What to Order, When: A Guide to Ordering Radiology Studies

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Goals:
Improve Initial Radiology Order Request Accuracy

- Improve efficiency
  - Reduce call backs/interruptions
- Improve patient satisfaction
  - Reduce cancellation of studies/delays
- Improve patient safety
  - Reduce redundancies
- Become familiar with ACR appropriateness criteria
- Ensure effective imaging
- Discuss risks associated with radiation exposure

OUTLINE

- General info about Radiology Department
- Protocoling CTs
- Emergent MRIs
- Indications for Ultrasounds

GENERAL INFO

Useful Rad Numbers

- KCH ED rad
  - Ext: 5121
- UHB ED rad
  - Ext: 6730
  - Pager: 917-760-1124 (5pm – 8am)
- Ultrasound Tech
  - KCH: 1405
  - UHB: 3901
- IR
  - KCH: 4442
  - UHB: 8292

Who to contact after-hours?

- IR
  - Contact ER radiology resident 5pm-8am @ KCH or UHB
- Ultrasound:
  - KCH: Ultrasound tech from 8am-5:30 pm M-Sat. On call resident 5:30pm – 8am M-Sat, Sunday 8am-8am.
  - UHB: Ultrasound tech from 8am-5:00 pm M-Fri. On call resident 5:30pm – 8am M-Fri, All weekend.
- Fluoro study:
  - Contact senior resident at UHB
- MRI:
  - Tech in house until midnight @ 2609. After midnight must get approval from ER radiology resident; on-call tech will be called in
  - Emergent MRIs: cord compression, pregnant woman r/o appy

CT

General CT Tips

- Ordering a study with contrast means IV contrast, not PO
- Always order CT abdomen AND pelvis
- Never order CT with and without
  - Only exception is CT head
  - Patient is scanned twice (double the radiation dose)
- Must have at least 20g, antecubital IV for CTA
  - For high injection rates of 4cc/s
- PLEASE provide relevant clinical history!
- Oral contrast
  - Bowel transit time: 90-120 minutes to opacify most of bowel

When to use IV contast?

- Infection
- Inflammation
- Malignancy
- Vascular injury

What are the cutoffs?

- We use GFR:
  - GFR > 30
  - Diabetics: GFR > 40
  - ESRD on HD: dialysis w/in 24-48hrs

CT HEAD

- w/o contrast (most cases)
  - Bleeds
  - CVA
  - AMS
  - HA
- w/ and w/o contrast
  - Malignancy
  - Infection
  - New onset seizure

CT Face/Sinus/Orbits/Temporal

- CT face, sinus, temporal ALWAYS w/o contrast
- CT orbits
  - w/ contrast: mass/infection
  - w/o contrast: trauma

CT NECK

- Always ordered w/ contrast, never w/o
- Indications:
  - Infection
  - malignancy

CT CHEST

- w/o contrast
  - Lung parenchyma (pulmonary nodules, mass)
- w/ contrast
  - To evaluate the pleura, mediastinum
- High resolution
  - Known ILD by PFTs

CT ABDOMEN/PELVIS

- w/ contrast
  - Focal pain, appendicitis, diverticulitis etc.
  - SBO
- w/o contrast
  - Kidney stones
  - Retroperitoneal hematoma

CT PELVIS

- w/ contrast, no oral
  - Perirectal abscess
  - CT cystogram

CT Extremity

- w/ contrast
  - Malignancy (soft tissue/bone)
  - Abscess/Infection
- w/o contrast
  - Trauma

**But, MRI with/without is test of choice for soft tissue and bony masses

Pediatrics

- Appendicitis:
  - Pediatric protocol: limited CT of the lower abd/pelvis
- ALARA
  - As low as reasonably achievable
  - Consider MRI or US when possible in pediatric patients

CTA = CT Angiography

- Pulmonary embolism: Pulmonary CTA
- Dissection/Aneurysm: Thoracic aorta CTA
  - please state whether you want abdominal aorta included
- Brain anerusym: Intracranial CTA
- Carotid disease: Extracranial CTA

Pulmonary CTA

- If low probability (Wells <4)
  - obtain D-Dimer,
    - If D-dimer negative -> no need for pulmonary CTA;
    - If D-dimer elevated → order pulmonary CTA
- If poor renal function
  - obtain doppler to r/o DVT
  - V/Q scan
    - Must have same day xray
    - Patient must be able to cooperate with exam
    - Only available 8am-5pm

Hematuria

- Microscopic hematuria
  - <50 years old → CT abd/pelvis without
  - >50 years old → CT abd/pelvis with

- Gross hematuria
  - CT urogram

Additional CT Trauma Examinations

- CT cystogram –> suspected bladder injury
- CT Abd/Pelvis with rectal contrast –> penetrating trauma

MRI

Important IV Contrast Points for MRI

- For all studies in which you think they will need IV contrast (Always order without and with)

MRI Safety Concerns

- Ask patients about
  - Pacemakers (always contraindicated)
  - aneurysm clips (may be contraindicated)
  - pain pumps (may be contraindicated)
- Shrapnel only contraindicated if near vessels/nerves/hollow viscous

ULTRASOUND

Ultrasound

- DVT study
  - Indication: unilateral swelling/pain
  - Most likely cause of bilateral, symmetric swelling is venous insufficiency, not DVT (Reference: BID study)
- Pelvic – should be TA and TV
  - Patient must have full bladder and gown
  - Chaperone if male ER rad resident
  - R/O Ectopic -> necessary to have BHcG to correlate with sono findings

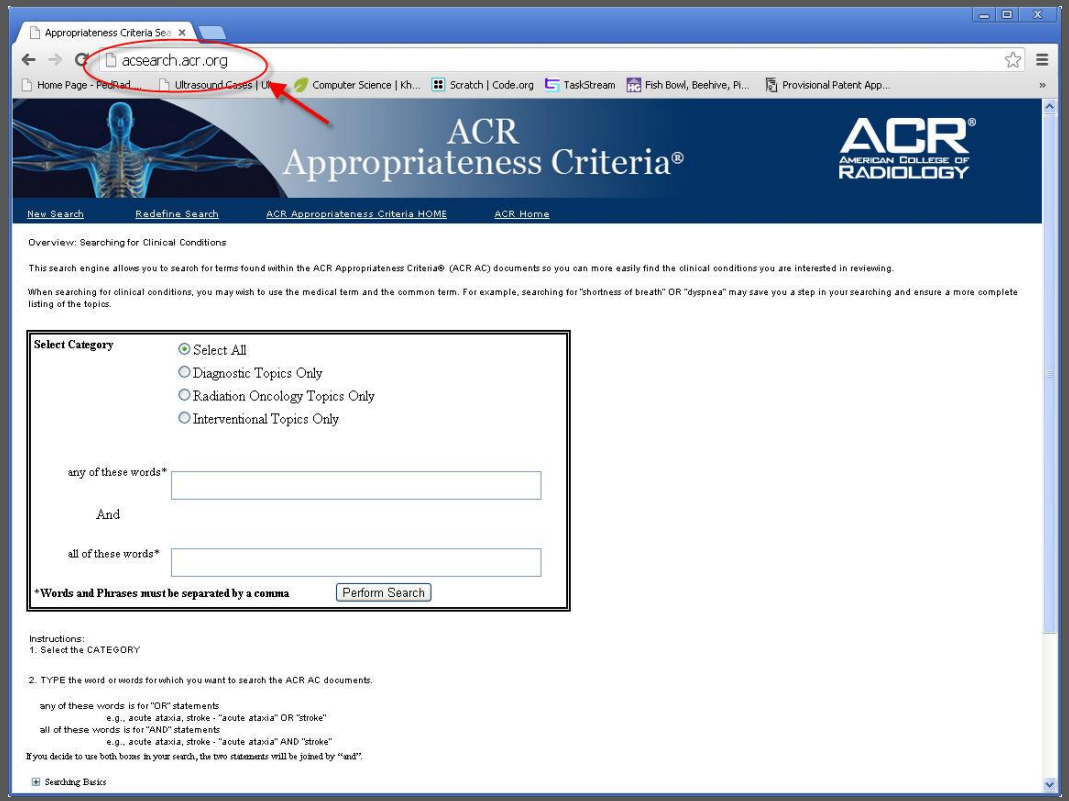
USEFUL WEBSITES

- ACR Appropriateness criteria
  - Guidelines for types of studies to be ordered for different indications
  - http://www.acr.org/SecondaryMainMenuCategories/quality_safety/app_criteria.aspx
  - these criteria assign values on a number scale to indicate the degree of appropriateness of many different types of imaging studies, which may be used for answering a specific clinical question, helping to provide guidance as to choice of imaging

- Ordering guide
  - http://www.choosingwisely.org

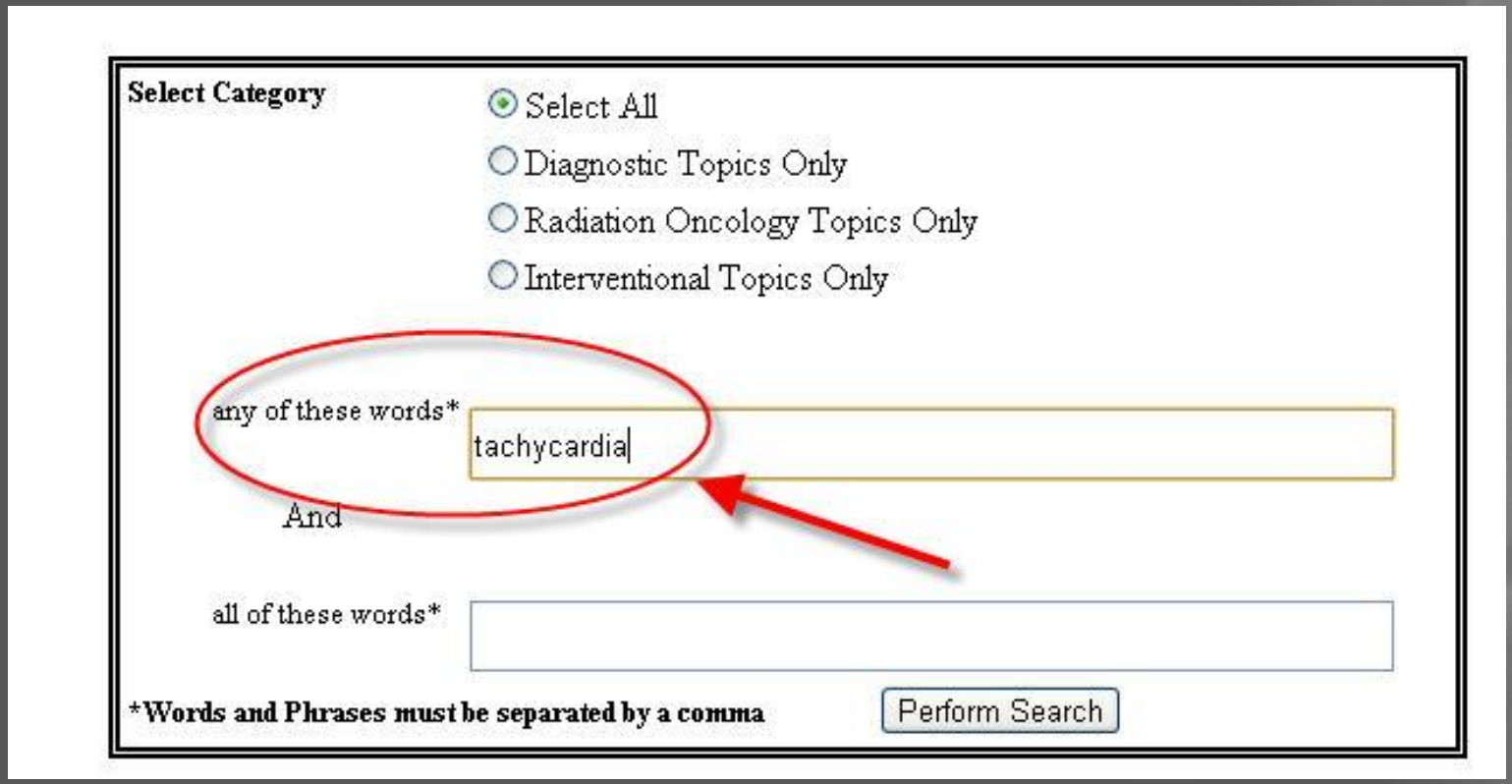
Using ACR Appropriateness Criteria

1. Log on to the website acsearch.acr.org



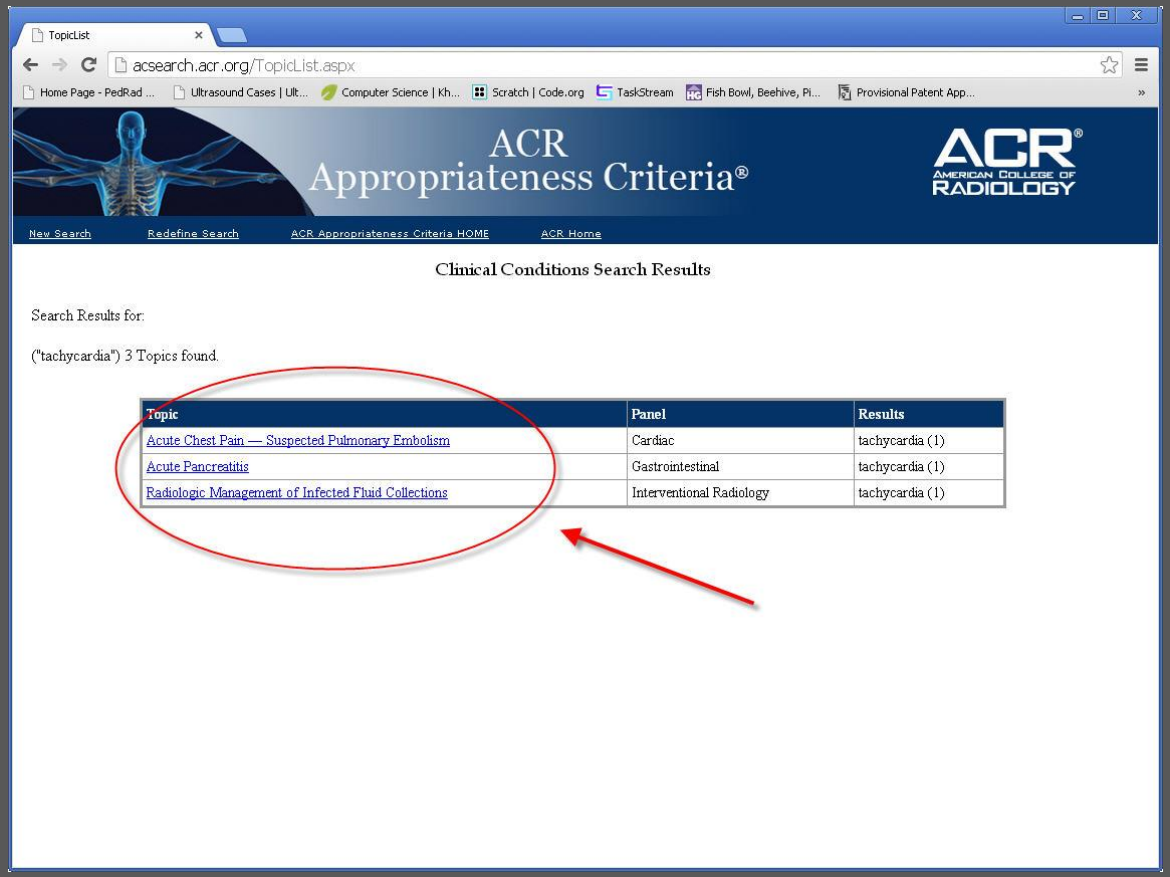
ACR Website

2. Enter search terms



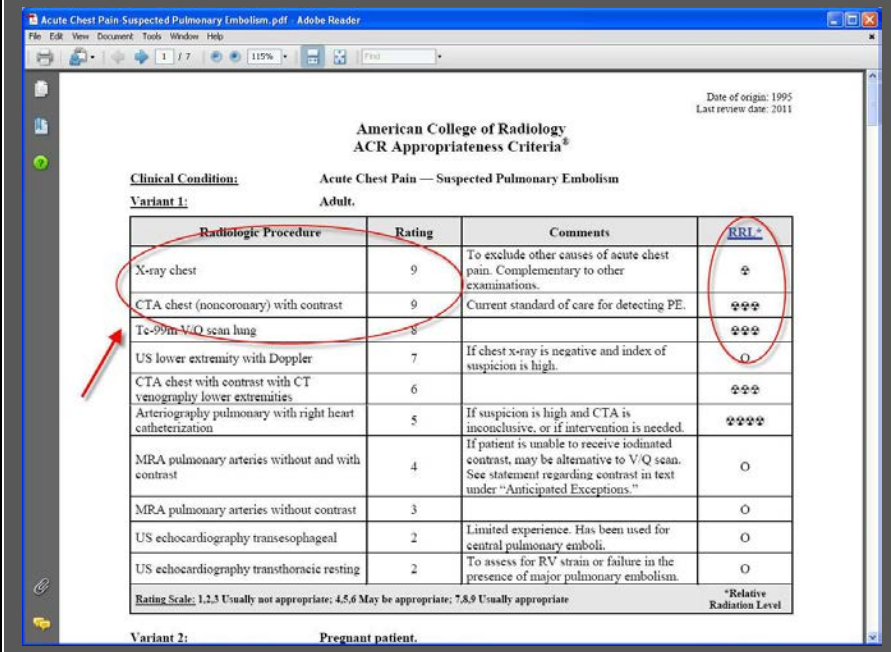
ACR Website

3. Select from provided topics



ACR Website

4. Review the PDF (Tables, explanations and summary)



Date of origin: 1995
Last review date: 2011

American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: Acute Chest Pain — Suspected Pulmonary Embolism

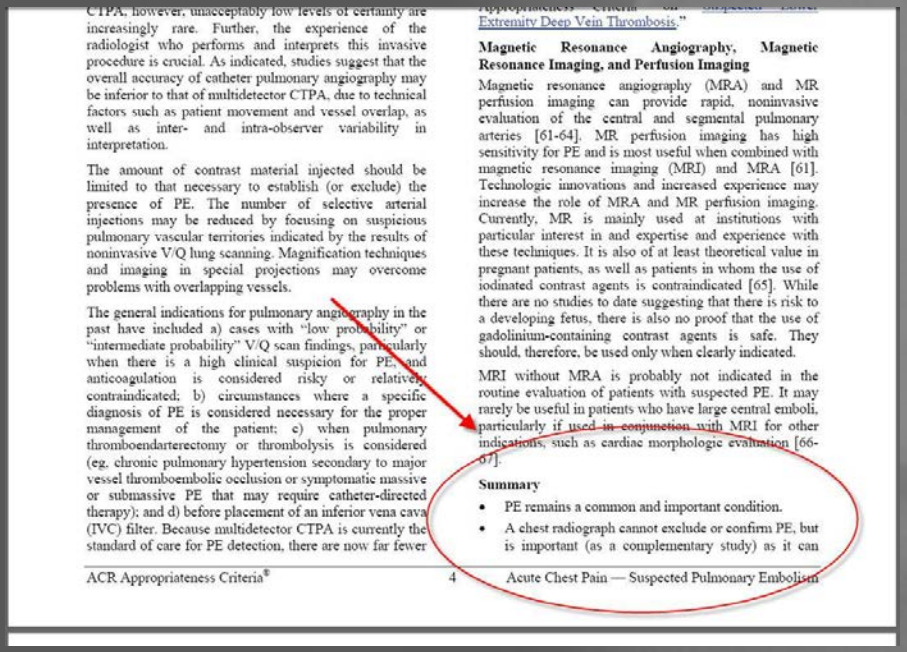
Variant 1: Adult.

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9	To exclude other causes of acute chest pain. Complementary to other examinations.	☢
CTA chest (noncoronary) with contrast	9	Current standard of care for detecting PE.	☢☢☢
Tc-99m V/Q scan lung	8		☢☢☢
US lower extremity with Doppler	7	If chest x-ray is negative and index of suspicion is high.	O
CTA chest with contrast with CT venography lower extremities	6		☢☢☢
Arteriography pulmonary with right heart catheterization	5	If suspicion is high and CTA is inconclusive, or if intervention is needed.	☢☢☢☢
MRA pulmonary arteries without and with contrast	4	If patient is unable to receive iodinated contrast, may be alternative to V/Q scan. See statement regarding contrast in text under "Anticipated Exceptions."	O
MRA pulmonary arteries without contrast	3		O
US echocardiography transesophageal	2	Limited experience. Has been used for central pulmonary emboli.	O
US echocardiography transthoracic resting	2	To assess for RV strain or failure in the presence of major pulmonary embolism.	O

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

*Relative Radiation Level

Variant 2: Pregnant patient.



CTPA, however, unacceptably low levels of certainty are increasingly rare. Further, the experience of the radiologist who performs and interprets this invasive procedure is crucial. As indicated, studies suggest that the overall accuracy of catheter pulmonary angiography may be inferior to that of multidetector CTPA, due to technical factors such as patient movement and vessel overlap, as well as inter- and intra-observer variability in interpretation.

The amount of contrast material injected should be limited to that necessary to establish (or exclude) the presence of PE. The number of selective arterial injections may be reduced by focusing on suspicious pulmonary vascular territories indicated by the results of noninvasive V/Q lung scanning. Magnification techniques and imaging in special projections may overcome problems with overlapping vessels.

The general indications for pulmonary angiography in the past have included a) cases with "low probability" or "intermediate probability" V/Q scan findings, particularly when there is a high clinical suspicion for PE, and anticoagulation is considered risky or relatively contraindicated; b) circumstances where a specific diagnosis of PE is considered necessary for the proper management of the patient; c) when pulmonary thromboendarterectomy or thrombolysis is considered (eg, chronic pulmonary hypertension secondary to major vessel thromboembolic occlusion or symptomatic massive or submassive PE that may require catheter-directed therapy); and d) before placement of an inferior vena cava (IVC) filter. Because multidetector CTPA is currently the standard of care for PE detection, there are now far fewer

Extremity Deep Vein Thrombosis."

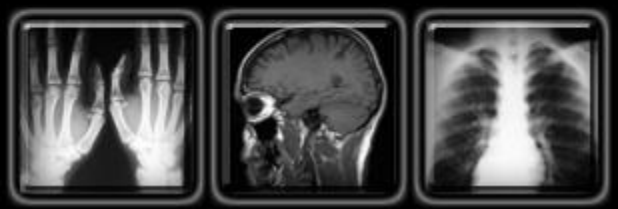
Magnetic Resonance Angiography, Magnetic Resonance Imaging, and Perfusion Imaging

Magnetic resonance angiography (MRA) and MR perfusion imaging can provide rapid, noninvasive evaluation of the central and segmental pulmonary arteries [61-64]. MR perfusion imaging has high sensitivity for PE and is most useful when combined with magnetic resonance imaging (MRI) and MRA [61]. Technologic innovations and increased experience may increase the role of MRA and MR perfusion imaging. Currently, MR is mainly used at institutions with particular interest in and expertise and experience with these techniques. It is also of at least theoretical value in pregnant patients, as well as patients in whom the use of iodinated contrast agents is contraindicated [65]. While there are no studies to date suggesting that there is risk to a developing fetus, there is also no proof that the use of gadolinium-containing contrast agents is safe. They should, therefore, be used only when clearly indicated.

MRI without MRA is probably not indicated in the routine evaluation of patients with suspected PE. It may rarely be useful in patients who have large central emboli, particularly if used in conjunction with MRI for other indications, such as cardiac morphologic evaluation [66-67].

Summary

- PE remains a common and important condition.
- A chest radiograph cannot exclude or confirm PE, but is important (as a complementary study) as it can



Thank You

Questions?