Imaging: Choosing the Appropriate Exam

Rob Milman, MD
Texas Nurse Practitioner
Dallas, TX
September 24, 2015

What is a Radiologist?
- A physician who specializes in diagnosing and treating disease and injury by using medical imaging techniques

Radiology: Diagnostic Imaging and Imaging-guided Interventions
- “Imaging is like oxygen; medicine without imaging cannot survive”
  - King Li, MD, MBA

Radiology
- Make tremendous difference in patients’ lives:
  - Diagnosing or excluding disease and injury
  - Evaluating response to therapy
  - Imaging guided treatments
  - Wide variety of pathology
  - Intellectually stimulating

Answer Clinical Question
- Image interpretation in context of clinical signs and symptoms

Ordering The Right Test
- Questions to answer
  - Is an imaging study necessary?
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- Is an imaging study necessary?
- Will the results alter therapy?
- What risks are associated with the test?
- Does the potential benefit outweigh those risks?
- What test will most likely answer the clinical question?
- What is the most cost effective imaging strategy?

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Modalities
- Radiography: X-rays, Fluoroscopy
- Ultrasound
- CT
- MRI, fMRI
- Nuclear Medicine
- Molecular Imaging
- Angiography, conventional vs. CTA or MRA
- Interventional Radiology
Health Care Reform

- Best outcomes – Quality
- Low cost
- Value = Quality/cost
- Evidence based

American College of Radiology (ACR) Appropriateness Criteria

www.acr.org/ac

Gastrointestinal
Imaging Workup Caveat

- The complexity and severity of the clinical condition should dictate selection of appropriate imaging procedures or treatments – ACR.
- Each patient is unique and workup may vary due to clinical circumstances such as age, condition, comorbidity, etc.
Pro and Cons

Ultrasound
- Noninvasive
- No ionizing radiation
- Real time imaging
- Safe and relatively painless
- Cost

CT
- Soft tissue contrast
- Any body habitus
- Bone imaging
- Fast

MRI
- Excellent soft tissue contrast
- No ionizing radiation
- Safe

Ultrasound
- Operator dependent
- Large body habitus
- Air (bowel gas) interference
- Bone interference

CT
- Uses ionizing radiation
- Relatively expensive

MRI
- Must hold still for extended periods of time
- Claustrophobia
- Patient size
- Indwelling metallic devices
- Expensive

Abdominal Pain
- Differential very broad
  - Work-up based on symptoms, exam, lab, and location (RUQ, RLQ, LUQ, LLQ, Epigastric, Flank)

RUQ Pain
Gallbladder disease
- Abdominal sonograms
- Hepatobiliary scan with CCK
- CT
- MRCP

Gastrointestinal

41 y/o female with RUQ pain, no fever, normal WBC

Hepatobiliary scan
- 70 y/o female with nausea and pain. Normal gallbladder ultrasound.

MRCP
- MR Cholangiopancreatography
  - Evaluate for duct abnormalities
RLQ Pain

- CT Abdomen and Pelvis
- Ultrasound (operator dependent)
  - Children (CT if US is non-diagnostic)
  - Pregnant (first and early second trimester)
- MRI
  - Pregnant

Left Lower Quadrant Pain

- CT
- Pelvic sonograms
- MRI
- Abdomen radiographs
- Barium enema

54 y/o male with fever, chills, and left lower quadrant pain

Urologic Imaging-Stone Disease

- CT without contrast is gold standard
  - Identifies stone
  - Determines degree of obstruction
  - May provide alternative diagnosis (e.g. appendicitis, diverticulitis)
  - Quick
  - No need for IV contrast
- US: pregnancy and children
Acute Pyelonephritis
- No imaging needed if uncomplicated
- CT with IV contrast
- MR with IV contrast

Pelvic Imaging - Gynecologic
- Ultrasound
- MRI

Polycystic Ovarian Syndrome (Stein-Leventhal)
- Infertility
- Hirsutism
- Acne
- Obesity
- Menstrual Disturbance
  - Oligomenorrhea
  - Amenorrhea
  - Anovulation

Imaging workup of abnormal vaginal bleeding
- Transvaginal pelvic sonograms
- Sonohysterography
- MRI
Pelvic Sonograms

- Endometrial stripe thickness - normal
  - Postmenopausal (not on HRT) < 5mm
  - Premenopausal < 16 mm

Neurological Algorithms

MR vs. CT Brain

- CT
  - acute trauma
  - acute severe headache
  - acute stroke
  - unexplained acute altered mental status
  - inner ear problems
  - bony abnormality
  - patients unable to have MRI
- MR for everything else

Headache - when to image

- Sudden severe headache (worst HA of life or thunderclap HA): CT
- Headache significantly different than past headaches or with neurologic symptoms: MR
- HA developing in pt with known condition (cancer, immunocompromised, drug abusers, etc.): MR

Headache

- Acute: CT
- Subacute or chronic: MRI
- Pre-existing condition: MRI
Spine: MRI vs. CT

- Radiographs
- CT:
  - Acute trauma
  - Bone tumors
- MRI: Everything else
- CT Myelogram:
  - MRI contraindicated
  - Spinal stenosis: Can image upright

Low Back Pain

- One of the most common health problems
- Cost of evaluation and treatment is billions of dollars each year, not including lost productivity

Low Back Pain - Uncomplicated

Low Back Pain - Red Flags

- Trauma
- Unexplained weight loss
- Unexplained fever
- Immunosuppression
- History of cancer
- IV drug use
- Osteoporosis or chronic steroid use
- Age >70
- Motor function or sensory loss

Acute low back pain with neurologic findings

- MRI
  - Without contrast
  - With contrast: postop or suspicion for infection or cancer
- CT Myelogram
  - Problem solving or if MR contraindicated
Musculoskeletal Pain or Instability

- Radiographs
- MRI
- CT
- Bone scan
- Ultrasound