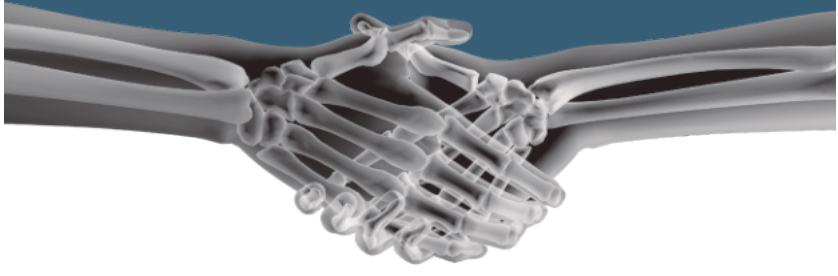
IMAGING
INDICATION GUIDELINES

Your partner in outpatient radiology



Bon Secours Diagnostic Imaging
BSDImaging.com

We are dedicated

to achieving the highest levels of quality and safety in outpatient imaging. We developed these Imaging Indication Guidelines to help you choose imaging examinations that will answer your clinical questions for your patients.

We hope they will assist you in the pre-authorization and Medicare Appropriate Use Criteria processes.

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Chief Medical Officer
July 2020

Quality

High quality reports and equipment

Convenience

Appointments when and where you need them

Affordability

Reduce your out-of-pocket imaging cost

Notes

Notes

We are dedicated to achieving the highest levels of quality and safety, and have developed these **Imaging Indication Guidelines** to provide information and guidance during the radiology ordering process.

General Contrast Guidelines

Choose **"Radiologist Discretion"** on the order and our board certified radiologists will select the contrast option suited to your patient's history and condition. This will facilitate the *pre*-authorization process.

Generally, contrast is indicated whenever you are concerned about:

- Infection (except uncomplicated sinusitis)
- Tumor or cancer
- Vascular abnormality (except stroke)
- Organ integrity
- Possible disc after lumbar surgery

Generally, contrasted MRI scans are performed with and without contrast.

Generally, CT scans are performed either with or without contrast in order to limit the patient's radiation dose. Without & with contrast CT scans are indicated for these conditions:

- Thoracic aortic dissection
- Painless hematuria
- Adrenal gland mass
- Kidney mass
- Pancreas mass
- Liver mass
- Bladder mass

Exams Commonly Confused:

• *Cervical CT or MRI* (for cervical spine)	vs.	*Soft tissue neck CT or MRI* (for soft tissue, e.g. lymph nodes)
• *Cervical CT or MRI* (for suspected cervical spine cause of arm pain)	vs.	*Shoulder CT or MRI* (for suspected shoulder cause of arm pain)
• *Abdomen CT or MRI* (covers diaphragm to iliac crests)	vs.	*Pelvis CT or MRI* (covers iliac crests to pubic symphysis)
• *Transabdominal* pelvic ultrasound (US probe on abdomen)	vs.	*Transvaginal* pelvic ultrasound (US probe in vagina)
• *Ankle CT, MRI, or X-ray* (looks at distal tibia, fibula, talus, calcaneus)	vs.	*Foot CT, MRI, or X-ray* (looks at tarsals, metatarsals, toes)
• *Lower extremity arterial Doppler ultrasound* (includes arterial waveforms & Doppler, with or without ABI)	vs.	*Ankle Brachial Index-ABI* (only ABI)

Abdomen & Pelvis

Clinical Problem	Preferred Study	Comments
Dysphagia	Barium esophagram with oral contrast	If retrosternal dysphagia, endoscopy also an excellent diagnostic test
Gastroesophageal reflux	Barium esophagram with oral contrast	Order to evaluate anatomy, not to diagnose reflux
Abdominal pain: increased amylase and lipase	US abdomen	If amylase and lipase equivocal or if critically ill, consider CT abdomen & pelvis with IV contrast, radiologist decides if oral contrast
Abdominal pain: non-focal	CT abdomen & pelvis with oral contrast and with IV contrast (if febrile) or without IV contrast (if afebrile)	If pregnant, consider US or MRI abdomen & pelvis without IV contrast
Abdominal pain: right upper quadrant	US abdomen	If US negative or equivocal, consider CT abdomen with IV and oral contrast or MRI abdomen with MRCP without & with IV contrast (with IV contrast is optional). Tc-99m cholescintigraphy also appropriate if febrile with elevated WBC
Abdominal pain: right lower quadrant	CT abdomen & pelvis with IV contrast, radiologist decides if oral contrast	If a child, consider US RLQ / If pregnant, consider US or MRI abdomen & pelvis without IV contrast
Abdominal pain: left lower quadrant	CT abdomen & pelvis with IV and oral contrast	
Abdominal mass: palpable	CT abdomen with IV and oral contrast or US abdomen	If suspect abdominal wall mass, MRI abdomen without & with IV contrast also appropriate
Cancer patient	CT abdomen & pelvis with IV and oral contrast	Consider Chest CT with IV contrast if lung metastasis common / MRI abdomen & pelvis without & with IV contrast is alternative to CT abdomen & pelvis / If hereditary renal cancer, consider without & with IV contrast / If bladder cancer, consider CT urography
Blunt trauma: clinically stable	CT abdomen & pelvis with IV contrast, radiologist decides if oral contrast	Also consider CT chest with IV contrast based on mechanism of injury / If thoracic aortic injury suspected, consider CTA chest with IV contrast
Jaundice	MRI abdomen with MRCP without & with IV contrast or CT abdomen with IV contrast (radiologist decides if oral contrast) or US abdomen	
Liver — screening for hepatocellular carcinoma in chronic liver disease or suspect metastases	CT abdomen with IV contrast (radiologist decides if oral contrast) or MRI abdomen without & with contrast	If screening for hepatocellular carcinoma and no prior cancer, US abdomen also appropriate

Abdomen & Pelvis

Clinical Problem	Preferred Study	Comments
Suspect small bowel obstruction	CT abdomen & pelvis with IV contrast, radiologist decides if oral contrast	If high-grade obstruction suspected, avoid oral contrast / If intermittent or low-grade obstruction suspected, consider CT or MRI enteroclysis (neutral contrast by NG tube)
Crohn's disease	CT abdomen & pelvis with IV and oral contrast or CT enterography	Consider MRI enterography if nonacute presentation or a child / Enterography uses neutral contrast by mouth (enteroclysis uses neutral contrast by NG tube)
Upper or Lower GI bleeding	Endoscopy is recommended rather than imaging	If endoscopy negative or cannot be performed, consider angiography (CT or catheter) / If endoscopy and angiography negative for lower GI bleeding, consider 99mTc-labeled RBC scan abdomen
Painful hematuria, r/o kidney stone	CT abdomen & pelvis without IV or oral contrast	If recurrent stone disease, consider US kidneys & bladder with X-ray KUB to decrease overall radiation dose to patient / If pregnant, consider US kidneys & bladder
Painless hematuria	CT abdomen & pelvis without and with IV contrast, without oral contrast (CT urography)	If hematuria due to renal parenchymal disease, consider US kidneys & bladder / If child and macroscopic hematuria or proteinuria, US kidneys & bladder / Imaging not indicated if hematuria clears with therapy, cessation of vigorous exercise or after urologic procedure (e.g. catheterization)
Acute pyelonephritis in complicated patient (eg, diabetes, stones, prior renal surgery, not responding to therapy, immunocompromised)	CT abdomen & pelvis with IV contrast (preferred) or without & with IV contrast—both without oral contrast	Imaging not indicated for uncomplicated patient with acute pyelonephritis
Recurrent lower urinary tract infections in women with frequent reinfections, risk factors or no response to conventional therapy	CT abdomen & pelvis without & with IV contrast (CT Urogram), oral contrast only if suspect enterovesical fistula	Imaging not indicated for uncomplicated patient with UTI / If child with atypical or recurrent febrile UTI, consider US kidneys & bladder
Chronic kidney disease	US kidneys & bladder	
Hypertension — high suspicion of renovascular hypertension (e.g. failure of medical therapy, progressive renal failure, young patient)	MR Angiogram abdomen without & with IV contrast or CT Angiogram abdomen with IV contrast	If eGFR less than 30, consider US duplex Doppler kidney / Imaging not indicated for hypertension well managed with medical therapy

Abdomen & Pelvis

Clinical Problem	Preferred Study	Comments
Acute scrotal pain without trauma	US duplex Doppler scrotum	
Hematospermia	US pelvis (prostate) transrectal — see comments	Imaging not indicated if less than 40 yo, transient or episodic hematospermia & no other signs or symptoms
Clinically suspected prostate cancer	US pelvis (prostate) transrectal — guided biopsy	
Abdominal aortic aneurysm — planning repair and follow-up after repair	CT Angiogram abdomen & pelvis with IV contrast	If screening, consider US aorta abdomen / If thoracic aorta involved, consider adding CTA chest with IV contrast
Abnormal vaginal bleeding — initial evaluation	US pelvis transvaginal	Consider adding US pelvis transabdominal--gives wider field of view & evaluates adjacent organs / If transvaginal probe cannot be tolerated, consider US pelvis transabdominal
Possible ectopic pregnancy	US pelvis transabdominal & transvaginal	Both transabdominal and transvaginal US should be performed if possible
Pelvic pain: woman with suspected gynecological etiology	US pelvis transabdominal & transvaginal	Both transabdominal and transvaginal US should be performed if possible
Pelvic pain: no suspected gynecological etiology and ß-HCG negative	CT abdomen & pelvis with IV contrast, radiologist decides if oral contrast	
Clinically suspected adnexal mass — initial evaluation	US duplex Doppler pelvis transabdominal & transvaginal	Transabdominal shows mass in relation to other structures / Transvaginal shows details of mass / Doppler shows vascularity of mass
Pelvic floor dysfunction	MRI pelvis dynamic with rectal contrast, radiologist decides if vaginal contrast	Alternatives include X-ray fluoroscopic cystocolpoproctography with IV, oral, vaginal, and rectal contrast, MR defecography with contrast, US pelvis transperineal

Cardiovascular & Chest

Clinical Problem	Preferred Study	Comments
Pulmonary embolism	X-ray chest and CT Angiography chest with contrast (preferred) or CT chest with contrast	If negative D-dimer in intermediate or low pretest probability patient, only X-ray chest preferred / If respiratory distress or chest pain, scan in an acute care setting / If new symptoms, this is a STAT & call report exam / If pregnant, consider X-ray chest and US duplex Doppler lower extremity instead
Acute respiratory illness	X-ray chest	Low yield if less than 40 yo, negative exam & no risk factors / If immunocompromised, consider CT chest without contrast if X-ray chest is normal, equivocal or nonspecific, or if suspect noninfectious disease
Acute asthma	X-ray chest	Low yield if uncomplicated acute asthma
Acute exacerbation of COPD	X-ray chest	
Chronic dyspnea — suspect pulmonary etiology	X-ray chest	If X-ray chest normal or does not provide a direct answer, consider CT chest without contrast
Dyspnea — suspect cardiac etiology	X-ray chest and/or Tc-99m SPECT MPI rest & stress or US echocardiography transthoracic resting or stress	X-ray chest may be helpful to determine if pulmonary or cardiac etiology / Tc-99m SPECT MPI detects significant coronary artery stenosis / US echocardiography transthoracic evaluates cardiac function and wall thickness
Hemoptysis	X-ray chest and CT chest with contrast or CT Angiogram chest with contrast	If planning Arteriography bronchial with embolization, consider CT Angiogram chest with contrast / If massive hemoptysis, consider bronchoscopy for unstable patients and consider Arteriography bronchial with embolization or CT Angiography chest with contrast for stable patients
Suspect TB	X-ray chest	If clinically suspect active TB, send to acute care setting with proper isolation & ventilation capabilities
Blunt chest trauma	X-ray chest and CT chest with contrast or CT Angiogram chest with contrast	If minor trauma & suspect rib fractures, consider only X-ray chest / CT or CTA low yield if normal X-ray chest, no distracting injuries and normal mental status / X-ray chest and CT/CTA chest are complementary / CT chest is generally preferred / CTA chest is preferred if suspect aortic injury
Occupational lung disease (e.g. silica, coal dust, asbestos)	X-ray chest	If suspect interstitial or airway disease, consider adding CT chest high resolution without contrast / If suspect thoracic neoplasm, consider CT chest with contrast

Cardiovascular & Chest

Clinical Problem	Preferred Study	Comments
Possible thoracic outlet syndrome	X-ray chest and for: - neurogenic: MRI chest without contrast - venous: CT chest with contrast - arterial: CT Angiogram chest with contrast	X-ray chest screens for bony abnormalities such as a cervical rib
Man with palpable breast mass, nipple discharge, or nipple retraction	Mammography diagnostic, Digital breast tomosynthesis diagnostic	If less than 25 yo, US breast is preferred / If nipple discharge, US breast also appropriate / If only gynecomastia, imaging exam not indicated
Acute chest pain — suspect thoracic aortic aneurysm complication	X-ray chest and CT Angiography chest with contrast	X-ray chest to exclude other causes of chest pain if it does not delay the CTA / MR Angiography chest without or with contrast is alternative, pending availability
Acute chest pain — low probability of coronary artery disease	X-ray chest	
Chest pain — acute & suspect acute coronary syndrome or chronic & high probability of coronary artery disease	X-ray chest and Tc-99m SPECT MPI rest and stress or Arteriography coronary with arterial contrast	X-ray chest to exclude non-cardiac causes of chest pain / Arteriography coronary is the gold standard, is invasive, and gives opportunity for interventional therapy
Abdominal aortic aneurysm	CT Angiogram abdomen & pelvis with IV contrast	If screening, consider US abdominal aorta / If thoracic aorta involved, add CTA chest with contrast
Hypertension — high suspicion of renovascular hypertension (e.g. failure of medical therapy, progressive renal failure, young patients)	MR Angiogram abdomen without & with IV contrast or CT Angiogram abdomen with IV contrast	If eGFR less than 30, consider US duplex Doppler kidney / Imaging not indicated for hypertension well managed with medical therapy
Vascular claudication — evaluation for revascularization	MR Angiogram lower extremities without & with contrast or CT Angiogram lower extremities with contrast	
Sudden onset of cold, painful leg	Arteriography lower extremity with arterial contrast	Arteriography allows diagnosis and treatment in same procedure / If noninvasive exam desired, consider CTA lower extremity with contrast or MRA without & with contrast
Suspected upper or lower extremity deep vein thrombosis	US duplex Doppler upper or lower extremity	If new symptoms, this is a STAT & call report exam

Head & Neck

Clinical Problem	Preferred Study	Comments
Headache	MRI head without & with contrast	Low yield if classic migraine or tension-type headache or if neuro exam normal and no new features / If sudden, "worst headache of life", consider CT head without contrast instead
CVA	- CT head without contrast (symptoms for 0-6 h) - MRI head without contrast (symptoms for more than 6h)	If symptoms less than 24h, referral to acute care facility preferred / Consider adding vascular evaluation with CTA head & neck with contrast or MRA head & neck without & with contrast
TIA	MRI head without & with contrast	Consider adding vascular evaluation with MRA head & neck without & with contrast or CTA head & neck with contrast
Acute mental status change: patient at risk for bleeding, hypertensive emergency, intracranial mass or infection	CT head without contrast	If the patient is not at risk for those conditions, there is disagreement if imaging is appropriate / If CT head is indeterminate, consider MRI head without contrast (without & with contrast if infection or mass is strongly suspected)
Dementia	MRI head without contrast	MRI better than CT for evaluation of white matter changes, patterns of atrophy / If suspect normal-pressure hydrocephalus, consider CT head without contrast instead
Neurodegenerative disorder (e.g. Parkinson's disease)	MRI head without contrast	
Asymptomatic carotid bruit &/or stroke risk factors	US duplex Doppler carotid	If positive, consider CTA neck with contrast or MRA neck without & with contrast
Vertigo with or without hearing loss	MRI head & IAC without & with contrast	Peripheral vertigo (e.g. benign paroxysmal vertigo or Meniere disease) often does not need imaging
Tinnitus, subjective or objective pulsatile (no myoclonus or eustachian tube dysfunction)	CT temporal bone without contrast or CT Angiogram head & neck with contrast	Usually do not need both exams
Tinnitus, subjective, nonpulsatile & unilateral (no otoscopic finding)	MRI head & IAC without & with contrast	Imaging not indicated if bilateral, nonpulsatile tinnitus without focal neuro abnormality, trauma or hearing loss (if focal neuro abnormality, trauma or hearing loss, choose imaging based on those conditions rather than tinnitus)

Head & Neck

Clinical Problem	Preferred Study	Comments
Cranial neuropathy	MRI head & cranial nerve of interest without & with contrast	Consider adding MRI orbit/face/neck without & with contrast for evaluation of the extracranial portion of the cranial nerve / Specify cranial nerve of interest on order / If CN X (Vagus), consider CT neck with contrast instead
Multiple sclerosis	MRI head without & with contrast	
Seizure, new onset without trauma	MRI head without contrast if 40 yo or less, MRI head without & with contrast if over 40 yo	If focal neurological deficit, MRI head without & with contrast regardless of age
Seizure, new onset with trauma	CT head without contrast	If trauma more than 1 week old, consider MRI head without & with contrast instead
Pituitary abnormality	MRI sella without & with contrast	
Brain tumor, metastases	MRI head without & with contrast	
CNS infection, abscess, meningitis	MRI head without & with contrast	
Aneurysm	MR Angiogram head without contrast or CT Angiogram with contrast	MRA for screening patients at increased risk for aneurysm (no radiation)
Acute bleed: intracranial or subarachnoid	CT head without contrast	Consider referral to acute care facility if clinically unstable
Closed head injury	CT head without contrast	If less than 24h post trauma, referral to acute care facility preferred / If delayed recovery or persistent unexplained deficits not explained by CT head, consider MRI head without contrast
Venous sinus thrombosis	MR Venogram head without & with contrast	MR Venogram is like an MR Angiogram, except it looks at the veins rather than the arteries
Visual defect after trauma, suspect orbital injury	CT orbits without contrast	
Nontraumatic orbital asymmetry, exophthalmos or enopthalmos	MRI orbits without & with contrast	
Orbital cellulitis, uveitis or scleritis	CT orbits with contrast	
Optic neuritis	MRI orbits without & with contrast and MRI head without & with contrast	MRI head without & with contrast to evaluate for multiple sclerosis

Head & Neck

Clinical Problem	Preferred Study	Comments
Ophthalmoplegia or diplopia	MRI orbits without & with contrast	If suspect brain stem or brain etiology (e.g. pupil-sparing 3rd nerve palsy), consider MRI brain without & with contrast instead
Visual loss, suspect intraocular mass, optic nerve, pre-chiasm abnormality	MRI orbits without & with contrast	If chiasm or post-chiasm symptoms, MRI head without & with contrast / If etiology diagnosed with ophthalmologic exam & lab tests (e.g. cataracts or macular degeneration), imaging is usually low yield
Vocal cord paralysis	CT neck with contrast	
Neck mass	CT neck with contrast	For a child, consider US neck or MRI neck without & with contrast
Thyroid nodule or suspected goiter	US neck	Must wait 4-8 weeks after IV CT contrast before radioiodine scanning or ablation can be done

Spine

Clinical Problem	Preferred Study	Comments
Neck pain without "red flags" (intractable pain with therapy, trauma, cancer, prior surgery, cord injury, IV drug use, immunosuppression, tenderness of vertebral body, systemic inflammatory arthritides)	X-ray cervical	Low yield if symptoms less than 6 weeks duration / If radiculopathy or X-rays show degenerative changes, consider MRI cervical spine without contrast / If X-rays show OPLL, consider CT cervical spine without contrast / Flexion/ extension views have limited value
New or increasing neck pain or radiculopathy: prior surgery	X-ray cervical &/or CT cervical without contrast	If suspect nonunion, consider adding flexion/extension X-rays
Brachial plexopathy	MRI brachial plexus without & with IV contrast	If traumatic, contrast not needed
Low back pain &/or radiculopathy without "red flags" (intractable pain with therapy, osteoporosis, prolonged steroid use, trauma, cancer, prior surgery, urinary retention or fecal incontinence, progressive LE motor weakness, IV drug use, immunosuppression)	X-ray lumbar	Low yield if symptoms less than 6 weeks duration / If surgery or intervention candidate or suspect cauda equina syndrome or rapidly progressive neurologic deficit, consider MRI lumbar without contrast instead
Low back pain: prior surgery	MRI lumbar without & with IV contrast	Contrast distinguishes between scar and disc / For evaluation of bone graft integrity, surgical fusion or instrumentation, consider CT lumbar without contrast
Lumbosacral plexopathy	MRI lumbosacral plexus without & with IV contrast	If traumatic, contrast not needed
Chronic back pain—suspect sacroiliitis &/or inflammatory arthritides, e.g. ankylosing spondylitis	X-ray sacroiliac joints	X-ray cervical, thoracic & lumbar spine is complementary to X-ray SI joints / If X-ray normal & continue to suspect, consider MRI SI joints without contrast (IV contrast may also help)
Suspect spine cancer, infection, &/or immunosuppression	MRI affected spine without & with IV contrast	If low risk of epidural &/or intraspinal disease, non-contrast may be sufficient
Myelopathy: non-traumatic	MRI cervical &/or thoracic &/or lumbar without contrast	The spinal levels imaged depend on clinical judgment and physical exam / If progressive symptoms, oncology patient or suspect infection or tumor, consider without & with IV contrast

Spine

Clinical Problem	Preferred Study	Comments
Acute spine trauma — no neurologic abnormalities	CT affected spine without contrast	Low yield of C-spine imaging if low-risk by CCR or NEXUS clinical criteria / If less than 24h post trauma, referral to acute care facility preferred / If injury not explained by bony fracture or suspect ligamentous injury, consider MRI affected spine without contrast / If suspect arterial injury, consider CT angiography with contrast or MR angiography without & with contrast / If no unstable injury on prior imaging and continued pain, consider CT without contrast, MRI without contrast or flexion & extension X-ray affected spine
Acute spine trauma — neurologic abnormalities	CT affected spine without contrast and MRI affected spine without contrast	CT and MRI are complementary
Compression fracture suspected	X-ray affected spine	If considering vertebral augmentation for poorly controlled pain, consider MRI affected spine without contrast / If known malignancy with back pain and compression fracture, consider MRI spine without & with IV contrast to distinguish between osteoporosis versus destructive lesion (if multiple myeloma and no neurologic symptoms, consider X-ray affected spine instead)
Scoliosis	X-ray complete spine	Always get PA view / Lateral view for initial exam and then only if sagittal balance altered

Musculoskeletal

Clinical Problem	Preferred Study	Comments
Acute or chronic bone or extremity pain	X-ray affected area	If X-rays do not explain symptoms and suspect rheumatoid arthritis or seronegative spondyloarthropathy, consider MRI affected area without contrast
Soft tissue mass	X-ray affected area	If X-rays indeterminate, consider US affected area / If US also indeterminate, consider MRI affected area without contrast (MRI without & with IV contrast if spontaneous hemorrhage or bruit)
Suspect stress (fatigue or insufficiency) fracture	X-ray affected area	If X-ray normal and "need-to-know diagnosis", consider MRI affected area without contrast (if suspected fracture not in hip, also consider repeat X-ray in 10-14 days)
Penetrating trauma and suspect soft tissue foreign body	X-ray affected area	If suspect soft tissue foreign body and X-ray normal, consider CT affected area without contrast (for radiolucent foreign body-e.g. wood or plastic-consider US affected area) / Consider MRI affected area without contrast if suspect nerve injury.
Suspect osteomyelitis, septic arthritis or soft tissue infection (except spine or diabetic foot)	X-ray affected area	If soft tissue or juxta-articular swelling, consider adding MRI affected area without & with IV contrast
Shoulder pain	X-ray shoulder	If X-rays noncontributory and: - persistent pain or suspect rotator cuff tear, adhesive capsulitis, tendonitis or bursitis, consider MRI shoulder without contrast - instability, suspect joint body, or suspect labral tear, consider MR arthrography shoulder - prior shoulder arthroplasty, consider CT shoulder without contrast (for possible rotator cuff tear, consider CT arthrography or US shoulder) - suspect re-tear after prior rotator cuff tear or post-traumatic instability or labral or rotator cuff tear, consider MR arthrography shoulder or MRI shoulder without contrast - suspect infection, consider aspiration of shoulder
Elbow chronic pain	X-ray elbow	If X-rays indeterminate and: - suspect joint body, collateral ligament tear or osteochondral injury, consider MR arthrography elbow or MRI elbow without contrast - suspect occult fracture, chronic epicondylitis, biceps tendon tear/bursitis, or nerve abnormality, consider MRI elbow without contrast - suspect soft tissue mass or bursitis, consider MRI elbow without & with IV contrast
Wrist, hand, finger, thumb acute trauma	X-ray affected area	If suspect fracture and X-ray normal, consider MRI without contrast, CT without contrast, or cast and repeat X-ray in 10-14 days / If suspect injury to ligament, tendon or nerve, consider MRI without contrast

Musculoskeletal

Clinical Problem	Preferred Study	Comments
Wrist chronic pain	X-ray wrist	If X-rays indeterminate and: - suspect tear of ligament or triangular fibrocartilage, consider MR arthrography wrist - persistent symptoms or suspect Kienböck's disease, consider MRI wrist without contrast (for suspected occult, stress or nonunion fracture, also consider CT wrist without contrast) - suspect mass or ganglion cyst or inflammatory arthritis, consider MRI wrist without contrast or MRI wrist without & with IV contrast - suspect infection, consider aspiration of wrist
Hip — acute pain, suspect fracture	X-ray hip and AP pelvis	If suspect fracture and X-ray normal or indeterminate, consider MRI or CT pelvis and affected hip without contrast
Hip chronic pain	X-ray hip and AP pelvis	If X-rays indeterminate and: - suspect bone, tendon, soft tissue abnormality, osteonecrosis or painful metal-on-metal total hip arthroplasty, consider MRI hip without contrast (for osteoid osteoma, consider CT hip without contrast) - suspect cartilage abnormality or impingement, consider MRI hip without contrast or MR arthrography hip - suspect labral tear or joint body, consider MR arthrography hip - suspect infection, consider aspiration of hip
Knee acute trauma	X-ray knee	Low yield if fall or twisting injury, no effusion, no focal tenderness, and able to walk / If suspect internal derangement and no fracture on X-ray, consider MRI knee without contrast
Knee chronic pain	X-ray knee	If X-ray normal or shows joint effusion or prior bone injury, or suspect joint body, osteochondritis dessicans or post-op recurrent meniscal tear, consider MRI knee without contrast / If suspect infection, consider aspiration of knee
Knee after total knee arthroplasty	X-ray knee	If pain or suspect infection, consider aspiration of knee by specialist
Ankle acute trauma	X-ray ankle	Low yield if able to walk, no bony point tenderness, and neuro intact (no peripheral neuropathy) / If persistent pain and no X-rays at time of injury, consider X-ray ankle / If more than 1 week persistent pain and X-rays negative, consider CT or MRI ankle without contrast
Ankle chronic pain	X-ray ankle	If X-rays normal and: - suspect osteochondral injury, tendon abnormality, ankle impingement, ankle instability or pain of uncertain etiology, consider MRI ankle without contrast - suspect osteochondritis dessicans, consider MR arthrography ankle - suspect inflammatory arthritis, consider MRI ankle without & with IV contrast

Musculoskeletal

Clinical Problem	Preferred Study	Comments
Foot acute trauma	X-ray foot	Low yield if able to walk, no bony point tenderness, and neuro intact (no peripheral neuropathy) / If Lisfranc injury suspected, consider weight-bearing X-ray foot (if not able to bear weight, consider CT foot without contrast or MRI foot without contrast) / If suspect occult fracture or dislocation, Lisfranc injury or tendon rupture and X-rays negative, consider CT or MRI foot without contrast / If suspect foreign body and X-rays negative, consider US foot
Foot chronic pain	X-ray foot	If X-rays indeterminate and: - pain, burning, and/or paresthesias on plantar surface, athlete with pain over tarsal navicular, or suspect tendinopathy, consider MRI foot without contrast - rigid flat foot, consider CT foot or MRI foot without contrast - suspect complex regional pain syndrome type I, consider Tc-99m 3-phase bone scan foot - suspect Morton neuroma, inflammatory arthritis, consider MRI foot without & with IV contrast If accessory ossicle and pain over tarsus, consider MRI foot without contrast
Foot — suspected osteomyelitis with diabetes mellitus	X-ray foot	If soft-tissue swelling, consider MRI foot without & with IV contrast or MRI foot without contrast

Women's Imaging

Clinical Problem	Preferred Study	Comments
Palpable breast mass — initial evaluation	Mammography diagnostic, Digital breast tomosynthesis diagnostic	If less than 30 yo, US breast is preferred / If 30-39 yo, US breast also appropriate
Breast pain without palpable mass	No exam indicated other than following routine breast cancer screening	If focal, noncyclical, clinically significant breast pain, - age less than 30 yo, consider US breast - age 30 yo or greater, consider digital breast tomosynthesis diagnostic, mammography diagnostic or US breast
Suspect breast implant complication	Age less than 30 yo: - US breast Age 30-39 yo: - Mammography diagnostic - Digital breast tomosynthesis diagnostic - US breast Age 40 yo or more: - Mammography diagnostic - Digital breast tomosynthesis diagnostic	If silicone breast implant, MRI breast without IV contrast also appropriate / If unexplained axillary adenopathy with silicone breast implant, US axilla also appropriate
Galactorrhea — hyperprolactinemia of unknown origin	MRI sella without & with contrast	
Galactorrhea — discharge from single duct, bloody, serosanguineous, associated with breast mass or in a man	Mammography diagnostic, Digital breast tomosynthesis diagnostic, US breast	If woman's age less than 30 yo, US breast is preferred
Abnormal vaginal bleeding — initial evaluation	US pelvis transvaginal	Consider adding US pelvis transabdominal–gives wider field of view & evaluates adjacent organs / If transvaginal probe cannot be tolerated, consider US pelvis transabdominal
Possible ectopic pregnancy	US pelvis transabdominal & transvaginal	Both transabdominal & transvaginal US should be performed if possible

Women's Imaging

Clinical Problem	Preferred Study	Comments
Pelvic pain: woman with suspected gynecological etiology	US pelvis transabdominal & transvaginal	Both transabdominal & transvaginal US should be performed if possible
Pelvic pain: no suspected gynecological etiology and ß-HCG negative	CT abdomen & pelvis with IV contrast, radiologist decides if oral contrast	
Clinically suspected adnexal mass — initial evaluation	US Doppler pelvis transabdominal & transvaginal	Transabdominal shows mass in relation to other structures / Transvaginal shows details of mass / Doppler shows vascularity of mass
Pelvic floor dysfunction	MRI pelvis dynamic with rectal contrast, radiologist decides if vaginal contrast	Alternatives include X-ray fluoroscopic cystocolpoproctography with IV, oral, vaginal, and rectal contrast, MRI defecography with contrast, US pelvis transperineal

Screening

Screening	Preferred Study	Timing and Indications for Screening	Comments
Breast cancer screening	Mammography screening, Digital breast tomosynthesis screening	Every year, starting at: - Low risk: 40 yo - BRCA carrier/ relative: age 30 yo - 1° relative with premenopausal breast cancer: later of age 30 yo or 10 years less than relative's age at diagnosis - Mantle radiation age 10-30 yo: 8 y after radiation but older than 25 yo - Diagnosis of lobular neoplasia, atypical ductal hyperplasia (ADH), breast carcinoma:	Digital breast tomosynthesis screening may be helpful if less than 50 yo or if dense breasts / If high risk (BRCA carrier/ relative, mantle radiation age 10-30 yo or with 20% or greater lifetime risk), consider adding MRI breast without & with contrast / If pregnant or lactating, recommendations are the same
Lung cancer screening	CT chest screening without contrast	Every year for patients: - Age 55-80 yo - Without lung cancer symptoms - 30 or more pack-year smoking history - Current smoker or stopped within past 15 years - Counselled on smoking cessation	CT done with very low radiation dose
Coronary artery disease screening	CT coronary artery calcium scoring or US carotid intima medial thickness	Asymptomatic with intermediate risk (10%-20% 10-year risk) for coronary artery disease	Useful for reclassifying intermediate risk patients to low or high risk / If low risk patient with family history of premature coronary artery disease, may be helpful
Abdominal aortic aneurysm screening	US aorta abdomen	Men over 65 yo, especially with hypertension, smoking, coronary artery disease, 1st degree male relative with AAA	
Peripheral vascular disease screening	US duplex Doppler lower extremities with ankle-brachial index	Older than 50 yo with history of diabetes or smoking	
Colon cancer screening	CT colonography	Every 5 years after negative screen, starting at 50 yo or more	Recommend if incomplete colonoscopy or refusal of optical colonoscopy / If high risk for colon cancer, recommend optical colonoscopy / Need colon prep

Screening

Screening	Preferred Study	Timing and Indications for Screening	Comments
Osteoporosis screening	DXA lumbar spine and hip(s)	Every 2 years until bone mineral density stabilizes unless risk factors* or treatment changes - All women age 65 yo & older and men age 70 yo & older - Women younger than 65 yo and men younger than 70 yo with risk factors* - 50 yo & older with wrist, hip, spine or proximal humerus fracture with minimal or no trauma - any age with insufficiency fracture, osteopenia on imaging, conditions that could alter bone mineral density *Risk factors include: - current smoker - loss of height, thoracic kyphosis - estrogen deficiency - maternal hip fracture after 50 yo - body weight less than 127 lb/57.6 kg - amenorrhea for more than 1 year before 42 yo	Fracture risk based on T- and Z-score / Follow bone mineral density (BMD), not the T- or Z-score / No fracture risk data for premenopausal women or men under 50 yo / If BMI over 35 kg/m2 , very large or very small body height, or advanced spine degenerative disease, consider Quantitative CT lumbar spine & hips without contrast
Ovarian cancer screening	None		No screening recommended for average-risk / No proven benefit to screening with CA-125 &/or US for high-risk

Our Commitment to Your Patients and Their Safety

IV Contrast

We Screen For:

Decreased Renal Function

- If eGFR below 30 mL/min/1.73 m^2, the radiologist may give less or no contrast

Allergies

- Mild allergies (e.g., rash, hives, swelling of eyes &/or face)
  - Recommend steroid premedication in non-emergent situations
- Moderate or severe allergies (e.g., inability to breathe, becoming unconscious)
  - Recommend giving IV contrast in an acute care setting after steroid premedication
- Arthrograms and myelograms usually not affected

Pregnancy

- IV contrast can cross the placenta
- CT/X-ray contrast
  - No available data for harm to fetus
- MRI contrast
  - May accumulate in amniotic fluid
  - Uncertain if leads to harm &/or NSF in fetus or mother
  - Recommend no MRI contrast unless:
    1) information cannot be acquired without contrast,
    2) the information would affect the care of the patient and fetus during the pregnancy, or
    3) it is not prudent to wait to obtain this information until the patient is no longer pregnant

Breastfeeding and MRI/CT/X-ray Contrast

- Safe to continue breast-feeding after receiving contrast according to available data
- If concerned, stop breast-feeding for 24 hours with active expression and discarding of breast milk from both breasts during that period

Metformin and CT/X-ray Contrast

- If eGFR below 30 mL/min/1.73 m^2
  - Stop metformin for 48 hours after contrast
  - Recommend renal function test after 48 hours before resuming metformin

Thyroid Abnormalities and CT or X-ray Contrast

- If a radioactive iodine thyroid scan or radioactive iodine uptake is planned, do before the patient has iodinated CT or X-ray contrast

Our Commitment to Your Patients and Their Safety

MRI Safety

We screen for implants and any metal in or on patients before they go in the MRI scanner.

Radiation Safety

We strive to limit radiation exposure while producing quality CT and X-ray examinations.

Suggested Premedication Protocols for Contrast Allergy

Protocol 1

- #16 of Methylprednisolone (Medrol) 4mg
  Label: Take eight (8) by mouth 12 hours and 2 hours before the exam is scheduled.
- And consider adding #2 of Diphenhydramine (Benadryl) 25mg
  Label: Take one or two (1 or 2) by mouth 1 hour before the exam is scheduled.
  Do not drive or operate heavy machinery for 4-6 hours after taking.

OR

Protocol 2

- #3 of Prednisone 50mg
  Label: Take one (1) by mouth 13 hours, 7 hours and 1 hour before the exam is scheduled.
- And #2 of Diphenhydramine (Benadryl) 25mg
  Label: Take one or two (1 or 2) by mouth 1 hour before the exam is scheduled.
  Do not drive or operate heavy machinery for 4-6 hours after taking.

Recommendations for Claustrophobic Patients

Patients with pain, anxiety, restlessness or claustrophobia

- For optimal image quality, it is important for patients to lie still during their CT and MRI exams.

Patients, consider:

- Taking your prescribed pain medication about ½ hour before the exam is to start
- Bringing a friend or family member to sit in the scanner room to read a book aloud or gently talk to you
- Bringing a favorite CD for listening during the exam
- Do not drive if taking an anxiolytic or if the pain medication instructions advise against it

Doctors, consider:

- Prescribing a single dose of an oral anxiolytic to take about ½ hour before the exam is to start. These should not be given to women who are pregnant or breastfeeding. Oral anxiolytics include, but are not limited to:
  - diazepam (Valium) (2-10 mg)
  - lorazepam (Ativan) (0.5-1 mg only for those over 12 yo)
  - alprazolam (Xanax) (0.25-0.5 mg for those over 18 yo)
  - oxazepam (Serax) (10-15 mg only for those over 12 yo)