Department of Radiology
Resident and Fellow Manual
2021-2022

CHAIR'S WELCOME AND MISSION STATEMENT

The Department of Radiology at The University of Texas Health Science Center at San Antonio (UT Health San Antonio) is a dynamic academic enterprise with diverse clinical, educational, and research initiatives. Our major strengths include:

- Diagnostic and Interventional Radiology - Integrated residency and fellowship training programs
- One of the largest Radiological Sciences Graduate Degree Program in the United States.
- Implementation of ~~an~~ ~~inaugural~~ Professional Doctorate of Medical Physics program- the first in South Texas.
- Innovative research laboratories that produced the Vascular Stent & Endothelial Cell Research of Dr. Julio C. Palmaz, the inventor of the Palmaz™ intravascular stent; Biomolecular Nanoparticle Imaging and Therapeutic Systems and the Oncological Imaging and Interventions Research
- Clinical trial projects that study investigational drugs or devices which are an important part of the process to assure the safety and efficacy of a drug or device

Our primary clinical partner is the University Health System. Together we provide care for the citizens of South Texas. We are part of UT Health San Antonio (UTHSA) and our imaging centers are located at The Medical Arts Research Center known as the "MARC", UT Health Hill Country, and at the Mays Cancer Center. I am also excited to say that construction has begun for The UT Health San Antonio Multispecialty and Research Hospital that will open in 2024. The hospital will offer specialty care in cancer, orthopedics, urology, and thoracic and bariatric surgery. It will also be the site of early phase clinical trials, including immunologic and stem cell therapies for cancer.

The partnership between our medical school and our collaborating facilities creates a stimulating environment which fosters professional growth and development for "Team Radiology" members and for each of our clinical, educational, and research programs.

I invite you to continue browsing through our website to learn more about our missions and academic practice. It is my hope that at the end of your visit, you will come to realize that the Department of Radiology at UT Health San Antonio does in fact- "Practice What We Teach".

DEPARTMENT OF RADIOLOGY MISSION STATEMENT:

To develop, promote, and integrate advances in imaging technology and imaging-based therapeutic procedures into the clinical, education, and research missions of UTHSCSA. The fundamental principles of each of the missions are as follows:

CLINICAL SERVICE:

- Practice at the leading edge of radiology
- Deliver all services in a professional, timely, and efficient manner
- Establish ourselves as valuable colleagues and consultants to referring physicians

- Ensure safe and appropriate utilization of diagnostic and interventional radiological services

EDUCATION:

- Provide an excellent, well-rounded educational experience in imaging, image-guided therapy, radiological science, and radiological research for medical students, residents, fellows, and graduate students
- Educate our colleagues about the availability, proper use, and associated risks of diagnostic and interventional radiological services
- Contribute to the education of the medical community and public through presentations and publications of original research and educational materials.

RESEARCH:

- Perform well-designed, high-quality research in imaging, image-guided therapy, and radiological science that will broaden the understanding of disease processes, expand our diagnostic and interventional armamentarium, and have a significant impact on patient care
- Present and publish scientific research that will receive national recognition and make a lasting contribution to the medical literature
- Educate and train residents and graduate students in the scientific methods of medical imaging research to promote future progress and improved patient care

Pamela M. Otto, MD, FACR
Professor and Chair
Stewart R. Reuter MD Chair in Radiology

Welcome from the Program Directors

So, you're finally here! You have just begun one of the most challenging periods of your career. Radiology residency is an exciting time, but the intellectual and emotional demands can be surprisingly rigorous. You are now part of a highly committed team that provides care ranging from cancer screening and non-invasive imaging to cutting-edge interventional procedures. And you are on your way to expertise that spans at least ten radiologic subspecialties. Many residents soon come to feel that four years is simply not enough time to learn it all (and they are probably right, but that's a whole other topic).

The practice of radiology touches such a diverse range of disease and anatomic detail, that there is no single source of information to depend upon. This manual is just a beginning, intended to give you objectives and guidelines that can help you optimize your experience on each clinical rotation.

We designed our program to provide you with the clinical and educational opportunities that will not only help you to become a board-certified radiologist but to practice with excellence. We are proud of the amazing learning opportunities made available directly by the residency program. However, there is simply too much radiologic knowledge to acquire during the regular workday or to learn at conferences.

Ultimately, the responsibility for your medical education is yours; a responsibility that will continue for the rest of your career. Your success will require a continuous plan for study and self-directed pursuit of educational experiences, through books, journals, seminars, and online courses. Do not hesitate to ask for resource guidance from me, other faculty members, or other residents. You never know where you will find the most helpful advice for developing your learning plan.

As with any other medical specialty, the degree to which you embrace your clinical responsibilities will directly affect the quality of your training. We have designed the curriculum so that it should be easy to stay within the ACGME resident duty hour requirements, even with your full commitment to the program. Within those guidelines, the more you actively seek to assume responsibility on your service, the more you will learn about that subspecialty of radiology.

Your first year of training will be a bit challenging. Almost every service rotation will be new to you. Two ways to prepare yourself include (1) reading about that specialty for at least several days before you arrive and (2) visiting your upcoming rotation a few days before you start, so the current residents can fill you in on how the service runs and what to expect. These steps will help you hit the ground running and get the most out of each rotation.

You will find that successful completion of your radiology residency is well worth the effort. This is an exciting and dynamic time for radiology; with a variety of practice settings available broader than ever before. The time and effort you put into your training will be one of the most sound investments you ever make.

Sincerely,

Angel Gomez-Cintron, MD, MPH
Program Director
Diagnostic Radiology

Ghazwan Kroma, M.D.
Program Director
Interventional Radiology

WELCOME FROM THE CHIEF RESIDENTS

Welcome to radiology at UTHSCSA. As chief residents, we take it upon ourselves to ensure that your first year of radiology is a positive experience. This manual was created to guide you during your first-year rotations. It contains a basic description of each rotation, resident expectations, and recommended reading material. We have also included information about ER coverage and vacations.

The first year of radiology can be daunting as most residents feel somewhat lost during the first days on a new rotation, and by the time they develop some degree of comfort the rotation is over. Just remember that staff and upper-level residents are here to guide you, and there will almost always be an upper-level resident with you during your first few months.

Radiology requires dedicated study time. Do not fall into the trap of learning just enough to get by on each rotation. Your first-year schedule is designed to prepare you for ER rotations in the 2nd year. The ER (as well as your core rotations) can be a lot of fun if you have developed a strong fund of knowledge. A dedicated radiology educational library is available in the resident room and several additional textbooks are available online through http://library.uthscsa.edu/.

Each resident is given a dedicated book fund, which can be used to purchase radiology textbooks, or you may choose to save your book fund for AIRP and CORE review courses such as Huda Physics review.

Daily educational conferences, which include both case conferences and lectures, occur daily at noon in the 6th-floor classroom. A lecture schedule will be emailed to you each month. Additional case conferences are also held from 7:30-8:00 AM Tuesday through Friday. **Please respect the lecturing staff and be on time.**

The American College of Radiology produces and distributes an in-service exam each year, which is formally given to all residents in early February. Your performance is rated against other residents around the country, and a percentile score is released, and exam results are reviewed by the program director. A collection of old tests is updated each year and available on the S drive.

Each resident is expected to take an active role in at least one research project during their residency. Please take the requirement seriously. Staff are always looking for residents to initiate their ideas. Presenting at a National Conference such as RSNA in the fall or Roentgen Ray in the spring means an all-expense-paid trip and free days off (academic days).

We want every resident to understand that he or she is an important participant in our program. Do not hesitate to ask for help from your colleagues, staff, and especially your chiefs.

George Ray, DO
Diagnostic Radiology
Rayg@uthscsa.edu

Amir Anvari, MD
Diagnostic Radiology
Anvari@uthscsa.edu

Arthur Joseph, DO
Interventional Radiology
JosephAS@uthscsa.edu

UTHSA GRADUATE MEDICAL EDUCATION

Welcome to the University of Texas (UT), Health-San Antonio! We are an innovative, vibrant, and dynamic community comprised of five health sciences schools – the Long School of Medicine, the Graduate School of Biomedical Sciences, the School of Nursing, the School of Dentistry, and the School of Health Professions. The campus climate is dedicated to our People, Passion, and Possibilities. Our major clinical partners are University Health System, South Texas Veteran's Health Care System (Audie L. Murphy VA Hospital), Brooke Army Medical Center, and the UT Health-San Antonio/M.D. Anderson Mays Cancer Center, the only National Cancer Institute-designated cancer center in South Texas. As the only civilian academic medical center and civilian Level I Trauma Center in the region for adults and pediatrics, we develop the knowledge, people, processes, and medicine to make health happen for our community and beyond.

Critical to the success of our institution is the Graduate Medical Education enterprise. With over 850 residents and fellows representing over 80 specialties, we are steadfastly committed to training the next generation of outstanding physicians. We are leaders in enhancing well-being, invited to engage with the Accreditation Council of Graduate Medical Education (ACGME) Physician Well-being Symposiums for the past three years. The Long School of Medicine was recently recognized as a finalist for the Spencer Foreman Award for Outstanding Community Service by the Association of American Medical Colleges. Our Office for GME's major initiatives center around work-life/well-being, educational innovation, health systems science, and professional development.

The San Antonio area has a population of 2.4 million people, offering all the amenities expected from a major metropolitan area; yet, it is remarkably affordable, diverse, and inviting, ranked 14th in the nation by U.S. News & World Report as one of the "Best Places to Live."

If you are a prospective resident or fellow or have already trusted us with your training, please use this site to learn more about our organization, programs, and commitment to excellence in health care and education. As the Office for Graduate Medical Education at this premier institution, we are here to support you, our training programs, and most importantly the patients we serve through our outstanding training programs, faculty, and clinical learning environments.

Our Mission

Improve healthcare by advancing the quality of resident physicians' education.

Our Vision

Foster growth of exemplary physicians, GME programs, and institutional practices, as a means to:

Achieve the quadruple aim of improving the patient experience of care (including quality and satisfaction), improving the health of our population, improving provider vitality, and reducing the per capita cost of health care.

Our Values

Woodson "Scott" Jones, M.D.
Vice Dean for Graduate Medical Education
Email: JonesW3@uthscsa.edu
Phone: 210-567-4511

UTHSA OFFICE FOR GRADUATE MEDICAL EDUCATION:
POLICIES AND PROCEDURES

The UTHSA Office for Graduate Medical Education (GME) has oversight for all residency and fellowship training programs at UTHSA, regardless of the accreditation status of the residency/fellowship program.

All Residents and Fellows are strongly encouraged to review the GME Policies and Procedures, which may be found online at http://uthscsa.edu/gme/gmepolicies.asp

Residents and Fellows should pay particular attention to the following policies (please note that "Resident" also includes "Fellow" in these policies):

Resident Promotion
Levels of Academic Status in Graduate Medical Education
Resident Grievance & Due Process Policy

RESIDENT WELLNESS:

The Office for GME maintains an excellent website on Resident Wellness, which may be found online at http://uthscsa.edu/gme/resident_wellness.asp.

DIVISION OF EDUCATION ORGANIZATION
LOCATION: 6TH FLOOR MEDICAL SCHOOL BLDG.
ROOM 652E
MAIN PHONE NUMBER: (210) 567-5552

Staff Areas of Responsibility:

Kevin Greene, M.ED.; Manager, Academic Programs

- Manager, Division of Education
- Diagnostic Radiology Residency/Body Imaging/Body MR Fellowships
- (210) 567-6482, GreeneK4@uthscsa.edu

Stephanie Navarro; Academic Programs Coordinator

- Breast Imaging & Intervention Fellowship
- Emergency Radiology Fellowship
- Cardiothoracic Imaging Fellowship
- Nuclear Medicine Fellowship
- Musculoskeletal Imaging Fellowship
- Neuroradiology Fellowship
- Women's Imaging & Intervention Fellowship
- Diagnostic Radiology Backup
- (210) 567-5563; NavarroSB@uthscsa.edu

Bianca Acosta; Academic Program Coordinator

- Medical Student Coordinator
- Interventional Radiology – Integrated Residency
- Interventional Radiology – Independent Residency
- Military Rotators
- Observerships
- Purchasing/Order Educational Office Supplies and Materials
- Administrative Support
- (210) 567-5550; AcostaB3@uthscsa.edu

General Policies & Procedures	Effective:	December 2000
	Revised:	April 2002, November 2006, May 2010, July 2011, February 2015, November 2019, December 2019 April 2020
Resident Supervision Policy		
	Responsibility:	Designated Institutional Official

Radiology Resident Supervision Policy

The purpose of GME is to provide an organized educational program with guidance and supervision of the resident, facilitating the residents' ethical, professional and personal development while ensuring safe and appropriate care for patients.

This policy will establish the minimum requirements for radiology resident supervision in clinical environments in which The University of Texas Health Science Center at San Antonio (UTHSA).

All physicians share responsibility for promoting patient safety and enhancing quality of patient care. Graduate medical education must prepare residents to provide the highest level of clinical care with continuous focus on the safety, individual needs, and humanity of their patients.

Section I. Definitions

The following definitions are used throughout the document:

Radiology Resident – a professional post-graduate resident or fellow in a specific specialty or subspecialty.

Licensed Independent Practitioner (LIP) – a licensed physician, dentist, podiatrist, or optometrist who is qualified usually by board certification or eligibility to practice his/her radiology specialty or subspecialty independently.

Medical Staff – an LIP who has been credentialed to provide care in his/her radiology specialty or subspecialty by a hospital.

Staff Attending – the immediate supervisor of a resident or fellow who is credentialed in his/her hospital for specific procedures in their radiology specialty and subspecialty that he/she is supervising.

Supervision may be exercised through a variety of methods. Some activities require the physical presence of the supervising faculty member. For many aspects of patient care, the supervising physician may be a more advanced resident.

Other portions of care provided by the radiology residents can be adequately supervised by the immediate availability of the supervising faculty member or resident physician, either in the institution, or by means of telephonic and/or electronic modalities.

In some circumstances, supervision may include post-hoc review of resident or fellow-delivered care with feedback as to the appropriateness of that care.

Levels of Supervision:

To promote appropriate radiology resident supervision and graded authority and responsibility, the Dept of Radiology must use the following classification of supervision:

Direct Supervision – the supervising physician is physically present with the radiology resident during key portions of the patient interaction.

Indirect Supervision - the supervising physician is not providing physical or concurrent visual or audio supervision but is immediately available to the radiology resident for guidance and is available to provided appropriate direct supervision.

Oversight – The supervising physician is available to provide review of procedures/encounters with feedback provided after care is delivered to the radiology resident/fellow.

Section II. General

Supervision of residents should be organized to provide gradually increased responsibility and maturation into the role of a judgmentally sound, technically skilled, and independently functioning “privileged” provider. The Radiology PD’s and APD’s will define specific criteria for evaluation of resident abilities allowing for a progressive authority and responsibility, conditional independence, and taking on of supervisory roles.

Residents must demonstrate the ability to analyze the care they provide, understand their roles within health care teams, and play an active role in system improvement processes. Graduating residents will apply these skills to critique their future unsupervised practice and effect quality improvement measures.

A culture of safety requires continuous identification of vulnerabilities and a willingness to transparently deal with them. An effective organization

has formal mechanisms to assess the knowledge, skills, and attitudes of its personnel toward safety in order to identify areas for improvement.

The Diagnostic Radiology Program Director will evaluate each resident's abilities baser on specific criteria, guided by the Milestones.

In addition, to the Dept of Radiology policy is compliance with the following below:

- At all times, patient care will be the responsibility of a licensed independent practitioner with appropriate clinical privileges in that health care system.
- Descriptions of the roles, responsibilities, and patient care activities of the radiology residents, by level, are available to medical faculty and to health care staff located in New Innovations. When necessary, nurses, radiology residents and/or other healthcare personnel will telephone the attending staff physicians (who is available 24/7) or Diagnostic Radiology Program Director to confirm whether a radiology resident is approved to perform a procedure without direct faculty supervision. Reference Section IX for details on procedural verification by hospital or clinic personnel.
- The descriptions identify mechanisms by which the radiology program faculty and diagnostic radiology program director make decisions about an individual radiology residents' progression of conditional independence.

<u>Those parameters may include but may not be limited to:</u>

1.) a given number of successfully performed, observed procedures;
2.) a total number of procedures or processes performed; the general impression of competence and professionalism perceived by faculty, etc.

- Delineation of order-writing privileges, including which orders if any must be countersigned.
- Radiology residents must be provided the equivalent personal protective equipment (PPE) as utilized by their faculty supervisor. If the same level of PPE is not available, then the resident should not participate in the care until the same level of PPE is provided or an emergency is declared by the faculty supervisor. Such declared emergencies must be reported to the diagnostic Radiology program director as soon as practicable.
- Supervision of radiology residents may occur through telephonic, video, or other electronic modalities. The defined levels of supervision: direct, indirect with direct immediately available,

indirect with direct available, and oversight apply to telephonic, video, or other electronic means of supervision as they do to supervision by the physical presence of the supervisor.

Section III. Procedures

- All resident patient care activities are ultimately supervised by credentialed providers ("staff attendings") who are licensed independent practitioners on the medical staff of the UTHSA teaching hospitals and/or clinics in which they are attending. The staff attendings must be credentialed in that hospital or clinic for the specialty care and diagnostic and therapeutic procedures that they are supervising. In this setting, the supervising staff attending is ultimately responsible for the care of the patient.

  By exception, supervision of residents may be performed by physician extenders (e.g., physician assistants or nurse practitioners) with particular expertise in certain diagnostic or therapeutic procedures, if so designated by the diagnostic radiology program director. Ultimate responsibility for the residents' patient care, in this case, will rest on the credentialed staff who oversees the physician extender's practice.

- The privilege of progressive authority and responsibility, conditional independence, and a supervisory role in patient care delegated to each resident is therefore assigned by the diagnostic radiology program director, with faculty members' feedback.

  The diagnostic program director must evaluate each resident's abilities based on specific criteria. When available, evaluation should be guided by specific national standards-based criteria.

- The Radiology Program Directors will define the mechanism by which radiology residents can be deemed competent to perform a procedure(s) without supervision.

- Additionally, a listing of approvals by individual will be located in NI and accessible by nurses, radiology residents, and other hospital or clinic personnel. If unable to satisfactorily confirm procedure verification in NI, nurses, radiology residents and other hospital personnel may call the attending or the Diagnostic Radiology Program Director.

  Radiology faculty members functioning as supervising physicians should delegate portions of care to residents based on the needs of the patient and the skills of the residents.

  Radiology Senior Residents should serve in a supervisory role of junior residents in recognition of their progress toward conditional

independence, based on the needs of each patient and the skills of the individual radiology residents.

- Each UTHSA Program Director will complete a listing of resident clinical activities that are permitted by level of training, the required level of supervision for each activity, and any requirements for performing an activity without direct supervision. See 2.9 as an example.

- Program Directors of ACGME-accredited programs will submit their listing of clinical activities by postgraduate year or by expected level of training to the Office for Graduate Medical Education for review and approval by the appropriate Action Committee.

- Each year the Diagnostic Radiology Program Director will annually review resident clinical activities by level and make changes (as needed).

- The Diagnostic PD and APD's will submit any new job descriptions and their updated listing of clinical activities by postgraduate year to the Office for Graduate Medical Education for review and approval by the appropriate Action Committee.

- The Dept of Radiology has set guidelines for circumstances and events in which residents must communicate with appropriate faculty members, such as the transfer of a patient to an intensive care unit or end-of-life decisions.

- Each radiology resident must know the limits of his/her scope of authority, and the circumstances under which he/she is permitted to act with conditional independence.

- In particular, PGY-1 residents should be supervised either directly or indirectly with direct supervision immediately available. (Each RRC has described the achieved competencies under which PGY-1 residents' progress to be supervised indirectly, with direct supervision.

- The Program Director will ensure that all supervision policies are distributed to and followed by residents and the medical staff supervising the residents. Compliance with the UTHSA residents' supervision policy will be monitored by the Program Directors.

Section IV. Supervision of Residents in the Inpatient Setting

- All lines of responsibility and authority for inpatient care delivered by inpatient ward or ICU teams are directed to a credentialed staff provider. Residents should write daily orders on inpatients for

whom they are participating in the care. These orders will be implemented without the co-signature of a staff physician. It is the responsibility of the resident to discuss their orders with the attending staff physician. Attending staff may write orders on all patients under their care. Residents will follow all local teaching hospital policies for how to write orders and notify nurses and will follow the "verbal orders" policies of each patient care area.

- General position descriptions of residents by year of training which may be adopted by programs are available in Appendix B. The descriptions may not apply to all programs, such as subspecialties which do not have PGY1 or PGY2 levels. Program Directors have the discretion to use or modify these descriptions as appropriate to their specialty or subspecialty.

- Staff supervision of care for hospitalized patients must be documented in the inpatient record. Documentation requirements for inpatient care are outlined next. These are the minimal requirements and may be more stringent depending on the UTHSA teaching hospital.

- Documentation, in writing, by *staff* must be in accordance with hospital policies. This documentation includes especially: concurrence with the admission, history, physical examination, assessment, treatment plan; orders concurrence with major interventional decisions; concurrence when any major change occurs in the patient's status, such as transfer into or out of an intensive care unit or changes in "Do Not Resuscitate" status. Documentation, in writing, by residents must also be in accordance with hospital policies.

Section V. Supervision of Residents on Inpatient Consult Teams

All inpatient consultations performed by residents will be documented in writing, with the name of the responsible staff consultant recorded. The responsible staff consultant must be notified verbally by the resident doing the consult within an appropriate period of time as defined by the particular consulting service. The consulting staff is responsible for all the recommendations made by the consultant team.

Section VI. Supervision of Residents in Outpatient Clinics

All outpatient visits provided by residents will be conducted under the supervision of a staff provider. The Program Director may, for each resident, define the conditions under which supervision may be other than direct (e.g., a defined period of clinical experience, with faculty feedback). The supervising staff will interview and examine the patient at the staff's discretion, at the resident or fellow's request, or at the patient's request. The supervising staff has full responsibility for care provided, whether or not he/she chooses to verify personally the interview or examination.

Section VII. Supervision of Residents in the Emergency Department

The responsibility for supervision of residents providing care in the Emergency Department (ED) to patients who are not admitted to the hospital will be identical to that outlined in the schema for outpatient supervision above. The responsibility for supervision of residents who are called in consultation on patients in the ED will be identical to that outlined in the schema for consultation supervision above. Consulting staff should be notified appropriately of ED consultations.

Section VIII. Supervision of Residents in Interpretive Settings

It is the responsibility of each training program/department in these areas to establish supervisory regulations in compliance with The Joint Commission & RC requirements.

Section IX. Supervision of Residents Performing Procedures

A resident will be considered qualified to perform a procedure if, in the judgment of the supervising staff and his/her specific training program guidelines, the resident is competent to perform the procedure safely and effectively. Residents at certain year levels in a given training program may therefore be approved to perform certain procedures without direct supervision, based upon specific written criteria set forth and defined by the Program Director. As such, residents may perform routine procedures that they are approved to perform (such as arterial line placement) for standard indications without prior approval or direct supervision of staff. However, the residents' staff of record will be ultimately responsible for all procedures on inpatients. In addition, residents may perform emergency procedures without prior staff approval or direct supervision when life or limb would be threatened by delay. All outpatient and inpatient procedures will have the staff of record documented in the procedure note, and that staff will be ultimately responsible for the procedure.

As previously mentioned, Program Directors will define the mechanism by which residents can be deemed competent to perform a procedure(s) without supervision. Additionally, a listing of approvals by individual will be located in NI and accessible by nurses, residents, and other hospital or clinic personnel. If unable to satisfactorily confirm procedure verification in NI, nurses, residents and other hospital personnel may call the attending or the Program Director. (If procedure approvals are made by PG years, the table per Appendix A may suffice for this.)

Residents who require direct supervision to perform procedures may be supervised by either staff or, instead, by more senior residents, when those latter are also "approved" by the program to perform the procedure independently.

Appendix A – Specific Clinical Activities and Level of Supervision

The template will be filled out by the Program Director to address the specific clinical activities and the level of supervision required. For each Clinical Activity, the following areas need to be addressed on the accompanying template:

Resident Level at Which an Activity Can be Performed: PGY year, if applicable

Method of Instruction:
Examples: Direct Clinical Instruction, Courses (e.g. ACLS)

Level of Instructor and Direct Supervisor: by PGY year or Attending

Requirements for Certification to Perform Activity Without Direct Supervision:
Examples: Program Certification, PGY year

Method of Confirming Certification of Residents or Fellows to Perform the Activity Without Direct Supervision:
Examples: Residents or fellows Procedure Tracker (in New Innovations); Site-of-Training hard copy display.

Template for Procedures List –

Template

Appendix B – General Descriptions of Level of Training

1. **Postgraduate year 1 (PGY1) residents**

The PGY1 residents will participate in daily rounds and write daily progress notes which include an interim history and physical exam, laboratory and radiographic data, and an assessment and plan. If a significant new clinical development arises, there will be timely communication by a member of the resident's team with the attending. The residents and attending must communicate with each other as often as is necessary to ensure the best possible patient care.

The PGY1 residents may be responsible for completion of discharge summaries. Transfer notes and acceptance notes between critical care units and floor units, when required, can be written by the PGY1 residents. Such transfer notes shall summarize the hospital course and list current medication, pertinent laboratory data, active clinical problems, and physical examination findings. The supervising residents and the attending must be involved to ensure that such transfer is appropriate.

All PGY1 residents, when leaving an inpatient team, must write an "off-service" note summarizing pertinent clinical data about the patient. The new resident's team must notify the attending physician of the change in residents or teams and review the management plan with him/her.

2. **Postgraduate year 2 (PGY2) residents**

PGY2 residents, when assigned to the service, will take responsibility for organizing and supervising the teaching service in concurrence with the attending physician and will provide the PGY1 residents and medical students under his/her supervision with a productive educational experience. In this role, they work directly with the PGY1 residents in evaluating all new admissions and reviewing all H&Ps, progress notes, and orders written by the PGY1 residents daily. They will also supervise, in consultation with the attending physician and if approved by the PD to perform independently, all procedures performed by the PGY1. PGY2 residents may perform any of the PGY1 tasks outlined above at the discretion of the attending or patient care area policies. PGY2 residents must maintain close contact with the attending physician for each patient and notify the attending as quickly as possible of any significant changes in the patient's condition or therapy. All decisions related to invasive procedures, contrast radiology, imaging modalities, and significant therapies must be approved by the attending.

3. **Postgraduate year 3 and above (PGY3) residents**

PGY3 residents will follow all responsibilities of the PGY2 outlined above when acting in a similar supervisory capacity. PGY3 residents may perform any of the PGY1 or PGY2 tasks outlined above at the discretion of the attending or patient care area policies. They will also be available to provide assistance with difficult cases and provide instruction in patient management problems when called upon to do so by other residents.

	They will assume direct patient care responsibilities when needed to assist more junior residents during times of significant patient volume or severity of illness. Supervision of procedures will be as outlined for PG 2 residents.
Reference	ACGME Institutional Requirements Effective 7/1/15, VI.D.

What Makes a Great Radiology Resident?[1]

Richard B. Gunderman, MD, PhD, Valerie P. Jackson, MD

> The wise man should always follow the roads that have been trodden by the great, and imitate those who have most excelled, so that if he cannot reach perfection, he may at least acquire something of its savor.
>
> Machiavelli, *The Prince*

Radiology faculty members, future employers of radiologists, and radiology residents all have a keen interest in clearly understanding what makes a great resident. To hit a target, it is necessary to see it clearly, and the characteristics of great residents can serve as a target for both faculty members and trainees throughout the 4 years of radiology training. No one's interests—least of all, those of patients—would be well served if either group treated residency training as a period of indentured servitude during which residents simply "put in their time" while accumulating sufficient knowledge to achieve professional certification. It is better if everyone sets their sights on higher levels of achievement. Even if our loftiest goals are not always achieved, their constant presence helps us reach a higher level of performance than we otherwise would.

For some radiology residents, the transition from medical school to residency is difficult. Throughout college and medical school, we grow accustomed to a system with relatively clear performance expectations—a system in which evaluations are frequent and unequivocal. We learn that to receive an *A* in this or that course, we must achieve a cumulative total of *X* points. By tracking our performance on each examination, we can readily determine whether we were meeting the standard. In contrast, many residency programs provide less clear-cut feedback, less regularly. As a result, radiology residents may be less likely than college and medical students to understand what is expected of them and how well they are performing. If radiology residency programs are to equip trainees with the knowledge they need to thrive during their training, it is vital that radiology educators develop and articulate a clear vision of resident performance—a vision that extends beyond mere competence to excellence.

Some residents' main goals may be to survive on-call duties, pass the board examinations, and avoid mistakes (1). We must show them that they are capable of more. Optimal residency training also prepares residents to provide outstanding diagnostic, consultative, and patient service, and thus to achieve the highest levels of clinical practice.

Furthermore, in the area of research, it is vital that some graduates do more than simply apply extant knowledge to patient care. They must challenge and extend the frontiers of radiology, continually renewing its knowledge base to support the work of the next generation of radiologists. In education, we must encourage the formation of academic radiologists who look beyond standardized test scores, by providing residents with training that addresses the full range of radiology-related activities, including those that are not assessed on the standard examinations. The quality of tomorrow's radiologists hinges in part on how we educate today's residents. In each of these spheres—patient care, research, and education—we should foster excellence, as opposed to mere adequacy.

As educators, we spend thousands of hours teaching residents how to detect lesions, formulate differential diagnoses, and perform various diagnostic and interven-

Acad Radiol 2003; 10:554–558

[1] From the Education Division, Department of Radiology, Indiana University School of Medicine, 702 Barnhill Dr, RI 1053, Indianapolis, IN 46202-5200 (R.B.G., V.P.J.); and the Departments of Medical Education, Philosophy, and Liberal Arts, Indiana University, Indianapolis (R.B.G.). Received December 30, 2002; accepted January 23, 2003. **Address correspondence to** R.B.G.

tional procedures, but little time outlining our vision of excellence. Yet this can be among the most fruitful topics for a residency program to address. Even if no formal, written vision is ever articulated, the conversation itself can be immensely valuable, helping residents and faculty develop a clearer idea of what they are trying to accomplish.

What follows is our view of what makes a great radiology resident. Some radiology educators might tweak this list in one or another respect, adding an item or two here or there and perhaps modifying others. The purpose of developing such a profile is not to present a final and immutable decree, but to stimulate discussion among residents and faculty about their own vision of excellence in radiology residency. To begin with, let us consider two relatively established and widely recognized characteristics of great residents.

FUND OF KNOWLEDGE

Great residents are highly knowledgeable. They tend to know more than most other trainees with a comparable level of experience. For one thing, they tend to have a better recall for basic facts of radiology, the information contained in textbooks. Yet they also excel at applying that information in daily work. When they read, they do so with a view toward the potential usefulness of what they are reading. When opportunities arise to put that knowledge into practice, they are better prepared than most residents to do so. In reflecting on how much the best residents know, it is important to recall that no one was born knowing everything. Their extensive knowledge results from a long history of good study habits.

It is also important to point out that no one expects residents to know everything, just as no radiology faculty member, no matter how accomplished, knows everything. Great residents may know more in absolute terms than most of their colleagues, but what really sets them apart is the ability to discern what is most worth knowing and to actively seek out and apply that knowledge. The American College of Radiology in-training examinations and the written and oral examinations administered by the American Board of Radiology provide a partial assessment of what residents know, but they are intended to certify minimal competence, not to serve as a vision of excellence. An equally important gauge is resident performance in regular case conferences and residents' capacity to make useful contributions to daily clinical work. It is important that our training programs not mislead residents into focusing all of their intellectual aspirations on passing standardized examinations, but instead encourage them to focus on learning what they must know to be first-rate radiologists.

TECHNICAL SKILLS

Compared to other residents at similar levels of training, great radiology residents also possess superior technical skills. They are adept at tasks such as manipulating an ultrasound transducer, providing protocols for cross-sectional imaging examinations, obtaining vascular access, and performing biopsies under imaging guidance. They also tend to be very proficient in using new technologic tools, such as the radiology information system and the picture archiving and communication system, and in reformatting and optimizing images at computer-based workstations. Finally, they tend to be especially proficient at interpersonal tasks such as obtaining informed consent, consulting with referring physicians, and interacting with patients and families. However, not all great residents are naturally gifted with superior manual dexterity and hand-eye coordination and with the ability to get along well with others, and they do not necessarily have an extensive background in computer programming or software design. Often they are highly motivated learners who have made a concerted effort to hone their skills in these areas.

WHAT IS MISSING?

Unfortunately, we sometimes give residents the impression that our vision of excellence stops at this point. We monitor their fund of knowledge and their technical skills but do little to assess other aspects of performance. Many seasoned radiology educators will have no difficulty recalling a radiology resident they have worked with who had outstanding scores on standardized tests and strong technical skills but who was not highly regarded as a radiologist by other residents and faculty. Conversely, we may recall residents with mediocre scores and only average technical capabilities who were outstanding performers and were chosen as chief residents by their peers and faculty. We simply cannot predict the overall excellence of residents based solely on their fund of knowledge and their technical skills.

CURIOSITY

In order to develop a more robust and complete portrait of great radiology residents, it is necessary to expand

our scope considerably, taking into account other important personal characteristics. One such characteristic is an inquisitive attitude. Great residents not only know a lot but also tend to learn more than others each day. They love to learn, and that love of learning shows in everything they do, whether it be asking questions of faculty members at the view station, reading more deeply than most of their colleagues, capitalizing on consultations with other physicians as opportunities to learn, or developing proficiency at navigating the print and electronic informational resources at their disposal. They seek not only to know what such learning resources can tell them but also to understand the "why" behind the information (2). They challenge faculty members not only to recall facts but also to analyze their practice at a deeper level, to express the rationale behind what they know and do. Working with such residents is one of the most engaging and rewarding experiences a radiology educator can have, because it stimulates even the most seasoned radiologist to continue to learn and grow.

CANDOR ABOUT ERROR

Some residents treat mistakes as embarrassments that should be ignored or even covered up. Great residents, in contrast, not only acknowledge their mistakes but also make a sincere effort to learn from them (3). They recognize that mistakes are a natural part of the learning process, just as they are an inevitable part of radiologic practice. No one is infallible. Hence, great residents do not bristle when a mistake is pointed out to them. They treat it as a learning opportunity. They take pride in their work, and they regret mistakes when they occur; but there is a difference between not caring whether you make a mistake and caring so much about having it brought to light that you are unable to learn from it. One of the best ways to help residents develop good habits of lifelong learning is to encourage them to recognize mistakes when they occur and to make the effort to analyze them and to learn from them so as not to repeat them.

DILIGENCE

Great radiology residents tend to be hard workers. Although few residents shirk work, the manner in which residents approach assignments differs widely. Some attempt to get work done as quickly as possible, even to the point of cutting corners. This leads to mistakes, such as failures to detect abnormalities. Others are so painstaking in their approach that they are inefficient and must work late every day. Somewhere between these two extremes are residents who are able to strike the right balance, getting work done expeditiously and maintaining high quality. Part of the reason for this difference is the fact that great residents sincerely enjoy the work for its own sake and therefore approach it with more gusto (4). Unless people enjoy their work and find it personally fulfilling, there is relatively little chance that they will excel at it. The best residents find radiologic work challenging and engaging and therefore take pleasure in doing it well.

INITIATIVE

Great residents actively seek out educational experiences and ways to make the clinical service run more smoothly. They eagerly volunteer to interpret and manage cases, instead of waiting for prompting from the faculty or staff. Most faculty members find it trying to have to tell a resident again and again to do something. Before long, it becomes easier for the faculty member simply to circumvent the resident and take care of the matter alone. This results in a missed educational experience for the resident. Great residents rarely, if ever, need to be told to take on a task.

RELIABILITY

Great residents are also notable for their reliability. They show up for work on time, stay until their duties are discharged, and can be counted on to be where they are supposed to be. When someone asks such a resident to do something and he or she agrees to do so, everyone knows that it will get done. Whether it be checking a patient's clinical history, conveying a specimen to the laboratory, following up with a patient, collecting experimental data, or preparing a professional presentation, great residents approach each task as though their reputation were on the line and make sure the task is completed. No matter how great a resident's fund of knowledge and technical skills, if that person cannot be counted on, colleagues will have reservations about his or her commitment and ability to perform.

AFFABILITY

Great residents need not be personality contest winners. They need not be the best-looking, most entertaining, best-dressed, or most debonaire individuals in the program. Yet great residents do tend to be likable individ-

uals, people whose relations with others are typically easy and congenial. Despite their own high level of excellence, they do not think only about themselves. The very best residents, the ones destined to rise to positions of leadership within their profession, look for opportunities to help others perform better and feel good about themselves. Because they are generally recognized as the most accomplished individuals in their group, others may seek them out for advice and help. They think of themselves not as competitors but as enablers, helping those they work with to be their best. As a result, they tend to be the first to acknowledge others for doing a good job.

ENTERPRISE

Great radiology residents are not focused primarily on the formal components of their job description. They do well what is required, but they are on the lookout for opportunities to do more. For example, recognizing that a particular clinical rotation lacks a core curriculum of readings or an up-to-date collection of clinical teaching material, great radiology residents might take it upon themselves to begin creating such a learning resource. Having seen a particularly noteworthy case, they are likely to pursue the possibility of writing it up for publication. Such activities add to the overall quality of a radiology department's programs and augment the knowledge and skills of the resident. When such residents later apply for jobs, they can cite contributions that set them apart from other applicants.

LIFE EXPERIENCE

Many great residents bring something unique to their work. This distinguishing feature might originate in their professional backgrounds, life experiences, or extracurricular interests. A background in computer programming, entrepreneurship, or teaching could provide a resident with an opportunity to make a special contribution toward improving workflow, developing new services, or improving a department's educational programs. Past experience in helping run a family business may enable a great resident to recognize opportunities for improvement that others would miss. The same can be said of many ongoing interests outside of radiology, from art history to bird watching, photography, woodworking, and dance. Great residents are interesting people, and interesting people typically have interests outside their work.

Another important "extra" is family life. Being married and having children can provide a vital sense of proportion, the ability to see day-to-day difficulties from a larger perspective. People operating from such a perspective may be less likely to flounder when they encounter difficulties. A grounding in family life can provide a maturity of judgment that enriches everyone's experience.

CHARACTER

Above all, great residents display admirable character. They are honest, unselfish, and understanding of others. No matter how brilliant or technically accomplished a resident may be, if that individual is perceived to be dishonest, selfish, or indifferent to colleagues, he or she will be regarded poorly. In a groundbreaking sociological study of surgical residency training, Charles Bosk (5) identified two types of errors that residents may make: technical and normative. Technical errors in radiology would include failing to detect a lesion, offering an inappropriate differential diagnosis, or failing to perform a procedure correctly. According to Bosk, residents tend to be forgiven for technical errors as long as they make an effort to learn from them. In contrast, normative errors, such as dishonesty or lack of dedication, are not easily forgiven. If a resident is found to have lied about some important aspect of a patient's care, the breach of trust may be so wide that it cannot be bridged again. Great residents are, above all, people others feel they can trust to do what is right.

GREATNESS

In conclusion, it is vital that we look beyond traditional parameters of resident performance, such as fund of knowledge and technical skills, and develop a more robust vision of what distinguishes our very best residents. To some degree, the new competencies implemented by the Accreditation Council for Graduate Medical Education will help to expand the scope of training in this sense (6). However, the Accreditation Council naturally focuses on competencies that can be operationalized and measured, and we must consider the possibility that everything that is important may not necessarily be measurable. By helping residents and faculty develop a clearer and more complete vision of what makes a great resident, we also help them to develop a clearer and more complete picture of a great radiologist. This vision can continue to guide their professional growth and development long after residency, because the characteristics of great residents are also the characteristics of great faculty members and practicing radiologists.

So long as everyone's nose is constantly pressed to the grindstone, there is a distinct danger that we will lose sight of our true mission. This in turn raises the possibility that our intrinsic motivation for the work we do and our overall level of performance will decline accordingly. Every residency program needs to encourage residents to step back from time to time and reflect on their larger purpose, what they really want to be and why. As we see our goals more clearly, we become better prepared to reach them.

REFERENCES

1. Gunderman RB. The perils of testing. Acad Radiol 2001; 8:1257–1259.
2. Brown AL, Bransford JD, Cocking RR, eds. How people learn: brain, mind, experience, and school. Washington, DC: National Academy Press, 2000.
3. Gunderman RB, Nyce J. The tyranny of accuracy in radiologic education. Radiology 2002; 222:599–603.
4. Herzberg F, Mausner B, Snyderman B. Motivation to work. New York, NY: Transaction, 1993.
5. Bosk C. Forgive and remember: managing medical failure. Chicago, Ill: University of Chicago Press, 1981.
6. Collins J, de Christenson MR, Gray L, et al. General competencies in radiology residency training: definitions, skills, education and assessment. Acad Radiol 2002; 9:721–726.

ADDITIONAL SELECTED READINGS IN ACADEMIC RADIOLOGY

Note: The following journal articles are all available for free from the UTHSA Library:

Baker S, Daginawala N. Leadership Training for Radiologists: A Survey of Opportunities and Participants in MBA and MPH Programs by Medical Students, Residents, and Current Chairpersons. *Journal of the American College of Radiology.* 2011;8(8):563-567. doi:10.1016/j.jacr.2011.02.013.

Collard MD, Tellier J, Chowdhury ASMI, Lowe LH. Improvement in Reporting Skills of Radiology Residents with a Structured Reporting Curriculum. *Academic Radiology.* 2014; 21(1):126-133. doi:10.1016/j.acra.2013.10.007.

Deitte L. The New Residency Curriculum: Professionalism, Patient Safety, and More. *Journal of the American College of Radiology.* 2013; 10(8):613-617. doi:10.1016/j.jacr.2013.01.027.

Deitte LA, Gordon LL, Zimmerman RD, et al. Entrustable Professional Activities: Ten Things Radiologists Do. *Academic Radiology.* 2016; 23(3):374-381. doi:10.1016/j.acra.2015.11.010.

Kelly AM, Mullan PB. Designing a Curriculum for Professionalism and Ethics Within Radiology: Identifying Challenges and Expectations. *Academic Radiology.* 2018; 25(5):610-618. doi:10.1016/j.acra.2018.02.007.

Kelly AM, Mullan PB. Teaching and Assessing Professionalism in Radiology: Resources and Scholarly Opportunities to Contribute to Required Expectations. *Academic Radiology.* 2018; 25(5):599-609. doi:10.1016/j.acra.2018.01.008.

Mauro MA. Guest editorial. To be or not to be an academic radiologist? *Applied Radiology.* 2008; 37(6):6-8. http://search.ebscohost.com.libproxy.uthscsa.edu/login.aspx?direct=true&db=rzh&AN=105799439&site=eds-live&scope=site. Accessed May 28, 2019.

Pfeifer CM. Changes to Radiology: Simpler is Better. *Academic Radiology.* 2015; 22(10):1326-1327. doi:10.1016/j.acra.2015.05.013.

Sarkany D, DeBenedectis CM, Brown SD. A Review of Resources and Methodologies Available for Teaching and Assessing Patient-Related Communication Skills in Radiology. *Academic Radiology.* 2018; 25(7):955-961. doi:10.1016/j.acra.2017.11.018.

Sherrier RH, Chang BK, Rawson JV, Romanelli G. The Role of the VA in Academic Radiology: A Report of the ACR's Committee on Governmental and Regulatory Affairs in Academic Radiology. *Journal of the American College of Radiology.* 2012; 9(8):564-570. doi:10.1016/j.jacr.2012.02.012.

Slanetz PJ, Mullins ME. Radiology Education in the Era of Population-based Medicine in the United States. *Academic Radiology.* 2016; 23(7):894-897. doi:10.1016/j.acra.2016.01.017.

Stalcup S, Leddy R, Hill J, Lewis M. Optimizing the Learning and Working Environment for Radiology Residents. *Academic Radiology.* 2019; 26(5):707-713. doi:10.1016/j.acra.2018.10.002.

Vijayasarathi A, Duszak JR, Gelbard RB, Mullins ME. Knowledge of the Costs of Diagnostic Imaging: A Survey of Physician Trainees at a Large Academic Medical Center. *Journal of the American College of Radiology.* 2016;13(11):1304-1310. doi:10.1016/j.jacr.2016.05.009.

HOLIDAYS

Two-holiday schedules will affect you during your training. UT Health San Antonio and University Health System. Interventional Radiology Trainees have three with the addition of the Veteran's Administration.

On University rotations, two-holiday schedules affect your work responsibilities. You are not automatically off on all of these days. Interventional Radiology Trainees will get a VA holidy off when assigned to a VA during that rotation. The actual dates vary by year, but include the following days:

UT Health (UT)	University Health System (UHS)	Veteran's Administration (VA)
New Year's Day	New Year's Day	New Years
Martin Luther King, Jr. Day	Martin Luther King, Jr. Day	Martin Luther King, Jr. Day
Presidents' Day	Presidents' Day	Presidents' Day
Battle of Flowers Day	Memorial Day	Memorial Day
Memorial Day	Independence Day	Independence Day
Independence Day	Thanksgiving	Labor Day
Labor Day	Labor Day	Columbus Day
Thanksgiving	Christmas Day	Veteran's Day
Christmas Day		Thanksgiving
		Christmas Day

On days that are both UT & UHS holidays, you will be excused from day rotation responsibilities (clinical responsibilities still apply).

On days that are UT, but not UHS holidays, special situations apply. Residents are typically UH employees so your typical rotation duties apply. Frequently, outpatient exams and interventions are limited.

On days that are UHS holidays but not UT holidays, studies are performed at the MARC and MARC Hill Country, but no UH outpatient or routine clinic imaging is performed. If faculty are working, during these holidays, you may be asked to come in as well. On these days, most residents will work at their usual rotations until the morning work is finished (typically up until noon). After 12:00 on these days, typically only emergent cases are read, and you could be dismissed for the day (but again, don't count on it).

A 2nd-year resident will work in the ER from noon to 5 pm and will read CTs and US as needed. The staff will be in the hospital with them. Another resident will be assigned to take a pager call if an emergent fluoroscopy, body interventional procedure, or angio case comes up from 8 am-5 pm. Since every rotation is different, your particular duties may vary at the discretion of the section.

Some workdays are "Mission Critical" when most people have off but your service may have critical functions to fulfill. If you work on these days, compensatory time off is earned. Except for call and pager responsibilities, if you work on a holiday, you will typically get compensatory time off.

Radiology Resident & Fellow Conferences

Current available educational conferences in the Department of Radiology:

Conferences, lectures, etc. (Intradepartmental)	Frequency And Time	Individual(s)/and specialty responsible for organization of sessions	Core or Subspecialty Teaching Conference (specify)
Subspecialty Lectures	M-W-F	Clinical Section of the Month	Core
Neuroradiology Case Conference	2 per month	Achint Singh, MD (Neuroradiology)	Core
Chest Case Conference	1 per month	Carlos Restrepo, MD	Core
Subspecialty Case Conference	2 per month	Clinical Section of the Month	Core
Journal Club	1 per month	Clinical Section of the Month	Core
Physics	June/July	Andrew Sampson, PhD (Physics)	Core
Research Conference	1 per month	Geoffrey D. Clarke, PhD (Research)	Core
Practice of Radiology	1 per month	Kent Rohweder, MD	Core
Mobidity and Mortality Conference	Monthly	Ghazwan Kroma, MD (Director QA)	Core
Resident Meeting	Monthly - Th	Chief Residents	Core
Resident Lunch	Monthly - Fri	Chief Residents	Core
Abdominal Imaging Conference	Weekly - Th	Venkata Katabathina, MD (Abdominal Imaging)	Subspecialty
Mammography Conference	Weekly - Wed	Kenneth Kist, MD (Breast Imaging)	Subspecialty
Musculoskeletal Conferences	Weekly - Fri	Michael Davis, MD (MSK)	Subspecialty
Nuclear Medicine Conference	Weekly - Th	Umber Salman, MD (Nuclear Medicine)	Subspecialty
IR Conferences (Rad Path conf. – Mon; Case conferences – Wed; Lecture – Thurs; M&M & Journal Club – Fri)	M,W,R,F	Jorge Lopera, MD (VIR)	Subspecialty

Conferences are divided into “Core” and “Subspecialty” conferences. Most of the core conferences are held from **12 pm – 1 pm** each day, although the Morbidity and Mortality Conference takes place at 7:00, **am** on the last Tuesday of each rotation block. Attendance at the core conferences is expected of all residents unless there are compelling clinical responsibilities that conflict.

The subspecialty conferences are designed primarily for those residents on that subspecialty rotation, although other residents are welcome to participate as long as it does not interfere with their clinical responsibilities (consider previewing cases for your service before the morning conference).

The core conferences are a required component of residency training and residents must attend at least 80% of these conferences when they are not on vacation or on away rotations (ARIP). Failure to comply may result in administrative status.

RESIDENT RESPONSIBILITIES (cont.)

ACGME CASE LOG

Diagnostic Radiology Residents are required by the ACGME Resident Review Committee (RRC) to meet minimum case numbers for specific procedures by the end of residency training.

Residents are responsible for logging these cases into the ACGME Case Log system; if you need help logging into the ACGME Case Log system please contact Kevin Greene, Edie Kenney-Perez, or Megan Delgado for assistance. The Case Log system is located at:
https://www.acgme.org/.

Below are the Diagnostic Radiology case log categories and required minimum numbers:

Case Log Categories	Required Minimum Number	CPT Codes
Chest X-ray	1900	71045, 71046, 71047, 71048
CT Abd/Pel	600	72192, 72193, 72194, 74150, 74160, 74170, 74176, 74177, 74178
CTA/MRA	100	70496, 70498, 70544, 70545, 70546, 70547, 70548, 70549, 71275, 71555, 72159, 72191, 72198, 73206, 73225, 73725, 73706, 74174, 74175, 74185
Image Guided Bx/Drainage	25	20604, 20606, 20611, 32555, 32557, 49083, 49405, 49406, 49407, 77012, 76942, 77002, 77021
Mammography	300	77065, 77066, 77067
MRI Body	20	71550, 71551, 71552, 72195, 72196, 72197, 74181, 74182, 74183, 74712, 74713
MRI Brain	110	70551, 70552, 70553
MRI Lower Extremity Joints	20	73721, 73722, 73723
MRI Spine	60	72141, 72142, 72146, 72147, 72148, 72149, 72156, 72157, 72158,
PET	30	78459, 78491, 78492, 78608, 78609, 78811, 78812, 78813, 78814, 78815, 78816
US Abd/Pel	350	76700, 76705, 76706, 76770, 76775, 76830, 76856, 76857

INTERVENTIONAL RADIOLOGY PATIENT CARE AND PROCEDURAL EXPERIENCES

Interventional Radiology Residents should pay special attention to the ACGME requirements for case logs and Patient Procedural Encounters logging. These requirements are mandatory and may be found online at:

https://www.acgme.org/Portals/0/PFAssets/ProgramResources/Guidelines_for_IR_Case_Logs.pdf?ver=2017-12-21-150901-507

Edie Kenney-Perez is the PC for the ESIR track, including applications for admission into this track. Please contact Edie for detailed information on how to apply to ESIR, including required documentation and deadlines.

NEW INNOVATIONS PROCEDURES LOGGER

The New Innovations procedure loggers are separate from the ACGME Case Logs and serve a different purpose. All procedures must be logged into New Innovations for Faculty review and sign-off. The intent behind the Procedure Logger is documentation of supervision for procedures; the ACGME Case Log serves as a record of the Resident meet minimum national standards for graduation from residency training.

This ensures that a permanent record of residents' procedures is maintained, particularly for Nuclear Medicine, and can be retrieved even after the Resident has graduated.

EVALUATIONS:

Residents will receive notifications from New Innovations at the end of each rotation block that evaluations of the Faculty and of the Rotation are available for completion. Residents are required to complete evaluations; timely feedback is critical for both Faculty and Resident continued performance improvement as well as overall program improvement.

Evaluations completed by Residents are strictly confidential and cannot be viewed by Faculty.

RESIDENT RESPONSIBILITIES

EVERYONE'S RESPONSIBILITIES

All residents will be assigned to evening triage responsibilities throughout their training. This starts in January of your 1st year and ends when you graduate from residency. You will get your scheduled shifts every few months from the chiefs.

Float rotations require you to fill in on services that find them short of residents due to vacations, sick days or other absences. The float's responsibilities are the same as the other residents on the service, commensurate with training level.

The hybrid rotation helps cover the AM morning tasks in the ED and in-house. The hybrid resident works from 7:00 AM – 10:00 (9:00) PM on weekends and acts as a float on Monday and Tuesday. The remaining weekdays serve as that resident's weekend.

We are also all responsible for getting our work finished in a timely and efficient manner. Sometimes that takes extra effort. If you can help get your colleagues through extra heavy workloads, it will be appreciated and will be noticed.

FIRST YEAR DR & IR RESIDENT RESPONSIBILITIES

1st year residents taking angio pager call on weekends and holidays are responsible for day coverage (8am - 10pm on Sat. and Sun. in addition to holidays) for emergent fluoroscopy, body interventional, or angio procedures.

On Mon. – Fri. 5pm – 9:30pm, the Evening Triage resident (which begins for the 1st years in January) will remain in the hospital to read emergent triage studies as well as to approve of emergent CT scans or ultrasounds. However, if an emergent fluoroscopy study, body interventional procedure, or angiogram needs to be performed, the procedure takes first priority. If there are no emergent procedures to perform, the resident is expected to assist the ER night faculty with ICU plain films as well as inpatient and clinic plain films at the UH.

SECOND YEAR DR & IR RESIDENT RESPONSIBILITES

This is the hardest year in the residency. Residents will perform the bulk of their night and weekend work.

Three people will be assigned to each "ER night float" rotation (more on this rotation later). Two of these will be 2nd year residents. Since the year is divided into 13 rotations of four weeks each, the 2nd year class will cover 26 ER rotations. These residents also cover the ER from 8am – 5pm on Sat., Sun., and holidays. These responsibilities begin on June 1 and end on May 31st the following year. Throughout the 2nd year, residents will continue to take the Evening Triage weekday shifts (5pm-9:30pm).

THIRD YEAR DR & IR RESIDENT RESPONSIBILITES

Third year residents are occupied with preparation for the ABR Core Exam and most will spend one rotation away at AIRP. They will also have regular rotation and triage responsibilities to fulfil. Please recognize that you will be in or have just been in the same place and act accordingly.

.

FOURTH YEAR DR RESIDENT REPONSIBILITIES

Fourth year residents have ER night responsibilities and as the most senior trainees, are often asked to apply their hard-earned expertise in helping more junior residents. Their experience at the institution means that faculty rely on their help with additional tasks. The Chiefs are typically chosen from the 4th year class.

The University of Texas Health
Science Center at San Antonio

Department of Radiology
Division of Education

RESIDENT GUIDE TO ONLINE PORTFOLIO IN NEW INNOVATIONS DIAGNOSTIC & INTERVENTIONAL RADIOLOGY RESIDENCY PROGRAMS

WHY DO WE HAVE TO MAINTAIN A PORTFOLIO?

The ACGME Resident Review Committee (RRC) for Radiology requires that Residents maintain a portfolio throughout the duration of their residency training. Specifically, Section IV .A.6.I states "Residents must maintain a Resident Learning Portfolio, which must include, at a minimum, documentation of the following…"

1. Patient Care
    a. Participation in therapies involving oral administration of sodium iodide I-131, including the date, diagnosis, and dosage (*tracked via Procedure Logger*)
    b. Interpretation/multi-reading of mammograms (*tracked via Procedure Logger*)
    c. Participation in hands-on ultrasonographic examination of various types (*tracked via Procedure Logger*)
    d. Performance of Invasive procedures and any complications (*tracked via Procedure Logger*)

2. Medical Knowledge
    a. Conferences/Courses/Meetings and Self-Assessment modules completed (*tracked via Scholarly Activities and Journal Module*)
    b. Performance on rotation-specific and/or annual objective examinations (*tracked via Evaluations, USMLE scores are recorded in the Personnel Records in NI*)

3. Practice-Based Learning and Improvement
    a. Evidence of a reflective process that must result in the annual documentation of an individual learning plan and self-assessment (*tracked via Journal module*)
    b. Scholarly activity, such as publications and/or presentations (*tracked via Journal module*)

4. Interpersonal and Communication Skills
    a. Formal assessment of oral and written communication (*tracked via Evaluations module*)

5. Professionalism
    a. Compliance with institution and departmental policies including, but not limited to HIPAA, Joint Commission, patient safety, Infection Control, and Dress Code (*tracked via UTHSA Knowledge Center*)

    b. Status of medical license, if appropriate (*recorded in Personnel Record of NI, including NPI number, current CPR certification, and DEA license if applicable*)

6. Systems-based Practice
    a. A learning activity that involves a solution to a system problem at the departmental, institutional, local, regional, national or international level (*Participation in UHS Root Cause Analysis (RCAs) meet this requirement, dates of attendance by Residents are documented in the Scholarly Activities module*)

The University of Texas Health
Science Center at San Antonio

Department of Radiology
Division of Education

WHY ARE WE USING NEW INNOVATIONS?

Due to the size and complexity of both the Diagnostic and Interventional Radiology Residency programs, New Innovations (NI) allows the department to collect a wide variety of data required by the ACGME and store it centrally in one location that all Academic Program Coordinators, Program Directors and Associate Program Directors have access to. This also ensured that documentation is not lost and is retained in a secure database to protect Residents' confidentiality.

I'M AN IR RESIDENT, WHY DO I HAVE TO DO THIS?

ACGME requires that certain documentation be on file for all residency programs, including scholarly activity, documentation of procedures performed, evaluations, etc.

WHY DO WE HAVE TO COMPLETE JOURNAL ENTRIES?

RRC requires evidence of a reflective process that must result in the annual documentation of an individual learning plan and self-assessment. The Journal Module is the best way to track this. The Program Coordinator will release the journal assignments with due dates.

WHAT MUST RESIDENTS NEED TO DO THROUGHOUT THE ACADEMIC YEAR?

- **WEEKLY**
  - Complete evaluations of Faculty and of Rotation.
    (ALL procedures must be signed off by a supervising Faculty)

- **MONTHLY**
  - Enter recent scholarly activity you have completed in New Innovations. (posters, abstracts, grants, committee membership, teaching presentations, etc.)

- **SEMI-ANNUALLY**
  - Complete your assigned journal entry for your annual self-assessment.

- **ON-GOING THROUGHOUT THE ACADEMIC YEAR**
  - Email your ACLS card to your PC whenever you get a renewal. PC will update NI.
  - Email changes in your TX Physician-In-Training Permit (PIT) or TX Full Medical License to your PC so your record in NI can be updated. Your PC will update UH Professional Staff Services.
  - Email updated USMLE scores to PC to update record in NI.
  - Provide paper forms to patients and techs who work with you for your semi-annual evaluation. Your PC will enter the information in NI and destroy the paper form.

WHAT HAPPENS AT MY SEMI-ANNUAL (6 MONTH) EVALUATION? DO I STILL NEED TO MEET WITH THE PD OR APD IN PERSON?

Yes, you will still meet in person with the Program Director or one of the Associate PD's. The PD or APD will complete an electronic evaluation summarizing your performance for the past 6 months. An example of the evaluation follows this page. Faculty completing your evaluation will rank you on the 6 ACGME competencies and include any additional comments if needed. The faculty will sign the electronic evaluation and the Resident will also electronically sign.

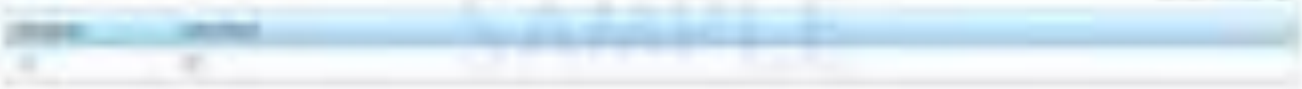
Duty Hour Rule Violations

Procedures Logged

Scholarly Activity

Conference Attendance

Journal Assignment Compliance

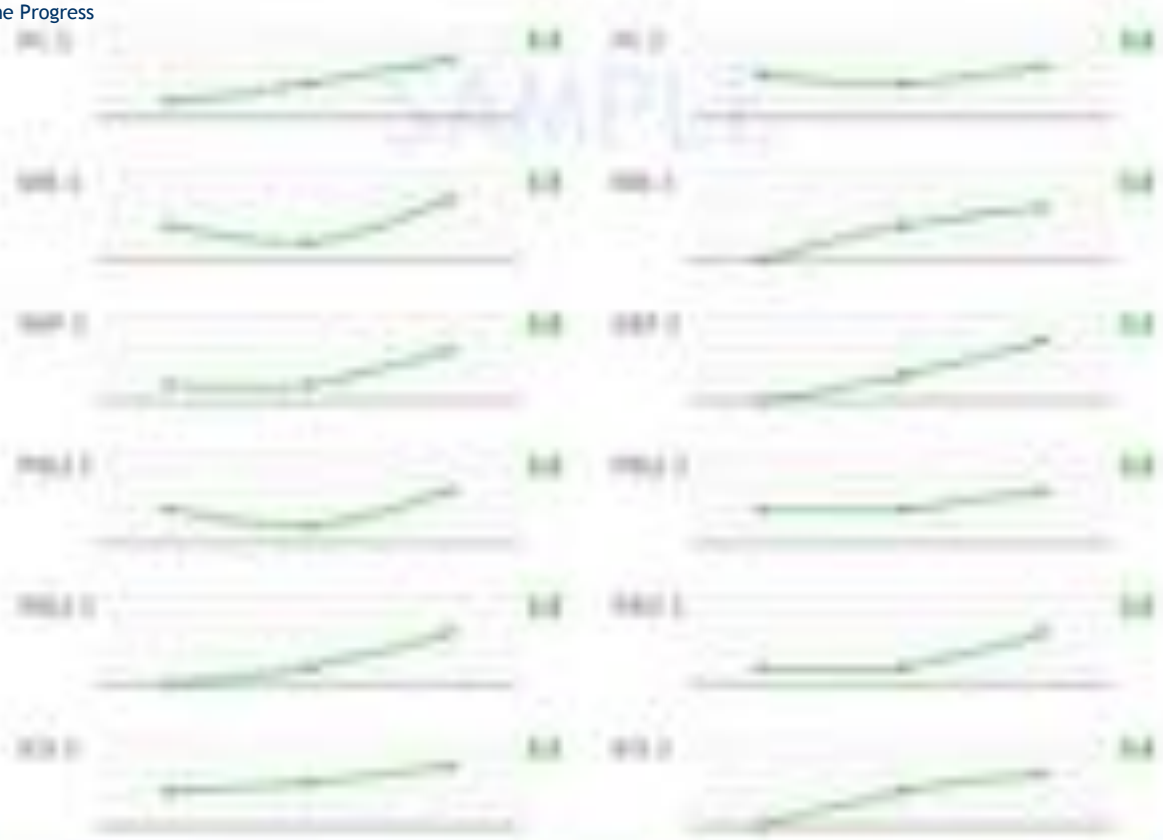


Compliance per Rotation

Evaluation Comments by Competency

Evaluation Comments - All

Milestone Progress



Test Scores

Certifications


SAMPLE
SAMPLE

Form A

American Board of Radiology — Program Director Attestation

COMPLIANCE WITH NRC TRAINING AND EXPERIENCE REQUIREMENTS

Forms A and B must be submitted after completion of your NRC training and experience.

More information can be found at the following link:

http://www.nrc.gov/reading-rm/doc-collections/cfr/part035/part035-0290.html

Resident Name _____ Program _____ Program # _____

	YES	NO
By the time of the ABR certifying examination, this applicant will have successfully completed the hours of training and experience as outlined in 10 CFR 35.290, 35.392, and 35.394	☐	☐
This applicant has taken part in ≥ 3 cases of oral administration of I-131 therapy ≤ 33mCi.....	☐	☐
This applicant has taken part in ≥ 3 cases of oral administration of I-131 therapy >33 mCi.....	☐	☐
The resident's log of these therapy experiences (date, dose, and preceptor attestation) is attached.....	☐	☐
I attest that the work experience cited above for § 35.290 was completed under the supervision of an Authorized User (AU) who meets the requirements under relevant sections of § 35.290 or equivalent Agreement State requirements.....	☐	☐
I attest that the work experience cited above for § 35.392 was completed under the supervision of an Authorized User (AU) who meets the requirements under § 35.390, 35.392 or 35.394, or equivalent Agreement State requirements.....	☐	☐
I attest that the work experience cited above for § 35.394 was completed under the supervision of an Authorized User (AU) who meets the requirements under § 35.390 or 35.394, or equivalent Agreement State requirements.....	☐	☐

Residency Program Director (Print Name) _____ Program Director (Signature) _____ Date _____

Form B

I-131 Therapy Experience Log

_____ Resident Name

_____ Program & Number

Date	Dose Administered	Preceptor (AU) Print & Sign Name
≤ 33mCi		
1. _____	_____	_____ **Print Name**
		_____ **Sign Name**
2. _____	_____	_____ **Print Name**
		_____ **Sign Name**
3. _____	_____	_____ **Print Name**
		_____ Sign Name

Date	Dose Administered	Preceptor (AU) Print & Sign Name
>33 mCi		
1. _____	_____	_____ **Print Name**
		_____ **Sign Name**
2. _____	_____	_____ **Print Name**
		_____ **Sign Name**
3. _____	_____	_____ **Print Name**
		_____ **Sign Name**

The preceding ABR forms do not have to be completed for a resident to take the ABR exam, including the Nuclear Medicine section of the exam. Completing the forms documents the required training and work experience, and allows the candidate to receive Authorized User (AU)-eligible designation on his/her certificate.

Candidates who fulfill all the requirements listed on Form A and Form B, and who pass all their ABR exams, will receive an ABR certificate that contains the additional designation "AU-eligible." This means that the person is eligible through the ABR pathway to be approved by the NRC or Agreement State as an AU of medical radionuclides for imaging and localization studies and for oral administration of sodium iodide I-131. NRC approval is obtained upon written application to the NRC/Agreement State and also requires submission of an NRC preceptor form, which has been completed and signed by the preceptor who must be an AU. The forms are available on the NRC website.

For International Medical Graduates (IMGs) via the Alternate Pathway program, the preceding ABR forms must be submitted six months prior to the Certifying Examination. Form A will be signed by the department chair, and Form B will be signed by the preceptor.

Radiopharmacy

Day 1: _____

Supervising Authorized User: _____

Location: _____

Day 2: _____

Supervising Authorized User: _____

Location: _____

Procedure	Day 1	Day 2
1. Eluting generator systems appropriate for the preparation of radioactive drug for imaging & localization studies		
2. Measuring & testing the eluate for radionuclidic purity		
3. Processing the eluate with reagent kits to prepare labeled radioactive drugs		
4. Aspects of radiation protection		
5. Ordering radioactive materials		
6. Receiving radioactive materials safely & performing the related radiation surveys		
7. Unpacking radioactive materials safely & performing the related radiation surveys		
8. Performing quality control procedures on instruments used to determine the activity of dosages		
9. Performing checks for proper operation of survey meters		
10. Calculating, measuring & safely preparing patient or human research subject dosages		

11. Using administrative controls to prevent a medical event involving the use of unsealed byproduct material

12. Using procedures to contain spilled byproduct material safely & using proper decontamination procedures

13. Administering dosages or radioactive drugs to patients or human research subjects

14. Processing the eluate with reagent kits to prepare labeled radioactive drugs

Nuclear Medicine
Training and Experience Documentation
for Radiology Residents

	Date	Supervising Staff
1. Instrumentation		
• Camera QC - flood	_____	_____
• Camera QC – linearity, resolution	_____	_____
• SPECT QC	_____	_____
• Dose Calibrator QC	_____	_____
2. CNS		
• Brain SPECT	_____	_____
• Brain Death	_____	_____
3. Thyroid		
• Thyroid Uptake & calculation	_____	_____
• Thyroid scan	_____	_____
• Endocrine conference presentation (6)		
• Benign Disease	_____	_____
	_____	_____
• Thyroid Cancer	_____	_____
	_____	_____
• Non-thyroid endo	_____	_____
4. Cardiovascular		
• Myocardial Perfusion		
• Chemical stress (3)	1._____ 2._____ 3._____	1._____ 2._____ 3._____
• Exercise stress (3)	1._____ 2._____ 3._____	1._____ 2._____ 3._____
• Process (6)	1._____ 2._____ 3._____ 4._____ 5._____ 6._____	1._____ 2._____ 3._____ 4._____ 5._____ 6._____
• Patient F/U: (3)	1._____ 2._____ 3._____	_____ _____ _____
• MUGA	_____	_____
• Process (3)	1._____ 2._____ 3._____	1._____ 2._____ 3._____

	Date	Supervising Staff
5. Respiratory		
• Ventilation		
• Perfusion		
• Process Quantitative Split Function		
6. GI		
• Hepatobiliary		
• Process GBEF		
• Liver Spleen Scan		
• GI Bleed		
• Gastric Emptying		
• Process Gastric Emptying		
7. GU		
• Renal Scan		
• Process Renal		
8. Infection		
• WBC Scan		
• Collection		
• Administration		
9. NRC + Radiation Safety		
• Survey Clinic		
• Wipe Test		
• Prepare Inpatient I-131 Room		
• Post I-131 Survey of Room & Patient		
10. Bone		
• Bone Scan		
• 3 phase Bone Scan		
• Bone SPECT		
• Bone Marrow Imaging		
• Subtraction – Process		

11. Radiopharmacy

Date: _____

Radiopharmacist: _____

RADIOLOGY FELLOW RESPONSIBILITIES

Monthly Timesheets:
Fellows whose salaries are funded by the Department of Radiology are required to submit monthly UHS AOA timesheets to their Program Coordinators. Your PC will inform you at the beginning of the academic year if you are required to submit a timesheet.

Fellows are responsible for entering accurate hours on their AOA timesheets, signing the timesheets, and submitting to their PCs by the deadline given. **Submission of late and/or inaccurate timesheets is considered a lack of professionalism and will be discussed with the Fellow if it becomes a repeated occurrence.**

Additionally, any **H1B visa holders and Specialists** are required to submit a second, department employee timesheet. The PC will inform Fellows if a second, department timesheet is required.

When completing UHS AOA timesheets, the following guidelines must be followed:

1. Report actual hours worked.
2. If Holiday, Vacation, and Sick hours are used, notate as such and a total of 8 hours should be in # of hours worked.
3. If worked on a Holiday, notate: ex: “Direct Patient Care-4 hours/Holiday-4 hours” and a total of 8 hours should be in the # of Hours Worked.
4. If Monday-Friday hours are not scheduled, notate “OFF” and leave the hours blank.
5. Do not put zero if no hours worked, leave hours blank.
6. Add # of Hours Worked to check Total Hours worked.
7. If Saturday or Sunday worked, notate “Direct Patient Care” or “On Call”.

American Board of Radiology – Alternate Pathway for International Medical Graduates

Fellows who have been accepted into the ABR Alternation Pathway for IMGs are expected to be proactive in reviewing the ABR’s requirements for this pathway, including admissions requirements, required fees and deadlines, and documentation of nuclear medicine training. Complete information may be found on the ABR website at:

https://www.theabr.org/diagnostic-radiology/initial-certification/alternate-pathways/international-medical-graduates

DEPARTMENT OF RADIOLOGY LACTATION POLICY
(effective July 1, 2019)

BACKGROUND:

The ACGME Common Program Requirements (Residency) effective July 1, 2019 outline required resources for residency training programs:

I.D.2. "The program, in partnership with its Sponsoring Institution, must ensure a healthy and safe learning and working environments that promote resident well-being and provide for: clean and private facilities for lactation that have refrigeration capabilities, with proximity appropriate for safe patient care" (I.D.2.d).

DEPARTMENT OF RADIOLOGY POLICY:

Nursing mothers will be given protected time for expressing milk for their infants. Faculty are expected to be understanding of lactating residents' needs and allow protected time for nursing mothers to meet their breastfeeding goals. Residents needing protected lactation time should plan their days in advance and notify their supervising physicians and Chief Residents of their needs in advance.

Residents should take lactation breaks at points when there is a minimal impact on patient care activities.

Lactation rooms are located at the following sites:

UT Health San Antonio Long Campus:
7703 Floyd Curl Drive, San Antonio, TX 78229

1st floor of the Dental School building; Room #114E
Take the elevator nearest to the Radiology Chair's office down to the 1st floor

5th floor of the Medical School building; Room #5.003.8
Located inside the women's restroom located near the double door entrance form the medical school to the dental school building.

Academic Learning and Teaching Center (ALTC); adjacent to Medical School bldg.
2nd Floor, small room to the side of Room 2.205; Room # 2.205.01 (has its own entrance; see diagram below):


(Lactation room, 2nd flr. ALTC)

Mays Cancer Center
7979 Wurzbach Road, San Antonio, TX 78229
4th floor Grossman Tower; take the Grossman elevator to the 4th floor and the room will be in the right before Medical Records; there is no room number but there will be a sign on the door.

University Hospital
4502 Medical Drive, San Antonio, TX 78229
NICU, 5th floor; just let the front desk staff know you need to use the room; be sure you have your UHS badge visible.
Any questions, please contact the NICU Director Rachel Rivas; (210) 358-1437
Rachel.Rivas@uhs-sa.com

UHS Robert B. Green Campus
903 W. Martin Street, San Antonio, TX 78207
Dept. of Radiology, 2nd Floor, Room #C2408

South Texas Veterans Health Care System,
Audie L. Murphy Memorial Veterans' Hospital
7400 Merton Minter Blvd., San Antonio, TX, 78229

South Texas Veterans Health Care System has a lactation room for employees at the Audie L. Murphy Memorial Veterans Hospital. The room is located near the **Spinal Cord Injury Center in room C001.** To use the room, employees will need to contact Occupational Health at ext. 14116 for the passcode. There is a sink, microwave, lockers, privacy curtains, electrical outlets, tables, and chairs. Continuing to breastfeed after returning to work has benefits for mothers, babies, and employers, and the VA supports employees who wish to do so.

FMLA GUIDELINES FOR RESIDENTS AND FELLOWS

UHS Regulations:

With some exceptions (see below), all Residents and Fellows in the Dept. of Radiology are covered under University Health System's benefits and regulations regarding FMLA.

If a Resident or Fellow anticipates needing to be on extended leave for any reason, he or she should first communicate their plans with their respective Program Director and Program Coordinator.

The Program Coordinator will submit a memo to UHS Professional Staff Services to notify UHS of the trainee's leave dates, how much paid leave is to be used, and the anticipate date of return to work.

For complete information on UHS policies regarding leave, please refer to the UHS Employee Leave of Absence Guide, which may be found online at: http://uthscsa.edu/gme/documents/Benefits/Leave%20of%20Absence%20Guide%2011.26.13.pdf.

H1B visa holders and Specialists are considered UTHSA employees and should check with the Department of Radiology Office and their Program Coordinator for UT policies and procedures regarding maternity and other leave covered under FMLA.

TRAVEL GUIDE FOR RESIDENTS & FELLOWS

RESIDENTS:

- $2,000 stipend for the duration of residency.
- Funding for 4 conferences for the duration of residency which Resident is the presenter and first author and/or presenting author; these 4 conferences will be paid by the department for up to 3 days/2 nights and do not count towards the $2,000 limit.

FELLOWS:

- $1,000 stipend for each fellowship year; **funds do not roll over year to year for multiple fellowships.**
- This includes 1 national meeting/conference per fellowship year; also comes out of $1,000 stipend.
- Funding by department for up to 3 days/2 nights for one trip per one year fellowship if Fellow/Specialist is invited to present as the first author at a national meeting; does not count towards $1,000 limit.

LEAVE:

- Residents/Fellows can use “Meeting” days for conferences/course reviews; Meeting days don’t count towards Vacation days.

TEXTBOOKS:

- If you purchase textbooks directly and ask for reimbursement you are responsible for sales tax; UTHSA is tax-exempt and doesn’t pay TX state sales tax.
- Contact your PC for your program for textbook orders – DR Residents, please contact Kevin Greene.
- Residents can use up to $750 of $2,000 stipend for textbooks.
- Fellows can use all $1,000 for textbooks.
- Contact the Education Division before purchasing textbooks; normally we can order textbooks directly so you don’t have to pay TX state sales tax.
- Book funds may not be used to purchase laptops/iPads/other equipment.

Who does travel:

- The PC assigned for your program; if any PC is out contact Jessica Craig for assistance; if Jessica is out please contact Edie Kenney-Perez.

What is covered for **3 days, 2 nights** of travel:

- Airfare; must be booked through Corporate Travel Planners (CTP)
- Lodging (including taxes/fees)
- Transportation for business purposes (uber/taxi/airport shuttle, etc.)
- Meals
- Registration fees
- Anything longer than 3 days/2 nights must be approved by Dept. Administrator and **is subject to funding availability.**

What is not covered:

- Car rentals (including gas for rental car)
- Transportation for non-business purposes (i.e., sightseeing)
- Tips/gratuities

- Alcoholic beverages
- Excess baggage fees
- Expenses for guests traveling with Resident/Fellow

AIRP 4-WEEK PATHOLOGY COURSE

1. Registration fee paid directly by department to ACR; does not count towards $2,000 limit.

2. You don't have to use all $2,000; you can choose to be reimbursed for only certain expenses, such as lodging or airfare.

3. Multiple lodging venues are available; visit the AIRP website for more information on housing; most Residents are able to save money through Air BnBs.

4. Any remaining funds can be used towards textbook purchases or Huda physics course registration.

TIPS FROM JESSICA:

1. Please don't assume something is covered. If you're not sure contact the Education Division; if you pay for something that is not reimbursable there's nothing we can do to cover that expense.

2. The departure/return city must be San Antonio; if you need to make special travel arrangements please contact your PC *BEFORE* making any airfare confirmations.

3. Any exceptions to the above guidelines must be approved by Lowell Glassburn. Dr. Otto has the final approval for all travel in the Department of Radiology. Dr. Otto's approval/denial is final.

4. If you want to request funding for a trip that you are not presenting at you must submit justification in writing to your Program Coordinator. Lowell will review the request for final approval.

5. No travel pre-approval = no reimbursement. This is per institutional rules, not just department rules.

6. Submit your receipts as soon as possible to your PC to help expedite reimbursement. Receipts for food must be itemized.

RADIOLOGY RESIDENT RESEARCH REQUIREMENTS

RADIOLOGY RESEARCH

The faculty leadership in the Department of Radiology are keenly aware from their own experience, that a vibrant research enterprise is necessary for the continued success and future development of our discipline. Radiologists have never been in greater demand yet ironically, radiology as a specialty is in danger of losing control over its future unless the imperatives for imaging research and related technological advances are recognized and management over these disciplines exerted through systematic programmatic development. The key to accomplishing these goals is to increase both the quality and quantity of research in academic radiology departments among the faculty, residents and other students involved in their training programs. Additionally, it is strongly believed that all radiologists must have an in-depth understanding of scientific methodology so that they can critically analyze existing and future scientific data/publications to determine the validity of the results. To this end, the academic faculty of the UTHSCSA, Department of Radiology and more recently the ACGME Residency Review Committee have mandated that research training must be an integral part of residency programs.

RESIDENCY RESEARCH TIMELINE AND PROCEDURES

At the outset of their residency, most incoming residents are not well acquainted with the faculty and many do not have a clear understanding of the various subspecializations that currently exist in field. During the first six months residents should begin to identify an area of research that is of interest that will meet the requirements as they are outlined below and a research advisor. As you become familiar with the individual faculty you will find that some are regularly engaged in research while others focus almost exclusively on clinical responsibilities or a combination of administrative and clinical work. You will find that many in these latter groups are a great source of information and are willing to provide technical support even though they do not have time to actively mentor you in your research project. So that you may move ahead with your research project and have the guidance of a faculty member with a well established research track record who can provide guidance on study design, the kinds and sizes of studies that are realistic and how to identify resources to complete your research, the Director or Resident Research will serve as your research advisor and will continue in that role as long as necessary. The Director of Research can work with other faculty who are willing to serve as subject matter experts when needed.

It is likely however, that you will identify another faculty member with whom you would like to work. If that is the case, you should approach that individual and discuss your interests and determine if they are willing and able to serve as your research mentor. If they are, they should send an e-mail to the Director or Resident Research indicating that they are willing to serve in this role. Choice of a research mentor may be based on the resident's research interests, availability of specific faculty members, funding availability and/or needs or other reasonable criteria. Each resident should determine who will be their research advisor and have an approved research topic by the end of their first year of radiology residency. It is important to understand that the Director of Resident Research is available to provide consultation, particularly in the areas of biostatistics, epidemiology, health services research, study design, survey studies and scientific writing as required by major journals. As a reviewer for two of the largest radiological journals as well as five other medical journals, he is well acquainted with current standards among the major publishers of medically related research.

A written research proposal should be prepared by the resident and submitted as soon as possible, but no later than the end of December of the second year. This proposal may undergo numerous revisions depending on the nature of the proposed project. Once a project has been submitted and approved, all changes must be reviewed and approved by both the resident’s research advisor and the Director of Resident Research.

No specific time will be allocated for the performance of resident research projects; typically, they will be performed as time allows during the clinical day or after routine clinical hours. This is analogous to the majority of clinical faculty who are engaged in research; they all multi-task. Because of the pressures of time and funding, residents should work with their advisors and the Director of Research to develop manageable research projects. It is frustrating to residents and faculty alike when good projects are not completed in time to meet the submission deadlines for scientific papers or poster presentations at national meetings. To avoid such problems, progress towards research completion will be monitored and requests for assistance that are recorded on the Residency Research Questionnaire will be addressed. This form will be distributed every three to four months. As shown in the tables below, the research requirement will be fulfilled by the end of the third year with the submission of a scholarly paper for publication to a refereed journal sponsored by one of the major national radiological organizations or other approved, peer reviewed medical journal. Each submission will be read and the journal where it is being submitted will be reviewed by the Director of Resident Research and one other senior faculty member identified by the

Department Chair or the Program Director. Any manuscripts that are found to be grossly inferior to articles currently appearing in major journals will be returned to the resident for revision.

The resident research requirement is an integral component of the residency program. Satisfactory completion of the requirement by the end of the third year will be necessary to enter the fourth year of the residency program. If the Residency Research Questionnaire has been completed, as required, there will be ample warning if an individual is not progressing satisfactorily.

NOTE: Failure to complete the Residency Research Questionnaire each time it is sent out will result in a written notice being placed in the resident's personnel file with a copy sent to the resident and their advisor. The purpose of the questionnaire is to assist every resident in the satisfactory completion of the research requirements. It is impossible for advisors/mentors and administrative faculty responsible for research, to help individuals who are not making satisfactory progress without having an ongoing record of their research activities.

To satisfy the requirements of the Department of Radiology, the RRC and their parent organization, the ACGME, a four track research program has been established. Although the subject matter and formats may differ between Tracks, the expectation of excellence is no different for one track compared with another. The differences between them reflect the nature of the research projects, subject matter areas, how the research projects will be reported and the interests/needs of individual residents.

TRACK A – Perform an In-Depth Review of the Literature on a Subject --- Results to be submitted as an educational exhibit at a national meeting, orally presented to the

Department faculty and residents, and submitted by the resident to a national journal for publication.

This research option is for residents who would prefer to engage in projects that are primarily clinically oriented. Such research might include performing an in-depth review of the imaging manifestations of a specific clinical condition, the pros and cons of the use of various imaging techniques for different applications, or the science of new or existing treatment modalities, e.g. technique, risks and benefits of interventional procedures. Another clinical research option includes assessment of the evidence-base for a subject that is frequently taught, but has limited substantiation in current texts. A potential use for all of these projects is incorporating them into the curriculum where they provide a stronger evidence base for the subject.

These projects must be submitted to a major national scientific meeting, e.g., RSNA, ARRS, or AUR, as an educational exhibit during the third year of residency. If the poster is rejected by one first society it should be revised and resubmitted another organization. If the submission is accepted to one or more of the meetings, the resident will be allowed to attend one of the meetings with his/her travel expenses reimbursed by the Department according to policy.

All projects must also be given as an oral PowerPoint presentation to the Department during the noon conference schedule and crafted into a manuscript and submitted to a peer reviewed journal for publication. If a poster was not accepted for presentation but a manuscript of the work is published, the resident will be allowed to attend a national meeting with his/her travel expenses reimbursed by the Department according to policy.

Lastly, all exhibits will be converted to electronic chapter format and added to the Department's online electronic textbook. This work will be done primarily by Department personnel; however, residents will be required to proof the finished work.

Track A	
Requirements	**Timeline**
1. Choose research mentor and topic	End of 1st year
2. Submit written research proposal	By Jan 1 of 2nd year
3. Submit abstract to national meeting	3rd year
4. Present poster at national meeting	3rd year
5. Oral presentation to Department	3rd year
6. Manuscript submission	End of 3rd year
7. Proof electronic chapter	4th year

TRACK B – Perform Original Research — Results to be presented at a national meeting, orally presented to the Department faculty and residents, and submitted by the resident to a national journal for publication.

Track B is envisioned primarily for residents wishing to pursue an academic or research based career. Every effort will be made to identify an opportunity for them to engage in original research that will lead to than as first author on a research publication in a recognized peer reviewed journal.

There are a variety of paths that a resident may take to achieve the Track B goal. The most likely is to collaborate with a researcher(s) within the Department of Radiology engaged in studies related to imaging and/or issues of central interest to radiologists. The goal of such collaboration is to identify a discrete portion of a larger study that would become the resident's primary responsibility. In this manner the research would clearly be identified as "belonging" to the resident so that they would be first author on the resulting publication(s) such agreements must be made at the outset of the research so that there is no misunderstanding regarding the authorship order.

The most ambitious alternative is for the resident to initiate an entirely new research project using an original design, securing necessary funding and carrying out the work with a minimum of supervision. Such situations are rare, but will be encouraged for those who are capable of doing this level of work.

All projects in Track B require the submission of an abstract for presentation at a national meeting. If the abstract is accepted for presentation the resident will present the material and his/her travel expenses will be reimbursed by the Department according to policy. Prior to the national meeting each resident will be required to give his/her PowerPoint presentation to the department, usually during a noon conference.

All projects must result in a manuscript that is submitted for publication. If an abstract is not accepted for presentation at a meeting but a manuscript of the material is published, the resident will be allowed to attend a national meeting with his/her travel expenses reimbursed by the Department according to policy.

TRACK C – Become Engaged as a Leader in a Major

Track B	
Requirements	**Timeline**
1. Choose research mentor and topic	End of 1st year
2. Submit written research proposal	By Jan 1 of 2nd year
3. Submit abstract to national meeting	3rd year
4. Oral presentation to Department	3rd year
5. Oral presentation at national meeting	3rd year
6. Manuscript submission	End of 3rd year

Radiological Society through the Resident's Section or Other Appropriate means.

The need for pro-active leadership in radiology has never been greater than it is today. The purpose of this track is to give credit to residents who become involved in the development and/or change of such policy issues as; reimbursement mechanisms; legal issues impacting medicine especially radiology; disparities between radiology residencies and other specialty training programs in obtaining support from medical schools, legislatures and the federal government. These disparities force academic radiologists to bear an unequal share of the cost of financing graduate medical education through professional services, resulting in their having less time and availability to teach and pursue research than other specialties.

Of particular importance is that research funds available for radiology are disproportionately low. Organizations representing radiology should be at the forefront in addressing the need for more research funding to support clinical radiology. Organizations representing various medical specialties typically have constituencies where the practitioners are dominant in both the percentage of membership and assets. Although academicians usually hold elected office as leaders of the societies, their voices in support of research are hard to hear given the disinterest among practitioners in spending more on research. Developing logical justifications that are clear and persuasive proving why increased research funding will benefit the practitioner as much or more than the scientist are activities that are both challenging and potentially very rewarding.

Through activity in professional societies it is possible for residents to develop policy papers, collect and present data and provide solid information that will convince politicians, the insurance industry, offices of higher education and a host of other groups that changes are necessary. Residents on this track would sit on committees within the professional organizations; write editorials, position papers, summarize research findings and offer commentaries using the platforms that have been created for residents. The opportunity to learn about the political and economic structure of the health care system in general and radiology in particular is relatively rare. This track could well be a training ground for the leaders in the specialty for years to come.

The specific requirements of Track C include becoming a resident officer of the Texas Radiological Society (TRS) and potentially the American College of Radiology (ACR), attending the annual meetings of the organizations, writing a manuscript on a political or practice issue and submitting it for publication, making an oral presentation to the Department faculty and residents that describes the function of the major radiology societies and possibly present in other venues the political or practice issue addressed in the manuscript. In addition the resident would keep a log or diary of activities carried out while engaged in these organizational actions. The timeline would coincide with those choosing Track B. A summary of activities and submission of the manuscript would be required by the end of the third year however the resident may elect to continue their activity during the balance of their training.

Track C	
Requirements	**Timeline**
1. Choose research mentor and topic	End of 1st year
2. Contact Society to work within	By beginning of 2nd year
3. Attend meetings and sit on committees	2nd - 4th year
4. Oral presentation to Department	3rd year
5. Submission of manuscript	End of 3rd year

TRACK D – Service to Department – Such as: Development of Teaching Materials or Standardized Templates for Reading Radiological Images

The goal of Track D research is to develop "tools" or "end products" that will have practical application in education and/or clinical practice. For example: Educational projects focusing on portions of the residency didactics that aren't currently being covered in sufficient depth relative to their prominence on board exams; new information that is of high importance to be added to the curriculum that will impact clinical practice; or amend or delete material currently being taught that has not been validated or been shown to be less beneficial than previously believed or has serious side effects that were not well studied in the past.

The development of teaching tools is predicated on the application of Evidence – Based Medicine. Although there are entire books on the subject, the following capsulizes the fundamentals of this process:

> *The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research. By individual clinical expertise, we mean the proficiency and judgment that individual clinicians acquire through clinical experience and clinical practice. Increased expertise is reflected in many ways, but especially in more effective and efficient diagnosis and in the more thoughtful identification and compassionate use of individual patients' predicaments, rights and preferences in making clinical decisions about their care. By best available external clinical evidence, we mean clinically relevant research, often from the basic sciences of medicine, but especially from patient-centered clinical research into the accuracy and precision of diagnostic tests (including the clinical examination), the power of prognostic markers and the efficacy and safety of therapeutic, rehabilitative and preventive regimens. External clinical evidence both invalidates previously accepted diagnostic tests and treatments and replaces them with new ones that are more powerful, more efficacious and safer.* [1]

From this quotation taken from the introduction to Evidence-Based Medicine, it should be clear that developing materials for use in teaching didactics to residents or any other group for that matter, it is not merely a matter of looking at the most recent literature on a topic. This "external evidence" needs to be judged on its merits as well. There are many articles that have appeared in journals with high impact ratings written by highly respected authors which have proven to have significant flaws. Consequently the development of an educational tool that will be of value includes conversations with clinicians, educators, statisticians, and other authors, especially those who have written letters to the editor critiquing an article providing not only a rational argument but also presenting data that refute the premise(s). The final product from this option will be a set of educational materials with documentation that can be used by faculty members in presenting the "correct" concepts.

The goal of the research in Track D is the development of a "product" that will provide a needed service to the Department of Radiology. The example above deals with a common problem of educational presentations that become outdated or have incorrect information based on unsupported theories. Another development service to the department would be a template or set of guidelines that would help to direct radiologists as they evaluate images. The philosophy behind this activity is that if a standard procedure is followed in reviewing radiographic images that the probabilities of error are significantly reduced. Reviewing images is a highly complex process if one breaks it down into its fundamental parts. The lack of standardization is often justified by teaching faculty because they can tailor their reviews to suite the individual

[1] Sackett DL, Straus SE, Richardson WS, Rosenberg W, Haynes RB. Evidence-based Medicine: How to Practice and Teach EBM (Second Edition). Churchill Livingstone: Edinburgh, 2000.

needs of a patient. Unfortunately imposing their “favorite” methods when guiding residents may reflect a propensity to form quick judgments and ignore data that don’t support their conclusions. Conversely, if indeed there is evidence that the “favorite” way yields consistently better results when used by all who adopt it, then it should be considered as a promising model in developing the new template. A major problem is how to standardize methods so that they have good transferability between clinicians and different types of problems.

Issues related to standardization have been studied by individuals in medical informatics for a number of years. Their goal has been to determine how best to present data on a computer terminal so it can be interpreted. The problems are far from solved and this is a fertile field of investigation. The underlying premise for this type of project is that the more standardized a procedure becomes the less likely it is for the “operator” to make errors by overlooking key pieces of information. This principle has been borne out thousands of times in the training of pilots. To some the idea of using a checklist every time they take off or land seems unnecessarily redundant. However, in reviewing data from crash sites or in those instances where pilots survived and could describe the event, the number of times that overlooking an obvious and “routine” item such as lowering the landing gear has been shown to be the single greatest cause of “accidents.” Pilots with thousands of hours, use checklists even though there is no doubt that they are aware of the importance of lowering landing gear, setting flaps and a series of very elementary steps. Commercial pilots are required to use the lists, and repeat verbally the action taken to the co-pilot or vice-versa. The penalty for failing to use the checklists is generally a fine, a period of suspension, or in some instances the loss of their license to fly.

These projects under track D are innovative and represent a great opportunity for individuals interested in this type of study. Again it is expected that a written report, suitable for submission to refereed journal will be completed by the end of the third year. The timelines are identical to those shown for Track B.

Track D	
Requirements	**Timeline**
1. Choose research mentor and topic	End of 1st year
2. Submit written research proposal	By Jan 1 of 2nd year
3. Submit abstract to national meeting	3rd year
4. Oral presentation to Department	3rd year
5. Oral presentation at national meeting	3rd year
6. Manuscript submission	End of 3rd year

National Radiology Meetings

(Check on-line for other national meetings of interest)

NAME OF SPONSORING ORGANIZATION	WEB ADDRESS (URL) FOR MORE INFO	CONTACT PHONE AND/OR E-MAIL
American Roentgen Ray Society (ARRS)	www.arrs.org	(800)438-2777 meeting@arrs.org
Radiological Society of North America (RSNA)	www.rsna.org	(630)571-2670 sdrew@rsna.org
Association of University Radiologists (AUR)	www.aur.org	(630)368-3730 aur@rsna.org
Society of Interventional Radiology (SIR)	www.sir.org	(703)691-1805
American Society of Head & Neck Radiology (ASHNR)	www.ashnr.org	(630)574-0220 vgeisendorfer@ashnr.org
American Society of Neuroradiology (ASNR)	www.asnr.org	(630)574-0220 meetings@asnr.org

Effective date: 4/01/2013
Revised date: 4/18/2016
Review date: 5/14/2019

TITLE: CONTRAST ADMINISTRATION

PURPOSE: The purpose of this policy is to ensure the appropriate utilization of contrast media so that imaging studies are optimized and the risk to the patient is minimized, to establish the guidelines for the safe and appropriate use of power injection equipment, and describe the procedure to follow when patients experience a reaction to contrast. This is a revised policy and supersedes policy dated 10/08/12. [Key Words: Contrast Media, Power Injectors, Contrast Media Reactions.]

POLICY STATEMENT:

The Department of Radiology routinely administers contrast media for the purpose of visualizing veins, arteries, vertebral disc spaces, and organs. The following guidelines must be followed to ensure the safe and appropriate administration of contrast media, minimizing the potential harmful effects, and to ensure the appropriate and safe use of power injection equipment.

POLICY ELABORATION:

I. DEFINITIONS

A. Contrast Media - Medical contrast agents used to improve the visibility of internal bodily structures in x-ray-based imaging techniques such as computed tomography (CT).

B. Power Injector - A medical device used for the intravenous or intra-arterial injection of contrast media at a pre-set dose and at a predetermined flow rate and pressure setting.

C. Estimated glomerular filtration rate (eGFR) - The estimated flow rate of fluid through the glomeruli each minute. It is generally accepted as the best overall indicator of kidney function.

D. Pediatric Patients- For the purpose of this policy, pediatric patients are those less than 18 years of age.

II. SCOPE OF RESPONSIBILITY AND AUTHORITY

A. The radiologist, based on protocols, determines which procedures require the use of contrast, which types of contrast to use, the contrast dose, and route. In addition, the radiologist will also determine if a power injector will be used.

B. A radiologist or designated licensed physician will be present in the facility when IV contrast is being administered and will be available to respond in the event of a contrast reaction.

C. An ARRT radiology technologist, radiology RN, or a physician can administer contrast via hand injections.

D. Power injectors are only to be used by ARRT radiology technologist after training and documented competencies on use of the power injection equipment is completed. The power injector competencies will be done annually as a part of the annual performance evaluation.

1. Only licensed employees are allowed to make connections between the power injector and a patient's IV.

2. Only licensed employees are allowed to set up power injectors. This includes preparation of the contrast.

3. The radiologist will establish written procedure protocols that describe the appropriate use of power injectors. The Radiologist will then order which protocol the technologist will follow for each power injection procedure.

III. CONTRAST SCREENING

A. The University Health System Form BCHD #7-075 NS, Contrast Medium Questionnaire, will be completed prior to contrast administration to outpatients by the technologist or the nurse caring for the patient during the procedure.

B. The inpatient medical record is utilized to obtain information pertinent to contrast administration. Items reviewed include pertinent blood and urine tests, documented medical history,

and allergy information. If the patient is responsive, the patient will be questioned about previous x-ray procedures involving use of contrast to gather information about any previous contrast reactions.

C. The technologist or the nurse will interview the patient and review the appropriate lab tests prior to the administration of contrast if indicated by the responses on the contrast medium questionnaire. Any patient age 60 or older or a patient under 60 that has a history of hypertension, heart disease or kidney disease will have a creatinine prior to receiving IV contrast. If there is a life threatening or critical indication the ordering physician may override the requirement to obtain a Creatnine prior to contrast administration. In this case the technologist will document in RIS the name of the physician who determined the need to override this. If an iStat (POCT) is readily available, is it preferable to perform a Creatnine test.

1. Serum creatinine or point-of-care testing creatinine levels will be done, and an estimated GFR calculated, on patients who meet screening criteria as high risk for kidney disease prior to contrast administration.

2. The radiology faculty, fellow, or resident must be notified before administering contrast in these situations:

   a. For iodinated contrast, eGFR < 60 with risk factors (refer to the Iodinated Contrast/Hydration Protocol)

   b. For gadolinium, eGFR ≤ 30

3. The radiologist will determine how to proceed with these patients. They may require a non-contrast study, a different exam, and/or pre-exam hydration (refer to the Iodinated Contrast/Hydration Protocol).

4. Patients that require iodinated contrast and are taking Metformin or a combination product with Metformin (Glucophage, Glucophage XR, Glucovance and Metaglip) and have a GFR <30 are to be informed that the Metformin product should then be held for 48 hours after receiving the iodinated contrast and they should return for a repeat GFR in 48 hours. Iodinated contrast for a patient with a GFR <30 requires approval by a Radiologist prior to administration. Patients who are taking a Metformin product and have a GFR >30 are not

required to withhold Metformin after receiving the iodinated contrast.

D. The radiologist will be notified if the patient has had a previous reaction to contrast administration.

1. The patient with a history of a contrast reaction will be interviewed for additional details about the previous contrast reaction, to include the following:

a. Date of the reaction.

b. Reaction symptoms.

c. Procedure requiring contrast and or type of contrast used.

d. Medications used previously to treat the contrast reaction.

e. Other allergies.

f. Current medications.

E. Based on the information obtained during the contrast screening, the radiologist will decide if the procedure can be completed using alternative contrast agents, if another procedure is indicated, or if the patient should be rescheduled with pre-medication prior to the use of contrast.

IV. CONTRAST DOSING

A. Pediatric patients require special considerations during the use of contrast. Infants and young children are unable to verbalize discomfort or symptoms of contrast reaction; therefore, pediatric patients will be observed closely during all contrast injection procedures.

For pediatric patients dose is 2 mL/kg of non-ionic contrast, up to a maximum of 100 mL unless otherwise ordered by the Radiologist.

B. Non-ionic contrast dosing for adults will be set by protocol.

C. If a repeat contrast CT scan is needed within 24 hours a repeat Creatnine will be performed prior to the repeat scan and a radiologist should be consulted.

D. Gadolinium dosing will be calculated using millimoles per kilogram of patient body weight except for specified protocols that use a set dose.

V. ORAL AND RECTAL CONTRAST

A. Oral contrast agents may be ordered alone or in conjunction with intravascular contrast.

1. Oral contrast is given in accordance with physician ordered protocols.

2. Oral contrast is administered only by a licensed employee, RN, ARRT.

3. The sending nursing unit will administer the contrast to all inpatients with an order for oral contrast. The contrast is to be mixed according to instructions for a 4% dilution of iodine.

4. For all emergency room abdomen/pelvis CT exams, the study will be done without oral contrast unless the requesting provider determines it is needed.

B. The need for rectal contrast will be determined by the radiologist and administered in the Radiology department.

VI. INTRAVASCULAR ADMINISTRATION OF CONTRAST

A. All intravascular lines accessed for contrast administration will be cleaned prior to access in accordance with the most current Infection Control policy.

B. If not drawn and used immediately, all syringes containing contrast should be labeled with name of the contrast, the concentration, date, amount if not apparent from the container, time, expiration time when expiration occurs in < 24 hours, and initialed by the person preparing or opening the syringe. Contrast is considered a medication and must be secured at all times.

C. The technologist may use an existing saline lock for contrast administration after verifying patency.

VII. USE OF POWER INJECTOR

A. A power injector will be used for all CT contrast exams unless the contrast dose is less than 20 mL, there is a contraindication, or unless otherwise instructed by the Radiologist.

B. Pediatric flow rates are dependent on the gauge of the I.V., and will not exceed the maximum rate below:

1. Flow rate for 24 gauge: 1 to 1.5 mL /second

2. Flow rate for 22 gauge: 1.5 to 2 mL/second

C. The maximum PSI will not exceed 150 for pediatric CT protocols.

D. The power injector will not be used on central lines in pediatric patients. PICC lines may be used if they are clearly labeled as power injectable (Power PICC).

In adults, the power injector is not to be used on tunneled central catheters (i.e. Hickman, Leonard, Broviac, Portacath, or PICC) unless the lines are designated power injection capable and the technologist or nurse can reference the manufacturer's specifications.

1. Injection flow rates and pressures must not exceed the manufacturer's specifications.

2. The manufacturers' recommended power injection procedure must be followed at all times.

E. It is the responsibility of the technologist to safely and correctly prepare the contrast power injector for use, and to follow current infection control guidelines.

F. The technologist will follow the radiologists' written protocol for specific instructions for performing the requested exam. In Interventional Radiology, the radiologist will verbally order which protocol to follow during the performance of the exam/procedure.

G. The technologist is responsible for checking for the presence of any air within the syringe or connecting tubing. All air should be purged from the system prior to connection to the patients IV.

H. The technologist is responsible for cleaning the power injector after each use.

VIII. CONTRAST EXTRAVASATION

A. Observe patient for signs of contrast extravasation throughout the contrast infusion while following appropriate radiation safety practices. Stop the infusion immediately if there are any signs of an extravasation which may include:

1. Pain at site.

2. Swelling at site.

3. No contrast visualized on scan.

B. If a contrast extravasation occurs, the radiology technologist will document its location, the type and amount of contrast, and the physical appearance of the site as well as patient's symptoms. The radiology nurse will be notified. If the nurse is unavailable, the technologist will notify the radiologist or designated physician.

C. The radiology nurse or physician will assess the patient and apply local applications as ordered.

D. If the patient is an inpatient, the radiology nurse will provide a hand-off to the unit nurse.

E. For outpatients, written discharge instructions will be provided.

F. All care related to contrast extravasations will be documented in the patient's medical record. An electronic risk assessment form (eRAF) will also be completed by the technologist or nurse.

G. The technologist will add the code for the extravasation to the original exam in the RIS.

IX. CONTRAST REACTION

A. Stop contrast infusion immediately.

B. Notify the radiology nurse, the radiologist, or the designated physician.

C. Obtain vital signs, to include pulse oximetry, blood pressure, respiratory rate, and heart rate. Use cardiac monitor if indicated.

D. The radiologist or physician will order medications as needed, based on patient symptoms.

E. Call a code blue if indicated.

1. If a code blue situation occurs while a patient is in MRI Zone 4, the patient must be removed from the magnet and moved to the holding area. CPR will not be delayed during this process. Emergency equipment such as crash carts, defibrillators, and laryngoscopes are not MRI compatible. Use of this equipment within the MRI suite could result in serious injury or death and could damage MRI equipment.

F. Radiology nurse responsibilities:

1. If the patient is an inpatient, the nurse will call and provide a hand-off to the patient's nurse describing the reaction event to include detailing all medications given to the patient.

2. All outpatients experiencing a contrast reaction will be given written discharge teaching information on contrast reactions.

3. Facilitate transfer of patient to the appropriate patient care unit as indicated by patient symptoms and physical condition.

4. An electronic adverse drug reaction report should be completed to include the name of contrast, the lot#, and the expiration date.

5. As applicable, nursing will ensure any suspected allergic reaction is documented in the EMR allergy section and the technologist will document the allergy in the RIS.

E. The technologist will add the code for the contrast reaction to the original exam in the RIS.

F. All care related to contrast reaction will be documented in the patient’s medical

record. An electronic risk assessment form (eRAF) will also be completed by the technologist or nurse.

REFERENCES/BIBLIOGRAPHY:

American College of Radiology, ACR Manual on Contrast Media, Version 10.1, 2015.

Association for Radiologic & Imaging Nursing; Clinical Practice Guidelines; Contrast Extravasation, 2009.

University Health System Infection Control Policy, IC 5.9 – Standard and Transmission Based Precautions.

University Health System Infection Control Policy, IC 5.10 - Hand Hygiene

OFFICE OF PRIMARY RESPONSIBILITY:

University Hospital Department of Radiology

_____	_____
Chris Vineyard	Rajeev Suri, M.D.
Executive Director	Medical Director
Radiology Services	Radiology Department

Outside Imaging Interpretation Policy

Background

As a tertiary referral and Level I Trauma Center, physicians practicing in the University Health System and at the UT Medical Arts and Research Center (MARC) often see patients from throughout South Texas and beyond. These patients often have had imaging examinations performed at outside institutions in order to diagnose or treat the patients' illness. As subspecialty-trained radiologists, we are consulted on these examinations and asked to render a second interpretation.

Procedure

To obtain an interpretation of an outside imaging examination there must be:

1. Documentation of medical necessity (necessary in order to assign the -77 modifier for Medicare billing)
   Examples include:
   - Disagreement with the outside report; clinical presentation not entirely consistent with report; or concerned about an alternative diagnosis
   - Further evaluation needed on the extent of disease or staging
   - Further information needed to assist in treatment decisions or surgical procedure planning
   - Other indication
2. A billable and complete history (ie trauma and pain will NOT be accepted)
3. An interpretation (**preliminary or final except for trauma**) from the outside institution (as per the Emergency Medical Treatment and Labor Act of 1986; 42 US Code 1395dd).
4. A patient's signature (if able) on a Beneficiary Notice in advance of an interpretation as the patient may be billed

Examinations must be:

1. Interpreted on our PACS (Synapse), NOT on LifeImage
2. Must be in the DICOM format and be able to be uploaded to Synapse
3. Current as no examination will be re-interpreted if more than 30 days old
4. Radiographs, CT, or MRI. No operator-dependent examinations such as ultrasound, fluoroscopy, or angiography will be re-interpreted

Please note:

1. To "nominate" the outside examination(s) so that they can be uploaded to PACS, complete the Nomination Form on LifeImage. Bring the CD's to be uploaded to the UHS Radiology Help Desk on the 2nd floor of the Rio Tower. Physicians should not attempt to upload the images themselves.
2. In order to obtain a second interpretation, the complete the Nomination Form as completely as possible, especially the section on Medical Necessity. Incomplete forms may result in a delay in interpretation.
3. The examination will NOT be repeated after an interpretation is rendered on an outside imaging examination unless there has been a considerable amount of time between the examination and the interpretation or if medically necessary
4. If multiple examinations of the same modality and body part are submitted for interpretation (ie 7 CT's of the Chest) only the most recent examination will be interpreted
5. The radiologist can decline re-interpreting the examination due to suboptimal image quality, technique, or inability to navigate the images
6. Interpretation of outside images may be prioritized lower than the interpretation of emergent imaging studies—except for trauma and ER.

In order to render a complete and billable report the radiologist must document:

- **An order** from the requesting physician **with reason why** second interpretation is necessary
- **Full name, type and date of original study** including whether IV and/or oral contrast were used

Outside study: MRI of the pelvis and left hip with and without IV contrast dated 12/19/2011 and submitted for interpretation on 1/11/2012

- **The indication for the study** and why the second interpretation is being requested

Clinical indication: Left hip lesion, further information needed to assist in treatment decisions

- **Comparisons** – if you have them
- **Technique/ # of views…**the more specific the better
- **Findings** – separate paragraphs for each body area
- **Impression**

- Other standard report data such as ordering physician and patient demographics

---

Qualifying Statement:

Our interpretation of studies performed at an outside institution is limited by factors including the absence of technical specifics of the examination including radiation dose and contrast dose, undisclosed clinical information, and comparison examinations. Specialists at the institution that performed the study may have access to information not available to us that could make a difference in this interpretation.

Effective Date: 4/15/2015
Revised Date: 3/8/2018
Reviewed Date:

TITLE: PROTECTION OF THE FETUS FROM IONIZING RADIATION AND HIGH MAGNETIC FIELDS

PURPOSE:

To prevent the inadvertent irradiation of an embryo or fetus and to outline safety guidelines for pregnant women and women of child bearing age during imaging procedures involving ionizing radiation or high magnetic fields. This is a revised policy and supersedes the policy dated 6/21/11. [Key Words: Women of Child Bearing Age, Shield, Collimation, Consent].

POLICY STATEMENT:

Every effort will be made to protect the embryo or fetus of a pregnant woman from unnecessary exposure to ionizing radiation or exposure to high magnetic fields. Medical Providers may consult with a Radiologist to determine the urgency of the situation and whether or not another examination might be an appropriate substitute for any exam or procedure that requires the use of ionizing radiation or high magnetic fields.

POLICY ELABORATION:

I. DEFINITIONS

A. Women of child bearing age: Women between the ages of 10-55.
B. Shield: Lead lined or lead equivalent device used to block radiation exposure; examples include lead-lined doorways, aprons, thyroid shields, screens and drapes.
C. Collimation: Technique used to narrow the radiation beam and decrease scatter.
D. Ionizing radiation producing imaging equipment: Any imaging equipment that produces ionizing radiation to obtain an image. Examples are: Computed Tomography, permanently mounted Fluoroscopy machines, portable C-Arms, Mammography machines and X-ray machines
E. Radiopharmaceuticals: Used in Nuclear Medicine for imaging and therapeutic purposes.
F. ALARA: as low as reasonably achievable concept which urges providers to use the minimum dose of radiation needed to achieve the necessary results.

II. PATIENT SCREENING AND PREGNANCY TESTING

A. A. All female patients of reproductive age must be screened for the possibility of pregnancy prior to performing any exam/procedure involving ionizing radiation exposure or high magnetic fields. An exception to this policy may be made for trauma patients and ED patients who are only to receive non-contrast CT brain.
B. Documentation of the results of the screening process will be made in the Radiology

Information System (RIS).

C. If the patient responds "yes" to the question of the possibility of pregnancy, a radiologist must be notified before proceeding with the study. The Radiologist will then decide if a quantitative serum HCG test is needed.
D. Specific Patient Screening Processes
    1. Inpatients
        a. The technologist or department staff may check the pregnancy status of women of childbearing age who are inpatients in the electronic medical record.
        b. The technologist or department staff will question the patient about her pregnancy status prior to the exam.
        c. The technologist or department staff performing the patient screening will document findings in the Radiology Information System (RIS).
    2. Outpatients
        a. Upon checking-in at the reception area, all women of child bearing age scheduled for an exam or procedure involving ionizing radiation or high magnetic fields will be asked about their pregnancy status or asked to fill out a pre-examination pregnancy determination form as applicable to the modality before the exam or procedure is performed.
        b. The technologist or department staff will review and discuss the answers with the patient prior to performing the exam.
    3. Non-responsive patients
        a. If the female patient is non-responsive or too sick to respond, the technologist or department staff should ask an appropriate care provider or the patient's known next of kin or surrogate decision maker in accordance with UHS Policy 9.02.
        b. If all attempts do not result in a clear answer, a Radiologist must be consulted for recommendations before proceeding.
E. Nuclear Medicine
    All women of child bearing ages will be screened for pregnancy before undergoing a nuclear medicine procedure. A quantitative serum HCG test will be performed if the patient has not had a menstruation cycle within two weeks of the procedure.

III. PATIENT CONSENT

A. The ordering provider is responsible for weighing the risks and benefits of using ionizing radiation in pregnant patients. Alternatives to ionizing radiation should be considered whenever possible.
B. All pregnant patients undergoing exams with ionizing radiation to the abdomen/pelvis region will be consented in writing by a Radiologist or provider (this should one physician) for the procedure using the standardized pregnancy and ionizing radiation language.
C. All pregnant patients undergoing nuclear medicine and interventional radiology procedures will be consented in writing regarding the risks to the fetus. This is in addition to consent for the procedure. In Nuclear Medicine, BCHD#739, Disclosure and Consent for Radiation Therapy will be used.

D. When the patient is known to be pregnant, the Radiologist is notified and will instruct the technologist on how to proceed.
   1. In-Department Procedures – If the examination/procedure requires pelvic exposure, the Radiologist will consult with the ordering physician to determine if the examination is indicated and explore alternative non-ionizing exams. If the examination is to be performed, the radiologist will specify the appropriate shielding and the Radiologist or provider (this should be one physician) will consent the patient in writing.
   2. Out–of–Department Procedures (portables) – If the examination/procedure requires pelvic exposure, the responsible Medical Provider may consult with a Radiologist to determine if the examination or procedure is indicated and to explore alternative non-ionizing radiation exams. If the examination/procedure is to be performed the radiologist can suggest appropriate safety precautions. Written consent will be obtained from the patient.

IV. MAGNETIC RESONANCE IMAGING (MRI)

A. University Health System follows the American College of Radiology Guidelines for imaging of pregnant patients. Gadolinium will not be administered to a pregnant patient without approval by a Faculty Radiologist and consent for the contrast by Radiologist.
B. As per the ACR guidelines; "Present data have not conclusively documented any deleterious effect of MR imaging exposure on the developing fetus. Therefore no special consideration is recommended for the first versus and other trimester in pregnancy."
C. As part of the screening process, if a patient is found to be pregnant, according to the ACR Safety Guidelines, "consideration should be given to reassessing the potential risks versus benefits of the pending study to determine whether performance of the requested MRI examination could safely wait until the end of the pregnancy".
D. The Radiologist will confer with the referring physician to analyze the risk-benefit ratio of performing the MR examination. The following will be documented by the Radiologist in the Radiology report:
   1. The information needed cannot be acquired from ultrasound or other diagnostic test that does not require ionizing radiation.
   2. The information needed affects the care of the patient and/or the fetus during pregnancy.
   3. The referring physician feels that the scan cannot wait until after the pregnancy.

V. ALARA GUIDELINES FOR PREGNANT PATIENT

A. Pelvic shielding shall be used whenever possible.
B. Proper collimation shall be used whenever possible.
C. Every effort shall be made by the technologist and or imaging provider to eliminate repeated exposures resulting from technical errors.
D. Fluoroscopy should be done at the lowest frame rate possible and with the minimum beam-on time.

REFERENCES/BIBLIOGRAPHY:

American College of Radiology, Practice Guideline for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation, 2008 (Res. 2006).

L. Wagner, R Lester, L Saldana, Exposure of the Pregnant Patient to Diagnostic Radiations 2nd ed., 1997 Medical Physics Publishing.

G El-Khoury, M. Madsen, M. Blake, J. Yankowitz. A New Pregnancy Policy for New Era. *American Journal Roentgenology* 2003; 181: 355-340.

Embracing Best Practices for Modality Specific Radiology Dictation

Nuclear Medicine Imaging

PET-CT

Exam: Dictate exam title.
History: Reason for the exam. Supplement with signs and/or symptoms when only equivocal indications are given.
Technique: Technique used in the exam.

- Document the quantity and name of radiotracer being administered.
- Document the non-diagnostic CT which was obtained for attenuation correction and anatomic correlation.

Findings: Include description of structures, clinical issue, comparative data and limitations.
Impression: Provide clinical impression/assessment.

Myocardial Perfusion

Exam: Dictate exam title.
History: Reason for the exam. Supplement with signs and/or symptoms when only equivocal indications are given.
Technique: Technique used in the exam.

- Document the quantity and name of radiotracer and other pharmacological substances being administered.
- Document if the images were obtained with **SPECT.**
- Type of stress used—pharmacological or exercise.

Findings: Include comments on **ventricular ejection fraction, wall motion—if measured.**
Impression: Provide clinical impression/assessment.

Bone Scans

Exam: Dictate exam title.
History: Reason for the exam. Supplement with signs and/or symptoms when only equivocal indications are given.
Technique: Technique used in the exam.

- Document the quantity and name of radiotracer and other pharmacological substances being administered.
- Document if the images were obtained with **SPECT.**
- Type of stress used—pharmacological or exercise.

Findings: Include comments on uptake in the multiple parts of the axial and appendicular skeleton—(head to toe).
Impression: Provide clinical impression/assessment

Non-Obstetric Ultrasound

Abdominal Ultrasound

Exam: Dictate exam title.
History: Reason for the exam. Supplement with signs and/or symptoms when only equivocal indications are given.
Technique: Complete Abdominal Ultrasound–Trans-abdominal approach.
Findings: Document visualization and assessment or reason for non-visualization of the following organs:

1. Gallbladder
2. Liver
3. Right and left kidneys
4. Common bile duct
5. Spleen
6. Pancreas
7. Abdominal aorta
8. Inferior vena cava

Impression: Provide clinical impression/assessment.

If ANY of the above organs are not documented, the procedure is LIMITED.

Retroperitoneal Ultrasound

Exam: Dictate exam title.
History: Reason for the exam. Supplement with signs and/or symptoms when only equivocal indications are given.
Technique: Complete Retroperitoneal Ultrasound–Trans-abdominal approach.
Findings: Document visualization and assessment or reason for non-visualization of the following:

2. Urinary Pathology
   - Kidneys and Urinary Bladder
2. Non-urinary Pathology
   - Kidneys (Visualization in multiple views, measurement and tissue texture)
   - Abdominal aorta
   - Common iliac artery origins
   - Inferior vena cava

Impression: Provide clinical impression/assessment.

If ANY of the above elements are not documented, the procedure is LIMITED.

Obstetric Ultrasound

< 14 Weeks Gestation

Exam: Dictate exam title and include gestational age.
History: Reason for exam. Supplement with signs and/or symptoms when only equivocal indications are given.
Technique: Complete OB Ultrasound < 14 weeks gestation – Trans-abdominal approach
Findings: Document visualization or reason for non-visualization of the following:

1. Fetal viability and anatomy appropriate for age
2. Number of fetuses and/or gestational sacs
3. Placental position and anatomy
4. Qualitative assessment of the amniotic fluid volume
5. Gestational sac shape
6. Crown rump length and head circumference (appropriate for gestation)
7. Description of maternal uterus and adnexa

Impression: Provide clinical impression/assessment.

If trans-vaginal examination is performed, it should be reported separately.

> = 14 Weeks Gestation

Exam: Dictate exam title and include gestational age.
History: Reason for the exam. Supplement with signs and/or symptoms when only equivocal indications are given.
Technique: Complete OB Ultrasound >= 14 weeks gestation – Trans-abdominal approach
Findings: Document visualization or reason for non-visualization of the following:

1. Fetal date and size
2. Number of fetuses and amniotic or chorionic sacs being evaluated
3. Measurements appropriate for gestational age (>= 14 weeks)
4. Survey of fetus to include observation of: intracranial, spinal, abdominal, 4 chambered heart
5. Umbilical cord insertion site
6. Placenta location
7. Assessment of amniotic fluid
8. Exam of maternal adnexa, when visible

Impression: Provide clinical impression/assessment.

If trans-vaginal examination is performed, it should be reported separately.

Breast Imaging

(Digital) Screening Mammogram

Exam: Dictate exam title.
History: **Annual screening** (If patient is in a high-risk category, describe one or more of the following):

- Prior (left/right) benign breast biopsy (year)
- Nulliparous before age 30
- Family history of breast cancer (mother, daughter, or sister only)
- Proven benign breast biopsy
- Personal history of breast cancer

Technique: Craniocaudal and mediolateral oblique screening views were obtained of the bilateral breasts.

- **If CAD add**: Computer Assisted Detection mammography was utilized.
- Document if digital or analog

Findings: Describe the structures being imaged.
Impression:

- Provide clinical impression/assessment.
- Include BI-RADS category.

(Digital) Diagnostic Mammogram

Exam: Dictate exam title.
History: Follow up to abnormal bilateral mammogram, (date)
Comparison: Mammogram dated (date) from (site)
Technique: CC and multiple spot compression mammographic views were obtained.

- **If CAD add**: Computer Assisted Detection mammography was utilized.
- Document if digital or analog

Findings: Describe the structures being imaged.
Impression: Provide clinical impression/assessment.

Breast Biopsy

Exam: Specify type of biopsy for (number) of lesions
History: Reason for the exam. Supplement with signs and/or symptoms when only equivocal indications are given**.**
Technique: Describe the following:

- Patient consent and explanation of risk
- Each lesion, their position, and any clips placed must be documented
- Type of guidance used (US, Mammograph, MR)
- Equipment Used (core biopsy needle, vacuum device, wire)
- Use of sterile technique and anesthesia

Findings: Describe the number of lesions with their positions and any other clinically relevant information.
Impression: Restate what was biopsied with initial

UTHSCSA DOCUMENTATION IMPROVEMENT FEEDBACK

Subitles

Notes Elements For Optimal Coding

- For optimum coding quality, all notes should contain these section headings:
  - EXAM:
  - INDICATION: (CLINICAL INDICATION, HISTORY, REASON FOR EXAM ok too)
  - TECHNIQUE: (optional)
  - FINDINGS:
  - IMPRESSION:
- All caps for section headings and titles is best.

Exam Title Elements

- Exam titles should meet the following requirements:
- Must contain! (if applicable)
  - Modality (e.g, XR, US, MRI, CT, etc.)
  - Body part (e.g., CHEST, ABDOMEN, BRAIN, FEMUR, etc.)
  - Views (e.g, 2, 3, FOUR, AP, LATERAL, OBLIQUE, etc.)
  - Contrast (e.g., W/WO CONTRAST, WITH CONTRAST, W/O CONTRAST, etc.)

Succinct Is Superior

- Use short titles like
  - Good - "PET CT WHOLE BODY”
  - Bad - "POSITRON EMISSION TOMOGRAPHY FROM THE TOP OF THE HEAD TO THE TIP OF THE TOES”
- Generic titles are best.
- Stick to CPT manual language & avoid unique or uncommon terms.

Multiple Exam Titles

- One procedure per title. Don’t combine tests into one title.
  - Bad - “XRAY OF THE KNEE AND HIP”
  - Bad - "3 VIEWS SHOULDER, 2 VIEWS ELBOW, WRIST & FOREARM”
- If multiple titles, each should end with a paragraph break
  - EXAM: THREE VIEWS OF THE RIGHT KNEE
  - EXAM: XRAY OF THE HIP 2 VIEWS

Language Quandaries

- Stick to CPT language.
- Avoid unique, ambiguous or uncommon terms and abbreviations
  - DUPLX LFT LWR EXT or CT STONE STUDY or RAD.CHE2V (UT)”
- Complete","series" or "protocol" do not equate to CPT codes.
  - Bad - ABDOMEN SERIES
- Use language to indicate number and/or type of views.
  - Good - LUMBAR SPINE 3 VIEWS
  - Good - ABDOMEN SUPINE, LATERAL AND OBLIQUE

The Good

- Good: Modality, body part, views and/or contrast; no verbs.
  - CT OF THE ABDOMEN WITH AND WITHOUT CONTRAST
  - CT OF THE PELVIS WITH CONTRAST
  - RIGHT KNEE FOUR VIEWS
  - LEFT KNEE, 4 VIEWS
  - TWO VIEWS OF THE LEFT LEG

The Bad

- Too verbose and lengthy. What does this all mean?
  - *PROCEDURE: Axial images are obtained through the abdomen both preceding and following the administration of nonionic intravenous contrast. Oral contrast was also administered. Delayed images are then obtained through the pelvis.*
  - *PROCEDURE: Four views of the right, four views of the left knee, and Hip-to-ankle views of the left leg are taken and compared to previous examination in 1998.*

The Ugly

- Titles not where they should be - at the top of the note, separately identified.
  - FINDINGS: Two views left ankle. Single view chest. Single the pelvis. Correlation is made to CT of the chest abdomen and dated 1/11/05.
  - IMPRESSION: Unremarkable CT of the head. Further evaluation with MRI of the brain would be helpful.
  - CLINICAL HISTORY: Frontal and lateral views of the skull, neck, chest, and abdomen were done in this infant with a ventriculoperitoneal shunt system in place. He presents with a bulging fontanel and vomiting.
  - The liver parenchyma demonstrates marked increase in echogenicity compatible with fatty infiltration.
  - Transabdominal exam shows the uterus to measure 7.3 x 5.2 x 6.1 cm.

Clinical Indications

- Use Signs, symptoms or medical condition that warranted the exam.
  - MVA & FALL are nouns, not diagnoses”
  - PICC LINE INSERTION" is a procedure not an ICD.
  - "RULE OUT PNEUMONIA" is negated language unless found in impression as a positive finding.
  - “TRAUMA” - of what? This site, another site, unknown site?

Rules Of Thumb

- If multiple exams on same note; dictate each one separately with dictation conventions above.
- Leave out non pertinent information; eg., patient demographics, location, room numbers etc..
  - *" This is a 27 year old woman admitted yesterday to Good Health Hospital with fever: room 119*
- Use CPT code descriptors as a guide.
- Titles in ALL CAPS
- Separate note sections with headers

CodeRyte

UTHSCSA EXAMPLES

Example 1

; HAYES,RUSSELL W PA-C;
HO,COTY MD;

EXAM: MAM - MAMMOGRAM UNILAT DIGITAL: 9/6/2011

IMPRESSION:
1. BIRADS II: Benign findings. There are expected post lumpectomy and post XRT changes in the left breast, without evidence of residual or recurrent malignancy, and without other significant changes.
2. A bilateral mammogram is recommended on or about 03/16/2012.

DISCUSSION:
History of left breast lumpectomy for invasive ductal carcinoma, on 03/12/2010, followed by XRT. No new breast symptoms are reported. Comparison study: 03/16/2011,09/13/2010, 02/10/2010, and 04/14/2005. Full field digital images of the left breast were obtained in the CC and MLO view, a total of four views. Images were processed and reviewed with Second - Look ICAD technology.

FINDINGS:
The breast tissue pattern is that of scattered fibroglandular tissue. ….. or other significant changes since the immediate previous study.

Example 1 – Current Markup

- ### PROCEDURE_PROBABLE:
  MAM MAMMOGRAM UNILATERAL DIGITAL

- HAYES,RUSSELL W PA-C;
  HO,COTY MD;

- ### IMPRESSION:
  1.
  BIRADS II:
  Benign findings.
  There are expected post lumpectomy and post XRT changes in the left breast, without evidence of residual or recurrent malignancy, and without other significant changes.
  2.
  A bilateral mammogram is recommended on or about 03/16/2012.

- ### FINDINGS:
  History of left breast lumpectomy for invasive ductal carcinoma, on 03/12/2010, followed by XRT.
  No new breast symptoms are reported.

- ### IMPRESSION:
  History of left breast lumpectomy for invasive ductal carcinoma, on 03/12/2010, followed by XRT.
  No new breast symptoms are reported.

- ### FINDINGS:
  The breast tissue pattern is that of scattered fibroglandular tissue.
  In the anterior breast, there is mild accentuation of progression of parenchymal changes…….

No clinical –
MD name being included in procedure title.
Multiple findings & impression markups.
Comparison & technique are included in history (ie DISCUSSION)
BIRADS is included in IMPRESSION

Example 1 – Ideal Format

EXAM: MAM - MAMMOGRAM UNILAT DIGITAL

HISTORY: History of left breast lumpectomy for invasive ductal carcinoma, on 03/12/2010, followed by XRT. No new breast symptoms are reported.

COMPARISON: Comparison study: 03/16/2011,09/13/2010, 02/10/2010, and 04/14/2005.

TECHNIQUE: Full field digital images of the left breast were obtained in the CC and MLO view, a total of four views. Images were processed and reviewed with Second - Look ICAD technology.

FINDINGS: The breast tissue pattern is that of scattered fibroglandular tissue. In the anterior breast, there is mild accentuation of progression…..

IMPRESSION: There are expected post lumpectomy and post XRT changes in the left breast, without evidence of residual or recurrent malignancy, and without other significant changes.
2. A bilateral mammogram is recommended on or about 03/16/2012.

BIRADS II: Benign findings.

Example 2 – As Submitted

EXAM: RAD - ABDOMEN (FLAT PLATE) 1VIEW: 12/19/2011

IMPRESSION:

Findings suggestive of constipation. Please see below.

DISCUSSION:

Supine and upright radiographs of the abdomen were obtained.

Please see the report of the recent abdominal series dated November 3, 2011.

Somewhat prominent quantity of stool is noted the colon,
such as may reflect constipation. No findings suspicious for bowel obstruction are present. The upper portion of the abdomen is not completely included on the upright radiograph nor on the supine radiograph. No pathologic intra-abdominal calcifications are seen…..

Example 2 – Current Markup

PROCEDURE_PROBABLE:
RAD ABDOMEN (FLAT PLATE) 1VIEW

IMPRESSION:
Findings suggestive of constipation.
Please see below.

Titled procedure & dictated procedure do not match.
No clinical history.
Poor parsing

FINDINGS:
Supine and upright radiographs of the abdomen were obtained.

Please see the report of the recent abdominal series dated November 3, 2011.

Somewhat prominent quantity of stool is noted the colon, such as may reflect….

IMPRESSION:
Supine and upright radiographs of the abdomen were obtained.

Example 2 – Ideal Format

PROCEDURE_KNOWN:

EXAM: SUPINE AND UPRIGHT ABDOMEN

CLINICAL_INDICATION:

CLINICAL: Abdominal Pain

COMPARISON:

COMPARISON: Please see the report of the recent abdominal series dated November 3, 2011.

FINDINGS:

Somewhat prominent quantity of stool is noted the colon, such as may reflect constipation. No findings suspicious for bowel obstruction are present. The upper portion of the abdomen is not completely included on the upright radiograph nor on the supine radiograph. No pathologic intra-abdominal calcifications are seen…..

IMPRESSION:

IMPRESSION: Findings suggestive of constipation.

CodeRyte

Questions?

DIVISION OF ABDOMINAL IMAGING

Section Chief:

- Venkata S. Katabathina, MD; Associate Professor and Medical Student Director, Dept. of Radiology
  Katabathina@uthscsa.edu
  P: (210) 567-6470

Section Faculty:

- Vijayanadh Ojili, MD; Associate Professor and Program Director, Body Imaging and Intervention Fellowship
- Abhijit G. Sunnapwar, MD; Associate Professor and Program Director, Body MR Imaging
- Apurva Bonde, MD; Assistant Professor
- Venkatesh J. Kadaba, DO; Assistant Professor
- Lokesh Khanna, MD; Assistant Professor
- Richi Tiwari, MD; Assistant Professor

Fellow: AY 2021-2022

- Haneen Marji, MD (Body MR)
- Matthew Freeman, MD (Body Imaging & Intervention)
- Kevin Roodhouse, MD (Body Imaging & Intervention)

Fellowship Academic Program Coordinators

- Bianca Acosta
  AcostaB3@uthscsa.edu
  P: (210) 567-5550
- Stephaine Navarro
  NavarroSB@uthscsa.edu
  P: (210) 567-5563

Clinical Administrative Assistant:

- Gladys Shults: shults@uthscsa.edu
  P: (210) 567-6470

UT Health San Antonio Radiology

Section Objectives:

The primary objective of the section of abdominal imaging is to perform high-quality work in the three branches of medical academia: clinical service, education, and research. The section considers each branch equally important to the creation and maintenance of a dynamic and progressive section. The objectives for each branch are:

Clinical Service:

- To provide the highest quality diagnostic and interventional service for the detection and treatment of abdominal and pelvic disease.
- To practice at the leading edge of our subspecialty.
- To deliver all services in a timely and efficient manner.
- To establish ourselves as valuable colleagues and consultants to physicians.
- To place the welfare of the patient above all other concerns.

Education:

- To provide an excellent, well rounded educational experience in abdominal imaging and intervention for radiology residents and fellows.
- To educate our colleagues about the availability and proper use of diagnostic and interventional services.
- To contribute to the education of the radiology community through presentation and publication of ongoing research performed at UTHSA.

Research:

- To perform well designed high-quality research in abdominal imaging and intervention that will have a significant impact on patient care.
- To present and publish scientific work that will receive national recognition and make a lasting contribution to the radiological literature.

General Information:

The section of abdominal imaging provides radiology services at UHS and UT healthcare facilities including MARC and UT Hill Country. The section is directly responsible for the performance and interpretation of all abdominal imaging studies including computed tomography (CT), sonography (US), magnetic resonance imaging (MR) and GI/GU fluoroscopy (Esophagram, Small bowel series, UGI, enema studies, intravenous urography, cystography, hysterosalpingography, fistulograms, loopograms, NG /Dobhoff tube placement). We perform some basic interventional procedures at MARC, including thyroid and neck lymph node FNACs. We also interpret CT studies for patients at the Mays Cancer Center and MARC. At UHS full service is provided Monday through Friday from 8am to 5pm, with emergency service available at all other times. For UT patients, full service is provided, including at MARC Tuesday through Thursday from 8 am to 5 pm and at UT Hill Country on Monday and Friday 8-5 pm.

Daily, UH service is usually covered by three faculty; the MARC and UT Hill Country are covered by one faculty throughout the day. One faculty works as a float to provide help in reading cases at all the facilities depending upon the demand. The CT staff at UH signs out the preliminary reads from residents, for patients from the clinic, in house, and ER. The other staff reads all sonograms. The third staff supervises and reads all the fluoroscopic and MRI studies. The UT faculty is responsible for all of the diagnostic studies performed at the UT and Hill Country throughout the day, and interventional procedures on Tuesdays.

There are two fellows in abdominal imaging who provide coverage at UH and UT.

Six residents are scheduled to cover UH abdominal imaging services, with one resident assigned to fluoroscopy, MR, CT, or US. One resident assigned to fluoroscopy cover the service for the entire rotation. The residents assigned to CT and US spend two weeks covering each modality. MR resident is supposed to help read MARC studies as needed.

Resident Vacation Policy

Please refer to the resident vacation policy under general departmental guidelines. Please always inform section secretary (Gladys) and section chief for upcoming vacations or any emergencies so adequate coverage can be arranged. For emergency sick time please inform Gladys, section chief, and attending on service. Please note that we need to have adequate coverage before vacations are approved. All vacation requests will be honored on a first-come, first-serve basis.

Call

Weekdays (Abdominal CT, USG, MR, and Fluoro) (8 am-5 pm)

Residents on their respective rotations including USG, CT, Fluoro, and MR are responsible to read the studies and finish the list which includes all studies from the last modified time of 730am till 430pm. They will be working among themselves and the fellows to complete the work, which also includes protocoling the studies and putting any relevant orders. All the studies are staffed by the faculty on that service.

Weekends
On-call Body staff reads all or most of MARC studies from Friday evening to Saturday evening and stat MRIs at UHS and coordinates any emergent fluoroscopic procedures with ER-resident if ER staff is not comfortable interpreting those.

NOTE:

- All the interventional procedures at UHS are performed by the section of interventional radiology at all times.
- Body staff are only involved in performing routine thyroid and neck lymph node FNACs at MARC on Tuesdays.

Conferences

Daily Conferences for Resident Teaching: A 15 min interesting case conference will be done by the staff in the main reading rooms every day at 2 pm. Involves quick presentation with salient features of 10 cases.

Weekly conference

- Interesting case conference (Thursdays at 8 am) - Given by faculty in the resident room. It is meant for residents rotating in the Body section, however, everyone is welcome to attend.

Monthly conferences:

- Interesting case conference- (4th week of rotation on Wednesday from 1 pm -140pm) - Given by the residents in the resident room. Each resident presents at least 2 interesting cases from the rotation.
- Journal club – (3rd Wednesday of the month from 1-140pm) - Presented by Body Fellow, an article provided by the faculty.
- Interesting MRI case conference – (4th Tuesday of rotation 12-1 pm) Given by resident and fellow on MR rotation.

Given the time constraints that these conferences impose on the workday, it is imperative that the residents work efficiently throughout the day and that they return promptly after the conferences

The ER faculty is responsible for all cases performed during the noon hour at UH

Teaching file

- The Abdominal Imaging Teaching File (TF) is one of the highest priorities of the section.
- The section needs a good TF for both teaching and research
- All computers will have a short cut to the AI Teaching File.
- The submission of cases to the TF is relatively simple. It requires having the appropriate images selected, going to the TF, and placing them in an appropriate folder as a bitmap file. A short history in word format with patient name and ID should also be created. This way, you can go back to the case and correct/add the final diagnosis.
- Submission of TF cases should be viewed as part of the residents or fellows education as the act requires a certain level of understanding of the case
- The TF is of such importance that a resident's or fellow's contribution to the TF will be reflected in their monthly evaluations.

Evaluations

- In fluoroscopy an evaluation will be done to assess the competency of residents in different procedures in order and they will be given cards or other written documentation about their progress. This will be also posted in the Fluoroscopy work area for the technologist.
- Residents are required to log their procedures in New Innovations every day.
- Both the residents and fellows will be evaluated each month that they are on the abdominal imaging service. A written test of 5 cases is also given during the rotation.
- Each resident on the service will get evaluated through '*New Innovations'*, at the end of the rotation.
- Both the residents and fellows will be evaluated on image interpretation, general base of knowledge, diagnostic and procedural skills, and professional behavior.

Dictating Reports

- All cases must be dictated into *powerscribe* and staffed on the same day. All preliminary reports should be corrected and signed off on the same day. Standard macros will be given to the residents and the resident should try to use them as needed. Always give the comparison study and date when available. Always define when a follow up should be done.

- The report must be finalized so that the billing is done efficiently. When there are multiple codes (Abd, Pelvis) all the codes should be entered, and findings dictated.

Billing Codes

All the reports should have a pertinent indication (history), body parts imaged, and correct and specific technique. The positive and pertinent negative findings should be dictated. All the relevant body parts need to be commented on for proper billing and to avoid malpractice issues. Do not slight this task! Erroneous coding is not viewed by Medicare as a mistake, it is considered fraud. Stiff penalties exist for anyone caught defrauding the government.

Resident Responsibilities

Development of Knowledge and Skills

A. Initial Rotations:

1. The resident is expected to develop an understanding of abdominal anatomy displayed on plain films, CT, and MR. All residents are expected to read Brant and Helms' Fundamentals of Diagnostic Radiology.
2. **BEFORE** the first day of their initial Body rotation the first-year residents are expected to read chapters on Basic principles of X-ray, CT, and ultrasound.
3. **Residents rotating through CT, ultrasound, and fluoro are required to read the** sections on basic anatomy in the chapters on Gastrointestinal, Genitourinary, and ultrasonography, BEFORE their first day of the rotation.
4. In their second week of rotation the residents are supposed to start reading the rest of the contents in the above-mentioned chapters, which should be finished by the end of the rotation.
5. Residents will be also provided with lists of additional literature including articles covering specific areas, which they will be encouraged to read.

2. The resident will arrive at 7 am and will make an initial assessment of all plain films and CT examinations performed before formal read-out sessions with staff. The resident will be responsible for the dictation of all reports into the appropriate system. All studies reviewed with staff will be dictated before the resident departs each evening. All dictations will be electronically signed each day.

Residents will rotate through 4-week blocks in abdominal imaging, i.e. fluoroscopy, CT, MR, and US. Fluoroscopy months will be limited to fluoroscopy, however, all other months in abdominal imaging will be evenly split between CT, MR, and US. In all rotations the residents are expected to assume complete responsibility for their area, including acting as primary liaison to the referring clinicians, assuring efficient progress of the day's work, triaging add-on and emergency studies, making sure that all studies performed till 430pm (last modified time) are read and signed off on the same day.

With the exception of conference time, each resident is expected to man his/her assigned section from 8 am to 5 pm Monday - Friday, however, if the routine workload on any rotation requires earlier or later attendance the resident is expected to adjust his/her hours accordingly. The residents on the abdominal imaging service should perceive themselves as a team and help each other out. Although a resident may be assigned to a specific area, he/she should help out in the other areas if the work in their area is light.

ULTRASOUND

- Assumes complete responsibility for the diagnostic sonograms

- Directly responsible for reviewing the technologist's images, rescanning, and signing out cases

- Assures that all emergency cases are done promptly and that the critical results are called immediately to the requesting physician

- Assures that all significant findings for both inpatients and outpatients are verbally reported to the referring physician and that the calls are documented in the dictation

- Reviews all scans with staff

- Saves interesting cases for Abdominal Teaching file

CT ROTATION

- Directly responsible for reading all of the CT studies

- Protocols should be done the same day and 2 weeks in advance.

- Should be aware of all pertinent clinical history and have reviewed related prior studies before rendering an opinion

- Reviews all examinations with abdominal imaging staff

- Assures that all significant findings for both inpatients and outpatients are verbally reported to the referring physician and that the calls are documented in the dictations

- Assures efficient throughput of ER patients and calls immediate reports on all ER studies and studies where clinicians have to act on the results.

- Immediately evaluates patient with contrast reaction or extravasation

MR ROTATION

- Directly responsible for reading all of the MR studies

- Protocols should be done the same day and 2 weeks in advance.

- Should be aware of all pertinent clinical history and have reviewed related prior studies before rendering an opinion

- Reviews all examinations with abdominal imaging staff

- Assures that all significant findings for both inpatients and outpatients are verbally reported to the referring physician and that the calls are documented in the dictations

- Assures efficient throughput of ER patients and calls immediate reports on all ER studies and studies where clinicians have to act on the results.

- Immediately evaluates patient with contrast reaction or extravasation

FLUOROSCOPY ROTATION

- Reports to fluoroscopic area at 8 am sharp to begin days' work

- Assures efficient throughput of patients with daily goal of finishing all cases

- Is directly responsible for performance and interpretation of all fluoroscopic studies

- Reviews all cases with staff

Expectations of Residents

CT Rotation

- Understand and apply principles of cross-sectional anatomy.
- Understand and apply CT protocols for examining various anatomic regions for a variety of pathologic processes.
- Understand and apply principles of modem CT scanners.
- Interact with referring physicians, technologists, nurses, and clerical personnel in a friendly and professional manner.
- Understand and apply the relative advantages and disadvantages of CT, MR, Sonography, and fluoroscopy in addressing clinical concerns.
- Obtain competence in the interpretation of abdominal CT and MR examinations.

Sonography

- Understand anatomy relevant to sonography
- Understand the physical principles of sonography relevant to diagnosis
- Obtain competence in the interpretation of sonographic studies

Fluoroscopy

- Learn to competently perform GI and GU contrast studies and procedures
- Learn the radiologic appearances of common and uncommon GI and GU diseases
- Understand and can operate fluoroscopic equipment
- Understand and apply basic radiation safety techniques
- Understand and utilize pharmacological agents in GI radiology
- Understand the value & role of GI/GU fluoroscopic studies in relation to cross-sectional imaging techniques
- Understand the types and appropriate uses of various contrast agents in GI and GU radiology
- Obtain competence in abdominal plain film interpretation

Premedication for Contrast Reactions

- Prednisone 40mg p.o. @ 13, 7, 1hour prior to CT or IVU Study
- Benadryl 50mg p.o. 1hour prior to CT or IVU Study

Premedication to Prevent contrast-induced renal dysfunction

- - Hydrate patient with saline concurrently

Treatment of Contrast Extravasation

- Mark the extravasation area with an ink marker
- Elevate the limb
- Cold compresses to the area [do not apply ice directly]
- *Warm compresses if the patient has peripheral vascular disease*

Diabetics on Metformin [Glucophage]

- Hold off Metformin on the day of CT or IVP for 2 days
- Can start Metformin later; preferably after checking serum creatinine

Table: MANAGEMENT OF ACUTE CONTRACT REACTIONS

Nausea/Vomiting	• Reassure the patient • Retain IV access and observe • Anti-emetics are rarely necessary
Mild scattered "hives"/urticaria	• Routine treatment is not necessary • Retain IV access and observe • If troublesome, administer an antihistamine, e.g. diphenhydramine (Benadryl) 25-50 mg PO, IM, or IV
Severe generalized urticaria	• Retain IV access and observe • Administer antihistamines, as above • Consider IV prednisone 50 mg (or 40 mg methylprednisolone) • Consider IM epinephrine 0.1 ml of 1:1000
Mild Wheeze	• Retain IV access and observe ECG, pulse oximetry, BP • Give oxygen at 6-10 L/min by mask (caution in hypercapnia) • Give an inhaled β2 agonist
Angio-oedema / urticaria / bronchospasm / hypotension / severe anaphylaxis and tachycardia	• Raise the patient's feet and start monitors: ECG, oximetry, BP • Give oxygen at 6-10 L/min by mask (caution in hypercapnia) • Secure IV access and rapidly infuse normal saline • If poorly responsive, slowly administer 1.0 ml (0.1 mg) of IV epinephrine of I in I0,000 – repeat as needed up to 1 mg total • CALL CODE
Unconscious / unresponsive / pulseless / collapsed patient	• CALL CODE • Institute Basic Life Support a) Establish airway, head tilt, chin lift b) Initiate ventilation and external chest compressions c) Continue uninterrupted until help arrives
Seizure	• Maybe the consequence of hypotension and primary treatment should be as indicated • Lateral decubitus position, give oxygen, 6-10 L/min by mask • If prolonged, consider anticonvulsant, e.g. diazepam IV 5 mg Second-line drugs such as phenytoin may be required but by this time patient should be intubated and ventilated

Table: MANAGEMENT OF ACUTE CONTRACT REACTIONS (con't)

Hypotension with bradycardia (vasovagal/faint)	• Raise the patient's feet and monitors: ECG, oximetry, BP • Give oxygen at 6-10 K/min by mask (caution in hypercapnia • Secure IV access and rapidly infuse normal saline • Slowly inject IV atropine, 0.6-1 mg for bradycardia • CONSIDER CALLING CODE

Becoming potentially life-threatening.

Hypotension alone, Not vasovagal or anaphylactoid	• Give oxygen at 6-10 K/min by mask (caution in hypercapnia) • Infuse rapid IV fluids • Establish BP + ECG monitoring and oximetry • CONSIDER CALLING CODE
Severe hypertension	• Start monitors: ECG, oximetry, BP • Nitroglycerin 0.4 mg sublingual (preferred to nifedipine) • Slowly inject IV phentolamine 5.0 mg for pheochromocytoma

IMPORTANT PARAMETERS FOR VASCULAR ULTRASOUND

Native Renal sonogram for Detecting Renal Arterial Stenosis

Gray Scale Images:

- 3 transverse and 2 longitudinal images of each kidney
- Transverse images of aorta showing origins of renal arteries

Color Images:

- Transverse images of aorta showing origins of renal arteries

Special Waveforms:

- Angle corrected peak velocity of the aorta at the level of renal arteries
- Angle corrected peak velocity of each renal artery at their origin
- One waveform form from the upper and lower poles and midsegment of each Kidney with RI and systolic acceleration time measured for each

Renal transplant sonogram

Gray Scale Images:

- 3 transverse and 2 longitudinal images of each kidney
- 1 transverse and longitudinal image of the bladder

Color Images:

- Longitudinal image of the main renal artery at the level of anastomosis

Spectral Waveforms:

- Angle corrected peak velocity of iliac artery at the level of anastomosis
- Angle corrected peak velocity of main renal artery at the level of Anastomosis
- One waveform form from the upper and lower poles and midsegment of the kidney with RI and systolic acceleration time measured for each.

Renal Transplant

Values for Transplant Kidney

MRA/ IA < 2:1

RI 0.5 to 0.8

Acceleration time <80msec

Look for perinephric fluid collection

Lymphocele

Seroma

Urinoma

Hydronephrosis

TIPS DOPPLER

1. Complete abdominal and pelvic examination. Localize and mark ascites.

2. Assess the patency of vessels.

3. Determine the flow direction.

4. Gray Scale Images:
   * Longitudinal images of a stent including portal and hepatic venous ends.
   * Longitudinal images of main portal vein

5. Color Images:
   * Longitudinal images of a stent including hepatic and portal venous ends
   * Longitudinal images of proximal and distal portions of draining hepatic vein

6. Spectral waveforms:
    * Angle corrected peak velocity in the portal vein and proximal, mid, and distal stent within the liver

    * Spectral tracings of the draining hepatic vein proximal to the stent

Normal:

1) Peak flow velocity within the stent > 90 cm/sec and < 190 cm/sec.
2) Spatial velocity gradient between various parts of the stent and temporal velocity gradient from the previous exam < 50 cm/sec.
3) Flow direction in proximal draining hepatic vein towards the IVC.
4) Peak flow velocity in the main portal vein >30 cm/sec.

Abnormal:

1) Peak flow velocity within the stent outside of the limits for normal.
2) Spatial and or temporal gradient >50 cm/sec.
3) The reversal inflow of proximal draining hepatic vein.
4) Peak flow velocity in the main portal vein of <30 cm/sec

Key:

DHV = Draining Hepatic Vein REV = Reversed
N = None PHV = Proximal hepatic Vein
HVS = Hepatic Vein Stenosis M = Mild
NL = Normal SS = Stent Stenosis S = Severe

TRANSPLANT LIVER SONO:

1. **Superior IVC anastomosis: (**above – often not obtained at, below) gradient less than 4:1 **(Most often only one anastomosis with PiggyBack IVC)**

2. **Inferior IVC anast:** Gradient less than 4:1

3. **Hepatic veins:** Patent

4. **Portal vein anast:** Gradient less than 4:1

5. **Left/Right Portal Veins:** Patent

6. **Hepatic Arteries (main, left, right):** RI > 0.5 △T < 0.08

7. **CBD:** ≤3mm (3-5mm = gray area – depends on the type of biliary anastomosis)

8. Look for ascitis, fluid collections, parenchymal abnormalities, etc.

Society of Radiologists in Ultrasound
Consensus Conference on Carotid Ultrasound
October 22-23, 2002

	ICA PSV	ICA/CCA PSV ratio	ICA EDV	Plaque
Normal	< 125 cm/s	< 2.0	< 4.0 cm/s	None
<50%	< 125 cm/s	< 2.0	< 4.0 cm/s	< 50% diameter Reduction
50-69%	125 – 230 cm/s	2.0 – 4.0	40 – 100 cm/s	≥ 50% diameter Reduction
≥ 70 to near Occlusion	> 230 cm/s	> 4.0	> 100 cm/s	≥ 50% diameter Reduction
Near Occlusion	May be low or Undetectable	Variable	Variable	Significant, detectable lumen
Total occlusion	Undetectable	Not applicable	Not applicable	Significant, no detectable lumen

RESIDENT RESPONSIBILITIES IN ABDOMINAL IMAGING

SONOGRAPHY	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**
Review Cases	X	X	X	X
Sign Out Cases with Staff	X	X	X	X
Dictate Cases	X	X	X	X

COMPUTED TOMOGRAPHY/MAGNETIC RESONANCE IMAGING	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**
Protocol Exams with Supervision	X	X	X	X
Protocol Exams Alone	X	X	X	
Read Cases and Render a Provisional Diagnosis	X	X	X	
Dictate Cases	X	X	X	X

FLUOROSCOPY	**1st Year**	**2nd Year**	**3rd Year**	**4th Year**
Perform Cases with Staff Supervision	X	X	X	X
Perform Cases Independently After Gaining Technical Proficiency	X	X	X	X
Perform Cases Independently and Dismiss Patients		X	X	X
Perform Cases After Hours		X	X	X
Read Cases and Render A Provisional Diagnosis	X	X	X	
Dictate Cases	X	X	X	X

GENERAL COMMENTS

1. Our function is to help provide high-quality patient care from the diagnostic and management aspects of problems in the urinary and gastrointestinal tracts. To do this effectively, there must be cooperation and communication among physicians, ward, and radiology personnel. Our utmost concern is the care and comfort of patients. If there are any difficulties or questions please free to call us, extension (during daytime).

2. IVUs can be done on the same day as UGI series (follow IVU prep) or barium enema (follow BE prep).

3. Diabetics on oral agents or insulin should skip their A.M. dose until after the examination when they then can resume their usual diet and then take the proper dose of medication. We will do our best to do these patients as quickly as possible.

4. Patients will be sent back to the ward if instructions are not followed, and preps are incomplete.

5. Please consult the patient's chart, whenever it is available.

6. Examinations will be added, subtracted, modified, rescheduled, etc. from what was ordered, by the radiologist as indicated by the problem presented and the clinical status of the patient. Any such changes will be noted in the patient's chart.

7. If the patient is to have multiple examinations, they should be scheduled in the following order: IVP, BE, UGI/SBFT. IVP may be combined with BE or UGI.

8. Computed tomography (CAT scan) and/or ultrasound of the abdomen should precede barium studies if at all possible.

9. Proper notification will be made for any changes in bowel preps and other policies.

10. All Upper GI and barium swallow examination patients should not eat/drink after midnight. No smoking or chewing gum, as they cause increased secretions.

CONTRAST STUDIES: GENERAL REMARKS

1. **Barium Sulfate -** The various barium sulfate suspensions differ in their properties. You must be familiar with the properties required for each specific examination and you should be familiar with the barium that is being used as well as the concentrations used for the various studies.

CONTRAINDICATIONS:

Barium is contraindicated in any case where it is suspected that the contrast might extravasate freely into the peritoneal space. This would include any patient with free air, suspected perforated ulcer, disrupted anastomosis, peritonitis, etc., Barium is also relatively contraindicated in the presence of a colonic obstructing lesion. In any case where there is doubt about the appropriateness of administering barium, consult the supervising radiologist.

2. **Water Soluble Contrast-** These contrast media are used in case of a suspected intestinal perforation or anastomotic leak since they are reabsorbed from the peritoneal cavity.

In the presence of suspected aspiration into the tracheo-bronchial tree, hyperosmolar water-soluble contrast media (Gastrografin) should ***NOT*** be used since they incite a severe form of pulmonary edema. In such cases omnipaque should be used, since it is iso-osmolar and is considered safe.

NOTE: When evaluating for an anastomotic leak or perforation in the esophagus and upper GI, water-soluble contrast (Omnipaque only) should be used first unless the area of concern may communicate with the airway. If this initial examination is negative then, the barium should be used. There is a small percentage of patients in which a small perforation may be seen with barium, but not with water-soluble contrast.

Post operative Gastrectomy Study

The study is done within 24hours after gastric surgery for obesity. The patient has an orogastric tube when they arrive in radiology.

Obtain a preliminary spot image of the left upper quadrant. Inject 15-20cc of Omnipaque through the tube and take spot images in AP, and both oblique positions. Withdraw the tube into the distal esophagus and obtain spot images. *Most surgeons want the tube removed. Make sure that you confirm this with the ordering physician*. After this, ask the patient to drink the contrast and confirm that there is no leak or problem. Following this, overhead films of the upper abdomen for upper anastamosis and lower abdomen showing the lower anastamosis will be obtained by the technologist.

BARIUM MENU UNIVERSITY HOSPITAL

UGI

E-Z-HD --- Add 65-70 cc distilled water --- 85% W/W, 250% W/V

HD-85 --- approximately 25% W/W (800 cc distilled water + 200 cc HD-85)

Barium Swallow --- same as UGI

Barium enema:

1. Single contrast: To barium powder already in BE bag - add warm water QS 2000 cc - 20% W/W

2. Double contrast: Conventional method - liquid polibar (E-Z-M Co.) 500 cc with 100 cc warm water - 50% W/W; or HD-85 (LaFayette) 40% W/W (also can use undiluted for esophagus)

Seven pump method - 400 cc polibar into enema bag with tubing shortened to one foot

Small Bowel:

1. Routine follow through - 24 oz. minimum of HD-85 (25% W/W)

2. Enteroclysis

   A. HD-85 or polibar both approximately 200% W/V) - with variable dilution with water (19-24% W/W), depending on size

UGI

1. Double
   E-Z HD (85% W/W) or barosperse 60% W/W or liqui jug 37% W/W

Barium Swallow: Same as UGI

Barium Enema

1. **Single contrast -** barosperse (water - OS to 2500 ml, 15-% W/W)
2. **Double contrast -** liquid polibar undiluted

Small Bowel - 24 oz. of liquid jug

UPPER GASTROINTESTINAL SERIES (UGI)

SMALL BOWEL FOLLOW THROUGH (SBFT)

Diet: NPO after midnight. No smoking or gum chewing. (These activities cause increased secretions.) Patients may brush their teeth.

Prep: None other than the above diet.

Procedure:

Where: X-ray at scheduled time - with chart
Dress: X-ray gown
Length of stay in X-ray: 30 - 60 Minutes
SBFT Up to 4 Hours

Patient Explanation:

A combination of Barium and Air will be swallowed to visualize the Esophagus, Stomach, and the most proximal portion of the Small Intestine.
If the entire Small Intestine is to be examined, more barium is given, and X-rays are taken at certain time intervals, to see all of the Small Intestine up to the point where it enters the Large Intestine (Colon).

N.B.

If the patient is very elderly and/or debilitated, it will be best for them, and for us, if arrangements are made ahead of time to do the examination at the end of the routine morning schedule or in the afternoon. (These patients can have a clear liquid breakfast).

PROTOCOL FOR ROUTINE BIPHASIC UPPER GASTROINTESTINAL SERIES

This is the routine upper GI series performed in all patients unless special situations apply.

1. Immediately post-gastric surgery.
2. Debilitated, uncooperative patients.
3. Food or fluid in the stomach (if gastric outlet obstruction - suck out stomach contents and proceed with single contrast study).

A. Materials

The barium used is a high density mixture with a concentration of approximately 200-250% W/V or 80% W/W. Make sure that the barium is well suspended and uniform in its consistency. It must be stirred once again before it is administered to the patient. Do not shake just before using it. Diluted barium of approximately 20% W/V is used for the single contrast portion of the study.

The effervescent agent to be used comes in a powdered form and must be mixed with water. Glucagon 0.10 cc diluted to 0.25 cc with sterile saline in a tuberculin syringe should be used in situations where there is hyperactive peristalsis or spasm of the stomach to the duodenum. This will allow temporary paralysis so that optimum high-quality double-contrast films can be obtained.

B. Procedure (Positioning is in reference to the tabletop)

The first part of this examination includes double-contrast views of the esophagus as described under the barium swallow. Take a minimum of two spot films of the lower portion of the esophagus with the double contrast technique. The table is then lowered with the patient in the supine position. Slowly turn the patient to the left and onto their stomach, pause, and have them roll back in the same direction onto their back. Do these three times, except that on the third rotation, have the patient rotate completely to the right in a full 360' circle. At this time check fluoroscopically to see if there is an optimum coating of the stomach. If the coating is inadequate, rotate the patient in the same fashion as above, as many times as necessary. Occasionally patients will not coat and after several rotations no further attempts should be made.

The next spot film is a supine AP stomach view, followed by two spots with the patient in shallow and steep left obliques. The anterior wall, especially the greater curvature is of interest here. On the shallower of the two LPO positions, be sure that the antrum of the stomach is in good profile.

Now turn the patient right lateral and spot film the gastric fundus with attention to the cardia where you will see the esophagus enter the stomach. You may need to elevate the table to get the pool of barium away from the EG junction.

Next turn the patient left lateral. Rotate the patient's right side slowly towards you until you have the duodenal bulb and C-loop in profile, distended and take two spot films of this area in slightly different positions.

Turn the patient prone and lower the table to a recumbent position. You are now ready for the single contrast portion of the examination. Change bariums.

With single swallows look at the esophagus with particular attention given to motility. Take two spot films of the distal esophagus filled with barium. The first is taken in suspended respiration, and the second taken following the valsalva maneuver.

Have the patient drink more barium and proceed on with multiple spot films of the duodenal bulb and C-loop filled with barium. Compression should be done at this time.

Now turn the patient on to their back. There should be a large collection of barium in the fundus of the stomach. At this time you will check for reflux by having the patient cough. Then have the patient rotate towards you while you fluoroscope the EG junction for reflux. Again have the patient cough. If there is an insufficient amount of barium in the fundus of the stomach, give the patient more or the less dense barium. Obtain additional spot films of the pathologic areas as needed.

At the end of fluoroscopy, AP, right lateral, and LPQ overhead radiographs will be obtained by the technician.

N.B:

1. Be patient when there is delayed emptying from the stomach. If you are having this difficulty, leave the room, or else you will be tempted to fluoro excessively. ('A watched pot...').

2. If there is gastric outlet obstruction, make sure the stomach has been drained of barium or gastrografin. Then flush the N-G tube with water, or else the barium or gastrografin may dry and plug the tube.

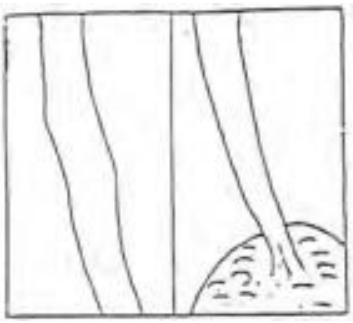
3. There will be some patients in whom you will not be able to obtain a diagnostic biphasic upper GI. These are usually elderly or debilitated patients. Do the best you can with the single contrast views of the esophagus and stomach, including compression views of the stomach and duodenum.

4. Do not forget to use compression as part of your examination whether it is of the upper GI tract or the lower GI tract. Using your hand with a lead glove or compression paddle can give you some very important information regarding full-thickness, pliability, presence or absence of an ulcer crater, etc.

5. Patients who have had previous partial or subtotal gastrectomy may be difficult to examine. You will not need as much in the way of barium nor effervescent powders. Therefore, if you know prospectively that the patient has most of their stomach removed, adjust the quantity of the materials you use accordingly. This is a situation in which glucagon can be very useful. The views that you obtain will be dictated by the type of surgery that has been performed.

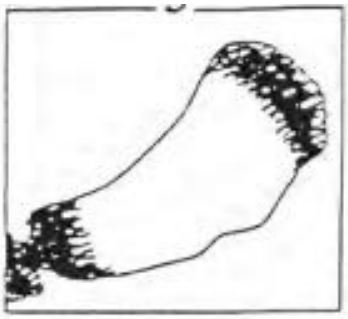
SPOT FILMS FOR BIPHASIC UGI SERIES

1 2



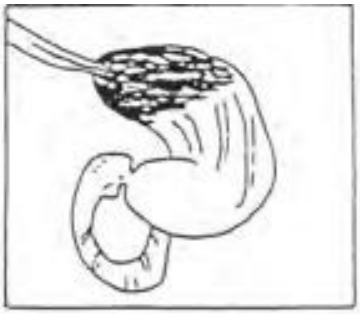
UPRIGHT DOUBLE CONTRAST LPO DISTAL

3



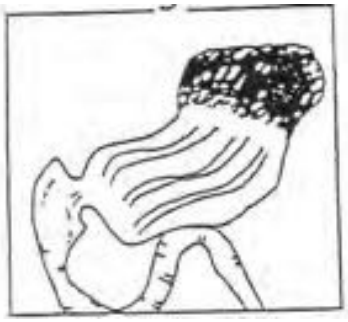
SUPINE AP BODY OF STOMACH

4



STEEP LPO STOMACH

5

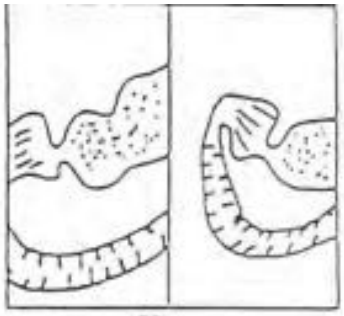


SHALLOW LPO STOMACH

6

RIGHT LATERAL CARDIA-E/G JCT

7 8

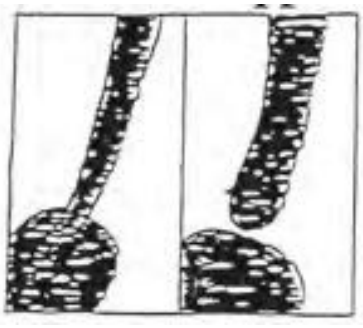


LPO ANTRUM/BULB/C-LOOP

9

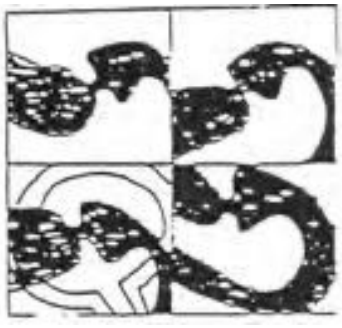
UPRIGHT LPO FUNDUS

10 11



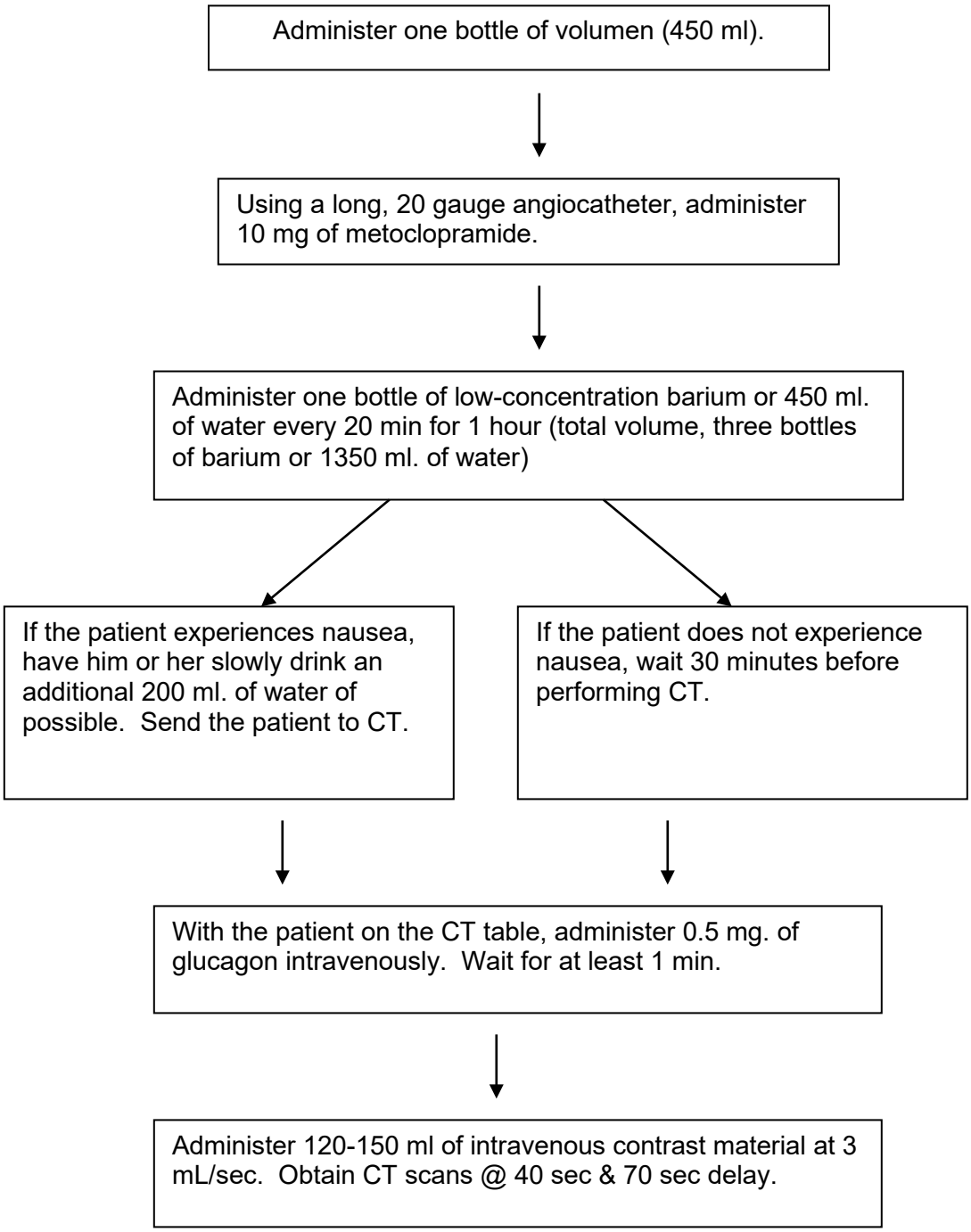
PRONE DISTAL RAO ESOPHOGUS

12 - 15



PRONE RAD- (R) LATERA BULB AND C-LOOP L

Due to the non-availability of methylcellulose, CT enterography with volumen has replaced conventional enterography. Following is the protocol for CT enterography.



SMALL BOWEL FOLLOW THROUGH

INDICATIONS

1. Inflammatory bowel disease, known or suspected.
2. Rule-out partial small bowel obstruction.
3. Suspected GI tract lymphoma
4. Work-up of abdominal mass looking for possible bowel involvement.
5. Malabsorption.
6. Large hernias.
7. Nonspecific abdominal pain workup, below the epigastrium.
8. Polyposis syndromes.
9. Fever of unknown origin (true criteria), looking for occult Crohn's disease or lymphoma

TECHNIQUE

This is <u>not</u> to be considered a passive examination. This is a dedicated study requiring careful attention to sequential filming and fluoroscopic evaluation.

Success of this examination depends on the following factors:

1. A high volume of barium. This means as much as it is necessary to distend the small bowel fully.

2. Frequent sequential filming. These should be done every 15 minutes.

3. Careful fluoroscopy. Ideally after jejunum is filled with barium fluoroscopy should be done. Many times this is not convenient. Therefore, fluoroscopy with careful compression is to be done whenever the full small bowel is identified.

   After the UGI is completed, if that is to be part of the evaluation, the patient is given two (2) six or eight-ounce cups of barium and a prone 14xl7 film is obtained at 15 minutes.

   At that time another cup of barium is given and a repeat film is obtained at 30 minutes. Depending upon what is seen at this time, additional barium and prone filming are done. Once barium is well into the right colon, fluoroscopy should be done at that time and spot films are to be obtained.

   In some patients, especially female patients who have had hysterectomies, the small bowel may collect in multiple overlapping loops within the pelvis. This may make it difficult to evaluate fluoroscopically. Some maneuvers can be performed to identify and evaluate the pelvic loops. These include the following:
   1. Prone oblique films of the pelvis;
   2. Trendelenberg position;
   3. Use of the compression paddle in the prone Trendelenberg position;
   4. Air inflation of the recto sigmoid to elevate the loops and small bowel.

BARIUM ENEMA
(B.E.)

DIET: Clear liquid diet for 24 hours before the examination. NPO after midnight.

PREP: Day before study:

1. Between 10:00 a.m. and 5:00 p.m. - drink four (4) 8 oz. glasses of water in addition to the fluids taken with meals.

2. 1:00 p.m., the day before the exam, drink 10 Oz. of flavored magnesium citrate (cold preferable) (at VAH - castor oil).

3. 7:00 p.m., the evening before the exam, take four (4) 5 mg Bisacodyl tablets with one 8 oz glass of water. (at VAH x-ray prep at 5:00 p.m.).

4. Early a.m. or evening before the exam, 2000 cc warm tap water enema. The patient should be rotated three tines with enema retained in the colon.

5. Diet as described above.

PROCEDURE: Where - x-ray at the scheduled time, with the chart.
Dress - x-ray gown.
Length of stay in x-ray - one to two hours.

PATIENT EXPLANATION:

A tube is placed in the rectum, through which barium flows and fills the colon (large intestine). Air is also placed through the tube. X-rays are taken. Usually the appendix (if not previously removed) is also seen. The patient will be moving into various positions and should do his (or her) best to hold in the barium. Mild to moderate discomfort will be experienced, the severity depending on the amount of muscle spasm of the colon. Occasionally a medication (Glucagon) is given in the vein to calm the intestine.

N.B:

1. Patients who are ill from acute colitis should not have a barium enema because of the potential for developing toxic megacolon & possible perforation, which are potentially fatal.

1. These instructions must be followed without deviation to assure a diagnostic examination and avoid a repeat prep and study. There will be some patients in whom the usual prep cannot be done. Any modified prep should be discussed first with the radiologist.

2. If you have a patient who is very elderly and/or debilitated, it would be best for them, and for us, if they are done at the end of the routine a.m schedule, or in the afternoon. Please call to arrange this before the patients are sent to the x-ray department. (These patients can have a clear liquid breakfast.)

3. After the barium enema, patients may experience constipation (especially if bedridden). Increasing fluid intake after the exam is usually sufficient; occasionally an enema or laxative is needed.

4. Patients with double-barreled colostomy or colostomy with mucous fistula need both sections of the colon prepared. The proximal functional segment prepared by the method outlined above, and the distal segment cleansed with Bisacodyl (fleet) enemas.

5. For special problem patients, the following is recommended:

a. Renal dialysis patients: B.E. should be scheduled in conjunction with dialysis so that the extra fluid load can be monitored and modified. Ideally, dialysis should be done the day before, or immediately following the barium study. Please call 82733 to make the appropriate arrangements.

b. Cirrhotic and/or cardiac patients requiring severe fluid restriction: disregard the additional 8 oz glasses of water (i.e., do not force clear liquids but do put on clear/liquid, low residue diet for 24 hours), but add a 2,000 cc tap water enema the evening before the examination. Other instructions prep items are the same.

6. If there are any questions, feel free to call the G.I. (fluoro) section of the Radiology department [82737].

COLON

1. PREPARATION

Adequate cleansing of the colon is critical. There are several ways to cleanse the colon and you should become familiar with the agents use for the barium study. It is important to note that elderly, debilitated patients, especially in-patients, are more difficult to cleanse and should probably receive a large volume (2000cc) warm tap water enema the evening before the examination. If upon review of the preliminary radiograph, there is evidence of substantial residual fecal material, further colonic preparation is required.

In some cases, considerations of colonic preparation must be somewhat modified. In patients with active inflammatory bowel disease, it is important to attempt colonic cleansing without substantially further irritating the colon. In these patients adequate preparation may be achieved with 48-72 hours of clear, forced liquids as well as a mild osmotic cathartic such as milk of magnesia. Go Lytely purge may also be done. Patients with colonic obstruction may be difficult to prepare for the B.E. and it may be necessary to examine the colon without optimal preparation.

2. Preliminary Abdominal Radiographs

In all patients, a preliminary abdominal radiograph is obtained before the colonic examination. Colonic cleansing is assessed in this film. Also, there may be substantial information present on the radiograph which will help in the assessment of the contrast examination. If, on the preliminary radiograph, you are unsure as to adequate cleansing, go ahead and begin the examination. If it is obvious that there are large pieces of feces, postpone the examination until further cleansing can be obtained.

3. Preliminary Considerations

A. Before the study is done, the patient talks to the patient for any prior surgery. Also, it is of vital importance to determine whether the patient has had a sigmoidoscopy and/or a rectal biopsy, and particularly when these procedures were performed. If a superficial biopsy has been performed more than 24 hours previously, then the barium enema can be done. For deep biopsies or polypectomies wait 7 days.

B. The barium enema tube should be placed after a digital examination. For most patients the standard tube is adequate. There will be approximately 10-20% of patients who require an inflatable rubber balloon. This should be inserted and inflated carefully. Over-inflation is uncomfortable for the patient and may predispose to spasm or perforation. If there is a very loose sphincter tone, then taping of the buttocks around the tube may be helpful. (If two attempts, including glucagon, fail - then cancel the examination)

C. 1 mg of glucagon may be injected intravenously if the patient experiences severe pain due to spasm or if one sees a narrowed segment which may be due to spasm or neoplasm. This will allow for a more comfortable examination for the patient as improved spot film quality. Repeat dosage as indicated.

SINGLE CONTRAST BARIUM ENEMA EXAMINATION:

A. INDICATIONS: The indications for single contrast barium enema will be all those not covered under indications for a double-contrast barium enema. This is specifically to include suspected fistulas from the colon, volvulus, or if the patient's age/clinical condition prevents turning or rolling for positioning.

B. Following the appropriate explanation of the exam and instructions to the patient, the flow of barium is begun in the supine position. A slow moderate flow rate is optimum and prevents the discomfort of the patient and the induction of spasm.

C. SPOT FILMING WITH FLUOROSCOPIC SEQUENCE

1. The first spot film is of the rectum and sigmoid in the patient in supine steep LPO position.

2. Second spot film with the patient turned the approximately one-half way to the left, i.e., 45 degrees LPO to the tabletop. This helps unwind the redundant sigmoid loops.

3. A third spot film is obtained of the junction of the sigmoid colon with the descending colon.

4. A fourth spot film is of the splenic flexure. For this film the patient is turned RPO to the tabletop until the splenic flexure uncurls and is seen in profile.

5. Fifth spot film is of the hepatic flexure. This film is taken with the patient in an LPO position to the table top, unwinding the hepatic flexure unit it also is seen in profile.

6. Sixth and seventh spot films are views of the filled cecum, with and without compression.

7. Using the compression paddle, the entire colon is palpated for mobility and evidence of filling defects. Any suspicious areas are then documented with additional spot films. Compression of all parts of the the colon is an essential part of the examination.

8. Make sure <u>all flexures</u> have been filmed.

D. OVERHEAD FILMS

These are obtained at high KV (100 - 120 KV). The high KV technique is utilized so that we may be able to penetrate the barium column and see overlying loops of bowel while allowing one to appreciate lucent filling defects within the barium column.

It is important to tell the technician of any variations, such as those with very high splenic flexures so that appropriate precautions taken for films.

All single contrast studies include a post-evacuation film. This important film gives a good idea of the mucosal pattern. Sometimes, when there is a question about rectal involvement, one may request post-evacuation lateral as well as a routine prone film. The examination is concluded when all films are checked.

TECHNIQUE FOR DOUBLE CONTRAST BARIUM ENEMA EXAMINATION (DCBE, ACBE)

A. INDICATIONS - DCBE, as a primary study, is indicated in patients with blood per rectum or guaiac positive stools. Other primary indications are all patients who have known polyps or prior colon carcinoma, families with histories of familial polyposis, or in patients who have had polyps demonstrated in the past and who are having a follow-up study to look for new polyps. This exam should also be used in patients with known or suspected inflammatory bowel disease (if not in a fulminant stage nor toxic megacolon being present).

The major strength of doing a DCBE is that you can get added information about the mucosal pattern. You do this at a price, however, because DCBE's provide many more line shadows to interpret than on a straight filled colon. In either case, air contrast barium enema is only as good as the cleansing of the colon. Fecal material adds confusing shadows that can easily be misinterpreted as polyps. Cleansing of the colon is the same for the single contrast and double-contrast exam.

B. CONTRAINDICATIONS - There are relatively few contraindications to the double contrast technique of examining the colon. An absolute contraindication for both double and single contrast B.E. would be a patient with suspected colonic perforation or toxic megacolon. Relative contraindications for double-contrast B.E. would include colonic obstruction, acute diverticulitis, acute fulminant colitis, and the inability of the patient to roll and turn during the examination.

C. MATERIALS - We utilize a barium suspension of either liquid polibar or HD-85. These suspensions are 85% W/W and generally will be diluted with a small amount of water to improve the flow.

The enema is administered from the enema bag through 1/2 inch wide bore tubing and triple lumen tip. This wide bore tip contains a large lumen for administering the viscous barium as well as a smaller central lumen through which air can be insufflated for the colon and for the retention balloon**.**

D. PROCEDURE - There are many techniques available to obtain diagnostic examinations. The two that will be taught to you are the conventional method and the seven pump method. The seven pump method is very easy to use and minimizes the fluoroscopic time. This latter method is recommended for most patients. However, what is most important is that you develop a fast technique that you are comfortable with and will give you consistently high-quality examinations.

CONVENTIONAL METHOD

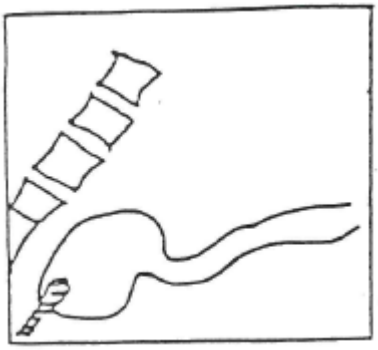
Prior to the start of the examination introduce yourself and briefly explain the sequence of the examination to the patient. The patient is placed in a prone position and barium is slowly administered to fill to the level of the mid-transverse colon. The initial barium administration must be slow and gradual as more rapid administration may result in a reflex increase in rectal tone and colonic spasm. Once the barium reaches the mid-transverse colon, air insufflation is begun. The patient is slowly turned on the right side. As the barium crosses the transverse colon air is continually insufflated until the barium column is seen to reach the mid-portion of the ascending colon. The patient is then turned onto his back and into a left posterior oblique position and more air is insufflated. At this point spot films of the sigmoid colon in the left posterior oblique position are obtained. Obtaining films at this point is helpful because generally there will not be a significant overlap of the cecum or significant reflux into the small bowel which might obscure sigmoid detail at a later point during the examination. The patient is then turned to the right and back to the prone position and the enema bag is dropped to the floor. Barium is allowed to drain out of the rectum. Drainage of barium from the rectum may be improved by elevating the head of the table. Encourage the patient to strain, and angle the tip somewhat inferiorly so it will drain the anterior rectal pouch.

Once the barium is cleared from the rectum the enema bag is clamped and additional gas is insufflated to fully distend the rectum and the remainder of the colon. Obtaining adequate colonic distension during this phase of the examination is critical. Gas should be insufflated until the haustra are delineated and distended. The cecum should be noted to distend and should attain a diameter of approximately 8-12 cm. Rotate the patient 360o as many times as needed to get a good mucosal coating.

A frontal spot film of the rectum and rectosigmoid is obtained with the patient prone. The patient is subsequently turned into a left posterior oblique view and one or more spot films of the sigmoid colon should be obtained. The patient is then turned into a right posterior oblique view and an additional view of the sigmoid is obtained. Next the table is placed in the upright position and upright spot films of the splenic, hepatic flexures, ascending, and descending colons are obtained with the patient in the appropriate obliquity. An upright spot of the rectosigmoid may be obtained at this time if specifically indicated during the examination. The table is brought back to 0 degrees with the patient in the supine position. Compression is applied with a paddle to encourage drainage out of the cecum and a spot film with compression of the cecum and terminal ileum is obtained.

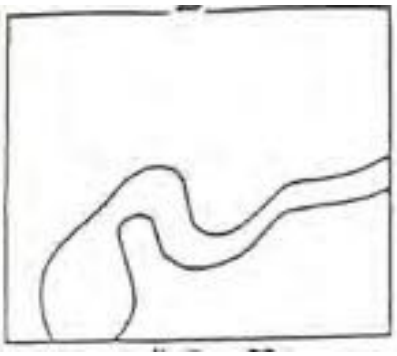
BARIUM ENEMA SPOT FILMS

1



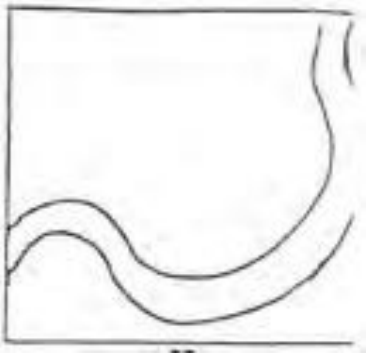
STEEP LPO
RECTO-SIGMOID

2



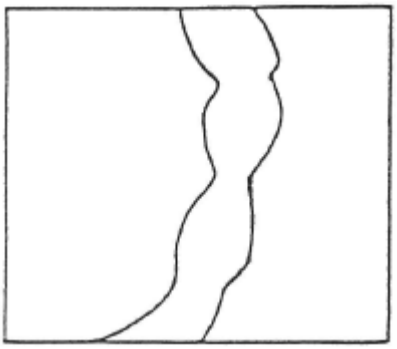
SHALLOW LPO
SIGMOID

3



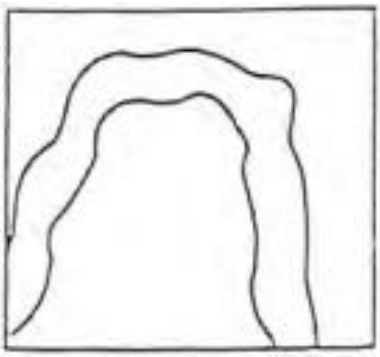
LOP
DESCENDING-SIGMOID

4



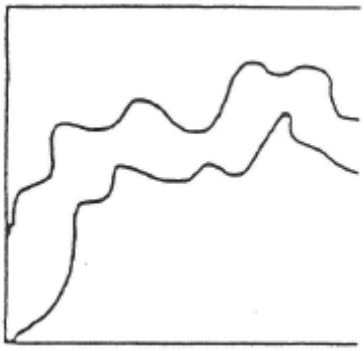
UPRIGHT LPO
DESCENDING COLON
(ACBE'S ONLY)

5



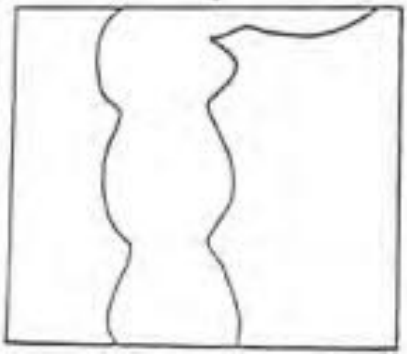
SPLENIC FLEXURE
(UPRIGHT FOR ACBE)

6



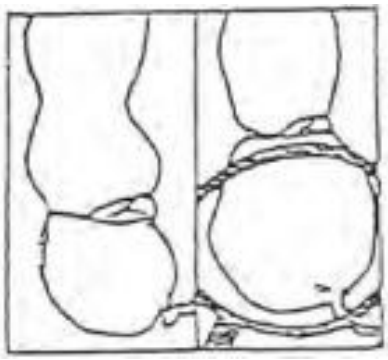
HEPATIC FLEXURE
(UPRIGHT FOR ACBE)

7



UPRIGHT ASCENDING
COLON (ACBE'S ONLY)

8 9



CELUM WITH AND
WITHOUT COMPRESSION

SEVEN PUMP METHOD

A standard double-contrast enema bag and tip are used but with the tubing shortened to one foot in length. 3-400 cc of liquid polibar or other high-density barium is placed in the bag. With the patient lying on the left side barium is placed into the colon (no fluoroscopy).

Beginning with the left side down, seven pumps of air are placed. The same is done in the following six positions (for a total of "seven"): LAO, PA, RAO, right lateral, RPO, AP (again no fluoroscopy).

At this time turn on fluoroscopy to examine the right colon. If no barium is present in the right colon, return the patient to the original position and repeat but with 2 pumps of air after an additional 100 cc of barium is instilled. At that point if no barium is seen in the right colon, continue rotating the patient as many times as needed to get the barium into the right colon. Sometimes fluoroscopic guidance can be used to place the barium into different parts of a very tortuous colon.

Drain the excess barium from the rectum as indicated. Then proceed with the same sequence of spot films as described in the conventional method. The overhead films are also the same.

E. Overhead Radiographs

The following overhead radiographs will be obtained by the technician: 14" x 17" AP, 14" x 17" right and left lateral decubitus views. Prone film of the rectosigmoid with the tube angled at 40oc towards the feet for improved delineation of the rectosigmoid and rectum. Prone, cross-table lateral of the rectum (retention balloon and tip removed). A KV lower than that for single contrast studies is used (approximately 90 KV). Optional views: supine or upright obliques, PA, upright AP, post-evac.

PITFALLS

1. Inability to Retain Barium and Air

Some patients, particularly elderly patients with a poor rectal tone, will be unable to retain the barium and air during the examination. Initially one should attempt to encourage the patient to relax by taking slow deep breaths. Frequently this will relieve the initial spasm and the examination will then continue without difficulty. If there is a persistent difficulty in retaining the barium, 1.0 mg of glucagon should be administered intravenously to relieve spasm and aid the patient in barium retention. In patients with difficulty retaining barium, the rectal balloon should be insufflated. A single squeeze on the sponge insufflation device delivers 90-100 cc of air to the rectal balloon which should be adequate for balloon distention.

WARNING - Do not inflate the balloon until there is a barium in the rectum and one can ascertain that there is no proctitis or obstructing lesion in the rectum. Do not inflate a rectal balloon in any patients with proctitis or rectal carcinoma under any circumstances.

After one has administered the intravenous glucagon and inflated the rectal balloon there is little else that can safely be done to ensure barium and air retention. Taping the buttocks together with adhesive tape as well as applying traction on the rectal balloon may aid in difficult cases. Should all maneuvers fail, the examination is to be discontinued.

2. Failure to Fill the Right Colon with Barium

One of the most frequent difficulties encountered by those beginning to do the double-contrast examination is failure to fill the right colon with barium. Allowing the patient to lie supine with continued gas insufflation may allow the barium to run posteriorly into the ascending colon. In redundant colons, bringing the patient from the right side to the supine position and back to the right with continued gas insufflation may aid in filling the right colon with barium. If the cecum did not fill, still proceed with the spot films. If none of these maneuvers is successful, the right colon and terminal ileum may fill in post-evacuation films.

3. Identification of a Constricting Lesion

Neoplasms, inflammatory disease as well as spasm, may all result in colonic constriction. Proper identification of constricting neoplasms in the colon requires exclusion of spasm simulating a constricting lesion. All annular lesions are to be re-examined following the administration of 1.0 mg glucagon intravenously. Generally, this can be accomplished during the spot filming sequence when the lesion is identified. If the lesion is seen upon review of the films, repeat spot filming after the administration of glucagon with additional insufflation of gas is recommended.

WATER SOLUBLE CONTRAST (GASTROGRAFIN) ENEMA

A. Indications

The gastrografin enema is indicated in all patients with suspected free colonic perforations. Patients with diverticulitis generally have confined or local perforation. These may be adequately examined with barium. Relative indication for the use of the water-soluble contrast enema is in the relief of right-sided fecal impaction. A 1:1 solution with water should be employed. The amount required will usually vary from 300-500 ml. The sequence of positioning and spot filming is the same as that obtained in the single contrast barium enema.

B. Dangers and Contraindications

Water-soluble contrast materials have an osmolar concentration 6 times that of plasma. Consequently, they tend to draw interstitial fluid into the intestinal lumen. All hypovolemic patients should be followed for their electrolyte and volume status, especially dangerous in infants.

COLOSTOMY ENEMA

You will undoubtedly be called upon to examine the colons of patients who have colostomies. In such cases it is important to identify the nature and extent of colonic resection, the reason for the colonic surgery, and the reason for the present examination. A review of old films before the beginning of the examination is mandatory.

A. Materials

We utilize the same barium suspension as for the single contrast barium enema. The barium is administered through tubing which connects to a large bore foley catheter with the balloon inflated. The catheter tip (not the balloon) is placed in the stomal site. The patient is asked to hold the tip securely against the stoma to provide a seal. Barium is carefully administered and the filming sequence obtained is the same as that in the conventional single contrast barium enema (for what colon remains). Overhead films: AP, both obliques, post-drainage (14"x l7").

Occasionally, one will be asked to examine the colon before reanastomosis and takedown of a colostomy. First, administer barium enema through the tube into the rectum. The tip of a clamped foley catheter should be placed in the stoma so that the colon being filled can be distended. Supine and left posterior oblique views of the rectal stump are obtained. This technique should also be used with the "double barrel' configuration.

For patients with a colostomy following resection of carcinoma, a double contrast exam is to be done, using the special double-contrast colostomy enema tip.

PROCEDURE: T Tube Cholangiography

INDICATIONS: After common duct explorations, common duct surgery, or choledochoenteric anastomosis; T-tube cholangiography is usually performed 7-10 days post-op.

CONTRAINDICATIONS:
Iodine allergy (cholangiovenous reflux may occur). Use sterile barium sulfate as an alternative contrast agent.

MATERIALS: Use 1 bottle of iodinated contrast by drip method; venous extension tubing; adapters as indicated by the configuration of the end of the T-tube.

TECHNIQUE: Scout film of RUQ to look for residual contrast, stones, air in the biliary tree. Inject in the supine position to filling. Right and left biliary radicles; do oblique spots. Upright frontal and oblique spots of dista1 CBD. It is important to eliminate all air from tubing to avoid bubbles. Contrast should be hand injected slowly under fluoroscopic control avoiding overdistention and the use of force. Alternatively, it can be dripped in by gravity with an infusion set-up as in a drip infusion IVP. Forceful injection increases the risk of cholangio-venous reflux and sepsis.

INTERPRETATION: Three common problems….

1. **Pseudo calculus**: Transient obstruction due to spasm of sphincter of Boyden (just above ODDI). Round defect distal CBD, lower border not seen. Defect and obstruction usually disappears spontaneously. 0.5-1 mg IV glucagon may help.

2. **Air Bubbles**: Usually round and smooth, rise on upright positioning. Stones are seldom perfectly round, usually sink. If doubt persists; repeat the study on another day.

3. **Anomalies and Variants**: A. Wavy appearance and slightly narrowed CBD due to partial contraction sphincters of ODDI-Boyden.
   B. Cystic duct remnants may contain residual stones.
   C. CBD entering duodenal tic - asymptomatic, no surgery needed.
   D. Choledochocele - dilated distal CBD, with prolapsed into duodenal lumen, causes partial/intermittent CBD obstruction. Treatment is indicated.

COMPLICATIONS: Injection of contrast material into an obstructed biliary tract can produce septicemia. Antibiotic prophylaxis is needed for them.

SINOGRAM/FISTULOGRAM

Fistula: An abnormal communication, usually between two internal organs, or from an internal organ to the skin surface.

Sinus: A blind-ending tract from an internal organ

Indications: Determining depth and extent of sinus tract(s) and communication with Viscera

Contra-Indications: Relative-Iodine Allergy

Material:

1. Water-soluble contrast, (Do Not Use If Tracheal or Bronchial Communication)
2. 30-50 cc Syringe
3. Foley Catheter - Size depending on the size of the Fistulous opening. Make an end hole. (Other types of catheters can be used if a tight seal can be made.)

TECHNIQUE:

1. Scout film
2. Make sure the skin surface is free of any densities that may cause confusing shadows.
3. Inflate balloon on Foley catheter
4. Insert Tip of Catheter and apply pressure so that there is a tight fit and good seal at the skin surface.
5. Inject Contrast. The endpoint of Injection: Back-flow of contrast out of Fistula in spite of tight seal.
6. Take spot films as contrast fills the tract; especially when more than one tract is seen, and/or it has a very tortuous course. Films should be done AP, Both Obliques and Lateral.
7. Remove Catheter. Do AP and Lateral Overhead Films.
8. Delayed (Post Drainage) Overhead Films.

N.B

1. Tight Catheter/Skin Seal
2. Scout Film
3. Wipe off any Contrast on the Patient's skin before Radiographs are taken.
4. Remember Lateral and Delayed Films

DEFECOGRAPHY

This is a radiographic test that is very seldom requested, for the evaluation of ano-rectal function. The indications for this examination include fecal incontinence, the sensation of incomplete evacuation, rectal prolapse, etc.

Procedure:

Barium Paste is injected manually by a syringe through a catheter inserted into the rectum while the patient is lying on his or her left side. Radiographs are obtained while the patient is sitting on a pan in the lateral position.

Images are obtained in the lateral position using the 100 mm camera and exposure rate of 1 frame per second.

In normal subjects at rest, the angle between the long axis of the anal canal and the rectum ranges between 65 - 134 degrees (mean 92 degrees). On straining, the anorectal angle increases to 105-164 degrees (mean 136 degrees). The smooth impression on the posterior wall of ano-rectal junction represents the contracted pubo rectalis muscle. During defecation, the ano-rectal junction descends an average of 2 cm which can be measured from the level of the tip of the coccyx or inferior margin of the femoral head. During straining, the anal canal width also increases with a mean measurement of 1.7 cm.

Abnormal test:

A position of the ano-rectal junction at rest lower than 4 cm below the level of the tip of the coccyx and/or descent of more than 4 cm during straining should be considered pathologic. The following illustrations show normal and abnormal studies.

INTRAVENOUS PYELOGRAM, (IVP)

Diet: Following a light noon meal, the Clear Liquid diet only is to be taken NPO after midnight.
Prep: One Cold 10 oz Bottle of Magnesium Citrate at 5:00 PM the day before the test
Procedure: **Where:** X-ray at the scheduled time With Chart
Dress: X-ray gown
Length of stay in X-ray: 60-90 Minutes (Longer if delayed films are needed)

Patient Explanation:

A pre-selected volume of fluid (Contrast Media) that contains Iodine will be injected into a vein. This will travel around the bloodstream and come out of the Kidneys. X-rays are then taken.
When first injected, this solution may cause some nausea, (occasionally vomiting), and a warm “flushed” feeling. This is normal and will pass quickly.

N.B.:

1. IVU Examinations in patients with Diabetes, Severe Atherosclerotic Disease, Renal Insufficiency, or Multiple Myeloma should only be done when the information needed can only be obtained by this method. These patients are not to be done unless well hydrated.

2. Patients with prior history of Contrast Reactions are to be done ONLY after Consultation with the Radiologist who will determine the usefulness of Iohexol. (IF prior reaction was severe, i.e., Laryngeal bronchospasm, Hypotension, or Anaphylactic Shock, anesthesia standby may be obtained.)

3. Diabetics on Glucophage or Glucovance should not take the medication on the morning of the examination and for 48 hours.

4. If there are any questions, feel free to call the GU Section, Department of Radiology.

EXCRETORY UROGRAM (XU)
OR INTRAVENOUS PYELOGRAM (IVP)

1. INDICATIONS

This widely ordered study has multiple indications. Common ones include Hematuria; flank pain or non-specific abdominal pain with suspected renal etiology; to rule out ureteral anomalies before pelvic surgery; suspected occult malignancy; W/U/of abdominal mass.

2. MATERIALS

Butterfly 19 or 21 gauge needles, paper tape, alcohol swabs, tourniquet, syringes, compression band, reaction tray, and "crash cart". 75 cc of nonionic contrast is routinely used.

3. PROCEDURE

A. Obtain plain film and examine for soft tissue calcification, masses, etc. (Get oblique views as needed).

B. IVP: All patients over age 35, and at any age with a history of hematuria, will have a complete examination including renal tomograms with compression, as follows:

1. Scouts: 14 x 17 and single renal tomogram. If there is much fecal material or bowel gas, an additional renal scout may be performed after giving gas crystals to distend the stomach.
2. REVIEW scouts with the radiologist before injection of contrast.
3. Immediate post-injection of kidneys, 11 x 14. CRITICAL TO DO THIS QUICKLY.
4. 3-minute on 14 x 17
5. Apply compression IF there is no suggestion of obstruction or other contraindication on the 3-minute film (see exceptions below).
6. Kidney tomograms (usually 3 slices) during compression.
7. RELEASE compression; obtain IMMEDIATE 14 x 17.
8. Bladder pre-and post-void on 11 x 14's.

EXCEPTIONS to the compression/tomo complete exam:

1. Patients with symptoms of acute obstruction or obstruction on the 3-minute film.
2. Underage 35 with no hematuria and normal kidneys at 3 minutes.
3. Overage 35 who has had normal IVP within the past year (e.g., follow-up of recurrent UTI's).
4. Individuals with suspected abdominal aneurysm or recent abdominal surgery or trauma.

OBTAIN EXTRA VIEWS AS DICTATED BY CLINICAL CIRCUMSTANCES!!!!

E.G., PRONE, DELAYED VIEWS, OBLIQUES

VOIDING CYSTOURETHROGRAPHY (VCUG) IN FEMALES FOR GU SERVICE

This examination is always requested by the Urology in patients with a history of Urinary incontinence, bladder prolapse, etc. before the bladder floor repair surgery.

PROCEDURE:

Please ask the nurse to place a bladder catheter (red rubber Robnel, usually a 14 French size). If the urethra is small, one can use an 8 French catheter. Take a scout film of the bladder area. If the patient did not have a KUB it would be preferable to obtain a 14 x 17 film to include the kidneys also. All the spot films should be on a 9 x 9 film. If the examination is done before renal transplantation, 100 mm spot films can be obtained.

Administer the contrast into the bladder (Conray 30 or equivalent) using gravity (by drip) until the patient feels full or you see ureteral reflux. Obtain AP, RPO, & LPO filling bladder and record the bladder capacity (usually 150-450 cc) remove the red rubber catheter. Watch for ureteral reflux, bladder incontinence, and bladder descent on the following x-rays: AP full bladder, RPO, LPO with LPO while coughing (with C marker). If there is no reflux or incontinence straining but only with coughing, I would recommend obtaining both RPO and LPO views. There is no reason to take several films during straining and coughing as the basic mechanism is the same (increase in the intra abdominal pressure that causes any leakage of urine).

Technologists will place towels between the legs of the supine female patients. Ask the patient to urinate and obtain a voiding oblique view of the bladder and urethra. Make sure that you obtain good images of the urethra and watch for uretheral reflux after voiding. After the examination, check the region of the kidneys to look for any reflux that was not identified during the procedure and obtain a post-void film. If the patient cannot void after several minutes, send the patient to the restroom, and then obtain the post-void film. In female patients, 6 to 8 films are adequate to do this examination.

NOTE:

If the examination is done before renal transplant surgery, the male patients can hold the urinal in the hand and the voiding films are obtained in the oblique position.

RETROGRADE URETHROGRAM (RUG) IN ADULT MALE

A. INDICATIONS

Trauma, Stricture, Chronic Infection with Difficulty Urinating

B. SUPPLIES

50 - 60% Iodinated Contrast (Hypaque, Renografin, ETC.)
Drawn up in a 50 CC Catheter Tip Syringe
A Luer-Lock 50 CC Syringe with Acorn Catheter Tip attached may also be used.

C PROCEDURE

1. Place the patient supine in a shallow oblique position facing you.
2. Cleanse the area of the external meatus and foreskin
3. After applying lubricant, gently insert the catheter tip into the external meatus.
4. Using your gloved hand, clamp the penile tissue tightly around the catheter tip, stretch out the penis, and inject the contrast.
5. Have assistant spot film the distended urethra (2 spots are usually adequate). If there are fistulous tracts, diverticula, etc. An AP or opposite oblique projection may be required. There may be an incomplete filling of the prostatic urethra. Additional pressure will not relieve this spasm. If visualization of this area is required, do subsequent antegrade urethrography (see VCUG).

CT COLONOGRAPHY

Patient preparation instructions

You are scheduled for a CT Colonography at University Hospital, 4502 Medical Drive on _____ at _____. The Colonography will be in the Department of Radiology on the second floor. Please check in with Admissions on the first floor one hour before your scheduled exam time. Pick up your medications from pharmacy by _____ (three days before your scheduled CT Colonography).

Please follow these instructions.

On (date)_____ (48 hours before your exam)

1. Begin a low residue diet

   Examples of food you can have:
   - Clear liquids: apple juice, tea, coffee, Jell-O, low-fat broth
   - White bread. No whole-grain breads
   - Boiled white rice
   - Baked, broiled, steamed, or boiled chicken or fish. NO Fried foods
   - Boiled egg
   - Jelly, jam. Seedless only
   - Pasta. Not whole grain
   - Banana, seedless grapes, canned peaches, canned pears, applesauce
   - Tender cooked seedless vegetables
   - Potatoes without skin
   - Butter or margarine
   - Plain cheerios, cornflakes, rice krispies
   - Limit non-fat milk to two 8 ounce cups

   Examples of foods you CANNOT have
   - Fried foods
   - Nuts
   - Canned pineapple
   - Whole grains
   - Raw vegetables
   - Red or purple juices
   - Coconut
   - Chunky peanut butter
   - Oatmeal
   - Prune juice, juices with pulp or fruit/vegetables with seeds
   - Whole milk

48 hours before your CT colonography:

On (date)_____ drink 250 ml of 2.1% barium

24 hours (one day) before your CT colonography:

On (date)_____

1. Begin a clear liquid diet - clear juices, broth, decaffeinated coffee and coffee, Jell-O, clear none carbonated drinks, sports drink, avoid red and purple juices.
   Put Magnesium Citrate in the refrigerator if you have not already done so. It should be cold when you drink it.
2. Between the hours of 10:00 AM to 05:00 PM drink four 8 ounces of water
3. At 05:00 PM drink the 10-ounce bottle of Magnesium Citrate.
4. At 07:00 PM take four Bisacodyl 5 mg tablet with one 8 ounce glass of water
5. Drink 60 ml (two ounces) of Gastroview at 6:00 PM. You may mix the gastroview with a clear soft drink like Sprite or 7-up
6. DO NOT eat or drink anything after midnight.

You will receive glucagon, an injection in your arm 15 minutes before the CT colonography.

DIVISION OF BREAST IMAGING AND INTERVENTION

Section Chief:

- Kenneth A. Kist, MD; Associate Professor and Program Director, Diagnostic Radiology Residency and Women's Imaging/Intervention Fellowship
  Kist@uthscsa.edu
  P: (210) 567-6482 (Office)

Section Faculty:

- Pamela M. Otto, MD, FACR, Professor and Stewart R. Reuter Chair, Dept. of Radiology; Program Director, Breast Imaging and Intervention Fellowship
- N. Carol Dornbluth, MD; Associate Professor
- Rachel A. Darling, MD; Assistant Professor
- T. Tanya Van, MD; Assistant Professor

Fellows: AY 2021-2022

- Chris Rhodes, DO
- Douglas Mathis, MD

Fellowship Academic Programs Coordinator:

- Stephanie Navarro,
- NavarroSB@uthscsa.edu
  P: (210) 567-5563

UT Health San Antonio Radiology

Mammography Training Curriculum-Plan

Overview

Breast imaging is pretty different from most other residency rotations, with a unique mix of diagnostic and screening studies, multiple procedures, and a myriad of technical, legal, ethical, administrative, and management requirements not seen elsewhere. We feel that the sub-specialty of Breast Imaging and Intervention is the most fulfilling and frankly, the most fun in Radiology. We have developed a basic curriculum plan to help you get the most from your breast imaging rotations. We will likely ask more of you as your skills advance. Our residents (and fellows) are an important part of our practice and it is a real pleasure to watch you grow in competence and confidence during your time with us. We will give you regular feedback during your rotations and we expect your feedback about our teaching and guidance as well.

ROTATION ONE

On your 1st day, be prepared: Have the Breast chapters 18-21, from Brant and Helms under your belt. The Breast Imaging rotation starts at 7:00 on most days and at 6:00 frequently. Expect to be on in the section until 17:00 or later. Business casual attire (sans jackets) is expected.

We expect the residents on service to complete evaluations and dictations on any unread studies before 8:00, especially breast MRIs, obtained on the prior workday. You should come prepared to discuss any assigned reading, including journal club articles, and be ready to present assigned educational projects to your faculty and trainee colleagues. Make sure that you review images and information for the day's scheduled interventions (biopsies, needle localizations, aspirations, etc.) before 8:00.

- Obtain Gilda Cardenosa's text (Clinical Breast Imaging, The Essentials). Other useful texts are Ikeda, The Requisites, Cardenosa, Breast Imaging Companion and Lee, Lehman & Bassett, Breast Imaging.
- Obtain basic Macros
- Learn data entry system for biopsy results, conference and follow up information (on the S drive)
- Understand which abnormal findings must be communicated
- Review the list of seminal journal articles in the S drive. You will need to read most if not all of them over your three breast rotations.
- Remember that our teaching environment is also a clinical environment. We may see different pathology as the rotations progress but make sure that you see everything listed (either in the clinic or from one of our teaching files)

    - **WEEK ONE**
        - In Cardenosa's Essentials, read chapters 1, 6, 7, 8, and 9.
        - Observe a mammogram
        - Learn normal breast anatomy
        - Basic assessment of film quality
        - Basic normal and abnormal calcification
        - Basic benign and suspicious masses
        - Indirect signs of malignancy, (e.g. architectural distortion, skin thickening, nipple retraction)
        - Seek your faculty's guidance on choosing a teaching file case, which you will present to your colleagues and place in the section's teaching file.

    - **WEEK TWO**
        - In Cardenosa's Essentials, read chapters 2, 3, 4, and 12.
        - Standard work-up of focal asymmetry and mass
        - Standard workup of calcifications
        - Accessory views of breast and purpose rolled views, tangential spots, ML views
        - Assessment of palpable mass
        - Discuss ultrasound basics, cysts, complex cysts, masses, etc
        - At the end of the week, complete a 25 question exam from RadPrimer or other provided source, in test mode, and forward a screenshot of your score to your evaluating faculty and the program director.

- **WEEK THREE**
    - In Cardenosa's Essentials, read chapters 5, 10, 11, and 13.
    - Benign lesions- fibroadenoma, hamartoma, cysts, complex cysts, lipomas, sebaceous cysts
    - Phyllodes management
    - Review the management of DCIS and high-risk lesions (ALH, ADH, FEA, etc.)
    - How to localize skin calcifications
    - Work-up of hypoechoic masses, complex cysts, indeterminate lesions.

- **WEEK FOUR**
    - Use Cardenosa's Companion to review basic and challenging cases and to solidify your understanding of the topics.
    - Surgically altered breasts, reduction mammoplasty, lumpectomy, flaps, assessment of biopsy scars by mammography and sonography.
    - Three-dimensional lesion localization.
    - Implant evaluation with mammography, sono, and MRI
    - Equipment and technique- OD, contrast, sharpness, noise, technique including mA, Kvp, density, dose, the effect of breast thickness.
    - Complete your first Breast Teaching File and review it with faculty before placing it in the S drive.
    - At the end of the week, complete a 25 question exam from RadPrimer or other provided source, in test mode, and forward a screenshot of your score to your evaluating faculty and the program director.

ROTATION TWO

- Read Breast Imaging by Lee, Lehman, and Bassett (selected chapters).
- Read selected journal articles as assigned
- Become familiar with the various Federal (MQSA) and state requirements for Breast practice.
- Remember that our teaching environment is also a clinical environment. We may see different pathology as the rotations progress but make sure that you see everything listed (either in the clinic or from one of our teaching files).

    - **WEEK ONE**
        - Read Breast Imaging by Lee, Lehman, and Bassett (chapters 1-12).
        - Breast pathology – types of cancer, the relevance of the type of staging
        - Paget's disease, inflammatory breast cancer
        - Staging and margin analysis
        - Treatment of stages of breast cancer

    - **WEEK TWO**
        - Read Breast Imaging by Lee, Lehman, and Bassett (chapters 13-24).
        - QA, artifacts
        - Equipment, quality control, moving equipment requirements
        - Observe QA documents performed by technologists
        - Describe the medical audit
        - Discuss desirable benchmark parameters, i.e., callback rate, positive biopsy rate, etc.
        - At the end of the week, complete a 25 question exam from RadPrimer or other provided source, in test mode, and forward a screenshot of your score to your evaluating faculty and the program director.

    - **WEEK THREE**
        - Read Breast Imaging by Lee, Lehman, and Bassett (chapters 24-42).
        - Risk factors for breast cancer, including definiation of high risk
        - Staging/survival rates
        - Discuss the economic of breast cancer detection
        - Breast cancer incidence and mortality
        - Submit a case for the Teaching File.

- **WEEK FOUR**
  - Read Breast Imaging by Lee, Lehman, and Bassett (chapters 43-52).
  - Evaluate the "hands-on" performance of stereo and ultrasound biopsies. Needle localization, Galactography, specimen radiography, MR biopsy
  - Optional training with a phantom to improve the accuracy of ultrasound biopsy
  - Review MR principles, usefulness to assess the extent of disease, work up dilemmas, BRCA
  - Management of benign and malignant masses
  - Complete your second Breast Teaching File and review it with faculty before placing it in the S drive.
  - At the end of the week, complete a 25 question exam from RadPrimer or other provided source, in test mode, and forward a screenshot of your score to your evaluating faculty and the program director.

ROTATION THREE

- **WEEK ONE**
  - Read Breast Imaging by Lee, Lehman, and Bassett (chapters 53-63).
  - Discuss lead time and length time bias, selection bias, interval cancer rate, prevalence and incidence
  - Review what you have read and what you need to complete before graduation. Review important journal articles in the S drive.

- **WEEK TWO**
  - Re-enforce management of screening and diagnostic mammography, ultrasound, and MRI of the breast in the current standard of care context.
  - At the end of the week, complete a 25 question exam from RadPrimer or other provided source, in test mode, and forward a screenshot of your score to your evaluating faculty and the program director

- **WEEK THREE**
  - Medicolegal and ethical aspects, breast imaging, coding, and billing

- **WEEK FOUR**
  - Evaluate mastery of the topic and asses for competence to practice breast imaging.
  - At the end of the week, complete a 25 question exam from RadPrimer or other provided source, in test mode, and forward a screenshot of your score to your evaluating faculty and the program director.

MINI-FELLOW

Your 3 months of Mini-fellowship will focus on developing the skills required for a certificate of additional qualifications in Breast Imaging. Your experiences will include instruction in advanced imaging techniques and interventions, and experience in breast section management and supervision. We will strive to provide experiences relevant to your professional and practice aspirations. It is imperative that you communicate your educational needs to your faculty, so we can help you meet them. You should re-read Bassett during these months, become very familiar with the BiRADS manual and become comfortable with MQSA rules and regulations, including inspection and practice audit functions.

Breast Imaging Residency Training Curriculum

MQSA requirement for the direct supervision of at least 240 mammography interpretations made within 6 months (or 2 years if board certification achieved by the end of residency) of beginning independent interpretation of mammography examinations. (The last month can be within the last 6 months of residency)

Resident Name:_____

Dates of Rotation:	Year of Residency:
Rotation 1._____	_____
Rotation 2._____	_____
Rotation 3._____	_____

By means of lectures, conferences, textbooks, syllabi, journal reprints, videotapes, teaching files, and other teaching materials, a resident should become familiar with and understand the following topics in breast disease:

Breast anatomy, physiology, and pathology

- Breast development
- Normal breast anatomy and histology; alteration with age, pregnancy, menstrual cycle, and hormonal effects; male breast anatomy
    - Pathologic appearance and clinical significance of benign breast lesions. In situ, and other histologic risk factors such as atypical ductal hyperplasia, atypical lobular hyperplasia, lobular carcinoma in situ.

American College of Radiology/Society of Breast Imaging Curriculum for Resident and Fellow Education in Breast Imaging†

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible]
  - [illegible]
  - [illegible]

[illegible]

[illegible]

[illegible]

Mammographic equipment and technique

[illegible]

Mammography quality assurance

[illegible]

Mammographic interpretation

[illegible]

Screening mammography

[illegible]

- 4 Role of Screening Ultrasound in Breast Cancer Detection
- 5 Breast Anatomy, Physiology, Histology, and Development
- 6 Core Biopsy
- 7 Contrast-Enhanced Mammography
  - Screening guidelines of the ACR, the American Cancer Society, the National Cancer Institute, the US Preventive Services Task Force, and others
- 8 Anatomy and Histologic Issues in the Performance and Interpretation of Screening Mammography Examinations
- 9 ACR Breast Guidelines for the Performance of Screening Mammography (2)

Diagnostic ipsilateral mammography

- 10 Indications and Indications for Additional Diagnostic Mammography Views
- 11 Technique and Views for
  - Evaluating the Findings of Breast Cancer Screening Examinations
  - Clinical Problems
  - Implants and Implant Complications
  - Evaluation of Palpable Lumps, Thickening, or Other Clinical Abnormality Without Mammographic Correlate
  - Assessment of Breast Pain
  - Evaluation of Nipple Discharge
  - Assessment of Breast Changes in Patients with Breast Malignancy (Staging)
- 12 ACR Practice Guidelines for the Performance of Diagnostic Mammography (3)

Breast ultrasound

- 13 Equipment and Physical Principles
- 14 Technique
- 15 Indications
- 16 Technique and Views for
  - Evaluating the Breast
  - Imaging the Breast Implant Patient
  - Performing Focused Ultrasound Examinations of Palpable Lumps, Palpable Pain
  - Performing Differential Diagnosis of Benign and Malignant Solid Masses
  - Evaluating Cystic Lesions
  - Correlating with Findings at Mammography, Ductography, and Clinical Nipple Discharge
- 17 Anatomy and Histologic Issues in the Performance and Interpretation of Breast Ultrasound Examinations
- 18 Characteristics Signaling the Role of Screening Breast Ultrasound Examinations
- 19 ACR Practice Guidelines for the Performance of Breast Ultrasound Examinations (4)
- 20 ACR Breast Ultrasound Accreditation Program

Breast MRI

- 21 Equipment and Physical Principles
- 22 Technique
- 23 Indications
- 24 Technique and Interpretation of Breast MR Examinations
- 25 Performance Issues
  - Recognizing Normal MRI Anatomy
  - Recognizing Differential Features of Benign and Malignant Masses
  - Recognizing Differential Features of Benign and Malignant Non-Mass–like Enhancement
  - Evaluating Implant Integrity
  - Correlating with Findings at Mammography, Ultrasound, and Clinical Examination
- 26 Interventional Procedures Guided by MRI
- 27 Characteristics Signaling the Role of Screening Breast MRI Examinations
- 28 ACR Practice Guidelines for the Performance of MRI of the Breast (5)

Screening and multimodal aspects of breast imaging

- 29 Characteristics of Breast Cancer Significant for Breast Imaging Appearance
  - BI-RADS Atlas® lexicon, scoring system, and management guidelines
  - Clinical Issues
  - Characteristics of Breast Carcinoma: BI-RADS® Breast Density Assessment
  - Final Assessment Categories (BI-RADS® Atlas) and Appropriate Management
  - Management of Complications
  - Characteristics Significant for Evaluation of Response to Neoadjuvant Therapy
  - Characteristics Significant for Assessment and Management of Contralateral Breast
- 30 MQSA requirements implementing the Mammography Quality Standards Act and Final Rules
- 31 Multimodal Aspects of Breast Imaging and Interventional Procedures
  - Understanding the Appropriate Application of Imaging Modalities in Evaluating the Various Categories of Lesions Found
  - Characteristics, Value, and Indications of Ultrasound Imaging
  - Interventional Procedures Guided by Ultrasound

Multicentric and metastatic disease

- 32 Prevalence, Indications, and Characteristics of Multicentric Disease, Including Multifocal and Multicentric Carcinoma

Additional Information:

All residents are expected to review final pathology on all lesions sampled during their time in the section. This is an important learning exercise in radiologic-pathologic correlation. Please be prepared to discuss the radiologic reasoning for sampling and concordance/discordance with expected pathology. All residents should be familiar with the scheduled procedures for the day, at their location, by the beginning of the day. The resident should be able to describe findings that lead to the recommendation for sampling/procedure and be able to discuss techniques for the procedure and have a reasonable differential for expected pathology. Trainees should be familiar with the morning needle localization patients as well, including modality, approach, etc..

Residents will be asked about this information. Familiarity with cases is required to participate in the procedure. The responsibility to confirm knowledge of the case/preparation will typically fall to a fellow on service, although upper level residents may also perform this task. Faculty will certainly ask.The residents on service at the Mays Cancer Center should check for unread MRIs each morning and review the studies to discuss with faculty in the morning.

The location assignments will typically be handled by a fellow, although an upper level resident may also be assigned the task. We will be as fair as possible within the limitations of trainee number, vacations, etc. Any change/trade must be confirmed through the fellow or resident making the schedule. In the interest of fairness and to address learning needs of individual trainees, schedule changes may not always be granted.

DIVISION OF CARDIOTHORACIC & INTERVENTION RADIOLOGY

Section Chief:

- Carlos Santiago Restrepo, MD; Vice Chair of Education
  RestrepoC@uthscsa.edu
  P: (210) 567-6488

Section Faculty:

- Amy L. Mumbower; MD; Associate Professor
- Sachin S. Saboo, MD; Associate Professor
- Ameya J. Baxi, MD; Assistant Professor

Fellows: AY 2021-2022

- Raul Porto, MD

Fellowship Academic Programs Coordinator:

- Stephanie Navarro
- NavarroSB@uthscsa.edu
  P: (210) 567-5563

Clinical Administrative Assistant:

- Angela Tarango: TarangoA@uthscsa.edu
  P: (210) 567-6488

UT Health San Antonio Radiology

Resident Responsibilities

Cardiothoracic radiology rotations take place both at University Hospital (UH) and at UT Health facilities (MARC and UT Hill Country). Clinical activities typically start at 8:00 am and extend until 5:00 pm Monday to Friday. Residents are required to stay until the clinical work is completed. Even though residents may be assigned primarily to one particular task (plain films, CT, or Cardiac imaging) these assignments are not exclusive, and they are expected to cross cover other areas as needed both to improve educational opportunities and expedite patient care.

Residents are expected to progress to the point of complete independence in ordering, monitoring, modifying, and interpreting cardiothoracic radiology examinations. He/She will also become a competent consultant to healthcare providers, integrating clinical and radiological information to provide appropriate interpretations and differential diagnosis.

I. Development of Knowledge and Skills

A. Initial Rotations:

1. The resident is expected to develop an understanding of thoracic anatomy displayed on a plain films, CT, and MR. All residents are expected to read Felson's Principles of Chest Roentgenology by L. Goodman and Chapter 10 of Brant and Helms' Fundamentals of Diagnostic Radiology (Methods of Examination, Normal Anatomy, and Radiographic Findings of Chest Disease) and Chapter 24 (Introduction to Cardiac Anatomy, Physiology, and Imaging Techniques) **BEFORE** the first day of their initial chest rotation.

2. The resident will arrive at 7 am and will make an initial assessment of all plain films and CT examinations performed before formal read-out sessions with staff. The resident will be responsible for the dictation of all reports into the appropriate system. All studies reviewed with staff will be dictated before the resident departs each evening. All dictations will be electronically signed each day.

3. The cardiothoracic radiology section recommends using Webb's textbook on Thoracic radiology as the main study guide during the residency training (Thoracic Imaging. Pulmonary and Cardiovascular Radiology. W. Richard Webb and Charles B. Higgins. Walters Kluwer publishers).

   The resident is also encouraged to read the chapters on the thoracic disease in:

   * Fundamentals of Diagnostic Radiology, 5th Edition by Brant/Helms

   Additionally, residents are expected to read daily about the diseases that are discussed in read-out sessions.

4. The resident will select at least 2 cases with interesting and important teaching points which will be incorporated into the chest radiology teaching file by each resident during each monthly rotation so that it will become a viable, growing resource of educational material.

5. Each resident will present a brief teaching conference on thoracic radiology subject to the other residents and faculty on the service.

B. Intermediate Rotations:

1. The resident will continue all previous responsibilities, excepting reading assignments.

2. Residents will develop differential diagnoses of fundamental thoracic disease patterns and augment their understanding of Cardiothoracic disease through:
    - Thoracic Imaging. Pulmonary and Cardiovascular Radiology. W. Richard Webb and Charles B. Higgins. Walters Kluwer publishers.
    - Multidetector-Row CT of the Thorax. UJ Schoepf, FG Meinel. 2nd edition. Springer International Publishing. 2nd edition.
    - ACR chest syllabi
    - ACR teaching file
    - Diagnostic Imaging Chest. Rosado-de-Christensen, Abbott, Martinez-Jimenez. Amyirsis. 2nd edition.
    - Diagnostic Imaging Cardiovascular. Abbara, Achenbach, carter, et al. Amyrsis. 2nd edition.
    - RadCases Thoracic Imaging. Restrepo CS, Zangan SM. Thieme Medical Publisher.
    - RadCases Cardiac Imaging. Restrepo CS, Bardo DME. Thieme Medical Publisher.
    - RadCases Plus Q&A Thoracic Imaging. Restrepo CS, Zagan SM. 2nd edition. Thieme Medical Publisher.
    - RadioGraphics (www.RSNA.org)

C. Senior Rotations:

1. The resident will continue all previous responsibilities.

2. Residents will expand the knowledge base of Cardiothoracic diseases and differential diagnoses through sources listed in the intermediate rotations. Dedicated rotation devoted to Cardiac Imaging will require an additional study on the use of Cardiac CTA (CCTA) and Cardiac MRI in cardiovascular diseases and conditions listed under the core curriculum.

II. Supervisory Lines of Responsibility

A. Initial Rotations:

1. All studies will be double read by a staff member before the formal report is rendered.

2. After an initial period of observation, residents will begin dictating studies before staff review, but residents must have staff review before the report is signed. All recommendations by staff will be incorporated into the final report before the preliminary dictation has been finalized.

3. The resident will develop a sense of ownership of the Thoracic Radiology Service. He/she will interact verbally with appropriate health care providers to convey clinically urgent radiologic findings and to obtain additional clinical information before rendering a radiologic interpretation. When necessary, he/she will enter the HIS/RIS and search for relevant history from prior hospitalizations, surgical procedures, or pathology reports. The resident will review arrange previous or additional imaging examinations as needed to improve the quality of radiological interpretation (prior similar studies, other imaging examinations, and their interpretations).

4. The residents will review all requests for studies directed to the Thoracic Radiology Service with staff before approval and/or modification. As they demonstrate competence, they will be allowed to protocol and approve studies on their own.

B. Intermediate Rotations:

1. There will be a further progression of the items listed in the initial rotations.

2. The resident will provide immediate consultation for residents of other clinical services.

C. Senior Rotations:

1. The residents will be responsible for operating the Cardiothoracic Radiology Service independently, to include providing verbal consultations to residents and staff from other departments regarding radiologic findings and appropriate differential diagnoses. However, staff will be readily available for consultation and/or review of any study.

2. Staff will double read all studies before reports are finalized and will be available for an immediate consultation.

III. End of Month Evaluation

End of rotation formal examination will be held at the discretion of section faculty and section chief. Residents in the first three years of training could be required to complete a practical evaluation during the fourth week of the cardiothoracic radiology rotation. In such cases the resident will be presented with no fewer than five unknown thoracic cases and will generate a full report for each case, emphasizing history, findings, pertinent negatives, synthesis of observations, differential diagnosis, final conclusion(s) and recommendations (as appropriate). A faculty member will assess the reports created by the resident and will review each case and its report with the resident.

IV. The following is the core curriculum for Thoracic and Cardiac Imaging that every resident is required to cover during their training:

Thoracic Imaging Core Curriculum (2 years cycle)

1. Normal anatomy and anatomic variants.
2. Imaging signs in Thoracic Imaging.
3. Infectious Pneumonia
4. Lung cancer
5. Thoracic lymphomas and sarcomas
6. The ICU chest X-ray.
7. Trauma
8. Congenital bronchopulmonary diseases.
9. High-Resolution CT
10. Cystic diseases of the lung
11. The trachea and central airways.
12. Small airways disease and COPD
13. Thoracic manifestations of systemic diseases
14. Diseases of the pleura, chest wall and diaphragm
15. Mediastinal masses
16. Pulmonary arteries (including PE)
17. Pulmonary and systemic thoracic veins
18. The postoperative chest (including lung transplantation)

Cardiac Imaging Core Curriculum (2 years cycle)

1. Normal anatomy and function
2. Imaging signs in cardiovascular diseases.
3. Congenital heart diseases
4. Vascular rings
5. CCTA in Coronary Artery Disease
6. MRI in Coronary Artery Disease

7. Cardiomyopathies
8. Cardiac masses
9. Valvular heart diseases
10. Pericardial diseases
11. Acquired diseases of the aorta and great vessels
12. Cardiac Infection
13. Cardiac trauma

V. Academic activities

Academic activities during the rotation include a weekly morning conference (Wednesday 7:30 am) and daily impromptu discussion of cases and teaching files during the regular working hours. The Wednesday morning conference would alternate case conferences, journal clubs, and review conferences, most of which are to be presented by a chest resident or fellow, as to assign by responsible faculty or section chief. Residents are required and encourage to attend noon-conference and all additional academic activities as determined by the Department of Radiology Program Director. Occasionally a resident may be required to participate in grand rounds and conferences with clinical services such as Pulmonary Medicine, Cardiology and Cardiothoracic surgery, etc.

VI. Online Study Aids

A. www.med-ed.virginia.edu\courses\rad
B. www.learningradiology.com
C. www.chestx-ray.com
D. www.thoracicrad.org (web site of the Society of Thoracic Radiology and has many full lectures from recent annual meetings of the society).
E. www.nasci.org (web site of the North American Society of Cardiac Imaging and has many full lectures from recent annual meetings of the society and seminal or pivotal papers in the field).
F. Radiopaedia.org
G. www.radiologyassistant.nl/ Radiology assistant
H. www.rsna.org/ Radiological Society of North America
I. www.arrs.org/ American Roentgen Ray Society

(Many Radiology societies like RSNA, ARRS, etc., offer free membership to residents. Residents are encouraged to enroll in these societies and take advantage of lectures and other education materials in website)

VII. Participation in scientific society meetings and publication:

Residents are encouraged to prepare, present, and publish research, scientific, educational, and review articles in academic journals and submit abstracts to scientific meetings. Cardiothoracic radiology faculty will collaborate with interested residents and provide guidance and protected time for this purpose.

DAYTIME ER RADIOLOGY FACULTY

Section Faculty:

- Darlene Metter, MD; Professor
- Kent Rohweder, MD; Associate Professor
- Anson Cone, MD; Specialist

Clinical Administrative Assistant:

- Angela Tarango: TarangoA@uthscsa.edu
  P: (210) 567-6488

UT Health San Antonio Radiology

We welcome you to the Daytime ER Radiology section and we hope this will be a positive educational experience for you. This section is staffed primarily by first year residents and occasionally upper levels. The Department daytime Faculty are Drs. Darlene Metter, Anson Cone, & Kent Rohweder. Occasionally other faculty members may fill-in. Resident responsibility is to read primarily plain films performed in the Emergency Department and plain films from Express Med Clinics #'s 11 & 12.

HOURS OF ROTATION:
8 am until all studies with last modified times up to 4:30 pm have been completed and finalized. After 4:00 pm, case should be assigned to the evening faculty. The Resident is also expected to stay until evening residents arrive.

LOCATION:
Skytower EC level G room SG-706 next to the trauma ER.

READ LISTS:
Read from the following queues primarily: Unread ED with focus on ER plain films (CXR's, KUB, Panarex, and MSK plain films) There is no expectation of reading pediatric cases. When these are sufficiently caught up, you can help with ICU and in-patient plain films. Faculty will review these cases with you shortly after your review. You have a protected noon hour which is usually reserved for Resident conferences. We will offer Faculty case presentation when time allows.

PERFORMANCE:

First Year: Staff may offer for the residents to observe their reading techniques, particularly the first year residents. This is completely optional for the staff. Residents goal of 5-8 studies/ hour, allowing time to compare and research cases, followed by film review.

Second Year: 7-10 studies/ hour.

Third Year: 10-12 studies/ hour.

SUGGESTED READING ASSIGNMENTS:

First Year Residents:
Most of the books I would recommend for this section are available in the electronic version from Briscoe library:

1) Chest Radiology Plain Film Patterns and Differential Diagnoses (https://www-clinicalkey-com.libproxy.uthscsa.edu/#!/browse/book/3-s2.0-C20090503984),
2) Fundamentals of Skeletal Radiology (https://www-clinicalkey-com.libproxy.uthscsa.edu/#!/browse/book/3-s2.0-C20100689620)
3) Arthritis in Black and White (https://www-clinicalkey-com.libproxy.uthscsa.edu/#!/browse/book/3-s2.0-C20110697030).
4) Radiology Review Manual by Wolfgang Daehnert is not available on line but is relatively inexpensive. I strongly recommend all residents have a copy. Edition 8 comes with an electronic version. I keep my hard copy in the reading area for reference.
5) Felson's (https://www-clinicalkey-com.libproxy.uthscsa.edu/#!/browse/book/3-s2.0-C2012002652X),
6) Fundamentals of Diagnostic Radiology Brant and Helms is also a valuable resource.
7) Atlas of normal Roentgen Variants that may Simulate Disease, Ninth Edition is a good reference text. (https://www-clinicalkey-com.libproxy.uthscsa.edu/#!/browse/book/3-s2.0-C20090425674).
8) We will supplement with cases from the ACR Case in Point library. Be sure to have have login criteria in place.
9) We will be giving assignments from RADPRIMER designed to augment your reading from Chest Radiology Plain Film Patterns and Differential Diagnoses as well as provide objective assessment of your development.

I would recommend the following before your first day, Felson's, chapters 1&3. In the first week, I would recommend Fundamentals of Diagnostic Radiology chapter 12 CXR normal anatomy & Fundamentals of Skeletal Radiology chapter 5 trauma. During your first rotation, I would recommend focusing on Chest Radiology Plain Film Patterns and Differential Diagnoses with supplemental reading from Fundamentals of Diagnostic Radiology Brant and Helms section III Pulmonary. I would recommend focusing on Arthritis in Black and White and Fundamentals of Skeletal Radiology when you encounter the spectrum of arthritic disease.

I also strongly encourage you supplement your learning in this and **all of your rotations** by reviewing differential diagnoses and specific details of encountered diseases processes in references such as STATDX or Daehnert's Radiology Review Manual, no pictures but great reviews of disease details. I found this to be very useful for In-service exams and boards.

We have been building a teaching file from which you will be given unknown cases in an oral board format designed to simulate real world radiology experiences. This will include discussion of differential diagnoses and clinical considerations.

This is based on your suggested reading detailed above, therefore, keep reading as much as you can and keep us informed of your progress.

Second Year & Third year Residents:
In addition to the above reading suggestions, I would recommend Emergency Radiology: The Requisites (https://www-clinicalkey-com.libproxy.uthscsa.edu/#!/browse/book/3-s2.0-C20110086969) in addition to specific topics to be assigned by staff and self-directed based on individual interests and cases reviewed.

PRACTICAL GOALS:

1. Learn general plain film radiology interpretation.
2. Learn how to independently create accurate, concise, and well-organized reports.
3. Learn how to communicate effectively with clinicians (and document when appropriate).
4. Learn how to maximize efficiency through optimization of available software.
5. Learn to employ the patient medical record to enhance radiology interpretation.

EVALUATION: We attempt to provide constructive criticism and continuous performance evaluation frequently during your rotation. There is usually a mid rotation evaluation and end of rotation evaluation. Consensus evaluation will be provided at end of your rotation by section members which will put into your New Innovations file. We also provide feed back during case reviews.

Thank you for your participation. Do not hesitate to contact any of the faculty if questions arise.

DIVISION OF EMERGENCY RADIOLOGY

Section Chief:

- Gregg W. Bean, MD; Associate Professor
  BeanG@uthscsa.edu
  P: (210) 567-3448

Section Faculty:

- Bundhit Tantiwongkosi, MD; Associate Professor
- Sandhya Vinu-Nair, MD; Assistant Professor & Fellowship Director, Emergency Radiology
- Joseph S. Ayoub, MD; Assistant Professor
- Kal L. Clark, MD; Assistant Professor
- Rashmi S. Katre, MD; Assistant Professor

Fellow: AY 2021-2022

- Sri Kantha Dommeti, MD
- Hasanagha Zalov, MD

Fellowship Academic Programs Coordinator:

- Stephanie Navarro
  NavarroSB@uthscsa.edu
  P: (210) 567-5563

Clinical Administrative Assistant:

- Angela Tarango: TarangoA@uthscsa.edu
  P: (210) 567-6488

UT Health San Antonio Radiology

6/28/2021

Emergency Radiology After-Hour Rotation Orientation

Welcome to the Emergency Radiology Rotation. We are glad to have you on the service for the next 4 weeks. This orientation packet is intended to introduce you to the Emergency Radiology Division, your responsibilities, and our expectations. We will occasionally update this packet to reflect new responsibilities or changes to the Division.

The Emergency Radiology rotation is unique in that you will be dictating Preliminary Reports which the providers will utilize for direct patient care, before a Final Report is available from faculty. Resident autonomy is imperative. The lessons you learn will benefit you for the remainder of your training and your future practice as a radiologist.

Members:

Gregg Bean – Division Director (Overnight)
Sandhya Vinu-Nair – Fellowship Director (Overnight)
Kal Clark (Overnight)
Joseph Ayoub (Evening)
Rashmi Katre (Evening)
Bundhit Tantiwongkosi (Evening)

The Emergency Radiology faculty shifts are 4pm-midnight (Evening) and 10pm-6am (Overnight) Monday-Friday. On Saturday and Sunday, the evening ER radiologists work from 3pm-11pm. The Faculty Radiologists work in a rotating schedule which works out to 1-week on, 2-weeks off on average.

We work both in the UHS Emergency Center Reading Room and remotely through the UHS VPN. There are advantages and disadvantages of working at both locations. We balance both the need for resident autonomy and resident support.

All of our policies (and some of the Departmental policies) can be found on the Emergency Radiology Teams Channel.

Responsibilities:

You will be on a 4-day rotating schedule consisting of a long-shift (Night Float A), short-shift (Night Float B), and off (Resident Wellness Day). In addition, this year the residency has decided to give you a week off during the 4-week rotation. The long shift is from 7pm-7am. During this time you are primarily responsible for the CT Neuro exams and radiographs. The short-shift is from 10pm-7am. While on this shift, you are primarily responsible for CT Body, CT Chest, and ultrasound studies. However, depending on how busy it is, please help your co-resident on the rotation. Please remember, although you are on the Emergency Radiology Rotation, we also take care of in-patients (including ICU's), floor patients, pediatrics, and UH Express Med sites (Pavilion and RBG).

Dictate from the Unread ED list which includes the EC, Express Med, and STAT in-patient exams. You must be able to triage the various locations and exams. Your priorities are:

1. Trauma (ERUH-Trauma Resus Unit)/Code Stroke CT's
2. ^Emergency Center (EC) CT's (UH ST G ADULT ED)
3. Emergency Center (EC) US's
4. Emergency Center (EC) Radiographs
5. STAT Express Med (RBG Express Med, other Express Med locations) radiographs
6. *STAT In-patient CT's
7. STAT In-patient and Transplant Ultrasounds (all DVT and Transplant US's need to be read)
8. #STAT In-patient and ICU CXR & Abdomen Radiographs including pediatrics

^Metastatic work-ups and similar obviously sdnon-emergent exams from the ER do not need to be interpreted after-hours. However, these must be reviewed and a note entered in the Study Comment section on AGFA stating, "No critical finding; OK for AM dictation."

*In-patient CT studies (STAT or routine) only need to be read if there is a concern for a critical finding (ie. PE, bleed, etc.). If the Reason for Study does not indicate there is a concern for a critical finding AND there are

no critical findings, it's appropriate to create a Study Comment in AGFA saying, "No critical finding; OK for AM dictation." If a referring provider is contacted, this should be documented as well. The Department's list of critical findings can be found on the department's Critical Findings Policy.

[#] Must dictate any radiograph when called by a provider whether it's STAT or Routine. Must also document all conversations with providers.

[$]Nuclear Medicine studies will be finalized by Nuclear Medicine faculty. Faculty from the other subspecialties are also on-call if necessary. The UHS Help Desk will have their contact information.

Don't forget to read the MSK CT's for infection or a suspected fracture, including the MR Pelvis for occult hip fracture. In the evenings and overnight you don't have to read the MSK CT's for operative planning, but you should open the exam and write a note saying you've looked at the study and it can wait until the next day (ie "Ok for AM interpretation").

Don't forget to occasionally open the "Unread STAT Last 48 Hours" folder to confirm you are not missing a STAT exam, especially at the end of your shift.

Remember, the Preliminary Report you render will have direct affect on patient care. The referring providers will triage and care for the patient based on your reads and will not wait for the Final Read from the ER faculty. This is the standard of care throughout the country.

Occasionally, you will be asked to give your opinion on an exam performed outside our institution without a formal order. This is called curbsiding/curbstoning ("wet read'). It is Department policy NOT to give an interpretation on a study that isn't formally ordered as those patients deserve a thorough interpretation, just as any other patient we serve. If you are approached and asked to "give a quick look" at an exam, tell them to ask for a formal interpretation.

CT Code Stroke

To expedite patient care and possible thrombectomy, the interpreting resident should contact the Emergency Radiology Faculty as soon as they are alerted to a Code Stroke by the CT Tech. The Emergency Radiology Resident and Faculty should be interpreting the Code Stroke in tandem.

MR Spines for "Cord Compression"

Occasionally, the Emergency Medicine Providers will order an MR Spine exam(s) for "cord compression" (ie cauda equina, spinal cord compromise). Currently, the provider will call the reading room and alert you to these exams. These exams should be treated like any other STAT exam and interpreted as soon as possible by the resident covering Neuro.

Dictations

Given the large volume of exams performed, it's important that you format the studies correctly and are brief in your dictations. **We prefer that you associate the CT Chest and CT Abdomen and Pelvis exams as well as the CT Head, CT Cervical Spine, and CT Maxillofacial exams for trauma**. Also, please combine the MSK radiographs when contiguous body parts (ie hip, femur, knee, tibia/fibula, etc.) are performed at the same time. Do not associate exams that have been performed at different times, non-contiguous body parts, or the same exams (ie multiple CXR's together).

Who's queue do I put the studies in?

The evening radiologist reads up to a Task Creation date of 9:30 PM, but stays until midnight on weekdays and 11 PM on weekends. Studies with a Task Creation date of after 9:30 PM should be put into the overnight radiologist's PowerScribe queue. **It's recommended that faculty and residents contact each other at the beginning of the shift and around the time the faculty will leave. Use the AGFA Collaborator Tool for HIPPA compliant communication. Never text message Patient Health Information (PHI) on your cellphone.**

The overnight Emergency Radiology Faculty read up until a Task Creation time of 4:30 AM (but stay on until 6am). If the overnight Emergency Radiology Faculty finish reading all the exams before the

Task Creation date of 4:30 AM then they will pick off studies in your queue. Please put all your studies after a Task Creation time of 4:30 AM in the PowerScribe queue of whoever is covering the ER during the day and the covering UHS Neuroradiologist.

Nuclear Medicine exams are interpreted by the on-call Nuclear Medicine physician, not the ER faculty. If an after-hours Nuclear Medicine exam is performed, please ask the Help Desk to contact the on-call physician.

In summary:

1. Before 9:30PM Task Creation time: Assign studies to the evening ER Facutly
2. From 9:30PM-4:30AM Task Creation time: Assign studies to the overnight ER Faculty
3. After 4:30AM Task Creation date: Assign studies to the morning ER Faculty, morning UHS neuroradiologist

Communication:

When we read remotely we prefer to communicate with you through text messaging using the AGFA Collaborator tool. Text messaging thru the AGFA Collaborator has several advantages over talking over the phone including documentation of misses and great calls, archiving interesting cases, and facilitating the creation of your midway and end of rotation evaluations/feedback. Also, if you are in the middle of a dictation, you are not interrupted by a phone call from your faculty. We also will document misinterpretations using the "!" (STAT) feature on PowerScribe. When we see a case we disagree with, we will put the discrepancies under the header, "ADDITIONAL FINDINGS AFTER STAFF REVIEW" and send it back to you with a description of the "miss" in the Comments. You will receive the Preliminary Read in your PowerScribe queue with a '!' next to it. You are to contact the referring provider about the discrepancy and dictate your communication under the Additional Findings.

If you look at study, you must dictate a Preliminary Report. A common scenario is that a referring physician will call you to take a "quick look" at an exam. We don't take "quick looks" (also called "curbsiding" or "curbstoning") or give a quick interpretation. All our interpretations are

thorough and thoughtful. **If you look at an exam and give a referring provider an interpretation you must dictate a report and document your communication.**

Discrepancies:

Although the residents are very good, occasionally we will disagree with your interpretations. When this happens, the faculty will include the additional findings at the end of the preliminary dictation by adding an "ADDITIONAL FINDINGS AFTER STAFF REVIEW" header. Underneath this header the faculty will add the discrepancies. The faculty will then reject the preliminary report and the dictation will come back to you with a "!" next to the report.

Because the relevant update or correction is included in the staff "Additional Findings" section, you do not need to change your original report or your original impression. This 1) prevents confusion from referring providers who may have already seen the original preliminary report, 2) saves you time, and 3) facilitates various department quality improvement's initiatives.

You must, however, then contact the referring provider through the Radiology Help Desk and document your communication. You will then need to sign the report, which we will then sign off.

This is very important…**IT IS YOUR RESPONSIBILITY TO COMMUNICATE THE MISSED FINDINGS/DISCREPANCIES TO THE REFERRING PROVIDER AND CORRECTLY DICTATE YOUR COMMUNICATION.**

By receiving this orientation packet you are accepting this responsibility.

Occasionally, the misses/discrepancies are regarding findings not associated with the patient's current visit (pulmonary and adrenal nodules, ovarian cysts, thyroid lesions, etc.). Unfortunately, we do not have a way better way to communicate these findings to the referring provider through the medical record. With our recent transition to EPIC,

we will hopefully be able to communicate these incidental findings through the use of the Inbox in the near future. However, even though these findings are not associated with the patient's current visit or condition, we must assure they are in the reports. You may be asked to call the referring provider if they are not in the original report. We will try to minimize these.

Quality of CT PE Exams:

To assure we are all on the same page when it comes to quality disclaimers for CT PE Protocols, the Division of Cardiothoracic Imaging often includes disclaimers when there are quality issues (respiratory motion, bolus timing) and to what level a pulmonary embolism can be confidently be excluded. Examples include:

"Limited exam with image quality significantly degraded by respiratory (or patient) motion. With this limitation, no pulmonary embolism in the central pulmonary arteries. "

"No pulmonary embolism in the central pulmonary arteries in this limited exam due to inappropriate bolus timing."

"Non-diagnostic exam for pulmonary embolism due to ___. "

If you are interpreting a CT PE exam and the exam is suboptimal, please use these disclaimers in IMPRESSION #1 when describing the presence of a PE.

BREAST ULTRASOUND OUT-PATIENT FOLLOW-UP:

We will occasionally be asked to interpret a breast ultrasound for a potential abscess or mass. So that a patient may have access to additional financial resources for further out-patient follow-up and assessment in a proper breast imaging facility (UT San Antonio Health Mays Cancer Center) you should include the following statement at the end of your IMPRESSION:

"out-patient follow-up with breast imaging to assess for resolution of the suspected abscess and to exclude underlying malignancy is recommended".

In addition, you must always give a BIRADS 0 to every Breast US performed in the ER. Remember, our techs are not breast imaging techs and this is not a breast imaging facility. All these exams require follow-up.

CONFERENCES:

Since the Emergency Radiology rotation is a non-traditional rotation, you will not be able to attend the noon conference during your 4-week block.

We will occasionally have an Emergency Radiology Fellow Journal Club, which you will be invited to. The month after your Emergency Radiology rotation, you will be asked to present interesting cases at a noon ER Interesting Case Conference. One of the Emergency Radiology Faculty will serve as the conference moderator. Please be sure to collect interesting cases you would like to present during your rotation.

MR Safety:

You will sometimes be asked to clear a patient for an MR exam that has an implantable device or prior surgery. The UHS MRI Safety Manual is on the S drive which comes in handy and/or access the website mrisafety.com for guidance.

Faculty Back-Up:

Finally, we know the rotation can be quite stressful. The Emergency Radiology Faculty may not always have the answer; however, there are on-call subspecialty faculty for back-up just in case there is a question we can't answer. Always check with the covering ER Radiologist first. The Help Desk is able to contact the subspecialist radiologist on-call if a question still cannot be answered. For example, if you have a nuclear medicine imaging examination, please contact the Nuclear Medicine faculty on-call.

DIVISION OF MUSCULOSKELETAL IMAGING

Section Chief:

- Angel A. Gómez-Cintrón, MD, MPH; Program Director-Diagnostic Radiology; Associate Professor
  GomezCintron@uthscsa.edu
  P: (210) 567-3448

Section Faculty:

- Michael A. Tall, MD; Associate Professor
- Michael A. Davis, MD; Assistant Professor & Program Director, Musculoskeletal Imaging & Intervention Fellowship
- Rebecca Loredo, MD; Professor
- Robert O. Cone, MD; Assistant Professor

Fellows: AY 2021-2022

- John Baxter Martin, MD (Specialist)
- Edrick Lugo Millan, MD

Fellowship Academic Programs Coordinator:

- Stephanie Navarro
  NavarroSB@uthscsa.edu
  P: (210) 567-5563

Clinical Administrative Assistant:

- Cheryl P. Howard; Division Head, Clinical Administration
  Portenier@uthscsa.edu
  P: (210) 567-3448

UT Health San Antonio Radiology

Musculoskeletal Radiology Resident Responsibilities (Adapted from the Society of Skeletal Radiology)

The Diagnostic Radiology resident is expected to progress to the point of complete independence in monitoring, modifying, and interpreting Musculoskeletal exams, including radiographs, computed tomography, magnetic resonance imaging, densitometry, and ultrasonography. He/she will also become competent in performing diagnostic and therapeutic musculoskeletal related image-guided procedures.

Rotation 1

Goals

After completing the first four-week rotation in musculoskeletal radiology, the resident will be able to:

- Demonstrate learning of knowledge-based objectives and mastery of technical objectives for the first rotation
- Generate accurate and concise radiographic reports
- Communicate effectively with patients, referring clinicians, technologists and supervisory staff
- Understand standard radiographic positioning and anatomy
- Obtain essential patient information pertinent to the radiologic examination
- Demonstrate knowledge of clinical indications for radiography and indications for urgent computed tomography (CT) and magnetic resonance (MR) examinations •Demonstrate a responsible work ethic
- Participate in quality improvement/ quality assurance activities
- Participate in the education of students and interns

Objectives

- Knowledge-based
    - Demonstrate learning of normal radiographic and CT anatomy of the axial and appendicular skeleton
    - Demonstrate learning of normal MRI anatomy of the knee and shoulder
    - Demonstrate learning of normal MRI anatomy of the cervical, thoracic, and lumbar spine
    - Recognize and accurately describe common fractures and dislocations of the appendicular skeleton
    - Recognize and describe fractures and dislocations of the cervical, thoracic, and lumbar spine. Understand basic mechanisms of injury and distinguish stable from unstable injuries
    - Demonstrate learning of pathophysiology and radiology of fracture healing and complications of healing such as delayed union, malunion and nonunion
    - Demonstrate learning of radiographic presentation and evaluation of osteomyelitis and septic arthritis
    - Recognize and describe complications of orthopedic devices including fracture fixation and spine and arthroplasty hardware
- Technical
    - Dictate clear, detailed, and accurate reports that include all pertinent information as established in the American College of Radiology (ACR) Guidelines for Communication4 (PBL, ICS)

- Use appropriate nomenclature when reporting radiographic, CT, MR or ultrasound (US) findings of musculoskeletal disease (ICS)
- Communicate all unexpected or significant findings to the ordering provider and document who was called and the date and time of the discussion in the report (ICS, PC, P)
- Obtain relevant patient history from electronic records, dictated reports, the patient, or by communication with referring provider (PC) oRecognize and describe positioning and anatomy of standard radiographic examinations of the musculoskeletal system (MK)
- Effectively provide feedback to radiology technologists regarding the quality of exposure and patient positioning (ICS, SBP)
- Recognize when it is appropriate to obtain help from senior residents or faculty when assisting referring clinicians (PC, P)
- Demonstrate responsible, ethical behavior; positive work habits; and professional appearance; and adhere to principles of patient confidentiality (P)
- Participate in discussions with faculty and staff regarding operational challenges and potential system solutions regarding all aspects of radiologic services and patient care (SBP)

Rotation 2

Goals

After completing the second four-week rotation in musculoskeletal radiology, the resident will be able to:

- Demonstrate learning of knowledge-based objectives and mastery of technical objectives for the second rotation
- Continue to build and improve on skills developed during the first rotation
- Develop skills in protocoling and monitoring CT and MR examinations
- Demonstrate an understanding of the ACR Appropriateness Criteria5 and ACR Practice Guidelines and Technical Standards for musculoskeletal imaging6
- Participate in the education of junior residents, interns, and medical students
- Perform image-guided procedures

Objectives

- Knowledge-Based
  - Recognize and describe the radiographic presentation of Paget disease
  - Demonstrate learning of a systematic approach to arthritis. Be able to describe and differentiate salient radiologic (radiographic, CT and MR) features of common arthropathies including osteoarthritis, inflammatory arthropathy (rheumatoid, psoriatic, reactive, juvenile chronic, and septic), crystal deposition diseases (calcium pyrophosphate deposition, gout, hydroxyapatite deposition), neuropathic arthropathy, connective tissue disease (systemic lupus erythematosis, scleroderma, dermatomyositis), pigmented villonodular synovitis, and synovial chondromatosis
  - Demonstrate a systematic assessment of a solitary lesion of bone and be able to categorize the lesion as aggressive or nonaggressive. Develop an appropriate differential diagnosis based on patient age, lesion location, and lesion characteristics (margin, matrix, periosteal reaction, soft tissue extension). Demonstrate knowledge of systematic, safe, and cost-effective

radiologic workup of bone lesions including biopsy approach and compartmental anatomy.
    - Recognize and describe common locations of and radiologic manifestations of osteonecrosis.
    - Demonstrate knowledge of MRI safety issues including contraindication to scanning and use of contrast.
    - Demonstrate learning of the use of various pulse sequences and planes of imaging used in MRI of musculoskeletal disorders
    - Demonstrate learning of common knee and shoulder pathology on MRI (meniscal tear, tendon and ligament injury, fracture, chondral disease, rotator cuff tear, and labral pathology)
    - Demonstrate learning of common pathology of the cervical, thoracic, and lumbar spine on MRI
    - Demonstrate learning of the normal MRI anatomy of the hip and ankle •Technical
    - Build and improve on skills acquired during the first rotation
    - Demonstrate the ability to gather essential and accurate patient information (electronic, personal communication) to appropriately prescribe MRI protocols (PC, ICS) oProvide effective and timely feedback and education to CT and MRI technologists regarding the quality of examinations (ICS, SBP)
    - Demonstrate the ability to monitor CT and MRI examinations to ensure the patient is adequately evaluated (MK, PC)
    - Demonstrate an understanding of indications, contraindications, needle path, risks and post-procedural management of CT and US-guided procedures including management of complications (MK, PC)
    - Provide technical and educational guidance to junior residents and students (ICS)
    - Safely perform fluroscopically guided joint injections and aspirations with faculty supervision (PC)
    - Demonstrate an understanding of indications, contraindications, radiation risks, and post-procedural management of fluroscopically guided procedures including management of complications (MK, PC)
    - Demonstrate an ability to counsel a patient and obtain informed consent before performing a procedure, including a description of the procedure, risks, benefits, and alternatives; and solicit and respond to patient questions without discrimination based on religious, ethnic, sexual, economic, or educational differences (ICS, PC, P)
    - Maintain a log of all procedures performed including complications (PBL)

Rotation 3

Goals

After completing the third four-week rotation in musculoskeletal radiology, the resident will be able to:

- Demonstrate learning of knowledge-based objectives and mastery of technical objectives for the third rotation
- Continue to refine skills developed during the first two rotations
- Effectively use information technology to address clinical problems
- Participate in the education of junior residents and medical students

- Become a more independent provider of musculoskeletal radiologic interpretive services
- Manage clinical and technical questions from technical and support staff

Objectives

- Knowledge-based
  - Recognize radiologic findings and describe the pathophysiology of endocrine disease including hyperparathyroidism, renal osteodystrophy, osteomalacia/rickets, hypophosphatasia, hypophosphatemia
  - Recognize radiologic findings of hematopoietic and storage diseases including sickle cell anemia, thalassemia, mastocytosis, and Gaucher's disease.
  - Demonstrate a systematic approach to relatively common dysplasias and congenital conditions such as achondroplasia, osteogenesis imperfecta, osteopetrosis
  - Demonstrate learning of common pathology of the hip and ankle on MRI
  - Demonstrate learning of anatomy and common injuries/pathology of the elbow and wrist on MRI
- Technical
  - Improve and build on skills acquired during the first two rotations
  - Demonstrate the ability to locate, appraise and assimilate evidence from scientific studies related to the performance and interpretation of musculoskeletal imaging (PBL)
  - Demonstrate the ability to teach a junior colleague how to protocol examinations and plan procedures (PC, ICS)
  - Demonstrate the ability to assess and prioritize requests for add-on procedures (PC)
  - Demonstrate the ability to answer common procedural and policy questions from technologists and support staff (PC, ICS)

References

1. Accreditation Council for Graduate Medical Education. Competencies Definitions and Practice Performance Measurements for Diagnostic Radiology. Available online at http://www.acgme.org/acWebsite/RRC_420/420_compDefsPerfMeas.pdf. Accessed 9/01/06.
2. Accreditation Council for Graduate Medical Education. Program Requirements for Graduate Medical Education in Diagnostic Radiology. Available online at http://www.acgme.org/acWebsite/downloads/RRC_progReq/420pr701_u705.pdf. Accessed 9/05/06
3. Collins J, Abbott GF, Holbert JM, et al. Revised Curriculum on Cardiothoracic Radiology for Diagnostic Radiology Residency With Goals and Objectives Related to General Competencies. Acad Radiol 2005; 12:210-223.
4. American College of Radiology. ACR Practice Guideline for Communication of Diagnostic Imaging Findings. Available online at http://www.acr.org/s_acr/bin.asp?CID=541&DID=12196&DOC=FILE.PDF. Accessed 9/06/06.
5. American College of Radiology. ACR Appropriateness Criteria: Expert Panel on Musculoskeletal Imaging. Available online at http://www.acr.org/s_acr/sec.asp?CID=1206&DID=15047. Accessed 9/06/06.

NORMAL VARIANTS

Fitzpatrick D, Walz DM. Shoulder MR imaging normal variants and imaging artifacts. Magn Reson Imaging Clin N Am 2010; 18(4): 615-632.

Sampaio ML, Schweitzer ME. Elbow magnetic resonance imaging variants and pitfalls. Magn Reson Imaging Clin N Am 2010; 18(4): 633-642.

Malone WJ, Snowden R, Alvi F, Klena JC. Pitfalls of wrist MR imaging. Magn Reson Imaging Clin N Am 2010; 18(4): 643-662.

DuBois DF, Omar IM. MR imaging of the hip: normal anatomic variants and imaging pitfalls. Magn Reson Imaging Clin N Am 2010; 18(4): 663-674.

Slattery T, Major N. Magnetic resonance imaging pitfalls and normal variations: the knee. Magn Reson Imaging Clin N Am 2010; 18(4): 675-689.

Gyftopoulos S, Bencardino JT. Normal variants and pitfalls in MR imaging of the ankle and foot. Magn Reson Imaging Clin N Am 2010; 18(4): 691-705.

Shortt CP. Magnetic resonance imaging of the midfoot and forefoot: normal variants and pitfalls. Magn Reson Imaging Clin N Am 2010; 18(4): 707-715.

Durand DJ, Hulsman T, Carrino JA. MR imaging features of common variant spinal anatomy. Magn Reson Imaging Clin N Am 2010; 18(4): 717-726.

CONGENITAL ABNORMALITIES

Laor T, Jaramillo D. MR imaging insights into skeletal maturation: what is normal? Radiology. 2009 Jan;250 (1):28-38.

Him H, Kim HS, Moon ES, et al. Scoliosis imaging: what radiologists should know. Radiographics 2010; 30(7): 1823-1842.

Sookur PA, Naraghi AM, Bleakney RR, et al. Accessory muscles: anatomy, symptoms, and radiologic evaluation. Radiographics 2008; 28(2): 481-499.

Newman JS, Newberg AH. Congenital tarsal coalition: multimodality evaluation with emphasis on CT and MR imaging. Radiographics 2000; 20(2): 321–32.

Thapa MM, Pruthi S, Chew FS. Radiographic assessment of pediatric foot alignment: review. AJR Am J Roentgenol 2010; 194(6): S51–58.

Zbojniewicz AM, Laor T. Focal Periphyseal Edema (FOPE) zone on MRI of the adolescent knee: a potentially painful manifestation of physiologic physeal fusion? AJR Am J Roentgenol. 2011 Oct;197(4):998-1004.

Morrell DS, Pearson JM, Sauser DD. Progressive bone and joint abnormalities of the spine and lower extremities in cerebral palsy. Radiographics. 2002 Mar-Apr;22(2):257-68.

Bedoya MA, Chauvin NA, Jaramillo D et al. Common Patterns of Congenital Lower Extremity Shortening: Diagnosis, Classification, and Follow-up. Radiographics. 2015 Jul-Aug;35(4):1191-207

Dighe M, Fligner C, Cheng E, Warren B, Dubinsky T. Fetal skeletal dysplasia: an approach to diagnosis with illustrative cases. Radiographics 2008; 28(4): 1061-1077.

Cheema JI, Grissom LE, Harcke HT. Radiographic characteristics of lower-extremity bowing in children. Radiographics 2003; 23(4): 871-880.

Starr V, Ha BY. Imaging update on developmental dysplasia of the hip with the role of MRI. AJR Am J Roentgenol. 2014 Dec;203(6):1324-35.

Ihde LL, Forrester DM, Gottsegen CJ, et al. Sclerosing bone dysplasias: review and differentiation from other causes of osteosclerosis. Radiographics. 2011 Nov-Dec;31(7):1865-82.

TRAUMA

Fractures/Dislocations/Complications

a. General Principles and Technique

ACR-SPR-SSR Practice parameter for the performance of radiography of the extremities. Revised 2014.

Harris JH, Pope TL. Chapter 2: General principles of osseous injury. In: Musculoskeletal imaging. Pope TL, Bloem HL, Beltran J, Morrison WB, Wilson DJ. 2nd ed. 2015. Pg 13-20.

Baker JC, Hillen TJ, Demertzis JL. The role of imaging in musculoskeletal emergencies. Semin Roentgenol 2014; 49(2): 169-185.

b. Spine

ACR-ASSR-SPR-SSR Practice parameter for the performance of spine radiography. Revised 2014.

Daffner RH, et al. ACR appropriateness criteria on suspected spine trauma. Last review date 2012.

Rogers LF, West OC. Chapter 6: the cervical spine. In: Imaging skeletal trauma. Rogers LF, West OC. 4th ed. Elsevier 2015. Pg 43-89.

Dreizin D, Letzing M, Sliker CW, et al. Multidetector CT of blunt cervical spine trauma in adults. Radiographics 2014; 34(7): 1842-1865.

Khurana B, Sheehan SE, Sodickson A, Bono CM, Harris MB. Traumatic thoracolumbar spine injuries: what the spine surgeon wants to know. Radiographics 2013; 33(7): 2031-2046.

c. Upper Extremity

Sandstrom CK, Kennedy SA, Gross JA. Acute shoulder trauma: what the surgeon wants to know. Radiographics 2015; 35(2): 475-492.

Sheehan SE, Dyer GS, Sodickson AD, Patel KI, Khurana B. Traumatic elbow injuries: what the orthopedic surgeon wants to know. Radiographics 2013; 33(3): 869-888.

Porrino JA Jr, Maloney E, Scherer K, Mulcahy H, Ha AS, Allan C. Fracture of the distal radius: epidemiology and premanagement radiographic characterization. AJR Am J Roentgenol 2014; 203(3): 551-559.

Scalcione LR, Gimber LH, Ho AM, Johnston SS, Sheppard JE, Taljanovic MS. Spectrum of carpal dislocations and fracture-dislocations: imaging and management. AJR Am J Roentgenol 2014; 203(3): 541-550.

Gyftopoulos S, Chitkara M, Bencardino JT. Misses and errors in upper extremity trauma radiographs. AJR Am J Roentgenol 2014; 203(3): 477-491.

d. Pelvis/Acetabulum

Khurana B, Sheehan SE, Sodickson AD, Weaver MJ. Pelvic ring fractures: what the orthopedic surgeon wants to know. Radiographics 2014; 34(5): 1317-1333.

Lawrence DA, Menn K, Baumgaertner M, Haims AH. Acetabular fractures: anatomic and clinical considerations. AJR Am J Roentgenol 2013; 201(3): W425-36

Lower Extremity

Sheehan SE, Shyu JY, Weaver MJ, Sodickson AD, Khurana B. Proximal femoral fractures: what the orthopedic surgeon wants to know. Radiographics 2015; 35(5): 1563-1584.

Gottsegen CJ, Eyer BA, White EA, Learch TJ, Forrester D. Avulsion fractures of the knee: imaging findings and clinical significance. Radiographics 2008; 28(6): 1755–70.

Markhardt BK, Gross JM, Monu J. Schatzker classification of tibial plateau fractures: use of CT and MR imaging improves assessment. Radiographics 2009; 29(2): 585-597.

Okanobo H, Khurana B, Sheehan S, Duran-Mendicuti A, Arianjam A, Ledbetter S. Simplified diagnostic algorithm for Lauge-Hansen classification of ankle injuries. Radiographics 2012; 32(2): E71–84. (R1)

Badillo K, Pacheco JA, Padua SO, Gomez AA, Colon E, Vidal JA. Multidetector CT evaluation of calcaneal fractures. Radiographics 2011; 31(1): 81-92.

Melenevsky Y, Mackey RA, Abrahams RB, Thomson NB 3rd. Talar fractures and dislocations: a radiologist's guide to timely diagnosis and classification. Radiographics 2015; 35(3): 765-779.

Ha AS, Porrino JA, Chew FA. Radiographic pitfalls in lower extremity trauma. AJR Am J Roentgenol 2014; 203(3): 492-500.

Myotendinous Injury

Morag Y, Jacobson JA, Miller B, De Maeseneer M, Girish G, Jamadar D. MR imaging of rotator cuff injury: what the clinician needs to know. Radiographics 2006; 26(4): 1045–65.

Hayter CL, Adler RS. Injuries of the elbow and the current treatment of tendon disease. AJR Am J Roentgenol 2012; 199(3): 546–57.

Demertzis JL, Rubin DA. Upper extremity neuromuscular injuries in athletes. Semin Musculoskelet Radiol 2012; 16(4): 316-330.

Rubin DA. Imaging diagnosis and prognostication of hamstring injuries. AJR Am J Roentgenol 2012; 199(3): 525-33.

Ligament

Bateni CP, Bartolotta RJ, Richardson ML, Mulcahy H, Allan CH. Imaging key wrist ligaments: what the surgeon needs the radiologist to know. AJR Am J Roentgenol 2013; 200(5): 1089–95.

Perrich KD, Goodwin DW, Hecht PJ, Cheung Y. Ankle ligaments on MRI: appearance of normal and injured ligaments. AJR Am J Roentgenol 2009; 193(3): 687-695.

Neurovascular

Kim SJ, Hong SH, Jun WS, et al. MR imaging mapping of skeletal muscle denervation in entrapment and compressive neuropathies. Radiographics 2011; 31(2): 319-332.

Andreisek G, Crook DW, Burg D, Marincek B, Weishaupt D. Peripheral neuropathies of the median, radial, and ulnar nerves: MR imaging features. Radiographics 2006; 26(5): 1267-1287.

Petchprapa CN, Rosenberg ZS, Sconfienza LM, Cavalcanti CF, Vieira RL, Zember JS. MR imaging of entrapment neuropathies of the lower extremity. Part 1. The pelvis and hip. Radiographics 2010; 30(4): 983-1000.

Donovan A, Rosenberg ZS, Cavalcanti DF. MR imaging of entrapment neuropathies of the lower extremity. Part 2. The knee, leg, ankle, and foot. Radiographics 2010; 30(4) 1001-1019.

Yablon CM, Hammer MR, Morag Y, Brandon CJ, Fessell DP, Jacobson JA. US of the Peripheral Nerves of the Lower Extremity: A Landmark Approach. Radiographics. 2016 Mar-Apr;36(2):464-78.

Brown JM, Yablon CM, Morag Y, Brandon CJ, Jacobson JA. US of the Peripheral Nerves of the Upper Extremity: A Landmark Approach. Radiographics. 2016 Mar-Apr;36(2):452-63.

Articular

Huang M, Schweitzer ME. The role of radiology in the evolution of the understanding of articular disease. Radiology 2014; 273(2 Suppl): S1-22

Chundru U, Riley GM, Steinbach LS. Magnetic resonance arthrography. Radiol Clin N Am 2009; 47: 471-494.

Hodler J. Technical errors in MR arthrography. Skeletal Radiol 2008; 37: 9-18.

Crema MD, Roemer FW, Marra MD, et al. Articular cartilage in the knee: current MR imaging techniques and applications in clinical practice and research. Radiographics 2011; 31(1): 37-61.

Kijowski R. Clinical cartilage imaging of the knee and hip joints. AJR Am J Roentgenol 2010; 195(3): 618-28.

Stress

Berger FH, Milko CdJ, Maas M. Stress fractures in the lower extremity: the importance of increasing awareness amongst radiologists. Eur J Radiol 2007; 62(1): 16-26.

Jaimes C, Mauricio J, Shabshin N, Laor T, Jaramillo D. Taking the stress out of evaluating stress injuries in children. Radiographics 2012; 32: 537-555.

Child Abuse

Lonergan GJ, Baker AM et al. From the archives of the AFIP. Child abuse: radiologic-pathologic correlation. Radiographics. 2003 Jul-Aug;23(4):811-45.

INFECTION

Rosen A, Lecomte M, Ossiani, Piran A. Chapter 19: Imaging of infection. In: Imaging of arthritis and metabolic bone disease. Weissman BN. 1st ed. Elsevier. Pg 314-339. https://www.clinicalkey.com/#!/content/book/3-s2.0-B9780323041775000197

Pattamapaspong N, Sivasomboon C, Settakorn J, Pruksakorn D, Muttarak M. Pitfalls in imaging of musculoskeletal infections. Semin Musculoskelet Radiol. 2014 Feb;18(1):86-100. doi: 10.1055/s-0034-1365838

Soldatos T, Durand DJ, Subhawong TK, Carrino JA, Chhabra A. Magnetic resonance imaging of musculoskeletal infections: systematic diagnostic assessment and key points. Acad Radiol. 2012 Nov;19(11):1434-43. doi: 10.1016/j.acra.2012.05.022

Vaidyanathan S, Patel CN, Scarsbrook AF, Chowdhury FU. FDG PET/CT in infection and inflammation--current and emerging clinical applications. Clin Radiol. 2015 Jul;70(7):787-800. doi: 10.1016/j.crad.2015.03.010

Osseous

Lee YJ, Sadigh S, Mankad K, Kapse N, Rajeswaran G. The imaging of osteomyelitis. Quant Imaging Med Surg. 2016 Apr;6(2):184-98. doi: 10.21037/qims.2016.04.01

ACR appropriateness criteria on suspected osteomyelitis in patients with diabetes mellitus. Revised 2012. https://acsearch.acr.org/docs/69340/Narrative/

Soft tissue

Turecki MB, Taljanovic MS, Stubbs AY, et al. Imaging of musculoskeletal soft tissue infections. Skeletal Radiol 2010; 39(10); 957-971. doi:10.1007/s00256-009-0780-0
Chaudhry AA, Baker KS, Gould ES, Gupta R. Necrotizing fasciitis and its mimics: what radiologists need to know. AJR Am J Roentgenol 2015; 204(1): 128-139. doi: 10.2214/AJR.14.12676

Joints

Lin HM, Learch TJ, White EA, Gottsegen CJ. Emergency joint aspiration: a guide for radiologists on call. Radiographics 2009; 29(4): 1139-58. doi:10.1148/rg.294085032

Karchevsky M, Schweitzer ME, Morrison WB, Parellada JA. MRI findings of septic arthritis and associated osteomyelitis in adults. AJR Am J Roentgenol 2004; 182(1): 119-122. doi:10.2214/ajr.182.1.1820119

Spine

Hong SH, Choi JY, Lee JW, Kim NR, Choi JA, Kang HS. MR imaging assessment of the spine: infection or an imitation? Radiographics 2009; 29(2): 599-612. doi:10.1148/rg.292085137

Mazzie JP, Brooks MK, Gnerre J. Imaging and management of postoperative spine infection. Neuroimaging Clin N Am. 2014 May;24(2):365-74. doi: 10.1016/j.nic.2014.01.003

ARTHRITIS

Osteoarthritis

Jacobson JA, Girish G, Jiang Y, Sabb BJ. Radiographic evaluation of arthritis: degenerative joint disease and variations. Radiology 2008; 248(3): 737–47.

Inflammatory

Jacobson JA, Girish G, Jiang Y, Resnick D. Radiographic evaluation of arthritis: inflammatory conditions. Radiology 2008; 248(2): 378–89.

Sommer OJ, Kladosek A, Weiler V, Czembirek H, Boeck M, Stiskal M. Rheumatoid arthritis: a practical guide to state-of-the-art imaging, image interpretation, and clinical implications. Radiographics 2005; 25(2): 381–98.

Demertzis JL, Rubin DA. MR imaging assessment of inflammatory, crystalline-induced, and infectious arthritides. Magn Reson Imaging Clin N Am 2011; 19(2): 339–63.

Sheybani EF, Khanna G, White AJ, Demertzis JL. Imaging of juvenile idiopathic arthritis: a multimodality approach. Radiographics 2013; 33(5): 1253-1273.

Taljanovic MS, Melville DM, Gimber LH, Scalcione LR, Miller MD, Kwoh CK, Klauser AS. High-resolution US of rheumatologic diseases. Radiographics 2015; 35(7): 2026-2048.

Crystalline

Roberts CC, Braunstein EM. Chapter 26: crystal diseases. In: Imaging of arthritis and metabolic bone disease. Weissman BN. 1st ed. Elsevier. Pg 506-519.

Desai MA, Peterson JJ, Garner HW, Kransdorf MJ. Clinical utility of dual-energy CT for evaluation of tophaceous gout. Radiographics 2011; 31(5) 1365-1375.

Neuropathic

Baker JC, Demertzis JL, Rhodes NG, Wessell DE, Rubin DA. Diabetic musculoskeletal complications and their imaging mimics. Radiographics 2012; 32(7): 1959-1974.

Schweitzer ME, Birnbaum M. Chapter 10: imaging of diabetes mellitus and neuropathic arthropathy. In: Imaging of arthritis and metabolic bone disease. Weissman, BN. 1st ed. Elsevier. Pg. 146-165.

PVNS

Garner HW, Ortiguera CJ, Nakhleh RE. Pigmented villonodular synovitis. Radiographics 2008; 28(5): 1519-1523.

NEOPLASMS

Liu PT, Valadez SD, Chivers FS, Roberts CC, Beauchamp CP. Anatomically based guidelines for core needle biopsy of bone tumors: implications for limb-sparing surgery. Radiographics 2007; 27(1): 189-205.

Hillen T, Baker JC, Jennings JW, Wessell DE. Image-guided biopsy and treatment of musculoskeletal tumors. Semin Musculoskelet Radiol 2013; 17(2): 189-202.

Osseous

Miller TT. Bone tumors and tumorlike conditions: analysis with conventional radiography. Radiology 2008; 246(3): 662-674.

Soft tissue

Rizer M, Singer A, Edgar M, Jose J, Subhawong T. The histological variants of liposarcoma: predictive MRI findings with prognostic implications, management, follow-up, and differential diagnosis Skeletal Radiol (May 2016) Wu JS, Hochman MG. Soft-tissue tumors and tumorlike lesions: a systematic imaging approach. Radiology 2009; 253(2): 297-316.

Tumor-like/sclerosing bone disease

Ihde LL, Forrester DM, Gottsegen CJ, Masih S, Patel DB, Vachon LA, White EA, Matcuk GR. Sclerosing bone dysplasias: review and differentiation from other causes of osteosclerosis. Radiographics 2011; 31(7): 1865–82.

Foot and ankle

Singer AD, Datir A, Tresley J, Langley T, Clifford PD, Jose J, Subhawong TK. Benign and malignant tumors of the foot and ankle. Skeletal Radiol. 2016 Mar;45(3):287-305. doi: 10.1007/s00256-015-2278-2.

Upper extremity

Nagata S, Nishimura H, Abe T. MR Imaging of Soft-Tissue Tumors of the Upper Extremity. Magn Reson Imaging Clin N Am. 2015 Aug;23(3):457-68.

Myeloma

Pianko MJ, Terpos E, Roodman GD, Divgi CR, Zweegman S, Hillengass J, Lentzsch S. Whole-body low-dose computed tomography and advanced imaging techniques for multiple myeloma bone disease. Clin Cancer Res. 2014 Dec 1;20(23):5888-97.

Reisenbuckler C. Multiple myeloma and diagnostic imaging. Radiol Technol. 2014 Mar-Apr;85(4):391-410

Agarwal A, Chirindel A, Shah BA, Subramaniam RM. Evolving role of FDG PET/CT in multiple myeloma imaging and management. AJR Am J Roentgenol. 2013 Apr;200(4):884-90.

Dutoit JC, Verstraete KL. MRI in multiple myeloma: a pictorial review ofdiagnostic and post-treatment findings. Insights Imaging. 2016 Aug;7(4):553-69. doi: 10.1007/s13244-016-0492-7

Mihailovic J, Goldsmith SJ. Multiple myeloma: 18F-FDG-PET/CT and diagnostic imaging. Semin Nucl Med. 2015 Jan;45(1):16-31.

Mesguich C, Fardanesh R, Tanenbaum L, Chari A, Jagannath S, Kostakoglu L. State of the art imaging of multiple myeloma: comparative review of FDG PET/CT imaging in various clinical settings. Eur J Radiol. 2014 Dec;83(12):2203-23

Treatment monitoring

Fitzgerald JJ, Roberts CC, Daffner RH, et al. ACR appropriateness criteria on follow-up of malignant or aggressive musculoskeletal tumors. Revised 2011.

Garner HW, Kransdorf MJ, Bancroft LW, Peterson JJ, Berquist TH, Murphey MD. Benign and malignant soft-tissue tumors: posttreatment MR imaging. Radiographics 2009; 29(1): 119-134.

Zbojniewicz Am, Sorger JI. Posttreatment imaging of pediatric musculoskeletal tumors. Radiographics 2014; 34(3): 724-740.

Chalian H, Töre HG, Horowitz JM, Salem R, Miller FH, Yaghmai V. Radiologic assessment of response to therapy: comparison of RECIST versions 1.1 and 1.0. Radiographics 2011; 31(7): 2093-105.

TOXIC/METABOLIC DISEASE

Smith SE, Murphey MD, Motamedi K, Mulligan ME, Resnik CS, Gannon FH. From the archives of the AFIP. Radiologic spectrum of Paget disease of bone and its complications with pathologic correlation. Radiographics 2002; 22(5): 1191–1216. doi:10.1148/radiographics.22.5.g02se281191

Murphey MD, Foreman KL, Klassen-Fischer MK, Fox MG, Chung EM, Kransdorf MJ. From the radiologic pathology archives imaging of osteonecrosis: radiologic-pathologic correlation. Radiographis 2014; 34: 1003-1028. doi: 10.1148/rg.344140019

Ihde LL, Forrester DM, Gottsegen CJ, et al. Sclerosing Bone Dysplasias: Review and Differentiation from Other Causes of Osteosclerosis. RadioGraphics. 2011;31(7):1865-82. doi: http://dx.doi.org/10.1148/rg.317115093

Ejindu VC, Hine AL, Mashayekhi M, Shorvon PJ, Misra RR. Musculoskeletal manifestations of sickle cell disease. Radiographics 2007; 27(4): 1005–21. doi:10.1148/rg.274065142

Guglielmi G, Muscarella S, Bazzocchi A. Integrated Imaging Approach to Osteoporosis: State-of-the-Art Review and Update. RadioGraphics. 2011;31(5):1343-64. doi: http://dx.doi.org/10.1148/rg.315105712

Sidhu HS, Venkatanarasimha N, Bhatnagar G, Vardhanabhuti V, Fox BM, Suresh SP. Imaging Features of Therapeutic Drug–induced Musculoskeletal Abnormalities. RadioGraphics. 2012;32(1):105-27. Doi: http://dx.doi.org/10.1148/rg.321115041

MARROW IMAGING

Kung JW, Yablon CM, Eisenberg RL. Bone marrow signal alteration in the extremities. AJR Am J Roentgenol 2011; 196: W492-W510. doi: 10.2214/AJR.10.4961

Long SS, Yablon CM, Eisenberg RL. Bone marrow signal alteration in the spine and sacrum. AJR Am J Roentgenol 2010; 195(3): W178–200. doi:10.2214/AJR.09.4134

Murphy DT, Moynagh MR, Eustace SJ, Kavanagh EC. Bone marrow. Magnetic resonance imaging clinics of North America. 2010;18(4):727-35. doi: 10.1016/j.mric.2010.07.003

Dietrich O, Biffar A, Reiser MF, Baur-Melnyk A. Diffusion-weighted imaging of bone marrow. Seminars in musculoskeletal radiology2009; p. 134-44. doi: 10.1055/s-0029-1220884

Disler DG, McCauley TR, Ratner LM, Kesack CD, Cooper JA. In-phase and out-of-phase MR imaging of bone marrow: prediction of neoplasia based on the detection of coexistent fat and water. American Journal of Roentgenology. 1997;169(5):1439-47.

Berg BCV, Malghem J, Lecouvet FE, Maldague B. Magnetic resonance imaging of the normal bone marrow. Skeletal radiology. 1998;27(9):471-83.

SPORTS AND INTERNAL DERANGEMENT

SHOULDER

Shoulder US: anatomy, technique, and scanning pitfalls.
Jacobson JA. Radiology. 2011 Jul;260(1):6-16.

Shoulder MR imaging normal variants and imaging artifacts.
Fitzpatrick D, Walz DM. Magn Reson Imaging Clin N Am. 2010 Nov;18(4):615-32.

MR imaging of rotator cuff injury: what the clinician needs to know.
Morag Y, Jacobson JA, Miller B, De Maeseneer M, Girish G, Jamadar D.
Radiographics. 2006 Jul-Aug;26(4):1045-65.

Superior labral anteroposterior lesions of the shoulder: part 1, anatomy and anatomic variants.
Modarresi S, Motamedi D, Jude CM. AJR Am J Roentgenol. 2011 Sep;197(3):596-603.

Superior labral anteroposterior lesions of the shoulder: part 2, mechanisms and classification.
Modarresi S, Motamedi D, Jude CM. AJR Am J Roentgenol. 2011 Sep;197(3):604-11.

Beyond the Cuff: MR Imaging of Labroligamentous Injuries in the Athletic Shoulder.
Roy EA, Cheyne I, Andrews GT, Forster BB. Radiology. 2016 Feb;278(2):316-32.

Imaging of shoulder instability. Walz DM, Burge AJ, Steinbach L. Semin Musculoskelet Radiol. 2015 Jul;19(3):254-68.

Upper extremity neuromuscular injuries in athletes. Demertzis JL1, Rubin DA. Semin Musculoskelet Radiol. 2012 Sep;16(4):316-30.

Review. The Rotator Interval: A Review of Anatomy, Function, and Normal and Abnormal MRI Appearance. Catherine N. Petchprapa, Luis S. Beltran, Laith M. Jazrawi, Young W. Kwon, James S. Babb, Michael P. Recht. American Journal of Roentgenology. 2010;195:567-576.

Postoperative MRI of the shoulder. Beltran LS1, Bencardino JT, Steinbach LS. J Magn Reson Imaging. 2014 Dec;40(6):1280-97.

ELBOW

Normal MR imaging anatomy of the elbow.
Fowler KA, Chung CB. Radiol Clin North Am. 2006 Jul;44(4):553-67, viii.

Elbow magnetic resonance imaging variants and pitfalls.
Sampaio ML, Schweitzer ME. Magn Reson Imaging Clin N Am. 2010 Nov;18(4):633-42.

Nerve entrapment syndromes of the elbow, forearm, and wrist.
Miller TT, Reinus WR. AJR Am J Roentgenol. 2010 Sep;195(3):585-94.

US of the elbow: indications, technique, normal anatomy, and pathologic conditions.
Konin GP, Nazarian LN, Walz DM. Radiographics. 2013 Jul-Aug;33(4):E125-47.

MR imaging of the elbow in the injured athlete.
Wenzke DR. Radiol Clin North Am. 2013 Mar;51(2):195-213.

Elbow Imaging in Sport: Sports Imaging Series.
Bucknor MD, Stevens KJ, Steinbach LS. Radiology. 2016 Apr;279(1):12-28.

MR imaging of the elbow in baseball pitchers. Ouellette H, Bredella M, Labis J, Palmer WE, Torriani M. Skeletal Radiol. 2008 Feb;37(2):115-21.

Magnetic Resonance Arthrography of the Wrist and Elbow. LiMarzi GM, O'Dell MC, Scherer K, Pettis C, Wasyliw CW, Bancroft LW. Magn Reson Imaging Clin N Am. 2015 Aug;23(3):441-55.

Epicondylitis: pathogenesis, imaging, and treatment. Walz DM, Newman JS, Konin GP, Ross G. Radiographics. 2010 Jan;30(1):167-84.

HAND AND WRIST

Sookur PA, Naraghi AM, Bleakney RR, Jalan R, Chan O, White LM. Accessory Muscles: Anatomy, symptoms and radiologic evaluation. Radiographics. 2008;28(2).

Imaging key wrist ligaments: what the surgeon needs the radiologist to know.
Bateni CP1, Bartolotta RJ, Richardson ML, Mulcahy H, Allan CH. AJR Am J Roentgenol. 2013 May;200(5):1089-95.

Pitfalls of wrist MR imaging.
Malone WJ, Snowden R, Alvi F, Klena JC.
Magn Reson Imaging Clin N Am. 2010 Nov;18(4):643-62.

Extensor mechanism of the fingers: MR imaging-anatomic correlation.
Clavero JA, Golanó P, Fariñas O, Alomar X, Monill JM, Esplugas M.
Radiographics. 2003 May-Jun;23(3):593-611.

MR imaging of ligament and tendon injuries of the fingers.
Clavero JA, Alomar X, Monill JM, Esplugas M, Golanó P, Mendoza M, Salvador A.

Radiographics. 2002 Mar-Apr;22(2):237-56. Review.

MRI of the thumb: anatomy and spectrum of findings in asymptomatic volunteers. Hirschmann A, Sutter R, Schweizer A, Pfirrmann CW. AJR Am J Roentgenol. 2014 Apr;202(4):819-27.

Gamekeeper's Thumb-A Treatment-Oriented Magnetic Resonance Imaging Classification. Milner CS, Manon-Matos Y, Thirkannad SM. J Hand Surg Am. 2015;40(1):90-95.

Gamekeeper thumb: diagnosis of ulnar collateral ligament injury using magnetic resonance imaging, magnetic resonance arthrography and stress radiography. Harper MT, Chandnani VP, Spaeth J, Santangelo JR, Providence BC, Bagg MA. J Magn Reson Imaging. 6(2):322-328.

Pitfalls that may mimic injuries of the triangular fibrocartilage and proximal intrinsic wrist ligaments at MR imaging. Burns JE, Tanaka T, Ueno T, Nakamura T, Yoshioka H. Radiographics. 2011 Jan-Feb;31(1):63-78.

MRI features of intersection syndrome of the forearm. Costa CR, Morrison WB, Carrino JA. AJR Am J Roentgenol. 2003 Nov;181(5):1245-9

Midcarpal instability: a radiologic perspective. Toms A, Chojnowski, et al. Skeletal Radiol 2011;40:533-541.

Multimodality Imaging of Peripheral Neuropathies of the Upper Limb and Brachial Plexus. Linda D, Harish S, Stewart B, Finlay K, Parasu N, Rebello R. Radiographics 2010; 30:1373-1400

HIP

Acetabular labrum. Magn Reson Imaging Clin N Am. 2013 Feb;21(1):21-33.
Blankenbaker DG1, Tuite MJ.

MR Imaging of the Hip: Normal Anatomic Variants and Imaging Pitfalls
DuBois, David F. et al. Magnetic Resonance Imaging Clinics , Volume 18 , Issue 4 , 663 - 674

Pediatric hip: pearls and pitfalls. Semin Musculoskelet Radiol. 2013 Jul;17(3):328-38.
Gill KG.

Femoroacetabular impingement: fact, fiction, or fantasy? AJR Am J Roentgenol. 2013 Sep;201(3):526-34. Rubin DA.

The Spectrum of MR Imaging in Athletic Pubalgia
Zoga, Adam C. et al. Radiologic Clinics , Volume 48 , Issue 6 , 1179 - 1197

KNEE

MR imaging-based diagnosis and classification of meniscal tears. Radiographics. 2014 Jul-Aug;34(4):981-99. Nguyen JC, De Smet AA, Graf BK, Rosas HG.

MR Imaging of Cruciate Ligaments
Naraghi, Ali et al. Magnetic Resonance Imaging Clinics , Volume 22 , Issue 4 , 557 - 580

Posterolateral and Posteromedial Corner Injuries of the Knee. Daniel Geiger, Eric Y. Chang, Mini N. Pathria, Christine B. Chung. Magnetic Resonance Imaging Clinics, Vol. 22, Issue 4, p581–599

MR Imaging of Extrasynovial Inflammation and Impingement About the Knee
Grando, Higor et al. Magnetic Resonance Imaging Clinics , Volume 22 , Issue 4 , 725 - 741

Magnetic Resonance Imaging of the Postoperative Meniscus
Boutin, Robert Downey et al. Magnetic Resonance Imaging Clinics , Volume 22 , Issue 4 , 517 - 555

Magnetic Resonance Imaging of Cartilage Repair Procedures
Michael C. Forney, Amit Gupta, Tom Minas, Carl S. Winalski
Magnetic Resonance Imaging Clinics, Vol. 22, Issue 4, p671–701

The Collateral Ligaments and Posterolateral Corner: What Radiologists Should Know.Semin Musculoskelet Radiol. 2016 Feb;20(1):52-64. Vasilevska Nikodinovska V1, Gimber LH2, Hardy JC3, Taljanovic MS2.

FOOT/ANKLE

Normal Magnetic Resonance Imaging Anatomy of the Ankle & Foot
Arnold, George et al. Magnetic Resonance Imaging Clinics , Volume 19 , Issue 3 , 655 - 679

Normal variants and pitfalls in MR imaging of the ankle and foot.Gyftopoulos S, Bencardino JT. Magn Reson Imaging Clin N Am. 2010 Nov;18(4):691-705.

US and MR imaging of the extensor compartment of the ankle.
Ng JM1, Rosenberg ZS, Bencardino JT, Restrepo-Velez Z, Ciavarra GA, Adler RS. Radiographics. 2013 Nov-Dec;33(7):2047-64.

Spring Ligament Complex and Posterior Tibial Tendon: MR Anatomy and Findings in Acquired Adult Flatfoot Deformity. Mengiardi B, Pinto C, Zanetti M. Semin Musculoskelet Radiol. 2016 Feb;20(1):104-15.

Dynamic high-resolution US of ankle and midfoot ligaments: normal anatomic structure and imaging technique. Sconfienza LM, Orlandi D, Lacelli F, Serafini G, Silvestri E.

Radiographics. 2015 Jan-Feb;35(1):164-78.

Plantar tendons of the foot: MR imaging and US. Donovan A1, Rosenberg ZS, Bencardino JT, Velez ZR, Blonder DB, Ciavarra GA, Adler RS. Radiographics. 2013 Nov-Dec;33(7):2065-85.

Evaluation of the tarsometatarsal joint using conventional radiography, CT, and MR imaging. Siddiqui NA, Galizia MS, Almusa E, Omar IM. Radiographics. 2014 Mar-Apr;34(2):514-31.

Medial Collateral Ligament Complex of the Ankle: MR Imaging Anatomy and Findings in Medial Instability. Mengiardi B, Pinto C, Zanetti M. Semin Musculoskelet Radiol. 2016 Feb;20(1):91-103.

Prosthesis

General

Koff MF, Shah P, Potter HG. Clinical implementation of MRI of joint arthroplasty. AJR Am J Roentgenol 2014; 203(1): 154-161. doi: 10.2214/AJR.13.11991

Hip

Mulcahy H, Chew FS. Current concepts of hip arthroplasty for radiologists: part 1, features and radiographic assessment. AJR Am J Roentgenol 2012; 199(3): 559-569. doi: 10.2214/AJR.12.8843

Mulcahy H, Chew FS. Current concepts of hip arthroplasty for radiologists: part 2, revisions and complication. AJR Am J Roentgenol 2012; 199(3): 570-580. doi: 10.2214/AJR.12.8844

Carli A, Jerabek S. Principles of design and fixation. Semin Musculoskelet Radiol. 2015 Feb;19(1):3-11. doi: 10.1055/s-0034-1396762

Chang CY, Huang AJ, Palmer WE. Radiographic evaluation of hip implants. Semin Musculoskelet Radiol. 2015 Feb;19(1):12-20. doi: 10.1055/s-0034-1396763

Hayter CL, Gold SL, Koff MF, Perino G, Nawabi DH, Miller TT, Potter HG. MRI findings in painful metal-on-metal hip arthroplasty. AJR Am J Roentgenol 2012; 199(4): 884-893.

Fritz J, Lurie B, Miller TT, Potter HG. MR imaging of hip arthroplasty implants. Radiographics. 2014 Jul-Aug;34(4):E106-32. doi: 10.1148/rg.344140010

Maloney E, Ha AS, Miller TT. Imaging of adverse reactions to metal debris. Semin Musculoskelet Radiol. 2015 Feb;19(1):21-30. doi: 10.1055/s-0034-1396764

Burge AJ. Total hip arthroplasty: MR imaging of complications unrelated to metal wear. Semin Musculoskelet Radiol. 2015 Feb;19(1):31-9. doi:10.1055/s-0034-139676

Knee

Mulcahy H, Chew FS. Current concepts in knee replacement: features and imaging assessment. AJR Am J Roentgenol 2013; 201(6): W828-842. doi: 10.2214/AJR.13.11307

Mulcahy H, Chew FS. Current concepts in knee replacement: complications. AJR Am J Roentgenol 2014; 202(1): W76-86. doi: 10.2214/AJR.13.11308

Fritz J, Lurie B, Potter HG. MR Imaging of Knee Arthroplasty Implants. Radiographics. 2015 Sep-Oct;35(5):1483-501. doi: 10.1148/rg.2015140216.

Sneag DB, Bogner EA, Potter HG. Magnetic resonance imaging evaluation of the

painful total knee arthroplasty. Semin Musculoskelet Radiol. 2015 Feb;19(1):40-8. doi: 10.1055/s-0034-1396766.

Li AE, Sneag DB, Miller TT, Lipman JD, Padgett DE, Potter HG. MRI of Polyethylene Tibial Inserts in Total Knee Arthroplasty: Normal and Abnormal Appearances. AJR Am J Roentgenol. 2016 Jun;206(6):1264-71. doi:10.2214/AJR.15.15107.

Li AE, Sneag DB, Greditzer HG 4th, Johnson CC, Miller TT, Potter HG. Total Knee Arthroplasty: Diagnostic Accuracy of Patterns of Synovitis at MR Imaging. Radiology. 2016 May 27:152828

Shoulder

Petscavage JM, Ha AS, Chew FS. Current concepts of shoulder arthroplasty for radiologists: Part 1—epidemiology, history, preoperative image, and hemiarthroplasty. AJR Am J Roentgenol 2012; 199(4): 757-767.

Ha AS, Petscavage JM, Chew FS. Current concepts of shoulder arthroplasty for radiologists: Part 2—anatomic and reverse total shoulder replacement and nonprosthetic resurfacing. AJR Am J Roentgenol 2012; 199(4): 768-776.

Roberts CC, Ekelund AL, Renfree KJ, Liu PT, Chew FS. Radiologic assessment of reverse shoulder arthroplasty. Radiographics 2007; 27(1): 223-235.

Konin GP. Imaging of shoulder arthroplasty. Semin Musculoskelet Radiol. 2015 Feb;19(1):49-59. doi: 10.1055/s-0034-1396767

Nwawka OK, Konin GP, Sneag DB, Gulotta LV, Potter HG. Magnetic resonance imaging of shoulder arthroplasty: review article. HSS J. 2014 Oct;10(3):213-24. doi: 10.1007/s11420-014-9399-3.

Elbow

Petscavage JM, Ha AS, Chew FS. Radiologic review of total elbow, radial head, and capitellar resurfacing arthroplasty. Radiographics 2012; 32(1): 129-149.

Roth E, Chew FS. Imaging of elbow replacement arthroplasty. Semin Musculoskelet Radiol. 2015 Feb;19(1):60-6. doi: 10.1055/s-0034-1396768

Ankle

Bestic JM, Peterson JJ, DeOrio JK, Bancroft LW, Berquist TH, Kransdorf MJ. Postoperative evaluation of total ankle arthroplasty. AJR Am J Roentgenol 2008; 190(4): 1112-1123. doi: 10.2214/AJR.07.2729

LiMarzi GM, Fursevich DM, Cole JD, Wasyliw CW, Bancroft LW. Imaging of ankle replacements. Semin Musculoskelet Radiol. 2015 Feb;19(1):67-76. doi:10.1055/s-0034-1396769

SPINE

Normal Spinal Anatomy on Magnetic Resonance Imaging. Gaurav Jindal, Bryan Pukenas
Magnetic Resonance Imaging Clinics, Vol. 19, Issue 3, p475–488

Basic aspects in MR imaging of degenerative lumbar disk disease.
Heuck A1, Glaser C1. Semin Musculoskelet Radiol. 2014 Jul;18(3):228-39.

Magnetic Resonance Imaging of Spinal Emergencies
Daniel Kawakyu-O'Connor, Ritu Bordia, Refky Nicola
Magnetic Resonance Imaging Clinics, Vol. 24, Issue 2, p325–344

Lumbosacral transitional vertebrae: classification, imaging findings, and clinical relevance.
Konin GP1, Walz DM. AJNR Am J Neuroradiol. 2010 Nov;31(10):1778-86.

INTERVENTIONAL MSK PROCEDURES

Emergency joint aspiration: a guide for radiologists on call. Lin HM, Learch TJ, White EA, Gottsegen CJ. Radiographics. 2009 Jul-Aug;29(4):1139-58.

Fundamentals of Joint Injection. Rastogi AK, Davis KW, Ross A, Rosas HG. AJR Am J Roentgenol. 2016 Jun 8:1-11.

Ultrasound-Guided Percutaneous Tendon Treatments. Burke CJ, Adler RS. AJR Am J Roentgenol. 2016 Sep;207(3):495-506. doi: 10.2214/AJR.16.16089.

Musculoskeletal applications of platelet-rich plasma: fad or future? Lee KS, Wilson JJ, Rabago DP, Baer GS, Jacobson JA, Borrero CG. AJR Am J Roentgenol. 2011 Mar;196(3):628-36. doi:

Musculoskeletal Ultrasound: How to Treat Calcific Tendinitis of the Rotator Cuff by Ultrasound-Guided Single-Needle Lavage Technique. Kenneth S. Lee, Humberto G. Rosas. American Journal of Roentgenology. 2010;195:W213.

Anatomically based guidelines for core needle biopsy of bone tumors: implications for limb-sparing surgery. Liu PT, Valadez SD, Chivers FS, Roberts CC, Beauchamp CP. Radiographics. 2007 Jan-Feb;27(1):189-205

Image-guided biopsy and treatment of musculoskeletal tumors. Hillen TJ, Baker JC, Jennings JW, Wessell DE. Semin Musculoskelet Radiol. 2013 Apr;17(2):189-202.

CT-guided biopsy of bone: a radiologist's perspective. Espinosa LA, Jamadar DA, Jacobson JA, DeMaeseneer MO, Ebrahim FS, Sabb BJ, Kretschmer MT, Biermann JS, Kim SM. AJR Am J Roentgenol. 2008 May;190(5):W283-9. doi: 10.2214/AJR.07.3138

Interventional procedures of the spine. Santiago FR, Kelekis A2, Alvarez LG, Filippiadis DK. Semin Musculoskelet Radiol. 2014 Jul;18(3):309-17.

Particulate versus non-particulate steroids for lumbar transforaminal or interlaminar epidural steroid injections: an update. Dietrich TJ, Sutter R, Froehlich JM, Pfirrmann CW. Skeletal Radiol. 2015 Feb;44(2):149-55.

Nwawka OK, Miller TT. Common US-guided Peripheral Nerve Injections. AJR Am J Roentgenol. 2016 Sep;207(3):507-16

PHYSICS

CT

Lewis M, Reid K, Toms AP. Reducing the effects of metal artefact using high keV monoenergetic reconstruction of dual energy CT (DECT) in hip replacements. Skeletal Radiology. 2013;42(2):275-82. DOI: 10.1007/s00256-012-1458-6

Coupal TM, Mallinson PI, McLaughlin P, Nicolaou S, Munk PL, Ouellette H. Peering through the glare: using dual-energy CT to overcome the problem of metal artefacts in bone radiology. Skeletal Radiol. 2014;43(5):567-75. doi: 10.1007/s00256-013-1802-5

Tamm EP, Rong XJ, Cody DD, Ernst RD, Fitzgerald NE, Kundra V. Quality initiatives: CT radiation dose reduction: how to implement change without sacrificing diagnostic quality. Radiographics 2011; 31(7): 1823-1832. doi: 10.1148/rg.317115027

MRI

Boyle GE, Ahern M, Cooke J, Sheehy NP, Meaney JF. An Interactive Taxonomy of MR Imaging Sequences. RadioGraphics. 2006;26(6):e24-e. DOI: http://dx.doi.org/10.1148/rg.e24

Kim Y-J. Novel cartilage imaging techniques for hip disorders. Magnetic resonance imaging clinics of North America. 2013;21(1):35-44.

Lee M-J, Kim S, Lee S-A, et al. Overcoming Artifacts from Metallic Orthopedic Implants at High-Field-Strength MR Imaging and Multi-detector CT 1. Radiographics. 2007;27(3):791-803. DOI: http://dx.doi.org/10.1148/rg.273065087

US

Jacobson JA. Musculoskeletal Ultrasound: Focused Impact on MRI. American Journal of Roentgenology. 2009;193(3):619-27. DOI:10.2214/AJR.09.2841

Gimber LH, Melville DM, Klauser AS, Witte RS, Arif-Tiwari H, Taljanovic MS. Artifacts at Musculoskeletal US: Resident and Fellow Education Feature. RadioGraphics. 2016;36(2):479-80. DOI: http://dx.doi.org/10.1148/rg.2016150200

Khoury V, Cardinal É, Bureau NJ. Musculoskeletal Sonography: A Dynamic Tool for Usual and Unusual Disorders. American Journal of Roentgenology. 2007;188(1):W63-W73. DOI:10.2214/AJR.06.0579

General

Don S, Whiting BR, Rutz LJ, Apgar BK. New exposure indicators for digital radiography simplified for radiologists and technologists. AJR 2012; 199: 1337-1341. doi: 10.2214/AJR.12.8678

Revised: February 2017/ttm

DIVISION OF NEURORADIOLOGY

Section Chief:

- Achint Singh, MD; Associate Professor
  SinghAK@uthscsa.edu
  P: (210) 567-3448

Section Faculty:

- Carlos Bazan, III, MD; Professor
- Jason Lally, MD; Assistant Professor
- Dr. Bundhit Tantiwongkosi, MD, Professor
- Dr. Nirav Das, MD, Assistant Professor
- Dr. Zachary Fulton, MD, Assistant Professor
- Venkatesh J. Kadaba, DO; Assistant Professor
- Pavel Rodriguez, MD, Ph.D.; Assistant Professor

Fellows: AY 2021-2022

- Daniel Vargas, MD

Fellowship Academic Programs Coordinator:

- Stephanie Navarro
  NavarroSB@uthscsa.edu
  P: (210) 567-5563

Clinical Administrative Assistant:

- Cheryl P. Howard; Division Head, Clinical Administration
  portenier@uthscsa.edu
  P: (210) 567-3448

UT Health San Antonio Radiology

Neuroradiology Section Educational Goals

First year Resident:

I. Knowledge of basic neuroanatomy and basic pathology
   a. Brain & Covering
   b. Spine
   c. Head & Neck

II. Knowledge of Imaging Modalities
   a. MRI
      1. Basic MRI concepts
      2. Contrast agents
      3. MRI safety considerations
   b. CT
      1. Basic CT concepts
      2. Radiation CT safety concepts
      3. Imaging Techniques

III. Knowledge of Interventional principles and procedures

Second year Resident:

I. General knowledge of neuroanatomy, specific neuro pathology and basic procedure protocols
II. Knowledge of Imaging modalities

Third year Resident:

I. Knowledge of neuroanatomy, advanced neuropathology, and procedure protocols
II. Advanced knowledge of imaging modalities and principles

Fourth year Resident:

Advanced knowledge of neuroanatomy, neuropathology, and procedure protocols

Supervisory Lines of Responsibilities *

First year Residents: Observation, assistance and participation in procedures; dictation of cases; participation in teaching conferences

Second year Residents: Assistance and participation in procedures; dictations of simple and complex cases; participation in teaching conferences

Third year Residents: Assistance and participation in all procedures; all dictation; participation in teaching conferences

Fourth year Residents: Participation in all procedures; all dictations; participation in teaching conferences

* All neuroradiologic imaging studies will be reviewed with a staff neuroradiologist before final dictation is released. Neuroradiologic procedures will be supervised by a staff neuroradiologist.

CONFERENCES

NOON NEURORADIOLOGY Case Presentations (Monthly)	1st Tuesday 12-1 PM UTHSCSA, 626F - CONF. ROOM
NEURORADIOLOGY Didactic Lecture Series (March/April)	Monday, Wednesday, Friday 12:45 – 12:45 UTHSCSA, 626F – CONF. ROOM
NEUROLOGY GRAND ROUNDS (Monthly)	2nd Friday 9 AM – 10:30 AM AUDITORIM
Epilepsy CONFERENCE (Weekly)	Wednesday 3-4 PM ALTC
ENDOCRINOLOGY PITUITARY CONF. (Monthly)	1ST Thursday 4:30 PM – 5:30 PM UTHSC, NEUROSURGERY CONF RM
Tumor Board (Biweekly)	2ND and 4th Friday 8:30 AM – 9:30 AM NEUROSURGERY CONF RM
MORNING NEURORADIOLOGY Case Presentation (Weekly)	Thursday 7:30 AM – 8 AM
Spine Meeting (Monthly)	FRIDAY 7-8 AM UTHSC, NEUROSURGERY CONF RM
Ear, Nose, Throat Meeting (Weekly)	Tuesday 7 AM – 8 AM MARC

NEURORADIOLOGY RESIDENT RESPONSIBILITIES

1. Prompt attendance at all neuroradiology reading sessions is required.
   a. Attendance is required at 8 AM sharp or 7:00 on conference days
   b. If a resident is late by 10-15 minutes on a few occasions then it may be fine but consistently late by 10-15 minutes will not be permitted

2. One resident is responsible for all procedures on a particular day. They should take care of the phone calls about the procedures, setting the procedure up and consent. Instructions will be given at the beginning of the rotation about how to handle these procedures. Each special procedure will be performed by the neuroradiology resident and supervised by the staff neuroradiologist.

3. The procedure resident should call the Fluoro room at 8-2737 every day to confirm the scheduled procedures for that day.

4. All procedure exams should be discussed in detail with the staff neuroradiologist before undertaking the study. Knowledge of all prior imaging studies as well as the clinical findings are mandatory. A post-procedure note is mandatory in Sunrise within 30 minutes of completion of the procedure.

5. All exams should be reviewed prior to final read-out with the staff neuroradiologist.

6. The NR Resident should share interesting cases with the other residents on a routine basis in the reading room.

7. The resident is expected to review the teaching material that is already in existence. A powerpoint is located in the shared drive:

S:\Radiology\RadChiefresidetn\Radiologycasesdatabase\neuro

The residents are expected to add interesting cases in this powerpoint with a few salient points.

8. Research projects are encouraged after general proficiency has been demonstrated by the resident.

NEURO CT

GUIDELINES FOR DETERMINING WHETHER OR NOT TO USE CONTRAST

A. CATEGORY 1: INDICATIONS FOR NON-CONTRAST SCAN

1. Sudden patient deterioration: tumor with hemorrhage, spontaneous hemorrhage (AVM, aneurysm, etc.).
2. Trauma
3. Stroke to R/O hemorrhage
4. Immediate post-op to R/O hemorrhage
5. Hydrocephalus (i.e. shunt, s/p SAH)
6. Spine + other bony studies (i.e. HNP, stenosis, most paranasal sinuses, facial bones, trauma)
7. Known contrast allergy (possible)
8. Renal failure, Diabetes, Cardiac disease
9. Very elderly, very fragile, very ill
10. Unknown history
11. Patient refused contrast

B. CATEGORY II: CONTRAST ONLY SCAN

1. Tumor follow-up without recent patient deterioration
2. Subacute, chronic onset seizures, dizziness, papilledema, headaches, fainting

C. CATEGORY III: DOUBLE DOSE STUDIES (OCCASIONAL USE)

1. Multiple sclerosis
2. Metastases-to evaluate for multiple, small lesions

D. CATEGORY IV: WITH AND WITHOUT CONTRAST

1. Immediately post-op to assess for residual tumor
2. Acute hemorrhage to find cause
3. Selected difficult diagnostic problems clinically
4. Some cord tumors and spinal inflammatory conditions
5. Post-op Spines
6. Any case where blood and/or calcifications are known to be present by prior imaging study

MAGNETIC RESONANCE IMAGING

MRI has become the modality of choice for evaluating most CNS lesions in elective situations. What advantage does MRI possess that have made it such a powerful tool for investigating CNS problems?

1. Compared to CT, MRI has much better contrast resolution. MRI is more sensitive to subtle differences in tissue types as well as chemical states. Lesions which may be questionable on CT are often dramatically obvious on MRI. The presence of normally occurring iron in some nuclei (substantia nigra, red nucleus, dentate nucleus, globus pallidus, and putamen) results in their routine demonstration during MRI brain examinations. This is especially so on T2 weighted images which are more sensitive to the local field inhomogeneity caused by the presence of iron.

2. CT has limited ability to obtain direct images in multiple planes and CT reformatted coronal and sagittal images have not had the high resolution of direct axial images. Direct multiplanar images are easily and routinely obtained with MN. Sagittal images can demonstrate certain structures to better advantage than axial images (aqueduct, hypothalamus, pituitary stalk, craniocervical junction, etc.).

3. Beam hardening artifacts through the posterior fossa which degrade CT images are not a problem with MRI. MRI routinely produces exquisite images of the posterior fossa. The rhomboid shaped medulla is clearly seen especially on axial T2 weighted images where it is outlined by bright CSF. The junction of the belly of the pons with the medulla and midbrain is clearly depicted on sagittal images. The tectal plate is seen to good advantage on sagittal images.

These three factors have allowed MRI to replace CT in most cranial imaging situations. In addition coupled with an intravenously administered paramagnetic gadolinium contrast agent, MRI has greater sensitivity than CT for detecting disruptions in the blood-CNS barrier. This increased sensitivity coupled with multiplanar capabilities greatly enhances our ability to precisely localize lesions for diagnosis and/or surgical resection.

However, there are a few serious disadvantages associated with MRI. Limited availability may produce delays and backlogs in patient scheduling. Patient motion can make even the best MR system's images uninterpretable. Acutely ill or injured patients are often unstable. Monitoring such patients inside the magnet is difficult, and resuscitation in the magnet room quite a challenge. For many patients claustrophobia is a real problem that may require patient sedation or cancellation of the scheduled MR examination. Careful screening for intracranial aneurysm clips, pacemakers, and intraocular foreign bodies is essential. CT remains extremely important in many urgent situations where MRI may be impractical in spite of MRI'S inherently superior images.

MR as it is generally configured today images hydrogen protons. In the brain the majority of the signal produced comes from hydrogen in water. Hydrogen in lipids can resonate and produce signal such as fat in the orbit, scalp, and bone marrow. Lipid forms 6% of gray matter and 16% of white matter. These lipid hydrogen protons are found in myelin, a complex lipoprotein. The heterogeneous local environment of myelin results in very rapid resonance decay of the hydrogen protons so that they produce minimal signal. The hydrogen in water is left to produce most of the useful imaging signal from the brain.

Most pathologic conditions found in the brain result in, increased water, either in the lesion matrix or the edema produced by the lesion. MRI is very sensitive in detecting this increased water content. T1 and T2 will both be lengthened by the increased water. On Tl weighted images (short TR, short TE) lesions will have less signal compared to unaffected brain tissue. On T2 weighted images (long TR, long TE) they will have increased signal making the lesions look bright. As a rule, lesions will be more conspicuous on T2 weighted images where they are brighter than on Tl weighted images where the reduced signal may not be so readily evident. Some lesions have characteristic signal appearances.

Meningiomas are usually isointense with gray matter on T1, proton density (long TR, short TE) and T2 weighted sequences. However, since most lesions result in increased water, signal characteristics tend to be similar for a wide variety of lesions. Differentiating between various disease processes usually depends on lesion location, lesion morphology, and of course clinical history.

MYELOGRAPHY

It is important to clearly understand the clinical indications for myelography so planning the procedure can be directed to answer the specific clinical questions of greatest importance. It is not always possible to evaluate every portion of the spine with equal accuracy. Therefore, focusing the exam to the specific level of suspected abnormality is important.

INDICATIONS AND CONTRAINDICATIONS

In most instances the indications for the exam are clear-cut and are related to evaluation of the patient with disc protrusion or a known metastatic tumor. There are a number of patients though who will have little in the way of symptoms and only a history suggesting a problem. These patients should be studied if clinical suspicion is high. If you have questions about the necessity of the exam, feel free to recruit the expertise of the neurologist and the neurosurgeon in the evaluation of the patients, particularly if the exam is referred to you by other subspecialists who have less expertise in dealing with these problems. It is also important to communicate, particularly with the surgeons, prior to the exam so that specific information can be made available to them to help surgical planning.

There is no absolute contraindication to the studies. In most instances lumbar/cervical spinal taps are contraindicated in patients with known increase in intracranial pressure. We still use water soluble agents in patients with seizures if they are adequately covered. Of course, avoid a specific contrast agent if the patient has a known allergy to it. Overall, myelography and cisternography are exceedingly safe procedures and can be completed on essentially all patients.

When doing a study, it is always recommended that a number of scout films/images be taken. Always review the scout films/images in detail to help localize the level of the abnormality. They can also be used to help plan your exam, whether you make a C 1-2 tap or a lumbar puncture. Another important thing to note from the plain films/images is the curvature of the spine, since the location of the contrast will be dependent on this. For example, if the patient has a reversed lordotic curve, you cannot do a regular prone cervical myelogram. The contrast will either spill into the head or the thoracic region unless you do the patient supine.

BASIC PRINCIPLES

Generally, it is best to make your site of injection of contrast, near but not exactly at the level of suspected pathology. In other words, if a cervical study is to be undertaken, a Cl-2 tap will probably work best. Avoid making the puncture exactly at the level in question. Do not perform an L4-5 puncture for an L4-5 herniated disc.

Before injecting a great deal of contrast, document that your needle is where you think it is by fluoroscopic observation. This is important since subdural myelograms are less than diagnostic and injection of contrast, particularly in the venous system, can be undesirable. Direct injection of contrast into the central nervous system is absolutely contraindicated.

Use as little contrast as possible since side effects and complications frequently are directly proportional to the total dose of contrast agent.

The location of the contrast agent will always follow the simple laws of gravity. The contrast will sink to the most dependent portion of the space in which you are studying. Therefore; changing the patient's position is the only way of specifically directing the contrast. Besides having the specific segment of the nervous system in a dependent position, it is important for the configuration of this segment to form a natural pool in which the contrast can be trapped, otherwise, it may extend above or below this level.

If you encounter difficulty moving the contrast from one level to another, particularly in patients with extensive degenerative disease or possible block, use the decubitus position as a substitute since it negates all of the other normal curvatures of the spine.

Complete evaluation at each level requested is essential. A minimum of an AP and Lateral films/images is essential. Obliques are also recommended.

When a spinal block is encountered, definition of both superior and inferior extent of the lesion is optimal since there may be multiple lesions. While pushing contrast by a block is often successful, sometimes a double level puncture may be necessary, introducing a radiographic contrast agent both above and below the block.

Computed tomography is used to supplement any finding seen on conventional myelography. Because of CT's greater contrast resolution, evaluation of regions above an apparent myelographic block may be possible since a small amount of contrast often seeps by. Never remove your needle until you are sure that you have a diagnostic study. You may need to inject more or a different type of contrast.

RECOMMENDATIONS FOR MYELOGRAPHY

LUMBAR
CONTRAST: OMNIPAQUE OR ISOVUE 300
VOLUME: 10 cc
FILMS: PA, LAT, OBLIQUES, AND CONUS VIEW

THORACIC
CONTRAST: ISOVUE or OMINIPAQUE 300
VOLUME: 10 CC
FILMS: AP, LAT, SWIMMER'S VIEW

CERVICAL
CONTRAST: ISOVUE OMNIPAQUE 300
VOLUME: 10 CC
FILMS: PA, LAT, SWIMMER'S VIEW, OBLIQUES

PRE MYELOGRAM
Progress note in chart Signed consent in chart

POST MYELOGRAM

Progress note with preliminary report ORDERS

1. Bed rest with head of bed elevated for 6 hours.
2. Vital signs Q 30 min x 4, Q l hr x 4, then routine.
3. Encourage PO fluids.
4. No phenothiazines for 24 hours.

GOALS AND EXPECTATIONS OF NEURORADIOLOGY ROTATION

FIRST YEAR AND/OR FIRST ROTATION

I. NEURORADIOLOGY EXAMINATION

1. Prior to: Indications & ACR appropriateness, Protocoling
2. During: Safety - contrast material, radiation dose; Quality - adequacy of images
3. Interpretation: Approach, Normal anatomy, Normal variants, & Pathology. (see below)
4. After: Reporting; Medicolegal considerations and responsibilities, including communicating results

II. TECHNIQUE, PHYSICS AND INDICATIONS

1. Understand the basic principles behind and indications for Radiological examinations-
    a. Radiography
    b. CT
        i. CT window and level settings, slice thickness, inter-slice gap
        ii. CT attenuation of normal and abnormal structures.
        iii. Dose measures for CT, i.e. CT dose index (CTDI) values, and strategies for radiation dose reduction.
        iv. Multiplanar Reformations and 3D reconstructions
    c. Contrast- Types of contrast media- identify risks and manage reactions
2. Recommended Supplement for call - **CT angiography & CT venography**

CT and CTA- helical imaging parameters i.e., pitch, and image reconstruction algorithms (e.g., MPR and 3D).

III. ANATOMY & NORMAL VARIANTS

1. Brain
    a. Cerebral lobes and surface anatomy, including identification of prominent sulci and gyri
    b. Basal ganglia and thalamus
    c. Brainstem and cranial nerves
    d. Pituitary and pineal glands
    e. Ventricles and basal cisterns
    f. Meninges
    g. Basic skull and skull base anatomy
    h. Vascular – cervical and intracranial- arterial and venous
    i. Normal variants, including vascular variants
2. Spine
    a. Osseous components
    b. Vertebral anatomy and differences between cervical, thoracic and lumbar spine
    c. Spinal canal and cord- intramedullary, intradural-extramedullary and extradural compartments
    d. Normal variants
3. Head and Neck
    a. Calvarium
    b. Anatomy of spaces of neck
    c. Salivary glands, thyroid
    d. Oral cavity and oropharynx, hypopharynx, laryngopharynx
    e. Lymph node levels
    f. Orbits- bony and ocular anatomy
    g. Sinus anatomy – turbinate and meatal anatomy, the osteomeatal unit (OMU) and normal drainage pathways of the paranasal sinuses
    h. Normal variants
4. Basic MR anatomy
    a.Brain
    b.Head & Neck
    c. Spine
    d. Normal MRI variants
5. CT Angiography and CT Venography

IV. INTERPRETATION APPROACH

1. Radiography
2. CT
3. Brain
4. ENT
5. Spine

V. BRAIN PATHOLOGY

1. Edema- cytotoxic (CVA) versus vasogenic (tumor, inflammation, infection), osmotic and interstitial

2. Stroke-

- ***a. Ischemic versus hemorrhagic***
- ***b. Arterial versus venous***
- ***c. Vascular distributions***
- ***d. Patterns of ischemic stroke***
- ***e. Early detection by CT***

3. Neoplasms-

- ***a. Single versus multiple***
- ***b. Primary versus secondary***
- ***c. Location: intra-axial versus extra-axial, gray or white matter, supra-versus infratentorial***
- ***d. Enhancement pattern***
- ***e. Pediatric versus adult***

4. Trauma-

- ***a. Fractures- calvarial, skull base, temporal bone***
- ***b. Hematomas-***

i. ***Extra-axial: Epidural (arterial and venous), Subdural (different ages)***
ii. ***Intra-axial: Contusions and shearing injury (grading)***

c. Non-accidental trauma

5. Hemorrhage

a. Blood Density evolution – expected evolution and variants

b. Type, by location – parenchymal, epidural, subdural, subarachnoid

c. Hemorrhagic transformation of infarcts- differentiation from contrast
d. Hypertensive bleeds- common sites
e. Differentiation of subdural from extradural blood
f. Hyperdense noncalcified lesions on CT
g. Calcified intraparenchymal lesions

6. Hydrocephalus-

a. Differentiate atrophy from hydrocephalus
b. Distinguish intraventricular vs extraventricular obstructive
c. Radiographic acuity/ compensation
d. Shunt types
e. Shunt follow up- ventricle size measurements
f. Complications of shunts- slit ventricle, shunt dependence, trapped ventricle

7. Brain herniation patterns
8. Calcifications- physiologic versus pathologic, causes
9. Postoperative findings on CT
10. Vascular disorders –

a. Aneurysms, arterio venous malformations
b. dissection,
c. thrombosis (arterial and venous)
d. NASCET criteria

VI. SPINE PATHOLOGY

1. Trauma-
   a. Stable versus unstable fractures
   b. Compression, burst and chance fractures
   c. Fracture patterns and associated injuries
   d. Spondylolysis and Spondylolisthesis
2. Post-operative spine- x-rays & CTs for assessment of hardware, alignment
3. Spinal Hemorrhage-
   a. Epidural
   b. Subdural
   c. Subarachnoid

VII. HEAD AND NECK

1. Maxillofacial, mandibular and orbital trauma- fracture classifications
2. Sinusitis- acute and chronicNeck Infections and abscesses- Airway compromise Foreign bodies
3. Thyroid lesions: Dx and management
4. Abnormal lymph nodes: Dx and management
5. Vascular anomalies – vascular compromise, including atherosclerosis, stenosis, clot and occlusion
6. Foreign bodies
7. Thyroid lesions: Dx and management
8. Abnormal lymph nodes: Dx and management
9. Vascular anomalies – vascular compromise, including atherosclerosis, stenosis, clot and occlusion

SECOND YEAR/ROTATION – Review all materials from 1st rotation plus:

I. TECHNIQUE AND INDICATIONS

1. Understand the basic principles behind and indications for use of methods of MR examinations
    a. Brain: T1, T2, FLAIR, DWI, SWI, 3D GRE, 3D, post-contrast, fat suppression
    b. Vascular: TOF MRA, post-contrast MRA, TOF MRV, post-contrast MRV, fat suppression techniques
    c. ENT: IR, fat sat post-contrast
    d. Spine: T1, T2, STIR, GRE, 3D, fat sat post-contrast
2. Types of contrast media- identify risks and manage reactions
3. Lumbar Punctures: fluoro-guided LP, myelogram (C/T/L), cisternogram- indications, techniques and perform

II. ANATOMY:

1. *Brainstem, cranial nerves, white matter tracts*
2. Spine vascular structures
3. Orbits and sinuses
4. Temporal bone
5. Skull base
6. Head and neck- spaces of neck, lymph node levels

III. BRAIN PATHOLOGY- CT and MRI Correlation:

1. Differential diagnosis by location
2. Stroke- Role of CTA, CTP, MRI, MRA, MRP, Evolution of stroke, TIA, vascular occlusion and atherosclerosis
3. Tumor-
    a. WHO Grading and imaging correlates
    b. Gliomatosis
    c. Tumor mimics- subacute infarcts, subacute hematomas, demyelinating lesions
    d. Ring enhancing masses
    e. Intraventricular masses
    f. Tumors crossing corpus callosum
    g. Cerebellopontine angle tumors and mimics
    h. Cortical based tumors
    i. Fat containing masses
    j. Calcified/hemorrhagic masses
    k. MR diffusion and MR Perfusion
    l. Pineal and pituitary tumors
    m. Nontumoral cysts- Arachnoid, Colloid, Dermoid/Epidermoid, Enlarged VR spaces, Porencephalic cysts
4. Trauma-
    a. Skull base and temporal bone fractures
    b. Evolution of hematomas based on location- Parenchymal vs. SAH vs. SDH/EDH
    c. Sequelae of brain herniation
    d. Chronic findings after trauma
    e. Criteria of brain death
    f. Chronic traumatic encephalopathy
    g. Traumatic intracranial and extracranial dissections
    h. Traumatic carotid cavernous fistula

5. Hemorrhage –
    a. Determining age of hemorrhage on MRI
    b. Patterns of bleeds- hypertensive, amyloid angiopathy
    c. When to suspect underlying lesion
    d. Primary tumors known to hemorrhage
    e. Hemorrhagic metastases to brain
    f. Hemorrhagic transformation of infarcts
    g. Venous infarcts
    h. Embolic- septic emboli and mycotic aneurysms, fat emboli
    i. Nontraumatic, nonaneurysmal subarachnoid hemorrhage
6. CNS infections-
    a. Parenchymal versus extra-axial
    b. Typical (pyogenic abscess) versus atypical (Herpes, Neurocysticercosis,Lyme)
    c. Infections in Immunocompromised (HIV/ AIDS)
    d. Chronic granulomatous infections (Tuberculosis, fungal)
    e. Noninfectious inflammatory conditions (including sarcoidosis)
7. Demyelinating diseases- primary- types of MS, criteria, role of imaging, ischemic, infection
8. CSF dynamics-
    a. Intracranial hypo-and hypertension
    b. CSF leaks
    c. CSF diversion procedures
    d. Normal Pressure Hydrocephalus
9. Vascular-
    a. Basics of CTA, MRA and DSA
    b. Aneurysms
    c. Arterial and venous variants
    d. Arteriovenous malformations (basics)
    e. Carotid stenosis
    f. Dissection
10. Epilepsy- Temporal Lobe anatomy, Mesial Temporal Sclerosis

IV. SPINE PATHOLOGY

1. Degenerative spine disorders, including lexicon
    a. Types of disorders –
        i. Diffuse idiopathic skeletal hyperostosis
        ii. Disc herniation
        iii. Disc-osteophyte
        iv. Juxtaarticular cysts
        v. Ossification of the posterior longitudinal ligament
        vi. Spinal stenosis
        vii. Spondylolisthesis and spondylolysis
    b. Disc morphology – bulge, protrusion, extrusion, sequestration
    c. Lumbar Disc pathology location – central, subarticular, foraminal, far lateral, anterior

2. Trauma-
    a. MRI- criteria of instability
    b. Ligamentous injuries
    c. Cord injury
    d. Epidural, subdural and subarachnoid hemorrhages
    e. Craniovertebral fractures- Atlantooccipital dislocation, C1/C2 fractures
3. Spine infections and inflammations
    a. Discitis Osteomyelitis
    b. Spinal Abscess
    c. Nonpyogenic infections
    d. Acute and chronic inflammatory polyneuropathies
    e. Demyelination- Multiple sclerosis and ADEM
    f. Transverse Myelitis
4. Tumors-
    a. Extradural
    b. Intradural extramedullary
    c. Intramedullary
5. Post-operative- CT and MRI for hardware, acute bleeds. Recognizing acute postsurgical complications including acute epidural and hardware associated hemorrhage; misplaced or incorrectly placed hardware. Chronic hardware failure including features of hardware loosening and fractures. Metal artifact reduction techniques for CT and MRI.

V. HEAD AND NECK PATHOLOGY

1. Sinus and osteomeatal unit (OMU) disease- infection, inflammation, tumors
2. Facial and orbital trauma- fracture associations and complications
3. Skull base and temporal bone basics
4. Neck- lymphadenopathy, infections, tumor classification based on location

THIRD YEAR/ROTATION Revise material for R1 and R2

I. **TECHNIQUE AND INDICATIONS** - Understand the basic principles behind and indications for use of methods of examination-

1. CT- CTA, CTV, CT Perfusion- Dual energy CT
2. MRI – Basics of advanced imaging techniques
   a. Diffusion tensor imaging (principles of DTI)
   b. Functional MRI (principles of BOLD)
   c. MR artifacts
   d. MR perfusion (use in neoplasms and stroke)
   e. MR spectroscopy (NAA, Choline, lactate)
   f. Susceptibility weighted imaging
3. Myelography
4. Cisternography
5. Digital Subtraction Angiography- Observe, indications, anatomy
6. Be able to choose appropriate examination types for a variety of clinical situations and recognize strengths and weakness of each type of imaging exam- ACR Appropriateness Criteria® (http://www.acr.org/Quality-Safety/Appropriateness-Criteria)

II. ANATOMY

1. White matter- normal myelination

III. BRAIN PATHOLOGY

1. Stroke –
   a. Hypoxic ischemic encephalopathy (HIE)-Preterm, Term and Adults
   b. Vasculitis
   c. Posterior reversible encephalopathy syndrome (PRES)
   d. Risks and benefits of and imaging after thrombolysis/ neurointerventional procedures
2. Tumor- MR Perfusion techniques, MR spectroscopy, RANO Criteria
3. Hemorrhage- underlying lesions, active bleeds
4. Vascular- atherosclerosis, vasculopathies, venous thrombosis, arteriovenous malformations, vascular injuries
5. CNS infections-
   a. Congenital Infections-CMV, Toxoplasmosis
   b. Fungal and less common infections
   c. Sequelae of infections
   d. AIDS and complications
   e. Routes of spread of non CNS infections to brain
6. White matter-
   a. Inherited metabolic disorders (limited)
   b. Demyelinating and dysmyelinating diseases- toxic and metabolic
7. Neurodegenerative- Alzheimer's, metabolic, infectious (Prion disease)
8. Cranial Nerve Pathologies- Schwannomas, leptomeningeal carcinomatoosis, perineural spread, infection (Lyme), inflammation (Sarcoid)
9. Congenital/developmental-
   a. Brain malformations- Chiari 1 and 2, Holoprosencephaly, Dandy Walker spectrum
   b. Corpus callosum anomalies-agenesis/dysgenesis
   c. Sulcation and migrational anomalies
   d. Phakomatoses- NF1, NF2, Tuberous sclerosis, Sturge Weber and von Hippel Lindau

10. Epilepsy- malformations of cortical development
    a. Hemimegalencephaly
    b. Heterotopia
    c. Polymicrogyria, Lissencephaly and schizencephaly
    d. Focal cortical dysplasia
11. Toxic/Metabolic- Alcoholic, Wilson's, Hepatic encephalopathy, Osmotic demyelination, Chemotherapy, drug abuse

IV. SPINE PATHOLOGY

1. Congenital-
    a. Neural tube defects-Myelomeningocele, Lipomyelomeningocele, Lipomas, Dermoid, Caudal Regression, Sacrococcygeal Teratoma
    b. Segmentation anomalies
    c. Phacomatoses -NF1, NF2
    d. Congenital/Metabolic/Connective tissue-- Osteogenesis Imperfecta, Marfan's, Osteopetrosis,
    e. Craniovertebral junction variants-Platybasia, Basilar invagination
2. Spine vascular- infarcts, vascular malformations
3. Miscellaneous- arachnoid cysts, cord herniation, DISH, OPLL, Longus colli tendonitis
4. Spinal manifestations of systemic diseases/Arthritis -Sickle cell, renal/dialysis, Gout/CPPD, seronegative spondyloarthropathy, rheumatoid arthritis
5. Post procedural imaging and complications- MRI findings- hemorrhage, soft tissue injury, arachnoiditis
6. Nerve plexus- Brachial and Lumbosacral-anatomy and pathology

V. HEAD AND NECK PATHOLOGY

1. Sinonasal tumors- nodal and perineural spread
2. Orbital tumors- Retinoblastoma, Lymphoma, optic glioma, meningioma
3. Orbital Infections and Inflammation-Preseptal versus post septal, endopthalmitis, optic neuritis, psueudotumor, PHPV, retinopathy of prematurity,thyroid orbitopathy
4. Congenital skull base variants and pathologies- nasal masses, meningioma, fibrous dysplasia, chordoma, cartilaginous tumors
5. Pharyngeal and laryngeal tumors-benign and malignant
6. Mandible/maxilla –cysts, infections, tumors, fractures
7. Salivary gland - infections and tumors
8. Temporal bone pathology
    a. Cholesteatoma and cholesterol granuloma
    b. Facial nerve & internal auditory canal enhancement differential diagnosis
    c. Fractures
    d. Glomus tumors
    e. Vascular anomalies – Aberrant carotid artery, vascular dehiscence
    f. EAC atresia
    g. Otitis Externa
    h. Coalescent Mastoiditis
    i. SCCD and EVAS/LESA
    j. Otospongiosus
9. Neck- pediatric cysts and tumors, venolymphatic malformations
10. Postsurgical/ Post treatment Neck
11. Calvarial Lesions- Craniosynostoses, Fibrous dysplasia, Paget's, Histoiocytosis

FOURTH YEAR (R4)

I. TECHNIQUE AND INDICATIONS

1. Review to ensure independent proficiency (R4 – 1 month)
    a. Obtaining informed consent
    b. Overseeing conscious sedation
2. Independently perform (with appropriate supervision) (R4 – 1 month)
    a. Lumbar Punctures
    b. Myelography
    c. Cisternography
3. Post-Processing (R4 – 3 month)
    a. Continue proficiency at creating 3D reformats for CT and MRI
    b. Continue proficiency at processing MR perfusion images
    c. Become familiar with DTI tractography
4. Contrast – Be familiar with the following (R4 – 3 month)
    a. Macrocyclic vs. linear gadolinium agents
    b. Relaxivity
5. Observe and participate in spine biopsies (R4 – 6 month)
6. Develop more in depth knowledge of advanced MRI techniques (R4 - 6 month)
    a. MR perfusion (further knowledge for use in neoplasms and stroke; specifically distinguish recurrent high grade glioma from radiation necrosis)
    b. MR spectroscopy (NAA, Choline, lactate)
    c. Susceptibility weighted imaging
7. Develop more in depth knowledge of CT techniques
    a. Dual energy CT (technique and applications) (R4 – 6 month)
    b. Radiation dose reduction (R4 – 6 month)

II. ANATOMY

1. General
    a. Be proficient with anatomy in the brain, spine, head & neck in appropriate depth on multi-planar and multi-modality images and especially be able to interrogate 3D image volumes to identify small structures. (R4 – 1 month)
2. Brain
    a. Be proficient with cortical anatomy in the eloquent regions (motor/sensory cortex – identify central sulcus, pre- and post-central gyri, superior and middle frontal gyri, superior frontal sulcus; Broca's area – inferior frontal gyrus including pars triangularis and pars opercularis; Wernicke's area – superior and middle temporal gyri, superior temporal sulcus) (R4 - 3 months)
    b. Review more global gyral and sulcal anatomy (R4 - 6 months)
    (i.e.,cingulate gyrus, angular gyrus, cuneus, calcarine sulcus, parahippocampal gyrus)
3. Head & Neck
    a. Name and recognize the anatomy of the spaces of the neck to include the nasopharynx, oropharynx, hypopharynx, oral cavity, larynx, prevertebral space, carotid space, parotid space, masticator space, pharyngeal mucosal space, parapharyngeal space. (R4 – 1 month)
    b. Be proficient with anatomy of the skull base, sinonasal region, temporal bone, and orbits. (R4 – 3 month)
    c. Become more familiar with the anatomical course of cranial nerves 1-12 including the 3 major divisions of CN 5. (6 months)

4. Spine
    a. Be proficient with the pertinent craniocervical junction anatomy including ligaments such as the alar and transverse ligaments and the tectorial membrane. (R4 – 3 month)
    b. Routinely recognize the main ligaments of the spine, including the anterior and posterior longitudinal ligaments, ligamentum flavum, interspinous ligaments, supraspinous ligament, and nuchal ligament.
    c. Be able to anatomically localize the extradural, intradural extramedullary, and intramedullary spaces.
5. Vascular
    a. Identify the main extra- and intracranial arteries.
        i. Neck – Aortic arch, brachiocephalic trunk, left and right common and internal carotid arteries, the external carotid arteries and their main branches (SALFOPSM mnemonic) (R4 – 1month)
        ii. Head – Internal carotid arteries, anterior cerebral arteries, middle cerebral arteries, anterior communicating artery, vertebral arteries, posterior inferior and anterior inferior cerebellar arteries, superior cerebellar arteries, basilar artery, posterior cerebral arteries, posterior communicating arteries. Know the segmental anatomy of these named arteries as well as their major branches.

III.BRAIN

1. General concepts
    a. Further develop the ability to use imaging findings to differentiate different types of focal intracranial lesions (neoplastic, inflammatory, vascular) based on anatomic location (e.g. intra- vs. extra-axial), contour, intensity and enhancement pattern. (R4 – 1 month)
    b. Accurately identify and differentiate diffuse intracranial abnormalities (e.g. hydrocephalus versus atrophy). (R4 – 3 month)
    c. Be able to identify and differentiate acquired lesions (traumatic, ischemic, inflammatory and neoplastic) of the newborn, infant, child, and adolescent. (R4 – 3 month)
    d. Learn to recognize congenital lesions, malformations, and disorders of the perinatal period on CT and MR. (R4 – 6 month)
    e. Deepen knowledge of treatment related findings (e.g. post-surgical and post-radiation) and the imaging techniques to discern these scenarios. (R1 – 3 month)
    f. Be able to access and incorporate clinical history including prescribed medications/therapies (bevacizumab) and histologic biopsy information as they impact imaging exam performance, protocol and interpretation. (R4 – 3 month)
2. Be proficient with the following scales
    a. American Society of Anesthesiologists (ASA) physical status classification system (prior to sedation) (R4 – 1 month)
    b. Glasgow Coma Scale (GCS) (R4 – 1 month)
    c. Alberta Stroke Program Early CT Score (ASPECTS) score (R4 – 1 month)
    d. National Institutes of Health Stroke Scale (NIHSS) (R4 – 3 month)
    e. Spetzler-Martin Arteriovenous (AVM) grading system (R4 – 3 month)
    f. Hunt-Hess score (aneurysms) (R4 – 6 month)
    g. Fisher Scale (subarachnoid hemorrhage) (R4 – 6 month)
3. Stroke
    a. Proficiency in interpretation of CT/CTA, MR/MRA, CT/MR perfusion images (R4 – 1 month)
    b. Grade internal carotid artery stenosis using NASCET criteria. (R4 - 1 month)
    c. Deepen familiarity with contraindications to tPA (e.g., MCA infarct greater than ½ of MCA territory, acute hemorrhage, time cut offs for IV tPA and mechanical thrombectomy) (R4 – 1 month)
    d. Recognize patterns of acute infarction (e.g., embolic, watershed/borderzone, vasculitis, diffuse hypoxic ischemia, venous infarction) (R4 - 3 month)
    e. Routinely identify cervical arterial stenosis in the carotid and vertebral arteries. (R4 - 3 month)
    f. Be able to routinely process and interpret MR and CT perfusion images for acute stroke cases. (R4 – 6 month)
    g. Confidently interact with clinical stroke team and neurointerventionalists. (R4 – 6 month)

4. Tumor
    a. Become proficient with the most recent WHO brain tumor classification (R4 – 3 month)
    b. Comfort with conventional MR imaging with DWI, MR perfusion, MR spectroscopy in initial tumor assessment and follow-up imaging (R4 - 6 month)
    c. Be able to list a reasonable differential for masses based on imaging appearance, location, age, sex, and clinical history (R4 – 6 month)
    d. Interpret MR perfusion to differentiation tumor progression from radiation necrosis (R4 – 6 month)
5. Vascular
    a. Proficiently identify the correct anatomical location of aneurysms (R4- 3 month)
    b. Be able to routinely recognize and grade AVMs, and recognize cavernous malformations, developmental venous anomalies, and capillary telangiectasias (R4 - 6 month)
    c. Become proficient with the indications, risks and benefits for neurointerventional procedures including thrombolysis, embolization, angioplasty, and stenting. (R4 – 6 month)
    d. Be familiar with certain etiologies of parenchymal hemorrhage (e.g., AVM, cavernous malformation, hypertension, amyloid angiopathy, primary tumors and metastases (R4 – 6 month)
6. CNS infections
    a. Comfort with diagnosing bacterial cerebral abscess and subdural empyema, recognizing source if via direct extension (e.g., paranasal sinus or mastoid temporal bone origin) (R4 – 1 month)
    b. Broaden and deepen your knowledge of viral and atypical infections (e.g., herpes encephalitis, tuberculosis, Lyme disease, progressive multifocal leukoencephalopathy, Creutzfeldt-Jakob Disease, neurocysticercosis, coccicioidomycosis) (R4 – 3 month)
7. White matter
    a. Broaden and deepen your knowledge of demyelinating and dysmyelinating diseases – (e.g., ADEM, PML, more in depth knowledge of MS) (R4 – 3 month)
    b. Broaden and deepen your knowledge of inherited metabolic disorders (i.e., MELAS, Alexander's disease, Canavan's disease) (R4 – 6 month)
    c. Broaden and deepen your knowledge of additional white matter diseases – (e.g., central pontine myelinolysis/extrapontine myelinolysis, heroin inhalation leukoencephalopathy, X-linked adrenal leukodystrophy) (R4 – 6 month)
8. Neurodegenerative
    a. Broaden and deepen your knowledge of the more common and some of the rare neurodegenerative disorders (e.g., Alzheimer Disease, Parkinson disease, iron deposition disease, Wernicke encephalopathy, normal pressure hydrocephalus, multisystem atrophy, progressive supranuclear palsy, amyotrophic lateral sclerosis) (R4 – 6 month)
    b. Recognize and correlate the typical patterns of Alzheimer disease on PET, MRI, and CT
9. Cranial Nerve Pathologies
    a. Differentiate cerebellopontine angle vestibular schwannoma from meningioma (R4 – 1 month)
    b. Recognize optic nerve pathology such as optic neuritis, optic nerve glioma and meningioma. (R4 – 3 month)
    c. Know the segments of the facial nerve and which can normally enhance (R4 – 3 month)
    d. Become proficient with the assessment of perineural spread of tumor and the connections between CNs 5 and 7 as well as their branches (R4 – 6 month)
10. Congenital/developmental
    a. Know some of the childhood causes of hydrocephalus (e.g., aqueductal stenosis, communicating hydrocephalus from infection or subarachnoid hemorrhage, choroid plexus papilloma) (R4 – 1 month)
    b. Be familiar with the phakomatoses (e.g., NF1, NF2, tuberous sclerosis, Sturge-Weber, Von Hippel-Lindau) (R4 – 3 month)
    c. Broaden and deepen your knowledge of brain malformations (e.g., schizencephaly, focal cortical dysplasia), sulcation and migrational anomalies (e.g., lissencephaly, heterotopia, polymicrogyria, holoprosencephaly spectrum) (R4 – 6 month)

IV. SPINE

1. General concepts to know
    a. Be able to localize spinal lesions to the appropriate space (extradural, intradural-extramedullary, intramedullary) and have a short differential for lesions in each space. (R4 – 1 month)
    b. Be proficient in differentiating inflammatory and neoplastic lesions. (R4 – 3 month)
    c. Broaden and deepen your knowledge of the imaging features of intraspinal processes including syringomyelia, arachnoiditis, and spinal dysraphism. (R4 – 3 month)
    d. Reliably recognize expected post-surgical findings and short term and long term complications of surgery (i.e., epidural scarring, CSF leak, phlegmon/abscess, hardware failure, non-union) (R4 – 3 month)
    e. Reliably recognize congenital lesions, malformations, and disorders of the perinatal period on CT and MR. (R4 – 6 month)
    f. Be able to integrate patient symptoms with imaging findings to discuss culprit lesions with referring clinicians and in interdisciplinary settings. (R4 – 6 month)
2. Congenital
    a. Gain more understanding of the spinal imaging findings of the phakomatoses (e.g., von Hippel-Lindau, NF2) (R4 – 6 month)
    b. Broaden and deepen your knowledge of neural tube defects (e.g., myelomeningocele, epidermoid) (R4 – 6 month)
    c. Learn more about segmentation anomalies (e.g., Klippel-Feil Spectrum, Diastematomyelia) (R4 – 6 month)
3. Degenerative
    a. Routinely use standard nomenclature and classification of lumbar disc pathology (R4 – 1 month)
    b. Differentiate disc bulge, protrusion, and extrusion (R4 – 1 month)
    c. Recognize the specific nerve root affected by degenerative lumbar disc pathology in the lateral recesses and foraminae (R4 - 3 month)
    d. Be able to identify varying degrees of spinal canal stenosis, cord compression, and myelomalacia (R4 - 3 month)
    e. Know imaging features of diffuse idiopathic skeletal hyperostosis (DISH) and ossification of the posterior longitudinal ligament (OPLL) (R4 - 6 month)
4. Spine vascular/trauma
    a. Be able to differentiate epidural hematoma, subdural hematoma, and subarachnoid hemorrhage (R4 – 1 month)
    b. Recognize traumatic spinal cord edema and hemorrhage (R4 – 1 month)
    c. Proficiently identify carotid and vertebral artery dissection on CT/CTA and MRI/MRA (R4 - 3 month)
    d. Routinely identify spinal ligamentous injury (e.g., ALL, PLL, ligamentum flavum, transverse ligament, tectorial membrane) (R4 - 3 month)
    e. Be familiar with the classification of spinal arteriovenous malformations/fistulas (types 1-4) (R4 – 6 month)
5. Spine Infection/Inflammation
    a. Consistently identify discitis/osteomyelitis and associated paraspinal/epidural phlegmon and abscess (R4 – 1 month)
    b. Recognize subacute combined degeneration (R4 – 3 month)
    c. Know imaging features of ankylosing spondylitis and spinal rheumatoid arthritis (R4 - 3 month)
    d. Recognize spinal multiple sclerosis imaging findings (R4 - 3 month)
    e. Know imaging features of neuromyelitis optica (R4 – 6 month)
6. Nerve plexus
    a. Be proficient with brachial and lumbosacral plexus anatomy (R4 - 3 month)
    b. Be proficient with brachial and lumbosacral plexus pathology (e.g., trauma, intrinsic/extrinsic tumor, infection) (R4 – 6 month)

V. HEAD AND NECK

1. General concepts to know
    a. Identify pathologic processes on multi-planar MRI examinations. (R4 – 1 month)
    b. Further hone the differential diagnosis of mass lesions. (R4 – 3 month)
    c. Be able to identify landmarks and anatomic features pertinent to the operative approaches to the sella and skull base. (R4 – 3 month)
    d. Learn to recognize post-treatment related findings (e.g. post-surgical and post-radiation). (R4 – 3 month)
    e. Reliably identify key areas of involvement which impact cancer staging schemes. (R4 – 6 month)
    f. Understand and be able to reliably identify patterns of disease spread within and between areas of the head and neck (e.g. perineural and nodal spread). (R4 – 6 month)
    g. Understand and reliably recognize congenital lesions, malformations, and disorders of the perinatal period on CT and MR. (R4 – 6 month)
2. Sinonasal cavities
    a. Describe adjacent anatomy to sinonasal tumors for pre-operative considerations (R4 - 1 month)
    b. Broaden and deepen your knowledge of invasive fungal sinusitis, allergic fungal sinusitis, sinonasal polyposis (R4 – 3 month)
    c. Be familiar with some of the more common congenital lesions (e.g., pyriform aperture stenosis, choanal atresia) (R4 – 3 month)
    d. Become familiar with functional endoscopic sinus surgery (FESS) (R4 – 6 month)
3. Skull base
    a. Be able to describe the components of the skull base typically involved in trauma or tumor (R4 – 1 month)
    b. Develop a differential for lesions within and around the sella turcica (R4 – 3 month)
    c. Be familiar with the various types of encephaloceles (R4 – 6 month)
    d. Be able to describe the course of perineural tumor spread from primary tumor to brainstem including skull base foramina. (R4 – 6 month)
4. Orbits/Face
    a. Accurately recognize post-septal infection and abscess, invasive fungal sinusitis (R4 - 1 month)
    b. Be proficient in recognizing and describing with zygomaticomaxillary complex (ZMC) fratures, naso-orbitoethmoid (NOE) fractures, and LaForte 1, 2, and 3 fractures. (R4 – 3 month)
    c. Be familiar with some of the congenital lesions (e.g., coloboma, dermoid/epidermoid, persistent hyperplastic primary vitreous (PHPV)) (R4 – 3 month)
    d. Be able to offer an ordered, appropriate differential diagnosis for orbital lesions (R4 – 6 month)
5. Temporal bone
    a. Broaden and deepen your knowledge of mastoiditis and complications (R4 – 1 month)
    b. Have a differential diagnosis for imaging findings that could explain tinnitus and trigeminal neuralgia (R4 – 3 month)
    c. Understand and be familiar with the utility of DWI for cholesteatoma detection and recurrence (R4 – 3 month)
    d. Be familiar with the third window phenomenon and some of its causes (most notably superior semicircular canal dehiscence) (R4 - 6 month)
6. Suprahyoid and Infrahyoid Neck
    a. Become familiar with the imaging findings of squamous cell carcinoma, lymphoma, and minor salivary gland tumors (R4 – 3 month)
    b. Learn about human papillomavirus (HPV) associated squamous cell carcinoma (R4 – 3 month)
    c. Develop a differential for lesions in each of the suprahyoid neck subsites (R4 – 3 month)
    d. Be familiar with some of the more common congenital head and neck lesions (e.g., hemangioma, venolymphatic malformation, branchial cleft cysts) (R4 - 3 month)
    e. Become familiar with the AJCC criteria for the various head and neck subsites and develop comfort in identifying the appropriate anatomy to give the correct T-stage. (R4 - 6 month)

7. Nodes
    a. Know the lymph node level classification per the American Joint Committee on Cancer (AJCC) (R4 - 6 month)
    b. Be familiar with the up to date AJCC cancer staging system for nodal metastatic disease from head and neck cancer (R4 – 6 month)
8. Post-surgical/Post-treatment Neck
    a. Recognize expected post-operative changes (R4 – 3 month)
    b. Recognize expected post-radiation changes on CT and MRI (R4 – 3 month)
    c. Identify post-operative complications (R4 – 3 month)
    d. Be able to identify post-operative tumor recurrence on CT and MRI (R4 – 6 month)
9. Become familiar with the following scales
    a. Keros Classification (R4 - 6 month)
    b. AJCC lymph node classification as above (R4 - 6 month)
    c. AJCC criteria for the various head and neck subsites for T and N staging as above (R4 - 6 month)

Books/Resources for Residents

Resources for first year residents

1. Brant and Helms
2. Core Radiology
3. Neuroimaging Essentials
4. Statdx
5. Imaios(e-anatomy)
6. Headneckbrainspine.com

Resources for 2nd year residents

1. Neuroradiology: Requisites
2. Osborn's Brain
3. Neuroradiology companion
4. Statdx

Resources for 3rd year residents

1. Osborn's Brain
2. Case review series
3. Neuroradiology core review
4. Rad primer cases
5. Statdx

Resources for 4th year residents

1. Osborn's Brain
2. Head & Neck Radiology, Som and Curtin
3. Pediatric neuroradiology. Barkovich
4. Statdx

ONLINE RESOURCES

Headneckbrainspine.com Imaios/e-anatomy Radiopaedia.com Radiologyeducation.com Radiologyassistant.nl Myelinationmriatlas.com Neuroradiologyeducation.com Eurorad.org

DIVISION OF NUCLEAR MEDICINE

Section Chief:

- Umber A. Salman, MD; Associate Professor
  SalmanU@uthscsa.edu
  P: (210) 567-6488

Section Faculty:

- Darlene F. Metter, MD; Professor
- Penny J. Vroman, MD; Associate Professor
- William T. Phillips, MD; Professor
- Kevin P. Banks, MD; Assistant Professor
- Michel-Alexis Courtines, MD; Specialist
- Daniel Duffy, MD; Specialist

Fellows: AY 2021-2022
None

Fellowship Academic Programs Coordinator:

- Stephanie Navarro
- NavarroSB@uthscsa.edu
  P: (210) 567-5563

Clinical Administrative Assistant:

- Angela Tarango: TarangoA@uthscsa.edu
  P: (210) 567-6488

UT Health San Antonio Radiology

GENERAL GUIDELINES FOR RADIOLOGY RESIDENTS

The following guidelines are to orient you to the clinical service and to delineate your responsibilities. They are designed to create a learning environment within you that may develop into a competent consultant within the allotted months. Operating within the following framework, one can become much more than a mere “reader of studies".

1. Learn as much as possible about instrumentation and radiopharmaceuticals. This will require that you--time permitting--leave the reading room and move about the “hot lab" and various imaging/detecting systems. The technologists are busy, but usually available for any questions.
2. Determine and prescribe appropriate radiopharmaceuticals, doses, and methods of administration for each study.
3. Evaluate initial patient requisition for clinical adequacy to proceed with the requested exam. Evaluate the images if the study is technically satisfactory or obtain more images.
4. Thyroid patients: Obtain pertinent history and physical examination thyroid function test results or pathology. Be able to answer the patient’s questions and learn complications of radioiodine therapy.

I. ROTATION REQUIREMENTS:

1. Completion of 700 hours of training and experience in basic radionuclide handling techniques and radiation safety applicable to the medical use of unsealed byproduct material for imaging and localization studies as delineated in Title 10 Code of Federal Regulations Part 35.290 (10 CFR 35.290)

2. A minimum of 80 hours of classroom and laboratory training, in basic radionuclide handling techniques applicable to the medical use of unsealed byproduct material for imaging and localization studies as outlined in 10 CFR 35.290.

3. Full participation in three I-131 therapy for hyperthyroidism with the appropriate documentation (separate forms available in UH computer S drive under radiology residents folder).

4. Completion of the Nuclear Medicine Training and Experience Documentation for Radiology Residents (see attached).

5. Completion of the Radiopharmacy two-day requirement form (see attached).

II. RESIDENT ROTATION GOALS

Initial Rotation

Begin to understand diagnostic and therapeutic Nuclear Medicine procedures, the operations of a Nuclear Medicine clinic, and demonstrate active learning in established nuclear medicine procedures and basic sciences to include radiation safety, Nuclear Regulatory Commission (NRC) rules and regulations, and nuclear medicine quality control.

Intermediate Rotation

Demonstrate greater independence in the operations of a Nuclear Medicine clinic, progressive involvement, and knowledge application in diagnostic and therapeutic Nuclear Medicine procedures, in addition to instrumentation, radiopharmacy, quality control, and radiation safety.

Senior Rotation
Progress to the point of sufficient professional ability to practice competently and independently by demonstrating complete independence in ordering, monitoring, modifying, and interpreting nuclear medicine exams. He/she will also be competent in radiotherapy procedures in the use of less than 33 mCi of I-131 for hyperthyroidism and the use of greater than 33 mCi of I-131 for thyroid malignancy.

III. RESIDENT ROTATION OBJECTIVES

Initial Rotation

(a) Begin to understand Nuclear Medicine procedures: physiology, indications, technique for adults and pediatric patients, instrumentation, quality control, radiation safety, and normal scan findings.
(b) Begin to understand the operations of a Nuclear Medicine clinic from evaluating the appropriateness of a referring clinician's request through monitoring and tailoring the study, scan interpretation, and dictating a draft report.
(c) Learn the proper interview and physical exam techniques in the evaluation of the thyroid patient

Intermediate Rotation(s)

(a) Demonstrate progressive involvement in planning, supervision, and interpretation to include abnormal scans, normal variants, and quality control issues that may impact on scan interpretation
(b) Demonstrate progressive understanding of radioiodine therapy in thyroid disease and management to include inpatient therapy procedures (admission process, treatment, follow-up, radiation safety, and responsibilities of an Authorized User as delineated by the Nuclear Regulatory Commission).

Senior Rotation(s)

(a) The resident will be sufficiently competent to independently be responsible for the daily operations of the nuclear medicine clinic as it relates to triaging and health care provider consultations, supervising and interpreting diagnostic studies.
(b) The resident will be sufficiently competent to independently and appropriately evaluate and treat patients for therapy with I-131 utilizing doses for hyperthyroidism.
(c) Demonstrate continuous acquisition of up-to-date evidence-based Nuclear Medicine knowledge.
(d) The resident will be able to competently utilize and independently apply the principles of radiation safety, radiopharmaceutical, and camera quality control in their daily practice of nuclear medicine.

IV. CLINICAL EXPECTATIONS:

ALL RESIDENTS shall be expected to take weekend Nuclear Medicine call.

1. **Initial rotation:** Begin to understand diagnostic and therapeutic Nuclear Medicine procedures
    a. Operating the NM workstations
    a. Common Nuclear Medicine procedures/protocols(minimum):
        i. Bone Scan, Myocardial Perfusion studies, V/Q, HIDA, Gastric emptying, GI bleed studies, renal scans
    b. Basics of frequently used radiopharmaceuticals (RP) and equipment

2. **Intermediate rotations:** Demonstrate greater independence in the operations of a Nuclear Medicine clinic, progressive involvement and knowledge application in diagnostic and therapeutic Nuclear Medicine procedures
    a. Knowledge of less common procedures and RP and advanced knowledge of equipment.
    b. PET-CT
        i. Obtain all available info, including path and prior/recent treatments.
        ii. Review studies for techs. Ask for additional imaging if needed.
        iii. Draft report
        iv. Observe techs, equipment. Learn equipment QC.
        v. Radiopharmacy
3. **Senior rotation:** Progress to the point of sufficient professional ability to practice competently. **For those desiring AU,** he/she will also be competent in radiotherapy procedures in the use of less than 33 mCi of I-131 for hyperthyroidism and the use of greater than 33 mCi of I-131 for thyroid malignancy.
    a. General NM:
        i. Review studies for techs. Ask for additional imaging if needed.
        ii. Draft complete report
        iii. Make recommendations
        iv. Observe techs, equipment. Learn equipment QC.
        v. Radiopharmacy
    b. PET-CT
        i. Obtain all available info, including path and prior/recent treatments.
        ii. Review studies and draft reports.

V. READING LIST:

1. Essentials of Nuclear Medicine Imaging. Fred A Mettler, Milton J Guiberteau. 6th Edition,
2. Fundamentals of Diagnostic Imaging. Brandt and Helms. 4thVolume. 4th Edition
3. Nuclear Medicine: The Requisites. Ziessmann, 3rd Edition.

Supplemental:

1. RadCases: Nuclear Medicine: Applebaum et al. 1st Edition
2. Case Review: Nuclear medicine. Ziessman. 2nd Edition

Useful on-line sources/websites:

1. StatDx
2. RadPrimer

VI. CONFERENCES:

1. Residents Noon Conference. Every day. 6th floor.
2. Endocrine -NM conference and Neoplasia board: 1st Wednesday at 7:30 am. NM reading rm.
    a. Radiology resident prepares cases
3. Dementia Consensus conference: 2nd Friday of the month at 11 am, 5th flr McDermott
    a. Radiology residents/Staff (NM MARC) prepare cases
4. Melanoma Tumor Board: 2nd Thursday at 1:00 pm, Mays cancer center
    a. Staff/MARC NM resident prepare cases

VII. TEACHING (* would depend on clinical):

1. Second week: Staff, case review. (Tentative) Thurs, 10:45-11:05 a.m.
2. Third week: Senior resident. Interesting cases. (Tentative) Thurs, 10:45-11:05 a.m.
3. Journal club: VTC Monthly, NM Fellow (SAMMC-UTHSA combined residency program).

VIII. FACULTY EVALUATION (consensus of NM faculty):

1. Mid rotation informal feedback
2. End rotation Verbal and online evaluation

Nuclear Medicine
Training and Experience Documentation
For Radiology Residents

1. INSTRUMENTATION — **Date** — **Supervising Staff**

- Camera QC - flood
- Camera QC – linearity, resolution
- SPECT QC
- Dose Calibrator QC

2. CNS — **Date** — **Supervising Staff**

- Brain SPECT
- Brain Death

3. THYROID — **Date** — **Supervising Staff**

- Thyroid Uptake & calculation
- Thyroid scan
- Endocrine conference presentation (6)
  - Benign Disease
  - Thyroid Cancer
  - Non-thyroid endo

4. CARDIOVASCULAR

- Myocardial Perfusion
  - Chemical stress (3) **1.** _____ **2.** _____ **3.** _____
    1. _____ **2.** _____ **3.** _____
  - Exercise stress (3) **1.** _____ **2.** _____ **3.** _____
    1. _____ **2.** _____ **3.** _____
  - Process (6) **1.** _____ **2.** _____ **3.** _____
    4. _____ **5.** _____ **6.** _____
  - Patient F/U (3) **1.** _____ **2.** _____ **3.** _____
    1. _____ **2.** _____ **3.** _____
- MUGA
  - Process (3) **1.** _____ **2.** _____ **3.** _____
    1. _____ **2.** _____ **3.** _____

5. RESPIRATORY — **Date** — **Supervising Staff**

- Ventilation
- Perfusion
- Process Quantitative Split Function

6. GI	Date	Supervising Staff
• Hepatobiliary		
• Process GBEF		
• Liver Spleen Scan		
• GI Bleed		
• Gastric Emptying		
• Process Gastric Emptying		

7. GU	Date	Supervising Staff
• Renal Scan		
• Process Renal		

8. INFECTION	Date	Supervising Staff
• WBC Scan		
• Collection		
• Administration		

9. NRC + RADIATION SAFETY	Date	Supervising Staff
• Survey Clinic		
• Wipe Test		
• Prepare Inpatient I-131 Room		
• Post I-131 Survey of Room & Patient		

10. BONE	Date	Supervising Staff
• Bone Scan		
• 3 phase Bone Scan		
• Bone SPECT		
• Bone Marrow Imaging		
• Subtraction – Process		

RADIOPHARMACY

DATE _____
RADIOPHARMACIST _____

DATE _____
RADIOPHARMACIST _____

RADIOPHARMACY

DAY 1:

Supervising Authorized User: _____

Location: _____

DAY 2:

Supervising Authorized User: _____

Location: _____

	PROCEDURE	DAY 1	DAY 2
1.	Eluting generator systems appropriate for the preparation of radioactive drug for imaging & localization studies.		
	a. Number of times participated in generator eluion.		
2.	Measuring & testing the eluate for radionuclidic purity		
3.	Processing the eluate with reagent kits to prepare labeled radioactive drugs.		
4.	Aspects of radiation protection.		
5.	Ordering radioactive material		
6.	Receiving radioactive materials safely & performing the related radiation surveys.		
7.	Unpacking radioactive materials safely & performing the related radiation surveys.		
8.	Performing quality control procedures on instruments used to determine the activity of dosages.		
9.	Performing checks for proper operation of survey meters		
10.	Calculating, measuring & safely preparing patient or human research subject dosages.		
11.	Using administrative controls to prevent a medical event involving the use of unsealed byproduct material.		
12.	Using procedures to contain spilled byproduct material safely & using proper decontamination procedures.		
13.	Administering dosages or radioactive drugs to patients or human research subjects.		
14.	Processing the eluate with reagent kits to prepare labeled radioactive drugs.		
	a. Number of times KIT times participated in preparing reagent kits		

DIVISION OF PEDIATRIC IMAGING

Section Chief:

- Jeffrey L. Foster, MD; Associate Professor
  FosterJ2@uthscsa.edu
  P: (210) 567-6448

Section Faculty:

- Riley P. Scott, MD; Assistant Professor

Clinical Administrative Assistant:

- Angela Tarango
  TarangoA@uthscsa.edu
  P: (210) 567-6448

UT Health San Antonio Radiology

Pediatric Radiology Rotation

Residents rotate through at least 2 one-month blocks of Pediatric Radiology during their training. Before the first rotation, the resident should contact the resident previously rotating on Pedi regarding daily schedules and other details of the rotation. You should also obtain a copy of *PEDIATRIC RADIOLOGY: THE REQUISITES* by Blickman and/or Donnelly's *Fundamentals of Pediatric Radiology.*

I Development of Knowledge and Skills

A. Initial Rotation:

1. Residents are expected to become familiar with the presentation, imaging findings, and recommended imaging work-up of common pediatric disorders. This should be accomplished by reading: *PEDIATRIC RADIOLOGY: THE REQUISITES* by Blickman and/or Donnelly's *Fundamentals of Pediatric Radiology*, and reviewing Dr. Clarke's teaching file.

2. Residents are expected to learn, from the example of the staff radiologists, how to operate a pediatric radiology service, including acting as primary liaison to the referring clinicians, assuring efficient progress of the day's work, and making sure that all studies are dictated.

3. They will learn the appropriate examinations for particular problems and how to tailor the examination to each individual situation and patient age.

4. They will learn how to perform all procedures, including GI and GU contrast examinations, ultrasound, and interventional procedures.

5. They will learn how to interpret pediatric imaging studies including fluoroscopy (gastrointestinal and genitourinary), sonography, cystography, and plain films.

B. Subsequent Rotations:

1. Residents will be expected to expand on the knowledge developed in the initial rotation. This will be accomplished by reading Kirks' *PRACTICAL PEDIATRIC IMAGING* and reviewing the pediatric section of the online files.

2. They will learn the principles and interpretation of specialized pediatric studies, including CT, MRI, and Nuclear Radiology.

II. Supervisory Lines of Responsibility

A. Initial Rotation

1. Residents are expected to assume partial responsibility for the service, including acting as primary liaison to the referring clinicians and assuring efficient progress of the day's work.

2. All studies will be cleared by staff prior to approval.

3. All studies will be reviewed by staff prior to rendering of the final report.

4. The resident will perform all procedures, including GI and GU contrast examinations, ultrasound, and interventional procedures, under the direct supervision of the attending radiologist.

B. Subsequent Rotations

1. Residents are expected to assume complete responsibility for the service, including acting as primary liaison to the referring clinicians, assuring efficient progress of the days work, and making sure that all studies are dictated.

2. The resident is expected to perform procedures independently with later review by the attending radiologist.

3. All studies will continue to be reviewed by staff prior to final report.

Residents will receive a written evaluation of their performance at the end of each month. Categories of evaluation include image interpretation, general fund of knowledge, manual diagnostic and procedural skills, and professional behavior.

PEDIATRIC PROCEDURES
RETROGRADE CYSTOGRAM AND VOIDING CYSTOURETHROGRAM

PURPOSE:

A. To evaluate the presence of vesicoureteral reflux
B. To clearly define the margin of the bladder
C. To assess voiding function
D. To determine the presence of posterior urethral valves

MATERIALS:

Sterile drapes, cleansing solution, small (sterile) 5 or 8 French feeding catheter but occasionally a small Foley in the older child, sterile contrast (in a drip infusion set-up), connecting tubing, sterile K-Y jelly, or equivalent.

METHOD:

1. Obtain preliminary KUB in adults.

2. Cleanse the perineal area and drape the patient.

3. Insert the catheter --GENTLY--and drain any residual urine after first applying sterile K-Y to ease its passage.

4. Connect to IV tubing.

5. Instill contrast media using bursts of Fluoro to assess correct positioning and reflux during filling.

6. Take AP spot films at 25%, 50%, 75% and 100% filling.

7. Instruct to patient to advise you when he/she MUST urinate. Do not remove catheter until voiding and films the urethra.

8. Quickly obtain both obliques spot films during voiding. Observe for reflux during voiding and film the urethra.

9. Obtain post-void KUB or spot film both kidneys to document reflux or lack thereof.

10. Remove the catheter.

BARIUM SWALLOW

The purpose is usually to rule out mass, vascular ring, T-E fistula, reflux, stricture, and aspiration. No prep necessary.

Both AP and lateral views are required with the table horizontal. Avoid the temptation to take long sequences of spot films. Always evaluate the stomach and pylorus as part of the study, as well as the position of the ligament of Treitz to rule out malrotation.

Infants will usually take thin barium from a bottle. Older children (1-4 years) can be forced to swallow if necessary, by forcibly restraining them and squirting barium into the back of their throat with a catheter tip syringe. This can also be done by introducing an 8 French feeding tube through the nose into the proximal esophagus.

Regular or thin barium should be used. Gastrografin diluted 50% with water is indicated only in cases where a leak is suspected, but not if aspiration into the lungs may occur. Observe filled stomach for 5 minutes in the supine position for G-E reflux.

UPPER GI:

Usually to rule out pyloric stenosis or malrotation. (Other cases of suspected bowel obstruction should be a BE first.) Other indications are ulcer disease, regional enteritis, or GI bleeding.

PREP: NPO after midnight.

NOTE: Ultrasound has replaced the UGI for the diagnosis of pyloric stenosis. The threshold for diagnosis is muscle thickness > 4 mm, total diameter >12 mm, and muscle length > 18 mm. In the case of equivocal Ultrasound, UGI should be performed.

Infants with suspected pyloric stenosis will take barium from a bottle. Observe but do not spot the esophagus and stomach. When the stomach contains enough barium the child is turned right side down so that the antrum is distended. The the pyloric region is then observed (intermittently) for up to ten minutes and spot films taken, whether or not the pyloric channel and duodenal bulb are demonstrated. Document Ligament of Treitz in LUQ!

Older children and adolescents are examined in the usual way, with single or double contrast determined by the degree of cooperation.

BARIUM ENEMA

Purpose in infants: Rule out malrotation, volvulus, obstruction, abscess Hirschsprung's, and intussusception. No prep necessary.

Purpose in older children: Rule-out regional enteritis, ulcerative colitis, GI bleeding, appendicitis, Hirschsprung's. Prep (48-hour clear liquids, cleansing) necessary only where mucosal detail is desired.

Use Foley catheter (14-26 French) except in adolescents. Tape buttocks tightly together along with the tube in infants, inflate the balloon only if' leakage is significant and only under fluoroscopy.

The examinations should be tailored to address the suspected problem. For example, if Hirschsprung's or fecal impaction is encountered, the entire colon should not be filled but a thorough exam of the distal colon should be performed. In other cases, the entire exam can be done with spot films. Spasm is often encountered, but persistence usually results in a complete exam.

GASTROGRAFIN IS CONTRA-INDICATED IN INFANTS WITH

DEHYDRATION OR ELECTROLYTE PROBLEMS.

INSTEAD, USE ISOVUE (NONIONIC) DILUTED 1:1 WITH WATER.

DIVISION OF DIAGNOSTIC IMAGING PHYSICS

Section Faculty:

- Andrew Sampson, PhD, DABR; Assistant Professor, Radiology; Director, Clinical Imaging Physics; Director, Radiological Sciences Graduate Program
  SampsonA@uthscsa.edu
  P: (210) 567-0655
- Jessica L. Nute, PhD, DABR; Assistant Professor, Radiology; Associate Director, Radiological Sciences Graduate Program
  NuteJ@uthscsa.edu
  P: (210) 567-1361
- Geoffrey Clarke, PhD; Professor, Research Imaging Institute
- Peter T. Fox, MD; Director, Research Imaging, Research Imaging Institute

Academic Program Coordinators:

- Laura Gomez; GomezL9@uthscsa.edu
  P: (210) 450-5369

Administrative Staff:

- Mary Ann Martinez; Assistant to the Chair, Research Imaging Institute: martinezma0@uthscsa.edu
  P: (210) 567-8150

UT Health San Antonio Radiology

DIAGNOSTIC IMAGING PHYSICS
FOR
RADIOLOGY RESIDENTS

PURPOSE:

This course aims to provide radiology residents with fundamental knowledge of physics behind medical imaging, including but not limited to: the physical basis of imaging formation, theory of operation for imaging equipment used in all modalities in diagnostic radiology, patient and staff radiation dose from diagnostic imaging and basic radiation safety.

TIME:

Faculty from the Radiological Sciences Graduate Program (RADISCI) teach this course over a 2-year cycle with 11 to 13 lectures per year. These lectures are offered as part of the noon resident conference series.

DESCRIPTION:

Lectures feature the physics of imaging systems, projection imaging, mammography, fluoroscopy, CT, MRI, ultrasound, patient exposure control, digital images, radiation safety, and Nuclear Medicine. The subject matter for these lectures is informed by the following: the ACR CORE Exam Study Guide, The AAPM “Diagnostic Radiology Residents Physics Curriculum”, and previous ACR In-Training Exams. Lectures have been split into two groups (Series A and Series B) which the faculty presents in alternate years to allow for the necessary depth and breadth of physics education required by the ACR CORE Exam. Lectures focusing on summative learning and integration of physics principles into clinical practice will be included in the late spring of each year.

Additional physics instruction is available through the RSNA/AAPM educational physics modules available on-line for free to RSNA members. RSNA membership is free for residents and fellows.

The faculty may present additional physics modules as part of other section lectures to enhance physics integration and to provide education on advanced topics.

SCHEDULE:

The RADISCI faculty offer a single, introductory lecture to all new, incoming residents (R1) annually in July during noon conference in the radiology classroom.

Other, more complete and comprehensive physics lectures are scheduled throughout the year based on the weekly department section schedule for the academic year from August through April. Topics for each lecture are listed below with an associated reading/viewing list. Reading is expected to be completed before the associated lecture.

Additionally, lectures in late April through early June are provided for radiology residents (R1 and R2) focusing on summative learning. These lectures will cover topics from both alternating year cycles with the goal of integrating physics principles across lectures for clinical application.

TOPICAL CONTENT OF PHYSICS LECTURE SERIES:

R 1 (PGY 2) Residents

1. Introduction to the Physics of Radiology

R 1 (PGY 2) and R 2 (PGY 3)

Lecture Series A (offered on alternate years)

1. **Radiation Interaction with Matter**
   - AAPM/RSNA Physics Tutorials for Residents: X-Ray Interactions (https://doi.org/10.1148/radiographics.18.2.9536489)
   - Huda, Review of Radiologic Physics, 4th Ed, Chapter 1
   - AAPM/RSNA Physics Module**: Interaction of Radiation and Tissue (2019)
2. **Radiological Quantities and Units (+ basic dosimetry)**
   - AAPM/RSNA Physics Tutorials for Residents: X-Ray Production pg 967-973 (https://doi.org/10.1148/radiographics.17.4.9225393)
   - Huda, Review of Radiologic Physics, 4th Ed Chapter 1
   - AAPM/RSNA Physics Module: Radiation Measurements and Units (2018)
   - AAPM/RSNA Physics Module: Fundamentals of Radiation Protection (2018)
   - AAPM/RSNA Physics Module: Radiation Dose and Risk (2019)
   - AAPM/RSNA Physics Module: Radiation Effects (2018)
3. **Radiation Safety**
   - Huda, Review of Radiologic Physics, 4th Ed Chapters 4 – 6
   - AAPM/RSNA Physics Module: Radiation Measurements and Units (2018)
   - AAPM/RSNA Physics Modules: Fundamentals of Radiation Protection (2018)
   - AAPM/RSNA Physics Modules: Radiation Dose and Risk (2019)
   - AAPM/RSNA Physics Modules: Radiation Effects (2018)
4. **Image Quality**
   - Huda, Review of Radiology Physics, 4th Ed, Chapter 3
5. **X-ray Production, X-ray Tubes, Generators and Systems**
   - AAPM/RSNA Physics Tutorials for Residents: X-Ray Production pg 973-984 (https://doi.org/10.1148/radiographics.17.4.9225393)
   - AAPM/RSNA Physics Tutorials for Residents: X-Ray Generators (https://doi.org/10.1148/radiographics.17.6.9397462)
   - Huda, Review of Radiologic Physics, 4th Ed, Chapter 2
   - AAPM/RSNA Physics Module: X-Ray Tubes and Spectra
6. **Projection Radiography and Image Formation**
   - Huda, Review of Radiologic Physics, 4th Ed, Chapter 7
   - AAPM/RSNA Physics Module: Basic concepts in Radiology (2019)
7. **Image Receptors – Analog and Digital (and review of Digital Images**)
   - Huda, Review of Radiologic Physics, 4th Ed, Chapter 2
   - AAPM/RSNA Physics Module: Radiographic Image Receptors
8. **Mammography**
   - AAPM/RSNA Physics Tutorials for Residents: Digital Mammography: An Overview (https://doi.org/10.1148/rg.246045102)
   - Huda, Review of Radiologic Physics, 4th Ed, Chapter 8
   - AAPM/RSNA Physics Module: Mammography Image Quality and Dose (2018)
   - AAPM/RSNA Physics Module: Radiographic and Mammographic Systems for Radiology Residents (2018)
9. **Fluoroscopy, Exposure Control and Patient Dose**

- AAPM/RSNA Physics Tutorials for Residents: General Overview of Fluoroscopic Imaging (https://doi.org/10.1148/radiographics.20.4.g00jl301115)
- AAPM/RSNA Physics Tutorials for Residents: Digital Fluoroscopy (Pooley)
- Huda, Review of Radiologic Physics, 4th Ed, Chapter 9
- AAPM/RSNA Physics Module: Fluoroscopy Systems
- AAPM/RSNA Physics Module: Radiation Dose and Safety in Interventional Radiology

10. **Computed Tomography**
    - AAPM/RSNA Physics Tutorials for Residents: Search for Isotropic Resolution in CT from Conventional through Multiple-Row Detector (https://doi.org/10.1148/radiographics.22.4.g02jl14949)
    - Huda, Review of Radiology Physics, 4th Ed, Chapter 11
    - AAPM/RSNA Physics Module: CT Image Quality and Protocols
    - AAPM/RSNA Physics Module: Imaging Gently – CT Imaging and Radiation Protection in Pediatric Patients
    - AAPM/RSNA Physics Module: Radiation Dose in CT

Lecture Series B (offered on alternate years)

1. **Ultrasound**
    - AAPM/RSNA Physics Tutorials for Residents: B-mode US: Basic Concepts and New Technology (https://doi.org/10.1148/rg.234035034)
    - AAPM/RSNA Physics Tutorials for Residents: Doppler US Techniques: Concepts of Blood Flow Detection and Flow Dynamics (https://doi.org/10.1148/rg.235035080)
    - Huda, Review of Radiologic Physics, 4th Ed, Chapters 17-18
    - AAPM/RSNA Physics Modules: Ultrasound – Concepts and Transducers (2019)
    - AAPM/RSNA Physics Modules: Interaction of Ultrasound with Tissue, and Doppler Ultrasound
    - AAPM/RSNA Physics Modules: Image Quality, Artifacts, and Safety in Ultrasound.
2. **MRI 1: Fundamentals, T1/T2 Relaxation, Image Contrast**
    - AAPM/RSNA Physics Tutorials for Residents: Fundamental Physics of MR Imaging (https://doi.org/10.1148/rg.254055027)
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 15
    - AAPM/RSNA Physics Module: Basic Principles of Nuclear Magnetic Resonance (2019)
    - AAPM/RSNA Physics Module: MRI Instrumentation
    - AAPM/RSNA Physics Module: MRI Tissue Properties, Contrast Agents, and Reactions
3. **MRI 2: Pulse Sequences, Image Formation, Clinical Applications**
    - AAPM/RSNA Physics Tutorials for Residents: MR Imaging: Brief Overview and Emerging Applications (https://doi.org/10.1148/rg.274065115)
    - AAPM/RSNA Physics Tutorials for Residents: MR Imaging Safety Considerations (https://doi.org/10.1148/radiographics.19.6.g99no331641)
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 16
    - AAPM/RSNA Physics Modules: MRI Imaging Formation (2019)
    - AAPM/RSNA Physics Modules: MRI Image Artifacts (2019)
    - AAPM/RSNA Physics Modules: MRI Pulse Sequences
4. **Radioactive decay**
    - Huda, Review of Radiologic Physics, 4th Ed. Chapter 13
5. **Radiopharmaceuticals and Internal Dosimetry**
    - AAPM/RSNA Physics Tutorials for Residents: Radiopharmaceuticals (https://doi.org/10.1148/radiographics.18.6.9821190)
    - AAPM/RSNA Physics Tutorials for Residents: Internal Radiation Dosimetry: Principles and Applications (https://doi.org/10.1148/radiographics.20.2.g00mc33533)
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 13-14
    - AAPM/RSNA Physics Modules: Nuclear Medicine Radioisotopes and Radiopharmaceuticals

- AAPM/RSNA Physics Modules: Radionuclide Dosimetry and Nuclear Regulations

6. **Radiation Detectors for Nuclear Medicine**
    - AAPM/RSNA Physics Tutorials for Residents: Radiation Detectors in Nuclear Medicine (https://doi.org/10.1148/radiographics.19.2.g99mr30481)
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 13
    - AAPM/RSNA Physic Modules: Radiation Detection Instrumentation in Nuclear Medicine Practice
7. **Anger/Gamma Camera**
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 13
    - AAPM/RSNA Physics Module: Gamma Camera/Image Quality
8. **SPECT**
    - AAPM/RSNA Physics Tutorials for Residents: Physics of SPECT (https://doi.org/10.1148/radiographics.16.1.173)
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 14
    - AAPM/RSNA Physics Module: SPECT/SPECT-CT/Image Quality
9. **PET**
    - AAPM/RSNA Physics Tutorials for Residents: Physics of PET (https://doi.org/10.1148/radiographics.15.5.7501858)
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 14
    - AAPM/RSNA Physics Module: PET/PET-CT/Image Quality (2019)
10. **Radiation Safety in Nuclear Medicine and Regulatory Issues**
    - Huda, Review of Radiologic Physics, 4th Ed, Chapter 14
    - AAPM/RSNA Physics Module: Radionuclide Dosimetry and Nuclear Regulations.

Summative Lectures Examples (may not correspond to lectures presented)

1. **X-ray Interactions and X-ray Production**
2. **Dosimetry in Ionizing Radiation Producing Modalities**
3. **Detector Types and Image Quality**
4. **Fundamentals of MRI and US**

SUGGESTED CORE TEXTS:	**Essential Physics of Medical Imaging, Third Edition**	**By: Bushburg**
	Review of Radiologic Physics, Third Edition	**By: Huda**

DIVISION OF VASCULAR & INTERVENTIONAL RADIOLOGY

Section Chief:

- Jorge E. Lopera, MD; Professor
  Lopera@uthscsa.edu
  P: (210) 567-5564

Section Faculty:

- Rajeev Suri, MD; Professor and Vice-Chair, Dept. of Radiology
- Ghazwan Kroma, MD; Professor and Program Director; VIR, IR Independent & IR Integrated
- Laura Barnes, MD; Assistant Professor
- Andres E. Garza-Berlanga, MD; Associate Professor
- Kent W. Rohweder, MD; Associate Professor
- John A. Walker, MD, PhD; Assistant Professor

Fellows: AY 2021-2022

- Andy Chesley, MD (IR-Independent)

Residency/Fellowship Program Coordinator (VIR, IR Independent & IR Integrated):

- Bianca Acosta, Academic Program Coordinator
  AcostaB3@uthscsa.edu
  P: (210) 567-5550

Clinical Administrative Assistant:

- Jessica A. Esquivel; EsquivelJ2@uthscsa.edu
  P: (210) 567-5564

UT Health San Antonio Radiology

Vascular and Interventional Radiology

Program Description

The goals of the Vascular and Interventional Radiology program in the Radiology Residency at UTHSCSA are to provide the residents with the knowledge and practical experience in vascular diagnostic and interventional radiology sufficient to support their functioning as general diagnostic radiologists upon graduation from the program. The residency graduate should be capable of performing routine vascular and non-vascular diagnostic and therapeutic procedures.

Vascular procedures include diagnostic examination of the thoracic, abdominal, and lower extremity arteries as well as the fundamentals of intervention such as balloon angioplasty and stent placement, thrombolytic therapy, and embolization techniques.

He or she should possess full interpretive skills for these procedures and should be fully cognizant of the indications and contraindications of these procedures, the disease processes involved, the various invasive and non-invasive means of evaluating the patient requiring such studies, and the various surgical and radiologic interventions available. He or she should be skilled at providing the appropriate pre- and post-procedure case measures and at recognizing and appropriately dealing with complications that may occur.

The principles of vascular and non-vascular interventions should be fully understood, and experience should have been gained in these procedures during the clinical rotations. Depending on clinical cases available during the resident's rotations, it is anticipated that the graduated resident will be capable of performing basic venous access, hemodialysis graft management, IVC filters, and pulmonary angiography. Residents will also perform percutaneous biliary and renal drainage.

It is extremely important that the residents realize that vascular and interventional radiology is a blending of clinical procedures **and** radiology. The radiologic interpretation of the images obtained is the reason for performing the invasive diagnostic examination, and analysis of the radiologic finds and pathophysiology of the patient's condition, and reporting the examination results are equally as important as performance of the examination. In addition, the peri-procedural aspects of the case, especially decision making concerning whether and how to perform a case and manage the patient are fully as important as the manipulations performed.

Vascular and Interventional Radiology is a rapidly changing field. This implies that available reference material is rapidly developing. Textbook references are listed below and represent a valuable learning resource. Specific mandatory reading assignments for the resident are given in the Cardiovascular and Interventional Radiology Training objectives.

Suggested Reading

1. Baum S, Pentecost MJ, H.L., ***Abrams Angiography*, 4th Ed.** Little Brown and Co. 2007.
This is the encyclopedic reference for classical angiographic technique, and probably the best source for disease processes. It is somewhat daunting in size but is very complete.

2. Kaufman JA, Lee MJ. *The **Requisites: Vascular and Interventional Radiology***. WB Mosby Co 2004.
This is an excellent book combining technique and radiology which is manageable in size, covering principally diagnostic angiography. This entire book should be covered by the resident during the 1st 2 yrs.

3. Valji K., ***Vascular and Interventional Radiology, 2nd* Ed.** Saunders, 2006.

GUIDELINES FOR NEW RESIDENTS AND FELLOWS ROTATING IN IR

1. In the morning a good time to show up in the Hospital is 7:00 am. Usually, patients are not ready by that time, but you can review the cases and get any consents.

2. Any in patients should be consented the day before the procedure. Make sure to either write or tell the primary MD to make the patient NPO after midnight and order all the Labs.

3. You are expected to attend the 7:30 meeting.

4. Board meeting to discuss the cases of the day starts at 8:00-8:05 am. The person giving the lecture should be finished at 8:00 or earlier.

5. Consent the patients in their language: If a patient speaks Spanish don't make them sign the form in English.

6. For any procedure add "and other possible interventions", that way any unexpected additional procedures are covered by the initial consent

7. Wash your hands using a full surgical scrub technique in the morning, after that use the Avagard for the rest of the day. Remember not to wear any jewelry like rings, watches, etc.

8. Any procedure that is finished is to have a Sunrise notes and orders within 30 minutes of completing the case. To avoid delays and jumping between cases, the orders can be written before the case for simple procedures such as central lines.

9. Protect yourself and others from accidental injuries. Always wear goggles. Many patients have a very contagious disease and splashes are common. Never place needles or other sharp objects on the table, always use the container of the table; if you cannot reach the container always tell other people in the room that you are placing a needle on the table.

10. Even though the resident may not like IR much and thinks that he/she will never hold a needle in their hands again, residents are expected to be proficient in basic IR techniques such as US guidance for venous access. Basic catheter and wires, exchange technique, and other procedures.

11. Last Wednesday of the rotation resident is expected to give a case presentation showing any interesting case followed by a short 5-10 minutes review of the topic.

12. The Lecture series is: On Tuesdays Vascular Surgery on 4th Medical Building at 6:45 am. On Wednesdays Fellow/Resident case presentation in the IR Reading room at 7:30. On Thursdays IR Faculty Lecture IR reading room. On alternate Fridays: Hepatology meeting at the VA or M&M -Journal club in the Angio reading room. Please review the attached calendar for each month.

FIRST ROTATION

Knowledge-based Objectives:

1. GI vascular anatomy in detail
2. Lower extremity vascular disease patterns and collateral pathways
3. Pathophysiology of carotid arterial disease and arterial manifestations
4. Basic understanding of the risks of and indications for the range of vascular interventional procedures.
5. Methodology of access to the urinary tract and biliary tract by percutaneous methods with primary and alternate approaches
6. Understanding of pathophysiology of biliary obstructive disease
7. Basic understanding of pathophysiology of urinary obstructive disease and renal stone disease
8. Understanding of the principles and use of doppler ultrasound
9. Differential diagnosis of plain film signs of cardiac disease

Technical Skills:

1. Catheterization of the femoral artery and vein and alternative puncture sites
2. Selective catheterization of major first order vascular branches with assistance
3. Selection of injection and filming rates in angiography
4. Performing catheter and wire exchanges
5. Fluoroscopically and sonographically guided puncture technique and use of the coaxial access systems
6. Basic operation of Doppler ultrasound equipment

Interpretive Skills:

1. Detail interpretation of peripheral vascular arteriography and CT Angiography
2. Detail interpretation of pulmonary arteriography and correlation with ventilation/ perfusion lung scanning

Cumulative Experience Goals:

1. Perform at least 10 venous catheterizations as the primary operator
2. Insert an inferior vena cava filter as the primary operator
3. Assist with at least 5 percutaneous GU interventional procedures (PCN, stent, PCNL)

Reading Recommendations:

1. Kadir S, *Diagnostic Angiography*, chapters 3, 11, 12, 13, 14, 15, 16, 20, 22, 23
2. Cope C, *Atlas of Interventional Radiology*, chapters 3, 7, 8, 11-14 to 11-17
3. Gedgaudas E, *Cardiovascular Radiology*, chapters 10, 11, 12; optional 5-9

SECOND ROTATION

Knowledge-Based Objectives:

1. GI vascular disease patterns and collateral pathways
2. Renal vascular disease patterns and differential diagnoses
3. Hepatic vascular disease patterns and differential diagnoses
4. Carotid vascular disease patterns and collateral pathways
5. Patterns of disease of vasculitis
6. Indications for and risks of GU and biliary interventions, with options for treatment and expected success rates
7. Methodology for various GU and biliary interventions
8. Basic knowledge of coronary artery anatomy
9. Knowledge of indications, risks, and methodology of basic percutaneous drainage of abscesses and intra-abdominal fluid collections

Technical Skills:

1. Central venous catheter venipuncture and catheter placement; sonographically guided puncture technique
2. Performance of routine aortography and venography procedures with assistance
3. Independent operation of the fluoroscopy equipment and table with technologist assistance
4. Directing catheter and wire exchanges with an assistant
5. Extremity venography with assistance
6. Nephrostomy access

Interpretive Skills:

1. Correlation of multi-modality vascular images for interpretation and diagnosis:
   CT, ultrasound, doppler ultrasound, angiography
2. In-depth interpretation of GI, renal and brachiocephalic arteriography
3. Interpretation of CTA images of the abdominal aorta and renal arteries

Cumulative Experience Goals:

1. Perform at least one antegrade femoral puncture and one radial puncture
2. Perform at least one central venous catheter placement as the primary operator
3. Perform an arterial angioplasty procedure as the primary operator
4. Percutaneously puncture and catheterize a vascular graft as the primary operator (includes dialysis grafts)
5. Perform at least one pulmonary arteriogram as the primary operator
6. Perform at least one percutaneous nephrostomy as the primary operator
7. Participate in at least one percutaneous primary biliary access procedure

Reading Recommendations:

1. Kadir S, *Diagnostic Angiography*, chapters 17, 18, 19 (again), 21
2. Cope C, *Atlas of Interventional Radiology*, chapters 4, 5, 6, 9, 10
3. Appropriate Interventional Radiology Handbook
4. Higgins CB, *Essentials of Cardiac Radiology and Imaging*, chapters 1, 3, 6, 8, 9
5. Complete ACR TF chest and cardiovascular sections

Knowledge-Based Objectives:

1. In-depth knowledge of vascular manifestations of systemic and organ disease processes
2. Understanding and ability to describe the indications, risks, capabilities, and limitations of the range of vascular interventional procedures: PTA, thrombolytic therapy, foreign body retrieval, embolization, stent placement, and TIPS
3. Methodology for percutaneous gastrostomy and gastrojejunostomy
4. Applicability and limitations of CTA and MRA

5. Knowledge of principles of MRA and CTA

Technical Skills:

1. Difficult femoral arterial punctures, antegrade approach and radial approach
2. Pulmonary arterial catheterization
3. Independent performance of routine aortography and extremity arteriography from the aorta
4. Independent performance of selective catheterization as needed for routine extremity arteriography
5. Independent extremity venography
6. Percutaneous biliary access

Interpretive Skills:

1. Correlation of multi-modality vascular images for interpretation and diagnosis: CT, ultrasound, Doppler ultrasound, angiography, CT angiography, magnetic resonance angiography
2. Differential diagnosis of the radiologic appearance of vascular manifestations of systemic and organ disease processes

Cumulative Experience Goals:

1. Participate in approximately 50 arteriograms and venous procedures; first operator in 10
2. Participate in approximately 25 non-vascular interventional procedures, the first operator in 2
3. Participate in approximately 10 GU interventions, the first operator in 10 including at least 1 primary access procedures
4. Participate in a TIPS
5. Participate in 10 balloon angioplasty procedures, the first operator in 2
6. Participate in a vascular stent placement procedure
7. Insert approximately 5 inferior vena cava filters, at least 1 from the jugular approach as the primary operator
8. Participate in 10 central venous access cases bring the prime operator in 2 cases.

Reading Recommendations:

1. Appropriate ACR Syllabi
2. Higgins CB, *Essentials of Cardiac Radiology and Imaging*. Entire book, review as needed.

Vascular and Interventional Radiology

Objectives and Responsibilities
Residents in Interventional Radiology

Resident Responsibilities

1. The resident is in charge of the smooth running of the VIR service, in conjunction with the IR fellow. This involves scheduling studies, fielding questions from referring physicians, helping to round up pertinent prior films or other imaging studies used for procedure planning (US, CT, and MR). The resident should be readily available in the Vascular Suite at all times.

2. Daily Schedule:

a. Day begins at 7:00 am. As conferences begin at 7.30 AM on some days (Wednesdays, Thursdays, and Fridays), the IR resident/Fellow should coordinate to consent the first outpatient case of the day before starting conference.

b. Review schedule book for cases for the day, and check to see that lab results are available on the patient.

c. Outpatients are scheduled in the morning. When the nurses inform you of the arrival of an outpatient, you should do a quick H and P and consent the patient for the procedure. The H and P forms must be filled out. Inpatients do not need this. Consent forms must be filled out completely before the signature is obtained.

d. Assist in cases during the day.

e. Between cases or at the end of the day, consent inpatients to be done the following day.

f. All same day add-ons must go through the primary fellow on the service (even if the schedule for the day is light). All routine studies can be scheduled for the next available slot.

g. Periodically check the book for messages the staff may have taken down for you (usually about scheduling).

h. Please make sure that any patient undergoing a procedure who needs sedation has been NPO since midnight and has an IV in place before beginning the case.

3. Goals: Familiarity with the indications, conduct and interpretation of vascular interventional procedures. Also, familiarity with potential complications.

CONFERENCES

Interdepartmental Conferences:

Alternative Mondays (7:30 – 8:00 AM)
Rad-Path Conference

Tuesdays (6:50 – 7:50 AM)
Vascular Surgery Conference is held in the UTHSC bldg. on the fourth floor (Rm 409L)

Fridays (Alternate weeks) (6:50 – 7:50 AM)
Interdisciplinary VA Liver Tumor Conference, which is held in the VA Radiology Conf. Room.

IR Departmental Conferences:

Tuesday (**7:30 – 8:00 AM)**
On the first Tuesday of the IR rotation block, IR faculty/Fellow shall present an IR case conference for Radiology residents (UHS 2nd floor IR Reading Room)

Wednesdays (**7:30 – 8:00 AM)**
IR faculty, residents, and fellows meet in the UHS 2nd floor IR Reading Room. Interesting cases from the previous week are discussed by the IR fellow/IR resident.

Thursdays (**7:30 – 8:00 AM)**
IR faculty, residents, and fellows meet in the UHS 2nd Floor IR Reading room. The IR faculty shall discuss a review article/present a lecture and/or case conference.

Fridays (**7:30 – 8:00 AM)**
On the Fridays alternating with the VA Liver Tumor Conference, the IR faculty, residents, and fellows meet in the UHS 2nd floor IR Reading Room. Every last Friday of the month shall be a Mortality and Morbidity conference. The other Friday of the month shall be a Journal club discussion (review of an IR manuscript) to be presented by every faculty, fellow, and resident.

Interventional Radiology Core Lectures/Reading Guide

Books available in Jessica Esquivel's office:

Interventional Radiology, A survival Guide (Kessel and Robertson) 4th Edition
Handbook of Interventional Radiology procedures, Kandarpa 5th edition

For the first rotation in IR:

Week 1: Section 1. Planning safe procedures, Chapter 1 Kessel
Pre-procedural safety list, Chapter 2 Kessel.
Week 2: Sedation,analgesia and anesthesia, Chapter 62 Kandarpa
Week 3: Vascular access and catheter-directed angiography, Kandarpa Handbook
Week 4: Central venous access, Chapter 28, 29, and 30 Kandarpa

Second month:

Week 1: Gastrostomy, GJ , jejunotomy, and cecostomy, Chapter 51 Kandarpa
Week 2: PCN and ureteral stents, Chapter 53 kandarpa
Week 3: Biliary interventions, Chapter 52 Kandarpa
Week 4: TIPS and portal hypertension, Chapters 38,40 and 41 Kandarpa

Third month:

Week 1: Chemoembolization and radioembolization, Chapters 23 and 24 Kandarpa
Week 2: Tumor ablation, Chapter 56 and 57 Kandarpa
Week 3: Dialysis interventions, Chapter 31,32, 33 Kandarpa
Week 4: Biliary drainage, Chapter 43 Kessel

Fourth-month rotation:

Week 1: IVC filter, Chapter 35 Kandarpa
Week 2: Uterine and prostate embolization, Chapter 27 Kandarpa
Week 3: Trauma, Chapter 15 Kandarpa
Week 4: Peripheral vascular interventions, Chapter 46, and 47 Kessel.

For the rotation in Body IR:

Week 1: Achieving Tissue diagnosis, Chapter 38 Kessel
Percutaneous abdominal biopsy, Chapter 49 Kandarpa
Week 2: Treating fluid collections and abscesses, Chapter 39 Kessel.
Week 3: Drainage of the abdominal abscess and fluid collections, Chapter 50 Kandrapa
Week 4: Biopsy Procedures of the Lung, mediastinum and chest wall, Chapter 46 Kandarpa

GENERAL POLICY OF RESIDENT SUPERVISION
Vascular and Interventional Radiology

Approved by GMEC 9 Sept 2003; reviewed & approved 13 April 2004

Section I. Introduction

Careful supervision and observation are required to determine the trainee's abilities to perform technical and interpretive procedures and to manage patients. Although they are not licensed independent practitioners, trainees must be given graded levels of responsibility while assuring quality care for patients. Supervision of trainees should be graded to provide gradually increased responsibility and maturation into the role of a judgmentally sound, technically skilled, and independently functioning credentialed provider.

Section II. Definitions

The following definitions are used throughout the document:

Resident – a professional post-graduate trainee in a specific specialty or subspecialty

Licensed Independent Practitioner (LIP) – a licensed physician who is qualified usually by board certification or eligibility to practice his/her specialty or subspecialty independently

Medical Staff – a LIP who has been credentialed to provide care in his/her specialty or subspecialty by a hospital

Staff Attending – the immediate supervisor of a resident who is credentialed in his/her hospital for specific procedures in their specialty and subspecialty that he/she is supervising

Section III. Purpose

This policy will establish the minimum requirements for resident supervision in teaching hospitals of The University of Texas Health San Antonio (UTHSA). An UTHSCSA teaching hospital may have additional requirements for resident supervision as they pertain to that specific hospital. Individual training programs may also have more requirements for their attendings and trainees.

Section IV. Procedures

A. Residents will be supervised by credential providers ("staff attendings") who are licensed independent practitioners on the medical staff of the UTHSA teaching hospital in which they are attending. The staff attendings must be credentialed in that hospital for the specialty care and diagnostic and therapeutic procedures that they are supervising. In this setting, the supervising staff attending is ultimately responsible for the care of the patient.

B. Each UTHSA Program Director will define policies in his/her discipline to specify how trainees in that program progressively become independent in specific patient care activities in the program while still being appropriately supervised by medical staff. Graduated levels of responsibility will be delineated by a job description for each year of training. A program's resident supervision policies must be in compliance with JCAHO policies on resident supervision. The policies will delineate the role, responsibilities, and patient care activities of trainees and will delineate which trainees may write patient care orders, the circumstances under which they may do so, and what entries if any must be countersigned by a supervisor. Each UTHSA Program Director will complete a listing of resident clinical activities that are permitted by year of training, the required level of supervision for each activity, and any requirements for independence in the performance of that activity (see Appendix A). Program Directors of ACGME credentialed programs will submit the job descriptions and their listing of clinical activities by postgraduate year to the Office of the Associate Dean for Graduate Medical Education (GME) for approval.

C. Yearly, each UTHSA Program Director will review the job descriptions listing or resident clinical activities and make changes as needed. Program Directors of ACGME-credentialed programs will submit the new job descriptions and their updated listing of clinical activities by postgraduate year to the Office of the Associate Dean for Graduate Medical Education (GME) and to the Graduate Medical Education Committee (GMEC) for approval.

D. The Program Director will ensure that all supervision policies are distributed to and followed by trainees and the medical staff supervising the trainees. Compliance with the UTHSA resident supervision policy will be monitored by the Program Directors.

E. Annually the Program Director will determine if residents can progress to the next higher level of training. The requirements for progression to the next higher level of training will be determined by standards set by each Program Director. This assessment will be documented in the annual evaluation of the trainees.

Section V. Supervision of Trainees in the Angiography Room

The staff physician must be present in the angiographic suite area for the key parts of all major cases. A major case is defined as a procedure that involves entering a major body cavity or that has potential for mortality, significant morbidity, or significant blood loss. Any procedure performed on a patient with major risks from anesthesia due to underlying medical problems will be considered a major case. In some cases, even positioning of the patient may be considered a key element. Even in his/her absence from the operating room area, the staff physician remains responsible for proper patient and operative site identification as well as care of the patient. If in the opinion of the staff, a surgical procedure is minor and of the low potential for significant morbidity, the procedure may be performed under the direction of a qualified (as defined in the training program's curriculum) resident after proper patient and operative site identification by the attending physician.

Section VI. Supervision of Trainees in Interpretive Settings

The radiology resident will be responsible for the reading and interpretation of the films performed during a working day. The most important findings will be discussed with either the attending physician or the interventional resident. The radiology resident will be responsible for the dictation of an understandable report describing the patient's clinical history, proper diagnostic codes, proper procedure codes, description of the procedure and procedure findings, and outcome. The reports will be reviewed by the attending physician who supervised the case.

Section VII. Supervision of Trainees Performing Procedures

A trainee will be considered qualified to perform a procedure if, in the judgment of the supervising staff and his/her specific training program guidelines, the trainee is competent to perform the procedure safely and effectively. Residents in their first rotation will learn to obtain arterial and venous access and perform non-complicated diagnostic arterial and venous diagnostic studies. They are also expected to learn image-guided vascular access for more complicated cases. Placement of long-term intravenous access systems will also be part of the skills to learn in the first rotation. Residents in their second rotation will be expected to participate more actively in more complicated procedures such as access to obstructed kidneys, biliary drainage, and embolization procedures as these procedures require a higher skill level and understanding. Finally, for their third rotation, the residents will be expected to participate in more complex procedures such as thrombolytic therapy, mechanical thrombectomy, stent placement, and more invasive procedures. The residents will be supervised accordingly. In addition, the residents are expected to understand the process of obtaining informed consent from the patient and this activity will also be supervised both by higher-level residents (interventional residents) and faculty.

GENERAL SUPERVISION POLICY
Interventional Radiology Integrated Residency Program
Effective Date: July 1, 2017

Section I. Introduction

Careful supervision and observation are required to determine the trainee's abilities to perform technical and interpretive procedures and to manage patients. Although they are not licensed independent practitioners, trainees must be given graded levels of responsibility while assuring quality care for patients. Supervision of trainees should be graded to provide gradually increased responsibility and maturation into the role of a judgmentally sound, technically skilled, and independently functioning credentialed provider.

Section II. Definitions

The following definitions are used throughout the document:

- IR – Interventional Radiology
- IR resident - A professional post-graduate trainee in IR subspecialty.
- LIP – A Licensed Independent Physician who is qualified usually by board certification or eligibility to practice his/her specialty or subspecialty independently.
- Staff Attending– The immediate supervisor of the IR resident who is credentialed in his/her hospital for specific procedures in the specialty and subspecialty that he/she is supervising.
- PD – Interventional Radiology residency program director.

Section III. Levels of Supervision

To ensure proper IR residents supervision and graded authority and responsibility, the program uses the following classification of supervision, in accordance with the Common Program Requirements:

LEVEL (1)-Direct Supervision – the staff attending is physically present with the trainee and the patient.

Indirect Supervision:

LEVEL (2)- with direct supervision immediately available – the staff attending is physically within the hospital or other site of patient care, and is immediately available to provide Direct Supervision.

LEVEL (3)-with direct supervision available – the staff attending is not physically present within the hospital or other site of patient care, but is immediately available by means of telephonic and/ or electronic modalities, and is available to provide Direct Supervision.

LEVEL (4)-Oversight – the staff attending is available to provide review of procedures/encounters with feedback provided after care is delivered.

Section IV. Purpose

This policy will establish the minimal requirements for IR resident's supervision in teaching hospitals of The University of Texas Health Science Center at San Antonio (UTHSCSA). A UTHSCSA teaching

hospitals may have additional requirements for IR residents' supervision as they pertain to that specific hospital.

Section V. Procedures

A. IR residents will be supervised by credential providers ("staff attendings") who are licensed independent practitioners on the medical staff of the UTHSCSA teaching hospital in which they are attending. The staff attending must be credentialed in that hospital for the IR diagnostic and therapeutic procedures that they are supervising, in this setting, the supervising staff attending is ultimately responsible for the care of the patient.

B. This policy defines how IR trainees progressively become independent in specific patient care activities in the program while still being appropriately supervised by medical staff. A graduated level of responsibility is defined in this policy. This policy is in compliance with TJC policy on resident supervision.

C. This policy will be reviewed yearly by the IR Program Director, and changes made as needed. If updated, the PD will submit the new job descriptions and their updated listing of clinical activities by postgraduate year to the Office of the Associate Dean for Graduate Medical Education (GME) and to the Graduate Medical Education Committee (GMEC) for approval.

D. The Program Director will ensure that this supervision policy is distributed to and followed by trainees and the medical staff supervising the trainees. Compliance with this supervision policy will be monitored by the IR Program Director.

Section VI. Supervision of the IR residents in the Angiography Room

The staff attending must be present in the angiographic suite area for the key parts of all major cases. A major case is defined as a procedure that has potential for mortality, significant morbidity, or significant blood loss. Any procedure performed on a patient with major risks from anesthesia due to underlying medical problems will be considered a major case. In some cases, even positioning of the patient may be considered a key element. Even in his/her absence from the operating room area (a possibility for central line access procedures, see below), the staff physician remains responsible for proper patient and operative site identification as well as care of the patient.

Section VII. Supervision of IR residents Performing Procedures

A trainee will be considered qualified to perform a procedure if, in the judgement of the supervising staff and the VIR program guidelines, the trainee is competent to perform the procedure safely and effectively.

IR residents in their first 6 months of IR focused training will learn to obtain arterial and venous access and perform non-complicated diagnostic arterial and venous diagnostic studies. Placement of long term intravenous access systems will also be part of the skills to learn in the first 6 months.

IR residents in their second 6 months of the IR focused training will be expected to perform more complicated procedures such as access to obstructed kidneys, biliary drainage, and embolization procedures as these procedures require a higher level of experience.

Finally, and for the rest of their training; the IR residents will be expected to perform more complex procedures such as thrombolytic therapy, mechanical thrombectomy, stent placement and more invasive procedures.

The PD may grant approval for independent performance of a procedure by the IR residents based on the direct supervision, logged cases, and the IR attending staff feedback during the quarterly evaluation (see

Appendix). Depiction of the approval will be hard copied in the Angiography suite and posted on the intranet page if available.

Section IX. Supervision of the IR residents in the afterhours and weekend calls:

All urgent and emergent afterhours and weekend cases that require sedation should be done with direct supervision of the staff attending on call. Minor procedures that require no sedation (Quinton dialysis catheter placement, paracentesis, thoracentesis) can be done by qualified IR residents with indirect supervision (level 3 supervision) by the staff attending on call.

Section X. Requirements for Contract Staff Attendings:

IR residents are required to contact their faculty immediately in cases of:

1. Deterioration in the status of patients with whom the IR resident has directly participated in their care, e.g., performed procedures on the patients. Such deterioration would be characterized by, for instance, transfer to a higher level of care such as an ICU.

2. Death of a patient with similar involvement as (1).

3. Requirement to return to a procedure area to address a complication from a previous procedure.

Section XI. Supervision of the IR residents in non-procedural settings (IR clinic, IR recovery rooms…):

The IR residents are expected to understand the process of obtaining informed consent from the patient and this activity will be supervised by IR staff attending. The IR residents are also expected to provide post procedure care under the supervision of the IR staff attending. All consultations from other provider in regard of IR should be discussed with the staff attending and documentation should be provided.

IR residents will be rotating in the IR clinic to learn how to establish a physician-patient relationship and understand the patient post-procedure follow up process. These activities will also be under the supervision of the IR staff attending.

IR residents, in addition, will be actively participating in multidisciplinary meetings under the direct/indirect supervision of the IR faculty.

Interpretive procedures including invasive studies (IR procedures) and non-invasive studies (CT Angiograms, post procedure imaging,..) interpretation will be over sighted (LEVEL 4 supervision) by the staff attending.

APPENDIX:

Clinical activity	Resident level	Method of instruction	Faculty	Method of confirming competency	Level of supervision
Superficial Tissue Biopsies	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1, 2, or 3
Paracentesis and Thoracentesis	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1, 2, or 3
Central venous Access	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1, 2, or 3
Deep Tissue Biopsies	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Diagnostic Venography	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Fistulogram	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
IVC Filter placement	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Aspiration and Drainage	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Diagnostic Angiogram	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Percutaneous Gastrostomy	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Percutaneous Nephrostomy	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Percutaneous Biliary Drains	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Selective Embolization	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1 or 2
Thrombolytic Procedures	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1
Angioplasty and Stent Placement	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1
Tumor Ablations	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1
TIPSS& related Procedure	PGY5/6	Direct clinical	IR Staff attending	PD approval	Level 1

Interventional Radiology Integrated Residency Program
Duty Hours Policy

The Interventional Radiology Resident Program recognizes that a sound academic and clinical education should be carefully planned and balanced with concerns for patient safety and residents well-being. Learning objectives of the program will not be compromised by excessive reliance on residents to fulfill service obligations.

Professionalism, Personal Responsibility, and Patient Safety

The IR Resident Program educates residents and faculty members concerning the professional responsibilities of physicians to appear for duty appropriately rested and fit to provide the services required by their patients and promotes patient safety and residents well-being in a supportive educational environment.

The program director ensures a culture of professionalism that supports patient safety and personal responsibility. Residents and faculty demonstrate an understanding and acceptance of their personal role in:

- Assurance of the safety and welfare of patients entrusted to their care;
- Assurance of their fitness for duty;
- Management of their time before, during, and after clinical assignments;
- Recognition of impairment, including illness and fatigue, in themselves and in their peers;
- Honest and accurate reporting of duty hours.

The IR Residency Program oversees resident duty hours and working environment. During all clinical rotations within the training program including rotations within other departments, trainees and staff conform to existing ACGME, RC, and institutional duty hours policies. Duty hours include activities related to the residency program, patient care (both inpatient and outpatient), administrative duties related to patient care, provision for transfer of patient care, call activities, and scheduled academic activities such as conferences. Duty hours do not include reading and preparation time spent away from the duty site.

- Duty hours must be limited to 80 hours per week, averaged over a four-week period, inclusive of all in-house call activities.

- Residents will on average (over a 4-week rotation) have one day (24 hours) in 7 free of patient care responsibilities.

- In-house call (defined as those duty hours beyond the normal work day when residents are required to be immediately available in the assigned institution) will be no more than once every third night averaged over a 4-week period.

- Continuous on-site duty, including in-house call, must not exceed 24 consecutive hours. Residents may remain on duty for up to four additional hours to participate in didactic

activities, transfer care of patients, conduct outpatient clinics, and maintain continuity of medical and surgical care as defined in Radiology RRC Program Requirements. No new patients, as defined in the Radiology RRC Program Requirements, may be accepted after 24 hours of continuous duty.

- Adequate time for rest and personal activities must be provided. This should consist of a 10-hour time period provided between daily duty periods and after in-house call.

- At-home call is not subject to the every third night limitation. However, at-home call will not be so frequent as to preclude rest and reasonable personal time for each resident. Residents taking at-home call will be provided with 1 day in 7 free of all educational and clinical responsibilities averaged over a 4-week period. When a resident is called into the hospital from home, the hours that a resident spends in-house are counted toward the 80-hour limit.

- Moonlighting is not allowed for the IR Residency program

All residents and faculty members demonstrate responsiveness to patient care needs that supersedes self-interest. Our physicians recognize that, under certain circumstances, the best interests of the patient may be served by transitioning that patient's care (reading studies and performing procedures) to another qualified and rested provider.

The program's policies and procedures, including this policy, are distributed to residents and faculty annually and after each policy change. The policy is posted on the departmental intranet website and will be posted on the New Innovations home page.

1. Contingency Plan and Recognition of Fatigue and Countermeasures

Faculty and residents are educated to recognize the signs of fatigue and sleep deprivation, and to adopt and apply measures to prevent and counteract the potential negative effects of fatigue. All residents must complete the on-line module of signs of fatigue and sleep deprivation during in-processing in New Innovations. In addition, we also have the presentation given by Dr. Jennifer Peel, on our Radiology intranet site.

A contingency or backup system has been set up that enables patient care to continue safely during periods of heavy use, unexpected residents shortages, or other unexpected circumstances. The program director and supervising faculty will monitor residents for the effects of sleep loss and fatigue, and take appropriate action in instances where overwork or fatigue may be detrimental to residents performance and the well-being of the residents or the patients or both.

To prevent and counteract the potential negative effects of fatigue, the following measures have been implemented:

- If workload exceeds the scheduled resident(s) ability to provide coverage within the duty hours limits, the Program Director will arrange coverage by other residents with less demanding schedules, or will rearrange rotations to distribute the workload so that no resident approaches the duty hours limitations.

2. Duty Hours Policy Compliance Monitoring

Duty hours must be logged contemporaneously in New Innovations, per institutional policy.

The program director and faculty monitor compliance with this policy by monitoring call and duty schedules, direct observation of residents, discussions with residents, review of residents evaluation of rotations, and by monitoring duty hours logs in New Innovations. Residents are instructed to notify the program director if they or other residents are requested or pressured to work in excess of duty hour limitations.

Director maintains an open-door policy so that any resident with a concern can seek immediate redress. If problems are suspected, the Program Director will notify the Designated Institutional Official and gather direct duty hour data to clarify and to resolve the problem. In addition, the GMEC's Duty Hours Subcommittee will confirm program compliance during its biannual surveys of all programs.

UTHSCSA Interventional Radiology Integrated Residency Program
Transition of Care / Hand off Communication Policy

POLICY

1. Digital work-lists are constantly maintained on password protected PACS (Picture Archival and Communications Systems) at both the UHS and VA, thus ensuring continuity of patient care as all studies are read off these lists
2. Critical information from imaging studies is communicated to the primary care provider and the communication is documented in the dictated report with the date and time
3. Patient information is also communicated during transfers of care from one provider (Interventional Radiology/procedural services) to another (Primary care provider) to assure continuity of patient care. Such communication is documented in the patient's digital chart and/or in the dictated report

PURPOSE OF POLICY

To provide consistent communication between staff ("hand-off"), including the opportunity to ask and respond to questions regarding critical findings, when a patient undergoes interventional radiology procedure.

PROCEDURE

Routine work flow:

1. Digital work-lists (imaging studies with patient information) are constantly updated on password protected PACS (Picture Archival and Communications Systems) at both the UHS and VA: Residents and faculty read off these lists and when an imaging study is reviewed/ dictated and preliminarily approved, the study is automatically taken off the list to avoid overlap. As all studies are read off these lists, this ensures continuity of patient care during the regular work day and when there is a change in shift at
    a. 5 PM onwards to the evening shift (5-10PM)
    b. 10 PM onwards to the night shift (10PM-7.30AM)
    c. 7.30 AM onwards for the regular workday (8AM-5PM)

For interpretive situations

1. Critical information from imaging studies is communicated to the primary care provider and the communication is documented in the dictated report with the date and time: The department has identified what constitutes a critical finding (some that majorly and acutely affects patient management) and a critical study (an imaging study ordered as stat or emergent). Results of all such studies and/or findings are conveyed to the care provider verbally and documented in the dictated report.

For procedural situations

1. Transfers of care from Interventional Radiology to other departments:
   Patient information is also communicated during transfers of care from one provider (Interventional Radiology/procedural services) to another (Primary care provider) to assure continuity of patient care. Such communication is documented in the patient's digital chart and/or in the dictated report

2. Transfers of care within Interventional Radiology:
   Patients needing follow up after procedures (Interventional Radiology) are listed on a follow up board at both the UHS and VA (in a safe environment to ensure no HIPAA violations) and residents and residents on the service follow up on the patients of this handwritten list.

3. Patient information communication in urgent and emergent situation:
   - Code angio was created in collaboration with trauma team to simultaneously alert all involved personnel to level 1 trauma cases needing emergent procedures.
   - Universal IR call pager is assigned to the IR residents on call to avoid confusion and delay in response to urgent and emergent situation.