

## **Resident Core Curriculum Interventional Radiology Rotation One Diagnostic Residents**

**General Goals:** The goals include objectives required for each rotation with graduated levels of supervision and responsibility. All aspects of interventional radiology are incorporated into the residency, including fluoroscopy, radiography, CT, ultrasound, and MRI. During each rotation, the resident will read the required literature, complete sections of the IR Procedures Manual, and study the teaching file in interventional radiology. An additional goal of the Interventional Radiology (IR) experience is to provide all diagnostic radiologists with an understanding of the role of Interventional Radiology in the diagnosis and management of patients with arterial disease, venous disease, biliary disease, urinary disease, and localized visceral tumors. The diagnosis requires a progressive and increased understanding of the imaging commonly used, and an understanding of the common clinical findings of the patients being considered for IR procedures. Developing an understanding of the management of these patients requires knowing the indications, contraindications, risks and outcomes of common IR procedures and of important alternative therapies. Residents should develop competence in patient evaluation for common IR procedures, gain credentials to perform conscious sedation at our hospital, and achieve competence in a variety of minimally invasive IR procedures.

### **OVERALL BENCHMARKS/OBJECTIVES**

1. Residents assigned to IR will be available for consultations by technologists, clinicians, and other health care providers. Similarly, all residents are expected to develop a working relationship with clinicians.
2. Residents will attend IR case conferences and morning huddle whilst on the rotation and should be excused from DR AM conferences during this time. Residents should, when possible, attend DR PM conference.
3. Resident questions will be referred to the supervising faculty on service..
4. Resident review of cases with the supervising faculty will be conducted as many times in the day as necessary to keep an efficient workflow.
5. Resident examinations will be dictated by the end of every working day.
6. Residents will check and sign his/her reports prior to final sign by supervising faculty.
7. Residents must be familiar with the operation of all imaging equipment.
8. Residents will acquire knowledge of radiation protection and ways to reduce radiation exposure to both patients and hospital personnel. The resident will be supervised to ensure that safe practices are followed. Including the wearing of their dosimeter badge at all times.
9. Residents will develop an understanding of patient triage, patient selection, risks, indications, and contraindications for each procedure.
10. Residents will understand the importance of continuity of care.
11. Residents will learn vascular, biliary, and urinary anatomy and common pathology.
12. Residents will understand techniques for arterial, venous, biliary and urinary access as well as having the fundamental skills for vascular selective catheterizations for both access and maintenance. Examinations will be checked before the patient leaves the department if requested to do so by the supervising faculty.
13. Residents will acquire an understanding of the proper preparation of patients for examinations/procedures and appropriate follow-up. Residents will gain experience to gather complete history and perform a physical (H&P) to formulate a pre-procedural assessment plan with guidance from a faculty member.

14. The resident will check orders for the next working day to evaluate for appropriateness of the requested procedure or if additional exams/protocols need to be performed. Absent clinical indication or seemingly inappropriate requests will be clarified and discussed with the referring physician.
15. Residents will be able to understand the role of IR in the diagnosis and treatment of patients with PAD, thromboembolic disease, biliary obstruction, urinary obstruction, and portal hypertension.
16. Residents will be able to define the role of common interventional procedures in patient management.
17. Residents will become knowledgeable about the basic interpretation skills for diagnostic angiography, venography, cholangiography, pyelography, and portography.
18. Residents will become familiar with contrast injections and filming sequences as listed in the procedure manual provided to all residents at the start of their first IR rotation.
19. Residents will do in-depth reading and study, along with a review of teaching file cases, to become knowledgeable about the normal anatomy and physiology of vascular, biliary, and urinary anatomy and the radiologic appearances of vascular diseases, and gain a general understanding of the disease entities, their clinical presentations, and certain modes of treatment.
20. Residents will serve as a secondary consultant to referring physicians regarding interventional imaging. This will strengthen the confidence of the resident in the very important role every radiologist must perform throughout his/her career as a consultant to clinicians.
21. Residents will become prepared to pass the IR section of the Core examination of the American Board of Radiology.
22. Residents will teach and share knowledge with medical students, radiologic technologists, technology students, and peers.
23. Residents must maintain a case log during the rotations which records the procedure, patient, date, resident's involvement and any complications that occurred.

### **Supervising Faculty Responsibilities:**

1. Supervising faculty will be available at all times for any questions or consultations needed by the resident.
2. Supervising faculty will follow the levels of supervision protocol.
3. Supervising faculty will review all cases with the residents before the end of the day.
4. Supervising faculty will provide the resident with constructive, in-person feedback during the rotation, and complete timely evaluations at the conclusion of the rotation.
5. Supervising faculty will verify resident-generated reports in a timely manner and inform the resident of any major changes made.

### **Educational Goals and Objectives (First Rotation - R1, R2 Resident):**

#### **Patient Care:**

##### **PC1: Reporting – To generate effective radiology reports tailored to the care provider**

Use PACS, voice recognition systems, and hospital information systems to become proficient in dictating reports of significant radiographic findings in a concise and clear manner

##### **PC2: Clinical Consultation – To provide a high-quality clinical consultation**

- Interact with clinicians when reviewing cases using the EHR to review radiographs and angiography imaging studies and show ability to provide preliminary readings, follow up with attending radiologists, formulate a plan for routine cases, and communicate any changes to referring clinicians

- Show ability to interact with clinicians regarding cost effective and streamlined evaluation for differing clinical entities

**PC3: Image Interpretation – To appropriately prioritize differential diagnosis for imaging findings and recommend management**

- Develop basic interpretation skills to identify primary imaging findings for angiography, venography, cholangiography, and pyelography
- Learn vascular, biliary, and urinary anatomy and common pathology
- Develop skills to dictate all cases involved with (templates are available for most procedures)

**DR PC4: Competence in Procedures – To proficiently perform procedures; to anticipate and manage complications of procedures**

- Develop, through performing, temporary venous access and NT/PTBD drain maintenance procedure skills (see #4-10)
- Perform procedures with direct supervision

**IR PC4: Pre-Procedural Consultation - To ensure progressive development of knowledge and skill required to evaluate and manage patients prior to intervention**

- Understand the importance of continuity of care by pre- and post-procedure assessments
- Understand patient triage, patient selection, risks, indications, and contraindications for each procedure.
- Understand the role of venous access procedures in the treatment of patients, and become proficient in the procedure
- Define the role of common interventional procedures in the management of patients
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- Understand techniques for arterial, and venous access, to be able to proficiently perform procedures.
- Learn the fundamentals of interventional radiology workups and consents (5 venous and 5 general workups) (see #2-3)
- Participate in performing inpatient/SDA evaluation and workup (triage). Rotate with the physician assistants on venous access triage and with the nurse practitioners on procedure triage one day a week during the first six week interventional rotation
- Develop conscious sedation competency

**IR PC6: Post-Procedural Patient Care – To ensure progressive knowledge base for the appropriate post procedure care of patients and the skills to manage post procedure complications**

- Manages routine post-procedure care with guidance
- Evaluates post-procedural complications

**Medical Knowledge:**

**MK1: Diagnostic Knowledge – To apply knowledge of anatomy pathophysiology, and cellular and molecular systems to generate a differential diagnosis**

- Demonstrate knowledge of imaging anatomy, pathophysiology of disease and cellular and molecular systems
- Demonstrate the ability to recommend additional imaging studies as appropriate to better assess findings on interventional imaging studies

- Explain the impact of the radiology findings on patient care, including what imaging studies may/may not be appropriate

**MK2: Physics – To apply knowledge of physics to imaging, including dose reduction strategies, and minimizing risk to patient**

- Gain knowledge of basic physics for imaging and image-guided intervention
- Become familiar with department protocols for imaging

**MK3: Protocol Selection and Contrast Agent Selection/Dosing – To apply knowledge of protocol selection to optimize imaging**

- Able to identify and discuss the indications for and contraindications to use of intravenous radiographic contrast, and be able to monitor its administration
- Acquire knowledge of the protocols and contrast agent/dose for image-guided intervention

**MK4: Imaging Technology and Image Acquisition – To optimize image acquisition**

- Demonstrate through discussion, knowledge of basic image acquisition, image processing, and recognize common imaging artifacts and technical problems

**System-Based Practice:**

**SBP1: Patient Safety – To engage in the analysis and management of patient safety events, including relevant communication with patients, families, and health care professionals**

- Familiarity with departmental procedures, contrast safety, and sedation required in the performance of examinations
- Make suggestions to improve methods and systems utilized in radiology whenever appropriate
- Knows the institutional reporting mechanism BeSafe and how to report an event

**SBP2: Quality Improvement – To demonstrate knowledge of core QI concepts and how they inform the modern practice of medicine, to demonstrate an ability to conduct a QI project**

- Acquire knowledge of basic quality improvement methodologies and metrics
- Able to describe department/institutional quality improvement initiatives

**SBP3: System Navigation for Patient-Centered Care – To effectively navigate the healthcare system, including the interdisciplinary team and other care providers, to adapt care to a specific patient population to ensure high-quality patient outcomes**

- Demonstrate knowledge of care coordination in radiology imaging/procedures
- Coordinate care of patients in routine imaging/procedures effectively using the roles of interprofessional teams.

**SBP4: Physician Role in Health Care Systems – To understand her/his role in the complex health care system and how to optimize the system to improve patient care and the health system's performance**

- Demonstrate knowledge of ACR appropriateness criteria and cost effective imaging evaluation of common disorders
- Show ability to interact with clinicians regarding cost effective and streamlined evaluation for differing clinical entities
- Develop an awareness of the venous access devices used, their cost, and alternatives
- Understands the mechanisms for reimbursement, including types of payors

**SBP5: Contrast Agent Safety – Demonstrates competence in recognizing and managing contrast (iodinated and gadolinium) reactions**

- Aware of the basic principles of radiation protection in order to reduce as much as possible the radiation dose to the patient and reduce exposure to healthcare providers
- Recognize and treat reactions to intravenous contrast
- Understand the indications and contraindications to the different types of contrast, dosages, side effects, and the differences and relative merits of single and double contrast studies.

**SBP6: Radiation Safety – To demonstrate competence in and to be an advocate for radiation safety awareness**

- Demonstrate knowledge of the mechanisms of radiation injury and the ALARA concept
- Uses radiation protection devices as appropriate
- Wears lead apron and dosimeter badge at all times

**SBP7: MR Safety – To have an understanding of the practical aspects of MR safety**

- Gains knowledge of the risks of MRI including safety zone and pre-MR screening
- Able to determine the imaging safety of implanted devices and retained foreign bodies

**SBP8: Informatics – To understand the technology underlying image acquisitions, transmission, and interpretation; to have a broader understanding of data use for regulatory requirements, billing, and quality and patient care improvement**

- Demonstrates familiarity with hospital/department information systems
- Is familiar with information standards in radiology such as ICD-10, CPT

**PBLI1: Evidence-based and Informed Practice – To incorporate evidence and patient values into clinical practice**

- Is able to access and use imaging safety literature and website
- Able to identify patients with conditional risks for imaging safety

**PBLI2: Reflective Practice and Commitment to Personal Growth – To seek clinical performance information with the intent to improve care; reflect on all domains of practice, personal interactions, and behaviors, and their impact on patients and colleagues (reflective mindfulness); develop clear objectives and goals for improvement in some form of a learning plan**

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- Creates a self-directed learning plan
- Identify, rectify, and learn from personal errors
- Incorporate feedback into improved performance
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- Maintain a log of all cases involved in and those cases received while on call using the Hi-IQ database system which will be reviewed with the program director (if on ESIR track). The log will include the procedure, patient, date, resident's involvement and any complications that occurred.
- Obtain an attending's signature for assisting and performing a certain number of cases for procedures #1-6 in the competency book
- Able and willing to participate in clinical conferences in which imaging studies are used to guide patient care/evaluations and be able to demonstrate understanding of how imaging relates to the

clinical care of the patient

**PROF1: Professional Behavior and Ethical Principles – To recognize and address lapses in ethical and professional behavior, demonstrate ethical and professional behaviors, and use appropriate resources for managing ethical and professional dilemmas:**

- Respect patient confidentiality at all times
- Present oneself as a professional in appearance and communication
- Acknowledges lapses in professional behavior and corrects
- Demonstrate a responsible work ethic with regard to work assignments
- Develop skills for evaluating and consenting patients with attention to their needs

**PROF2: Accountability/Conscientiousness – To take responsibility for his/her actions and the impact on patients and other members of the health care team**

- Demonstrate respect for patients, families, and all members of the healthcare team and be able to discuss significant radiology findings
- Completes tasks in a timely manner that includes dictations, informed consent, and responding to other members of the healthcare team

**PROF3: Self-Awareness and Help Seeking – To identify, use, manage, improve, and seek help for personal and professional well-being for self and others**

- Has self-awareness of personal and professional well-being, and is aware of available resources
- Has self-awareness of potential stressors and how seek advice

**Interpersonal and Communication Skills:**

**ICS1: Patient and Family-Centered Communication – To deliberately use language and behaviors to form a therapeutic relationship with a patient and his/her family; to identify communication barriers, including self-reflection on personal biases, and minimize them in the doctor-patient relationship; to recognize and lead communication around shared decision making**

- Introduce and state one's role in the patient care team
- Adjusts communication based on situation and/or patient and/or family expectations
- Communicate with the patient at all times during the examination to ensure that patient remains comfortable

**ICS2: Interprofessional and Team Communication**

- Communicate effectively with all members of the health care team (technologists, medical students, fellows, residents, allied health providers, support staff, and attending physicians/radiologists)
- Call results to the referring physicians and show ability to interact with referring physicians
- Develop a working relationship with clinicians that refer patients
- Adequately explain each examination to the patient in order to ensure that the patient feels comfortable and to provide patient care that is compassionate, appropriate, and effective

**ICS3: Communication within Health Care System – To effectively communicate using a variety of methods**

- Demonstrates knowledge of institutional communications policies; e.g., cell phone, email, social media
- Uses appropriate communication method as required by institutional policy

## **Monitoring and Assessment of Resident Performance**

The resident's progress will be monitored by the faculty on the service. Written evaluations, organized by the core, and sub-competencies, will be completed by all IR faculty at the end of each rotation. Deficiencies or substandard performance will be discussed personally and privately with the resident and will be brought to the attention of the Diagnostic Residency Program Director by the attending radiologist. Resident performance is also evaluated through direct observation, case logs, multi-source professional evaluations, structured case discussion, review of patient outcomes, completion of the competency booklet handed out at the beginning of the first rotation, participation in the monthly M&M, and feedback by faculty physicians on oral presentations given at morning case conference and huddle. Additional evaluations of performance include oral testing at morning case conference, interaction with faculty during patient evaluation, procedures, and patient follow-up, attendance at required conferences, reviewing of case log in Hi-IQ, multi-rater evaluations, and other performance evaluation methods as determined.

The objectives for prior rotation, as well as the following:

## **Reading List for All Rotations**

1. Karim Valji. *Vascular and Interventional Radiology*. Saunders, 2<sup>nd</sup> Edition, 2006.

## **Supplemental Reading for All Rotations**

1. J. Kauffman. *Interventional Radiology Essentials*. 2005
2. Herbert L. Abrams. *Abram's Angiography: Vascular and Interventional Radiology*. 4<sup>th</sup> Ed., Vol I-III, Little Brown and Co., 2003.

## **Other Requirements/Expectations**

### **Learning Resources**

1. Competency booklet handed out at start of rotation

2. Teaching file cases
3. Review of all cases in which the resident was involved. Familiarity with references and current literature is expected.

### **Required Conferences**

1. Daily case conference and huddle 07:00 – 08:00
2. Attend weekly, 3pm, Liver Tumor Board Conference

### **Case Sign-off**

Residents will be given a log book to record signatures of assisting and performing a certain number of patient evaluations, conscious sedation and procedures. They must get signed off on the patient evaluations and conscious sedation **DURING THE FIRST ROTATION**. They should strive to get sign-off on as many of the procedures listed in the log book as possible.

### **Case Log**

Each resident is required to maintain a case log during the rotation which records the procedure, patient, date, resident's involvement and any complications that occurred. The log will be maintained in Hi-IQ database system. The Hi-IQ data will be reviewed halfway through the first rotation and at each rotation after the first rotation with an angio attending.

### **Schedule**

#### **Schedule of first rotation:**

Week 1: Spend the first 2 days observing procedures to get an overview of area. Then spend two days doing venous access IR triage and one day doing general IR triage

Week 2-4: Triage with NPs (1 day a week) perform vascular access cases whenever possible with guidance from PA's, Fellows, and attendings

Otherwise follow a general daily schedule of attending the morning conference, present the venous access and tube maintenance patients at case planning conference, perform venous access procedures, and get dictations completed prior to leaving for the day.

#### **Duties to be completed prior to first rotation:**

1. Make sure you are aware of the weekend workup coverage
3. Obtain Hi-IQ login from Anita Bell
6. Read the fellow's manual, especially parts on triage and venous access procedures.

#### **Tasks to complete the first two days of first rotation**

1. Have sterile technique in-service
2. General rotation overview by attending
3. Find a "visitor lead" apron that fits and put your name on it.
4. Get HI-IQ orientation from fellow or attending
5. Watch as many cases as possible



**Resident Daily Responsibilities:**

1. During the first rotation residents spend 2 days a week performing inpatient/SDA evaluation and workup (triage). Rotate with the physician assistants on venous access triage and with the nurse practitioners on procedure triage 1 day a week during the first IR rotation.
  - a. You will learn of additional requests not yet on the schedule by getting paged by the front desk. They will hand you a new request for procedure.
  - b. See all inpatients immediately when a procedure request arrives.
  - c. Review chart, check labs, get an EKG if needed, obtain consent, write the pre-procedure note and place pre-procedure orders.
  - d. Scheduling of cases, or add-on cases, should be referred to triage NP, PA, fellow or the attending of the day
  
2. Residents should arrive on time to round on any patients they are following.
  
3. Procedures:
  - e. Check for old studies.
  - f. Perform procedures with supervision by Fellow/attending. There must be an attending present before starting the cases.
  - g. A physician or nurse must be present in the procedure room at all times. No patient can have conscious sedation without a physician in attendance.
  - h. Fill out post note, enter post-orders into Epic, and call referring physician if no fellow involved in case.
  - i. Review your cases with an attending, and then dictate and bill cases.
  - j. All direct referrals for procedures from outside physicians need copies of films (CD or film sheet) to go with the patient. The patient is instructed to deliver these films to their doctor at their next visit.
  - k. See in-house patients after all **procedures** for follow up and write note in chart later that same day. Report any problems to the fellow or attending on call.
  - l. Round on them every morning until discharge. If you go off-service make sure one of the other residents or fellows picks up the case.
  
4. Attend AM conferences. (see under fellow section for schedule)
  
5. Keep a case log of all cases you are involved in while on your angio rotation and while on call using the HiQ system.
  
6. Review the competence log bi-weekly with an attending during the first rotation
  
7. Keep “Resident diary” updated.

## Appendix I:

### Core Knowledge Presentation Topics (Two-Year Lecture Series)

#### **Abdominal Trauma**

- Liver and splenic Lacerations—when to intervene
- Mesenteric pseudoaneurysms—diagnosis and treatment
- Renal and other visceral dissection
- Pelvic fracture

#### **Thromboembolic Disease and Filters**

- Diagnosis
- Filter indications and contraindications
- Identifying complications on CT

#### **Peripheral Vascular Disease—Inflow Disease**

- Operative options
- Outcomes

#### **Peripheral Vascular Disease —Infrainguinal Disease**

- Indications for treatment
- Case selection
- Outcomes

#### **Renal Artery Disease (AHM)**

- Imaging and clinical evaluation
- Evaluation of HTN and insufficiency
- Role of angiography and PTA

#### **Endocrine Imaging and Role of Sampling**

- Adrenal
- Pancreatic
- Pituitary
- Ovarian
- Parathyroid

#### **Extremity Venous Thrombolysis**

- Current indications
- Risks and benefits

#### **Acute and Chronic Mesenteric Ischemia**

- Current imaging methods
- Operative and percutaneous treatment

#### **Liver Transplant Intervention**

- Duplex and MRA for diagnosis and follow-up
- Treatment options

#### **AV Fistula Duplex and Intervention**

Duplex screening role  
PTA  
Thrombectomy

### **Vascular Malformations**

MRI findings  
Intervention

### **Gastrointestinal Bleeding**

Role of NM and angiography  
Treatment with vasoactive infusions  
Arterial embolization

### **Intravascular Foreign Bodies**

Imaging findings—normal or abnormal?  
Retrieval techniques

### **Central Venous Access**

Indications and contraindications  
Technique and outcomes

### **TIPS**

Pre-procedure imaging evaluation  
Follow-up duplex findings

### **Arterial Thrombolysis**

Clinical evaluation and triage  
Technique  
Outcome  
Risk factors

### **Urologic Non-Vascular Intervention**

Contact lithotripsy  
Ureteral strictures  
Stone retrieval  
Ureteral occlusion

### **PTC and Biliary Intervention**

Biliary duct dilatation  
Stents  
Chemodissolution of stones  
Percutaneous stone removal

### **Gastrointestinal Non-Vascular Intervention**

Percutaneous cholecystostomy  
Gastrojejunostomy  
Foreign Body retrieval  
Strictures of bowel

**Reproductive Intervention**

- Fallopian recanalization
- Impotence
- Testicular venous embolization

**HCC**

- Imaging findings in liver cancer
- TACE indications and contraindications
- TACE outcomes
- Imaging the post-TACE liver

**Liver Metastatic Disease**

- RFA
- Y90
- Portal vein embolization for resection

**General**

- Tumor board planning
- Informed Consent
- Mock Code
- Billing and Coding

## **Resident Core Curriculum Interventional Radiology Rotation Two or Greater Diagnostic Residents**

**General Goals:** The goals include objectives required for each rotation with graduated levels of supervision and responsibility. All aspects of interventional radiology are incorporated into the residency, including fluoroscopy, radiography, CT, ultrasound, and MRI. During each rotation, the resident will read the required literature and study the teaching file in interventional radiology. An additional goal of the Interventional Radiology (IR) experience is to provide all diagnostic radiologists with an understanding of the role of Interventional Radiology in the diagnosis and management of patients with arterial disease, venous disease, biliary disease, urinary disease, and localized visceral tumors. The diagnosis requires a progressive and increased understanding of the imaging commonly used, and an understanding of the common clinical findings of the patients being considered for IR procedures. Developing an understanding of the management of these patients requires knowing the indications, contraindications, risks and outcomes of common IR procedures and of important alternative therapies. Residents should develop competence in patient evaluation for common IR procedures, gain credentials to perform conscious sedation at our hospital, and achieve competence in a variety of minimally invasive IR procedures.

### **Resident Daily Work Responsibilities (OVERALL BENCHMARKS/OBJECTIVES for Self-Evaluation)**

1. Residents assigned to IR will be available for consultations by technologists, clinicians, and other health care providers. Similarly, all residents are expected to develop a working relationship with clinicians.
2. Residents will attend IR case conferences and morning huddle whilst on the rotation and should be excused from DR AM conferences during this time but attend DR PM conference as able.
3. Resident questions will be referred to the supervising faculty on service.
4. Resident review of cases with the supervising faculty will be conducted as many times in the day as necessary to keep an efficient workflow.
5. Resident examinations will be dictated by the end of every working day.
6. Residents will check and sign his/her reports prior to final sign by supervising faculty.
7. Residents must be familiar with the operation of all imaging equipment.
8. Residents will acquire knowledge of radiation protection and ways to reduce radiation exposure to both patients and hospital personnel. The resident will be supervised to ensure that safe practices are followed. Including the wearing of their dosimeter badge at all times.
9. Residents will develop an understanding of patient triage, patient selection, risks, indications, and contraindications for each procedure.
10. Residents will understand the importance of continuity of care.
11. Residents will learn vascular, biliary, and urinary anatomy and common pathology.
12. Residents will understand techniques for arterial, venous, biliary and urinary access as well as having the fundamental skills for vascular selective catheterizations for both access and maintenance. Examinations will be checked before the patient leaves the department if requested to do so by the supervising faculty.
13. Residents will acquire an understanding of the proper preparation of patients for examinations/procedures and appropriate follow-up. Residents will gain experience to

gather complete history and perform a physical (H&P) to formulate a pre-procedural assessment plan with guidance from a faculty member.

14. The resident will check orders for the next working day to evaluate for appropriateness of the requested procedure or if additional exams/protocols need to be performed. Absent clinical indication or seemingly inappropriate requests will be clarified and discussed with the referring physician.
15. Residents will be able to understand the role of IR in the diagnosis and treatment of patients with PAD, thromboembolic disease, biliary obstruction, urinary obstruction, and portal hypertension.
16. Residents will be able to define the role of common interventional procedures in patient management.
17. Residents will become knowledgeable about the basic interpretation skills for diagnostic angiography, venography, cholangiography, pyelography, and portography.
18. Residents will become familiar with contrast injections and filming sequences as listed in the procedure manual provided to all residents at the start of their first IR rotation.
19. Residents will do in-depth reading and study, along with a review of teaching file cases, to become knowledgeable about the normal anatomy and physiology of vascular, biliary, and urinary anatomy and the radiologic appearances of vascular diseases, and gain a general understanding of the disease entities, their clinical presentations, and certain modes of treatment.
20. Residents will serve as a secondary consultant to referring physicians regarding interventional imaging. This will strengthen the confidence of the resident in the very important role every radiologist must perform throughout his/her career as a consultant to clinicians.
21. Residents will become prepared to pass the IR section of the Core examination of the American Board of Radiology.
22. Residents will teach and share knowledge with medical students, radiologic technologists, technology students, and peers.
23. Residents must maintain a case log during the rotations which records the procedure, patient, date, resident's involvement and any complications that occurred.

### **Supervising Faculty Responsibilities:**

1. Supervising faculty will be available at all times for any questions or consultations needed by the resident.
2. Supervising faculty will follow the levels of supervision protocol.
3. Supervising faculty will review all cases with the residents before the end of the day.
4. Supervising faculty will provide the resident with constructive, in-person feedback in any problem areas encountered during the rotation, and complete timely evaluations at the conclusion of the rotation.
5. Supervising faculty will verify resident-generated reports in a timely manner and inform the resident of any major changes made.

**Patient Care:**

- **PC1: Reporting – To generate effective radiology reports tailored to the care provider**  
Effectively uses lexicon and structured reporting, templates
- Efficiently generates clear and concise reports which do not require substantive correction

**PC2: Clinical Consultation – To provide a high-quality clinical consultation**

- Demonstrates knowledge of ACR practice guidelines and technical standards and able to suggest appropriate exam
- Able to provide consultation with guidance for more complex clinical questions

**PC3: Image Interpretation – To appropriately prioritize differential diagnosis for imaging findings and recommend management**

- Able to prioritize differential diagnosis with guidance and recommends management options
- Given appropriate images, demonstrate a thorough knowledge and confidence of the arterial and venous anatomy of the vascular system and procedures
- Identify common pathology in order to interpret routine studies with accuracy appropriate to the level of training when presenting to the attending
- Become proficient in detecting abnormalities on plain radiographs and interventional studies while in progress
- Distinguish between normal and abnormal vascular, biliary, and urinary anatomy to level of training when presenting to the attending and demonstrate improvement compared to the prior rotation
- Detect abnormalities while the interventional procedures are in progress, such as 1) disease recognition skills will continue to increase on angiography plain radiographs and contrast studies, and 2) develop a meaningful differential diagnoses for the pathology that is found
- Develop advanced interpretation skills for diagnostic angiography, venography, cholangiography, and pyelography
- Demonstrate an ability to accurately interpret angiograms and pressure measurements to recognize vascular pathology and discuss treatment options
- Understand the physiology and clinical impact of noninvasive procedures
- Relate the imaging findings to the clinical condition and its pathology

**IR PC4: Pre-Procedural Consultation - To ensure progressive development of knowledge and skill required to evaluate and manage patients prior to intervention**

- Chooses appropriate pre-procedural lab and imaging studies
- Able to formulate a pre-procedural assessment and plan for common disorders
- Develop an understanding of complex patient triage, with focus on the risks, indications, and contraindications for complex procedures

**DR PC4: Competence in Procedures – To proficiently perform procedures; to anticipate and manage complications of procedures**

- Continue to improve skills for performing interventional examinations, and tailor examinations to answer all questions being asked by the clinician; anticipate those questions that should have been asked but were not

- Able to perform common procedures with indirect supervision
- Manages complications with supervision
- Develop confidence in performing permanent venous access procedures (see #11-15)
- Demonstrate techniques for arterial, venous, biliary and urinary access and continue to develop skills in vascular selective catheterizations
- Know and understand the uses for the array of devices, wires, catheters, needles, etc., used in interventional procedures
- Scrub in on the whole breadth of IR procedures as much as possible
- Gain exposure to fistulography, IVC filter placement, and arterial access (see #16-18)
- Observe interventional procedures and assist more senior residents and faculty as needed

**IR PC6: Post-Procedural Patient Care – To ensure progressive knowledge base for the appropriate post procedure care of patients and the skills to manage post procedure complications**

- Manages post-procedural care with minimal guidance
- Manages minor post-procedural complications

**Medical Knowledge:**

**MK1: Diagnostic Knowledge – To apply knowledge of anatomy pathophysiology, and cellular and molecular systems to generate a differential diagnosis**

- Recommend the appropriate study based on the clinical scenario and understand the relative strengths of each modality
- Protocol cases, in consultation with the attending, to ensure that the examination is appropriate and of sufficient quality to address the clinical concerns of the patient and referring physician
- Develop a working knowledge of the natural history, prognosis, and need for therapy in patients with common acute and chronic vascular disease
- Demonstrate knowledge of indications for the examinations requested (when the reason for the examination is not clear, the resident will effectively communicate with the patient and referring physician until clarified)
- List appropriate indications and contraindications for those studies performed in the interventional section

**MK2: Physics – To apply knowledge of physics to imaging, including dose reduction strategies, and minimizing risk to patient**

- Applies knowledge of basic medical physics and radiobiology to imaging and image-guided intervention

**MK3: Protocol Selection and Contrast Agent Selection/Dosing – to apply knowledge of protocol selection to optimize imaging**

- With guidance, selects appropriate protocols and contrast agent/dose for emergent and routine imaging and image-guided intervention

**MK4: Imaging Technology and Image Acquisition – To optimize image acquisition**



- Demonstrates knowledge of instrument quality control and image reconstruction and troubleshoots for artifact reduction

#### **Systems-Based Practice:**

**SBP1: Patient Safety – To engage in the analysis and management of patient safety events, including relevant communication with patients, families, and health care professionals**

- Participates in analysis of patient safety events (simulated or actual)
- Participates in disclosure of patient safety events to patients and families (simulated or actual)

**SBP2: Quality Improvement (QI) - To demonstrate knowledge of core QI concepts and how they inform the modern practice of medicine, to demonstrate an ability to conduct a QI project**

- Make suggestions to improve methods and systems utilized in radiology whenever appropriate
- Participates in local quality improvement initiatives

**SBP3: System Navigation for Patient-Centered Care – To effectively navigate the healthcare system, including the interdisciplinary team and other care providers, to adapt care to a specific patient population to ensure high-quality patient outcomes**

- Coordinates care of patients in routine radiology imaging/procedures effectively using the roles of interprofessional teams
- Performs safe and effective transitions of care/hand-offs in routine clinical situations

**SBP4: Physician Role in Health Care systems – To understand his/her role in the complex health care system and how to optimize the system to improve patient care and the health system's performance**

- Demonstrate knowledge of ACR appropriateness criteria and cost-effective imaging evaluation
- Develop an awareness of the venous access devices used, their cost, and alternatives
- States relative cost of common procedures

**SBP5: Contrast Agent Safety – Demonstrates competence in recognizing and managing contrast (iodinated and gadolinium) reactions**

- Recognizes contrast reactions (simulated or actual)
- Manages contrast reactions, with supervision (simulated or actual)

**SBP6: Radiation Safety – To demonstrate competence in and to be an advocate for radiation safety awareness**

- Communicates the relative risk of exam-specific radiation exposure to patients and practitioners

**SBP7: MR Safety – To have an understanding of the practical aspects of MR safety**

- Communicates MR safety, including implants and retained foreign bodies, to patients and

practitioners

**SBP8: Informatics – To understand the technology underlying image acquisitions, transmission, and interpretation; to have a broader understanding of data use for regulatory requirements, billing, and quality and patient care improvement**

- Describes approaches to capture and integrate data from radiology examinations into medical decision making

**Practice-Based Learning and Improvement:**

**PBLI1: Evidenced-Based and Informed Practice – To incorporate evidence and patient values into clinical practice**

- Describes approaches to capture and integrate data from radiology examinations into medical decision making

**PBLI2: Reflective Practice and Commitment to Personal Growth – To seek clinical performance information with the intent to improve care; reflect on all domains of practice, personal interactions, and behaviors, and their impact on patients and colleagues (reflective mindfulness); develop clear objectives and goals for improvement in some form of a learning plan**

- Identify, rectify and learn from personal errors
- Incorporate feedback into improved performance
- Analyzes and reflects on factors which contribute to gap(s) between expectations and actual performance

**Professionalism:**

**PROF1: Professional Behavior and Ethical Principles – To recognize and address lapses in ethical and professional behavior, demonstrate ethical and professional behaviors, and use appropriate resources for managing ethical and professional dilemmas**

- Demonstrate respect for patients and all members of the healthcare team (technologists, nurses, and other healthcare workers)
- Demonstrates insight into professional behavior in routine situations and takes responsibility for own professionalism lapses
- Analyzes straightforward situations using ethical principles
- Observe ethical principles when recommending further work-up
- Promptness and availability at work are required of every resident
- Dress appropriately for work

**PROF2: Accountability/Conscientiousness – To take responsibility for his/her actions and the impact on patients and other members of the health care team**

- Performs tasks and responsibilities in a timely manner to ensure that the needs of patients, teams, and systems are met in routine situations

**PROF3: Self-Awareness and Help Seeking – To identify, use, manage, improve, and seek help for personal and professional well-being for self and others**

- Independently recognizes status of personal and professional well-being using available

resources when appropriate

- Independently recognizes limits in the knowledge/skills of self or team and demonstrates appropriate help-seeking behaviors

### **Interpersonal and Communication Skills:**

**ICS1: Patient and Family-Centered Communication – To deliberately use language and behaviors to form a therapeutic relationship with a patient and his/her family; to identify communication barriers, including self-reflection on personal biases, and minimize them in the doctor-patient relationship; to recognize and lead communication around shared decision making**

- Appropriately obtain informed consent
- Obtain consent for more complex procedures and answer all questions the patient may have
- Explain the nature of the examination or findings in an examination to patients and their families when needed
- Identifies barriers to effective communication (e.g., language, health literacy, cultural)

**ICS2: Interprofessional and Team Communication – To effectively communicate with the health care team, including with consultants, in both straightforward and complex situations**

- Communicate effectively with all members of the healthcare team
- Communicate effectively the results of studies to referring clinicians whenever needed (for emergent studies, this will be accomplished in a timely manner)
- Effectively convey the findings of examinations through accurate dictation of reports
- Develop a working relationship with clinicians that refer patients
- Produce concise reports that include all relevant information
- Provide preliminary reports to all referring clinicians if needed before the final review of cases (when there is a significant discrepancy between the preliminary reading and final reading, the resident will notify the referring clinician immediately)
- Use appropriate language in communicating to clinicians through reports or consultations so proper management decisions can be made
- Thorough dictations will be made with indications, techniques, findings, and conclusions
- Dictate and correct reports in a timely fashion to avoid delay in patient disposition

**ICS3: Communication within Health Care Systems – To effectively communicate using a variety of methods**

- Appropriately selects direct (e.g., phone, in-person) and indirect (e.g., progress notes, text messages) forms of communication based on context
- Communicates appropriately as required by institutional policy

### **Monitoring and Assessment of Resident Performance**

The resident's progress will be monitored by the faculty on the service. Written evaluations, organized by the core competencies, will be conducted in consensus, by all IR faculty at the end of each rotation. Deficiencies or substandard performance will be discussed personally and privately with the resident and will be brought to the attention of the Residency Program Director by the attending radiologist. Resident performance is also evaluated through direct observation, case logs,

multi-source professional evaluations, structured case discussion, review of patient outcomes, completion of the competency booklet handed out at the beginning of the first rotation, participation in the monthly M&M, and feedback by faculty physicians and fellows on oral presentations given at morning case planning conference. Additional evaluations of performance include oral testing at morning case-planning conference on Thursday and Friday mornings, interaction with faculty during patient evaluation, procedures, and patient follow-up, attendance at required conferences, reviewing of case log in Hi-IQ, quality of teaching files, evaluations by nurses and technologists, and other performance evaluation methods as determined by the program.

### **Reading List for All Rotations**

1. Karim Valji. *Vascular and Interventional Radiology*. Saunders, 2<sup>nd</sup> Edition, 2006.

### **Supplemental Reading for All Rotations**

1. J. Kauffman. *Interventional Radiology Essentials*. 2005
2. Herbert L. Abrams. *Abram's Angiography: Vascular and Interventional Radiology*. 4th Ed., Vol I-III, Little Brown and Co., 2003.

### **Other Requirements/Expectations**

#### **Learning Resources**

1. Competency booklet handed out at start of rotation
2. Bibliography (books available for check out in radiology library and daily reading in IR reading room)
3. Core curriculum lectures given at noon given throughout the year and the Wednesday morning lectures and case conference lectures during IR rotation
4. Teaching file cases
5. Review of all cases in which the resident was involved. Familiarity with references and current literature is expected.

#### **Required Conferences**

1. Daily case conference and huddle 07:00 – 08:00
2. Attend daily DR 12:15 conference schedule whenever possible
3. Attend weekly, 3pm, Liver Tumor Board Conference

#### **Case Sign-off**

Residents will continue to maintain the log book to record signatures of assisting and performing a certain number of patient evaluations, conscious sedation and procedures. Residents should strive to get sign-off on as many of the procedures listed in the log book as possible.

## Case Log

Each resident is required to maintain a case log during the rotation which records the procedure, patient, date, resident's involvement and any complications that occurred. The log will be maintained in Hi-IQ database system. The Hi-IQ data will be reviewed halfway through the rotation with an IR attending.

## Schedule

### Schedule of second or greater rotation:

Week 1: Spend the first 2 days observing procedures to get an overview of area. Then spend two days doing venous access IR triage and one day doing general IR triage

Week 2-4: Triage with NPs (1 day a week) perform vascular access cases whenever possible with guidance from PA's, Fellows, and attendings

Otherwise follow a general daily schedule of attending the morning conference, present the venous access and tube maintenance patients at case planning conference, perform venous access procedures, and get dictations completed prior to leaving for the day.

### Duties to be completed prior to first rotation:

1. Make sure you and the other resident on service have a schedule for Sunday workup coverage
2. Epic, PACS access
3. Obtain Hi-IQ login from Anita Bell
4. On-line training on confidentiality and conscious sedation
5. BLS, ACLS certification, as deemed necessary (on-line and a class in radiology)
6. Read the fellow's manual, especially parts on triage and venous access procedures.

### Tasks to complete the first two days of first rotation

1. Have sterile technique in-service
2. General rotation overview by attending
3. Find a "visitor lead" apron that fits and put your name on it.
4. Get HI-IQ orientation from fellow or attending
5. Watch as many cases as possible

### Schedule of second rotation:

Triage duties after 4:00 PM and Sunday evenings shared with other residents on service.

Otherwise follow a general daily schedule of rounding on your "big" cases, attending morning conference, present your share at case planning conference, perform procedures, and completing dictations prior to leaving for the day.

### Resident Daily Responsibilities:

1. During the first rotation residents spend 2 days a week performing inpatient/SDA evaluation and workup (triage). Rotate with the physician assistants on venous access triage and with the nurse practitioners on procedure triage 1 day a week during the first six week IR rotation.

- a. You will learn of additional requests not yet on the schedule by getting paged by the front desk. They will hand you a new request for procedure.
  - b. See all inpatients immediately when a procedure request arrives.
  - c. Review chart, check labs, get an EKG if needed, obtain consent, write the pre-procedure note and place pre-procedure orders.
2. Scheduling of cases, or add-on cases, should be referred to triage NP, PA, fellow or the attending of the day Residents should arrive on time to round on any patients they are following.
3. Procedures:
- d. Check for old studies.
  - e. Perform procedures with supervision by Fellow/attending. There must be an attending present before starting the cases.
  - f. A physician or nurse must be present in the procedure room at all times. No patient can have conscious sedation without a physician in attendance.
  - g. Fill out post note, enter post-orders into Epic, and call referring physician if no fellow involved in case.
  - h. Review your cases with an attending, and then dictate and bill cases.
  - i. All direct referrals for procedures from outside physicians need copies of films (CD or film sheet) to go with the patient. The patient is instructed to deliver these films to their doctor at their next visit.
  - j. See in-house patients after all **procedures** for follow up and write note in chart later that same day. Report any problems to the fellow or attending on call.
  - k. Round on them every morning until discharge. If you go off-service make sure one of the other residents or fellows picks up the case.
4. Attend AM conferences. (see under fellow section for schedule)
5. Keep a case log of all cases you are involved in while on your angio rotation and while on call using the HiQ system.
6. Review the competence log bi-weekly with an attending during the first rotation
7. Keep “Resident diary” updated.

## **Appendix I:**

### **Core Knowledge Presentation Topics (Two-Year Lecture Series)**

#### **Abdominal Trauma**

- Liver and splenic Lacerations—when to intervene
- Mesenteric pseudoaneurysms—diagnosis and treatment
- Renal and other visceral dissection
- Pelvic fracture

**Thromboembolic Disease and Filters**

- Diagnosis
- Filter indications and contraindications
- Identifying complications on CT

**Peripheral Vascular Disease—Inflow Disease**

- Operative options
- Outcomes

**Peripheral Vascular Disease —Infrainguinal Disease**

- Indications for treatment
- Case selection
- Outcomes

**Renal Artery Disease (AHM)**

- Imaging and clinical evaluation
- Evaluation of HTN and insufficiency
- Role of angiography and PTA

**Endocrine Imaging and Role of Sampling**

- Adrenal
- Pancreatic
- Pituitary
- Ovarian
- Parathyroid

**Extremity Venous Thrombolysis**

- Current indications
- Risks and benefits

**Acute and Chronic Mesenteric Ischemia**

- Current imaging methods
- Operative and percutaneous treatment

**Liver Transplant Intervention**

- Duplex and MRA for diagnosis and follow-up
- Treatment options

**AV Fistula Duplex and Intervention**

- Duplex screening role
- PTA
- Thrombectomy

**Vascular Malformations**

- MRI findings
- Intervention

**Gastrointestinal Bleeding**

Role of NM and angiography  
Treatment with vasoactive infusions  
Arterial embolization

### **Intravascular Foreign Bodies**

Imaging findings—normal or abnormal?  
Retrieval techniques

### **Central Venous Access**

Indications and contraindications  
Technique and outcomes

### **TIPS**

Pre-procedure imaging evaluation  
Follow-up duplex findings

### **Arterial Thrombolysis**

Clinical evaluation and triage  
Technique  
Outcome  
Risk factors

### **Urologic Non-Vascular Intervention**

Contact lithotripsy  
Ureteral strictures  
Stone retrieval  
Ureteral occlusion

### **PTC and Biliary Intervention**

Biliary duct dilatation  
Stents  
Chemodissolution of stones  
Percutaneous stone removal

### **Gastrointestinal Non-Vascular Intervention**

Percutaneous cholecystostomy  
Gastrojejunostomy  
Foreign Body retrieval  
Strictures of bowel

### **Reproductive Intervention**

Fallopian recanalization  
Impotence  
Testicular venous embolization

### **HCC**

Imaging findings in liver cancer



TACE indications and contraindications  
TACE outcomes  
Imaging the post-TACE liver

**Liver Metastatic Disease**

RFA  
Y90  
Portal vein embolization for resection

**General**

Tumor board planning  
Informed Consent  
Mock Code  
Billing and Coding