What is MRI's Role in Breast Screening?

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As women, we've all seen the commercials and public service announcements encouraging us to attend regular breast screening appointments so that, together with our physicians, we can be proactive in identifying anything that might be considered abnormal.

This is because early-stage breast cancer typically manifests without symptoms, and as such can go undetected for a long time. Unfortunately, by the time symptoms appear the cancer has often grown or spread, making treatment more difficult and invasive. This is why it's so important to participate in regular breast screening, using technologies such as 2D and 3D mammography, breast ultrasound, and breast magnetic resonance imaging (MRI) which are among the most reliable methods of detecting such abnormalities early. Statistically[1]:

- About 1 in 8 U.S. women (12.4%) will develop invasive breast cancer over the course of their lifetime.

[1] https://www.breastcancer.org/symptoms/understand_bc/statistics

- In 2018, an estimated 266,120 new cases of invasive breast cancer were expected to be diagnosed in women in the U.S., along with 63,960 new cases of non-invasive (in situ) breast cancer.
- Breast cancer doesn't only affect women; a man's lifetime risk of breast cancer is about 1 in 1,000 and about 2,550 new cases of invasive breast cancer are expected to be diagnosed in men in 2018.

Breast cancer is the most common form of cancer in women, and unfortunately more than 40,000 women in the U.S. alone were expected to die in 2018 as a result. However, mortality rates have been steadily decreasing over the past 2 decades, with women under 50 experiencing the sharpest decline. This promising trend is in part due to increased awareness and earlier detection through broader participation in breast screening programs.

Traditional Mammography Screening

Breast screening typically begins with a mammography exam, which uses a combination of compression and low dose x-ray technology to acquire images of the internal breast tissue. Compression is required for several reasons. First, to ensure the breast remains still to prevent blurring of the resulting image. As well, to reduce the distance the x-rays need to travel through the breast tissue, which improves image quality and reduces the amount of radiation exposure required to capture them. Lastly, compression helps spread out normal breast tissue making it easier for radiologists to detect abnormal tissue that might otherwise be hidden underneath overlapping structures.

There are two forms of x-ray-based mammography imaging; 2-dimensional (2D) mammography and 3-dimensional (3D) digital breast tomosynthesis (DBT). With the former, 2D images are acquired from the front and the side of the breast, which are used in combination to identify and triangulate potential lesions. With the latter, a series of images is taken from many different angles to produce a series of images or 'slices' of the breast that provide better visualization of the entire breast, enabling better and earlier identification of small lesions, and improved detection of

lesions in women with dense breast tissue.

Abnormalities appear on the images as bright white spots, or as apparent changes in tissue structure when compared to previous studies. If no abnormalities are found, the patient is sent on their way with a negative diagnosis. However, when abnormalities are detected it is not always obvious whether they are cancerous or benign. Whenever such an inconclusive discovery is made additional studies will be ordered.

Some abnormalities can be dismissed with additional mammographic imaging, some with a breast ultrasound or breast MRI, and some will have all of the above which, if still indeterminate, will result in a breast biopsy – an invasive procedure that requires extraction of physical tissue samples from the beast. In mammography, the rate of false positives is higher than other imaging specialties, which can unfortunately lead to unnecessary biopsy procedures on healthy women.

Figure 1: 2D Mammography Image

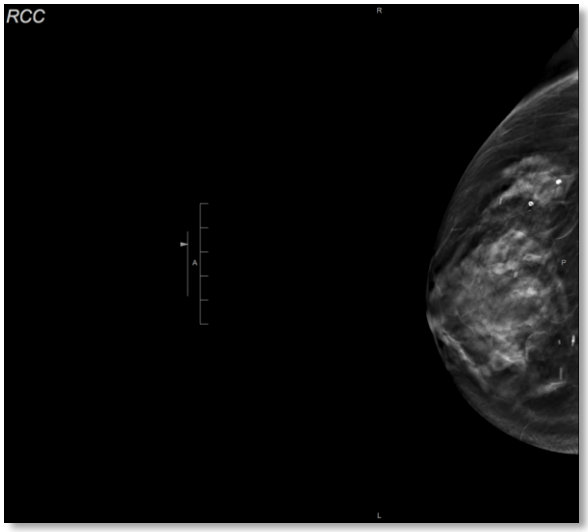
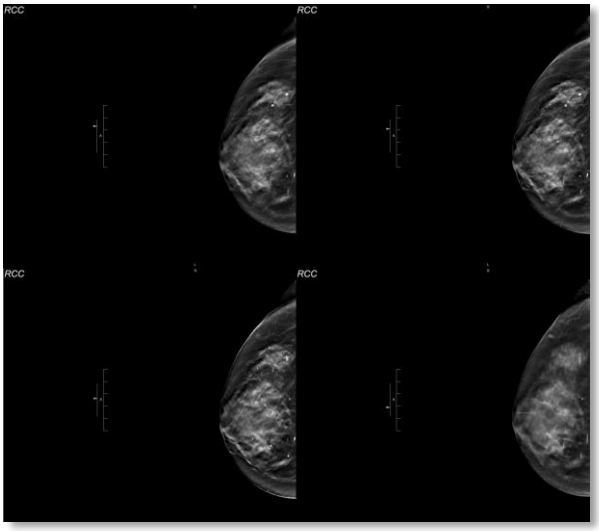


Figure 2: DBT Images/Slices



Advancements in technology position magnetic resonance imaging (MRI) as a tool that offers a safe and non-invasive method to help categorize suspicious breast findings as benign or cancerous when they have been identified as inconclusive through x-ray imaging.

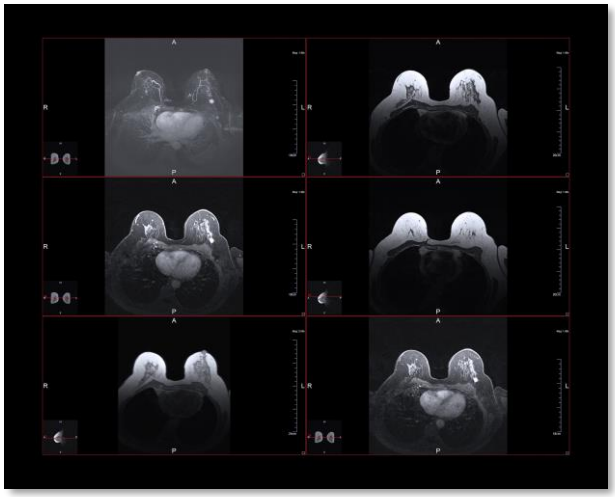
This technology can reduce the number of biopsies performed on benign lesions – making the breast screening process less stressful for women and reducing the amount of cost and effort involved in gathering and analyzing specimens. In fact, according to a study published in the American Journal of Roentgenology, breast MRI was found to be an effective tool for further assessment of inconclusive DBT findings. In their study researchers found that MRI had greater accuracy for both positive and negative predictive values than digital mammography/DBT (see Table 1 below)[2].

Table 1: Breast MRI vs. digital mammography/DBT for equivocal findings

Breast MRI vs. digital mammography/DBT for equivocal findings		
	Digital Mammography/DBT	Breast MRI
Positive predictive value	6%	19%
Negative predictive value	90%	98%

MRI technology uses a large magnet and radio waves to produce highly-detailed images of tissues and structures within the body – much more detailed than what is produced in traditional mammography imaging. Occasionally, a contrast agent is also used to further enhance and outline any abnormalities in the breast. This allows radiologists to better classify lesions on the industry standard Breast Imaging-Reporting and Data System (BI-RADS) scale, which categorizes findings based on its likelihood of malignancy.

Figure 3: Breast MRI Images



[2] https://www.auntminnie.com/index.aspx?sec=sup&sub=wom&pag=dis&ItemID=121857

By enabling more reliable and conclusive results breast MRI technology reduces the rate of false-positives in women's breast imaging procedures. For women with negative or benign findings this not only allows them to safely avoid unnecessary biopsy procedures, it also avoids the stress and worry that accompanies a false-positive or inconclusive diagnosis. For women where cancer has been identified it allows their physicians to act quickly and begin treatment, which can reduce the duration and intensity of the treatment program and leads to better outcomes and a greater likelihood of full recovery.

A Personalized Approach to Breast Screening

The one-size fits-all guideline for breast cancer screening is changing to become more personalized with the evolving knowledge of increased risk factors such as dense breast tissue and genetic mutations. Regular breast screening is essential for proactively identifying the presence of breast cancer and enabling earlier intervention and better outcomes for women, and typically begins with x-ray-based mammography imaging and can be augmented with breast MRI to further investigate and conclusively categorize any inconclusive findings without the use of invasive biopsy procedures. As well, breast MRI provides an effective alternative for women who present challenges such as young age, dense breast tissue, or the presence of implants.

Screening breast MRI is currently recommended for women with 20% or greater lifetime breast cancer risk by the American Cancer Society (ACS), the American College of Radiology (ACR), and the Society for Breast Imaging (SBI).

Unfortunately, supplemental breast MRI screening is currently underused with higher-risk women[3]. Understanding how breast MRI can be used as a tool to supplement breast screening studies, help radiologists more accurately assess breast lesions not fully identified by mammography and ultrasound, or in place of traditional mammography for high-risk patients will enable more patients and physicians to reap the benefits of this technology ■

[3] https://www.auntminnie.com/index.aspx?sec=sup&sub=wom&pag=dis&ItemID=121083

Need help defining or executing your Women's Health Imaging strategy?

Once an outlier, Women's Health has evolved into an integral component of departmental and enterprise imaging strategies. Consolidation of mammography information into the EHR, transitioning from 2D to 3D DBT (digital breast tomosynthesis), and implementation of a universal diagnostic viewer are just a few ways organizations are looking to enhance their Women's Imaging service line.

With over 20 years of practical experience in Women's Imaging, we can help you create stand-alone or integrated enterprise strategies that overcome the challenges associated with ever-changing regulatory requirements, state and government mandates, shifting reimbursements, and technological advances to deliver superior services for women's care.

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