

Musculoskeletal Radiology Curriculum

12 month Clinical Fellowship Goals and Objectives

Clinical radiology fellows beginning the musculoskeletal radiology fellowship at Thomas Jefferson University are expected to review, develop and practice skills as defined in the six ACGME general competencies. More specific definitions of the knowledge, skills and attitudes expected of fellows during each 3 month segment of the fellowship are presented below.

First Quarter

Patient Care:

1. Provide clear, detailed and accurate radiology reports. Emphasis will be placed on detecting and describing fellowship subspecialty level bony and soft tissue pathologies encountered on radiographic, CT and MRI examinations of the musculoskeletal system, including the spine.
2. Work effectively with health care providers from other disciplines (specifically: orthopedic surgery, neurosurgery, rheumatology and rehabilitation medicine) to develop and carry out plans for imaging patients with these common musculoskeletal pathologies, as well as develop an appropriate treatment plan for patients with spinal emergencies warranting biopsy, augmentation procedures (vertebroplasty), and pain control procedure.
3. Appropriately counsel patients, show respectful behavior, and demonstrate baseline skills in performing joint injections (e.g., shoulder, hip and wrist arthrography). Adhere to principles of radiation safety and limit patient radiation exposure.

Medical Knowledge:

1. Learn normal MRI and CT anatomy of the axial and appendicular skeleton, including normal variations.
2. Recognize and describe common soft tissue lesions of the appendicular skeleton, such as rotator cuff tear, meniscal tear, muscle strains and fractures. Recognize injury

patterns associated with an abnormal biomechanical axis, such as those related to posterior tibial tendon dysfunction.

3. Recognize and describe fractures/dislocations of the cervical, thoracic and lumbar spine. Understand the basic mechanisms of cervical spine trauma and be able to distinguish stable from unstable injuries.

5. Perform and correctly interpret shoulder, wrist and hip arthrography.

6. Recognize and describe commonly encountered complications of prosthetic devices.

7. Develop a basic expertise in musculoskeletal anatomy using ultrasound imaging.

Practice-Based Learning and Improvement

1. All musculoskeletal cases chosen by staff during readout are to be submitted and appropriately categorized in the TJUH musculoskeletal teaching file after review at the weekly Interesting Case Conference (ICC). Discussions should reflect an understanding of important musculoskeletal findings specific to the case presented, but also should reflect a broader understanding based on a review of recent textbooks and scientific literature.

2. Participate in weekly ICC conferences in order to discuss teaching points from interesting or challenging musculoskeletal cases encountered in daily practice and to facilitate the learning of others.

3. Effectively provide feedback to MRI and CT technologists regarding quality of imaging studies, with special attention to patient positioning, exposure techniques and tissue coverage.

Interpersonal and Communication Skills

1. Refer to the appropriate section on ACGME general competencies in this handbook.

2. First quarter musculoskeletal fellows are expected to develop an appropriate language when communicating imaging findings to referring clinicians. For example, descriptions of ligament tears should include detail on

position, chronicity and potential subsequent instability. Unexpected findings are to be called to the referring clinician within one hour of attending review.

Professionalism

Refer to the appropriate section on ACGME general competencies in this handbook. Residents must demonstrate responsible, ethical behavior; positive work habits, including punctuality and professional appearance; and adhere to principles of confidentiality.

Systems-Based Practice

1. Residents are expected to apply principles of cost effective, quality health care by knowing the ACR appropriateness criteria for evaluating patients in the following situations: meniscal tear, rotator cuff pathology, spine trauma, tumor and infection, stress fractures, acute extremity trauma, and imaging evaluation of diabetic patients with suspected osteomyelitis.

Second Quarter

Patient Care:

1. Work more effectively with referring health care providers to develop and carry out plans for imaging patients with musculoskeletal diseases emphasized during the first rotation. The fellow should now be able to recommend appropriate, tertiary musculoskeletal imaging techniques for all orthopedic injuries, including focused musculoskeletal ultrasound examinations, PET scans, spinal augmentation procedures and image guided anesthetic and corticosteroid injections.

2. Appropriately recommend, plan and perform image-guided interventional procedures, with emphasis on biopsy of bone and soft tissue tumors.

3. Based on patient history, practice experience, and scientific literature, appropriately select and implement departmental CT/MR imaging protocols for patients with musculoskeletal disease. Select patients who may benefit from addition of intravenous or intraarticular contrast material, additional MRI pulse sequences, or additional MDCT reconstructions.

Medical Knowledge

1. Retain and expand knowledge base in topics covered during first rotation.

2. Recognize and describe less common but reproducible patterns of musculoskeletal pathology such as Osteochondral lesions, bursitis and inflammatory arthropathies.

3. Develop a knowledge of articular anatomy on MRI of large joints suitable for resident instruction. Develop the ability to describe a "timeline of pathology" in common musculoskeletal diseases encountered on MRI of the shoulder, knee, ankle and spine. Predict further sequelae of the disease process with this understanding of the pathology, and recite appropriate therapeutic options available to referring clinicians.

4. Learn a systematic approach to arthritis on all imaging modalities. Be able to recognize, describe and differentiate salient features of certain arthritides with emphasis on RA, JRA, CPPD, gout, non-rheumatoid HLA B-27 spondyloarthropathies, PVNS, neuropathic joints, and DISH.

4. Accurately describe a solitary lesion of bone on MRI and place it in an aggressive or non-aggressive category. Based on patient age, lesion characteristics (margin, matrix, host response) and location (central versus eccentric; epiphyseal, metaphyseal or diaphyseal), develop an appropriate differential.

Interpersonal and Communication Skills

1. Fellows are expected to provide a clear, informative, subspecialty level radiologic report including a precise diagnosis when possible, a differential diagnosis when

appropriate, and recommend follow-up or additional studies when appropriate.

2. Provide direct communication to the referring health care providers when interpretation reveals urgent or unexpected findings and document this communication in the radiologic report.

3. Demonstrate effective skills of face-to-face listening and speaking with physicians, patients, patient's families and support personnel. Develop a rapport with referring subspecialty orthopedic surgeons by actively participating in subspecialty conferences (sports, joint, foot and ankle, hip, spine)

4. Demonstrate appropriate telephone communication skills.

5. Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives and possible complications.

Practice-Based Learning and Improvement

1. Each fellow is expected to prepare three clinical cases for presentation at the Orthopedic-Radiologic-Pathologic (ORP) conference sponsored by the Philadelphia Roentgen Ray Society. TJUH fellows annually present cases at the first of five ORP conferences on the annual curriculum. Imaging, pathology and didactic review slides are prepared by the fellow for each case in conjunction with Department of Pathology staff. Angela Gopez serves as the ORP coordinator, and guides fellows in case selection and presentation.

2. Participate in 4th year medical student teaching by delivering 3 didactic lectures (canned lectures on arthritis, fractures and spinal trauma) to the rotating students. The musculoskeletal fellow should be equipped to appropriately answer all questions presented by the medical students on these topics.

3. Support quality assurance/improvement by effectively providing feedback and education to general radiology, CT and MRI technologists who acquire musculoskeletal images.

4. Review at least one musculoskeletal imaging topic and its current science in the literature, and propose a research study design in an effort to advance this science.

Professionalism

1. Refer to the appropriate section on ACGME general competencies in this handbook. Residents must demonstrate responsible, ethical behavior; positive work habits, including punctuality and professional appearance; and adhere to principles of confidentiality.

Systems-Based Practice

1. Fellows are expected to apply principles of cost effective, quality health care by knowing the ACR appropriateness criteria for evaluating patients with tumors and infections involving the musculoskeletal system.

Third Quarter

Patient care

1. Further develop consultative abilities with referring clinicians on a subspecialty expert level. Also, effectively work with other health care professionals to gather essential patient-specific information, develop management plans, and make informed decisions about which imaging modalities, if any, should be applied to evaluating patients with suspected musculoskeletal neoplasms and metabolic bone diseases (e.g., osteoporosis).

2. Appropriately counsel patients, show respectful behavior, and demonstrate skill in performing joint injections, spinal pain procedures and tumor biopsies.

Medical Knowledge

1. Demonstrate an expert level knowledge of normal and variant anatomy of all joints by MRI and ultrasound. Recognize, distinguish and describe less common injuries at these joints as well as their relation to patient activities including entrapment neuropathies, chronic myotentinous strains, causes of athletic pubalgia and degenerative conditions related to overuse such as medial epicondylitis, ulnar collateral ligament degeneration and humeral stress response in overhand pitchers. Recognize and describe increasingly complex abnormalities on MRI of the knee (e.g., combined injury patterns; ACL reconstructions;

posterolateral corner injuries) and shoulder (e.g., ALPSA and GLAD lesions; SLAP tears; paralabral cysts).

2. Be familiar with imaging findings on all modalities for tumors in the osteoid, chondroid, fibrous, cystic, angiomatous, and round cell series, to include tumor-like lesions of bone (e.g., Langerhan's cell histiocytosis). Specifically, be able to discuss common locations, radiographic and advanced imaging features, and common age at presentation for these tumors.

3. Recognize multimodality imaging findings indicative of a systemic process such as osteoporosis, hyperparathyroidism, osteomalacia/rickets, hypophosphatasia, sickle cell anemia, thalassemia, Gaucher's, sarcoidosis.

4. Know and recite imaging features of common congenital/dysplastic conditions such as tarsal coalitions, achondroplasia, osteogenesis imperfecta, osteopetrosis, melorheostosis, mucopolysaccharidoses, etc.

Practice-Based Learning and Improvement

1. Carry out the processes of data collection and statistical analysis for the study design proposed during quarter two. As the deadline for RSNA abstract submission falls in the latter portion of this quadrant annually, submission of these findings to RSNA should be considered, though a later submission to ARRS, ISMRM or the following year's RSNA are acceptable.

2. Participate on a teaching level in monthly resident case conferences and resident QA conferences in order to discuss teaching points from interesting or challenging musculoskeletal cases encountered in daily practice and facilitate the learning of others.

3. Support quality assurance/improvement by effectively providing feedback and education to general radiology, CT and MRI technologists who acquire musculoskeletal images.

Interpersonal and Communication Skills

1. Fellows at this level are expected to provide a clear, informative subspecialty expert radiologic report including a precise diagnosis when possible, a differential diagnosis when appropriate, and recommend follow-up or additional studies when appropriate, and propose image guided treatment options when appropriate.
2. Provide direct communication to the referring health care providers when interpretation reveals urgent or unexpected findings and document this communication in the radiologic report.
3. Demonstrate effective skills of face-to-face listening and speaking with physicians, patients, patient's families and support personnel.
4. Demonstrate appropriate telephone communication skills.
5. Demonstrate skills in obtaining informed consent, including effective communication to patients of the procedure, alternatives and possible complications.

Professionalism

1. Refer to the appropriate section on ACGME general competencies in this handbook. Residents must demonstrate responsible, ethical behavior; positive work habits, including punctuality and professional appearance; and adhere to principles of confidentiality.

Systems-Based Practice

1. Residents are expected to apply principles of cost effective, quality health care by knowing the ACR appropriateness criteria for evaluating patients with all musculoskeletal and spinal pathologies.

Fourth Quarter

Patient Care and Medical Knowledge

1. Demonstrate appropriate knowledge, skills and attitudes in the six ACGME competencies in order to function on a subspecialty musculoskeletal imaging expert level.
2. Review musculoskeletal radiology topics covered during the first three months. Demonstrate skills in reporting, interpreting, and managing patients with all commonly encountered diseases encountered and discussed in previous rotations. Effectively use resources (e.g., textbooks, journals and on-line material) when evaluating patients with uncommon diseases or uncommon presentations of common disease.
3. Work with health care professionals from a variety of disciplines (e.g., general medicine, physical medicine, rheumatology and orthopedic surgery) to provide patient focused care.

Practice-Based Learning and Improvement

1. During this quarter, each fellow should review the Thomas Jefferson University Hospital musculoskeletal radiology practices and protocols, and suggest revisions, improvements additions and subtractions to improve the practice and improve the curriculum for future fellows, based upon their fellowship experience.
2. Effectively run weekly ICC conferences with staff guidance discussing teaching points from challenging musculoskeletal cases with non musculoskeletal fellows and residents in attendance.
3. Support quality assurance/improvement by effectively providing feedback and education to general radiology, CT and MRI technologists who acquire musculoskeletal images.
4. Submit a musculoskeletal imaging project to a radiology journal for publication.

Systems-Based Practice

Demonstrate a knowledge base and radiology practice in line with the ACR appropriateness criteria for all musculoskeletal pathologies.

Musculoskeletal Radiology Reading List

Prior to fellowship:

Harris and Mirvis: Radiology of Acute C-spine Trauma - Chapters 1,2,3, and 11

Greenspan: Orthopedic Radiology: A Practical Approach - Chapters 4-10 or corresponding chapters in Musculoskeletal Requisites.

Kaplan, Helms: Musculoskeletal MRI. Chapters on Knee and Shoulder

ACR Teaching File: First half of Bone Section

ACR Bone Syllabus I

First quarter

Mitchell DG: MRI Principles

Brower: Arthritis in Black and White

Greenspan: Orthopedic Radiology: A Practical Approach - Chapters 11-20 or corresponding chapters in Musculoskeletal Requisites.

Rogers: Radiology of Skeletal Trauma - Chapters 3,4,8, and 9

Recommended:

RCNA Dec 81: Rad-Path Analysis of Solitary Bone Lesions pgs 715-813.

ACR Teaching File: Second Half of Bone Section

ACR Bone Syllabus II, III

Second Quarter

MRI Clinics of North America: all volumes from 2000 - 2006 dedicated to joint, spine and sports imaging

All current Musculoskeletal papers in Radiology, Radiographics, AJR, and Skeletal Radiology

ACR Bone Syllabus IV

Third Quarter

Seminars in Musculoskeletal Radiology: all volumes from 2004 - 2006.

All current Musculoskeletal papers in Radiology, Radiographics, AJR, and Skeletal Radiology

Fourth Quarter

Seminars in Musculoskeletal Radiology: all volumes from 2001 - 2004.

All current Musculoskeletal papers in Radiology, Radiographics, AJR, and Skeletal Radiology