



College of Radiology,
Academy of Medicine of Malaysia

**Clinical Practice Guidelines
for
Interventional Radiology**

30 June 2008

These recommendations provide guidance to radiology and allied professionals in the field of interventional radiology for appropriate interventional radiology practice that is as effective as possible and safe for the patient.

Whilst all are encouraged to strive for the best standard of care, these recommendations are not intended and should not be used for medico legal purposes. As always, practicalities as well as circumstances may warrant variations or adaptations of these recommendations yet, should not compromise the delivery of adequate interventional radiological care to the patient.

The recommendations will be reviewed as and when the need arises or when new techniques, information, study results and technology emerges.

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Preamble

In the age where accreditation and quality assurance programmes are keywords, we as doctors must not forget that the aim of medical and surgical treatment is to always provide the best standard of care to patients. In order to do this the College of Radiology, Academy of Medicine of Malaysia (CoR) set out to establish certain guidelines. The CoR understands that there is a wide variation of facilities within our hospital and clinics in Malaysia and these guidelines should be use as educational tools for practising radiologists and other practitioners of interventional radiology and should not be used to establish a legal standard of care.

Interventional radiology in Malaysia has grown in leaps and bounds in the last 10 years. One of the pioneers of interventional radiology is Dato' Dr Abdul Samad Sakijan. He performed the first image guided procedure and trained the first few batches of interventional radiologists. The teaching hospitals have since taken the mantle and provided more extensive and comprehensive training. Interventional radiology is a specialized field that covers diagnostic radiology with minimally invasive procedures. As such it has its own unique safety issues which are the procedure itself, the contrast use and radiation protection.

The guidelines are for the more common procedures done such as angiograms and ultrasound-guided drainage procedures. The guidelines are devised by a team of interventional radiologists who looked through published and accepted guidelines from the Society of Interventional Radiology, American College of Radiology and several other published papers and have selected the most appropriate guidelines with regards to our local context.

The guidelines are intended to provide education and awareness on the best clinical practice in performing interventional procedures. The procedures covered would be:

1. Diagnostic Angiography
2. Percutaneous drainage procedure

This document does not cover:

1. Detailed radiation protection guidelines on room requirements
2. Detailed qualification requirements of the interventional radiology practitioner

The guideline is to be used by practising interventional radiologists, medical physicists, cardiologists, other interventional radiology practitioners and hospital management. The guidelines cover procedures for both adults and the paediatric population.

TABLE OF CONTENTS FOR DIAGNOSTIC ANGIOGRAPHY

I. INTRODUCTION	5
II. DEFINITION AND TERMS IN ANGIOGRAPHY	5
III. INDICATIONS AND CONTRAINDICATIONS	6
IV. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL	8
V. SPECIFICATIONS OF THE EXAMINATION	8
VI. RADIATION SAFETY IN IMAGING	10
VII. QUALITY IMPROVEMENT	10
VII. TABLE 1: INDICATORS AND THRESHOLDS FOR COMPLICATIONS IN DIAGNOSTIC ARTERIOGRAPHY	13
IX. APPENDIX A	14
X REFERENCES	15

GUIDELINES FOR DIAGNOSTIC ANGIOGRAPHY (ARTERIOGRAPHY) IN ADULTS

I. INTRODUCTION

The guidelines were adapted from the Society of Interventional Radiology (SIR) and the American College of Radiology (ACR) guidelines.

II. DEFINITIONS AND TERMS IN ANGIOGRAPHY

For the purposes of this document, the following definitions are used:

Diagnostic arteriogram - a procedure involving percutaneous passage of a needle and/or catheter into an artery followed by injection of contrast material and imaging of the vascular distribution in question using digital imaging or serial film systems.

Indicator - a specific, quantifiable, and objective measure of quality. For example, when measuring the safety of a procedure as one aspect of quality, specific complications would be the indicators.

Threshold - the specific level of an indicator that would cause a review to be performed. For example, if the incidence of contrast media associated nephrotoxicity is used as an indicator of the quality of arteriography, exceeding a defined threshold in this case 0.2%, should trigger a review of the individual or department to determine causes and to implement changes to lower the incidence.

Success - the completion of the arteriogram, including gaining access to the artery, choosing the appropriate catheters, obtaining a set of complete images, and the timely and accurate interpretation of the findings. A successful arteriogram does not necessarily imply that the procedure is complication free; one may have a successful arteriogram with or without complications.

III. INDICATIONS AND CONTRAINDICATIONS

A. Indications

1. Pulmonary arteriography [3-11; ACR]
 - a. Suspected acute pulmonary embolus, in particular when other diagnostic tests are inconclusive or discordant with clinical findings.
 - i. High-probability ventilation-perfusion or helical CT scan when there is a contraindication to anticoagulation.
 - ii. Indeterminate ventilation-perfusion or helical CT scan in a patient suspected of having pulmonary embolus.
 - iii. Low-probability ventilation-perfusion or helical CT scan in a patient with a high clinical suspicion of pulmonary embolus.
 - iv. Ventilation perfusion or helical CT scan cannot be performed.
 - b. Suspected chronic pulmonary embolus.
 - c. Other suspected pulmonary abnormalities, such as vasculitis, congenital and acquired anomalies, tumor encasement, and vascular malformations.
 - d. Prior to pulmonary artery interventions.
2. Spinal arteriography [12,13;ACR]
 - a. Spine and spinal cord tumors.
 - b. Vascular malformations.
 - c. Spinal trauma.
 - d. Preoperative evaluation prior to open or endovascular aortic or spinal surgery.
 - e. Prior to interventional procedures.
3. Bronchial arteriography [7,9,11;SIR]
 - a. Haemoptysis.
 - b. Suspected congenital cardiopulmonary anomalies.
 - c. Assessment of distal pulmonary artery circulation (through collaterals) in patients who are potential candidates for pulmonary thromboendarterectomy or endovascular surgery.
 - d. Prior to interventional procedures.
4. Aortography [11,12;SIR]
 - a. Intrinsic abnormalities, including transection, dissection, aneurysm, occlusive disease, aortitis, and congenital anomaly.
 - b. Assessment of aorta and its branches prior to selective studies.
 - c. Prior to interventional procedures or in conjunction with endovascular surgery.
5. Abdominal visceral arteriography [13-19;SIR]
 - a. Acute or chronic gastrointestinal hemorrhage.
 - b. Blunt or penetrating abdominal trauma.
 - c. Intra-abdominal tumors.
 - d. Acute or chronic intestinal ischemia.
 - e. Portal hypertension and varices.
 - f. Primary vascular abnormalities, including aneurysms, vascular malformations, occlusive disease, or vasculitis.
 - g. Preoperative assessment.
 - h. Preoperative and postoperative assessment of organ transplantation.
 - i. Preoperative and postoperative assessment of portosystemic shunts.
 - j. Preliminary procedure for CT portography.
 - k. Prior to interventional procedures.

6. Renal arteriography [**20,21;SIR**]
 - a. Renovascular occlusive disease (e.g., for hypertension or progressive renal insufficiency).
 - b. Renal vascular trauma.
 - c. Primary vascular abnormalities, including aneurysms, vascular malformations, and vasculitis.
 - d. Renal tumors.
 - e. Hematuria of unknown cause.
 - f. Preoperative and postoperative evaluation for renal transplantation.
 - g. Prior to interventional procedures or in conjunction with endovascular surgery.

7. Pelvic arteriography [**13,22;SIR**]
 - a. Atherosclerotic aortoiliac disease.
 - b. Gastrointestinal or genitourinary bleeding.
 - c. Trauma.
 - d. Primary vascular abnormalities, including aneurysms, vascular malformations, and vasculitis.
 - e. Male impotence caused by arterial occlusive disease.
 - f. Pelvic tumors.
 - g. Prior to interventional procedures.

8. Extremity arteriography [**23-29;SIR**]
 - a. Atherosclerotic vascular disease, including aneurysms, emboli, occlusive disease, and thrombosis.
 - b. Vascular trauma.
 - c. Preoperative planning for and postoperative evaluation of reconstructive surgery.
 - d. Assessment of surgical bypass grafts and dialysis grafts and fistulas.
 - e. Other primary vascular abnormalities, including vascular malformations, vasculitis, entrapment syndrome, thoracic outlet syndrome, etc.
 - f. Tumors.
 - g. Prior to interventional procedure.

B. Contraindications

There are no absolute contraindications to diagnostic arteriography.

Relative contraindications include:

1. Severe hypertension.
2. Uncorrectable coagulopathy
3. Clinically significant sensitivity to iodinated contrast material
4. Renal insufficiency
5. Not-fasting for the past 4 hours

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.

IV. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

Continuous Radiological Education is needed to maintain competence and update knowledge,

All staff in the department needs to be adequately trained and understand the principles in sedation and resuscitation.

All radiologists, trainees, nurses, and radiographers need to attend the Basic Resuscitation Course. Advanced Course in Life Support is recommended for doctors and nurses.

All personnel should have basic radiation protection and safety training and be a registered radiation worker.

V. SPECIFICATIONS OF THE EXAMINATION

A. Equipment and Facilities

1. A high-resolution image intensifier and television chain with standard arteriographic filming capabilities. Digital angiographic systems are recommended, as they allow for reduced volumes of contrast material and reduced examination times. Imaging and image recording must be consistent with the as-low-as-reasonably-achievable (ALARA) radiation safety guidelines.
2. Adequate angiographic supplies such as catheters, guidewires, needles, and introducer sheaths.
3. An angiographic injector with appropriate safety mechanisms.
4. An angiography suite that is large enough to allow safe transfer of the patient from the bed to the table and allow room for the procedure table, monitoring equipment, and other hardware such as respirators, anesthesia equipment, and oxygen tanks.
5. An area for pre-procedural preparation and post-procedural observation and monitoring of the patient with immediate access to emergency resuscitation equipment.

B. Physiologic Monitoring and Resuscitation Equipment

1. Sufficient equipment for monitoring the patient's heart rate, cardiac rhythm, and blood pressure. If the patient is to receive moderate sedation, a pulse oximeter should be available.
2. There should be ready access to emergency resuscitation equipment and drugs. Resuscitation equipment should be monitored and routinely checked in compliance with institutional policies.
3. If peripheral or pulmonary arteriography is regularly performed, physiologic pressure monitors should be available for determining intra-arterial pressure gradients as needed.

C. Surgical Support

Although complications of diagnostic arteriography only rarely require urgent surgery, these procedures should be performed in an environment where operative repair can be instituted promptly. Ideally, this would be an acute-care hospital with adequate surgical, anesthesia, and ancillary support.

D. Patient Care

1. Pre-procedural care

- a. Neurological assessment for neuroradiological procedures and assessment should be repeated after the procedure.
- b. Blood investigation:
Full Blood Count: Hb > 10 g/L; Platelet > 150 x 10⁹/L
Coagulation profile: INR < 1.4
Renal profile
- c. Deviated coagulation profile needs to be corrected.
- d. Renal protection should be commenced 12 hours before and after the procedure in renal insufficiency and diabetes mellitus.
- e. Proper hydration needed to prevent risk of thrombosis in dehydrated patients before the procedure.
- f. Patients requiring general anaesthesia or pain control device should be referred to the anaesthetist before the procedure.

2. Procedural care

- a. For patients undergoing long interventional procedures, particular attention should be paid to patient positioning, proper padding which can avoid patient discomfort and reduce risk to pressure areas, protection of painful and ischemic feet. Extra care if oblique /prone position.
- b. Venous access should be available and reassessed prior to procedure.
- c. Vital signs monitoring throughout the procedure.
- d. Routine administration of oxygen is recommended for all patients given intravenous sedation.
- e. Adequate administration of local anaesthesia or sedation provides patient comfort.

3. Post-procedure care

- a. All patients should be at rest and observed in the initial post-procedure period.
- b. Particular attention should be taken to ensure adequate haemostasis at the puncture site and pain control.
- c. Periodical monitoring of the puncture site and status of distal vasculature.

- d. Vital signs and symptoms monitoring for signs of complications e.g. bleeding.
- e. Renal function profile is advised for renal insufficiency and diabetic patients.
- f. Periodical neurological assessment when procedure requires manipulation in the ascending or arch of the aorta or brachiocephalic vessels.
- g. The initial ambulation of the patient must be supervised. Vascular perfusion, puncture site stability, and independent patient function and mobility must be ensured.

VI. RADIATION SAFETY IN IMAGING

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

VII. QUALITY IMPROVEMENT

These guidelines are to be used in quality improvement (QI) programs to assess diagnostic arteriography. The most important processes of care are patient selection, performance of the procedure, and monitoring the patient. The major outcome measures for diagnostic arteriography include complete imaging of the pathology, success rates, and complication rates. Outcome measures are assigned threshold levels.

For the purpose of these guidelines, a threshold is a specific level of an indicator which, when reached or crossed, should prompt a review of departmental policies and procedures. Procedure thresholds or overall thresholds refer to a group of outcome measures for a procedure, e.g., major complications for diagnostic arteriography. Individual complications may also be associated with complication-specific thresholds, e.g., fever or hemorrhage.

Complications can be stratified on the basis of outcome. Major complications may result in admission to a 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 refer to major complications, unless otherwise stated.

A. Measure of Success

The rate for successful completion of a diagnostic arteriogram is 95%.

B. Complication Rates and Thresholds

Complications from diagnostic arteriography are uncommon. Digital subtraction angiography may allow reduced contrast load and reduced time of study, and it may result in lower incidence of complications [37;ACR].

Arteriographic complications may be divided into three groups:

- i. puncture site
- ii. systemic
- iii. catheter induced.

i. Puncture site

The most frequent puncture site complication is haematoma. While the incidence of minor haematomas is quite variable and may be as high as 10%, major haematomas are unusual [37-39; ACR]. A major haematoma, defined as one requiring transfusion, surgical evacuation, or delay in discharge, occurs in 0.5% of femoral punctures and 1.7% of axillary punctures [40; ACR]. Other puncture-site problems, including dissection, thrombosis, pseudoaneurysm, or arteriovenous fistula, are also rare, occurring in less than 1% of femoral punctures. There is some variation in the number of complications, depending on the puncture site chosen [39; ACR]. For example, a small haematoma at an axillary puncture site may cause neural injury and require surgical evacuation earlier than a similar femoral haematoma.

Clinically significant infection at the puncture site with bacteremia is very rare, occurring most often in repeated punctures of the same artery over a short period of time or with long-term sheath access, as in endovascular procedures. Although antibiotic prophylaxis is not generally required for diagnostic arteriography [41, 42; ACR], it may be warranted in patients who are at risk for infection (e.g., diabetic or immunocompromised patients) or who undergo vascular closure placement, or in patients subjected to lengthy procedures [43; ACR].

ii. Systemic

Systemic complications occur in less than 5% of cases. Among the most common are nausea, vomiting, and vasovagal syncope. Minor nausea, without associated vomiting, occurs more frequently but usually with mild symptoms that pass in a few moments. This generally is not listed as a complication, as the episode is self-limited, is not associated with changes in pulse or blood pressure, and does not require specific therapy. Nausea may also be a symptom of vasovagal hypotension, which is usually characterized by lightheadedness, bradycardia, diaphoresis, and hypotension.

Idiosyncratic (allergic) contrast reactions, which include urticaria, periorbital edema, wheezing, etc., complicate less than 3% of arteriographic procedures [44; ACR]. Most reactions are mild - more than half do not require therapy, and less than 1% necessitates hospitalization. There are fewer reactions with lower-osmolality agents, particularly for patients with a history of a previous contrast reaction or more than one other major risk factor [45-48; ACR].

The incidence of contrast-media-associated nephrotoxicity is difficult to determine from a review of the literature, in part due to the varying definitions that have been used [50-53; ACR].

Predisposing factors: Pre-existing renal insufficiency, insulin-dependent diabetes, possibly dehydration, and large contrast volume.

Digital subtraction arteriographic systems have allowed lower contrast doses and, as a result, may lower the risk of renal injury [37; ACR].

Low-osmolar contrast medium has a small but definite benefit over high-osmolar contrast media for patients with pre-existing azotemia [54; ACR]. Pre-procedural hydration may have a protective effect in high-risk patients.

For the purposes of these guidelines, contrast-media associated nephrotoxicity as a major complication is clinically defined as an elevation of serum creatinine requiring care that unexpectedly delays discharge or results in unexpected admission, readmission, or permanent impairment of renal function. This definition focuses on the outcome of renal impairment, which is the central issue in any monitoring program. The threshold chosen is 0.2% and is based on consensus and a review of the pertinent literature. It is very dependent on the patient population, and practitioners are encouraged to modify this threshold to reflect the circumstances of their practice.

iii. Catheter induced

These include subintimal passage of the guide wire or catheter and dissections or emboli caused by catheter manipulation or contrast injection. These have been reported to occur in 0.5% to 2.0% of cases, with the most recent series reporting a frequency of less than 0.5% [37, 39, 55; ACR]. In recent years, these types of complications have decreased in frequency, in part due to advances in guide wire and catheter technology.

Other complications can be stratified on the basis of outcome. Major complications may result in admission to a hospital for therapy (for outpatient procedures), an unplanned increase in the level of care, resulting in 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 listed in Table 1 refer to major complications unless otherwise noted. Any death within 24 hours of the procedure or a puncture-site infection should be reviewed as part of the institution-wide quality improvement (QI) program.

Indicators and thresholds for complications in diagnostic arteriography are listed in Table 1. The thresholds listed were determined by consensus after review of the pertinent literature.

TABLE 1
Indicators and Thresholds for Complications in Diagnostic Arteriography [37-42, 44-64; ACR]

<u>Department Indicators</u>	<u>Reported Rates</u>	<u>Major Adverse Event Threshold</u>
Puncture site complications		
Haematoma (requiring transfusion, surgery, or delayed discharge)	0.0%-0.68%	0.5%
Occlusion	0.0%-0.76%	0.2%
Pseudoaneurysm or arterio-Venous fistula	0.04%-0.3%	0.2%
Catheter-induced complications (other than puncture site)		
Distal emboli	0.0%-0.10%	0.2%
Arterial dissection/ subintimal passage	0.43%	0.5%
Subintimal injection of contrast	0.0%-0.44%	0.5%
Major contrast reactions	0.0%-3.58%	0.5%
Contrast-media- induced nephrotoxicity	0.2%-3.0%	0.2%
Overall procedure threshold for Major complication		1.0%

The overall procedure threshold for major complications is determined by the following formula:

$$\frac{\text{number of patients with major complications undergoing diagnostic arteriography only} \times 100}{\text{total number of patients undergoing arteriography only}}$$

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. It is also 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 QI program). In this situation, the overall procedure threshold is more appropriate for use in a QI program.

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

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

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TABLE OF CONTENTS FOR GUIDELINES FOR ADULT IMAGE- GUIDED PERCUTANEOUS DRAINAGE / ASPIRATION OF ABSCESSSES AND FLUID COLLECTIONS (PDAFC)

I. INTRODUCTION	18
II. DEFINITION AND TERMS	18
III. INDICATIONS AND CONTRAINDICATIONS	19
IV. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL	19
V. SPECIFICATIONS OF THE EXAMINATION	20
VI. RADIATION SAFETY IN IMAGING	22
VII. QUALITY IMPROVEMENT	22
REFERENCES	24
APPENDIX B	25

GUIDELINES FOR ADULT IMAGE-GUIDED PERCUTANEOUS DRAINAGE / ASPIRATION OF ABSCESSSES AND FLUID COLLECTIONS (PDAFC)

I. INTRODUCTION

The guidelines were adapted from the Society of Interventional Radiology (SIR) and the American College of Radiology (ACR) guidelines.

Percutaneous drainage/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 hospital length of stay and hospital costs [1-7; ACR].

Modalities used for image guidance:

- ionizing radiation modalities including fluoroscopy or computed tomography (CT),
- 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, and others), and knowledge of the advantages and disadvantages of one imaging modality versus another for any particular drainage procedure.

This document 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
- 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:

Placement of a catheter using image guidance to provide continuous drainage of a fluid collection. It includes localization of the collection, placement and maintenance of the drainage catheter(s).

Percutaneous aspiration:

Evacuation of a fluid collection using either a catheter or a needle, with removal of the catheter or needle immediately after the aspiration.

III. INDICATIONS AND CONTRAINDICATIONS

The indications for PDAFC include, but are not limited to:

- a. Presence of an abnormal fluid collection with suspicion that the fluid is infected.
- b. Need for fluid characterization.
- c. Suspicion that the collection is producing symptoms sufficient to warrant drainage.

Percutaneous drainage and aspiration may be performed in essentially every organ system. The contraindications are relative and depend on the suitability of surgical alternatives.

There are no absolute contraindications.

The relative contraindications for PDAFC include:

- a. Known coagulopathy that 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 for the performance of the procedure.
- d. Hemodynamic instability.
- e. Lack of a safe pathway to the lesion.
- f. Severely compromised cardiopulmonary function for patients undergoing thoracic interventions when there are risks of further compromise inherent to the procedure.

All imaging facilities should have policies and procedures to reasonably attempt to identify pregnant patients prior to the performance of any 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. (1995, 2005 - ACR Resolution 1a)

IV. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

Continuous Radiological Education is needed to maintain competence and update knowledge,

All staff in the department needs to be adequately trained and know the principles of sedation and resuscitation.

All radiologists, trainees, nurses, and radiographers need to attend the Basic Resuscitation Course. Advanced Course in Life Support is recommended for doctors and nurses.

V. SPECIFICATIONS AND PERFORMANCE OF THE PROCEDURE

A. Imaging Equipment and Facilities

1. When fluoroscopic guidance is used, a high resolution imaging chain with adequate shielding and collimation is desirable. Ability to perform complex angle (e.g., anteroposterior [AP], lateral, or oblique) fluoroscopy views is often necessary to ensure proper needle placement. Radiation is kept to the minimum consistent with “As Low as Reasonably Achievable (ALARA)”.
2. 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 such as in the pleural space and peritoneal cavity.
3. When appropriate, CT and/or CT fluoroscopic capability is desirable to better demonstrate anatomy, particularly in:
 - a. Patients with fluid collections that are difficult to access or are in unusual or precarious locations.
 - b. Planning the optimal access route to avoid, when possible, transgression of vital structures.
 - c. Patients with unusual anatomy.
4. The facility should provide an area within the institution appropriate for patient preparation and for observation after the procedure with immediate access to emergency resuscitation equipment.
5. For patients undergoing thoracic procedures, a full array of percutaneous catheterization equipment for treatment of pneumothorax should be available.
6. Access to a laboratory with expertise in cytopathology, microbiology, and chemistry should be available.

B. Physiologic Monitoring and Resuscitation Equipment

Sufficient equipment should be present to allow for monitoring the patient's heart rate, cardiac rhythm, and blood pressure. For facilities using moderate “conscious” sedation, a pulse oximeter should be available.

There should be ready access to emergency resuscitation equipment and drugs. Resuscitation equipment should be checked routinely in compliance with institutional policies.

C. Surgical 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.

D. Patient Care

1. Pre-procedure care

- a. Informed consent must be in compliance with state laws.
- b. Blood investigation:
FBC:Hb > 10 g/L, Platelet > $150 \times 10^9/L$
Coagulation profile: INR < 1.4
Renal profile
- c. Deviated coagulation profile needs to be corrected.
- d. Renal protection should be commenced 12 hours before and after the procedure in renal insufficiency and diabetes mellitus in cases requiring injection of contrast material.
- e. Patients requiring general anaesthesia or pain control device should be referred to the anaesthetist before the procedure.

2. Procedural care

- a. For patients undergoing long interventional procedures, particular attention should be paid to patient positioning, proper padding which can avoid patient discomfort and reduce risk to pressure areas, protection of painful and ischemic feet. Extra care if oblique /prone position.
- b. Venous access should be available and reassessed prior to procedure.
- c. Vital signs monitoring throughout the procedure.
- d. Routine administration of oxygen is recommended for all patients given intravenous sedation.
- e. Adequate administration of local anaesthesia or sedation provides patient comfort.

3. Post-procedure care

- a. Orders for post-procedure patient care should include frequency of monitoring of vital signs, drainage catheter care and discharge instructions
- b. Specific anatomic considerations
 - i. Thoracic cavity: pulmonary assessment for the presence of pneumothorax and to confirm adequate catheter placement.
 - ii. If guidance was by fluoroscopy or ultrasound, an upright chest radiograph should be obtained when appropriate
 - iii. If guidance was by CT, a tailored post-procedure scan should be obtained
 - iv. Peritoneal and other cavities: confirmation of appropriate tube placement.
- c. Post-procedure imaging and follow-up may involve gentle injection of contrast material to confirm tube placement within the abscess/symptomatic fluid collection cavity, and assessing the appropriate setting of fistulae to bowel.

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 (PCD) 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 expected that the fluid collection is extremely thick and viscous, which may dictate the use of a larger gauge needle or catheter.
- 3) The physician should be aware of the technique for definitive drainage with needle/guidewire/ catheter/trocar techniques since diagnostic percutaneous fluid aspiration may lead to therapeutic placement of a percutaneous drainage catheter.
- 4) The physician performing PDAFC must understand tube maintenance and pos-procedure 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.

VI. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, radiologic technologists, and all supervising physicians have a responsibility to minimize radiation dose to patients, to staff, and to society as a whole, while maintaining the necessary diagnostic image quality. This is the concept of “As Low As Reasonably Achievable (ALARA)”.

VII. QUALITY IMPROVEMENT

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.

A. Success Rates and Threshold

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>
Drainage of infected collections	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%-10% of patients. Failure occurs in 5%-10% and recurrence in 5%- 10% [**1-3; SIR**].

These results are similar for both abdominal and chest drainage procedures [**4-7;SIR**]. 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.

<u>Successful Drainage (curative and partial success)</u>	<u>Threshold</u>
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 Thresholds

Complications for PDAFC

Complications occur in approximately 10% of patients [**1-7;SIR**]. Published complication rates and suggested thresholds include the following:

<u>Specific Major Complication</u>	<u>Reported Rate</u>	<u>Suggested Threshold</u>
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.

	<u>Overall Procedure Threshold</u>
All major complications resulting from adult PDAFC	10%

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APPENDIX B

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