Wake Radiology
Utilization Management Program
Cost-effective and efficient radiology ordering
Welcome

This is a guide to the rational ordering of diagnostic imaging studies in a variety of relatively common clinical situations. This pamphlet should take some of the guesswork out of ordering imaging studies and it should help answer clinical questions in the most direct route possible.

This guide has been adapted from Cost-Effective Diagnostic Imaging by Zachary D. Grossman, MD. For a deeper understanding of the rationale in ordering imaging studies, the clinician is encouraged to consult this book.

We hope this directed set of guidelines will help in most clinical situations. Obviously, many situations arise that are either not included or require individualized approaches. In these instances, it is very important to consult our team of sub-specialty radiologists for the most expedient work-up strategy. The phone numbers for each sub-specialty team are located at the bottom of the respective ordering page.

For the most updated version of this guide, please visit us online at wakerad.com
Adapted from:
Cost-Effective Diagnostic Imaging: The Clinician's Guide
Zachary D. Grossman, MD, FACR, Douglas S. Katz, MD, Ronald A. Alberico, MD, Peter A. Loud, MD, Jonathan S. Luchs, MD, and Ermelinda Bonaccio, MD.
Wake Radiology PACS
(Picture Archive and Communication System)

Using our easy single-login step, you will see a list of your patients who have been scheduled at our offices during a period that you select. For each patient you can view:

- exams scheduled in the future
- status, including cancelled and no-show
- diagnostic report and images (printable)
- list of prior exams and reports ordered by you or other physicians
- reports and images from all affiliated hospitals including, WakeMed Health & Hospitals, Maria Parham Medical Center, Johnston Health and Dorothea Dix Hospital/ Central Regional Hospital.

It’s easy to get started with this free service by visiting us at <wakerad.com> and pressing the PACS Login button and following the simple instructions.

For PACS assistance, you may always call our IT Hotline: 919-788-7885 (M–F, 7:00 AM – 6:00 PM).
I. Gastrointestinal Imaging

1. Acute Cholecystitis
   - U/S initial study
   - Hepatobiliary scan: if diagnosis is equivocal, performed to establish patency of cystic duct
   - MRCP: pre-op – MRI is more sensitive and specific for acute cholecystitis. Many times, MRI will be positive immediately after a negative U/S. Thus if clinical symptoms warrant further investigation after negative U/S, consider MRI. *Please note that MRCP/MRI is the most accurate imaging method to non-invasively detect choledocholithiasis (bile ductal stones) – please see below.*

2. Chronic Cholecystitis
   - U/S initial study
   - Hepatobiliary scan with gallbladder ejection fraction for gallbladder dysfunction as cause of abdominal pain

3. Gallstones or Bile Duct Stones (Choledocholithiasis)
   - U/S is initial study.
   - Preoperative MRI should always be considered if stones seen within the GB are tiny or “granular”, even in the setting of “normal caliber ducts” by US. The risk of nonobstructing choledocholith increases as the size of the observed choleliths decrease.

4. Appendicitis
   - Often a clinical diagnosis
   - U/S in infants, young children, pregnant and childbearing-age women, allowing for appropriate body habitus
   - CT recommended after US in all but pregnant patients. MRI is preferred in pregnant patients, and is extremely sensitive to appendicitis.
   - If sonogram and CT are negative, in the setting of strong clinical concern, MRI should be considered in children and pregnant patients. *CT should not be used in pregnant patients.*

5. Biliary Obstruction (Jaundice or RUQ pain)
   - U/S is initial study
   - If U/S shows dilated duct, MRI/MRCP or CT used to differentiate between common duct stone and tumor of pancreatic head
   - HIDA scan may play role in functional evaluation of benign appearing dilated duct

6. Focal Liver Lesions
   - While in the past multiphasic CT has been used to characterize liver lesions as benign or malignant, concerns for radiation exposure have emphasized that Liver MRI is a preferable first choice for liver lesion characterization. Multiphase CT should only be used in patients who have contraindications to Liver MRI.

7. Bile Leak
   - Hepatobiliary scan
   - T-tube cholangiogram, if present
   - MRI/MRCP can also be considered in selected cases. Typically it is more accurate for chronic rather than acute bile leaks.

8. Pancreatic Mass
   - While in the past multiphasic CT has been used to characterize pancreatic lesions as benign or malignant, concerns for radiation exposure have emphasized that Pancreatic MRI is a preferable first choice for pancreatic lesion characterization. Multiphase CT should only be used in patients who have contraindications to Pancreatic MRI.
9. Hepatosplenomegaly
- U/S for spleen
- In those patients where surveillance monitoring of the liver or spleen volume is required for treatment decision making, MRI is the most accurate method for volume quantification, without exposure to radiation (CT should not be used).

10. Acute GI Bleeding
- If endoscopy or NG tube aspirate is negative, radiolabeled RBC scan
- If negative, then bleeding will not be demonstrated by angiography
- If positive, can direct angiography for location

11. Chronic GI Bleeding
- Upper/lower endoscopy: initial study
- CT enterography
- If all studies are negative, then angiography may find angiodysplasia
- Meckel's scan may be useful in children

12. Blunt Abdominal Trauma
- Pertains to hospital-based cases only
- In stable patient, CT scan of abdomen and pelvis with intravenous contrast is initial study

13. Small Bowel Obstruction (SBO)
- Start with acute abdomen series
- Routine CT may be definitive and can direct surgical planning. Oral contrast optional.
- MR Enterography is preferred for the surveillance imaging of the complications of inflammatory bowel disease (IBD) to avoid unnecessary exposure to radiation, which can increase the risk of cancer development over the lifetime of the patient.
- CT Enterography to characterize partial SBO

14. Dysphagia
- Barium swallow is initial study
- Suspicious findings should be followed by endoscopy.
- Speech modified barium swallow to investigate swallowing mechanism performed in conjunction with speech pathologist.

15. Screening for Colorectal Cancer and Polyps
- Average-risk patients: Colonoscopy and BE every 10 years. CT colongraphy (under development) every 5 years
- High-risk patients: Start above at age 40. Colonoscopy or BE recommended every 3–5 years

16. Chronic Inflammatory Bowel Disease
- While CT Enterography (CTE) is the primary modality for confirmation of a new diagnosis of Crohn’s Disease, MR Enterography (MRE) is preferred for their long term surveillance. MRE has the same sensitivity and specificity as CTE, but without radiation. Every effort must be made to reduce a patient’s lifetime imaging radiation exposure.
II. Genitourinary System

1. Obstruction Uropathy
   - Radiograph (stones)
   - Helical CT using renal stone protocol
   - After initial CT, follow-up radiograph and U/S used for recurrent obstruction. Every effort must be made to reduce patient exposure to imaging radiation. Patients with chronic stone disease and recurrent obstructive uropathy are best managed with the judicious application of CT. U/S, plain films, and occasionally MRI are methods which can be used to reduce exposure to imaging radiation in selected patients.
   - Radionuclide renogram with Lasix: evaluation of physiologic significance of hydronephrosis (obstruction vs. reflux)

2. Painless Hematuria
   - KUB for stones
   - CT Urogram
   - MRI can be used in selected patients along with Renal MR angiography.

3. Renal Mass
   - U/S cyst vs. solid
   - MRI is preferred over CT for any “hyperechoic” lesion seen by U/S. Also, “hyperdense” or “equivocally enhancing” lesions seen on CT are accurately characterized as benign or malignant by MRI without and with contrast, and subtraction imaging.

4. Renal Failure
   - U/S assesses renal size, echotexture, cortical thickness, R/O hydronephrosis
   - CT without contrast can look for source of obstruction if hydronephrosis is present. Obstruction present, then go to 1

5. Suspected Renovascular Disease
   - MR angiography
   - CT angiography
   - Captopril renogram

6. Scrotal Imaging
   - Ultrasound

7. Penile Masses
   - MRI is the preferred modality.

8. Adnexal Masses
   - Ultrasound
   - Pelvic MRI for characterization

9. Ectopic Pregnancy
   - Ultrasound

10. Dysfunctional Uterine Bleeding
    - Ultrasound
    - Pelvic MRI for characterization
11. UTI in Infants and Children
- UTI must be clinically documented
- R/O reflux with VCUG; follow up reflux with NM cystogram
- U/S to look for hydro, anatomic anomalies, scar, renal size, cortical thickness
- DMSA for cortical scarring

12. Prostate Cancer
- MRI is used for locoregional staging
- Bone scan for bone mets
III. Chest Imaging

1. Solitary Pulmonary Nodule
   - CT (Fleischner Society recommendations)
   - PET-CT scan to help characterize

2. Mediastinal Mass
   - CT with contrast first study for patients with abnormal CXR or clinical suspicion for mediastinal mass other than substernal thyroid
   - MRI for problem solving
   - PET-CT scan for staging of lung cancer or malignant adenopathy

3. Pulmonary Embolism
   - CXR performed to exclude other causes of symptoms. Assists in interpretation of ventilation perfusion lung scan (V/Q scan)
   - PE CT. Preferred in pregnancy
   - V/Q scan

4. Aortic Dissection
   - MRI is used for surveillance imaging required for chronic dissection.
   - MRI is also preferred for chronic dissection cases that have undergone surgical repair.
   - CT is used only for ACUTE dissection. Every effort should be made to reduce exposure to imaging radiation.

5. Aortic Aneurysm
   - CT for detection or follow-up
   - MRI for surveillance imaging required

6. Interstitial Lung Disease
   - High-resolution chest CT protocol

7. Pleural Effusion
   - CXR for detection or follow-up
   - CT to characterize pleural effusion and underlying disease process
IV. Brain Imaging

1. Cerebral Metastases
   • MRI with gadolinium is most sensitive and specific
   • CT with contrast when MRI is contraindicated
   • PET-CT

2. Acute Head Trauma
   • CT without contrast is first choice
   • MRI sometimes used for follow-up of unexplained symptomology
   • Skull films have essentially no role

3. Acute Spine Trauma
   • Plain radiographs are best used when the suspicion of significant injury is low.
   • CT is quickest and most accurate in acute setting to exclude fracture. Also used when plain radiographs are equivocal or to further evaluate fractures.
   • MRI is used when neurologic symptom or deficit not explained by plain radiographs or CT. May also be used in comatose patient.

4. Normal-Pressure Hydrocephalus
   • MRI is first choice to screen for hydrocephalus and to exclude other causes of symptoms
   • MRI can also evaluate CSF flow dynamics (if specifically requested)
   • CT used when MRI contraindicated
   • Radionuclide cisternogram often necessary to further support NPH diagnosis in appropriate clinical setting

5. Nasal CSF Leak (CSF Rhinorrhea)
   • Unenhanced high-resolution facial bone CT may suffice when rhinorrhea is copious.
   • CT cisternography (CT of the sinuses after intrathecal injection of myelographic contrast) may be used to document the specific location of the leak when needed.
   • Radionuclide cisternogram, (measuring activity in cotton pledges inserted in the nasal cavities after intrathecal injection of radionuclide) may be used to confirm the presence of a CSF leak into the sinuses or nasal cavity when the rate of CSF leak is too low to be demonstrated by CT cisternography.

6. Spinal CSF Leak
   • Radionuclide cisternogram is first choice.
   • MRI may be used to clarify etiology of leak if leak is demonstrated in a specific location on Radionuclide cisternogram.

7. Encephalitis
   • MRI with contrast is best.
   • CT with contrast if MRI is contraindicated

8. New-Onset Seizures
   • MRI is first choice. Contrast is generally added for patients > 40 years old with new seizures.
   • CT if MRI is contraindicated

9. Chronic Intractable Epilepsy
   • MRI is first choice. Please include epilepsy when requesting the study (High resolution coronal T2-weighted imaging of the hippocampi will be added for detection of mesial temporal sclerosis).
10. Cerebral Aneurysms
- CT without contrast for acute presentation when subarachnoid hemorrhage is suspected
- MRI and head MRA (usually without contrast) in non-emergency situations
- Head CTA (CT angiography with contrast) when MRI is contraindicated
- Angiography used to further evaluate aneurysm detected by MRA/CTA, or to detect tiny aneurysm when MRA/CTA is negative and clinical suspicion remains very high.

11. Vascular Malformations
- Unenhanced CT used for acute presentation when hemorrhage suspected
- MRI with head MRA (usually without contrast) in non-emergency situations
- Head CTA (CT angiography with contrast) when MRI is contraindicated
- Angiography used to further evaluate vascular malformation detected by MRI/CT, or when MRI/CTA is negative and clinical suspicion remains very high.

12. Vasculitis
- MRI with head MRA (usually without contrast) in non-emergency situations
- CT head with CTA (CT angiography with contrast) when MRI is contraindicated
- Angiography used when MRI/CT is negative and clinical suspicion remains very high.

13. Demyelinating Disease
- MRI with contrast is exam of choice. Please specify suspicion of, or history of, demyelinating disease when requesting the study (Axial and/or coronal FLAIR and STIR imaging will be added).
- CT with contrast when MRI unavailable or contraindicated

14. Sellar and Juxtasellar Lesions
- MRI with contrast is exam of choice. Please specify pituitary MRI when requesting the study (High resolution T1 weighted imaging of the pituitary without and with contrast will be added).
- CT with contrast is sometimes helpful for calcification and bone destruction
- CT angiography or MRA may be indicated if lesion appears to be an aneurysm on MRI

15. Stroke
- CT without contrast is first choice in the acute setting.
- After CT, MRI is recommended to confirm and better characterize acute infarctions, old infarctions, and chronic ischemic disease.
- MRI is also superior to CT for detection of posterior fossa infarctions, very early infarctions, or small infarcts. MRI is also superior to CT in the detection of mimickers of ischemic disease.
- MRA is used to evaluate vascular luminal compromise.
- CTA if MRA is contraindicated. (Please note: Within the first few hours after the onset of stroke symptoms, it is sometimes possible to limit the extent of cerebral infarction by endovascular intervention. If a stroke is identified within several hours of onset, the patient should go directly to a designated Stroke Center, such as WakeMed Raleigh Campus (on New Bern Ave.), as quickly as possible. There, the patient can be evaluated with CT perfusion and examined for possible endovascular intervention that may limit the extent of infarction.)

16. Dementia
- PET-CT is the most sensitive test for Alzheimer's disease. Medicare approved indication, CPT 78608.
- MRI is most useful in excluding other causes of dementia (e.g. multi-infarct dementia)
- CT should be used if MRI is contraindicated.
V. Musculoskeletal System

1. Osteomyelitis
   - Plain radiographs as baseline study. Can be diagnostic. With initial normal study, repeat in 10–14 days can be diagnostic
   - MRI is sensitive and anatomically specific in diagnosis of osteomyelitis
   - Triple phase bone scan can be performed if plain plain radiographs are not helpful or patient cannot undergo MRI
   - Dual-isotope nuclear medicine scan can offer increased specificity for infection and includes labeled-WBC and sulfur colloid (e.g., fracture deformity or Charcot foot)

2. Skeletal Metastases
   - Start with plain plain radiographs in patients with focal pain and known primary.
   - PET-CT or bone scan used for staging
   - MRI can detect disease where bone scan is negative or when there is a focal/isolated lesion
   - Percutaneous bone biopsy with image guidance for tissue diagnosis
   - CT can be helpful in characterization

3. Stress Fractures
   - Plain plain radiographs: baseline, follow-up, and comparison
   - MRI is most sensitive for marrow abnormalities and periosteal inflammatory processes. May be positive in presence of normal plain plain radiographs
   - Bone scan is more sensitive than plain plain radiographs and less specific than MRI

4. Joint-replacement Failure
   - Plain plain radiographs are essential for baseline and comparison
   - Bone scan is sensitive but non-specific (infection vs. loosening). For increased specificity regarding infection, would require dual-isotope nuclear medicine study with labeled-WBC and Sulfur Colloid
   - Joint aspiration with contrast administration. Evidence of loosening, as well as culture of aspirated fluid

5. Child Abuse
   - Skeletal survey is cost-effective evaluation of areas of known trauma, as well as additional areas of old or new injury
   - Bone scan is sensitive (although increased activity at growth plates may be normal)
   - CT/MRI for suspected intracranial injury

6. Avascular Necrosis (Osteonecrosis) of the Hip
   - Plain radiographs: used as baseline (may be normal early on)
   - MRI is most sensitive for evaluation of osteonecrosis, as well as evaluation of opposite hip

7. Deep-Vein Thrombosis
   - Color doppler U/S: Very sensitive and specific for DVT from common femoral vein to popliteal vein
   - MR venography (particularly for more central (pelvic, IVC) clot
   - Venogram: The gold standard, but uncommonly utilized. Better than U/S for detection of calf DVT with non-filling, can be difficult to distinguish chronic from acute DVT (U/S can help sometimes)
MSK Exams and Services
At Wake Radiology, we offer more comprehensive sports medicine imaging than anyone in the area. With imaging specialists in all areas, we’re equipped to handle any sports injuries. Our West Raleigh musculoskeletal center is staffed daily by two subspecialty-trained radiologists.

- Conventional radiography, CT, and MRI of all joints
- Peripheral ultrasound with special attention to the shoulder
- Conventional, CT, and MR arthrography
  - Shoulder, elbow, wrist, hip, knee and ankle
- Interventional procedures:
  - Extremity joint injections for pain management (e.g., upper or lower extremities, spine, foot/ankle)
  - Shoulder brisement for adhesive capsulitis
  - Joint aspirations
  - Ultrasound-guided cyst aspiration, and removal of bursal and tendon calcium deposits
  - Sacroiliac joint injections
  - Facet joint injections
  - Traditional and caudal epidural injections (through sacral hiatus) for relief of sacroccocygeal, low back, and sciatic pain. This procedure is performed at Wake Radiology Cary Interventional Services by our MSK Radiologists.

- Bone densitometry — International Society for Clinical Densitometry (ISCD) certified radiologists read all DXA exams at Wake Radiology. Wake Radiology is the only multi-site DXA provider in the country to have ISCD certification.
VI. Cardiovascular Imaging

1. Elective evaluation of myocardial ischemia, CAD, and myocardial viability myocardial perfusion with spect for suspected CAD or to follow CAD
   - Cardiac MRI
   - Multidetector CT for calcium screening and/or CT coronary angiography
   - PET-CT for myocardial viability

2. Left ventricular ejection fraction
   - Radionuclide ventriculogram and echocardiography
   - Cardiac MRI also available
   - CXR is first exam. Cannot rule out small effusions
   - Echocardiogram preferred method in most situations
   - CT or gated MRI used when echo is equivocal
   - MRI for constrictive pericarditis

3. Pericardial effusion
   - Echo is the first line.
   - MRI is used when echo is nondiagnostic.
VII. General

1. Abdominal and pelvic masses in children
   • Plain radiographs (bowel gas patterns/Ca++)
   • History/physical should direct imaging (e.g., bowel: barium studies; extra-gastric or intestinal: U/S; renal: U/S (may be further evaluated with CT, MRI, VCUG, or nuclear renal scan)

2. Pelvis
   • Plain radiographs
   • U/S is primary modality
   • For older pediatric patients with indeterminate or non-diagnostic U/S, use CT, MRI, or nuclear medicine studies)

3. Occult bacterial infection
   • CXR
   • Abdomen/pelvis CT (diverticulitis, abscess, visceral infection)
   • Radionuclide WBC scan

4. Sinusitis
   • Standard plain radiographs
   • CT for further evaluation and preoperative planning

5. Patients with elevated creatinine and need for contrast-enhanced cross-sectional exam
   • MRI

6. Patients with severe allergy to iodinated contrast and need for contrast-enhanced sectional exam
   • MRI

7. Patients who are unable to follow commands. CT is less sensitive to motion
   • CT
VIII. Endocrine Disorders

1. Adrenal
   - Pheochromocytoma: 10% multiple, bilateral; 10% extra-adrenal, 10% malignant
     - Thorough clinical work-up
     - First imaging study: CT abdomen/pelvis and possibly chest without contrast.
     - MRI
     - Nuclear medicine study (MIBG): occult sites
   
   - Small non-functioning incidental adenomas in patients with no history of malignancy, no prior CT:
     - If < 10 HU, no further imaging
     - If > 10 HU, MRI or CT follow-up
     - If > 5 cm, surgery
     - If increase in size, biopsy
     - Characterize with washout CT

2. Thyroid
   - Solitary palpable mass in euthyroid patient
     - U/S allows for confirmation of origin and characterization (cystic or solid).
     - Biopsy
   - Multinodular gland on PE
     - U/S allows for confirmation of origin and characterization (cystic or solid).
     - Biopsy
   - Toxic multinodular goiter: clinical hyperthyroid
     - 131-I thyroid scan and uptake
     - Treat with I-131
   - Graves' Disease: clinical hyperthyroid (incr TSH)
     - 131-I scan and uptake
     - Treat with I-131
   - Evaluation for metastasis in-patient with thyroid Ca.
     - I-131 whole body scan.
     - Treat with high doses of I-131
   - PET-CT/CT as indicated

3. Parathyroid Tumor
   - Sestamibi scan is exam of choice. Image neck, mediastinum
IX. Breast Imaging

1. Screening
   - Screening Mammography
     - Guidelines
       • Asymptomatic
       • Age 40 - 80 yearly
       • Exceptions
         Baseline at 35+ OK
         Strong family hx (mother or sister with pre-menopausal br ca) start at age 30
         and screen yearly.
         Prior to augmentation or reduction
       • High risk women (personal hx of br ca, LCIS or ADH; strong family hx)
         - Diagnostic mammography
         - BSGI (Breast Specific Gamma Imaging or Molecular Breast Imaging)
         - BMRI (Breast MRI)

2. Diagnostic Breast Imaging
   - Indications:
     - Significant symptoms
     - Abnormal screening mammogram
   - Tools:
     - Diagnostic mammography
     - U/S
       • Indications:
         Evaluation of mammographic or palpable lesion
         Not for screening at this time
         Staging
         • Determination of multifocality
         • Evaluation of ipsilateral axilla
     - Interventional procedures
       • Limitations:
         Will usually miss DCIS
         Significant false positives (specificity = 25-55%)
         Inaccurate in areas of prior surgery (especially lumpectomy)
     - Aspiration and pneumocystography
       • Further evaluation of questionable cyst found at U/S
       • Therapeutic
     - Ductography Indications
       • Persistent bloody nipple discharge
       • Copious, spontaneous serous discharge from a single duct
     - BMRI
       • Indications:
         Staging for breast cancer
         • Determination of multifocality/multicentricity
         • Pre/post neo-adjuvant chemotherapy to assess tumor responsiveness
         Positive nodes but negative mammogram
         Questionable recurrence after breast conserving therapy
         Evaluation of indeterminate finding in area of prior biopsy
         Evaluation of non-specific mammographic and U/S findings
         Screening in some women with dense breasts who are at high risk
         Evaluation of implant integrity (when clinically indicated)
       • Limitations
         Cost and access
         Claustrophobia (IV Valium highly successful for anxiolysis)
         Pacemakers, etc.
Breast Imaging (Continued)

- BSGI

  • Indications
    Essentially the same as MRI (except not for implant integrity)
    In our practice used primarily for screening
    • Women with low to moderate increased risk and dense breasts
    • Women with normal risk, but with very difficult mammograms

  • Limitations
    Essentially none

3. Diagnosis

1. FNA (Fine Needle Aspiration)
   To confirm malignancy in BIRADS 5 lesion
   To R/O malignancy in non-suspicious palpable mass

2. Core bx

   • Indications:
     Replace surgical biopsy in ~ 80% of cases
     Probably benign lesions
     • Only if pt. is very anxious
     • Should not be done if lesion will be removed anyway

   • Limitations:
     Radial scar or other poorly defined architectural distortion
     Loosely clustered microcalcifications
     Difficult location of lesion or very small breasts
     Anticoagulant therapy or bleeding disorder
     May under-diagnose (ADH/DCIS, DCIS/IDC)
     Cannot determine multifocality or multicentricity with single biopsy

   • Sensitivity:
     2-4% false negative results

   • Notes:
     Stereotactic with VACB best for calcifications
     U/S guidance with 12-14g biopsy needle best for most solid lesions (VACB usually not necessary)
X. PET·CT and Oncology

1. PET·CT for Staging and Differentiating Benign from Malignant Mass

**PET·CT CPT Codes**
- 78814 (limited area)
- 78815 (skull base to mid-thigh)
- 78816 (whole body)

**Solitary Pulmonology**
- Characterization of indeterminate SPN

**Lung Cancer – non small cell**
- Diagnosis, initial staging and restaging

**Colorectal Cancer**
- Diagnosis, initial staging and restaging

**Melanoma**
- Diagnosis, initial staging and restaging

**Lymphoma**
- Diagnosis, initial staging and restaging

**Head & Neck Cancer (excluding thyroid and CNS cancers)**
- Diagnosis, initial staging and restaging

**Esophageal Cancer**
- Diagnosis, initial staging and restaging

**Breast Cancer**
- Imaging for breast ca, staging for distant metastases, or restaging loco-regional recurrence or metastasis i.e. staging/restaging after or prior to course of treatment, monitoring tumor response to treatment in locally advanced and metastatic br ca when a change in therapy is contemplated.

**Thyroid Cancer**
- Imaging restaging or recurrent or residual thyroid cancer of follicular cell origin previously treated by thyroidectomy & radiation ablation, after negative I–131 whole body scan and thyroglobulin levels >10ng/ml.

**Cervical Cancer**
- Imaging for staging newly diagnosed and locally advanced cervical cancer with no extra-pelvic metastasis on conventional imaging test, such as CT or MRI.
XI. Interventional Radiology

1. Varicose Veins
   - Venous insufficiency is common with half of all adults > age of 40
     Common symptoms:
     - Chronic leg pain
     - Unsightly varices
     - Venous stasis ulcers
     - Spontaneous bleeding and possible limb loss, in some cases
     - Conservative management: using surgical compression stockings and leg elevation
     - Laser ablation of greater saphenous vein under U/S guidance
     - Microphlebectomy used when large superficial veins need to be removed

2. Sclerotherapy
   - Appropriate for smaller veins not requiring phlebectomy
   - Used for the treatment of “spider veins”

3. Compression Fractures
   - Vertebroplasty: methyl methacrylate (aka cement) is injected directly into a fractured vertebral body, resulting in pain relief by stabilizing the fracture
   - Balloon kyphoplasty: utilizes a balloon to create a void for the cement as well as to attempt to correct the fracture deformity, obtaining fracture reduction and fixation
     - Used primarily for treatment of fractures associated with osteoporosis
     - Used in the treatment of painful bone tumors involving the vertebrae including metastatic disease
     - Low risk of complication (<1%)

4. Sacral Insufficiency Fractures
   - Sacroplasty – Internally setting a fracture via the percutaneous approach

5. Uterine Fibroids
   - Uterine artery embolization: an alternative to surgery for the treatment of symptomatic uterine fibroids.
     - The number of women who have fibroids increases with age until menopause
     - Approximately 20% of women who have fibroids also have symptoms that merit treatment

6. Venous Access (Port, PICC, Hickman)
   - An important part of outpatient chemotherapy and long-term antibiotic administration (e.g., osteomyelitis and Lyme’s treatment) is venous access

7. Thyroid Biopsy
   - Thyroid nodules are a very common entity in the population, approaching rates of 50%
   - An ultrasound guidance biopsy has a very high rate of gaining sufficient tissue for pathologic diagnosis

8. Pleural Effusion and Ascites Management
   - Malignant pleural effusions and ascites can severely compromise a patient’s pulmonary function and quality of life
   - Repeated procedures are very inconvenient for the patient and introduce the risk of infection with each intervention
   - Placing a Denver Pleurex® catheter can allow the patient to drain ascites or pleural effusion at home, without the need for repeated needle punctures of the pleura and peritoneum
9. Peripheral Angiography and Angioplasty

- Peripheral vascular disease (PVD) or peripheral arterial disease (PAD) is a common circulation problem in which the arteries that carry blood to the legs or arms become narrowed or clogged
- Affects 10 million people in the United States, including 5% of the over age 50 population
- Angioplasty: treatment of narrowed arteries using balloon catheters; sometimes combined with the placement of a vascular stent

10. Interventional Oncologic Radiation Therapies

- Primary Liver Cancer (hepatocellular carcinoma, HCC). Liver cancer is one of the most commonly occurring solid tumors worldwide
- Secondary Liver Cancer
  - Colorectal metastases to liver: Colorectal cancer is the fourth most common malignancy in the United States. About 70% of patients with colon cancer eventually develop liver metastases. At the time of diagnosis, 30% to 40% of patients with colorectal metastases have disease localized to the liver; however, only a 1/4 of these patients are surgical candidates
  - The liver is a common site for spread of tumors of the breast, colon, stomach, pancreas, lung, and skin (melanoma)
  - Incidence rates of primary and secondary liver cancer increase with an aging population and new therapies are needed to prolong survival
- Current treatment for liver cancer:
  - Systemic chemotherapy
  - Hepatic artery chemoembolization
  - Surgical resection
  - Ablations (e.g., cryoablation, RF ablation, alcohol ablation)
  - Targeted radioembolization (SIR-spheres®)

SIRT (Selective Internal Radiation Therapy)

- SIR-spheres are biocompatible yttrium-90 microspheres, which are selectively injected through transcatheter methods directly into a liver tumor, destroying it while simultaneously preserving most normal liver tissue

Radiofrequency Ablation (RFA)

- A treatment option for patients with primary or metastatic liver lesions who are currently deemed inoperable
- RFA is also an option for the treatment of renal cell carcinoma. RFA employs imaging guidance (CT or U/S) to achieve thermal destruction of individual solid tumors
- RFA has been performed on lung, kidney, pancreas, bone, and retroperitoneal soft tumors
Office Locations

Administrative and Business Office
3949 Browning Place
Raleigh, NC 27609
(919) 787-8221

Wake Radiology North Hills
3821 Merton Drive
Raleigh, NC 27609

Wake Radiology West Raleigh Imaging
4301 Lake Boone Trail
Raleigh, NC 27607
(3 Offices)

Wake Radiology Northwest Raleigh
American Institute of Healthcare & Fitness
8300 Health Park, Ste 221
Raleigh, NC 27615

Wake Radiology Cary
300 Ashville Avenue, Ste 100
Cary, NC 27518
(6 Offices)

WR Comprehensive Breast Services
300 Ashville Avenue, Ste 260
Cary, NC 27518

WR Interventional Services
300 Ashville Avenue, Ste 160
Cary, NC 27518
Scheduling: (919) 854-2180

Wake Radiology Oncology Services
300 Ashville Avenue, Ste 110
Cary, NC 27518
Scheduling: (919) 854-4588

WR Raleigh MRI Center
3811 Merton Drive
Raleigh, NC 27609

Wake Radiology Wake Forest
American Institute of Healthcare & Fitness
3150 Rogers Road, Ste 115
Wake Forest, NC 27587

Wake Radiology Garner
300 Health Park Drive, Ste 100
Garner, NC 27529

Wake Radiology Chapel Hill
110 S. Estes Drive
Chapel Hill, NC 27514

Affiliated Hospitals

WakeMed Raleigh Campus
3000 New Bern Avenue
Raleigh, NC 27610
(919) 350-8511
(919) 350-8959 Fax

WakeMed Apex Healthplex
120 Healthplex Way
Apex, NC 27502
(919) 350-4300

WakeMed Briar Creek Medical Park
10208 Cerny Street
Raleigh, NC 27617
(919) 350-0978

WakeMed Cary Hospital
1900 Kildaire Farm Road
Cary, NC 27511
(919) 350-2412
(919) 350-2418 Fax

WakeMed Clayton Medical Park
555 Medical Park Place
Clayton, NC 27520
(919) 350-4242

WakeMed North Healthplex
10000 Falls of Neuse Road
Raleigh, NC 27614
(919) 350-1300

Maria Parham Medical Center
1805 Ruin Creek Road
Henderson, NC 27536
(252) 436-1145
(252) 436-1173 Fax

Johnston Health
509 Brightleaf Blvd.
Smithfield, NC 27577
(919) 934-8171
(919) 934-1920 Fax

Central Regional Hospital–Raleigh
820 S. Boylan Avenue
Raleigh, North Carolina 27603
(919) 733-5540

Central Regional Hospital–Butner
300 Veazey Road
Butner, NC 27509
(919) 764-2000
<table>
<thead>
<tr>
<th>Name</th>
<th>NPI Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bird, Richard E.</td>
<td>1982669909</td>
</tr>
<tr>
<td>Burge, Holly J.</td>
<td>1710944186</td>
</tr>
<tr>
<td>Burke, Eithne T.</td>
<td>1568429942</td>
</tr>
<tr>
<td>Caskey, Cynthia I.</td>
<td>1316904790</td>
</tr>
<tr>
<td>Cerwin, Robert A.</td>
<td>1962467944</td>
</tr>
<tr>
<td>Chandler, Kerry</td>
<td>1285692244</td>
</tr>
<tr>
<td>Coates, G. Glenn</td>
<td>1609833011</td>
</tr>
<tr>
<td>Coates, Karen A.</td>
<td>1376501239</td>
</tr>
<tr>
<td>Cornett, Joseph B.</td>
<td>1629036439</td>
</tr>
<tr>
<td>Djang, William T.</td>
<td>1548228372</td>
</tr>
<tr>
<td>Douglas, M. Rans</td>
<td>1396703153</td>
</tr>
<tr>
<td>Douglas, Margaret R.</td>
<td>1710945571</td>
</tr>
<tr>
<td>Dziedzic, T. Scott</td>
<td>1073719746</td>
</tr>
<tr>
<td>Fein, Alan B.</td>
<td>1588622351</td>
</tr>
<tr>
<td>Gaal, Imre</td>
<td>1609834613</td>
</tr>
<tr>
<td>Gullotto, Carmelo</td>
<td>1720046634</td>
</tr>
<tr>
<td>Haugan, Paul A.</td>
<td>1841258761</td>
</tr>
<tr>
<td>Jordan, III, Lyndon K.</td>
<td>1407895154</td>
</tr>
<tr>
<td>Kennedy, Andrew S.</td>
<td>1467491019</td>
</tr>
<tr>
<td>Kennedy, Susan L.</td>
<td>1679512313</td>
</tr>
<tr>
<td>Kwong, Michael D.</td>
<td>1154361301</td>
</tr>
<tr>
<td>Lerner, Catherine B.</td>
<td>1467631523</td>
</tr>
<tr>
<td>Leuchtmann, Peter L.</td>
<td>1396791745</td>
</tr>
<tr>
<td>Ling, David</td>
<td>1376583419</td>
</tr>
<tr>
<td>Lipton, Melissa C.</td>
<td>1407896566</td>
</tr>
<tr>
<td>Marchand, Mark D.</td>
<td>1710959804</td>
</tr>
<tr>
<td>Matzko, John</td>
<td>1578503645</td>
</tr>
<tr>
<td>Max, Richard J.</td>
<td>1518913458</td>
</tr>
<tr>
<td>Melamed, Joseph</td>
<td>1851330534</td>
</tr>
<tr>
<td>Merten, David F.</td>
<td>1568402568</td>
</tr>
<tr>
<td>Meyer, Laura T.</td>
<td>1124293014</td>
</tr>
<tr>
<td>Mihalovich, Timothy J.</td>
<td>1497779961</td>
</tr>
<tr>
<td>Mills, Steven R.</td>
<td>1285674283</td>
</tr>
<tr>
<td>Mintz, R. David</td>
<td>1598704298</td>
</tr>
<tr>
<td>O’Donnell, Dennis M.</td>
<td>1023057734</td>
</tr>
<tr>
<td>Overton, Carroll C.</td>
<td>1154361160</td>
</tr>
<tr>
<td>Peters, Bryan M.</td>
<td>1063451706</td>
</tr>
<tr>
<td>Pope, Charles V.</td>
<td>1982644902</td>
</tr>
<tr>
<td>Posillico, Louis F.</td>
<td>1457308595</td>
</tr>
<tr>
<td>Poyet, Claire M.</td>
<td>1609823418</td>
</tr>
<tr>
<td>Presson, Jr., Thomas</td>
<td>1568419398</td>
</tr>
<tr>
<td>Pretter, Philip C.</td>
<td>1688621492</td>
</tr>
<tr>
<td>Ross, Michael L.</td>
<td>1982643607</td>
</tr>
<tr>
<td>Rougier-Chapman, Duncan P.</td>
<td>1134176019</td>
</tr>
<tr>
<td>Rush, Elizabeth A.</td>
<td>1700833860</td>
</tr>
<tr>
<td>Saba, Philip R.</td>
<td>1265489124</td>
</tr>
<tr>
<td>Sailer, Scott L.</td>
<td>1336196203</td>
</tr>
<tr>
<td>Schaeaf, Robert E.</td>
<td>1942265475</td>
</tr>
<tr>
<td>Schulz, David I.</td>
<td>1578734208</td>
</tr>
<tr>
<td>Secrist, Randy D.</td>
<td>1861432080</td>
</tr>
<tr>
<td>Sierra, John</td>
<td>1710927744</td>
</tr>
<tr>
<td>Spargo, J. Mark</td>
<td>1407896244</td>
</tr>
<tr>
<td>Townsend, Brent A.</td>
<td>1457565806</td>
</tr>
<tr>
<td>Vanarthos, William J.</td>
<td>1578519872</td>
</tr>
<tr>
<td>Wasudev, Nikunj P.</td>
<td>1639286651</td>
</tr>
<tr>
<td>Way, William G.</td>
<td>1740220003</td>
</tr>
<tr>
<td>Weeks, Susan M.</td>
<td>1174579817</td>
</tr>
<tr>
<td>Wilson, Russell C.</td>
<td>1124068432</td>
</tr>
<tr>
<td>Wu, Andrew C.</td>
<td>1699714212</td>
</tr>
</tbody>
</table>

**Quick Phone Numbers**

WR EXPRESS SCHEDULING: 919-232-4700  
EXPRESS FAX SCHEDULING: 919-235-3940  
CHAPEL HILL SCHEDULING: 919-942-3196  
CHAPEL HILL EXPRESS FAX: 919-933-9925  
IT HELP DESK (PACS INFO): 919-788-7885  
QUESTIONS? ADMIN, BILLING, IT: info@wakerad.com
KAREN A. COATES, MD
Body Imaging Radiologist

DAVID F. MERTEN, MD
Pediatric Radiologist

J. MARK SPARGO, MD
Body Imaging Radiologist

SUSAN L. KENNEDY, MD
Women’s Imaging Radiologist

JOSEPH W. MELAMED, MD
Musculoskeletal Radiologist

G. GLENN COATES, MS, MD
Body Imaging Radiologist
Director of Body MRI

ELIZABETH A. RUSH, MD
Women’s Imaging Radiologist

JOHN MATZKO, MD
Body Imaging Radiologist

KERRY E. CHANDLER, MD
Women’s Imaging Radiologist
Director of Women’s Imaging

CARROLL C. OVERTON, MD
Interventional Radiologist
Director of Interventional Services

WILLIAM J. VANARTHOS, MD
Musculoskeletal Radiologist

LYNDON K. JORDAN III, MD
Musculoskeletal Radiologist

JOSEPH B. CORNETT, MD
Neuroradiologist

PHILIP C. PRETTER, MD
Interventional Radiologist

M. RANS DOUGLAS, MD
Body Imaging Radiologist
Wake Radiology Physicians

MARGARET R. DOUGLAS, MD
Pediatric Radiologist
Director of Pediatric Imaging

IMRE GAAL JR., MD
Body Imaging Radiologist

RANDY D. SECRIST, MD
Diagnostic Radiologist

THOMAS L. PRESSON JR., MD
Interventional Radiologist
Radiation Safety Officer

PHILIP R. SABA, MD
Neuroradiologist
Co-director of Neuroradiology

ANDREW S. KENNEDY, MD, FACRO
Radiation Oncologist
Co-director of Oncology Services

STEVEN R. MILLS, MD
Body Imaging Radiologist

R. DAVID MINTZ, MD
Emergency Department Radiologist

CYNTHIA I. CASKEY, MD
Emergency Department Radiologist

MICHAEL D. KWONG, MD
Interventional Radiologist

MELISSA C. LIPTON, MD
Emergency Department Radiologist

LOUIS F. POSILlico, MD
Emergency Department Radiologist

SCOTT L. SAILER, MD
Radiation Oncologist
Co-director of Oncology Services

DUNCAN P. ROUGIER-CHAPMAN, MD
Body Imaging Radiologist
Co-director of Breast MRI

PAUL A. HAUGAN, MD
Body Imaging Radiologist
Wake Radiology provides imaging services for WakeMed Health & Hospitals, Maria Parham Medical Center, Johnston Health and Dorothea Dix Hospital/Central Regional Hospital.