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PRACTICE GUIDELINE FOR INTERVENTIONAL CLINICAL PRACTICE

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 on 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. It should be recognized; therefore, 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 developed and written collaboratively by the American College of Radiology (ACR), the American Society of Interventional and Therapeutic Neuroradiology (ASITN), and the Society of Interventional Radiology (SIR).

Interventional radiology and interventional neuroradiology are clinical subspecialties of radiology focused on minimally invasive, imaging-guided therapy for numerous diseases. The terms interventionalist, intervention, or interventional will be used throughout this document to represent both interventional radiologists and interventional neuroradiologists.

An interventionalist interacts directly with patients and counsels them regarding their diseases and therapeutic options. Interventional therapy is defined by longitudinal involvement of the interventionalist in patient care, beginning with the initial consultation, often involving therapeutic interventions, and continuing through time to eventual resolution of the clinical problem or establishment of an alternative care plan. To achieve these ends, it is necessary for the interventionalist to see patients in clinical practice settings and often to create and execute management plans. Traditional clinical office space and privileges to manage patients in the hospital are required.

In addition to the mandatory infrastructure requirements, there are benchmarks that define an interventional clinical practice. These benchmarks should be used as goals for developing the practice. Clinical interventionalists should:

1. Accept referrals for therapeutic interventions as the sole or primary consultant for the disease process.
2. Routinely perform and bill for consultations for patients prior to and following planned or elective interventions.
3. Routinely inform patients referred for diagnostic services of the spectrum of therapeutic options that might benefit them and provide interventional treatment if they desire.
4. Routinely establish treatment plans and implement them without requiring the participation of another specialist.
5. Admit patients to the interventional service who require inpatient services after undergoing therapeutic interventions.
6. Provide longitudinal patient care.

The following guidelines should be used to develop an interventional clinical practice for both inpatient and outpatient clinical services. Recommendations will include requirements concerning processes for handling referrals, the physician-patient relationship, scheduling of invasive procedures, staffing, clinic space, time dedicated to clinical duties, equipment needs, clerical services, and continuous quality improvement programs.

II. THE CLINICAL TEAM

A. Interventionalist

The interventionalist should be an individual dedicated to the clinical management of patients and the performance of interventional procedures. The need for and number of interventionalists are based primarily on the volume of procedures performed. As clinical activity increases there will be increased staffing needs. It is recognized that there is no substitute for clinical care conducted by the interventional physician, especially with regard to handling new consultations. However, other nonphysician practitioners can help to improve the efficiency of the clinical practice, especially with regard to routine follow-up care in the hospital or in the office.

B. Nonphysician Practitioner

Nonphysician practitioners include nurse practitioners (NPs) and physician assistants (PAs). These individuals are specifically trained to function in the inpatient and outpatient clinical settings and are equipped with the skills needed to perform daily clinical duties. They can perform histories, physical examinations, and participate with the interventionalist in forming a clinical assessment

and plan. Their clinical training makes them valuable complementary members of the interventional clinical team.

A nonphysician practitioner employed by a radiology group can function as an independent member of the interventional team. Medicare and most other third-party payers allow them to bill under their own identification numbers for the clinical services they provide. In most settings, the nonphysician practitioner can perform minor interventional procedures, thereby increasing the productivity of the interventional clinical team.

Although PAs and NPs can function in a similar if not identical manner, there are clear differences in the way they can practice in the eyes of Medicare, other regulatory agencies, and local hospitals. Interventionalists are advised to consult with their local regulatory agencies and hospitals regarding the modes of practice that are acceptable in their regions.

C. Nursing

Registered nurses (RNs) play a critical role during interventional procedures; in addition, they can be used to augment clinical services. RNs are not trained or may not be authorized to provide the types of clinical duties that the nonphysician practitioner provides. However, the addition of an RN to an interventional team should be considered when there is a need to provide care adjunctive to that provided by the practitioner. However, medical assistants or aides can accomplish many office-based tasks. Nurses are particularly helpful in assisting in screening or triaging referrals, or assisting with research protocols.

Examples of adjunctive care include, but are not limited to, obtaining portions of the history, gathering laboratory values, and speaking with family members. In the outpatient setting, adjunctive care might include obtaining vital signs, drawing blood, providing patient education, and telephone consultation and follow-up with patients.

D. Radiologic Technologist

A radiologic technologist plays a critical role during interventional procedures. The technologist should be certified by the American Registry of Radiologic Technologists (ARRT) or have an unrestricted state license with documented training and experience in interventional procedures. Optimally the technologist will also have special certification in cardiovascular procedures (e.g., RT(R)(CV)).

Radiologic technologists are not trained and are not authorized to provide the types of clinical duties that the nonphysician practitioner provides. However, the addition of a technologist to the interventional team is essential for

image and data management and quality assurance. The role of the radiology technologist may evolve to include other responsibilities.

III. ADMINISTRATIVE SERVICES

The administrative resources required to run an office-based clinical practice effectively include a transcriptionist, an office manager, coding and billing personnel, a scheduler, and individuals who can perform insurance precertification and compliance.

In addition, personnel who can perform data management and quality improvement are required. The following elements are necessary to implement an effective quality program:

- A computer with a database such as the SIR HI-IQ™ for tracking outcomes. (Other databases are available.)
- Resources to track procedures, outcome data, and long-term follow-up.
- Regular analysis of the quality data and implementation of quality improvement actions.

A single individual may fill the responsibilities of more than one position. Many of these services are already available and could be expanded or modified to meet the additional requirements to meet the clinical service.

IV. THE OUTPATIENT CLINIC

The outpatient interventional clinic should become the cornerstone of interventional clinical practices and can serve as the front door through which most patients enter the practice. The outpatient clinic is essential in providing longitudinal care, including monitoring and surveillance of disease progression or recurrence, which will require further interventional or diagnostic studies. This type of care is what patients and referring physicians expect from a clinical practice and is vital to the growth and future success of interventional practices.

In the outpatient clinic setting the interventionalist and support staff can perform the following duties while providing evaluation and management (E&M) services:

- Determining appropriate diagnostic workup.
- Determining need for and arranging consultation with other physicians.
- Scheduling interventional procedures.
- Providing follow-up care, including post-procedure testing.
- Providing counseling visits.

A. Space and Equipment

A successful interventional clinic practice requires quality dedicated clinic space. Although placing the interventional clinic within the radiology department is certainly economical and convenient for the physician, it can be confusing to the outpatient who is expecting to see the interventionalist in a traditional physician office setting. The interventional clinic is best designed as a conventional doctor's office, with a waiting room, a receptionist, and a private and confidential setting. This can be most economically achieved using an office-sharing arrangement within a hospital-owned clinic or within another specialty clinic (e.g., a surgical or internal medicine clinic).

There are many advantages to establishing an office practice outside the hospital (such as a medical office building). They include an increased profile for the clinical practice among other doctors in the building, an increased understanding by potential referring doctors of the practice's level of commitment to longitudinal patient care, and an improved status with the hospital. Specifically, trying to perform clinical medicine in the radiology department, either in a dedicated holding/recovery area, an office, or an angiography suite, is suboptimal for resource utilization, patient comfort, and practice promotion.

The examination room(s) should be large enough to accommodate an examination table, a sink, and two chairs (for the patient and at least one family member), and a wheelchair if needed. Equipment requirements for the examination room(s) should include:

- Examination table.
- Sphygmomanometer.
- Stethoscope.
- Hand-held Doppler.
- Educational material.
- Desk.

Other office requirements should include:

- Equipment and medical record storage space.
- Consultation space.
- Computer.
- Dictation/transcription capabilities.
- PACS or viewbox.
- Restroom availability.

A patient education room is an optional feature.

Additional equipment may be required for the interventional neuroradiology clinic in order to perform a thorough neurological examination.

B. Personnel

Whether in an office-sharing arrangement or in a freestanding interventional clinic, certain personnel will be required:

- Receptionist.
- Scheduler.
- Clerical support to perform typing and maintain medical records.
- Nonphysician practitioner (RN if a nonphysician practitioner is not available).
- Interventional physician.

A single individual may fill the responsibilities of more than one position. A receptionist, for example, may provide typing/dictation service and also manage medical records.

C. Time

Interventional clinics should be staffed with dedicated doctors not scheduled concurrently to perform procedures. The physician time recommended for evaluating new patients and providing adequate follow-up care for interventional patients is expected to be in the range of 5 to 15 hours per week. The exact time required will vary depending on the size of the practice. The time (including both physician and ancillary personnel time) allotted per clinic patient should be 45 to 60 minutes for each new patient and 20 to 30 minutes for each follow-up patient.

- Practices performing fewer than 1,000 procedures per year will require at least 5 hours per week.
- Practices performing between 1,000 and 3,000 procedures per year will require at least 5-15 hours per week.
- Practices performing more than 3,000 procedures per year will require at least 15 or more hours of clinic time per week.

D. Communication of Clinical Care

A written consultation report describing the preoperative clinical interaction with the patient must be sent to the referring physician in a timely fashion. It should be in the form of a letter, and not an X-ray report. This letter may be communicated electronically.

V. INPATIENT REQUIREMENTS

A. Admitting Privileges

Hospital admitting privileges are critical for a successful clinical interventional service. It not only signifies that the interventionalist is willing and able to take the lead

responsibility for the patient while in the hospital; it also is an important aspect of a service that will facilitate direct referrals to the interventionalist.

The interventional service is best informed about post-interventional procedure management and complications that may arise, how to address complications, and the appropriate timing of hospital discharge and outpatient follow-up. Therefore, the following patients should be admitted to the interventional service unless a medical condition exists or arises that is optimally managed by another service:

- All patients seen in consultation and felt to warrant elective inpatient interventional therapeutic procedures.
- Most patients seen in the angiography suite for diagnostic procedures who develop complications warranting admission.
- Patients admitted strictly for diagnostic tests.
- Urgent referrals from outpatient offices that require interventional services and then require admission.

The number of physicians in the radiology department who provide interventional services and have admitting privileges should be sufficient to provide 24-hour interventional call coverage. This includes managing the clinical problems that fall within the interventionalist scope of practice and making appropriate referrals when clinical problems go beyond the interventionalist scope of practice.

Part of the duties of the interventionalist should be daily clinical rounds. Patients to be seen should include:

- Any patient who is admitted to the interventional service, or has a significant portion of his or her inpatient care managed by the interventional service, including patients with abscess drainage.
- Any patient with a clinical problem that is being managed by the interventional service in consultation.

The physician inpatient visit can be done in concert with the nonphysician practitioner visit. This strategy will insure the most efficient use of physician time and help reduce costs while maintaining the all-important personal contact provided to the patient by the interventional radiologist.

B. Time Allotment for Inpatient Clinical Duties

The time allocation includes the total time spent by the physician, nonphysician practitioner, and any other ancillary staff that the interventionalist and hospital deem appropriate. The exact amount of time required for daily

rounds and admissions will depend on the size of the practice and procedure mix as described below:

Practices with <1,000 procedures per year	1-2 hours per day
Practices with 1,000 – 3,000 procedures per year	2-4 hours per day
Practices with > 3,000 procedures per year	4-6 hours per day

The amount of time required will also depend on case mix. Practices performing large volumes of procedures such as arterial interventions, chemoembolization, uterine fibroid embolization, and abscess/drain management require more admissions and inpatient care.

C. Scheduling of Interventional Procedures

It may be acceptable to schedule some invasive diagnostic radiology procedures, such as arthrography, based on a direct request from a physician's office to booking personnel. However, direct booking of invasive diagnostic procedures that have a reasonable likelihood of entailing therapeutic options should not be scheduled in this way but rather should be referred to the clinic for consultation with the interventionalist. The interventionalist will examine the patient, determine how to proceed and, if a diagnostic/therapeutic interventional procedure is to be scheduled, arrange it him/herself.

VI. IMAGING REQUIREMENTS

Radiology departments must continue to take the lead in providing state-of-the-art vascular imaging. It is important for radiology departments to be actively involved in duplex imaging and nonimaging Doppler studies. This may require the initiation of new programs in some departments. Fortunately, the only equipment a radiology department may lack is equipment to do extremity physiologic testing (e.g., segmental pressures, continuous wave Doppler). This equipment is relatively inexpensive. Initiation of a new program in vascular ultrasound will often require the cooperation of radiologists experienced in ultrasound along with those experienced in angiography and interventional procedures.

Traditionally, anatomic maps of vascular systems have been generated with angiography, but increasingly they are being done with MRA and CTA. The interventionalist may not be involved in these latter two studies. CTA and MRA are often handled by imaging sections, and this is a reasonable way of handling the studies. However, there are two potential pitfalls. First, if the interventionalist is not involved with the examination, he/she may not have the opportunity to discuss the results of the diagnostic mapping procedure with the referring physician, and treatment decisions can be made without an interventionalist ever having input. Secondly, many imagers do not have the same degree of experience with

vascular diseases and with pathological vascular anatomy as angiographers and interventionalists. This may decrease the value of the interpretations. Both of these problems can be mitigated in various ways but are most easily dealt with if there is good communication and a good working relationship between the interventional and imaging sections.

Patients who may benefit from a vascular or nonvascular interventional procedure are often seen first in the radiology department for imaging studies. These patients should be identified and the information promptly conveyed to the referring physician(s). This will help to optimize the use of interventional procedures in clinical practice. If the radiologist who reads the study is not entirely familiar with the indications for a specific interventional procedure, he/she should involve an interventionalist as a consultant in order for the best patient care decisions to be made. Quality control mechanisms that track the imaging of potential interventional patients to guarantee that the imaging is done with high quality and with a high level of service may be helpful in promoting interventional procedures. These goals are best accomplished in most radiology departments using a team approach. The critical points in the program include:

1. Having a full-service line of vascular imaging, including vascular ultrasound.
2. Maintaining high-quality image interpretation. In many departments, this will require involvement of the interventionalist either in a primary reading role or in a support role.
3. Identifying patients who may benefit from interventional procedures.
4. Communicating knowledgeably about potential interventions to the referring physician.
5. Promoting the role of the interventionalist in the evaluation and management of those patients who are found to have treatable disease at the time of imaging. At times, this will be best accomplished by having the interventionalist directly communicate with the referring physician.
6. Providing the time necessary for the interventionalist to participate in such a program.

These collaborative measures are in the interest of patient care and in the interest of the future strength of interventional radiology, and, they will help promote the future strength of radiology.

VII. INTERVENTIONAL SUITE REQUIREMENTS

This section summarizes the equipment required to operate a clinical interventional practice. This equipment capabilities needs to be located in a setting that is

sufficiently sophisticated to provide the electrical, HVAC, air exchanges, sterile conditions, and patient amenities required for these types of procedures. The setting may be within a hospital or in a sophisticated outpatient facility. The interventional suite must be of sufficient size to hold the imaging and nonradiographic equipment, provide easy access to the patient from multiple approaches, and accommodate the necessary life support equipment that often accompanies the interventional patient. It should be recognized that interventional procedures may be performed in other parts of the department such as CT, US, and MRI.

A. Radiographic Equipment

Fixed-installation X-ray equipment, designed and specified for interventional procedures, is preferable. The equipment parameters should be sufficient to perform interventional procedures. Some of these parameters include the following:

1. Image receptor size.
2. Permanent recording modes (e.g. DSA, cine).
3. X-ray tube focal spot(s), output, heat load and cooling capacity.
4. Generator capacity.
5. Software packages.
6. Local modality image storage capacity.
7. DICOM capability – ability to integrate with PACS.
8. Radiation dose management package.
9. Patient table weight limits.

Biplane imaging and 3D angiography are strongly recommended for the interventional neuroradiology practice.

Sophisticated portable X-ray equipment, though less satisfactory for these procedures, may suffice in circumstances of limited funds, limited space, or an institutional need to design a multi-task suite. This latter circumstance is to be strongly discouraged, since suites designed for multiple tasks generally function in a less than ideal way for each of the individual procedures, compared with suites designed for fewer dedicated purposes.

B. Patient Preparation Area and Recovery Room

To optimize utilization of hospital resources, space needs to be allocated to hold inpatients and outpatients while awaiting procedures or transport, to observe patients prior to transfer to the wards, and for recovery for outpatients. The amount of space should be approximately four beds per angiography room. This could include space in a dedicated recovery area not necessarily in the radiology department, provided such space is allocated for interventional patients.

C. Medical/Surgical Supply Inventory

The dedicated interventional suite must have sufficient space and a control mechanism to manage the required inventory. This space needs to be located close to the suite.

The following items relevant to inventory should be considered when developing the modern-day interventional practice suite:

- Sufficient facility budgetary commitment to sustain the supply and disposable equipment needs of the suite.
- Dedicated personnel responsible for inventory management.
- An inventory control system, ideally with barcode reading capability.

D. Nonradiographic Equipment

The modern interventional suite often requires other invasive and noninvasive equipment for nonradiographic imaging and interventions. The following list of such equipment is intended to serve as a guide:

1. Transcutaneous ultrasound.
2. Intra-arterial ultrasound.
3. Tissue ablation devices, such as radiofrequency, cryotherapy, lasers, microwaves, and associated probes.
4. Atherectomy devices with associated catheters and heads.
5. Thrombectomy devices with catheters.

E. Staffing

Nurse staffing levels should always be sufficient to provide one nurse for each procedure room to prepare, provide, and monitor patient care, as well as to perform other departmental activities such as quality assurance. In addition, the recovery room should have at least one nurse per four patient beds. Intensive care patients or sedated pediatric patients require one-to-one nurse staffing. Facilities with high volumes of ICU or pediatric patient populations will require a higher nurse-to-bed ratio in the recovery room setting.

Radiologic technologist staffing levels should be sufficient to always provide at least one technologist per procedure room to perform imaging functions as well as functions related to inventory, cleanup, room preparation, film or digital image processing, and data entry into inventory management or quality assurance computer programs.

To achieve consistent coverage, the above staffing recommendations should be considered in light of local

staffing factors. This will require greater than one FTE per procedure room to cover vacations, sick time, and educational leave and can vary from 1.2 to approximately 1.8 FTEs per staff position depending on the benefit levels and numbers of shifts per day.

F. Physiological Monitoring Equipment

The interventional suite must be capable of monitoring critically ill patients and patients under moderate (conscious) sedation and/or general anesthesia. The ability to monitor blood pressure, heart rate, ECG, venous and arterial pressure measurements, and pulse oximetry must be available at a minimum. An additional desirable feature is the ability to measure simultaneous pressures from dual inputs. A paper printer connected to the physiological monitor device is desirable to produce permanent hard copy of any selected physiological parameter.

VIII. MARKETING AND EDUCATION

Once a clinical office practice is established, marketing is accomplished by letting potential referring doctors and the public know what services are offered. There are many ways to achieve this, all of which require resources. One method is to advertise in local newspapers or magazines announcing the opening of the new clinical office or the addition of new physicians and their areas of interest. Another way is by mailing such notification directly to physician and nonphysician practitioners, medical directors of practices, and practice managers. If research is being done, this is often an attractive aspect of the practice to promote. Practice managers often know how patients enter the system and how referrals are generated, and they can be a useful resource for direct contact by the physician. In most cases, targeted, personal, and sequential marketing tactics will build long-term relationships better than mass marketing without personal follow-up. Therefore, resources would be required to cover the time of practice personnel and doctors to make follow-up phone calls or visit with other physician groups in addition to the expense of advertisement and/or mailings.

Promotion should ideally be along service lines rather than generically promoting interventional practice. Noting outcomes, board certification, specialty training, ongoing research, or other unique achievements can help differentiate one from the competition. In larger practices, having individual interventionalists subspecialize along broad disease categories or service lines may enhance promotion. For example, an interventionalist may specialize in uterine fibroid embolization and serve as the primary contact person in that practice for that group of doctors. Similarly, scheduling of clinic days around the specific disease entities or service lines will provide continuity for referring physicians.

The primary means by which a clinical practice interacts with its referring community is through letters generated during patient consultations or follow-up. Such letters should have a letterhead that reflects the practice's interventionalist focus. They should not use the letterhead of a radiology practice or hospital or resemble X-ray reports. Copies of letters should be sent to all doctors important in the care of the patient, not just the referring doctor, and should always include the primary care doctor whether or not he/she is the referring doctor. In practices that use electronic communications, this correspondence can be provided electronically.

Other ways to interact with potential referring doctors can be to provide grand rounds on topics for which interventional services are available, and to sponsor educational symposia or dinners with presentations by a local interventionalist, or in some cases by a national expert.

Patient-oriented educational brochures covering diseases that are treated routinely should be available to patients in the waiting room and distributed to patients scheduled for procedures. They may also be given to referring physicians for distribution to their patients. These brochures should be informative and present interventional services in a balanced way.

IX. QUALITY IMPROVEMENT

Maintaining and improving quality is a cornerstone of all of the guidelines and standards programs of the ACR. This optimizes patient care and is required by the JCAHO in the hospital setting. Individual physician outcomes data are also necessary for the granting and maintaining of physician credentials. Outcomes data are also important as a means to inform referring physicians of the benefits of referring patients to interventional radiology and interventional neuroradiology.

Quality parameters should be set for the clinical aspects of interventional practice as well as the technical outcomes of the procedures. The clinical practice of radiology will include the assessment of the patient's signs and symptoms in order to set forth a treatment plan. The assessment may lead to the determination that no treatment is necessary. Constant evaluation of the treatment plan is necessary to insure that the interventionalist has diligent follow up concerning the clinical, laboratory, and treatment recommendations that result from the clinical evaluation of the patient.

Office practices are encouraged to monitor relevant aspects of their operations, to include clinical as well as business aspects, and can include any of the following:

1. A practice may identify which procedures it chooses to track.

2. A practice may identify which aspects of clinical decision-making it chooses to track:
 - a. Appropriateness of clinical diagnosis.
 - b. Appropriateness of laboratory and radiological tests ordered.
 - c. Appropriate follow-up on laboratory tests and radiological studies ordered.
 - d. Thoroughness of medical record keeping.
 - e. Appropriate mechanisms to track those patients who fail to keep outpatient follow-up appointments.
 - f. Appropriate mechanisms to insure adequate follow-up of inpatients.
 - g. Has clinical benefit been gained following completion of the treatment plan.
 - h. Adherence to the appointment schedule.
3. Thresholds for any criteria for which quality assurance will be performed should be determined for any criteria for which quality assurance will be performed.
4. In the hospital setting, quality outcomes are analyzed in a regular forum.
5. There must be actions designed to improve quality if a problem is identified.
6. These corrective actions must be monitored to ensure improvement.

Given that outcomes of the procedural and clinical decisions made by the interventionalist will often manifest themselves over time, the clinical practice's dedication to long-term follow-up will become the critical component in any quality assurance program.

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 Concerns appearing elsewhere in the ACR Practice Guidelines and Technical Standards book.

Equipment performance monitoring should be in accordance with the [ACR Technical Standard for Diagnostic Medical Physics Performance Monitoring of Radiologic and Fluoroscopic Equipment](#).

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REFERENCES

1. American College of Radiology. [White paper: clinical practice of interventional radiology and neurointerventional radiology](#). March 2003. ACR Web site. Available at: http://www.acr.org/dyna/?doc=departments/stand_accred/standards/ir_white_paper.html. Accessed September 8, 2003.
2. Barth KH, Matsumoto AH. Patient care in interventional radiology: a perspective. *Radiology* 1991; 178:11–17.
3. Becker GJ. 2000 RSNA annual oration in diagnostic radiology: the future of interventional radiology. *Radiology* 2001; 220:281–292.
4. Katzen BT, Kaplan JO, Dake MD. Developing an interventional radiology practice in a community hospital: the interventional radiologist as an equal partner in patient care. *Radiology* 1989; 170:955–958.
5. Kinnison ML, White RI Jr., Auster M, et al. Inpatient admissions for interventional radiology: philosophy

- of patient management. *Radiology* 1985; 154:349–351.
6. Murphy TP. Clinical interventional radiology: serving the patient. *J Vasc Interv Radiol* 2003; 14:401–403.
 7. Murphy TP. Interventional radiology: a call to arms. *J Vasc Interv Radiol* 1999; 10:377–378.
 8. Ring EJ, Kerlan RK Jr. Clinical responsibility in interventional radiology. *Radiology* 1983; 147:285.
 9. White RI Jr. Status of admitting privileges for university-affiliated diagnostic radiology departments. *Radiology* 1990; 175:391–392.
 10. Zoetelief J, Faulkner K. Equipment requirements and specification for digital and interventional radiology. *Radiat Prot Dosimetry* 2001; 94:43–48.