VASCULAR-INTERVENTIONAL RADIOLOGY (VIR)
DIAGNOSTIC RADIOLOGY RESIDENT ROTATIONS

The goal of the Vascular and Interventional Radiology rotation is to produce Diagnostic Radiology residents that have thorough knowledge of the role of percutaneous image-guided interventions in patient management, can interpret angiographic studies, are able to clinically manage patients undergoing interventional procedures, and are comfortable performing interventional procedures. The curriculum described here covers relies on an understanding of imaging obtained on general radiology, body imaging, nuclear medicine rotations. There are some areas of overlap with Body Imaging procedures and Neuroradiology interventions.

2yr VIR Curriculum

I General Topics in IR

A. Patient Care
B. Reducing Occupational Hazards
C. Interventional Radiology Team / Clinical Practice II Vascular Diagnosis
A. Thoracic Aorta and Upper Extremities
B. Vascular Diagnosis of the Abdominal Aorta and Iliac Systems
C. Lower Extremity Vascular Disease
D. Evaluation of Patients after Vascular Reconstruction Bypass
E. Gastrointestinal Tract Vascular Evaluation
F. Liver, Spleen and Pancreatic Angiographic Studies III Vascular Intervention
A. Peripheral Vascular Disease – Extremity Ischemia Peripheral Vascular Disease – Renal Vascular Disease Peripheral Vascular Disease – Mesenteric Vascular Disease Peripheral Vascular Disease – Carotid Vascular Disease
Peripheral Vascular Disease – Abdominal Aneurysm and Dissection
B. Management of Hepatic Malignancy
C. Gynecologic Interventions
D. Trauma Interventions
E. Portal Hypertension
F. Central Venous Access
G. Hemodialysis Access Interventions
H. IVC Filter Placement/Pulmonary Thromboembolic Disease
I. Evaluation and Management of Vascular Malformations IV Non Vascular Intervention
    A. Image-Directed Biopsy
    B. Image-Guided Fluid Aspiration and Drainage
    C. Hepatobiliary Interventions
    D. Genitourinary Interventions
    E. Gastrointestinal Interventions
    F. Spinal Intervention

Resident Responsibilities
The diagnostic radiology resident's responsibilities during the VIR rotation include the following:

1) Review (with staff) any requests for procedures or consultations for management and preparation of the pre-procedure or consult note, as appropriate. This is usually performed 1-3 days prior to a scheduled examination but occurs more urgently for add-on or emergency cases.
2) Presence from 7 am to 5 pm. Personal involvement in at least two procedures per day, where the resident takes primary responsibility for the pre-procedure work-up, obtains informed consent, is primary operator or first assistant for the procedure, and manages post-procedure care, including discussion of the findings and results with the patient and their family.
3) After initial training, independent preparation of a structured VIR procedure report for review these with the attending staff.
5) Availability for consultation and/or to review cases with referring clinicians.
6) Participation in VIR conferences and pursuance of an independent course of study (see reading list) to learn the spectrum of VIR interventions and their place in management algorithms for common pathologies.
7) Adhere to all guidelines for resident responsibilities, including staff/rotation evaluations.

Staff Responsibilities
The staff covering VIR will perform the following functions:

1) Review and approve all consult and procedure requests with the resident.
2) When scheduled on the VIR service, be present from 7 am (when designated Doc of the Day, 7:30 am when not) for morning work rounds. If assigned to VIR in the afternoon, arrive no later than 12:30. When on non-clinical time, be available.
3) An attending is available 24/7 for consultation by the resident for any question or problems that may arise.
4) Actively participate in the assignation of progressive intra-procedural responsibility to the resident as their training and demonstrated abilities allow.
5) Adhere to all guidelines for staff responsibilities, including resident/program evaluations.

Performance Criteria for Residents

In addition to the graduated expectations for a particular resident's performance in the daily clinical work, residents' work done outside of the angiography suite will be assessed during morning report, during procedures, and at Journal Club. Diligent reading of core text books (see reading list) and literature to result in familiarity with concepts of Vascular and Interventional Radiology commensurate with level of training is expected. Reading should be dictated in part by upcoming scheduled cases or conferences. At times, patient care may mandate literature

review of a particular disease or procedure. Resident evaluations will depend in part on their achievement of these performance criteria.

Goals and Objectives:

The Goals and Objectives for the Diagnostic Radiology Residents are described with regard to the specific Competency, broken down by level of training. Assessment methods are noted after the specific Competency for the first rotation; as these do not change, they are not noted for the later rotations.

The described graded progression in levels of performance is a rough target; actual achievement will vary due to parameters outside of the control of the resident. The rotations vary in length from 2-10 weeks, although we attempt to have two 4- week and one 8-week long rotation. Those with contiguous months of training would be expected to achieve greater levels of expertise than those with shorter rotations separated by longer intervals. The objectives are specified with respect to training obtained during four rotations, one month in duration, and expectations would be adjusted in case of variations.

Levels of technical performance are categorized as introductory, competency, or mastery. At all levels of training, achievement of the performance criteria for previous levels is subsumed.
<u>introductory</u>--the resident has the didactic background and seen the task performed enough times
to accurately describe technical factors necessary for performance of the task, and anticipate next steps while assisting.
<u>competency</u>--the resident has observed and performed the task with supervision enough times to be capable of performing the task in an uncomplicated setting with direct or indirect supervision, but without explicit direction.
<u>mastery</u>--the resident has observed and performed the task with supervision enough times to be capable of performing the task without direct or indirect supervision. A thorough understanding of the anatomy and pathophysiology is required. Ability to manage potential complications is demonstrated.

Further, the procedures are categorized as Basic, Intermediate, or Advanced.

<u>Basic</u> interventional procedures include but are not limited to chest tube placement, paracentesis, thoracentesis, exchange of nephrostomy tubes, and exchange of gastrostomy and gastrojejunostomy tubes and basic drain changes and checks. Diagnostic Radiology residents are expected to achieve performance competency in these by the end of the program.
<u>Intermediate</u> interventional procedures include but are not limited to complex Basic procedures, arterial access and closure, angiography, hemodialysis access evaluation, central venous access, image guided biopsy, and placement of percutaneous nephrostomy tubes, gastrostomy and gastrojejunostomy tubes and cholecystostomy tubes. The Diagnostic Radiology residents are expected to achieve introductory performance ability, and may achieve competence depending on case volumes and level of interest. A thorough knowledge of the related imaging findings, pathophysiology, and indications is expected.

Advanced interventional procedures include but are not limited to complex Standard procedures, subselective angiography, embolizations, transcatheter arterial recanalizations, venous stents, foreign body retrieval, ureteral stents, biliary internal external drain or stent, image guided tumor ablation, IVC filter placement. A thorough knowledge of the related imaging findings, pathophysiology, and indications is expected.

Introductory Rotation –

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of health problems. Residents are expected to:

Pre-procedural

- Gather the essential and accurate medical, lab, and radiologic history (from electronic or hard copy records) pertinent to the consultation request or specific procedure requested for Basic and Intermediate VIR procedures.
- Accurately perform a history and physical examination
- Make informed decisions about Basic diagnostic and therapeutic interventions based on patient information and preferences, current scientific evidence, and clinical judgment.

Procedural

- Use universal precautions and sterile technique
- Be able to obtain venous access using ultrasound and Seldinger technique.
- Plan a straightforward drainage procedure.
- Ably assist (manage the 'back table', maneuver the angio table/collimators to optimize visualization, minimize radiation dose) in fluoroscopy-guided interventional procedures.
- Become competent with performance of Basic interventional procedures.
- Achieve an Introductory understanding (able to anticipate next steps as an assistant) of Standard interventional procedures.

Post-procedure

- Be able to write appropriate post-procedure orders for Basic interventions.
- Be actively involved in daily patient rounds, examining and evaluating patients who have undergone procedures.
- Reliably handle daily management requirements of the inpatients under direction of senior residents and fellows under staff supervision.
- Describe endpoints for treatment for Basic procedures

Assessment:

Global ratings by faculty 360 degree evaluation Medical Student evaluation ACR In-Service Exam ABR Exam
Document conference attendance
Learning Portfolio

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate sciences and the application of this knowledge to patient care. During this rotation, residents are expected to:

Technology

- Be familiar with basic components and operations of an angiography suite
- Be familiar with basic components and operations of a fluoro-CT scanner
- Describe Seldinger technique (apply to vascular access, abscess access)
- Describe access wire / needle combinations used for vascular or visceral access /drainage

Anatomy

- Vascular
    - Know first and second order aortic branches- names, location, and appearance of normal
    - Know parameters to describe a stenosis/occlusion
    - Know the central venous structures
- Non-vascular
    - Recognize obstructed urinary and biliary systems
    - Identify intra-abdominal collections/masses and select a safe access path

Pathophysiology

- Vascular
    - Arteriosclerotic disease
    - Renovascular hypertension
    - Urinary tract obstruction
    - Deep vein thrombosis

Non-imaging tests:

- Understand the physiology and clinical impact of ankle brachial indices, high venous pressures

Procedures

- Be able to describe the technical steps involved in the performance of vascular / visceral access and Basic procedures

Management

- Describe the management of allergic reactions
- Describe the management of chest tubes (pneumothorax and effusions)
- Discuss the management of the suspected infected tunneled central venous catheter.

Assessment:
Global ratings by faculty 360 degree evaluation ACR In-Service Exam ABR Exam
Conference Attendance and Participation Learning Portfolio

Practice-Based Learning and Improvement
Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. Residents are expected to:

- Address each problem individually, approach a request for a procedure as a consult for the indication, and ensure that the considered procedure is appropriate and the optimal approach to the clinical needs
- Actively manage their personal involvement in procedures to ensure a broad experience on the VIR service.
- Attend the VIR work rounds, Monday VIR conferences and combined Vascular conference.
- Utilize information technology to access on-line medical information, and support their own education
- Locate, appraise, and assimilate evidence from scientific studies
- Maintain a personal case log including the trainee's level of participation.
- Prepare at least one case-based 20 minute presentation for the VIR morning conference
- Participate in journal club meetings scheduled during their rotation

Assessment:
Global ratings by faculty 360 degree evaluation Procedure Log
Medical Student Evaluation ACR In-Service Exam ABR Exam
Conference attendance and participation Learning Portfolio

Interpersonal and Communication Skills
Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. Residents are expected to:

Patients
- Communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families
- Completely explain to the patient, the indications, the Basic interventional procedure to be performed, potential complications, and alternatives. Provide the opportunity for the patient to ask questions and be able to answer the questions clearly.

Interventional Team
- Provide concise and accurate patient presentations for Basic procedures.
- Work professionally and effectively with other health care professionals, including technologists, secretaries, schedulers, nurses, students, residents, and physicians

Non-VIR Physicians
- Create an accurate, concise, and grammatically correct radiology report for Basic

procedures in eDH so that is immediately available after a procedure.
- Directly communicate urgent or unexpected findings of Basic procedures with the referring clinicians
- Document the communication of critical findings with the appropriate medical personnel in a timely fashion

Assessment:
Global ratings by faculty 360 degree evaluation Medical Student evaluation Dictation evaluation
ACR In-Service Exam ABR Exam
Conference attendance and participation Learning Portfolio

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. Residents are expected to:

- Demonstrate respect, compassion, and integrity.
- Demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities.
- Present one's self as a professional in appearance, demeanor and in one's communication.
- Have an appropriate work ethic. Always report to cases and conferences on time.
- Demonstrate a commitment to excellence and on-going educational and professional development
- Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, and confidentiality of patient information.
- Recognize their own limitations

Assessment:
Global ratings by faculty 360 degree evaluation Medical Student evaluation ACR In-Service Exam ABR Exam
Conference attendance and participation Learning Portfolio

Systems-Based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

- Review the request for a Basic interventional procedure with the attending as regards cost, effectiveness, and appropriateness, and to facilitate performance of an alternative study if indicated
- Practice cost-effective health care and resource allocation that does not compromise quality of care
- Become familiar with the ACR Appropriateness Criteria as it applies to VIR Basic procedures

- Use information technology to manage information, access on-line information, and support their own education
- Participate in the recording of complications in the VIR quality assurance data base, and participate in Morbidity and Mortality rounds.
- Describe and use appropriately the Quantros incident/occurrence reporting system

Assessment:
Global ratings by faculty 360 degree evaluation Medical Student evaluation ACR In-Service Exam ABR Exam
Document conference attendance Learning Portfolio

Second Rotation

Patient Care
Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of health problems. Residents are expected to:

Pre-procedural
- Gather (from electronic or hard copy records) the essential and accurate medical, lab, and radiologic history pertinent to the consultation request or specific procedure requested for Basic and Intermediate VIR procedures.
- Accurately perform a history and physical examination
- Make informed decisions about Basic diagnostic and therapeutic interventions based on patient information and preferences, current scientific evidence, and clinical judgment.
- Develop a patient management plan for Basic procedures.

Procedural
- Be able to obtain venous access using ultrasound and Seldinger technique.
- Plan an image-guided biopsy or drainage procedure that requires angulation..
- Ably assist (manage the 'back table', maneuver the angio table/collimators to optimize visualization, minimize radiation dose) in fluoroscopy-guided interventional procedures.
- Be competent with performance of Basic interventional procedures.
- Anticipate next steps as an assistant in Intermediate interventional procedures.

Post-procedure
- Be able to write appropriate post-procedure orders for Basic and Standard interventions.
- Be actively involved in daily patient rounds, examining and evaluating patients who have undergone procedures.
- Reliably handle daily requirements of the inpatients in cooperation with other residents and fellows under staff supervision.
- Describe endpoints for treatment for Basic and Standard procedures

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate sciences and the application of this knowledge to patient care. In addition to expectations from the first rotation, residents are expected to:

Technology

- Be familiar with basic components and operations of an angiography suite : including roadmap technique
- Describe methods of dose reduction
- Be familiar with basic components and operations of a fluoro-CT scanner
- Describe Seldinger technique (apply to vascular access, abscess access)
- Describe access wire / catheter combinations for first order selective catheterizations

Anatomy

- Vascular
    - Know first and second order aortic branches—name, location, and appearance of normal
    - Know upper and lower extremity arteries to the digits
    - Know the parameters to differentiate an aneurysm from penetrating ulcer
    - Understand the relationship between arteriographic findings in trauma and the underlying pathology
    - Know the upper and lower extremity venous structures
- Non-Vascular
    - Know renal, gastric vascular anatomy with regard to routes of access
    - Differentiate urinary and biliary mural lesions vs calculi
    - Describe the pleural reflection and landmarks relevant to percutaneous access to upper abdominal structures

Pathophysiology

- Vascular
    - Arterial trauma natural history
    - Mesenteric ischemia
    - Hemodialysis graft dysfunction
- Non-Vascular
    - Renal calculi
    - Biliary calculi

Non-imaging tests:

- Understand the physiology and clinical impact of pulse volume recording, recirculation times, urea reduction ratio.

Procedures

- Be able to describe the technical steps involved in the performance of Basic and some Intermediate procedures

Management

- Describe the management of percutaneous drainage catheters.

- Describe the management of chest tubes (pneumothorax and effusions)
- Describe indications for and the various management options of DVT
- Describe the role of interventional techniques in the maintenance of dialysis access patency with reference to DOQI guidelines.
- Discuss the management of the suspected infected tunneled central venous catheter.
- Describe indications for gastrostomy versus gastrojejunostomy vs jejunostomy
- Describe the follow up after percutaneous nephrostomy, gastrostomy

Practice-Based Learning and Improvement

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. Residents are expected to:

- Address each problem individually, approach a request for a procedure as a consult for the indication, and ensure that the considered procedure is appropriate and the optimal approach to the clinical needs
- Actively manage their personal involvement in procedures to ensure a broad experience on the VIR service.
- Attend the VIR work rounds, Monday conferences and combined Vascular conference.
- Use information technology to manage information, access on-line medical information, and support their own education
- Locate, appraise, and assimilate evidence from scientific studies
- Maintain a personal case log including the trainee's level of participation.
- Participate in journal club meetings scheduled during their rotation

Interpersonal and Communication Skills

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. Residents are expected to:

Patients

- Communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families
- Completely explain to the patient, the indications, the Basic or Intermediate interventional procedure to be performed, potential complications, and alternatives. Provide the opportunity for the patient to ask questions and be able to answer the questions clearly.

Interventional Team

- Provide concise and accurate patient presentations for Basic and Intermediate procedures.
- Work professionally and effectively with other health care professionals, including technologists, secretaries, schedulers, nurses, students, residents, and physicians
- To present a 20-minute presentation at the morning VIR work rounds (if on a 2 month rotation). This presentation should be based on a case in which the trainee was

involved and highlight the current literature regarding a selected

Non-VIR Physicians

- Create an accurate, concise, and grammatically correct radiology report for Basic and Intermediate procedures in eDH so that is immediately available after a procedure.
- Directly communicate urgent or unexpected findings of Basic and Intermediate procedures with the referring clinicians
- Document the communication of critical findings with the appropriate medical personnel in a timely fashion

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. Residents are expected to:

- Demonstrate respect, compassion, and integrity.
- Demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities.
- Present one's self as a professional in appearance, demeanor and in one's communication.
- Have an appropriate work ethic. Always report to cases and conferences on time.
- Demonstrate a commitment to excellence and on-going educational and professional development
- Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, and confidentiality of patient information.
- Recognize their own limitations
- Demonstrate initiative by being available and volunteering services during procedures and between cases.

Systems-Based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

- Review the request for a Basic or Intermediate interventional procedure with the attending as regards cost, effectiveness, and appropriateness, and to facilitate performance of an alternative study if indicated
- Practice cost-effective health care and resource allocation that does not compromise quality of care
- Become familiar with the ACR Appropriateness Criteria as it applies to VIR
- Use information technology to manage information, access on-line information, and support their own education
- Participate in the recording of complications in the VIR quality assurance data base, and

participate in Morbidity and Mortality rounds.

- Describe and use appropriately the Quantros incident/occurrence reporting system

Third rotation

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of health problems. In addition to expectations from the second rotation, the residents are expected to:

Pre-procedural

- Gather (from electronic or hard copy records) the essential and accurate medical, lab, and radiologic history pertinent to the consultation request or specific procedure requested for all levels of procedures.
- Accurately perform a history and physical examination; demonstrate accurate clinical assessment of the patient, particularly those with vascular disease.
- Recognize and be able to discuss with the patient or health care staff the indications, contraindications, risks, benefits, and alternatives for Basic and Intermediate procedures.
- Develop a patient management plan for Basic and Intermediate procedures.

Procedural

- Be competent in the performance of Basic interventional procedures.
- Be able to obtain arterial or venous access using ultrasound and Seldinger technique, and place a catheter (non-selectively) in the aorta or cava.
- Demonstrate knowledge of the appropriate contrast injection rates and volumes, filming rates, and properly interpret images.
- Perform a straightforward image-guided biopsy or drainage procedure.
- Place a tunneled catheter and port
- Gain an introductory level of performance of Intermediate interventional procedures

Post-procedure

- Be able to write appropriate post-procedure orders for Basic and Standard interventions..
- Understand endpoints for treatment for Basic and Standard procedures of inpatients

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate sciences and the application of this knowledge to patient care. In addition to expectations from the prior rotations, residents are expected to:

Technology

- Describe digital subtraction angiography
- Know dose differences between conventional II and flat panel, un- vs magnified
- Be familiar with injector parameters (rate of rise, pressure limit, optimal filming rates for various vascular beds)

- Be familiar with Advanced abilities of a fluoro-CT scanner (angled gantry, summation of images)
- Describe potential advantages of US vs CT guidance for biopsy/drainage procedures
- Describe an AccuStick set and discuss when it might be advantageous
- Describe difference between guide wires (.018 vs .035; Amplatz vs Newton vs Bentson vs Glidewire)
- Detail the function of an angioplasty balloon catheter.
- Describe the benefits/disadvantages of self-expanding and balloon-expandable stent

Anatomy

- Vascular
  - know mesenteric, pelvic, bronchial arteries
  - describe collateral arterial anatomy for aorto-iliac occlusive disease
  - know the portal and azygous venous systems
  - describe collateral anatomy for internal jugular vein occlusion
- Non-Vascular
  - Know liver segmental anatomy
  - Identify pulmonary lesions and select safest target

Pathophysiology

- Vascular
  - Aneurismal disease
  - trauma (recognize / describe intimal flap vs filling defect vs occlusion vs false aneurysm vs extravasation)
  - SVC syndrome
  - Portal venous hypertension
  - Budd-Chiari syndrome

Non-imaging tests:

- Understand the use and significance of hepatic wedge pressure measurement, arterial or venous pull-back pressure gradients

Procedures

- Be able to describe the technical steps involved in the performance of Intermediate procedures

Management

- Develop a working knowledge of the natural history, prognosis and indications for therapy in patients with vascular disease
- Describe the management of percutaneous drainage when an enteric fistula is involved.
- Describe the indications for chronic chest drainage (PleruRx) and pleurodesis
- Describe indications for various the management options for portal hypertension.
- Discuss internal-external biliary drainage catheter versus metallic stent placement.
- Discuss the rationale and role for mesenteric arteriography in the evaluation of patients with GI bleeding, and the percutaneous treatment options.

- Describe the diagnostic algorithm for the detection of renovascular hypertension. And describe the potential percutaneous treatment options.
- Understand the pathophysiology and manifestations of peripheral vascular disease as well as the applicable medical, interventional and surgical therapies.
- Understand the applications of vascular embolization (i.e. trauma, tumor therapy, bleeding disorders, AVMs).
- Describe the differences between the available embolic agents.

Practice-Based Learning and Improvement

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. In addition to expectations from the prior rotations, the residents are expected to:

- Address each problem individually, approach a request for a procedure as a consult for the indication, and ensure that the considered procedure is appropriate and the optimal approach to the clinical needs
- Actively manage their personal involvement in procedures to ensure a broad experience on the VIR service.
- Apply knowledge of study designs and statistical methods to the appraisal of clinical studies on diagnostic and therapeutic effectiveness of interventional procedures.
- Teach, and facilitate the learning of students and other health care professionals
- Incorporate feedback obtained during morning report and daily procedures into improved performance.
- Attend the VIR work rounds, Monday VIR conferences and combined Vascular conference.
- Utilize information technology to access on-line medical information, and support their own education
- Locate, appraise, and assimilate evidence from scientific studies
- Maintain a personal case log including the trainee's level of participation.
- Participate in journal club meetings scheduled during their rotation

Interpersonal and Communication Skills

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. In addition to expectations from the prior rotations, residents are expected to:

Patients

- Communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families
- Completely explain to the patient the indications, technical detail, potential complications, and alternatives of the Basic or Intermediate interventional procedure to be performed, potential complications, and alternatives. Provide the opportunity for the patient to ask questions and be able to answer the questions clearly..

Trainees

- Effectively teach medical students on the VIR rotation.

Interventional Team

- Provide concise and accurate patient presentations for Basic and Intermediate procedures.
- Work professionally and effectively with other health care professionals, including technologists, secretaries, schedulers, nurses, students, residents, and physicians
- Be able to briefly present cases during in-patient rounds. These presentations cover the presenting complaint, basic history, previous relevant studies that led up to the patient's interaction with the VIR service, and on post-intervention patients, details of the procedure performed and the hospital course since the intervention.

Non-VIR Physicians

- Create an accurate, concise, and grammatically correct radiology report for Basic and Intermediate procedures in eDH so that is immediately available after a procedure.
- Document the communication of critical findings with the appropriate medical personnel in a timely fashion
- Appropriately discuss Basic and Intermediate VIR procedures with referring and consulting physicians.
- Directly communicate urgent or unexpected findings with the referring clinicians
- Develop the skills necessary to present the findings on a diagnostic vascular study at an interdisciplinary conference.

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. In addition to expectations from the prior rotations, residents are expected to:

- Demonstrate respect, compassion, and integrity.
- Demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities.
- Present one's self as a professional in appearance, demeanor and in one's communication.
- Have an appropriate work ethic. Always report to cases and conferences on time.
- Demonstrate a commitment to excellence and on-going educational and professional development
- Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, and confidentiality of patient information.
- Recognize their own limitations
- Demonstrate initiative by being available and volunteering services during procedures and between cases.
- Serve as a role model for junior residents and medical students..
- Demonstrate willingness to perform additional duties that contribute to the overall patient care and academic interests of the section.
- Demonstrate a commitment to self directed study and learning
- Demonstrate a responsiveness to the needs of the patient and society that supersedes self interest.

Systems-Based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

- Review the request for a Intermediate interventional study imaging with the attending as regards cost, effectiveness, and appropriateness, and to facilitate performance of an alternative study if indicated
- Understand how their professional practice affects other health care professionals, the health care organization, and the larger society, and how these elements affect their own practice
- Begin to understand the relative costs of the various imaging studies, invasive procedures and their surgical alternatives, and become familiar with issues such as cost containment.
- Assist referring clinicians in providing cost-effective health care: evaluate requests for a Standard interventional study as regards cost, effectiveness, and appropriateness, and to facilitate performance of an alternative study if indicated
- Learn the ACR Appropriateness Criteria as it applies to VIR procedures
- Present critical analysis of literature pertinent to cases

Fourth rotation

Patient Care

Residents must be able to provide patient care that is compassionate, appropriate, and effective for the diagnosis and treatment of health problems. In addition to expectations from the prior rotations, residents are expected to:

Pre-procedural

- Perform a complete yet focused assessment for all levels of procedures, including an accurate history and physical examination to produce an appropriate management plan for the complaint.
- Be able to discuss any procedure with the patient or health care staff, with regard to the indications, contraindications, risks, benefits of the proposed treatment and compare with the alternatives.
- Develop a patient management plan for all levels of procedures.

Procedural

- Master the performance of Basic VIR procedures.
- Be competent with performance of Intermediate interventional procedures.
- Perform first order selective arterial catheterization
- Demonstrate knowledge of the appropriate contrast injection rates and volumes, filming rates, and properly interpret images.
- Be able to perform a percutaneous nephrostomy or cholangiogram on a dilated system.

- Place a gastrostomy tube.
- Perform hemodialysis access contrast study, balloon angioplasty of stenosis
- Perform IVC evaluation and IVC filter placement.
- Perform straightforward CT guided biopsy and/or drainage procedure with proficiency, including optimal patient positioning, device choice and demonstrate reasonable intra-procedural decision making
- Accurately interpret the imaging and have an introductory understanding (ably assist / anticipate) of Advanced interventional procedures

Post-procedure

- Be able to write appropriate post-procedure orders for all levels of interventional procedures, particularly including transcatheter embolization and tumor ablation patients.
- Understand endpoints for treatment in all procedures.

Medical Knowledge

Residents must demonstrate knowledge about established and evolving biomedical, clinical, and cognate sciences and the application of this knowledge to patient care. In addition to expectations from the prior rotations, residents are expected to:

Technology

- Describe the mechanism of 3D reconstruction from a spin- angio versus Dyna CT
- Describe how combined modalities (US and fluoro or fluoro and CT) may be advantageous for nephrostomy tube placement or direct jejunostomy tube placement.
- Define at what dose (by fluoro time, dose-area product) one would monitor for radiation injury to the skin.
- Describe a snare and how it is used.
- Describe the mechanism of percutaneous mechanical thrombectomy
- Describe the mechanisms of arterial closure devices (Mynx, AngioSeal, Perclose)
- Describe the method for administration of thrombolytic therapy.
- Describe construction and deployment of a stent graft.

Anatomy

- Vascular
  - Recognized and categorize endoleaks
  - Visceral aneurysm
  - Uterine arteries and ovarian arteries
  - Testicular veins
  - Adrenal Veins
- Non-vascular
  - Liver tumor diagnosis by CT and MRI
  - Renal cyst classification

Pathophysiology (etiology, natural history, and imaging)

- Vascular

- Massive PE
- Varicocele and pelvic congestion syndrome

Procedures

- Be able to describe the technical steps involved in the performance of Advanced procedures

Management

- Develop a working knowledge of the natural history, prognosis and need for therapy in patients with vascular disease.
- Describe the indications for and the management options for sub-massive and massive
- Discuss the rationale and role for mesenteric arteriography in the evaluation of patients with mesenteric ischemia, and the percutaneous treatment options.
- Describe indications for and the management options for portal hypertension.
- Describe the indications for IVC filter removal.
- Understand the applications of vascular embolization (i.e. trauma, tumor therapy, bleeding disorders, AVMs).
- Describe the considerations to select an interventional liver tumor therapy (different types of embolotherapy and ablative techniques).

Practice-Based Learning and Improvement

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices. Residents are expected to:

- Address each problem individually, approach a request for a procedure as a consult for the indication, and ensure that the considered procedure is appropriate and the optimal approach to the clinical needs
- Actively manage their personal involvement in procedures to ensure a broad experience on the VIR service.
- Attend the VIR work rounds, Monday conferences and combined Vascular conference.
- Use information technology to manage information, access on-line medical information, and support their own education
- locate, appraise, and assimilate evidence from scientific studies
- Maintain a personal case log including the trainee's level of participation.
- Prepare at least one case-based 20 minute presentation for the VIR morning conference (if on service for two consecutive months.)
- Apply knowledge of study designs and statistical methods to the appraisal of clinical studies on diagnostic and therapeutic effectiveness of interventional procedures.
- Teach, and facilitate the learning of students and other health care professionals
- Incorporate feedback obtained during morning report and daily procedures into improved performance.
- Participate in journal club meetings scheduled during their rotation

Interpersonal and Communication Skills

Residents must be able to demonstrate interpersonal and communication skills that result in effective information exchange with technologists, referring physicians, and other medical personnel. Residents are expected to:

Patients

- Communicate effectively and demonstrate caring and respectful behaviors when interacting with patients and their families
- For All interventional procedures, completely explain to the patient, the indications, the procedure to be performed, potential complications, and alternatives. Provide the opportunity for the patient to ask questions and be able to answer the questions clearly.

Trainees

- Effectively teach medical students on the VIR rotation.

Interventional Team

- Provide concise and accurate patient presentations for all procedures.
- Work professionally and effectively with other health care professionals, including technologists, secretaries, schedulers, nurses, students, residents, and physicians
- Be able to briefly present cases during in-patient rounds. These presentations cover the presenting complaint, basic history, previous relevant studies that led up to the patient's interaction with the VIR service, and on post-intervention patients, details of the procedure performed and the hospital course since the intervention.

Non-VIR Physicians

- Create an accurate, concise, and grammatically correct radiology report for any procedure.
- Document the communication of critical findings with the appropriate medical personnel in a timely fashion
- Appropriately discuss any level of VIR case with referring and consulting clinicians
- Directly communicate urgent or unexpected findings with the referring clinicians
- Develop the skills necessary to present the findings on a diagnostic vascular or interventional (vascular or non-vascular) study at a multidisciplinary conference.

Professionalism

Residents must demonstrate a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient and professional population. . In addition to expectations from the prior rotations, residents are expected to:

- Demonstrate respect, compassion, and integrity.
- Demonstrate sensitivity and responsiveness to patients' culture, age, gender, and disabilities.
- Present one's self as a professional in appearance, demeanor and in one's communication.
- Have an appropriate work ethic. Always report to cases and conferences on time.
- Demonstrate a commitment to excellence and on-going educational and professional development
- Demonstrate a commitment to ethical principles pertaining to provision or withholding of clinical care, and confidentiality of patient information.

- Recognize their own limitations
- Demonstrate initiative by being available and volunteering services during procedures and between cases.
- Serve as a role model for junior residents and medical students..
- Demonstrate willingness to perform additional duties that contribute to the overall patient care and academic interests of the section.
- Demonstrate a commitment to self directed study and learning
- Demonstrate a responsiveness to the needs of the patient and society that supersedes self interest.
- Strive to function at a fellowship level in terms of management of the logistics of the service, and in decision making, and generating a preliminary interpretation.

Systems-Based Practice

Residents must demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value. Residents are expected to:

- Review the request for an any interventional procedure with the attending as regards cost, effectiveness, and appropriateness, and to facilitate performance of an alternative study if indicated
- Understand and apply the ACR Appropriateness Criteria as they apply to VIR diagnostic and therapeutic procedures.
- Use information technology to manage information, access on-line information, and support their own education
- Participate in the recording of complications in the VIR quality assurance data base, and help lead Morbidity and Mortality rounds.
- Be able to discuss the relative merits of endovascular versus surgical approach to oncologic, peripheral vascular and neurovascular diseases; i.e. chemoembolization, cholangiography, port placement, metastatic liver disease, uterine artery fibroids, etc.
- Be able to discuss the relative costs of imaging studies, invasive procedures and their surgical alternatives in specific clinical circumstances.

Reading List:

General texts:

Image-guided Interventions. Mauro, Murphy, Thomson Second Edition, 2014 Phil, PA

Vascular diseases: Surgical and Interventional Therapy. Strandness DE, van Breda A Churchill Livingstone; New York, New York 1994

Atlas of normal and variant angiographic anatomy. Kadir S. W.B. Saunders Co.; Philadelphia, 1991.

Diagnostic Angiography. Kadir S. Saunders; Philadelphia 1986.

Venous interventional radiology with clinical perspectives Scott J. Savader, Scott O.

Trerotola Edition: 2, illustrated Thieme, 2000 ISBN 0865778949, 9780865778948

Abrams' angiography: interventional radiology. Herbert L. Abrams, Stanley Baum, Michael J. Pentecost Edition: 2, illustrated Lippincott Williams & Wilkins, 2005 ISBN 0781740894, 9780781740890

Vascular and interventional radiology; the requisites John A. Kaufman, Michael J. Lee Mosby, 2003 ISBN 0815143699, 9780815143697

CT and MR Angiography of the Peripheral Circulation: Practical Approach with Clinical Protocols. Mukherjee D, Rajagopalan S (eds). CRC Press, 2007 ISBN 1841846066, 9781841846064

Either of these handbooks provide good overviews, and are useful guides when you are on the VIR service:

Handbook of Interventional Radiology and Angiography Myron Wojtowycz Mosby, June 1995 ISBN 0815194404, 9780815194408

Handbook of interventional radiologic procedures Krishna Kandarpa, John E. Aruny Published by Lippincott Williams & Wilkins, 2001 ISBN 0781723582, 9780781723589

Selected journal articles to be designated.

Conference Schedule (2 year)

month	topic	presenter
7	Overview VIR	RH/AF
7	Risk Assessment	VS
8	Angiography / Interventions	RH
8	Renal	VS
8	Carotid Occlusive	VS
9	Biopsy / Drain	RH
10	Central Venous Access	AF
10	Great vessel, vertebral	VS
11	IVC Filter	RH /JG
11	Thoracic Aorta Pathology	VS
12	Hemodialysis Access	AF
12	Vascular trauma	VS
1	Venous thromboemboli	VS
1	Acute Arterial Occlusion	VS
2	Venous Thrombosis / Lysis	RH
3	Embolization-Trauma	RH

4	GU interventions	AS
4	Aortic Aneurysms	VS
5	Vascular Access	VS
6	Thoracic Interventions	SE
6	Radiation Biology	JW
6	A-V malformations	VS
7	Pulmonary embolism - Dx	AF
7	Pulm Emb, IVC filter	VS
8	Upper extremity angiography	NM
8	Mesenteric	VS
9	Renal Artery stenosis / stent	RH
9	Thoracic outlet	VS
10	Portal hyprtension, TIPS	RH
11	chemoembolization	RH
11	Peripheral aneurysms	VS
11	Carotid-Other	VS
12	Solid tumor ablation	JG
12	Diabetic foot problems	VS
1	Venous ablation	RH
2	uterine fibroid embolization	JG
2	Upper Extremity	VS
3	GI Bleed	AS
3	Amputations	VS
4	PVD clinical, US, MRA	JG
4	Venous Insuff, Lymphedema	VS
4	Popliteal entrap., etc.	VS
5	Biliary dx, interventions	NM
5	PVD- Ao Iliac PTA / stent	RH
5	Coagulation disorders	VS
6	Vertebroplasty / bone biopsy	JG
6	Radiation Biology	JW
6	Pediatric Vasc. Disease	VS
6	Vasculitis	VS