

Requirements for Training in Interventional Radiology

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ABBREVIATIONS

ACGME = Accreditation Council for Graduate Medical Education, DR = diagnostic radiology, IR = interventional radiology, IVC = inferior vena cava, RRC = Residency Review Committee, VIR = vascular and interventional radiology

PREAMBLE

In recent years, the Society of Interventional Radiology (SIR) has become aware of a growing heterogeneity in the learning experiences of radiology trainees (residents and fellows) as it pertains to the subject of interventional radiology (IR). Unfortunately, the Accreditation Council for Graduate Medical Education (ACGME) program requirements are somewhat vague as to what constitutes adequate training in this field. Therefore, a task force was created to create guidelines for training in the field of IR. Task force members included physicians who practice in academic and private-practice settings. Also, the task force contained a cross-section of thought leaders in the various clinical realms of IR (peripheral arterial disease, interventional oncology, venous disease, interventional neuroradiology, and renal insufficiency). Many members are current or past program directors of diagnostic radiology (DR) residencies or IR fellowships.

The guidelines put forth in this document are intended for the training of radiology residents and IR fellows in the knowledge base and technical skills related to minimally invasive interventional procedures. As part of this education, trainees must gain an appropriate depth of understanding of the disease states being treated and their clinical management to allow for optimal clinical outcomes. It is intended that program directors in DR residencies and program

directors in vascular and IR (VIR) fellowships will use this document as a basis for the creation of program-specific curricula and goals and objectives documents for trainees. In addition, this document is intended for reference by radiology chairs, designated institutional officials, and deans so they may allocate appropriate resources to training programs to meet these training requirements. Finally, although training paradigms differ around the world, it is hoped that these guidelines will also be helpful in the creation of educational curricula for international IR programs as well.

SIR recognizes that the multiple levels of trainees covered by this document will require differing experiences to meet their differing needs. For example, the DR trainee who is pursuing a career in a general radiology or in a diagnostic imaging subspecialty will not require the same training as a resident planning to enter into a VIR fellowship. Therefore, four separate sets of training requirements will be set forth in this document:

1. General DR training: training requirements for the DR trainee who is pursuing a career in a general radiology or in a diagnostic imaging subspecialty;
2. IR-focused DR training: training requirements for the DR trainee who is planning on pursuing further training in a VIR fellowship;
3. IR fellowship: training requirements for successful completion of a VIR fellowship; and
4. Dual primary DR/IR certification pathway: training requirements for the trainee pursuing the combined DR/IR residency pathway.

Trainees who wish to pursue general radiology or a diagnostic imaging subspecialty as a career path will require a minimum exposure to IR with regard to time on service. Although trainees in this category may not gain sufficient expertise to perform invasive procedures independently, they should have a general knowledge of IR and how imaging plays a key role in the various disease states and their associated image-guided interventions.

For trainees who wish to pursue a career in IR, it is imperative that focused training begins in residency so that individuals beginning fellowship have a minimum skill set and knowledge base to build on during their advanced training. If the trainee coming out of residency has had insufficient preparatory IR training during their DR training, the 1-year fellowship program will be markedly handicapped.

The portion of this document dealing with the training requirements for successful completion of a VIR fellowship will be directed toward the creation of a well-rounded interventional radiologist. The individual who meets these training requirements will be competent in all basic percutaneous image-guided minimally invasive interventional procedures being performed in academic and private-practice radiology groups. This generalized skill set will also make this graduate capable

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of attaining additional competence in new/developing or advanced procedures with a minimum of additional training needed. VIR fellowship training will also incorporate appropriate imaging interpretive skills and clinical care skills relevant to the pre- and postprocedural care of patients.

Many advanced interventions fall under one of the recently developed SIR service lines, and future training guidelines along these service line designations (interventional oncology, peripheral vascular disease, venous disease, interventional neuroradiology, and renal insufficiency) are planned for the programs and trainees who wish to attain advanced competencies in one or more subspecialties within the field of IR. This designation would require significant additional clinical and procedural experience along with expert technical and knowledge-based skills over and above that of the baseline VIR training requirements outlined in this document. IR practitioners completing their training from programs that comply with these advanced training guidelines should have the necessary skills to join an academic or private practice and immediately be able to build a new practice in their area of expertise or join an existing high-level practice with minimal orientation.

GENERAL PRINCIPLES OF TRAINING

Regardless of the level of training, there are some general principles that must be adhered to during the training period. Failure to do so would adversely impact the learning environment to such a degree that the educational objectives for training would be unlikely to be met.

Continuity of clinical experience is a fundamental element of IR training. If trainees are pulled or otherwise absent from their assigned clinical rotation to meet some other need within the department, they will not be getting the planned educational benefit from their original assignment. Program directors should minimize trainees being pulled to cover other assignments during IR rotations to assure that training is not fragmented. Continuity of clinical experience extends from patient assessment and preprocedure planning to immediate (ie, within days) and long-term postinterventional follow-up care. During a typical 4-week IR rotation during residency, a trainee should not be absent from the rotation for more than 25% of the rotation for vacation or for coverage of other services. It is also important that, within a rotation (ie, 4-wk block), a minimum of two consecutive weeks of uninterrupted time on rotation be maintained. Trainees in VIR fellowship training programs should likewise not be pulled to cover non-IR-related services such as nonvascular, imaging, or night “float”/DR call.

Senior residents and fellows should serve in a supervisory role of residents in recognition of their progress toward independence, based on the needs of each patient and the skills of the individual resident or fellow. All trainees must be aware of the limits of their scope of authority and the circumstances under which they are permitted to act with conditional independence.

Longitudinal care is another fundamental principle that is an extension of continuity of clinical experience whereby trainees participate in long-term patient follow-up. All trainees should have some form of long-term follow-up of their patients to assess the results and long-term implications of their interventions. Examples of activities that would meet this requirement could include participation in the IR division's outpatient clinic and rounding on inpatients while on service. In the absence of these two options, trainees could also perform periodic chart reviews on their patients to achieve this goal.

Finally, all trainees must maintain a case log of their experience. For those trainees who are entering the field of IR as their primary specialty, it is recommended that they use the case log format that is required by the American Board of Radiology for the purpose of applying to take the Certificate of Added Qualifications Examination in VIR (1). This can be used verbatim or as a starting point for the creation of a program-specific case log. Regardless of the format used, the log should include a summary of the procedural and clinical care experience of the trainee. As such, it should not only document the diagnostic and interventional cases in which the trainee participated,

but it should also document numbers of patients admitted to the hospital, formal inpatient/outpatient initial consultations performed, and outpatient follow-up clinic visits. Parts of this document will define minimum numbers of specific procedures that should be performed to meet the educational needs of a trainee. It should be self-evident that the performance of this minimum number of procedures by a trainee must not be interpreted as an equivalent to competence achievement. Competence should be determined not just on the numbers of procedures performed but also on the achievement of educational milestones.

General DR Training: Training Requirements for the DR Trainee Entering General Radiology Practice or a Diagnostic Imaging Subspecialty

The overall goals for the trainee pursuing a career in general radiology or in a diagnostic imaging subspecialty are twofold. The first goal is to give DR trainees the opportunity to experience the field of IR so they may make an educated decision as to their ultimate career choice. Second, the trainee should be educated as to what their IR partners may have to offer patients so that dictated diagnostic imaging reports can make appropriate recommendations for IR consultation.

Overall, SIR agrees with the Association of Program Directors in Radiology Residency Restructuring Committee report published in 2010 (2). In this document, the Association of Program Directors in Radiology makes the following recommendation (2):

“Proposed guidelines for the core curriculum R1–R3 include three rotations in each of the core subspecialties (or equivalent, depending on the unique features of each training program): neuroradiology, vascular and interventional radiology...”

Three rotations of at least 4 weeks each (or its equivalent, such as two 6-wk blocks) are deemed to be the minimum requirement to meet the educational goals for this type of trainee. Rotation duration of fewer than four consecutive weeks is deemed inadequate to meet the educational training goals of the trainee as a result of the lack of continuity of patient care. As noted earlier, trainees should not be pulled to cross-cover other services to such an extent that it adversely impacts their educational experience.

Additionally, experience in the clinical care of patients and in the longitudinal care of patients should be a component of training.

Procedural experience as primary operator should include experience in imaging-guided biopsies, imaging-guided drainage, vascular access procedures, diagnostic arteriography of the peripheral and neurologic vasculature, and percutaneous organ access (ie, nephrostomy, biliary drainage, and/or gastrostomy). Exposure to arterial percutaneous revascularization techniques, dialysis access interventions, and inferior vena cava (IVC) filters should also be a part of training (and may be satisfied as a first assistant).

IR-focused DR Training: Training Requirements for DR Trainee who Is Planning to Pursue Further Training in a VIR Fellowship

The overall goal for the trainee in the category of IR-focused DR training is to lay the groundwork in preparation for matriculation into an ACGME-accredited VIR fellowship training program. As such, the expectations for time-based experience and in the breadth/depth of procedural experience are increased relative to their colleagues who are pursuing diagnostic imaging.

For this type of trainee, the usual three 4-week rotations would be insufficient. The DR program requirements (at the time of this writing) allow for as much as 16 months of training in any given subspecialty. DR programs should strive to provide the full 16 months of rotations in IR and/or clinical rotations (eg, intensive care unit) for trainees who have identified themselves as desiring to pursue IR as a career. If providing the full 16 months of IR/clinical rotation experience would put an undue burden on the DR program, other trainees (resident or

fellow), or the hospital facility, a minimum experience of 9 months should be given.

As with the general DR trainee, the DR trainee pursuing IR should receive primary operator-level experience in imaging-guided biopsies, imaging-guided drainage, vascular access procedures, diagnostic arteriography of the peripheral and neurologic vasculature, and percutaneous organ access (ie, nephrostomy, biliary drainage, and/or gastrostomy). However, primary operator experience in arterial percutaneous revascularization techniques, dialysis access interventions, IVC filters, and embolization techniques should also be a part of training.

In this type of trainee, experience in the clinical and longitudinal care of patients are crucial components of training. As such, it is highly recommended that these residents have the opportunity to participate in an ongoing continuity clinic throughout the academic year.

Finally, all trainees must engage in some form of scholarly activity as required and defined by the ACGME. As stated in the March 2010 Residency Review Committee (RRC) News for DR, “fellows in ACGME-accredited programs are expected to complete one research project during the course of their education. To meet the requirement, this project must be either presented at a local, regional or national meeting, or published.” Additionally, the RRC defines a publication as including, “book chapters, publications in peer-reviewed journals and online publications, such as ‘ACR Case-in-Point’” (3).

IR Fellowship: Training Requirements for Successful Completion of a VIR Fellowship

The trainee who successfully completes an ACGME-accredited fellowship in VIR should be able to perform all basic percutaneous image-guided minimally invasive interventional procedures being performed in academic and private-practice radiology groups. This training should also provide a sound foundation of interventional skills such that attaining additional competencies in advanced or new/emerging procedures can be performed with a minimum of additional training needed. The training period is defined in the VIR fellowship program requirements as being 12 months in length.

Although a certain base of experience, technical skills, and fund of knowledge should be attained by trainees during a DR residency, this should not be assumed by training programs. As such, each trainee's skills and knowledge should be assessed, formally or informally, in the beginning of the fellowship year so that an appropriate educational plan can be made. This is also required so the program can determine the intensity of supervision/independence appropriate for each trainee.

During the fellowship year, trainees must have primary operator experience in a sufficient diversity of procedures that they are capable of joining essentially any academic or private-practice radiology group as an independent practitioner. Additional training and/or experience should be required for only the most advanced of procedures.

Trainees should receive experience in all the following procedures, without exception:

1. Imaging-guided biopsy and drainages;
2. Venous access placement;
3. Diagnostic peripheral angiography;
4. Peripheral arterial revascularization techniques;
5. Endovascular repair of abdominal and thoracic aneurysms;
6. Visceral/renal arteriography;
7. Diagnostic neuroangiography;
8. Embolization techniques
 - a. Those used to treat traumatic bleeding, gastrointestinal bleeding, portal vein embolization, or fibroid tumors, and
 - b. The proper use of microcatheters and wires should be included in this experience;
9. Percutaneous transhepatic cholangiography, biliary drainage, and biliary stent placement;

10. Nephrostomy tube placement;
11. Gastrostomy tube placements;
12. Dialysis fistula/graft evaluation and intervention;
13. IVC filter placements;
14. Vascular thrombolysis and thrombectomy techniques; and
15. Interventional oncology therapies such as ablative and transcatheter therapies.

Finally, all trainees must engage in some form of scholarly activity as required and defined by the ACGME. As stated in the March 2010 RRC News for DR, “fellows in ACGME-accredited programs are expected to complete one research project during the course of their education. To meet the requirement, this project must be either presented at a local, regional or national meeting, or published.” Additionally, the RRC defines a publication as including, “book chapters, publications in peer-reviewed journals and online publications, such as ‘ACR Case-in-Point’.”

Regarding the numbers of procedures that must be performed during training, the overriding principle will be to produce graduates who can be credentialed in the procedures considered core to the practice of IR. The exact number of procedures will, of necessity, change over time as the practice of medicine evolves and as technologies such as medical simulation mature. Overall, the authors would defer to the credentialing recommendations published in the *Journal of Vascular and Interventional Radiology* by the Standards Division of SIR. As the Standards Division sees the need to revise their recommendations, so should the numbers of procedures performed by trainees in fellowship training be adjusted.

At the time of writing of this document, the program requirements for training in VIR state, “Fellows must document their direct participation in a minimum of 500 vascular and interventional procedures that cover the entire range of the specialty” (4). SIR recommends that the following subcategorization of procedures with accompanying numbers be used to help assure that “the entire range of the specialty” be covered during the training period (4). The SIR believes this combination of procedures would ensure that the necessary technical skill set would be attained by trainees to allow them to apply these skills to a diverse procedural practice in the field of IR. For the purpose of attaining numbers of procedures, vascular procedures (eg, catheterizations, angioplasty, stent placement) can be performed in any vascular bed in the arterial or venous systems.

1. One hundred (100) percutaneous vascular punctures;
2. Two hundred (200) selective vascular catheterizations;
3. Fifty (50) vascular angioplasties;
4. Twenty-five (25) vascular stent placements;
5. Fifty (50) embolization procedures (eg, for trauma or gastrointestinal bleeding, transcatheter chemoembolization, yttrium-90 therapy); and
6. Fifty (50) image-guided nonvascular procedures (eg, abscess drainages, nephrostomies, biliary/gallbladder drainages, gastrostomies, ablation).

Dual Primary DR/IR Certification Pathway: Training Requirements for the Trainee Pursuing the Combined DR/IR Combined Residency Pathway

In general terms, the dual certificate pathway is a combination of the DR residency and IR fellowship. The time requirements for rotational experience in this pathway will be explicitly defined in the ACGME program requirements when they are developed. In general, this program will be 6 years in length, leading to a combined primary certificate in IR and DR. At the time of this writing, an outline of these rotational requirements (based on a hypothetical 4-wk rotation block schedule) are summarized in the [Table](#).

The graduate from a dual primary certificate program should be considered equivalent in capabilities to a graduate from a traditional

Table . Schematic of Dual Primary Certificate DR/IR Residency

Postgraduate Year	IR Primary Certificate
1	Internship
2	DR 12/IR 1
3	DR 12/IR 1
4	DR 12/IR 1
5	IR 10/ICU 1/DR 2
6	IR 13

ICU = intensive care unit.

DR residency/VIR fellowship pathway. As such, all comments made earlier regarding the training of a VIR fellowship trainee would apply to these trainees as well. Therefore, these trainees should be also able to perform all basic percutaneous image-guided minimally invasive interventional procedures being performed in academic and private-practice radiology groups, and they should also obtain a sound foundation of interventional skills such that attaining additional competencies in advanced or new/emerging procedures can be performed with a minimum of additional training needed. The overall procedural experience for dual primary certificate pathway graduates should be the same as the VIR fellowship graduate given earlier.

CONCLUSIONS

In the past, training in IR has shown wide variation in the residency and fellowship years. Unfortunately, the ACGME program require-

ments for both DR residencies and VIR fellowships are vague as to what does or does not constitute adequate training in the field of IR. Inconsistent lengths of time on service, clinical training, and procedural experience have led to a wide variation in the knowledge base and technical skill of trainees graduating from both types of programs. In the future, SIR expects that the creation of milestones will be incorporated into the education and evaluation of trainees. SIR hopes that the training requirements outlined here will provide the needed guidance to program directors and institutions around the world so their graduates are well prepared for their chosen field of practice after graduation.

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