Standards for the Performance of Percutaneous Abscess Drainage

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The standards of the Canadian Association of Radiologists (CAR) are not rules, but are guidelines that attempt to define principles of practice that should generally produce radiological care. The physician and medical high-quality physicist may modify an existing standard as determined by the individual patient and available resources. Adherence to CAR standards will not assure a successful outcome in every situation. The standards should not be deemed inclusive of all proper methods of care or exclusive of other methods of care reasonably directed to obtaining the same results. The standards are not intended to establish a legal standard of care or conduct, and deviation from a standard does not, in and of itself, indicate or imply that such medical practice is below an acceptable level of care. The ultimate judgment regarding the propriety of any specific procedure or course of conduct must be made by the physician and medical physicist in light of all circumstances presented by the individual situation.

I. INTRODUCTION AND DEFINITION

Abscesses carry a mortality rate of up to 80% if left undrained. Percutaneous abscess drainage (PAD) combines principles of surgical drainage with percutaneous techniques and equipment. PAD is as successful as surgical drainage in many cases with a much lower morbidity and mortality.

PAD is defined as percutaneous introduction of a drainage catheter into an abscess. This involves precise needle puncture using CT or ultrasound guidance with or without fluoroscopic assistance.

II. RADIOLOGIST QUALIFICATION

Physicians involved in the performance, supervision and interpretation of percutaneous abscess drainage should be Diagnostic Radiologists and must have a Fellowship or Certification in Diagnostic Radiology with the Royal College of Physicians and Surgeons of Canada and/or the Collège des médecins du Québec. Also acceptable are equivalent foreign Radiologist qualifications if the Radiologist is certified by a recognized certifying body and holds a valid provincial license.

As new imaging modalities and interventional techniques are developed additional clinical training, under supervision and with proper documentation, should be obtained before radiologists interpret or perform such examinations or procedures independently. Such additional training must meet with pertinent provincial/regional regulations. Continuing professional development must meet with the requirements of the Maintenance of Certification Program of the Royal College of Physicians and Surgeons of Canada.

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

The physician performing PAD must fully appreciate the benefits, alternatives, and risks of the procedure. He/she 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 safely perform the procedure. Physicians must perform a sufficient number of percutaneous aspirations and drainages to maintain image-guided their skills with acceptable success and complication rates as laid out in this standard. Continued competence should depend on participation in a quality improvement program that monitors these rates. Appropriate attendance at postgraduate courses that provide continuing education on diagnostic advances, newer techniques, and equipment is necessary.

III. TECHNOLOGIST CREDENTIALS CRITERIA

The Medical Radiation Technologist must have Canadian Association Medical Radiation Technologist certification or be certified by an equivalent licensing body recognized by the CAMRT.

Under the overall supervision of the Radiologist the Technologist will have the responsibility for patient comfort and safety, for examination preparation and performance, for image technical evaluation and quality, and
applicable quality assurance. The training of Technologists specifically engaged in CT shall meet with applicable and valid National and Provincial Specialty qualifications.

IV. INDICATIONS AND CONTRAINDICATIONS

A. Indications

The indications for PAD include, but are not limited to:
A. Diagnosing the nature of a fluid collection, particularly to exclude infectious or malignant etiology.
B. Treating symptomatic fluid and/or air collection(s).
C. Treating recurrent fluid collection(s) with instillation of a sclerosing agent.
D. Treating infected collections

Examples of anatomic regions where PAD may be appropriate include, but are not limited to: solid organs such as the kidney, liver, and lung; pleural, peritoneal, and retroperitoneal spaces; subcutaneous tissues; and muscle.

There are no absolute contraindications. However, there are relative contraindications. As with all patients considered for this procedure, the relative benefits and risks of the procedure should be weighed carefully.

B. Contraindications

The relative contraindications for PAD include:
A. Known coagulopathy, which cannot be adequately corrected;
B. Inability of the patient to cooperate with, or to be positioned for, the procedure;
C. Known adverse reaction to contrast media when contrast media administration is critical to the safe performance of the procedure;
D. Hemodynamic instability;
E. Lack of a safe pathway to the lesion; and
F. Not all collections are suitable for percutaneous drainage
G. Multiple collections
H. Collections with solid or necrotic tissue
I. Severely compromised pulmonary function for patients undergoing thoracic interventions when there are risks of further compromise inherent to the procedure.

Patient management should address these relative contraindications prior to the procedure. Every effort should be made to correct or control these clinical situations before the procedure, if feasible.

All imaging facilities should have policies and procedures to reasonably attempt to identify pregnant patients prior to the performance of any diagnostic examination involving ionizing radiation. If the patient is known to be pregnant, the potential radiation risk to the fetus and clinical benefits of the procedure should be considered before proceeding with the study.

V. EXAMINATION TECHNIQUE, PERFORMANCE AND RELATED MATTERS

PAD may start with diagnostic sampling of a fluid collection. This requires percutaneous needle placement into the collection; the principles are similar to those of percutaneous biopsies. After the puncture, a small amount of fluid is aspirated for gram stain and cultures. However, aspiration of visibly purulent material is also diagnostic of abscess. Once an abscess has been identified as such, a drainage catheter can be placed either by the seldinger or trocar technique.

The procedure can be performed using CT or US guidance with or without fluoroscopy. US is well suited for PAD; the initial needle puncture can be guided with US in the angiography suite, which permits fluoroscopic guidance for subsequent guidewire and catheter manipulation.

Many operators rely on the CT examination to plan the needle track. It is also possible to puncture the abscess with CT guidance but guidewire and catheter manipulation can be better monitored under fluoroscopy.

A. Imaging Equipment and Facilities

1. The minimum requirements for facilities in which PAD is performed include:
a. A high-resolution imaging chain with adequate shielding and collimation are essential for fluoroscopic guidance. Ability to perform complex angle (e.g., anteroposterior (AP), lateral, or oblique) views is often necessary during fluoroscopically guided procedures to ensure proper needle placement. Image and written documentation of needle or drainage catheter tip location are essential. Overhead fluoroscopic tube suites are less desirable because of 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 capability is desirable to better demonstrate anatomy, particularly in:

   i. Patients with fluid collections in unusual or difficult to access locations.

   ii. Locating the optimal access route to avoid, when possible, transgressing vital structures.

   iii. Patients with unusual anatomy.

d. The facility should provide an area within the institution appropriate for patient preparation prior to the procedure and for observation of patients after the procedure. This might be within the radiology department, in a short-stay unit, or on a routine nursing unit as outlined in Section V. D below. There should be immediate access to emergency resuscitation equipment.

e. For patients undergoing thoracic procedures, a full array of percutaneous catheterization equipment for treatment of pneumothorax should be available.

f. Laboratory facilities should be available with expertise in cytopathology, microbiology, and chemistry.

2. Performance standards

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

a. Fluoroscopic time 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.

b. Tight collimation and, when appropriate, shielding (e.g., thyroid, gonadal, etc.).

3. An emergency cart containing appropriate medication and resuscitation equipment must be available to treat adverse reactions.

B. Physiologic Monitoring and Resuscitation Equipment

1. Sufficient equipment should be present to allow for monitoring the patient’s heart rate, cardiac rhythm, and blood pressure. For facilities utilizing conscious sedation, a pulse oximeter should be available.

2. There should be ready access to equipment and drugs for emergency resuscitation. The equipment should include an emergency defibrillator with paper recorder and quick-view capability, oxygen supply and appropriate tubing and delivery systems, suction equipment, tubes for endotracheal intubation, laryngoscope, ventilation bag-apparatus, and central
venous line sets. Drugs mask-valve for treating cardiopulmonary arrest, contrast reaction, vasovagal reactions, narcotic or benzodiazepine overdose, bradycardia, and ventricular arrhythmias should also be readily available.

C. Surgical Support

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

D. Patient Care

1. Preprocedure 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 including an awareness of clinical or medical conditions which may necessitate specific care.

      iii. Possible alternative methods, such as surgery, to obtain the desired diagnostic information or therapeutic result.

   b. Informed consent is recommended.

2. Procedural care

   a. During the use of fluoroscopy, the physician should use exposure factors ALARA.

   b. Nursing personnel, technologists, and those directly involved in the patient care during PAD should have protocols for use in standardizing care. These should include, but are not limited to, the following:

      i. Equipment needed for the procedure.

      ii. Patient monitoring.

      Protocols should be reviewed and updated periodically.

3. Postprocedure 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 used by fluoroscopy or ultrasound, an upright chest radiograph should be obtained when appropriate.

      b. If guidance was by CT, a tailored postprocedure 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 tube placement within the abscess/symptomatic fluid collection cavity. Assessment in appropriate setting of fistulae to bowel.

c. Clinical and imaging follow-up

i. Periodic imaging follow-up may be appropriate to facilitate abscess/symptomatic fluid collection resolution.

ii. Clinical follow-up only may suffice if patient condition, tube 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 (PAD) are performed for specific indications, and the examination/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 is advisable unless it is known that the fluid collection is extremely thick and viscous, which may dictate the use of a larger gauge needle.

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.

4. The physician performing PAD of fluid collections must understand tube maintenance and postprocedure care. This includes the appropriate use of suction or water-seal drainage versus gravity drainage; the need for follow-up imaging, possibly with contrast injection into a cavity to search for fistulous connections; the possible need for irrigation of the abscess cavity; the occasional need for tube upsizing; and the need for antibiotic therapy, etc.

VI. 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 Threshold

Success Rates
Diagnostic fluid aspiration
Successful diagnostic fluid aspiration is defined as the aspiration of material sufficient for diagnosis.
Successful diagnostic fluid aspiration Threshold
Drainage of Infected Collections 95%

Curative drainage is defined as complete resolution of infection requiring no further surgical 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%-10% of patients. Failure occurs in 5%-10% and recurrence in 5%-10% (1-3). These results are similar for both abdominal and chest drainage procedures (4-7). These 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 and partial success)
Threshold
Drainage of Uninfected Collections: 85%

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

B. Complication Rates and Threshold

DEFINITION: Complications can be stratified on the basis of outcome. Major complications result in admission to the hospital for therapy (for outpatient procedures), an unplanned increase in the level of care, prolonged hospitalization, permanent adverse sequelae, or death. Minor complications result in no sequelae; they may require nominal therapy or a short hospital stay for observation (generally overnight) (See Appendix A). The complication rates and thresholds presented refer to major complications, unless otherwise noted. Indicator thresholds may be used to assess the efficacy of ongoing quality improvement programs.

Complications for (PAD)

Published complication rates and suggested thresholds include the following:
Specific Major Complications Reported Suggested Rate Threshold
Septic shock 1%-2% 4%
Bacteremia requiring significant new intervention 2%-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%-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. Therefore, we recommend that thresholds be set higher than the complication-specific published rates listed above. It is also complication-specific recognized that a single complication can cause a rate to cross above a complication-specific threshold when the complication occurs in a small volume of patients (e.g., early in a program). In this situation, the quality-improvement overall procedure threshold is more appropriate for use in a program. quality-improvement program

Overall procedure threshold
All major complications resulting from adult PDAFC 10%

VI. REFERENCES


