Radiology for the Wards

Edwarda Golden

RAD-AID
Radiology for the Wards

Edwarda Golden, MD
PGY-3
Outline

● General Info
  ○ Modalities
  ○ Types of contrast
  ○ Phases
● ACR Appropriateness Criteria
● Choosing Wisely
● Cases-EM
● Cases-IM
● Pearls
Modalities
X-Ray Modalities

- Use x-rays to produce an image
MNI

- Tissue behavior in a magnet produces images
Contrast
Iodine

- Iodinated
  - Contrast that contains iodine (radiodense on imaging)
  - IV and PO (can also be administered rectally, into the bladder, etc for various clinical questions)
  - Modalities: Any that use X-rays to make the image (eg, CT, fluoroscopy, angiography etc)
Barium

- Contains Barium (radiodense on imaging) not iodine
- PO. Used in fluoroscopy
- Not given when a leak is suspected: risk of chemical peritonitis
- So dense that the presence of barium causes so much streak artifacts it makes subsequent studies difficult
Gadolinium

- Gadolinium
  - Physics are a bit more complicated: it shortens T1 relaxation time among other things→bright
  - Modality: MRI
MRI Contrast Uses

- Pathologies that disrupt the BBB including neoplasm, infection, inflammatory conditions including demyelinating disease, etc.
- Also helpful to evaluate vessels. However, unlike CT, there are ways in MRI to evaluate vessels without contrast.
- Don’t use in patients that have renal failure (NSF).
- Try to avoid in pregnant patients as we don’t know how gad affects fetuses.
Protocols
Components of a Protocol

In order to best answer a clinical question, we need to consider three questions:

1. What do we image?
2. Do we need contrast, and if so what kind?
3. What phases do we need?
How do I place an order? What does “With Contrast” mean in the EMR?

- “With contrast” generally means with *intravenous* contrast
  - If you do not want IV contrast, order “without”
  - If you do want IV contrast, order “with”

- Generally speaking, you pretty much should always order WITH contrast, unless:
  - The patient can’t have contrast
  - If contrast would preclude answering your clinical question (eg, kidney stones)
  - Its an initial neuro study (CT head, CT C-spine)

- If you want positive *PO* contrast, write so in the ordering comments
PO Contrast

- Usually refers to “positive” contrast
- Not indicated for most studies and can actually decrease sensitivity!
  - Obscures subtle bowel wall thickening and intraluminal bleeding
- It is useful to distend the stomach and bowel → negative contrast aka water
- Positive contrast indications: suspected post-op bowel leak, suspected GI fistula, to distinguish between fluid collection and bowel fluid, some oncologic staging and surveillance scans
Phases
Non-contrast scans.

Sometimes, as part of tumor protocols we include a non-contrast scan in addition to 1 or more contrast enhanced scan.

**Pulmonary Arterial**

IV contrast is given and the image is taken as soon the density in the pulmonary artery reaches a predetermined density.

**Arterial**

Sec after

Two flavors:

- **Early Arterial 25-30s**
  - Aorta/Major artery emergencies

- Late 35-45s
  - Used mainly in tumor protocols

**Venous**

60s

Contrast in the portal system

**Delayed**

5 min or more

Evaluates collecting system

Also often included in multiphase tumore protocols.
Pulmonary Arterial phase: Just PEs

Lights up the pulmonary vasculature so that you can see filling defects
Early Arterial phase: something is bleeding, dissecting or dying...

- Your “go to” if you suspect dissection, ischemia or an active bleed
- Often ordered in addition to venous phase imaging to assess for active bleed
Portal Venous Phase: I’ll have the usual...

The workhorse. Pretty much the go for any abdominal indication, if a CT is indicated.
No contrast: wow, no thank you...

- Usually **not** useful.
  - We only do it if the patient can’t have contrast and understand the study may be limited OR
  - or in specific circumstances described below

- **Notable Exceptions:**
  - Pretty much all initial neuro CT imaging (stroke, trauma, and AMS to rule out a bleed) including CT head and spine
  - Chest CT if you don’t care about the vasculature (eg, outpatient scan for ILD)
  - Kidney stone evaluation
  - As part of a multiphase study to characterize a neoplasm
Protocol References

- Johns Hopkins Hospital [Body CT Protocol Design](#)
- AJR Paper [Positive Oral Contrast Material for Abdominal CT: Current Clinical Indications and Areas of Controversy](#)
ACR
Appropriateness Criteria
Choosing Wisely
Cases
First Day

You’re a newly minted intern at your dream residency program.
49 yoM presenting with acute on chronic lower back pain. Neurologic examination is normal.

A. Imaging is not required.
B. Lumbar spine radiographs
C. Lumbar spine CT
D. Lumbar spine MRI
Back pain

ACR Recommendations:
Low Back Pain

Choose Wisely: American Association of Neurologic Surgeons
49 yoF with a history of IVDU and diabetes presenting with a draining wound on their foot. You are concerned about possible osteomyelitis. You examine the patient and are not able to probe to bone. You order xrays of the foot which is the first line exam in the ACR appropriateness criteria for suspected osteomyelitis.

Radiology Impression: No radiographic evidence of osteomyelitis.

You...

A. Order an MRI with contrast to evaluate for osteomyelitis, since radiographs are not sufficiently sensitive for osteomyelitis.
B. Send the patient home with antibiotics, as radiographs are sufficiently sensitive for osteomyelitis.
## Suspected Osteomyelitis of the Foot in Patients with Diabetes Mellitus

### Initial Imaging

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Appropriateness Category</th>
<th>Relative Radiation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiography foot</td>
<td>Usually Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>CT foot with IV contrast</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>CT foot without and with IV contrast</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>CT foot without IV contrast</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>FDG-PET/CT whole body</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>WBC scan and sulfur colloid scan foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>WBC scan foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>MRI foot without and with IV contrast</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>MRI foot without IV contrast</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>3-phase bone scan and WBC scan foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>3-phase bone scan and WBC scan and sulfur colloid scan foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>3-phase bone scan and WBC scan with SPECT or SPECT/CT foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>US foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
</tbody>
</table>

### Additional Imaging

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Appropriateness Category</th>
<th>Relative Radiation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI foot without and with IV contrast</td>
<td>Usually Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>MRI foot without IV contrast</td>
<td>Usually Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>CT foot with IV contrast</td>
<td>May Be Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>CT foot without IV contrast</td>
<td>May Be Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>3-phase bone scan and WBC scan foot</td>
<td>May Be Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>3-phase bone scan and WBC scan with SPECT or SPECT/CT foot</td>
<td>May Be Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>3-phase bone scan foot</td>
<td>May Be Appropriate (Disagreement)</td>
<td>▲</td>
</tr>
<tr>
<td>FDG-PET/CT whole body</td>
<td>May Be Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>WBC scan foot</td>
<td>May Be Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>WBC scan and sulfur colloid scan foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>3-phase bone scan and WBC scan and sulfur colloid scan foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>CT foot without and with IV contrast</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
<tr>
<td>US foot</td>
<td>Usually Not Appropriate</td>
<td>▲</td>
</tr>
</tbody>
</table>

**ACR Recommendations:** [Suspected Osteomyelitis of the Foot in Patients with Diabetes Mellitus](https://www.radiology.org/education/osteomyelitis-foot-diabetes)
Ankle Injury

19 yoF with ankle pain after “landing wrong” while playing basketball. You order ankle radiographs.
Radiology Impression: No radiographic evidence of fracture.
You:
A. Send the patient home, as she does not have a fx
B. Order a CT to rule out a fx, just to be sure, as fractures can be radiographically occult immediately after injure.
C. You wrap it, ask her to stay off of it, and have her get follow up xrays in 10 days as fractures can be radiographically occult immediately after injure.
RUQ Pain

39 yoF with right upper quadrant pain. What is the best examination for this patient?

A. CT abdomen and pelvis with IV contrast
B. Right upper quadrant ultrasound performed by an experienced ultrasonographer
C. Point of care right upper quadrant ultrasound
D. CT abdomen and pelvis without contrast
ACR Recommendations: **Right Upper Quadrant Pain**

Choose Wisely: Society of American Gastrointestinal and Endoscopic Surgeons

### ACR Recommendations

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Appropriateness Category</th>
<th>Relative Radiation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>US abdomen</td>
<td>Usually Appropriate</td>
<td>0</td>
</tr>
<tr>
<td>CT abdomen with IV contrast</td>
<td>May Be Appropriate</td>
<td>❀</td>
</tr>
<tr>
<td>MRI abdomen without and with IV contrast with MRCP</td>
<td>May Be Appropriate</td>
<td>❀</td>
</tr>
<tr>
<td>MRI abdomen without IV contrast with MRCP</td>
<td>May Be Appropriate</td>
<td>❀</td>
</tr>
<tr>
<td>Nuclear medicine scan gallbladder</td>
<td>May Be Appropriate</td>
<td>❀</td>
</tr>
<tr>
<td>CT abdomen without IV contrast</td>
<td>May Be Appropriate</td>
<td>❀</td>
</tr>
<tr>
<td>CT abdomen without and with IV contrast</td>
<td>Usually Not Appropriate</td>
<td>❀</td>
</tr>
</tbody>
</table>

### Choose Wisely

Avoid other imaging tests apart from ultrasound for the initial evaluation of patients with suspected gallstone disease.

The diagnostic workup of acute right upper quadrant pain is informed by risk factors for cholecystitis. When acute cholecystitis is suspected the initial imaging modality of choice is ultrasound based on availability, examination time, lack of ionizing radiation, morphologic evaluation, confirmation of the presence or absence of gallstones, evaluation of bile ducts, and identification or exclusion of alternative diagnoses. When the clinical features, examination, laboratory and ultrasound findings are congruent, no further imaging is required.
69 yoM with right flank pain and a history of kidney stones. What is the most appropriate study?

A. Abdominal radiographs to visualize the kidney stone.
B. CT abdomen and pelvis without IV contrast
C. Renal ultrasound
### Flank Pain

**ACR Recommendations:**

[https://acsearch.acr.org/docs/69362/Narrative](https://acsearch.acr.org/docs/69362/Narrative)

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<table>
<thead>
<tr>
<th>Clinical Condition: Acute Onset Flank Pain—Suspicion of Stone Disease (Urolithiasis)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Variant 1:</strong> Suspicion of stone disease.</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT abdomen and pelvis without IV contrast</td>
<td>8</td>
<td>Reduced-dose techniques are preferred.</td>
<td>****</td>
</tr>
<tr>
<td>CT abdomen and pelvis without and with IV contrast</td>
<td>6</td>
<td>This procedure is indicated if CT without contrast does not explain pain or reveals an abnormality that should be further assessed with contrast (eg, stone versus phleboliths).</td>
<td>****</td>
</tr>
<tr>
<td>US color Doppler kidneys and bladder retroperitoneal</td>
<td>6</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Radiography intravenous urography</td>
<td>4</td>
<td></td>
<td>****</td>
</tr>
<tr>
<td>MRI abdomen and pelvis without IV contrast</td>
<td>4</td>
<td>MR urography.</td>
<td>0</td>
</tr>
<tr>
<td>MRI abdomen and pelvis without and with IV contrast</td>
<td>4</td>
<td>MR urography.</td>
<td>0</td>
</tr>
<tr>
<td>X-ray abdomen and pelvis (KUB)</td>
<td>3</td>
<td>This procedure can be performed with US as an alternative to NCCT.</td>
<td>***</td>
</tr>
<tr>
<td>CT abdomen and pelvis with IV contrast</td>
<td>2</td>
<td></td>
<td>****</td>
</tr>
</tbody>
</table>

**Rating Scale:** 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate

**Relative Radiation Level:**

* RRL: Relative Radiation Level
Melena

49 yoM with tarry black stools and lightheadedness. FOBT is positive. The best study to order is:

A. CT abdomen and pelvis with IV and PO contrast
B. CT abdomen and pelvis with IV contrast and no PO contrast
C. CT abdomen and pelvis without IV or PO contrast
D. CT abdomen and pelvis without IV contrast but with PO contrast
Unidentified male, likely in his mid-twenties presents after MVC. He is intoxicated.
Trauma

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Appropriateness Category</th>
<th>Relative Radiation Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT whole body with IV contrast</td>
<td>Usually Appropriate</td>
<td></td>
</tr>
<tr>
<td>Radiography trauma series</td>
<td>Usually Appropriate</td>
<td></td>
</tr>
<tr>
<td>US FAST scan chest abdomen pelvis</td>
<td>Usually Appropriate</td>
<td></td>
</tr>
<tr>
<td>CT whole body without IV contrast</td>
<td>May Be Appropriate</td>
<td></td>
</tr>
<tr>
<td>Fluoroscopy retrograde urethrography</td>
<td>Usually Not Appropriate</td>
<td>🌟🌟🌟</td>
</tr>
<tr>
<td>MRI abdomen and pelvis without and with IV contrast</td>
<td>Usually Not Appropriate</td>
<td>🌟🌟</td>
</tr>
<tr>
<td>MRI abdomen and pelvis without IV contrast</td>
<td>Usually Not Appropriate</td>
<td>🌟</td>
</tr>
</tbody>
</table>

ACR Recommendations: [Major Blunt Trauma](#)
Head Trauma

81yoM with afib on AC. Presents after falling down the stairs. Positive head strike. Unknown LOC.
Head Trauma - moderate to severe

ACR Recommendations: Head Trauma
Head Trauma-minor

ACR Recommendations: Head Trauma

<table>
<thead>
<tr>
<th>Clinical Condition</th>
<th>Head Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor or mild acute closed head injury (GCS 3-13), imaging indicated by NOC or CCRH or NEXUS-II clinical criteria (see Appendix 1). Initial study.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comment</th>
<th>RRL*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT head without IV contrast</td>
<td>9</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>MRI head without IV contrast</td>
<td>2</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>MRA head and neck without IV contrast</td>
<td>2</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>CTA head and neck with IV contrast</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>MRI head without and with IV contrast</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>MRI head without IV contrast with DTI</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>CT head without and with IV contrast</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>CT head with IV contrast</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>To-Do: IMPACT/SPIC head</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>ECG/TOOC /CT head</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>X-ray skull</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
<tr>
<td>Ax-radiography cervical</td>
<td>1</td>
<td></td>
<td>O</td>
</tr>
</tbody>
</table>

Inclusion criteria: 352 Usually not appropriate; 356 May be appropriate; 556 Usually appropriate

National Emergency X-Ray Utilization Study (NEXUS-II) [20]

- Head CT is not required if ALL of the following are absent:
  - Age <65 years
  - Evidence of significant skull fracture
  - Scalp laceration
  - Neurologic deficit
  - Altered level of awareness
  - Abnormal behavior
  - Convulsions
  - Recurrent or forceful vomiting

New Orleans Criteria (NOC) [18]

- Inclusion criteria:
  - GCS 15
  - Age >18 years
  - Traumatic head trauma occurring within 24 hours and causing loss of consciousness, amnesia, or disorientation
- Head CT is not required if ALL of the following are absent:
  - Headache
  - Vomiting
  - Age >65 years
  - Alcohol or drug intoxication
  - Deficits in short-term memory
  - Visible trauma above clavicles
  - Seizures

Canadian CT Head Rule (CCRH) [19]

- Exclusion criteria:
  - Age <6 years
  - Minimal head injury (no loss of consciousness, amnesia, or disorientation)
  - No clear history of trauma as the primary event
  - Obvious penetrating skull injury or depressed skull fracture
  - Acute focal neurologic deficit
  - Uncal vital signs associated with major trauma
  - Had seizure before assessment in the emergency department
  - Has a bleeding disorder or is anticoagulated
  - Return visit to emergency department for reassessment of same head injury
- Pregnancy
- Head CT is not required if ALL of the following are absent:
  - GCS >13 at 2 hours postinjury
  - Suspected open or depressed skull fracture
  - Any sign of basilar skull fracture (hematoma, moco-cerebral, CSF, subarachnoid hemorrhage, Battle sign)
  - Two or more episodes of vomiting
  - Age >65 years
  - Amnesia before impact >30 minutes
  - Dangerous mechanism (pedestrians struck by vehicle, ejection from moving vehicle, fall from elevation >1 foot or >2 meters)
81yoM with severe abdominal pain and guarding. He is hemodynamically stable.
Acute abdomen

ACR Recommendations:
CT Abdomen and Pelvis with IV contrast

Acute Nonlocalized Abdominal Pain
Nights on the ward
Back pain

19 yoF with history of IVDU is admitted for endocarditis. You are paged by the overnight nurse because the patient is having bilateral lower extremity weakness.

You are concerned for an epidural abscess given the patient’s history. You order:

A. Spine radiographs
B. Spine CT with IV contrast
C. Spine CT without IV contrast
D. MRI spine with contrast
E. MRI spine without contrast
### Clinical Condition: Low Back Pain

#### Variant 3:
Acute, subacute, or chronic low back pain or radiculopathy. One or more of the following: suspicion of cancer, infection, or immunosuppression.

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI lumbar spine without and with IV contrast</td>
<td>8</td>
<td>Contrast is useful for neoplastic patients suspected of epidural or intraspinal disease. Noncontrast MRI can be sufficient if there is low risk of epidural and/or intraspinal disease.</td>
</tr>
<tr>
<td>MRI lumbar spine without IV contrast</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>CT lumbar spine with IV contrast</td>
<td>6</td>
<td>MRI is preferred. CT is useful if MRI is contraindicated or unavailable and/or for problem solving. MRI is preferred. CT is useful if MRI is contraindicated or unavailable and/or for problem solving.</td>
</tr>
<tr>
<td>CT lumbar spine without IV contrast</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>X-ray lumbar spine</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Tr-99m bone scan whole body with SPECT spine</td>
<td>4</td>
<td>SPECT-CT can be useful for anatomic localization and problem solving, in particular for looking for widespread tumor burden. It is valuable when multifocal metastases are suspected.</td>
</tr>
<tr>
<td>FDG-PET/CT whole body</td>
<td>4</td>
<td>MRI is preferred. This procedure can be indicated if MRI is contraindicated or nondiagnostic. It can distinguish benign versus malignant compression fractures.</td>
</tr>
<tr>
<td>CT lumbar spine without and with IV contrast</td>
<td>3</td>
<td>MRI is preferred. This procedure can be indicated if MRI is contraindicated or nondiagnostic. MRI is preferred. This procedure can be indicated if MRI is contraindicated or nondiagnostic and can be useful for anatomic localization and problem solving.</td>
</tr>
<tr>
<td>CT myelography lumbar spine</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

#### Rating Scale:
1-2.0 Usually not appropriate; 4.5-6 May be appropriate; 7-9.5 Usually appropriate

*Relative Radiation Level*
72 yoF admitted for total knee replacement. A rapid is called for respiratory distress and hypoxia. You stabilize the patient and learn that she has no health problems or medical history except the TKR. You are concerned for PE. You:

You:
A. Order a D-dimer.
B. Order a CT chest with IV contrast
C. Order US venous Doppler studies of the lower extremities
D. Order a VQ scan
### Suspected Pulmonary Embolism

#### Variant 2: Suspected pulmonary embolism. Intermediate probability with a positive D-dimer or high pretest probability.

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRI.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-ray chest</td>
<td>9</td>
<td>This procedure should be optimized for pulmonary circulation.</td>
<td>⚫⚫⚫</td>
</tr>
<tr>
<td>CTA chest with IV contrast</td>
<td>9</td>
<td>This procedure should be optimized for pulmonary circulation. This procedure may be an alternative to CTA, but both should not be performed.</td>
<td>⚫⚫⚫</td>
</tr>
<tr>
<td>CT chest with IV contrast</td>
<td>9</td>
<td>This procedure should be optimized for pulmonary circulation. This procedure may be an alternative to CTA, but both should not be performed.</td>
<td>⚫⚫⚫</td>
</tr>
<tr>
<td>Tc-99m V/Q scan lung</td>
<td>7</td>
<td>This procedure may be an alternative to CTA, but both should not be performed.</td>
<td>⚫⚫⚫</td>
</tr>
<tr>
<td>US duplex Doppler lower extremity</td>
<td>7</td>
<td>This procedure may be an initial study prior to CTA.</td>
<td>(O)</td>
</tr>
<tr>
<td>MRA chest without and with IV contrast</td>
<td>6</td>
<td>(O)</td>
<td></td>
</tr>
<tr>
<td>CTA chest with IV contrast with CT venography lower extremity</td>
<td>5</td>
<td>⚫⚫⚫</td>
<td></td>
</tr>
<tr>
<td>Angiography pulmonary with right heart catheterization</td>
<td>3</td>
<td>⚫⚫⚫⚫</td>
<td></td>
</tr>
<tr>
<td>US echocardiography transesophageal</td>
<td>3</td>
<td>(O)</td>
<td></td>
</tr>
<tr>
<td>CT chest without IV contrast</td>
<td>2</td>
<td>⚫⚫⚫</td>
<td></td>
</tr>
<tr>
<td>CT chest without and with IV contrast</td>
<td>2</td>
<td>⚫⚫⚫</td>
<td></td>
</tr>
<tr>
<td>MRA chest without IV contrast</td>
<td>2</td>
<td>This procedure has limited sensitivity and may be indicated for rare situations or certain contraindications for a specific patient.</td>
<td>(O)</td>
</tr>
<tr>
<td>US echocardiography transesophageal</td>
<td>2</td>
<td>(O)</td>
<td></td>
</tr>
</tbody>
</table>

**Rating Scale:**
- 1: Usually not appropriate
- 2: May be appropriate
- 3: Usually appropriate

**Relative Radiation Level:**
- (O) Unknown
- ⚫ Low
- ⚫⚫ Medium
- ⚫⚫⚫ High
- ⚫⚫⚫⚫ Very High
You’re crosscovering and you’re paged for right sided weakness. The patient is a 63yoF with atrial fibrillation admitted for a total hip replacement, awaiting placement for rehab. Patient’s anticoagulation was stopped by the day team due to concern for bleed after her Hgb dropped. What is the first test you order?

A. A non contrast head CT  
B. An MRI of the brain-stroke protocol  
C. Carotid Doppler studies  
D. A TTE to evaluate for a clot
## Stroke

<table>
<thead>
<tr>
<th>Radiologic Procedure</th>
<th>Rating</th>
<th>Comments</th>
<th>RRI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>CT head without IV contrast</td>
<td>9</td>
<td>Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.</td>
<td></td>
</tr>
<tr>
<td>MRI head without IV contrast</td>
<td>8</td>
<td>Parenchymal brain imaging and CT or MR vascular imaging of the head and neck should be considered. Can be useful if there is a contraindication to contrast. Noncontrast head CT is often obtained first to assess for hemorrhage or large infarct. MRI is more sensitive than CT for acute infarct.</td>
<td></td>
</tr>
</tbody>
</table>

**Cerebrovascular Disease**
PEARLS
Everyone wants the same thing.
Radiation is a risk...but not a reason to order inferior tests.
Don’t fear contrast
Radiology is a consult, not a lab test.
Call early in the day for IR procedures.
Call early in the day for nuclear medicine studies.