desirable to better demonstrate anatomy, particularly in:
 - i. Patients with fluid collections that are difficult to visualize or access with other modalities, or are in unusual or precarious locations.

²See the [ACR Practice Guideline for the Use of Intravascular Contrast Media](#).

- ii. Planning the optimal access route to avoid, when possible, transgression of vital structures.
- iii. Patients with unusual anatomy.
- d. The facility should provide an area within the institution appropriate for patient preparation and for observation after the procedure. This might be within the radiology department, in a short-stay unit, or in a routine nursing unit as outlined in the Patient Care section below. There should be immediate access to emergency resuscitation equipment.
- e. For patients undergoing thoracic procedures, a full array of percutaneous catheterization equipment for treating pneumothorax should be available.
- f. Access to a laboratory with expertise in cytopathology, microbiology, and chemistry should be available. (These resources need not be located in the facility.)

2. Performance guidelines

When using fluoroscopy for PDAFC, a facility should meet or exceed the following imaging practices:

- a. Fluoroscopic times for both X-ray and CT guidance should be kept to a minimum. The operator will use only as much fluoroscopy as is necessary to achieve aspiration and/or catheter drainage, consistent with the as-low-as-reasonably-achievable (ALARA) radiation safety guidelines. One method to minimize fluoroscopic time is to employ units with “last image hold” capability.
 - b. Tight collimation and, when appropriate, shielding (e.g., thyroid, gonadal) should be used.
 - c. On units where dose reduction pulsed fluoroscopy is available, its use is recommended.
3. Appropriate emergency equipment and medications must be immediately available to treat adverse reactions associated with administered medications. The equipment should be monitored and medications inventoried for drug expiration dates on a regular basis. The equipment, medications, and other emergency support must also be appropriate for the range of ages and/or sizes in the patient population.

B. Physiologic Monitoring and Resuscitation Equipment

- 1. Appropriate equipment should be present to allow for monitoring the patient’s heart rate,

cardiac rhythm, and blood pressure. For facilities using moderate sedation, a pulse oximeter should be available. (See the [ACR–SIR Practice Guideline for Sedation/Analgesia](#).)

- 2. There should be ready access to emergency resuscitation equipment and drugs, to include the following: a defibrillator, oxygen supply and appropriate tubing and delivery systems, suction equipment, tubes for endotracheal intubation, laryngoscope, ventilation bag-mask-valve apparatus, and central venous line sets. Drugs for treating cardiopulmonary arrest, contrast reaction, vasovagal reactions, narcotic or benzodiazepine overdose, bradycardia, and ventricular dysrhythmias should also be readily available. Resuscitation equipment should be monitored and checked on a routine basis in compliance with institutional policies.
- 3. Any procedure performed using MRI guidance must have MRI safety compatible emergency resuscitation equipment available.

C. Acute Care Support

Although complications of PDAFC only rarely require urgent surgery, some of these procedures should be performed in an environment where surgical intervention can be instituted promptly. Ideally, this would be a facility with adequate surgical, anesthesia, and ancillary support. When these procedures are performed in a freestanding center, detailed protocols for the rapid transport or admission of patients to an acute-care hospital should be formalized in writing.

D. Patient Care

The written or electronic request for PDAFC should provide sufficient information to demonstrate the medical necessity of the procedure and allow for its proper performance and interpretation.

Documentation that satisfies medical necessity includes 1) signs and symptoms, 2) relevant history (including known diagnoses, and/or 3) prior imaging). Additional information regarding the specific reason for the procedure or a provisional diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the procedure.

The request for the procedure 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)

1. Preprocedural care
 - a. The physician performing the procedure must have knowledge of the following:
 - i. Clinically significant history, including indications for the procedure.
 - ii. Clinically significant physical examination findings, to include an awareness of clinical or medical conditions that may necessitate specific care, such as preprocedure antibiotics or other measures.
 - iii. Possible alternative methods, such as surgery, to obtain the desired diagnostic information or therapeutic result.
 - b. Informed consent must be in compliance with state laws and should comply with the [ACR–SIR Practice Guideline on Informed Consent for Image-Guided Procedures](#).

2. Procedural care
 - a. Adherence to the Joint Commission’s Universal Protocol for Preventing Wrong Site, Wrong Procedure, Wrong Person Surgery™ is required for procedures in non-operating room settings including bedside procedures. “Time out” must be conducted in the location where the procedure will be done just before starting the procedure and must:
 - Involve the entire operative team.
 - Use active communication.
 - Be briefly documented, such as in a checklist, and include at least:
 - Correct patient identity.
 - Correct site.
 - Agreement on the procedure to be done.

The organization should have processes and systems in place for reconciling differences in staff responses during the “time out.”

- b. During the use of X-ray or CT fluoroscopy, the physician should use exposure factors consistent with the ALARA radiation safety guidelines.
- c. Nursing personnel, technologists, and those directly involved in the patient care during PDAFC should have protocols for use in standardizing care. These should include, but are not limited to:
 - i. Equipment needed for the procedure.
 - ii. Patient monitoring.
- d. Protocols should be reviewed and updated periodically.

3. Postprocedural care
 - a. Orders for postprocedure patient care should include frequency of monitoring of vital signs, drainage catheter care, discharge instructions, etc.
 - b. Specific anatomic considerations
 - i. Thoracic cavity: pulmonary assessment for the presence of pneumothorax and to confirm adequate catheter placement.
 - a. If guidance was by fluoroscopy or ultrasound, an upright chest radiograph should be obtained when appropriate.
 - b. If guidance was by CT, a tailored postprocedure CT scan should be obtained.
 - ii. Peritoneal and other cavities: confirmation of appropriate tube placement.
 - iii. Postprocedure imaging and follow-up may involve gentle injection of contrast material to confirm catheter placement within the abscess or symptomatic fluid collection cavity, assessing fistulae to bowel or other structures, or documenting the reduction in cavity size and absence of fistulous connections.
 - iv. Appropriate adjunct drainage maneuvers include: irrigation of the abscess cavity, drainage tube upsizing, antibiotic therapy, etc.
 - c. Clinical and imaging follow-up
 - i. Periodic imaging follow-up may be appropriate to facilitate resolution of abscess or symptomatic fluid collection.
 - ii. Clinical follow-up only may suffice if patient condition, catheter drainage output, and laboratory evidence confirm progressive improvement.

E. Specifics of the Procedure

1. All invasive image-guided percutaneous procedures involving aspiration of fluid collections with or without percutaneous catheter drainage (PCD) are performed for specific indications, and the examination or procedure should therefore be tailored accordingly.
2. In the setting of image-guided percutaneous aspiration of fluid collections for diagnostic purposes, initial placement of a small needle (i.e., 18-22 gauge) is advised when appropriate.
3. The physician should be aware of the technique for definitive drainage with needle/guide-

wire/catheter/trocar techniques since diagnostic percutaneous fluid aspiration may lead to therapeutic placement of a percutaneous drainage catheter.

VI. DOCUMENTATION

Reporting should be in accordance with the [ACR–SIR Practice Guideline for Reporting and Archiving of Interventional Radiology Procedures](#).

VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, radiologic technologists, and all supervising physicians have a responsibility to minimize radiation dose to individual patients, to staff, and to society as a whole, while maintaining the necessary diagnostic image quality. This concept is known as “as low as reasonably achievable (ALARA).”

Facilities, in consultation with the medical physicist, should have in place and should adhere to policies and procedures, in accordance with ALARA, to vary examination protocols to take into account patient body habitus, such as height and/or weight, body mass index or lateral width. The dose reduction devices that are available on imaging equipment should be active; if not, manual techniques should be used to moderate the exposure while maintaining the necessary diagnostic image quality. Periodically, radiation exposures should be measured and patient radiation doses estimated by a medical physicist in accordance with the appropriate ACR Technical Standard. (ACR Resolution 17, adopted in 2006 – revised in 2009, Resolution 11)

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

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading *Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education* on the ACR web page (<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](#).

IX. QUALITY IMPROVEMENT

While practicing physicians should strive to achieve perfect outcomes (e.g., 100% success, 0% complications), in practice all physicians will fall short of this ideal to a variable extent. Thus, indicator thresholds may be used to assess the efficacy of ongoing quality-improvement programs. For the purposes of these guidelines, a threshold is a specific level of an indicator that should prompt a review. Procedure thresholds or overall thresholds refer to a group of indicators for a procedure (e.g., major complications). Individual complications may also be associated with complication specific thresholds.

When measures such as indications or success rates fall below a minimum threshold or when complication rates exceed a maximum threshold, a review should be performed to determine causes and to implement changes, if necessary. For example, if the incidence of sepsis is one measure of the quality of abscess drainage, then values in excess of the defined threshold (in this case 4%) should trigger a review of policies and procedures within the department to determine the causes and to implement changes to lower the incidence of the complication. Thresholds may vary from those listed here; for example, patient referral patterns and selection factors may dictate a different threshold value for a particular indicator at a particular institution. Thus, setting universal thresholds is very difficult, and each department is urged to alter the thresholds as needed to higher or lower values to meet its own quality-improvement program needs.

A. Success Rates and Thresholds

Success Rates

Successful diagnostic fluid aspiration is defined as the aspiration of material sufficient for diagnosis.

<u>Successful Diagnostic Fluid Aspiration</u>	<u>Threshold</u>
Aspiration of adequate fluid for diagnostic characterization	95%

Curative drainage is defined as complete resolution of infection requiring no further operative intervention. Curative drainage has been achieved in more than 80% of patients. Partial success is defined as either adequate drainage of the abscess with surgery subsequently performed to repair an underlying problem or as temporizing drainage performed to stabilize the patient prior to surgery. Partial success occurs in 5% to 10% of patients. Failure occurs in 5% to 10% and recurrence in 5% to 10%. These results are similar for both abdominal and chest drainage procedures. Success rates will depend on the proportion of collections drained in patients with relative contraindications, on the complexity of the

collection, and on the severity of the underlying medical problems.

Successful drainage (Curative or partial success) Threshold 85%

Drainage of infected collections: Due to the variability of the types of infected collections, the success rate of drainage will be highly variable and it is not believed that a specific threshold for success can be set.

B. Complication Rates and Thresholds

Complications for PDAFC are reported to occur in approximately 10% of patients. Published complication rates and suggested thresholds include the following:

Specific Major Complication	Reported Rate	Suggested Threshold
Septic shock	1% to 2%	4%
Bacteremia requiring significant new intervention	2% to 5%	10%
Hemorrhage requiring transfusion	1%	2%
Superinfection (includes infection of sterile fluid collection)	1%	2%
Bowel transgression requiring intervention	1%	2%
Pleural transgression requiring intervention (abdominal procedures)	1%	2%
Pleural transgression requiring additional intervention (chest procedures)	2% to 10%	20%

Published rates for individual types of complications are highly dependent on patient selection and are based on series comprising several hundred patients, which is a volume larger than most individual practitioners are likely to treat. Generally the complication-specific thresholds should be set higher than the complication-specific reported rates listed above. It is also recognized that a single complication can cause a rate to cross above a complication-specific threshold when the complication occurs within a small patient volume (e.g., early in a quality improvement program). In this situation, the overall procedure threshold is more appropriate for use in a quality-improvement program. In the above table all values were supported by the weight of literature evidence and panel consensus.

Overall Procedure Threshold
All major complications resulting from adult PDAFC 10%

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REFERENCES

1. Quality improvement guidelines for adult percutaneous abscess and fluid drainage. Society of Cardiovascular and Interventional Radiology Standards of Practices Committee. *J Vasc Interv Radiol* 1995;6:68-70.
2. Brown CV, Abrishami M, Muller M, Velmahos GC. Appendiceal abscess: immediate operation or percutaneous drainage? *Am Surg* 2003;69:829-832.

3. Chou YH, Tiu CM, Liu JY, et al. Prostatic abscess: transrectal color Doppler ultrasonic diagnosis and minimally invasive therapeutic management. *Ultrasound Med Biol* 2004;30:719-724.
4. Cinat ME, Wilson SE, Din AM. Determinants for successful percutaneous image-guided drainage of intra-abdominal abscess. *Arch Surg* 2002;137:845-849.
5. Gervais DA, Ho CH, O'Neill MJ, Arellano RS, Hahn PF, Mueller PR. Recurrent abdominal and pelvic abscesses: incidence, results of repeated percutaneous drainage, and underlying causes in 956 drainages. *AJR* 2004;182:463-466.
6. Gjelland K, Ekerhovd E, Granberg S. Transvaginal ultrasound-guided aspiration for treatment of tubo-ovarian abscess: a study of 302 cases. *Am J Obstet Gynecol* 2005;193:1323-1330.
7. Gupta S, Suri S, Gulati M, Singh P. Ilio-psoas abscesses: percutaneous drainage under image guidance. *Clin Radiol* 1997;52:704-707.
8. Leborgne F, Leborgne F. Treatment of breast abscesses with sonographically guided aspiration, irrigation, and instillation of antibiotics. *AJR* 2003;181:1089-1091.
9. Siewert B, Tye G, Kruskal J, Sosna J, Opelka F. Impact of CT-guided drainage in the treatment of diverticular abscesses: size matters. *AJR* 2006;186:680-686.
10. Singh AK, Gervais DA, Alhilali LM, Hahn PF, Mueller PR. Imaging-guided catheter drainage of abdominal collections with fistulous pancreaticobiliary communication. *AJR* 2006;187:1591-1596.
11. Thanos L, Dailiana T, Papaioannou G, Nikita A, Koutrouvelis H, Kelekis DA. Percutaneous CT-guided drainage of splenic abscess. *AJR* 2002;179:629-632.
12. Thanos L, Mylona S, Kalioras V, Pomoni M, Batakis N. Potentially life-threatening neck abscesses: therapeutic management under CT-guided drainage. *Cardiovasc Intervent Radiol* 2005;28:196-199.
13. Yu SC, Ho SS, Lau WY, et al. Treatment of pyogenic liver abscess: prospective randomized comparison of catheter drainage and needle aspiration. *Hepatology* 2004;39:932-938.
14. Gervais DA, Hahn PF, O'Neill MJ, Mueller PR. Percutaneous abscess drainage in Crohn disease: technical success and short- and long-term outcomes during 14 years. *Radiology* 2002;222:645-651.
15. Gutierrez A, Lee H, Sands BE. Outcome of surgical versus percutaneous drainage of abdominal and pelvic abscesses in Crohn's disease. *Am J Gastroenterol* 2006;101:2283-2289.
16. O'Moore PV, Mueller PR, Simeone JF, et al. Sonographic guidance in diagnostic and therapeutic interventions in the pleural space. *AJR* 1987;149:1-5.
17. Parker LA, Charnock GC, Delany DJ. Small bore catheter drainage and sclerotherapy for malignant pleural effusions. *Cancer* 1989;64:1218-1221.
18. Silverman SG, Mueller PR, Saini S, et al. Thoracic empyema: management with image-guided catheter drainage. *Radiology* 1988;169:5-9.
19. Stavas J, vanSonnenberg E, Casola G, Wittich GR. Percutaneous drainage of infected and noninfected thoracic fluid collections. *J Thorac Imaging* 1987;2:80-87.
20. vanSonnenberg E, D'Agostino HB, Casola G, Wittich GR, Varney RR, Harker C. Lung abscess: CT-guided drainage. *Radiology* 1991;178:347-351.
21. Walser EM, Nealon WH, Marroquin S, Raza S, Hernandez JA, Vasek J. Sterile fluid collections in acute pancreatitis: catheter drainage versus simple aspiration. *Cardiovasc Intervent Radiol* 2006;29:102-107.
22. Giorgio A, de Stefano G, Di Sarno A, Liorre G, Ferraioli G. Percutaneous needle aspiration of multiple pyogenic abscesses of the liver: 13-year single-center experience. *AJR* 2006;187:1585-1590.
23. Rajak CL, Gupta S, Jain S, Chawla Y, Gulati M, Suri S. Percutaneous treatment of liver abscesses: needle aspiration versus catheter drainage. *AJR* 1998;170:1035-1039.
24. Wroblecka JT, Kuligowska E. One-step needle aspiration and lavage for the treatment of abdominal and pelvic abscesses. *AJR* 1998;170:1197-1203.
25. ACR ASRT joint statement radiologist assistant roles and responsibilities. In: *Digest of Council Actions*. Reston, Va: American College of Radiology; 2007:149.

APPENDIX A

Society of Interventional Radiology Standards of Practice Committee Classification of Complications by Outcome

Minor Complications

- A. No therapy, no consequence.
- B. Nominal therapy, no consequence; includes overnight admission for observation only.

Major Complications

- C. Require therapy, minor hospitalization (<48 hours).
- D. Require major therapy, unplanned increase in level of care, prolonged hospitalization (>48 hours).
- E. Permanent adverse sequelae.
- F. Death.

*Guidelines and standards are published annually with an effective date of October 1 in the year in which amended, revised, or approved by the ACR Council. For guidelines and standards published before 1999, the effective date was January 1 following the year in which the guideline or standard was amended, revised, or approved by the ACR Council.

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