




How & Why of Breast MRI


Unveiling the Advantages of MRI in Breast Health




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1

MRI & MRI Safety Considerations




MRI scanners use a strong magnetic field, measured in units of Tesla (T) to produce diagnostic images:

- It's crucial to ensure no ferromagnetic objects, such as jewelry, watches, or certain implanted medical devices are brought into the MRI room as they can become projectiles and cause bodily harm when brought into the magnetic field.
- Patients with certain medical implants or devices, such as pacemakers, defibrillators, or cochlear implants, may not be able to undergo MRI scans due to safety concerns.
- MRI scanners always have a magnetic field whether they are active or idle, so it is important to adhere to all safety precautions when entering an MRI scan room.

Technologist guidance, setup, and proper patient preparation is crucial to achieve a quality diagnostic MRI exam:

- MRI scanners can be noisy and potentially claustrophobic for certain individuals. Technologists will provide hearing protection and/or headphones with audio to reduce the acoustic noise produced from the MRI scanner and to help alleviate anxiety.

Overall, MRI scanners are safe and widely used as diagnostic tools, but it's essential to follow safety protocols and guidelines to minimize risks and ensure the well-being of patients and staff.



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2

Breast MRI Positioning & Techniques




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Breast MRI Coils & Patient Positioning

MRI imaging uses specialized coils (antennas) to capture the images throughout the exam. Coils vary in shape and contour to the body region being imaged.

Positioning and coil placement for a breast MRI exam are crucial for patient comfort to obtain clear and accurate images.

Patient Positioning:

- The patient typically lies face down (prone) on the breast coil with their arms overhead and breasts positioned between the elements of the coil.
- This positioning technique helps to elongate the breast tissue and provide better visualization of axillary lymph nodes breast parenchyma.
- Breast MRI exams can last from 10-30 minutes in length.
 - Patient comfort & technologist setup play a vital role in achieving a high-quality breast MRI exam.
 - Many breast MRI exams are becoming shorter in length due to newer vendor imaging techniques.

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4

Breast MRI Biopsies

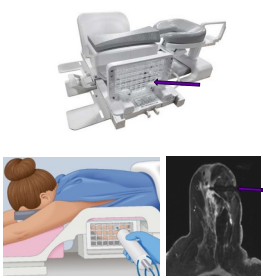

MRI can also be used to aid in breast cancer diagnosis by way of a breast MRI biopsy. MRI biopsies are typically performed when other imaging tests, such as mammograms or ultrasound, indicate a potential abnormality that needs further evaluation.

Patient Preparation:

- Before the biopsy, the patient may undergo imaging tests such as a diagnostic breast MRI to locate the abnormal area in the breast.

Biopsy Procedure:



- The patient will lie prone on a specifically designed coil that allows for biopsy capability to the breast tissue via devices called "grids".
- Real-time MRI imaging along with software aided-tools are used to guide the biopsy needle into the targeted area of interest. This ensures accurate sampling of tissue from the suspicious lesion.
- Breast biopsy procedures are most commonly performed by a breast Radiologist in conjunction with the MRI Technologist and a team member of the breast imaging department.

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5

20-minute Routine Breast MRI Exam






Images courtesy of University of California San Diego Health—San Diego, CA, USA

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6

10-minute Ultrafast Breast MRI Exam

Images courtesy of University of Chicago Medical Center—Chicago, IL, USA

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7

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How and Why of Breast MRI:
Unveiling the Advantages of Breast MRI in Breast Health

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1

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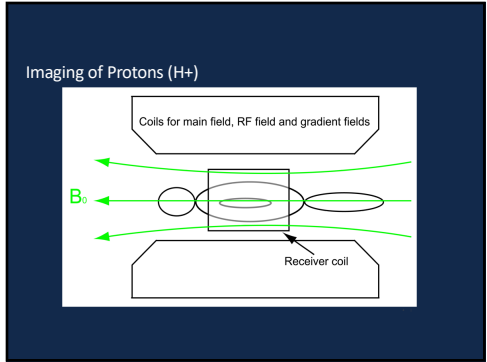
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Outline

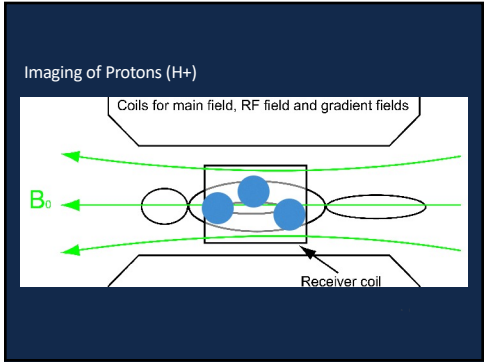
- MR physics in a minute
- Normal workflow in breast imaging
- Indications for a breast MRI
- Breast MR protocol
 - Post processing
- Contrast Agents
- Assessing Breast MRI
 - BIRADS
 - Kinetics

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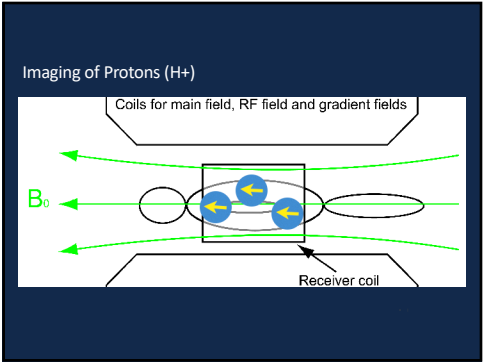
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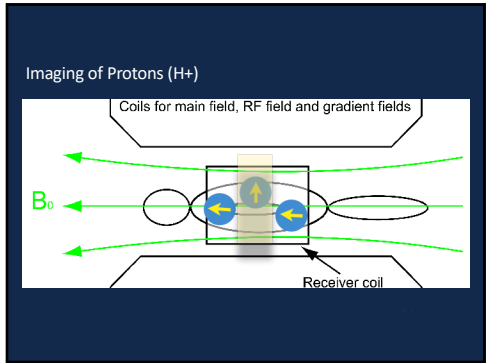
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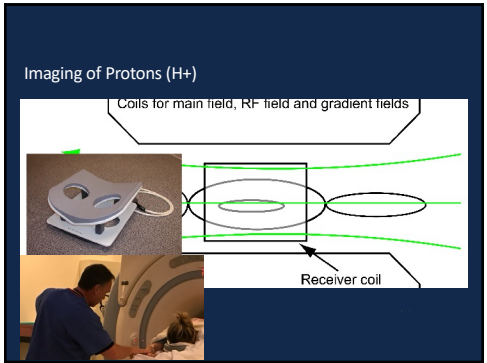
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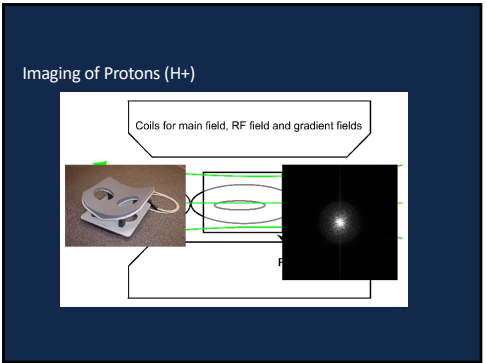
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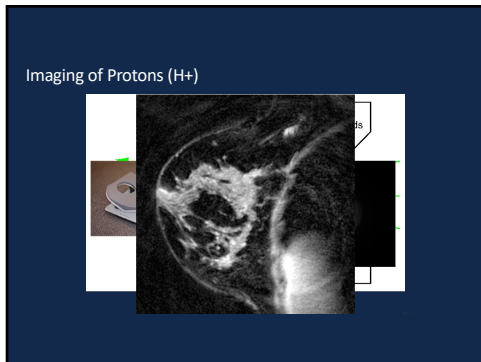
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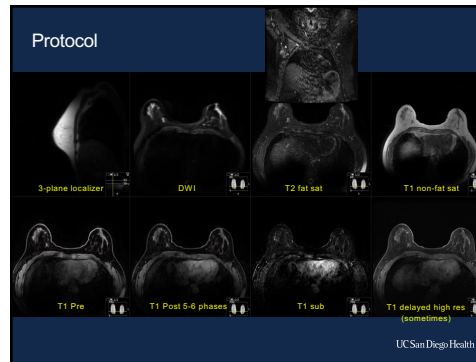
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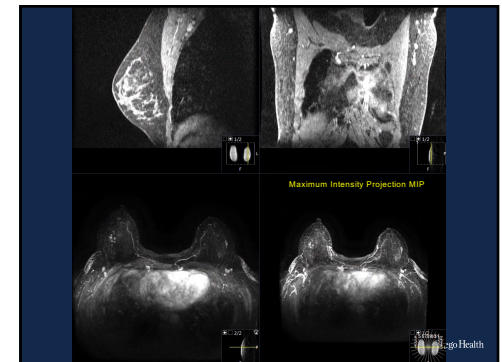
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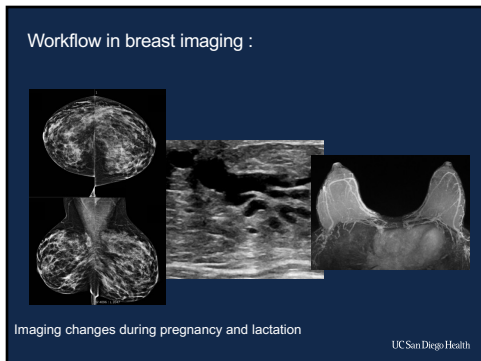
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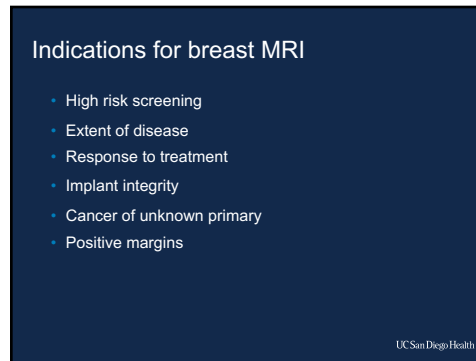
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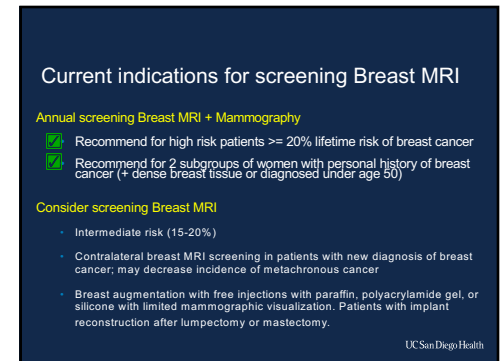
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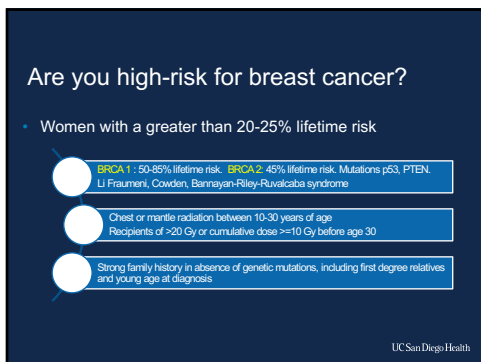
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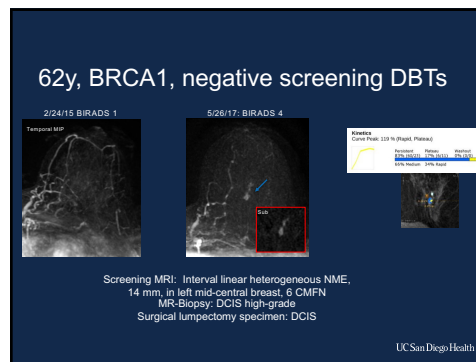
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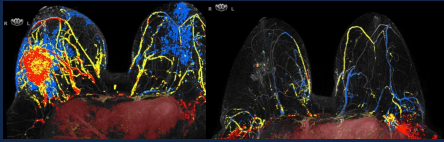


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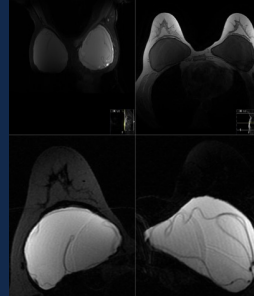
Response to treatment: Pre and post treatment



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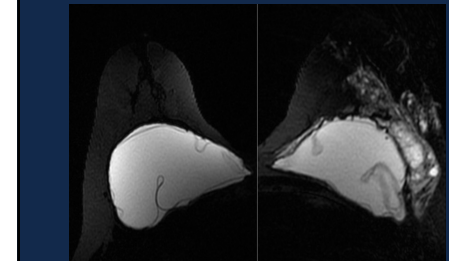
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Implant Integrity



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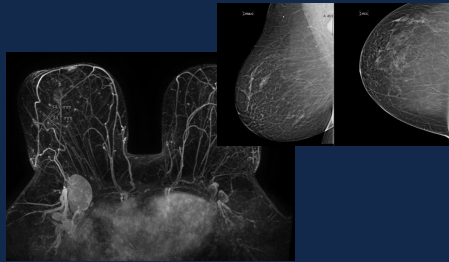
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21

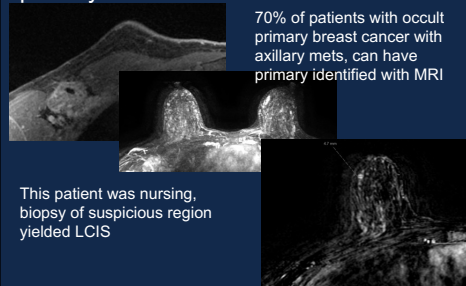
Cancer of Unknown Primary



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Met disease in lymph node, unknown primary

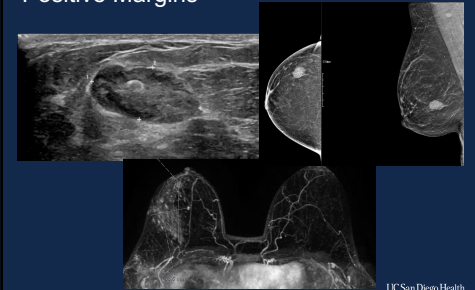


70% of patients with occult primary breast cancer with axillary mets, can have primary identified with MRI

This patient was nursing, biopsy of suspicious region yielded LCIS

23

Positive Margins



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Contrast agents...

25

Gadolinium

- Gadolinium contrast excreted by kidneys
 - $t_{1/2}$ = 1.3 hrs normally
 - $t_{1/2}$ = 10 hrs with GFR 20 – 40 ml/min
 - $t_{1/2}$ = 34 hrs with ESRD
 - Excess exposure to free Gd^{3+} with renal disease can lead to tissue damage
- ** ACR recommendations do not require GFR screening prior to delivery of macrocyclic agents **



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Gadolinium

Brain accumulation

- Mostly concern for *linear* Gd
 - Macrocyclic Gd does not retain as much in brain
- Gd is deposited in the brain even in subjects without severe renal dysfunction
- Higher gadolinium concentration was seen in the dentate nucleus and globus pallidus than in other regions of the brain
- No known clinical significance at this time**
- Of particular interest in high risk screening breast MR since patient may be exposed to annual Gd dose

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Gadolinium

Nephrogenic systemic sclerosis (NSF)

- Mostly a problem for linear Gd, not so much for the macrocyclics
- Rare but serious systemic disease characterized by rapidly progressive fibrosis of the skin and other tissues
- Biggest risk factor for NSF is degree of renal dysfunction
- No treatment for NSF
- Gd is contraindicated in patients with severe acute or chronic renal failure (GFR < 30)
- Note that dialysis will not reverse the effects of Gd

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Contrast Agents

| Trade name | Generic name | Structure |
|------------|---------------------------|----------------------|
| Omniscan | Gadodiamide | Linear nonionic |
| Optimark | Gadoversetamide | Linear nonionic |
| Magnevist | Gadopentetate dimeglumine | Linear ionic |
| Multihance | Gadobenate dimeglumine | Linear ionic |
| Eovist | Gadoxetate disodium | Linear ionic |
| Ablavar | Gadofosveset trisodium | Linear ionic |
| Dotarem | Gadoterate meglumine | Macrocyclic ionic |
| Gadavist* | Gadobutrol | Macrocyclic nonionic |
| Prohance | Gadoteridol | Macrocyclic nonionic |

*Only macrocyclic agent approved for breast MR

* 1 mmol/mL v. others 0.5 mmol/mL

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29

Gadolinium is helpful!

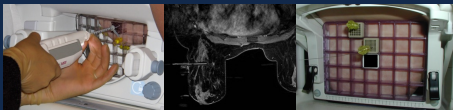
- Patients should not be deprived of crucial, sometimes life-saving medical data from Gd contrast-enhanced MRI
- Potential risk associated with residual Gd concentrations in the brain must be weighed against the clinical benefit of the diagnostic information
- There are no MRI breast emergencies, however there is urgency for both the patient and the referring clinician
- Need to keep up to date on Gd recommendations and safety issues

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MRI procedures

- Role of the breast imager includes MR imaging and MR guided procedures (wire localizations, biopsies)



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Summary

- Basic knowledge of how MRI works allows safe practices
- Screening recommendations for MRI
- Keep up to date on latest information on MR contrast agents
 - Patients appreciate the explanation and are more willing to complete an exam with contrast

32



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33