

Cost Effective Radiology: What Specialists Should Now Know

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Disclosure

- Consultant: Medicalis (health IT vendor)



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Objective

All slides and answers can be found at:
Center for Evidence based Imaging web-site
(presentations page from left menu bar)

- I. Discuss factors that may contribute to the inappropriate use of radiological studies
- II. Discuss the imaging workup of some commonly encountered clinical problems
- III. Recommend methods to reduce inappropriate use of imaging studies



Background

- Excessive number of tests with ? Impact on patients' outcome
 - concern of radiation risk; Increasing concern of costs
 - *Patient experience*
- 'Steady' growth of imaging costs
 - Pre-authorization programs by payers
 - CMS program on Imaging CDS
- Proper selection of imaging tests
 - Clinical problem, test characteristics, local expertise
 - Increasing complexity of imaging technology
 - Use of contrast-e.g. gadolinium induced NSF

Impossible to present “all” guidelines



I. Main causes of inappropriate use of imaging studies

- Test results are unlikely to affect patient management
- “short” interval follow-up studies
- Repeating studies which have already been performed (including elsewhere)
- Patient demand
- Not requesting the best test
 - Access to technology
- Inadequate clinical information provided on the ‘requisition’



II. Imaging Guidelines

- American College of Radiology (ACR)
 - “Appropriateness criteria”; 1995, 1999, 2002, updates through 2008, 2010, 2013, 2014, 2015
- The British royal College of Radiologists (BRCR):
 - “Making the best use of a department of clinical radiology: guidelines for doctors”; 1995



II. Imaging Guidelines

- 80-90% of recommendations based on consensus opinion
- Take a long time to develop
- These are not algorithms:
 - do not account of local expertise
 - do not account for patient to patient variations
- Role of a Radiology Consultation Service?



Radiology Consultation Service- Peer to peer consultation

- Designed like other consultation services in medicine
- Allows for on-the-ward, or outpatient clinic consultation
- Comprehensive imaging consultation
- Many advantages and disadvantages
- Expect expansion of concept with 'value-based' contracts



Imaging Modalities

- Ultrasound:
 - adv: ionizing radiation, relatively cheap and accessible. Exam of choice in OB, excellent in the female pelvis
 - disadv: operator dependent, interference from bone, air, fat, difficult in the very obese



Imaging Modalities

- Computed Tomography (CT):
 - adv: no interference from bone, air or fat, easy in the obese, non-operator dependent, rapid exam, easily accessible at most sites
 - disadv: more expensive than US, ionizing radiation, intravenous contrasts with associated costs and risks



Imaging Modalities

- Magnetic Resonance Imaging (MRI):
 - adv. No ionizing radiation, exquisite soft tissue contrast (similar spatial resolution to CT), multiplanar imaging
 - disadv: more expensive than CT, less accessible than US/CT, rapidly changing technology, length of exam longer than CT, patient contraindications



Clinical Problem: Imaging Strategy

- Neuroradiology:
 - acute and chronic headache, low back pain
- Thoracic Radiology:
 - pulmonary embolism
- Abdominal Radiology:
 - bowel obstruction, appendicitis, renal colic, hematuria, common incidental lesions
- Musculoskeletal radiology
 - hip fracture

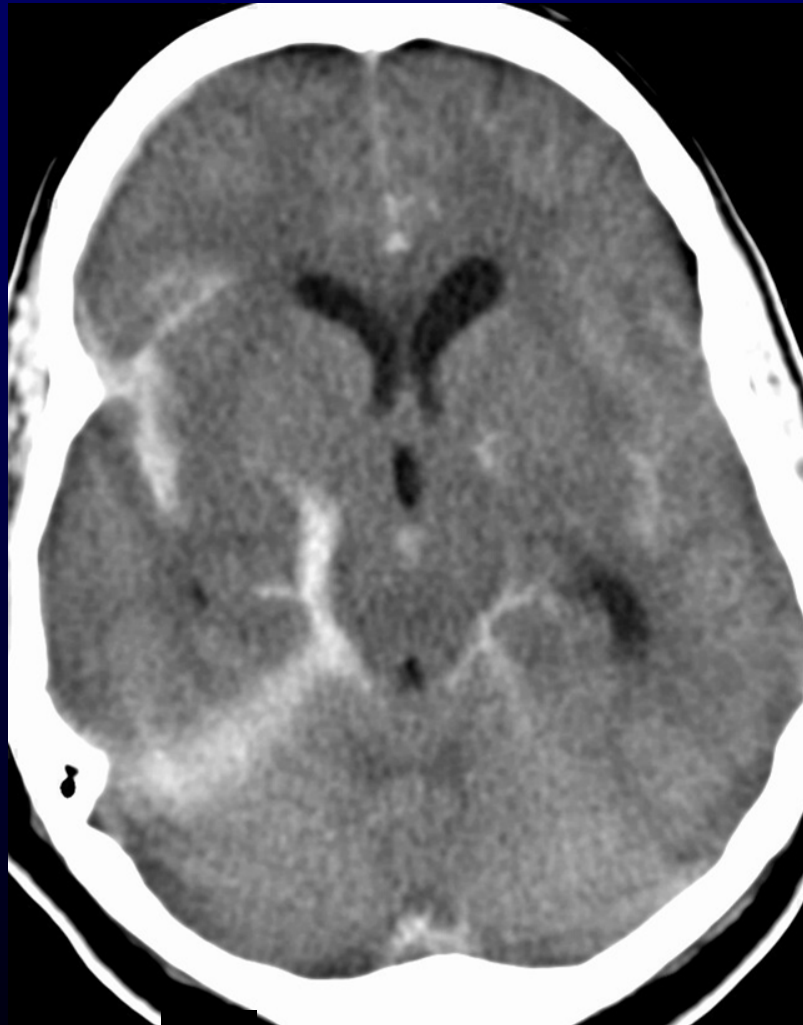


Case 1

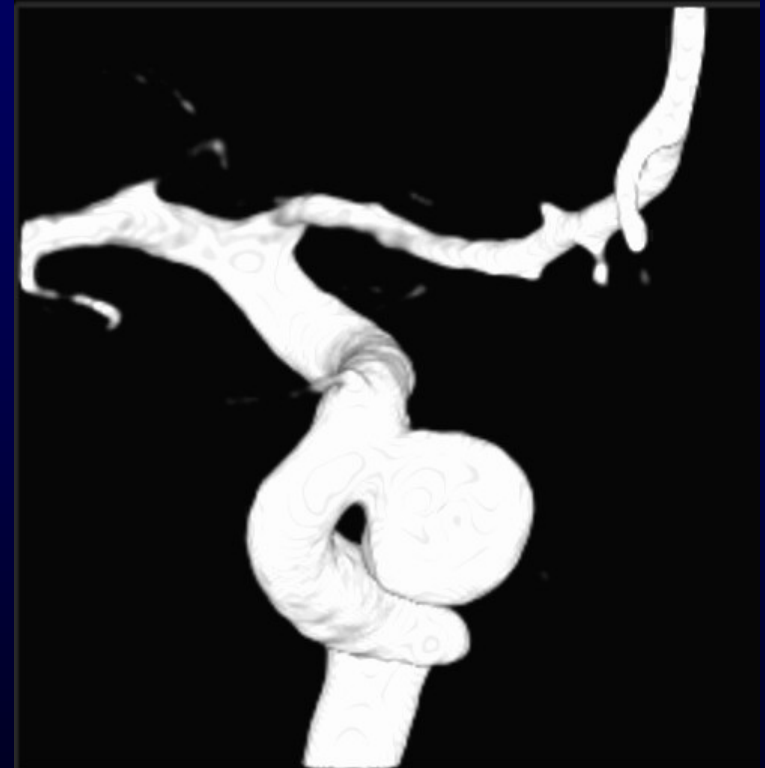
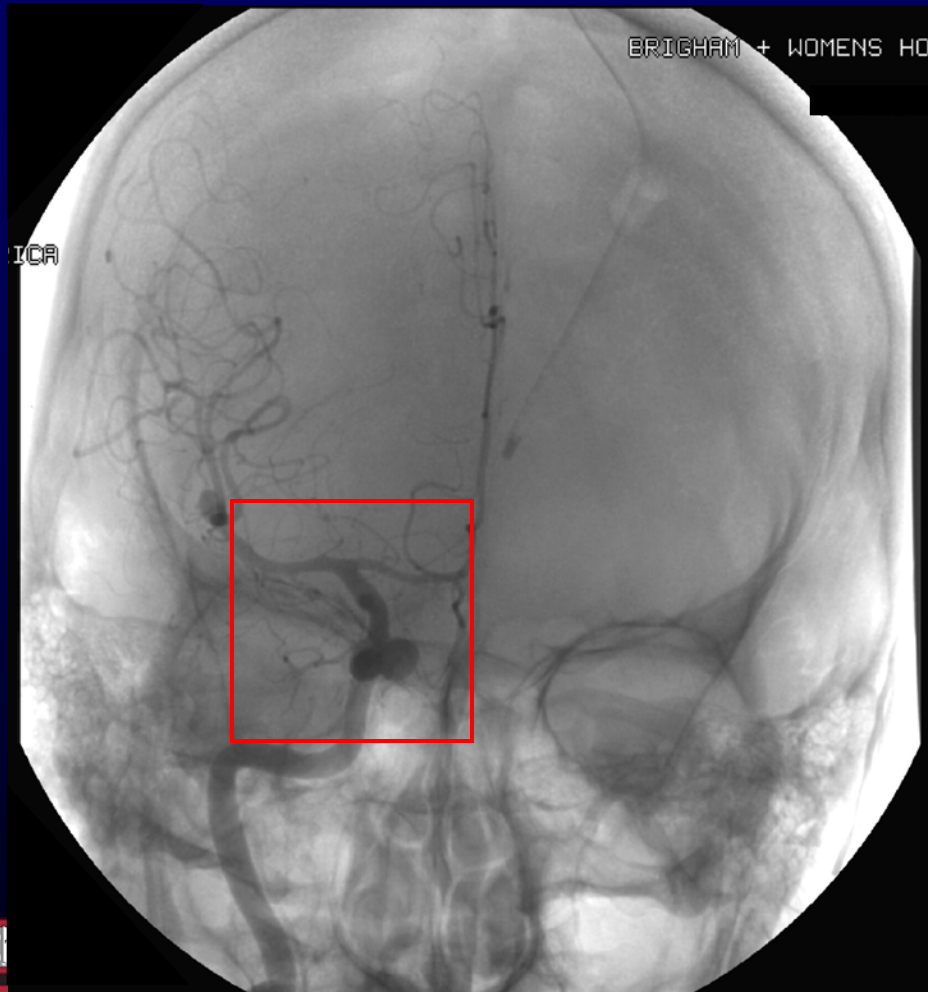
- 40 year old female with acute onset of severe headache and loss of consciousness
- Best study to do first:
- If the first study is normal, the next test:



Best study to do first: CT



Next imaging study: cerebral arteriogram



Order #:1 Modified from #:0 Requested Date:
Order: HEAD -VGH ED- CT Side:
Special View(s):

Pertinent History/Reason for Exam:
wrong place, wrong time

Contraindications:
Comments:
Physician Name/Pager: ed

Diabetic: Not Diabetic
Latex Allergy: None Known- No Latex Allergy
CREAT: 64 UMOL/L 2013-07-31
EGFR: >120 ML/MIN 2013-07-31
INR:
PTT:
PLT: 326 GIGA/L 2013-07-31

Transport: **Stretcher** []No Sling
[]O2 []HiFlow O2 []Vent
[]Dumb []Multi Pump []Monitor



Clinical Decision Support for *iterative* Data Collection- e.g. Head CT Minor Head Trauma

Decision Support

Please Does any of the following apply to your patient:

1. Dic

Decision Support

Please select ALL of the following that apply to your patient.

- 2
- ☐ Persistent anterograde amnesia (short-term memory deficit)
 - ☐ Posttraumatic amnesia of 2 to < 4 hours
 - ☐ Contusion of the skull
 - ☐ Neurologic deficit
 - ☐ Glasgow coma scale deterioration of 1 point (1 hour after presentation)
 - ☐ None of the above

This information is presented to assist you in providing care to your patients. It is your responsibility to exercise your independent medical knowledge and judgment in providing what you consider to be in the best interest of the patient.

-
-
-
-

This information is presented to assist you in providing care to your patients. It is your responsibility to exercise your independent medical knowledge and judgment in providing what you consider to be in the best interest of the patient.

Submit

Cancel

This information is presented to assist you in providing care to your patients. It is your responsibility to exercise your independent medical knowledge and judgment in providing what you consider to be in the best interest of the patient.

Submit

Cancel



Clinical Decision Support Output for Imaging Study Requests Deviating from Evidence

Decision Support

In patients with minor head injury and based on the information you have provided, the chance of positive findings on Head CT is extremely small according to three published large prospective controlled trials.

Stiell IG, Wells GA. et al. [The Canadian CT Head Rule for Patients with Minor Head Injury](#). Lancet 2001; 357: 1391-96.

Haydel MJ., Preston CA. et al. [Indications For Computer Tomography in Patients with Minor Head Injury](#). The New England Journal of Medicine 2000; 343: 100-5.

Smits M, Dippel DWJ. et al. [Predicting Intracranial Traumatic Findings on Computed Tomography in Patients with Minor Head Injury: The CHIP Prediction Rule](#). Annals of Internal Medicine 2007; 146: 397-405.

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Continue

Cancel



Head and Neck

Clinical Problem: headache

- Acute, severe:
 - CT excellent for intracranial hemorrhage,
- Chronic
 - imaging not routinely indicated in the absence of focal signs or symptoms, unless evidence of raised intracranial pressure, posterior fossa signs
- MRI is superior to CT in the posterior fossa, sellar and juxta-sellar regions

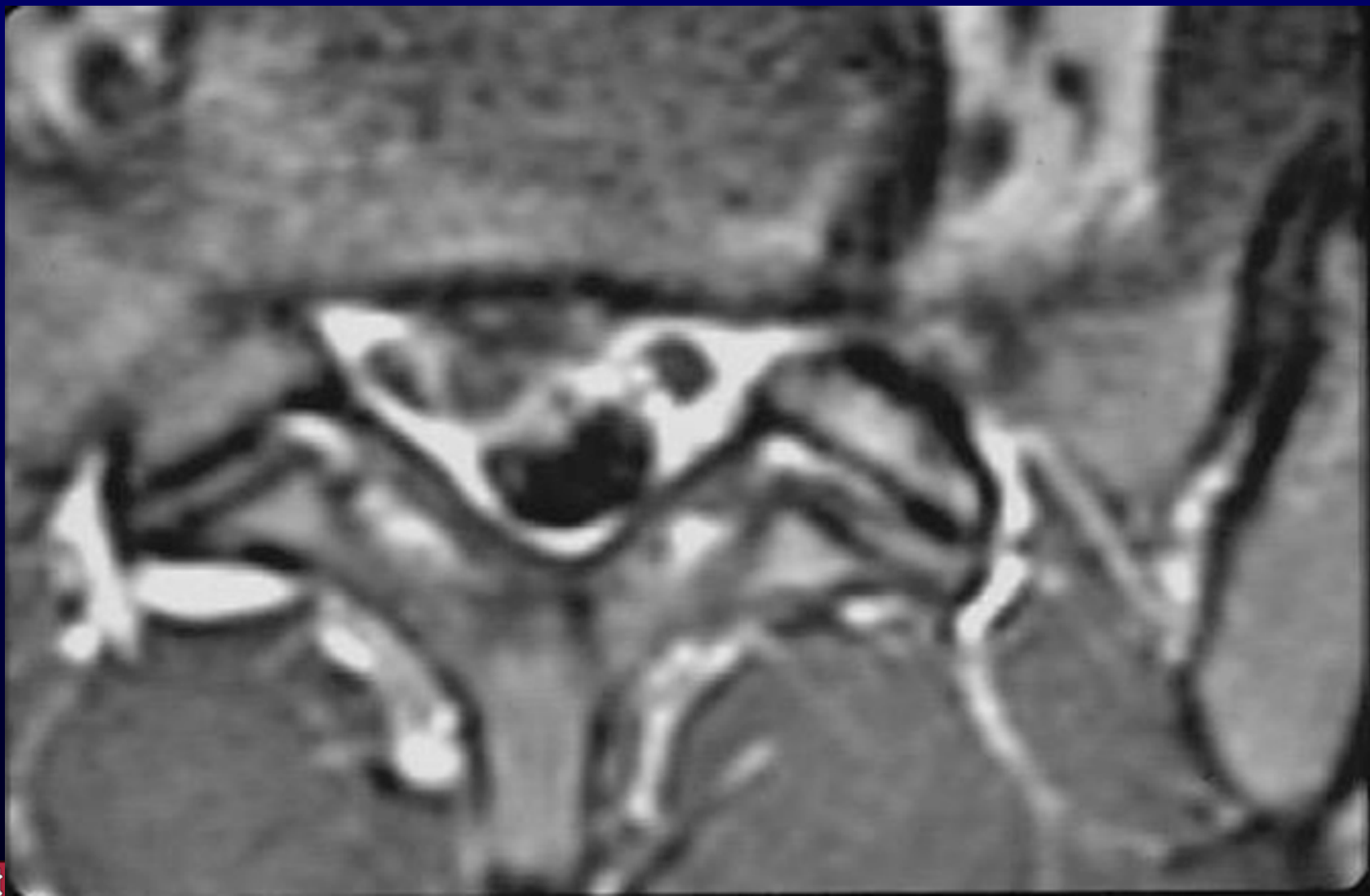


Case 6

- 24 year old male with 6 wk history of low back pain not improving despite conservative treatment, right S-1 radiculopathy
- Best study to do first:
- If first study is normal, the next test:



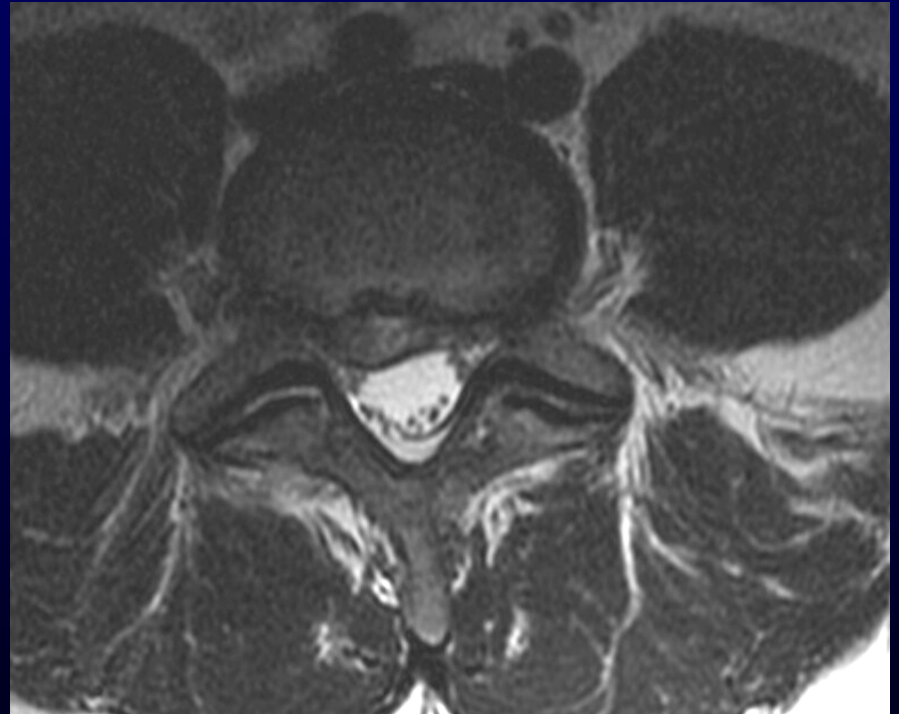




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Best study to do first: MRI



Spine- Clinical Problem: low back pain

- 4-6 weeks of conservative treatment if no ‘red flag’
 - E.g. Malignancy, infection, bladder/bowel symptoms
- Remember that normal patients can have abnormal MRIs
- Need to continue to develop better decision rules and guidelines-
 - ACP October 2007, ACR
 - Embed as decision support in order entry systems



* Pain severity (Specify) ▶

Specify

mild
moderate
severe

Leg weakness left (Specify) ▶

* Pain duration (Specify) ▶

Specify

Acute (<4 weeks)
Subacute (>4 weeks - <3 months)
Chronic (>3 months)

Leg weakness right (Specify) ▶

Radicular pain left (Specify) ▶

Radicular pain right (Specify) ▶

Radicular pain bilateral (Specify) ▶

Radicular numbness/tingling left (Specify) ▶

Radicular numbness/tingling right (Specify) ▶

Radicular numbness/tingling bilateral (Specify) ▶

☐ Back Pain

☐ Asymptomatic

Other:

Leg weakness bilateral (Specify) ▶

☐ Progressive focal motor weakness

Bladder/Bowel dysfunction (Specify) ▶

☐ Fever

☐ Neuralgia

Reflex change (Specify) ▶

☐ Myelopathy

☐ Saddle anesthesia

Relevant History: (Select one or more)

* Course of conservative treatment during this episode (Specify) ▶

Specify

None
Pharmacological therapy
Physical Therapy

Differential Diagnosis: (Select one or more)

☐ Disc herniation

Trauma severity (Specify) ▶

Trauma: chronicity (Specify) ▶

☐ IV conscious sedation/anesthesia required

☐ Spinal stenosis

☐ Fracture

☐ Demyelinating disease



BWH

Ordering Physician: Khorasani, Ramin, M.D., M.P.H.

Site: Primary Care Assoc of Norwood

Logoff

Welcome to Percipio - bwfapp4-ORM1

Decision Support

Order Placement

Patient Name: Oettest, Carol		PERCIPPIO MRN M8652089	
Birth Date: February 2, 1974	Age: 34 years	Gender: Unknown	Phone Number:
Ordering Provider: Khorasani, Ramin, M.D.		Payor: Fallon	
Exam: MRI L-Spine		Order ID: 12408448	
Signs and Symptoms: Pain severity(Specify:mild), Pain duration(Specify:Acute (<4 weeks))			
Relevant History: Course of conservative treatment during this episode(Specify:None)			
Created By: N/A		Ordering Site: Primary Care Assoc of Norwood	

Decision Support

Based on published evidence MRI is not recommended in the absence of clinical "red flags". If symptoms are disabling, consider consultation with the comprehensive spine center at 617 732-6600.

Clinical guidelines from the American College of Physicians and American Pain Society: Clinicians should perform diagnostic imaging and testing for patients with low back pain when severe or progressive neurologic deficits are present or when serious underlying conditions are suspected on the basis of history and physical examination (strong recommendation, moderate-quality evidence).

Please note that the information is presented to assist you in providing care to your patients. We do not provide advice regarding the appropriateness of coding, billing or claims processing. We make no representations regarding the payment or reimbursement for services rendered.

Add Indications

Ignore

Cancel



More Info



Feedback



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About Advice

Comments: Advise,

Source 1:Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society

- **Recommendation 3:** Clinicians should perform diagnostic imaging and testing for patients with low back pain when severe or progressive neurologic deficits are present or when serious underlying conditions are suspected on the basis of history and physical examination (strong recommendation, moderate-quality evidence).
- **Recommendation 5:** Clinicians should provide patients with evidence-based information on low back pain with regard to their expected course, advise patients to remain active, and provide information about effective self-care options (strong recommendation, moderate-quality evidence).
- **Recommendation 6:** For patients with low back pain, clinicians should consider the use of medications with proven benefits in conjunction with back care information and self-care. Clinicians should assess severity of baseline pain and functional deficits, potential benefits, risks, and relative lack of long-term efficacy and safety data before initiating therapy (strong recommendation, moderate-quality evidence). For most patients, first-line medication options are acetaminophen or nonsteroidal anti-inflammatory drugs.

Ann Intern Med. 2007;147:478-491. www.annals.org

Source 2: American College of Radiology

ACR Appropriateness Criteria [American College of Radiology Appropriateness Criteria.pdf](#)

Indications of a more complicated status, often termed

"red flags," include the following:

- Recent significant trauma, or milder trauma, age > 50

BWH

Ordering Physician: Khorasani, Ramin, M.D.,M.P.H.

Site: Primary Care Assoc of Norwood

[Logoff](#)

Welcome to Percipio - bwfapp4-ORM1

Decision Support

Order Placement

Patient Name: Oettest, Carol	PERCPIO MRN M8652089
Birth Date: February 2, 1974	Age: 34 years
Gender: Unknown	Phone Number:
Ordering Provider: Khorasani, Ramin, M.D.	Payor: Fallon
Exam: MRI L-Spine	Order ID: 12408448
Signs and Symptoms: Pain severity(Specify:mild), Pain duration(Specify:Acute (<4 weeks))	
Relevant History: Course of conservative treatment during this episode(Specify:None)	
Created By: N/A	Ordering Site: Primary Care Assoc of Norwood

Decision Support

A peer-to-peer consultation is required in order to submit an order.

Peer-to-peer consultation is available Monday - Friday 8 am - 6 pm. Please page Percipio Support at pager #38499 during off-hours.

For a faster response, please be sure to enter a direct call back number in the space provided below.

Click the "SEND PAGE" button for peer-to-peer consultation.

Name:	Lumbar Spine, Mri
Telephone:	None
Pager:	17032
Call Back #:	(e.g. 1112223333) SEND PAGE

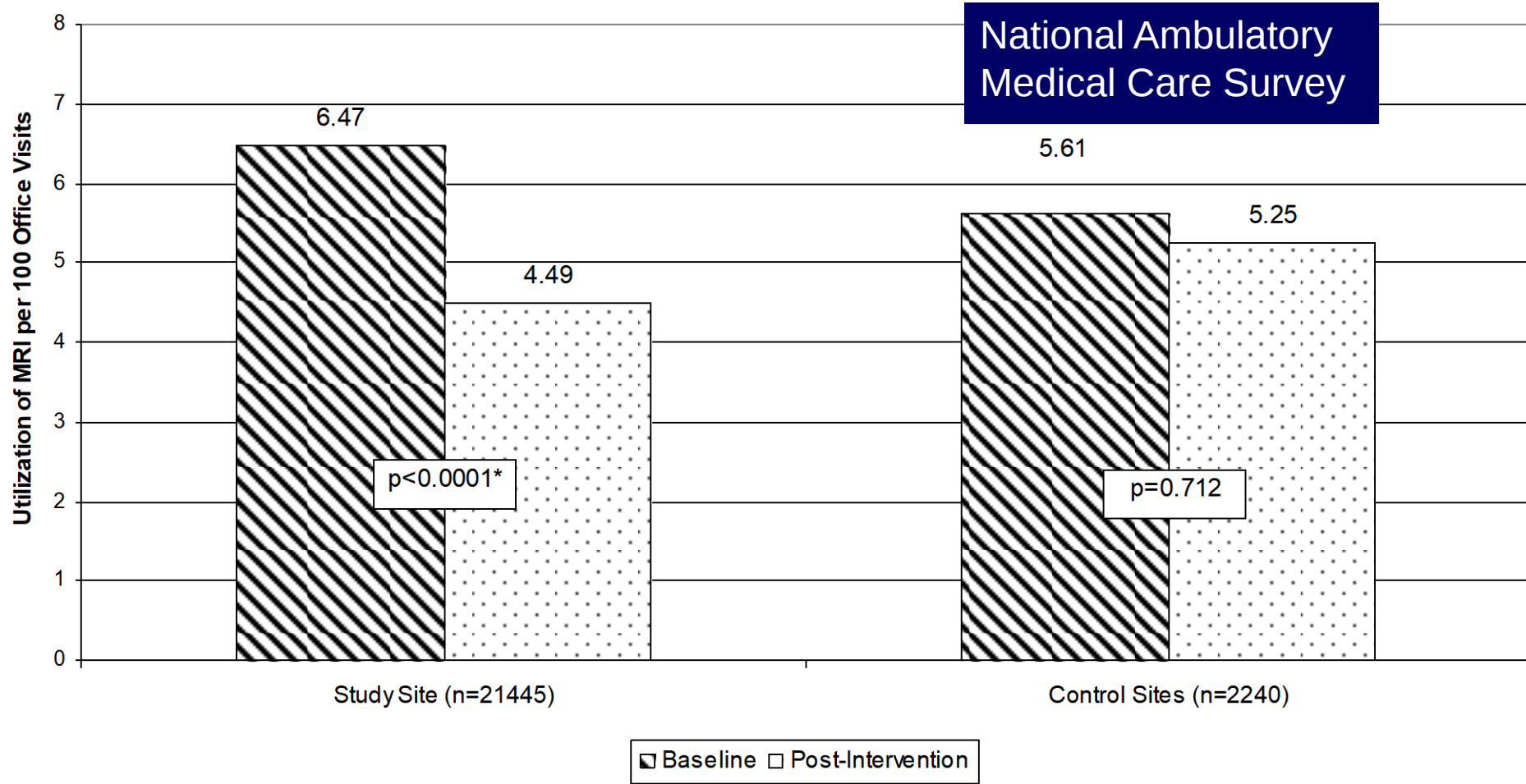
Enter the peer-to-peer consultation number **here**:

Please note: If you have not received a callback within 15 minutes of clicking the "SEND PAGE" button, please page Percipio Support at pager #38499


[More Info](#)

[Feedback](#)

Utilization of Magnetic Resonance Imaging in Back-Pain Related Primary Care Office Visits



Reference:

Ip IK, Schneider LI, Gershanik EF, Raja AS, Mar W, Seltzer S, Khorasani R. Promoting primary care physician guideline adherence for MRI use among patients with low back pain: Impact of clinical decision support and accountability tools. Am. J. Med. 2014.

<i>Outcome Measure</i>	<i>Pre- Intervention</i>	<i>Post- Intervention</i>	<i>p-value</i>
Lumbar Spine MRI ordered by PCP on Day of Office Visit	443 (5.3%)	477 (3.7%)	<0.001*
Lumbar Spine MRI ordered by any outpatient providers within 30 days of index primary care visit	753 (8.9%)	1009 (7.8%)	0.0023*
Lumbar Spine MRI ordered by Specialty Clinics within 30 days	188 (2.2%)	352 (2.7%)	0.0292*
Lumbar Spine MRI ordered by primary care outpatient providers within 30 days	565 (6.7%)	657 (5.1%)	<0.001*
Follow-up PCP Visit within 30 days	855 (10.1%)	1224 (9.4%)	0.080
Guideline adherence rate in the use of lumbar spine MRI based on manual chart review	78/100 (78%)	96/100 (96%)	0.0002*

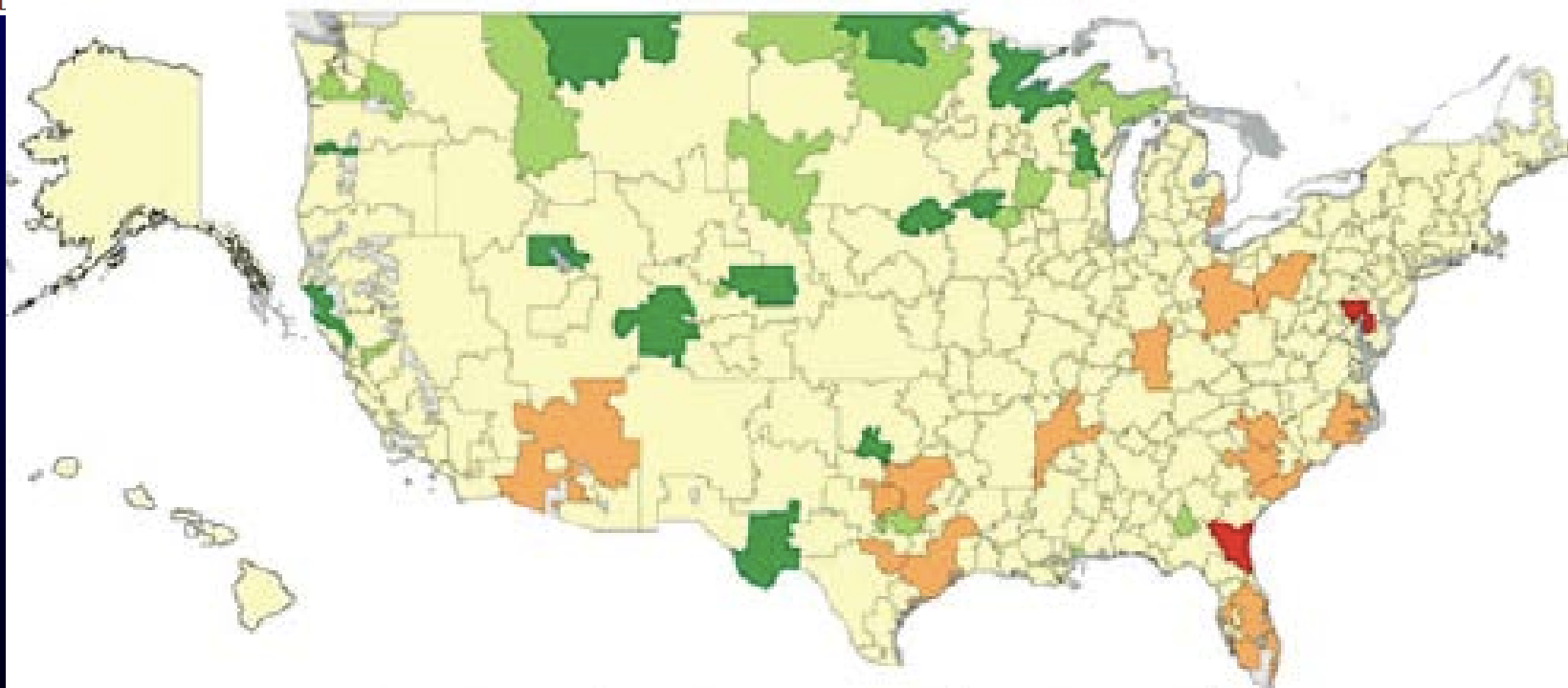
Ip IK, Schneider LI, Gershanik EF, Raja AS, Mar W, Seltzer S, Khorasani R. Promoting primary care physician guideline adherence for MRI use among patients with low back pain: Impact of clinical decision support and accountability tools. AM. J. Med. 2014.

*ePublished
February 2015*

Use of Public Data to Target Variation in Providers' Use of CT and MR Imaging among Medicare Beneficiaries¹

Ivan K. Ip, MD, MPH
Ali S. Raja, MD, MBA
Steven E. Seltzer, MD
Atul A. Gawande, MD
Karen E. Joynt, MD, F
Ramin Khorasani, MD

Heatmap of CT Utilization by Payment (\$)



**Heatmap of Impact Hospital Referral Region for
Diagnostic CT (overlapping intensity and payment)**



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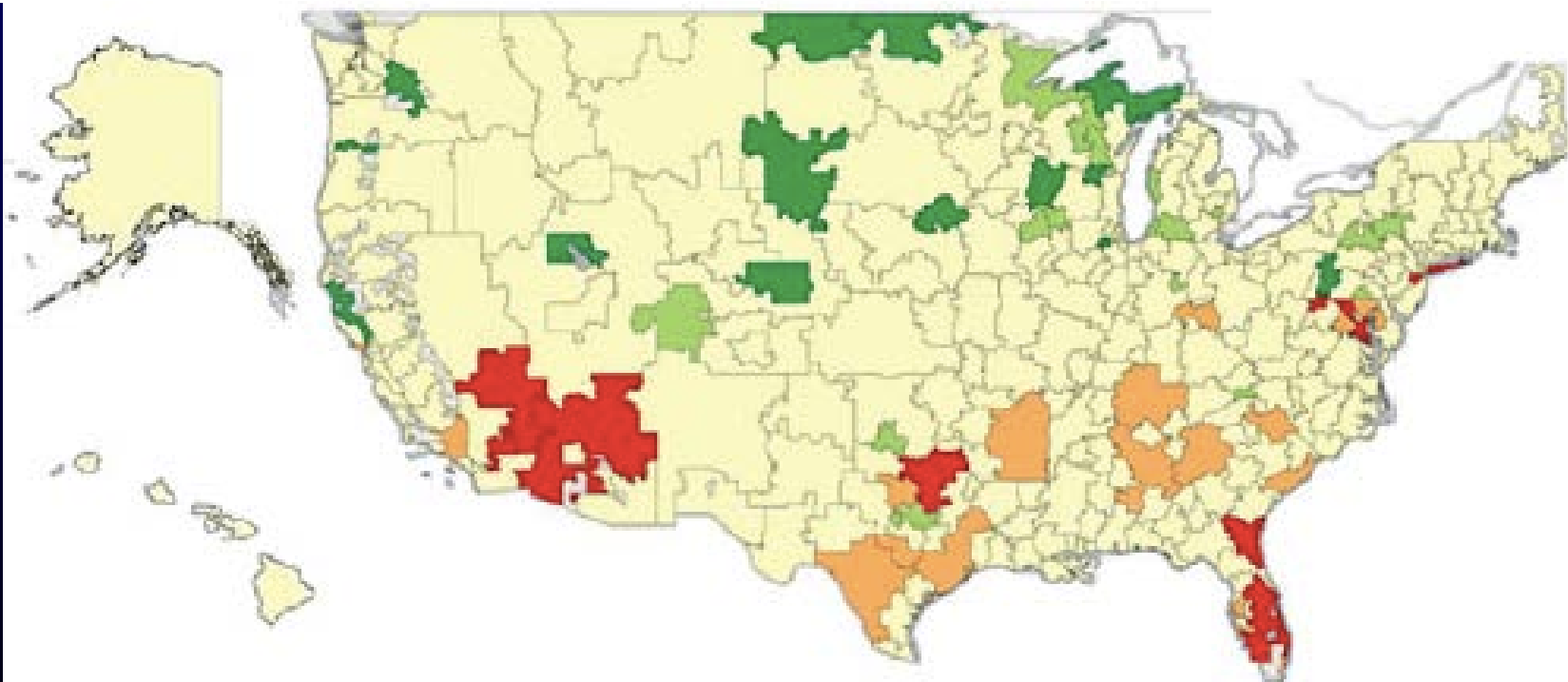
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Ramin Khorasan

Heatmap of MR Utilization by Payment (\$)



Heatmap of Impact Hospital Referral Region for Diagnostic MR (overlapping intensity and payment)



Protecting Access To Medicare Act (PAMA; 2014)

*Section 218b:
Promoting Evidence Based Care*

Through the use of Imaging CDS

The imaging CDS requirement is
not in MACRA



What is “MACRA”?

The **Medicare Access and CHIP Reauthorization Act of 2015 (MACRA)** is a bipartisan legislation signed into law on April 16, 2015.

What does Title I of MACRA do?

- **Repeals** the Sustainable Growth Rate (SGR) Formula
- **Changes the way that Medicare** rewards clinicians for **value** over volume
- **Streamlines** multiple quality programs under the new **Merit-Based Incentive Payments System (MIPS)**
- Provides **bonus payments** for participation in eligible **alternative payment models (APMs)**



Protecting Access to Medicare Act (HR 4302; 2014)- Section 218b *Promoting Evidence-Based Care*

- New Requirement: Ordering professionals for ambulatory and ED ‘applicable’ advanced imaging services *must* be exposed to specified Appropriate Use Criteria (AUC) via a certified CDS mechanism
 - Consequence for failure—imaging provider (pro to tech) will not be paid
 - Implementation date January 1, 2018
- *AUC: evidence-based criteria linking a clinical condition to an imaging service with an assessment of appropriateness



PAMA rules: Key provisions

- Specified AUC will be developed and published by “qualified provider-led entities” (qPLE)
 - qPLE must have rigorous processes to assess, grade the evidence and publish evidence-based criteria on web-site
 - Excludes ‘RBMs’
 - Enables accommodation for local best practices
 - First application cycle January 1, 2016, then annually
- Implication: Providers can meet PAMA by implementing a ‘certified CDS mechanism’ with an AUC set from any qPLE
 - CDS mechanism applications March 2017; certifications –expected summer 2017



Key provisions under PAMA 218(b)

- **Priority clinical areas**
 - Coronary artery disease (suspected or diagnosed)
 - Suspected pulmonary embolism
 - Headache (traumatic and non-traumatic)
 - Hip pain
 - Low back pain.
 - Shoulder pain (to include suspected rotator cuff injury)
 - Cancer of the lung (primary or metastatic, suspected or diagnosed)
 - Cervical or neck pain
- Outlier ordering professionals after 2020 to be potentially exposed to pre-authorization



Harvard Medical School eLibrary of Evidence

DASHBOARD

WORKLIST

LIBRARY

USERS

Q Search in guideline name, dx/symptom or piece of logic

Filter by:

Modality ▾ Body Region ▾ Contrast ▾ 1a x 1b x 1c x 2a x 2b x 2c x Oxford Grade USPSTF

Professional Society ▾ Choosing Wisely ▾ Endorsed by ▾

FILTER

Quick Filters: All (374) Choosing Wisely (7) Oxford Grade 1-2 (37) Oxford Grade 1-4 (39)

LIBRARY

currently displaying 1-37 of 37 results

EXPORT

Dx/Symptom	Source Type	Publisher	Choosing Wisely	Endorsed by Professional Society	Imaging Modality	Body Region	Contrast	Final Oxford Grade	Strength of Evidence	Final USPSTF	Select All Select None
Minor Head Trauma	Local best practice		N		CT	Head	N/A	1a		Non-I	☐
Source Title: BWH Percipio - Minor Head Trauma Source Type: Local best practice	Source Link:	Piece of Clinical Logic: IF NOT ([LOC] OR [Post-Traumatic Amnesia]) AND NOT ([Focal neurologic deficit] OR [Coagulopathy] OR [Vomiting] OR [GCS<15] OR [Headache] OR [Physical evidence of trauma above the clavicles] OR [Deficits in short-term memory] OR [Post-traumatic seizure] OR [Drug] OR [alcohol intoxication] OR [Trauma more than 24h ago] OR [Hemodynamically unstable]) AND [Age <65] THEN NOT [CT Head]						Validating Clinician Name: Ivan Ip Curator Name: David Osterbur Curator Name: Julia Whelan	Grading Dates: Mar 4, 2015 Public Comment:	OPEN	



Case 9

- 32 Y.O. Female with Braca1 gene mutation. Need to screen for breast cancer.
- Best study to do first:
- If the first study is normal, the next test:

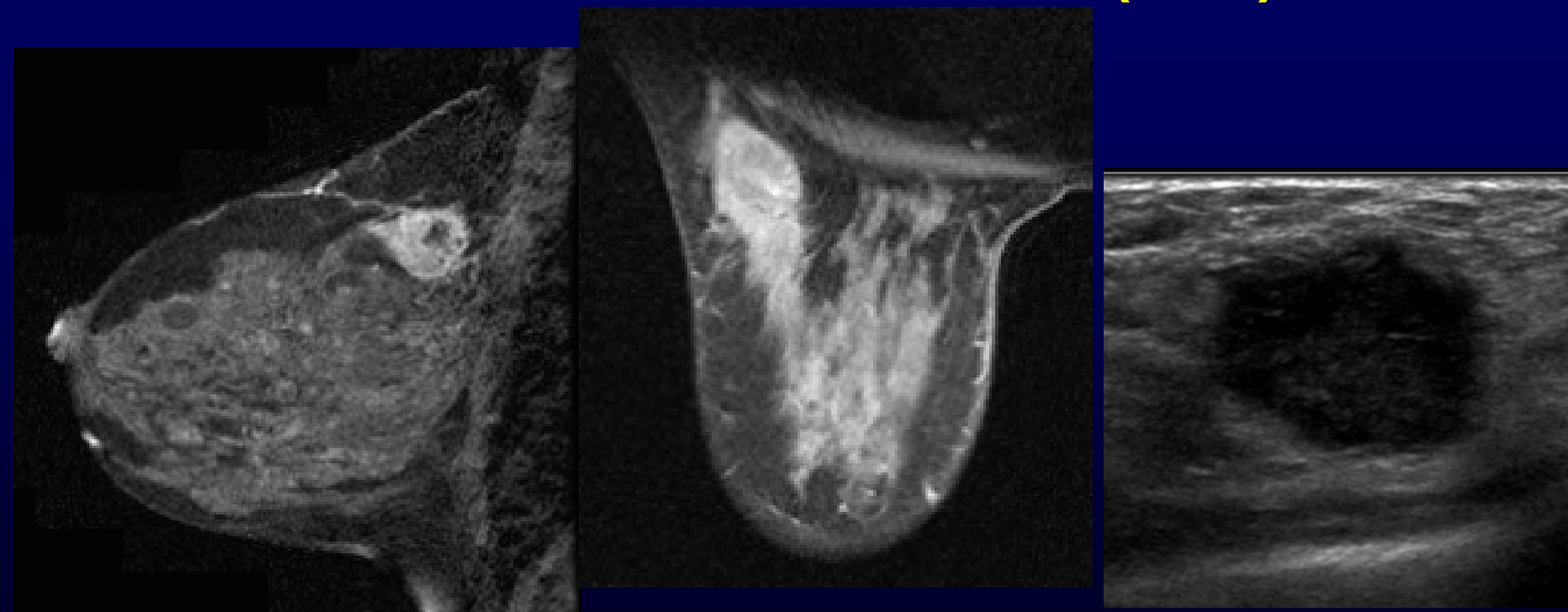


42 y/o BRCA 1

ER/PR Her2/Neu Negative

High Grade Invasive Ductal Carcinoma (IDC)

No Ductal Carcinoma In situ (DCIS)



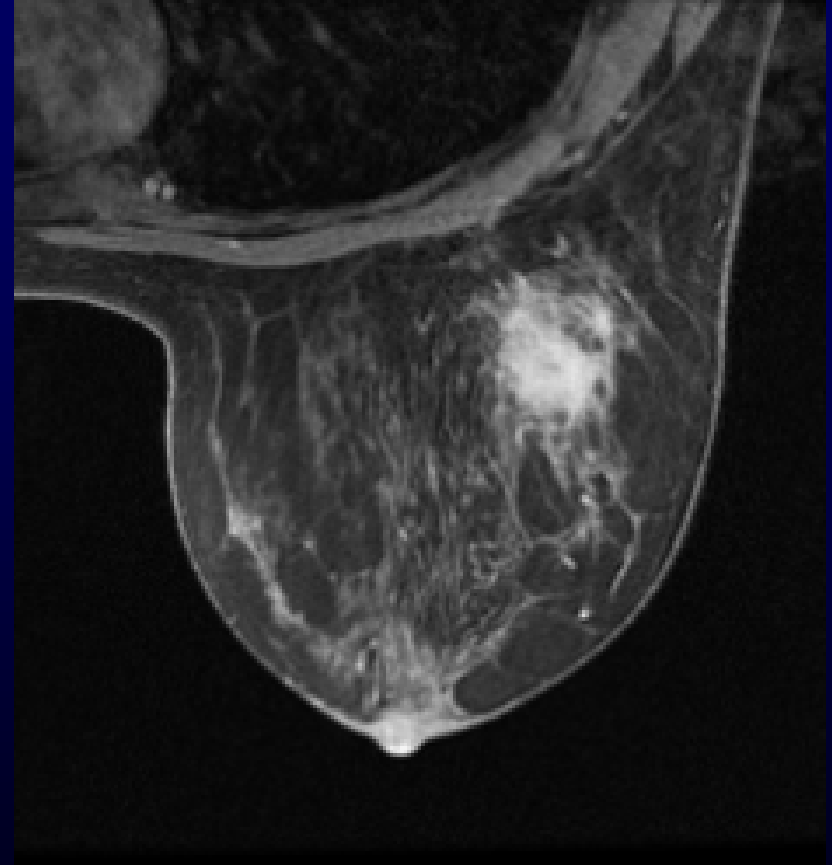
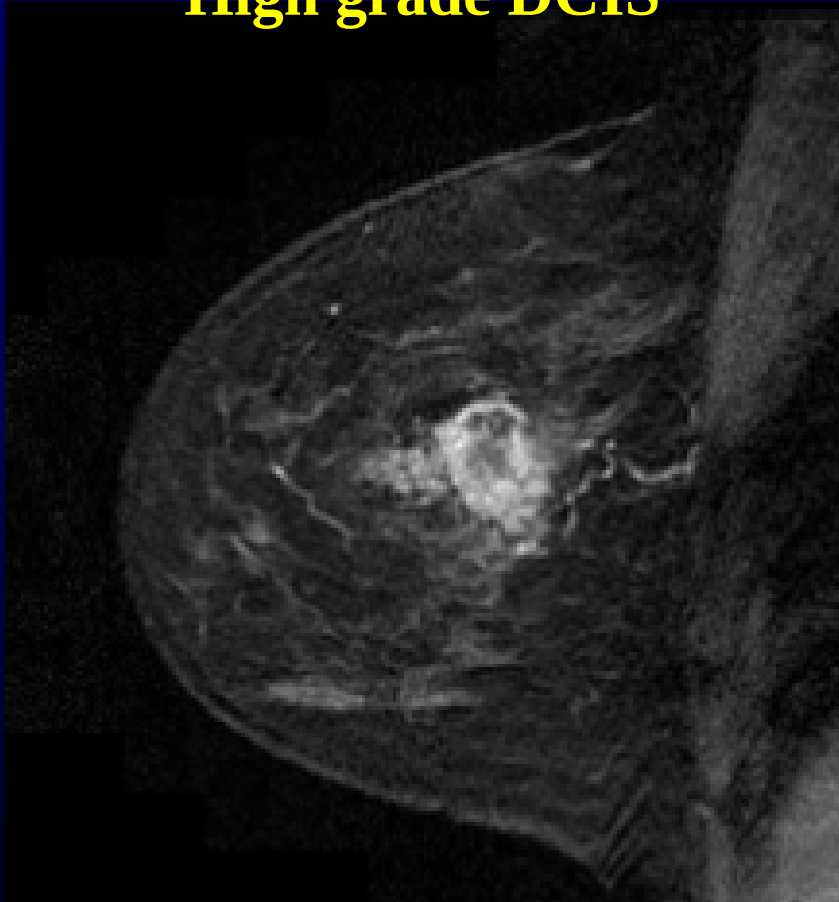
MR post contrast shows round rim enhancing mass

Axial delayed MR shows washout delayed kinetics

Ultrasound shows an oval mass with irregular margins



56 y/o , Strong Family History; BRCA Negative
ER/PR Her2/neu Negative
High Grade IDC
High grade DCIS



Contrast enhanced MRI shows an oval mass with irregular margins and rim enhancement. Around the mass is non-masslike enhancement worrisome for DCIS

Breast MRI and breast cancer

- Established yearly screening tool adjunct to mammography in high risk population- e.g. Braca1 gene mutation
- It is being used [with large variation in practice] in staging of newly diagnosed breast cancer primarily to look for multi-centric disease
 - Need to develop evidence on use of MRI in this context to improve patient outcomes
- Other screening use not supported by current evidence
 - ‘dense breast legislation’ adjunct screening with ultrasound or MRI



Case 10

- 42 F with acute onset lower abdominal pain, N/V, no fever, normal WBC, no prior surgical history, you are worried about an acute small bowel obstruction
- Best study to do first:

If the first study is normal, the next test:











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Abdomen utility of “KUB”

- Excellent for suspected perforation (supine abdomen, erect CXR),
- If suspected bowel obstruction with history of prior obstruction (supine and upright)
- In most other instances not very helpful as negative or positive result usually leads to another imaging test such as CT or US



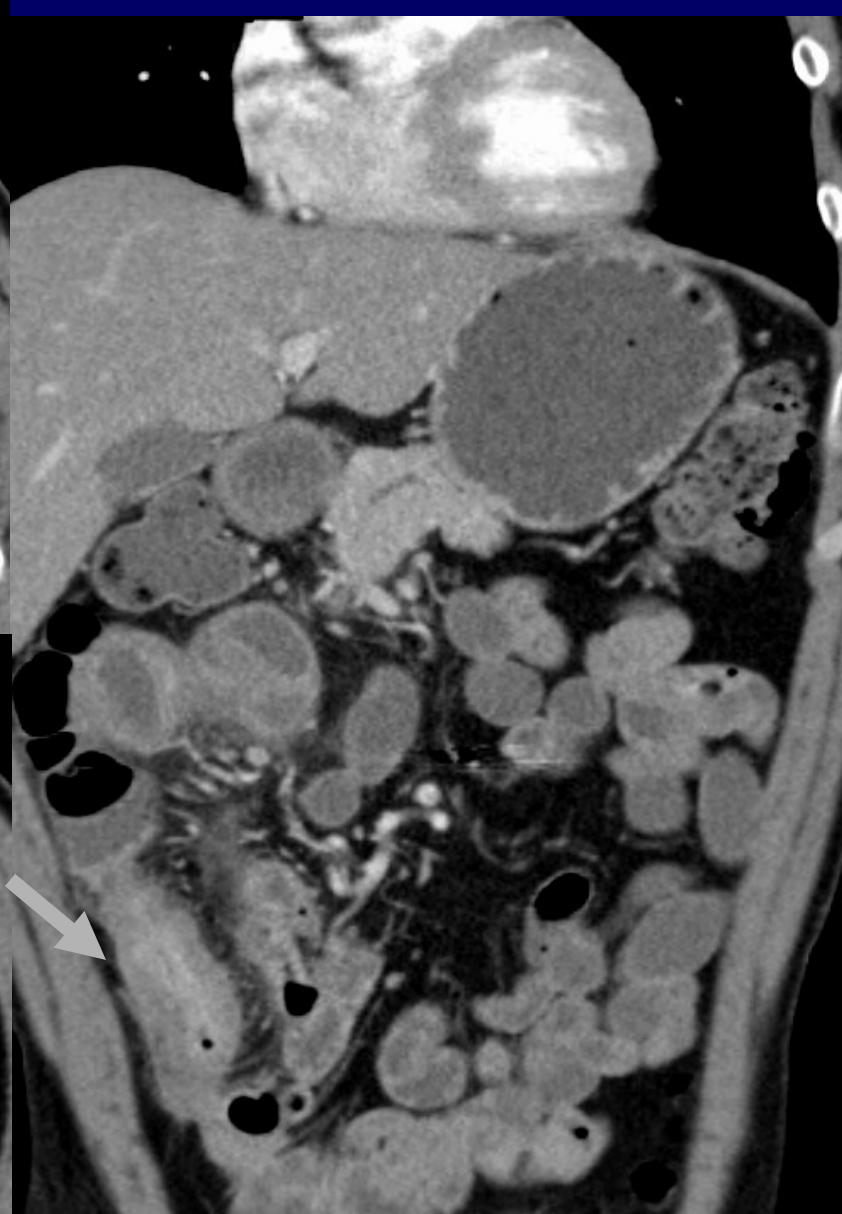
Abdomen-Clinical Problem:

? Small bowel obstruction

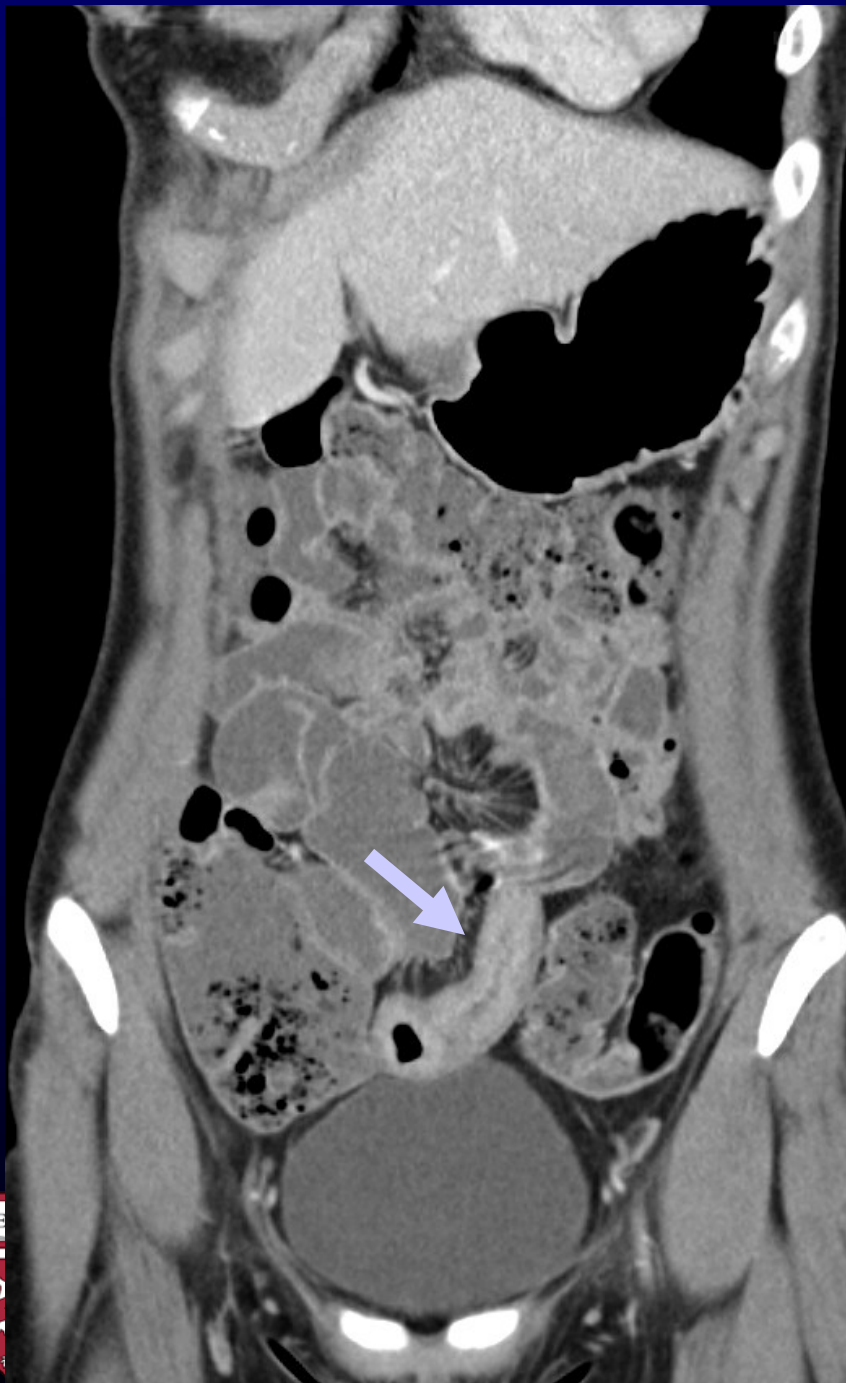
- “KUB” good first test if:
 - prior surgery, obstruction;
 - may be normal rarely in acute obstruction
- Acute SBO:
 - if further imaging, CT far better than small bowel follow through (barium study) to diagnose obstruction and its etiology
- Unexplained chronic or recurrent SBO:
 - CT/MRI enterography
- CT to look for other etiologies for pain

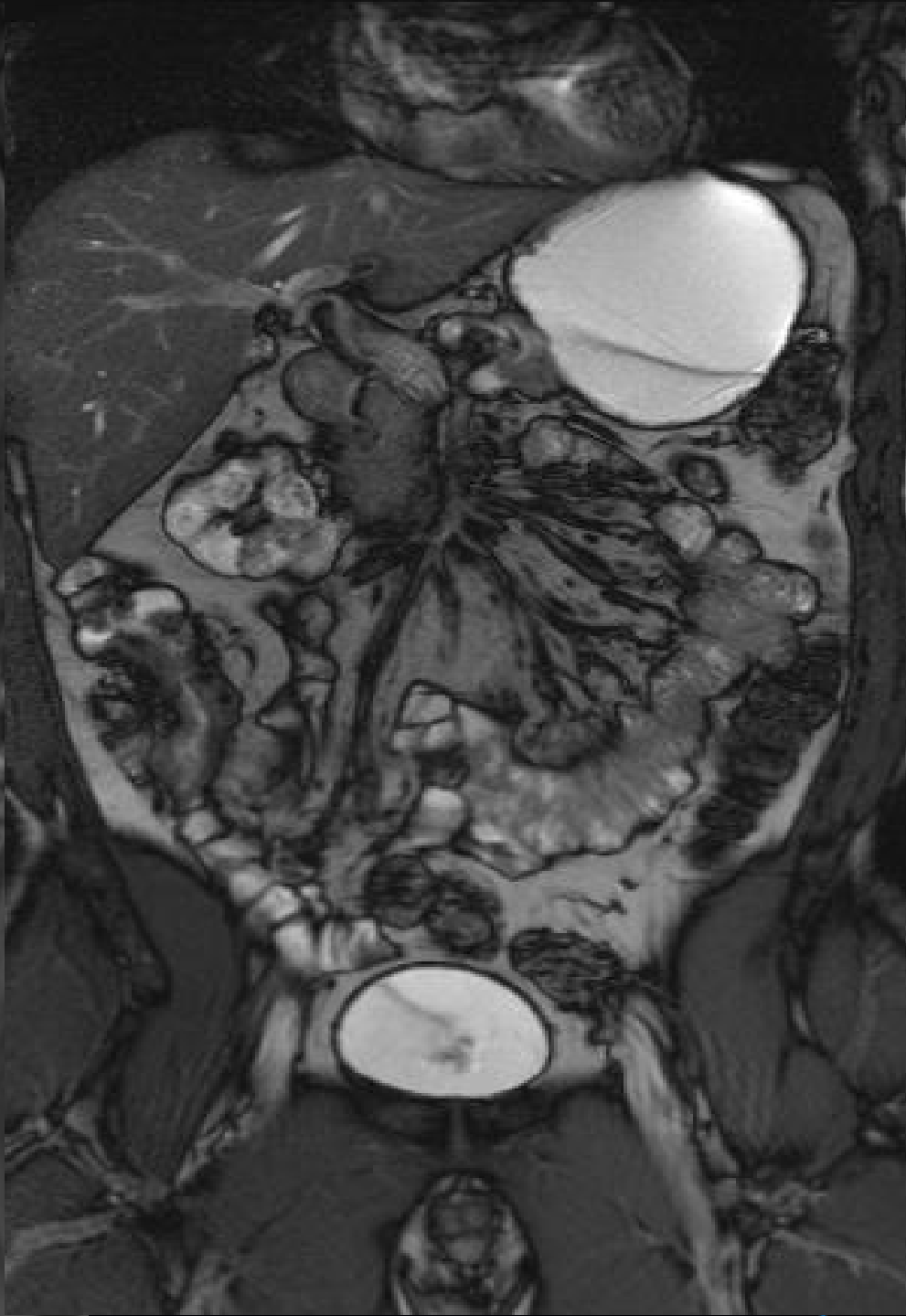
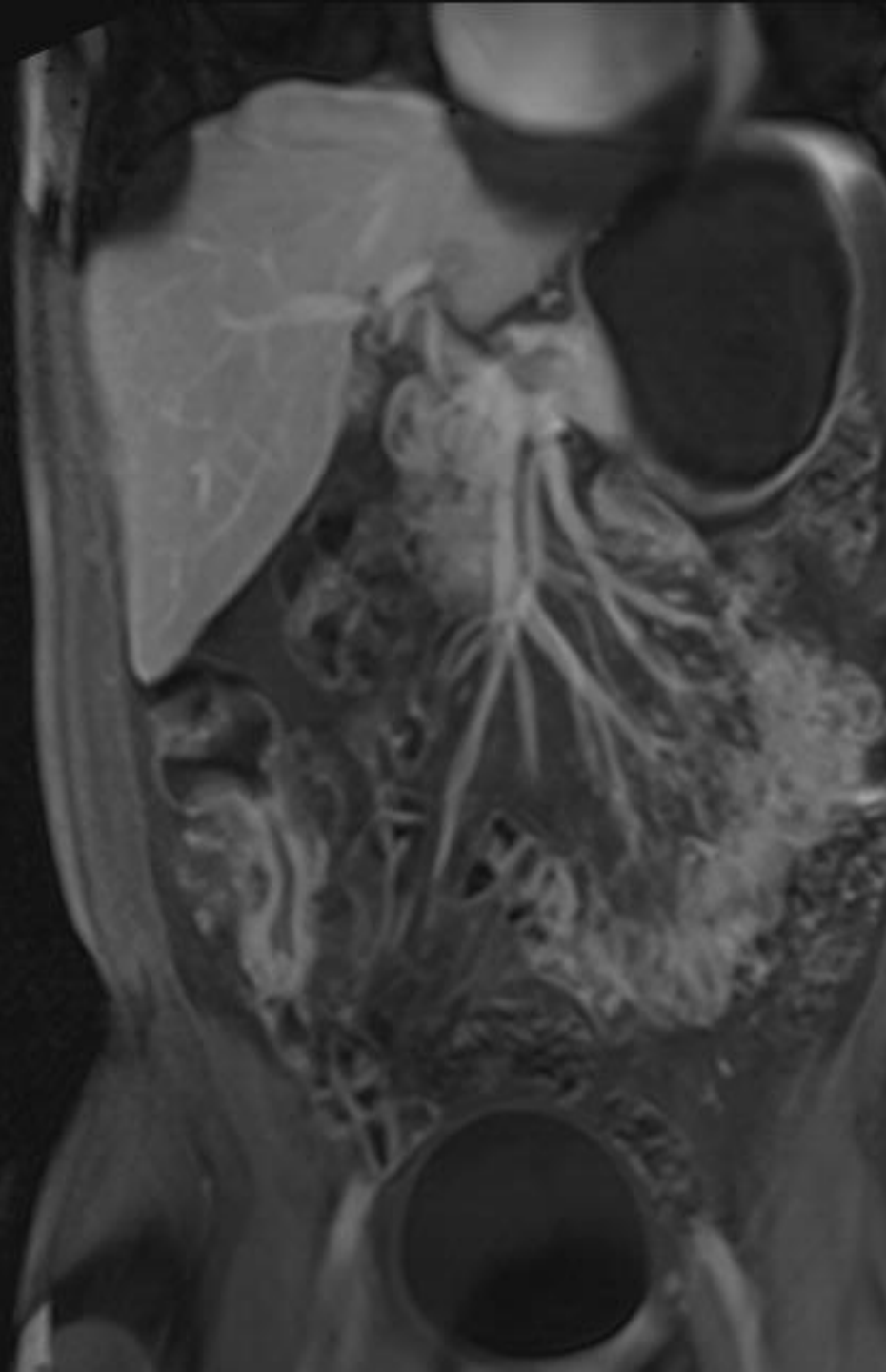


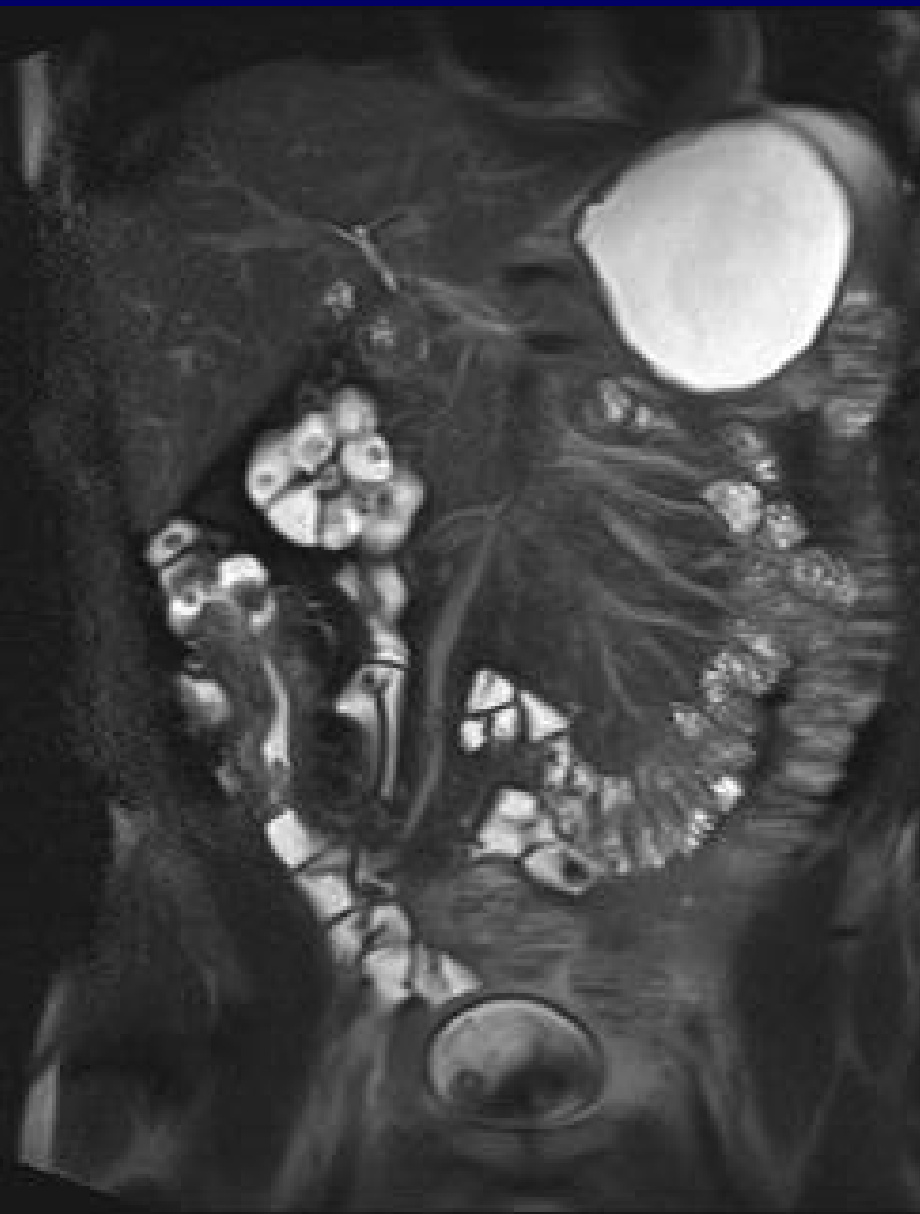




mucosal hyperenhancement: segmental attenuation greater than adjacent jejunum or ileum (+/- wall thickening [$> 3\text{mm}$])







Case 11

- 24 F, with 2 day history of RLQ pain, anorexia, fever, no prior surgical history, peritoneal signs in the RLQ, WBC = 12k, negative BHCG
- Best study to do first

If first study is normal, the next test:

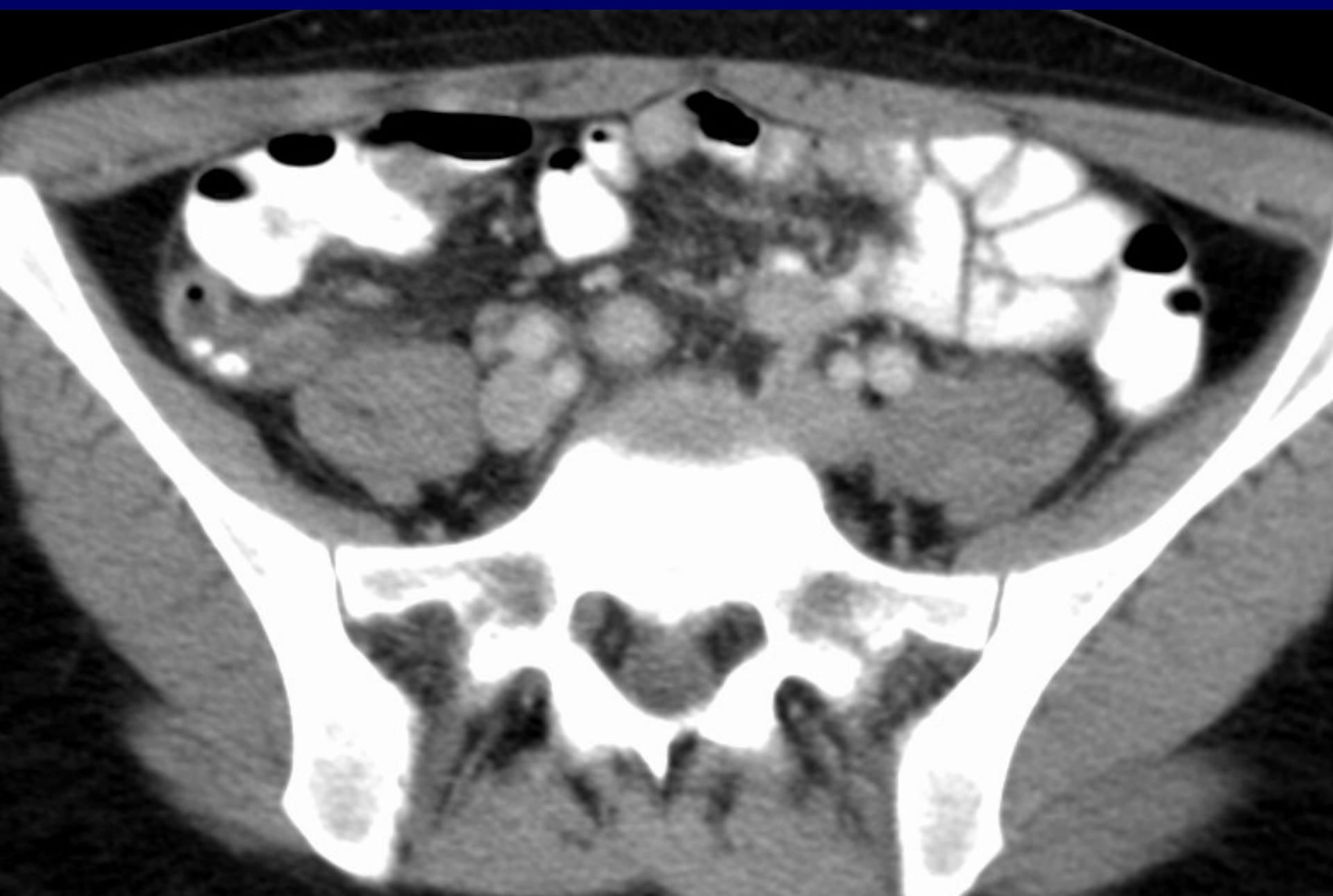


Case 12

- 24 M diabetic with 2 day history of RLQ pain, fever, WBC = 6k, elevated blood sugars, could be acute appendicitis
- Best study to do first:
- If first study is normal, the next test:



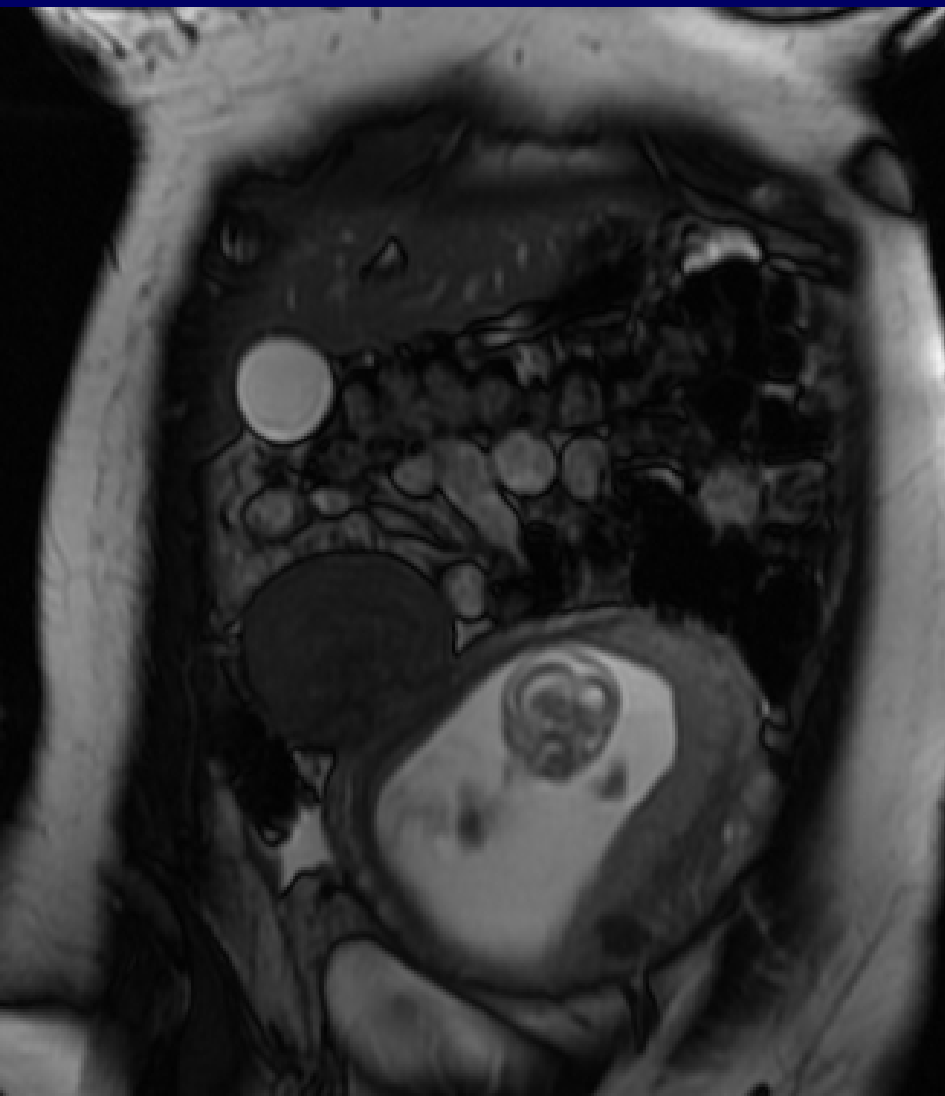




Case 12 variant

- RLQ pain x2days, 16 wks pregnant
- Best study to do first:
- If first study is normal, the next test:





Abdomen-Clinical Problem: appendicitis

- Clinical diagnosis, imaging not routinely indicated
- If equivocal clinical diagnosis: CT is test of choice in this scenario with sensitivity and specificity > 95%
- In pregnancy, ultrasound in expert hands, MRI best test
- NEJM
 - 1/98: CT on all patients with RLQ pain-not standard of care
 - 2008- CT decreased negative appendectomy rate to <2%
- BWH
 - NAR 30% in females, 12% in males in 1990
 - NAR 1.5% females, 1.8% males in 2007
 - >95% of appendectomies had preoperative CT
 - 14.6% of CT for appendicitis went to OR
 - Estimate 20 CT per 1 less appendectomy-need further studies



How about harm from radiation exposure?

- ‘Substantial’ concern for harm from radiation exposure from Medical Imaging, esp CT-
 - Real but overblown in the media
- 1-2% potential (many assumptions) incrementally increased risk of malignancy over baseline of approximately 40% lifetime cancer risk in US



How about harm from CT radiation exposure?

- If CT is clinically appropriate and superior to other imaging modalities, its benefits substantially exceed the potential harm
- We do need better science to more accurately assess risk

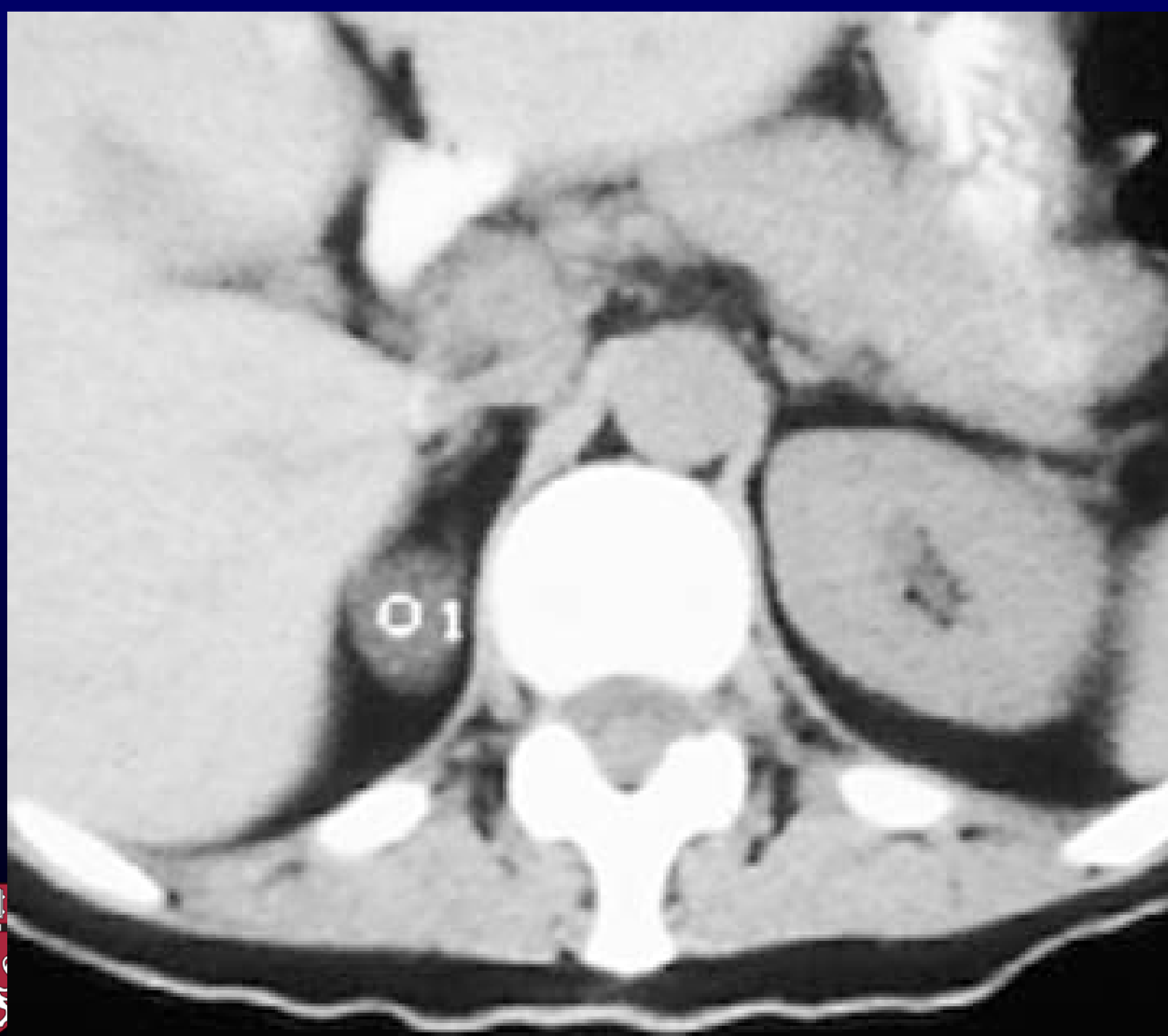


Case 14

- 45 F with an incidental 2.5 cm right adrenal mass found on CT, performed to evaluate an incidental liver lesion on RUQ US looking for gallstones!
- Best study to do first:

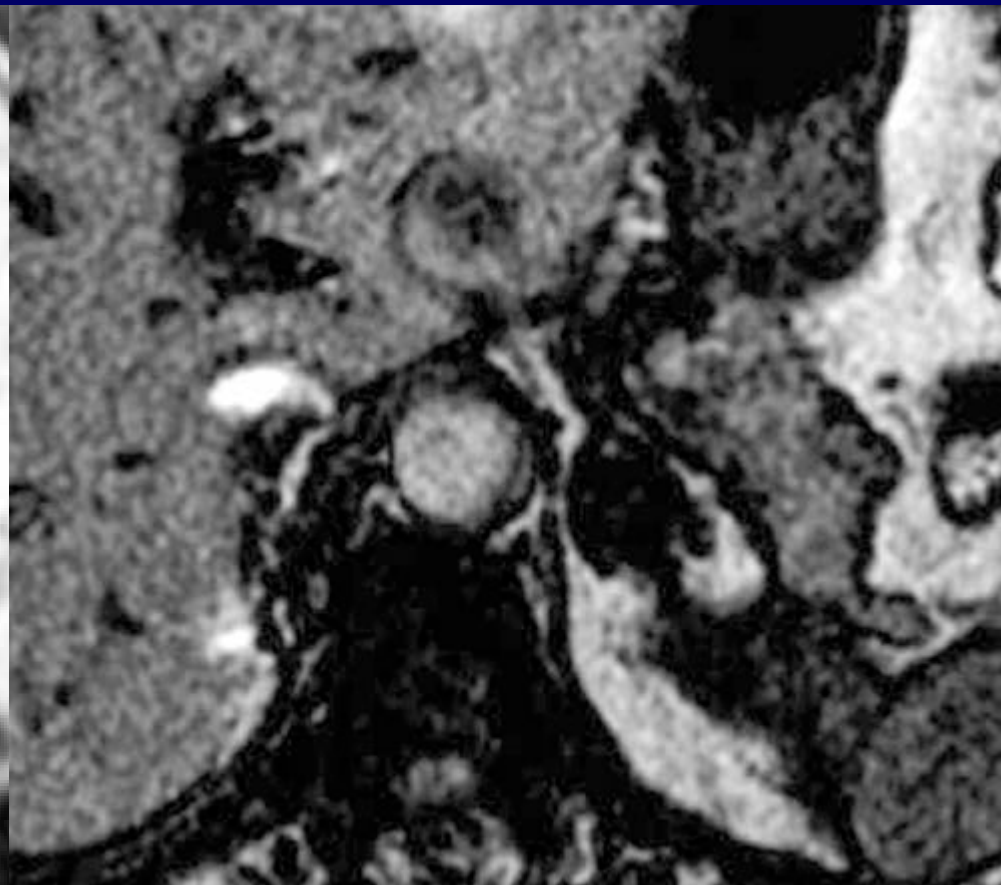
If the first study is normal, the next test:







In-Phase



Out of Phase



“Lipid-poor” Delayed Washout

A

B

C

A: Unenhanced CT HU= 29

B: Enhanced HU= 73

C: 15 min. HU= 44

Absolute enhancement washout=
 $(73-44/73-29) \times 100 = 66\%$



Abdomen-Clinical Problem: adrenal lesion

- Adrenal imaging predominantly anatomic, diagnosis of functional adrenal tumors requires biochemistry
- In patients with an incidental adrenal lesion or those with a primary malignancy, a non-contrast CT, limited adrenal MR, washout CT, or occasionally PET CT may obviate the need for follow up or biopsy



Case 15

- 45 M, medical malpractice lawyer, found to have an incidental 6 cm simple right renal cyst on abdominal ultrasound
- Best study to do first:
- If first study is normal, the next test:

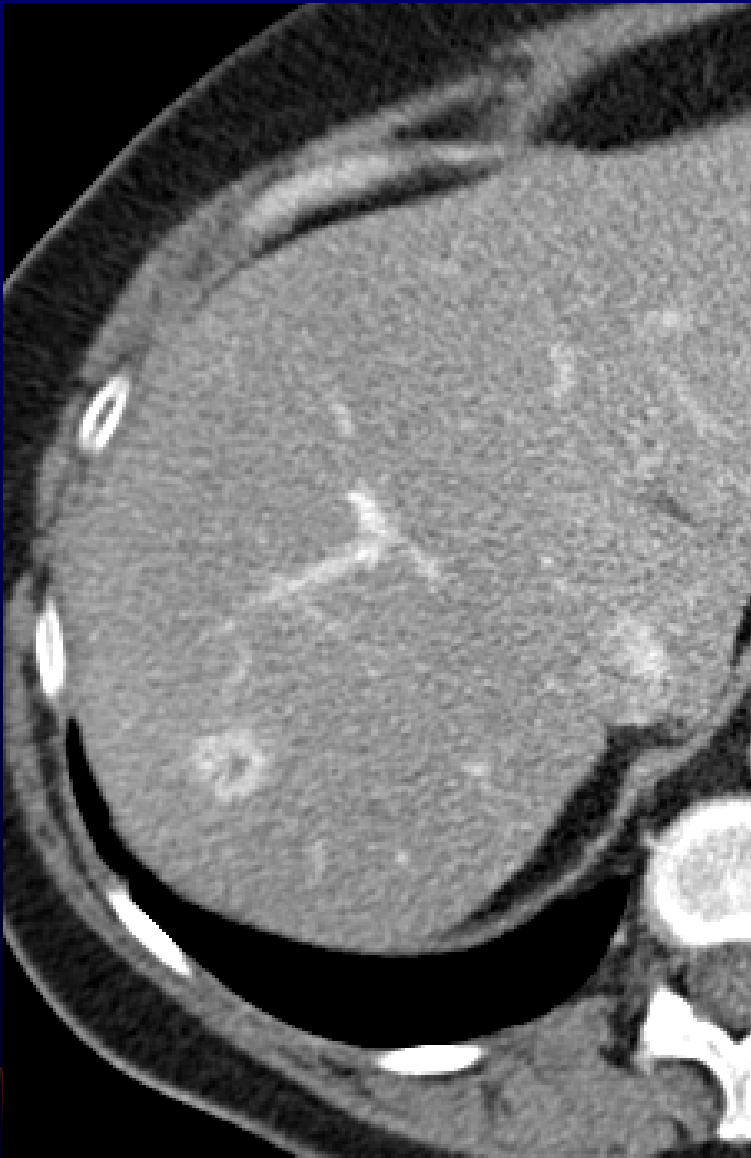


Case 16

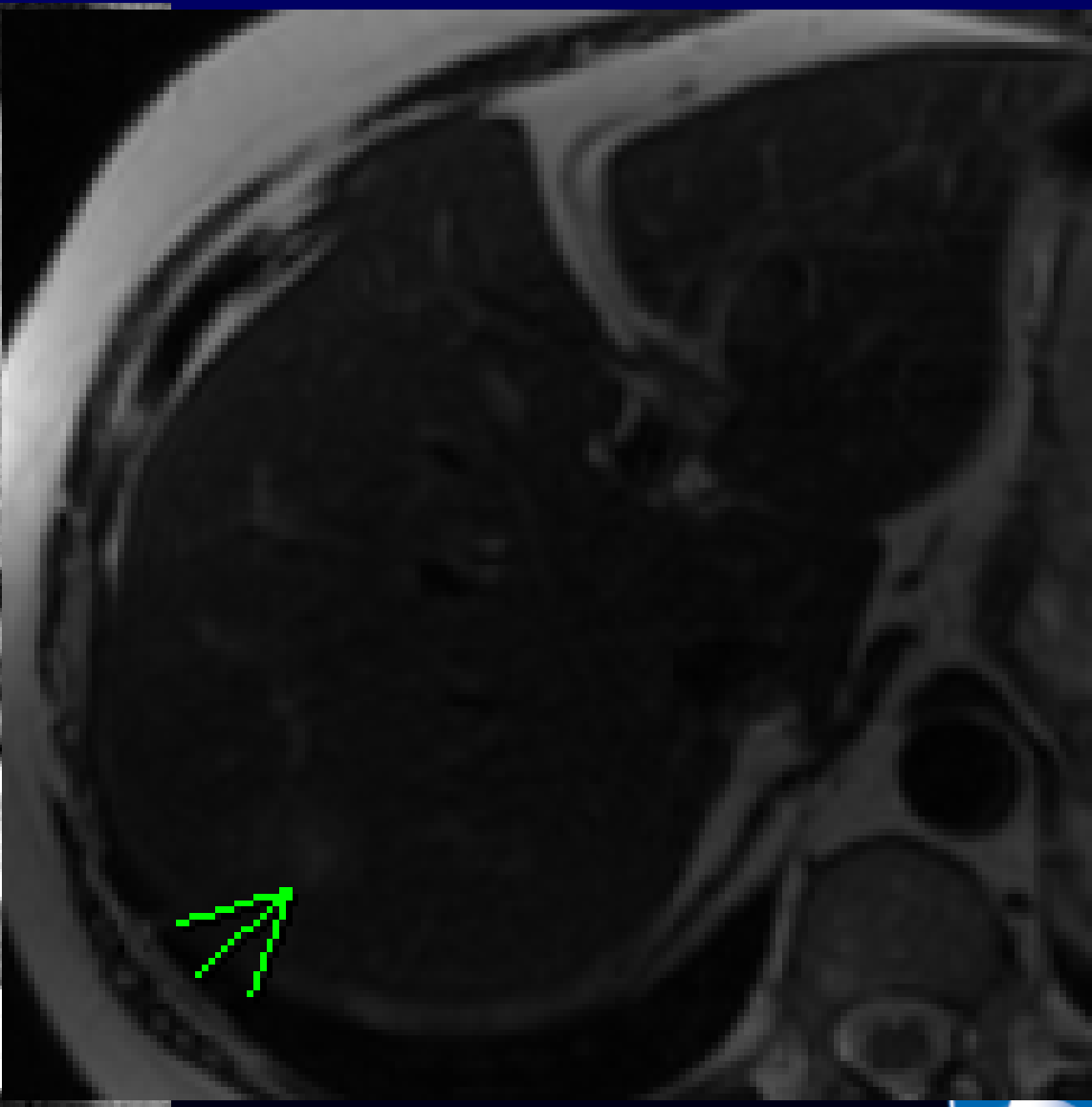
- 73 F, who has a 2 cm echogenic mass in the liver found incidentally on ultrasound, no prior medical history
- Best study to do first:
- If first study is normal, the next test:



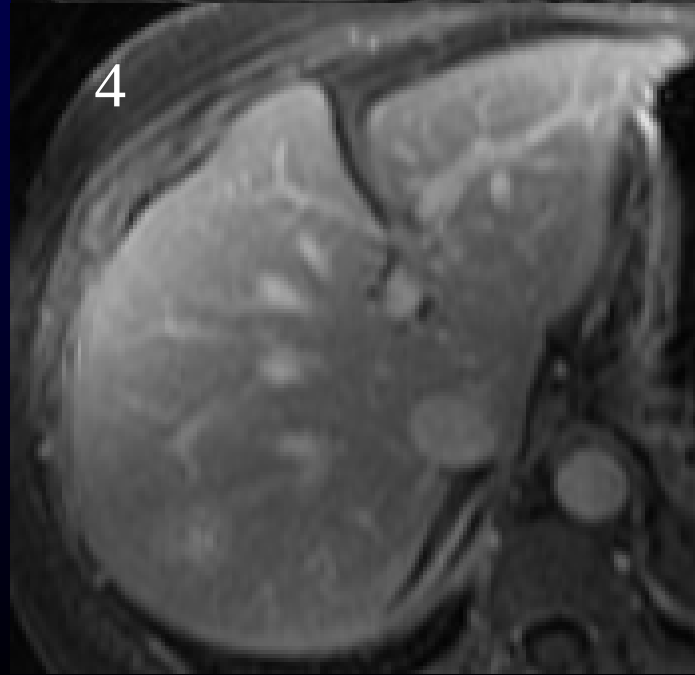
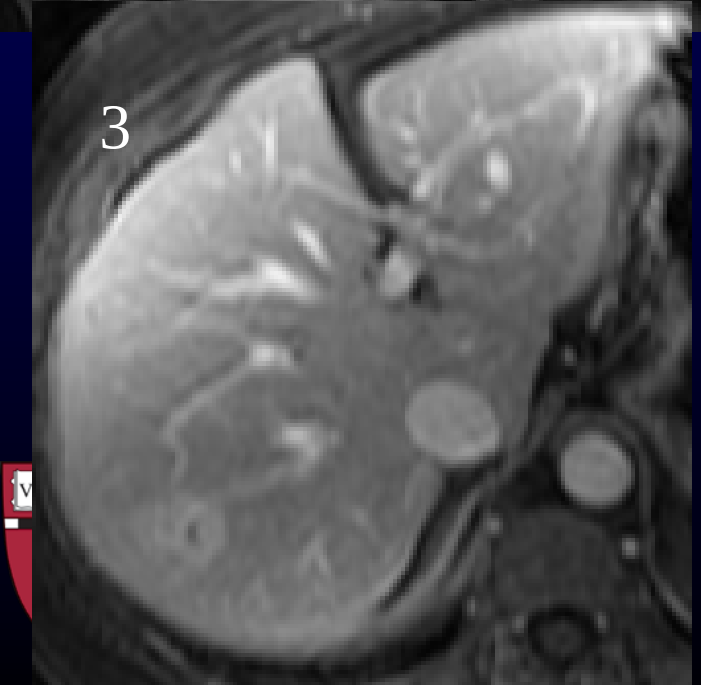
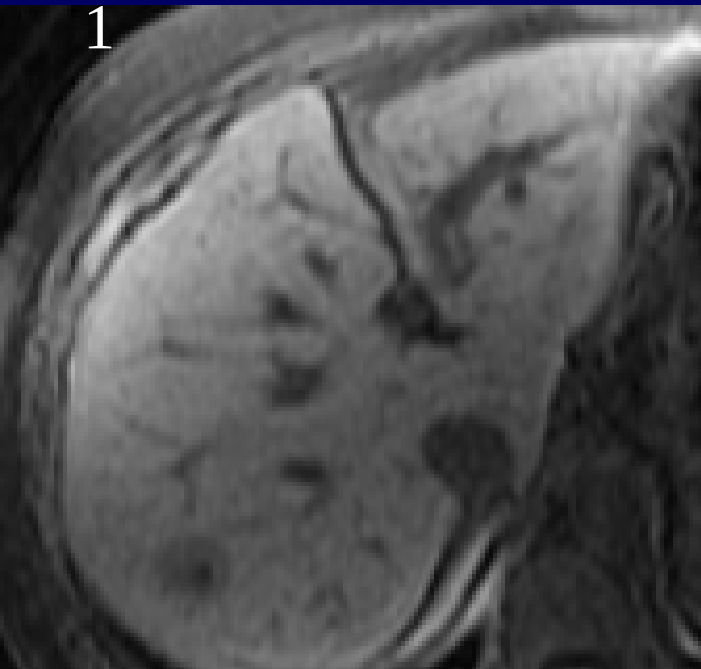
CT with Contrast



T2 Weighted MRI



Dynamic MRI sequence with Gadolinium: FNH



Incidental Liver lesions

- Great majority are benign cysts, hemangiomas- diagnosis can be made on ultrasound, CT, MRI
- If no prior malignancy, indeterminate solitary <15 mm hepatic lesion is highly likely to be benign (>98%), options:
 - Do nothing
 - Re-image in 6-12 months-show stability-then stop
 - Make benign diagnosis with MRI then stop



Incidental Liver lesions

- Modality of choice for characterization is MRI



Case 17

- 52 M physician, s/p fall with right hip pain, unable to move right hip
- Best study to do first:
- If the first study is normal, the next test:



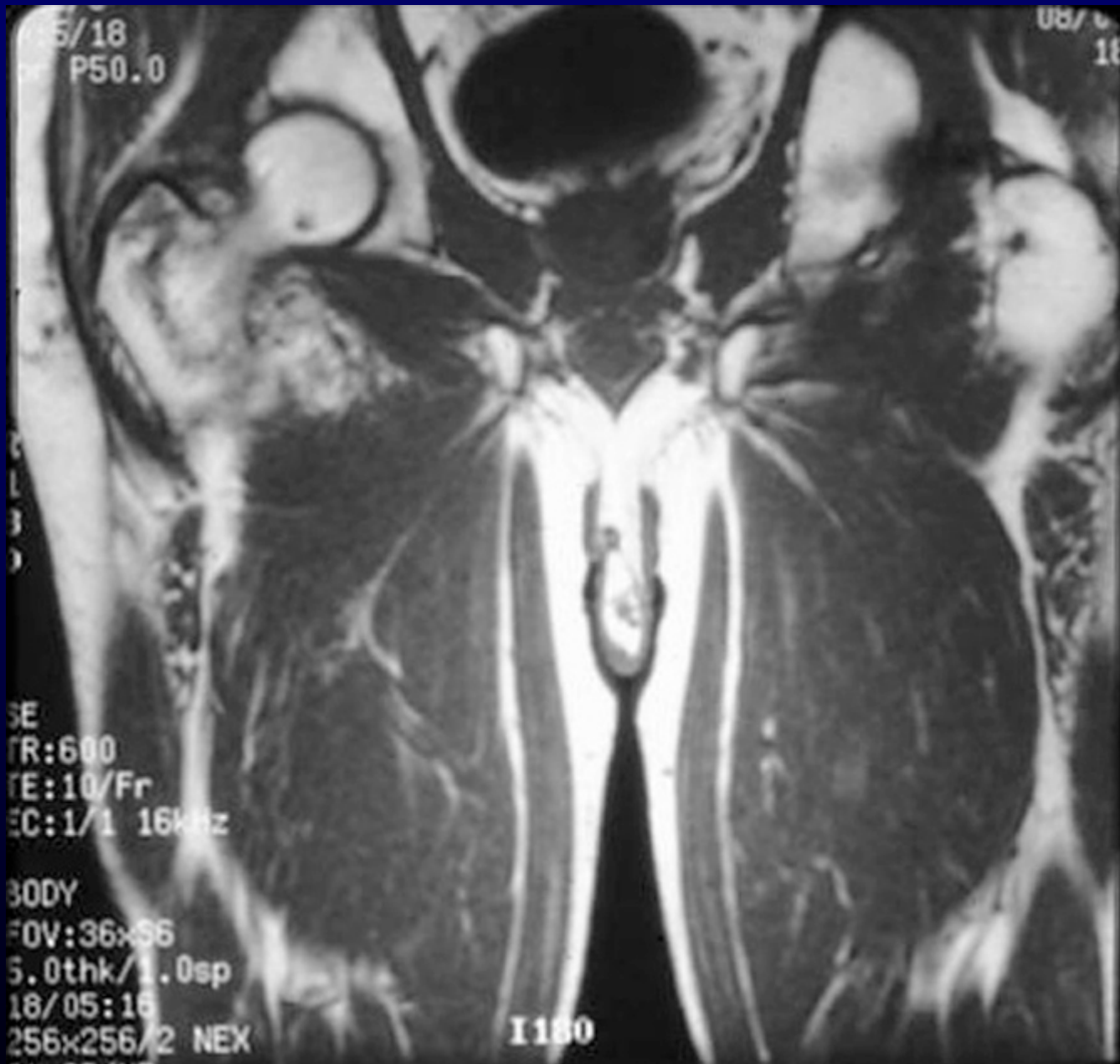
Best study to do first: Plain films



Next imaging study?:



Ramin Khorasani, MD, MPH,



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Musculoskeletal Clinical Problem: ? Hip fracture

- Plain films are the first choice
- Normal plain films, high clinical suspicion: MRI is the study of choice to exclude occult fracture



Case 23

- 25 y.o F with presentation suggestive of appendicitis. There is a 30% chance in your estimation that she has appendicitis. We have a test with 95% sensitivity, 95% specificity. The test is positive. What is the chance that she has appendicitis?

<30% 30-75% 75-90% >90%



Case 24

- 25 y.o F with presentation unlikely of appendicitis. There is a 2% chance in your estimation that she has appendicitis. We have a test with 95% sensitivity, 95% specificity. The test is positive. What is the chance that she has appendicitis?

<30% 30-75% 75-90% >90%



Prevalence 30%

	Appy	Normal appendix	P
Positive test	2850	350	0.89
Negative test	150	6650	0.98
Total	3000	7000	10000



Prevalence 2%

	Appy	Normal appendix	P
Positive test	190	490	0.28
Negative test	10	9310	0.999
Total	200	9800	10000



III. Recommendations

- Think of how the result of an imaging test may change the management of your patient BEFORE you request an examination
- Give as much clinical information as reasonable on the requisition
 - history more helpful than “rule out”s!!
 - blank requisition may result in a radiologist missing a subtle but important finding



III. Recommendations

- Use your radiologist as a consultant, this is her/his Job!!
- Get familiar with the new Law pertaining to Imaging CDS-begins January 2017
- **Slides at Center for Evidence-Based Imaging web-site**

