

## Imaging Update for Primary Care

Bruce A. Wolf, DO, FAOCR  
Assistant Professor  
Interventional Radiology  
Michigan State University

---

---

---

---

---

---

---

---

- No conflicts of interest.
- No off-label uses.

---

---

---

---

---

---

---

---

## Objectives

- Understand the up to date information about prostate cancer evaluation and mammography
- Understand when to use IV contrast in CT and MRI exams
- Understand where to locate the ACR Appropriateness Criteria

---

---

---

---

---

---

---

---

## PSA Screening and Treatment

- 2010 AUA – screen by PSA in “well-informed” men age 40+
- 2012 NEJM Radical Prostatectomy versus observation for localized Prostate cancer
  - Compared to observation, prostatectomy did not significantly improve overall or cancer specific survival over a 12yr period in **localized low risk** prostate ca.
- 2012 USPSTF – recommends against PSA based screening
- 2013 AUA – consider PSA screening after “shared decision-making” every 2yrs for men 55-69 only
- 2017 USPSTF Recommendation Statement – PSA screening
  - Small possibility of benefit outweighs the known risk of harms.
  - Grade C recommendation – age 55 to 69 d/w clinician (April 2017 draft)
  - Grade D recommendation – age 70 and older

---

---

---

---

---

---

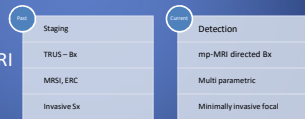
---

---

## Role of Prostate Imaging

- Address the central challenges in Prostate cancer (PCa)
  - Improve detection of clinically significant PCa – reduce mortality
  - Increase confidence in benign diseases and dormant malignancies
  - reduce unnecessary biopsies and treatment

- Multiparametric MRI
  - Anatomy
  - Biology
  - vascularity



---

---

---

---

---

---

---

---

## Active surveillance for PCa

- Planned monitoring
- Well defined selection criteria
- Identification of PCa progression
- Curative intent

---

---

---

---

---

---

---

---

### Role of prostate MRI in active surveillance

- Baseline MRI after TRUS-guided biopsy proven PCa
  - Risk stratification
  - Treatment selection
- Baseline prior to biopsy in typical AS protocol

```
graph LR; A((A)) --> A1[+TRUS + PSA (q 3-6mo)]; A1 --> A2["@ 12-24mo TRUS"]; B((B)) --> B1[+TRUS + PSA (q 3-6mo)]; B1 --> B2[↑ PSA]; B2 --> B3[TRUS];
```

---

---

---

---

---

---

---

---

### PI-RADS: lesion risk assessment

- PIRADS 1 – Very low (clinically significant cancer is highly unlikely)
- PIRADS 2 – Low (clinically significant cancer is unlikely)
- PIRADS 3 – Intermediate (clinically significant cancer is equivocal)
- PIRADS 4 – High (clinically significant cancer is likely)
- PIRADS 5 – Very high (clinically significant cancer is highly likely)

---

---

---

---

---

---

---

---

PIRADS 2

---

---

---

---

---

---

---

---



---

---

---

---

---

---

---

---



---

---

---

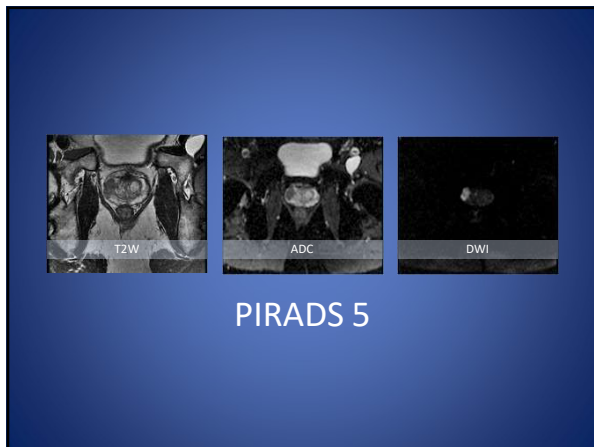
---

---

---

---

---



---

---

---

---

---

---

---

---

# Breast Cancer and Screening

---

---

---

---

---

---

---

---

### Cancer Rates per 100,000 Women

	New Diagnosis	Deaths
Breast	123.9	20.5
Lung	50.8	34.7
Colorectal	32.8	11.9

Source: U.S. Cancer Statistics Working Group. United States Cancer Statistics: 1999-2014 Incidence and Mortality Web-based Report. Atlanta (GA): Department of Health and Human Services, Centers for Disease Control and Prevention, and National Cancer Institute; 2017.

---

---

---

---

---

---

---

---

The American Cancer Society's estimates for breast cancer in the United States for 2018 are:

- About 266,120 new cases of invasive breast cancer will be diagnosed in women.
- About 63,960 new cases of carcinoma in situ (CIS) will be diagnosed (CIS is non-invasive and is the earliest form of breast cancer).
- About 40,920 women will die from breast cancer.

---

---

---

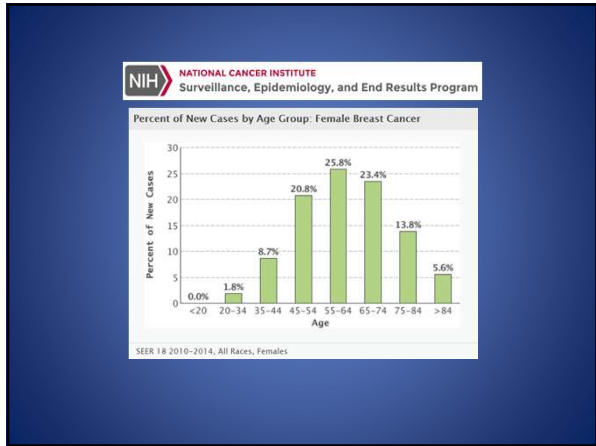
---

---

---

---

---




---

---

---

---

---

---

---

---

---

---

---

---

### Screening and Treatment for Breast Cancer Mortality 2000-2012

- Models: Cancer Intervention and Surveillance Network (CISNET)
- Baseline Rate: 64 deaths/100,000 women in 2000
- 2000: 37% reduction in overall cancer mortality
  - 44% of reduction from screening
  - 56% of reduction from treatment
- 2012: 49% reduction in overall cancer mortality
  - 37% of reduction from screening
  - 63% of reduction from treatment

Source: JAMA. 2018;319(2):154-164

---

---

---

---

---

---

---

---

---

---

---

---

Comparison of Breast Cancer Screening Guidelines (January 2016)						
Recommended	ACOG	ACR/IBI	ACS	AMA	NCCN	USPSTF
Age to Start Mammograms	40	40	40 Individual choice 40-44	40	40	50
Age to Stop Mammograms	Annual as long as women in good health	When life expectancy is >5 years	When life expectancy >5 years	When life expectancy >5 years	Upper age limit not established	74
Interval	Annual	Annual	Annual 45-54; 1-2 years 55+	Annual	Annual	2 years
Summary synthesis (US Mammography)	Further study to confirm whether cost-effective; digital mammography alone in first-line screening	No longer investigated; represents an advance in breast imaging	Improvement in detection, lower chance of death	Silent	Promising, definitive studies pending	Inconsistent evidence to support routine use; grade "C"
Notes	Summary synthesis shows to improve early detection compared to digital mammography	40-44 Opportunity to begin screening; 45-49 Annual exam; 55-1-2 years Triennial or biennial with opportunity for annual exam		Eligible at age 40, if they choose and their doctors agree; annual at 50		40-49 Grade "C" 50-74 Grade "B" 75-84 Grade "D" Insufficient Evidence

---

---

---

---

---

---

---

---

---

---

---

---

## MSU Women's Imaging Center Experience

- 100 consecutive breast cancer diagnoses.
- 25 women were less than 50 years old.
- Why not look for 25% of the breast cancers?

---

---

---

---

---

---

---

---

---

---

---

---

**American College of Radiology  
ACR Appropriateness Criteria®  
Palpable Breast Masses**

**Variant 1:** Palpable breast mass, (Woman 40 years of age or older, initial evaluation) (See Appendix 13.1) for additional steps in the workup of these patients.

Radiologic Procedure	Rating	Comments	RRL*
Mammography diagnostic	9	See references [13-15].	☐☐
Digital breast tomosynthesis diagnostic	9	See references [16-18,20,85].	☐☐
US breast	4	If she had recent mammogram (ie, past 6 months), US may be appropriate.	○
MRI breast without and with IV contrast	2	See references [4,49].	○
MRI breast without IV contrast	1		○
FDG-PET	1		☐☐☐☐
Tc-99m sestamibi MIBI	1		☐☐☐
Image-guided core biopsy breast	1		Varies
Image-guided fine-needle aspiration breast	1		Varies

\*Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate. †Relative Radiation Level

---

---

---

---

---

---

---

---

---

---

---

---

## Standard Views

Lateral

Superior

---

---

---

---

---

---

---

---

---

---

---

---



---

---

---

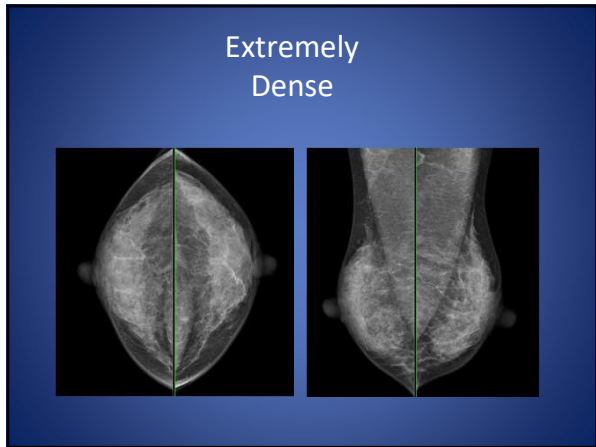
---

---

---

---

---



---

---

---

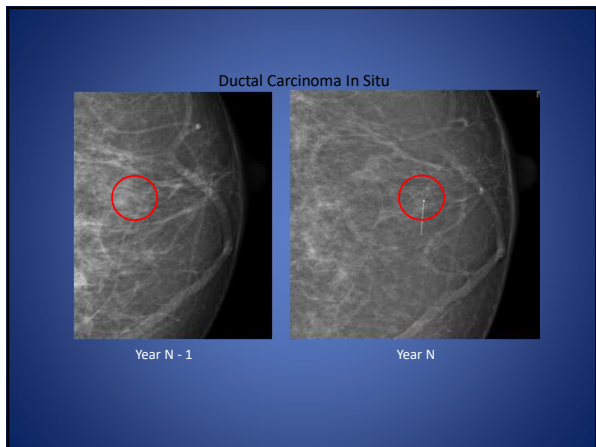
---

---

---

---

---



---

---

---

---

---

---

---

---



## Breast Update

- Digital breast tomosynthesis – “3-D” Mammography
- Abbreviated breast MRI
- Breast density
- Whole breast ultrasound
- Contrast enhanced mammography
- Breast specific gamma imaging
- Artificial intelligence
- Risk assessment
- Seeds/reflectors for surgical localization

---

---

---

---

---

---

---

---

?



---

---

---

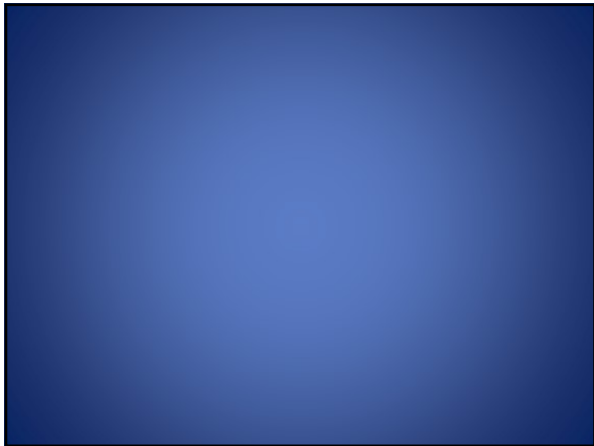
---

---

---

---

---



---

---

---

---

---

---

---

---

## Advanced Imaging

• MRI	
• Brain	
• Stroke, memory loss, mental status changes, dementia.	W/O
• Demyelination, Tumor, most other symptoms	With and W/O
• Stereotactic Metastatic dz, primary malignancy	With
• Pituitary, sinuses, IAC's, orbit	With and W/O
•	
• MRA brain	W/O
• MRA for sinus thrombosis	With
• MRA Neck	With and W/O
• Spine	
• Radiculopathy, disc herniation, myelopathy, pain	W/O
• Syrinx, MS, Post op, mets, abscess, osteo	With and W/O
• Non-joints, long bones	
• Pain, tears, fracture, DID	W/O
• Infection, mass, tumor	With and W/O
• Brachial plexus	With and W/O
• Joints	
• AVN, tear, pain, FX, DID	W/O
• Infection, tumor, mass	With and W/O
• Labral tear	With and W/O arthrogram
• MRI abdomen/MRCP biliary issues	W/O
• Abdomen all other issues	With and W/O
• Pelvis	With and W/O
• MRA Abdomen, pelvis, runoff	With and W/O
• Breast	With and W/O

---

---

---

---

---

---

---

---

---

---

---

---

• CT	
• Chest nodules	W/O
• Essentially everything else	With only
• Interstitial lung disease HI Res	W/O
• Neck swelling, adenopathy, etc	With only
• Face (maxillofacial)	
• Swelling, mass	With
• Salivary, Ca++, trauma	W/O
• Abdomen/Pelvis	
• Pain, mets, it is	With
• GU Ca++	W/O
• Hematuria	With and W/O
• Liver hemangioma (abdomen only)	With and W/O
• Brain	
• Stroke, seizure, HA, trauma, mental status change	W/O
• Tumor, other ax	With and W/O
• IAC's	With and W/O
• Orbits	With
• Sinus for sinusitis	W/O
• Sinus tumor	With
• Extremity, Spine pain, trauma, DID	W/O
• Extremity, Spine tumor, infection	With only
• CTA abd, neck, brain, pelvis, legs, etc	With
• CT Ca++ score	W/O
• CTA Cardiac	With

---

---

---

---

---

---

---

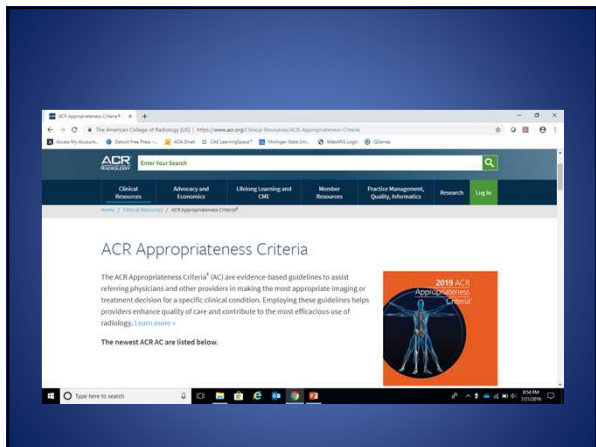
---

---

---

---

---




---

---

---

---

---

---

---

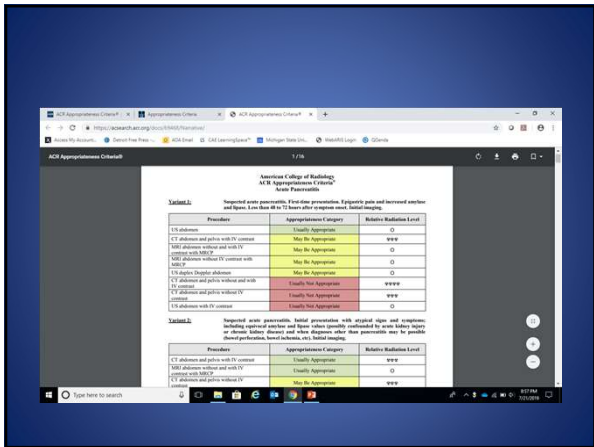
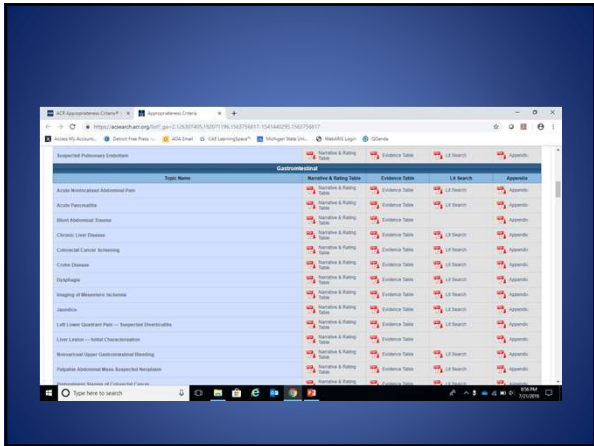
---

---

---

---

---



## Choosing Wisely

- 1. No imaging for uncomplicated HA.
- 2. No F/U for incosequential adnexal cysts.
- 3. No CT for appendicitis in kids until US considered.
- 4. Avoid admission or pre-op CXR with unremarkable Hx and exam.
- 5. Don't image for suspected PE unless mod or high pre-test probability.



10 y/o M Lower Abd Pain  
Mild elev WBC and low grade temp

- A. MRI Abdomen
- B. US Abdomen Attn RLQ
- C. CT Abdomen Limited
- D. X-ray

---

---

---

---

---

---

---

---

- B. US Abdomen Attn RLQ
- If unable to see appendix then CT scan.

---

---

---

---

---

---

---

---

33 y/o F R neck swelling  
Normal thyroid labs, non-tender

- A. CT neck w/ contrast
- B. MRI neck w/ contrast
- C. X-ray soft tissue neck
- D. US neck/thyroid

---

---

---

---

---

---

---

---

- A. CT neck with contrast
- If there is pain over the parotid or submandibular region consider CT neck w/o contrast to assess for salivary Ca++.

---

---

---

---

---

---

---

---

- 40 y/o F Fell c/o persistent HA
- A. MRI Brain w/o contrast
  - B. MRI w/ contrast
  - C. CT scan w/o contrast
  - D. CT scan w/ contrast

---

---

---

---

---

---

---

---

- C. CT scan w/o contrast

---

---

---

---

---

---

---

---

65 y/o M cough and SOB  
chest pain, elevated d-Dimer

- A. CXR
- B. CT chest w/o contrast
- C. CT chest w/ contrast PE protocol
- D. VQ scan

---

---

---

---

---

---

---

---

- C. CT chest w/ contrast PE protocol
- If d-Dimer is normal then CXR.
- If true severe allergy to contrast then VQ or treat empirically.

---

---

---

---

---

---

---

---

60 y/o M LLQ pain  
Constipated, no fever

- A. Abdominal x-ray
- B. CT abdomen and pelvis w/ contrast
- C. CT abdomen and pelvis w/o contrast
- D. MRI abdomen

---

---

---

---

---

---

---

---

- B. CT abdomen and pelvis w/ contrast
- Needs oral contrast to asses the colon, (CA vs diverticular dz)

---

---

---

---

---

---

---

---

- 75y/o F c/o LLE pain relatively new-onset, DM, GFR 35
- A. MRA Abdomen, Pelvis, Runoff w/contrast
  - B. Duplex B/L LE arteries
  - C. CTA Abdomen, Pelvis, Runoff w/ contrast
  - D. Arteriogram

---

---

---

---

---

---

---

---

- D. Arteriogram.
- Less contrast can be used than CTA.
- Doubt MRA due to the low GFR.
- Intervention can be performed at the same time.
- If GFR >40 and SX more remote then CTA or MRA

---

---

---

---

---

---

---

---

66 y/o M c/o HA and poor balance  
Hx Lung Cancer

- A. CT scan brain w/o contrast
- B. CT brain w/ contrast
- C. MRI w/ and w/o contrast
- D. MRI brain w/ contrast

---

---

---

---

---

---

---

---

- C. MRI brain w/ and w/o contrast

---

---

---

---

---

---

---

---

Blooper

- An intern working the night shift was supposed to deliver a stool sample to the lab.
- He inadvertently sent down an empty container.
- The report came back only flatus received.

---

---

---

---

---

---

---

---