

Quality Improvement Guidelines for Diagnostic Arteriography

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ABBREVIATIONS

CA = catheter angiography, CIN = contrast agent-induced nephropathy

PREAMBLE

The membership of the Society of Interventional Radiology (SIR) Standards of Practice Committee represents experts in a broad spectrum of interventional procedures from the private and academic sectors of medicine. Generally, Standards of Practice Committee member dedicate the vast majority of their professional time to performing interventional procedures; as such, they represent a valid, broad expert constituency of the subject matter under consideration for standards production.

METHODOLOGY

SIR produces its Standards of Practice documents with the use of the following process: Standards documents of relevance and timeliness are

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conceptualized by the Standards of Practice Committee members. A recognized expert is identified to serve as the principal author for the document. Additional authors may be assigned depending on the magnitude of the project.

An in-depth literature search is performed with use of electronic medical literature databases. Then, a critical review of peer-reviewed articles is performed with regard to the study methodology, results, and conclusions. The qualitative weight of these articles is assembled into an evidence table, which is used to write the document such that it contains evidence-based data with respect to content, rates, and thresholds.

When the evidence of literature is weak, conflicting, or contradictory, consensus for the parameter is reached by a minimum of 12 Standards of Practice Committee members with use of a modified Delphi consensus method (**Appendix A**). For the purpose of these documents, consensus is defined as 80% Delphi participant agreement on a value or parameter.

The draft document is critically reviewed by the Standards of Practice Committee members in a telephone conference call or face-to-face meeting. The finalized draft from the Committee is sent to the SIR membership for further input/criticism during a 30-day comment period. These comments are discussed by the Standards of Practice Committee, and appropriate revisions are made to create the finished standards document. Before its publications, the document is endorsed by the Executive Council.

INTRODUCTION

A considerable amount of work in this document is based on the 2003 Quality Improvement Guidelines for Diagnostic Arteriography (1). However, a paradigm shift has occurred in the interim since publication of these original guidelines. Numerous improvements and technologic advances of multidetector computed tomographic (CT) angiography and magnetic resonance (MR) angiography have transformed the diagnostic capabilities of these modalities, and they have become complementary to, or reduced the need for, catheter-based diagnostic angiography, or catheter angiography (CA). The diagnostic sensitivity and specificity of these and other less invasive imaging modalities continue to improve. In many instances, CA remains the gold standard as a result of its superior resolution and ability to isolate small caliber vascular anomalies as well as provide therapeutic options. Therefore, this document updates previous references and emphasizes the current literature of the foregoing points.

CA remains an established, safe, and accurate method of evaluating vascular disease. Advantages include better spatial resolution, the ability to adjust contrast agent delivery to optimize imaging and to evaluate blood flow rate and directionality, the option of using alternative contrast agents such as CO₂ or gadolinium when

appropriate, the capacity of intravascular manometry, and the ability to use CA to direct transcatheter/endovascular therapies. Disadvantages of CA include its invasive nature with the attendant potential for procedure-related complications, the more limited area of evaluation compared with other imaging modalities, increased radiation exposure, and the somewhat lengthy procedure times. Arteriography remains the diagnostic standard in instances in which noninvasive imaging is inconclusive or not able to be performed, or before treatment.

Because of the varying skill levels and training of physicians performing arteriography procedures, the potential exists for variation in success rates, complication rates, and diagnostic study quality. The indications for arteriography have evolved over time, and there may be considerable variation in practice. Interventional radiologists must consider the potential risks and benefits of CA and its impact on patient management. CA is no longer a generalized procedure, and it should be performed with a specific goal in mind that cannot be achieved with a less invasive test or procedure.

The present standard was developed as a guide for practicing interventional radiologists to ensure that patients undergo arteriography for appropriate reasons, that the methods used and the periprocedural care provided minimize the potential for complications, and that the studies obtained are of adequate diagnostic quality to answer the clinical questions that prompted them. The qualifications for physicians performing arteriography have been previously published (2).

This standard is intended to define a minimal standard of care and the indications for arteriography in vessels other than the coronary or cervicocerebral circulation. Similar documents have been published for the coronary arteries (3) and for diagnostic neuroangiography (4). Some of the indications, techniques, and complications of CA may be found in a document specific to pediatric patients (5). Patients will likely benefit when appropriate selection criteria, pre- and postprocedural care, and monitoring are used. In all cases, the type of care provided should be directed by the operating physician, and treatment decisions should be made after individual consideration of each case. Variation from this standard may be necessary and appropriate depending on the specific clinical circumstances.

DEFINITIONS

Diagnostic Arteriogram: For the purposes of this standard, diagnostic arteriography is defined as a procedure involving percutaneous passage of a needle and/or catheter into an artery under imaging guidance, followed by injection of contrast media and imaging of the vascular distribution in question. Several projections, eg, orthogonal obliquities, may be required to best demonstrate the targeted area. Patient positioning, magnification of image intensifier, and frame rates must be optimized. Additionally, radiation dosage to the patient (eg, fluoroscopy time, reference air kerma, dose area product, and peak skin dose [if available]) must be recorded (6).

Success: For the purposes of this document, success is defined as the successful completion of arteriography, including gaining access to the artery, choosing the appropriate catheter, obtaining a complete set of images, and the timely and accurate interpretation of the findings. A complete set of images in the lower extremity, for example, is defined to include the vessels down to the level of the foot. In the upper extremity, the entire extremity from the origin of the great vessels from the thoracic aorta should be imaged. In the kidney, it is defined as imaging from the abdominal aorta to the renal parenchyma.

These guidelines were developed for use in institution-wide quality improvement programs to assess the practice of diagnostic arteriography. The most important processes of care are (i) patient selection; (ii) performance of the procedure; and (iii) monitoring the patient. The major outcome measures for diagnostic arteriography include complete imaging of the pathologic process, success rates, and complication rates. Outcome measures are assigned threshold values.

While practicing physicians should strive to achieve perfect outcomes (eg, 100% success, 0% complications), in practice, all physicians will fall short of this ideal to a variable extent. Therefore, in addition to quality-improvement case reviews customarily conducted after individual procedural failures or complications, outcome measure thresholds

should be used to assess diagnostic arteriography in ongoing quality improvement programs. For the purpose of these guidelines, a threshold is specific level of an indicator which, when reached or crossed, should prompt a review of departmental policies and procedures. "Procedure thresholds" or "overall thresholds" reference a group of outcome measures for a procedure; for example, major complications for diagnostic arteriography. Individual complications may also be associated with complication-specific thresholds, such as fever or hemorrhage. When outcome measures such as success rates or indications fall below a (minimum) threshold, or when complications rates exceed a (maximum) threshold, a departmental review should be performed to determine causes and to implement changes if necessary. For example, if the incidence of contrast agent-induced nephropathy (CIN) is one measure of the quality (indicator) of arteriography, exceeding a defined threshold, in this case 5%, should trigger a review of policies and procedures within the department to determine the causes and implement changes to lower the incidence of the complication. Thresholds may vary from those listed here; for example, patient referral patterns may dictate a different threshold value for a particular indicator at a particular institution. Therefore, 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.

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 (Appendix B). The complication rates and thresholds in this document refer to major complications unless otherwise noted.

INDICATIONS

Noninvasive imaging techniques such as multidetector CT angiography and MR angiography have replaced diagnostic arteriography for many indications. However, indications for CA still exist.

A summary of the indications for CA is provided. The threshold for the department and for each individual is 95% (ie, 95% of procedures should be performed for one of the indications listed). When fewer than 95% of procedures are for these indications, the department will review the process of patient selection. Indications in which noninvasive imaging may be better used (in lieu of CA) will also be discussed.

General Indications

- Assessment of vascular anatomy/disease not characterized by other imaging tests;
- Assessment of small-vessel disease (eg, vasculitis, vascular malformations) in cases in which the spatial and temporal resolution of other noninvasive imaging is insufficient;
- Assessment of direct arterial supply to neoplasms.

Pulmonary Arteriography (7–12)

- Suspected acute pulmonary embolism in which CT angiography is nondiagnostic;
- Suspected chronic pulmonary embolus;
- Other suspected pulmonary vascular abnormalities, such as vasculitis, congenital and acquired anomalies, and tumor encasement;
- Before pulmonary artery interventions.

The evolution of multidetector CT has allowed for highly sensitive and specific detection of acute pulmonary embolism, and it provides quick acquisition time, less exposure to ionizing radiation, as well as additional diagnostic considerations (eg, airspace disease, pleural effusion, cardiac causes of chest pain) (13).

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