

## Are You Dense? Handy Patient Guide to Screening Options for Dense Breasts★

The purpose of breast screening is to find cancer **EARLY** when there are better survival outcomes & more treatment options

<b>SCREENING TEST</b>	<b>Approximate CANCER Detection Rate per 1000 Screenings</b>	<b>BENEFITS</b>	<b>POTENTIAL HARMS</b>	<b>OTHER CONSIDERATIONS</b>
<b>2D Mammography</b>	3-5	15 to 40% reduction in deaths (Randomized Controlled Trials)	Radiation, False Negatives-Cancer masked by dense tissue Under diagnosis	Standard for Front-line Breast Cancer Screening Readily available Potential for over diagnosis
<b>3D Mammography/Tomosynthesis</b>	4-7 (2D+3D)	15 to 40% reduction in deaths (Randomized Controlled Trials) Less callbacks	Radiation, False Negatives-Cancer masked by dense tissue Under diagnosis	Becoming Standard of Care Current Breast Cancer Screening Trial 2D vs 3D (TMIST)
<b>Contrast Enhanced Spectral Mammography (CESM)</b>	Detects more cancer than mammography Similar detection as MRI (see below)	Less expensive & shorter exam than MRI w/similar yield	Injection - Iodine contrast	Mostly used when mammography is inconclusive
<b>Hand-Held Ultrasound</b>	3-7 (as secondary screen after 'normal' mammo in women w/ dense breasts)	No Ionizing Radiation No Compression Readily Available	False Positives – Biopsies that end up being negative for cancer	Operator Dependent/Practice & Training Reduces False Positives/ Insurance coverage varies depending on coding/state law/patient plan
<b>Automated Ultrasound</b>	2-4 (as secondary screen after 'normal' mammo in women w/ dense breasts)	No Ionizing Radiation/No Compression/Designed to reduce operator dependence	Mixed findings on reducing False Positives	Not readily available/Patient may be recalled for second look/ Insurance coverage varies depending on coding/state law/patient plan
<b>Magnetic Resonance Imaging (MRI)</b>	11 (average-risk) to 18+ (high risk)	High Sensitivity in seeing cancer	Gadolinium Contrast Injection Potential for false positives	Mostly Reserved for high risk & women w/genetic mutations/ Confined space & patient size may lead to non-compliance/ Costly
<b>Abbreviated/Fast MRI</b>	15-18	High Sensitivity in Seeing Cancer/Shorter exam time & reading time than traditional MRI w/similar results	Gadolinium Contrast Injection Potential for false positives	Not readily available Multi-Center Trial for women with dense breast tissue ECOG/ACRIN EA1141
<b>Molecular Breast Imaging</b>	8-9	Sensitive to finding cancer in dense breasts Less false positives	Radioactive Tracer Injection/Whole body radiation	Not readily available/Fasting before study/Ask about dose as radiation dose varies

## ★ References - Guide will be updated as new studies are published

### 2D Mammography

**Duffy SW**, Tabar L, Fagerberg G, et al. Breast screening, prognostic factors and survival-results from the Swedish Two County Study. Br J Cancer 1991; 64:1133-8. **Nelson HD**, Cantor A, Humphrey L, et al. Rockville (MD): Screening for Breast Cancer: A Systematic Review to Update the 2009 U.S. Preventive Services Task Force Recommendation [Internet]. Agency for Healthcare Research and Quality (US); 2016 Jan. **Nelson HD**, Pappas M, Cantor A, Griffin J, et al. Harms of Breast Cancer Screening: Systematic Review to Update the 2009 U.S. Preventive Services Task Force Recommendation. Ann Intern Med. 2016 Feb 16;164(4):256-67. **Tabar L**, Vitak, B, Chen, T et al. Swedish Two-County Trial: Impact of Mammographic Screening on Breast Cancer during 3 Decades. Radiology 2011; Vol 260 Issue 3.

### 3D/Tomosynthesis

**Conant EF**, Beaber EF, Sprague BL, et al. Breast cancer screening using tomosynthesis in combination with digital mammography compared to digital mammography alone: A cohort study within the PROSPR consortium. Breast cancer research and treatment. 2016;156(1):109-116. **Friedewald SM**, Rafferty EA, Rose SL, et al.: Breast cancer screening using tomosynthesis in combination with digital mammography. JAMA 2014;311 (24): 2499-507. **Houssami N**, Macaskill P, Bernardi D, et al. Breast screening using 2D-mammography or integrating digital breast tomosynthesis (3D-mammography) for single-reading or double-reading-- evidence to guide future screening strategies. Eur J Cancer. 2014 Jul;50(10):1799-807. **Tagliafico AS**, Calabrese M, Mariscotti G, et al. Adjunct screening with tomosynthesis or ultrasound in mammography-negative dense breasts (ASTOUND): Interim report of a prospective comparative trial. J Clin Oncol, 2016

### Contrast Enhanced Spectral Mammography

**Fallenberg EM**, Dromain C, Diekmann F, et al. Contrast-enhanced spectral mammography versus MRI: initial results in the detection of breast cancer and assessment of tumour size. Eur Radiol, 2014;(24):256–264. **Mori M**, Akashi-Tanaka S, Suzuki S, et al. Breast Cancer. Diagnostic accuracy of contrast-enhanced spectral mammography in comparison to conventional full-field digital mammography in a population of women with dense breasts. 2017;24(1):104-110.

### Hand-held Ultrasound

**Berg WA**, Zhang Z, Lehrer D, et al. Detection of breast cancer with addition of annual screening ultrasound or a single screening MRI to mammography in women with elevated breast cancer risk. 2012;307(13): 1394-1401. **Gordon PB**, Goldenberg SL. Malignant breast masses detected only by ultrasound: a retrospective review. Cancer 1995;(76):626-30. **Hooley RJ**, Greenberg KL, Stackhouse RM, et al. Screening US in patients with mammographically dense breasts: initial experience with Connecticut Public Act 09-41. Radiology, 2012;265:59–692. **Kolb TM**, Lichy J, Newhouse JH. Comparison of the performance of screening mammography, physical examination and breast US and evaluation of factors that influence them: an analysis of 27,825 patient evaluations. Radiology, 2002;225:165-75. **Weigert J**. The Connecticut Experiment; The third installment: 4 years of screening women with dense breasts with bilateral ultrasound. The Breast Journal, 2017,23(1)34-39.

### Automated Ultrasound

**Brem RF**, Tabar L, Duffy SW, et al. Assessing improvement in detection of breast cancer with three-dimensional automated breast US in women with dense breast tissue: The Somolnsight Study. Radiology. 2015;274(3):663–73. **Kaplan, S**. Automated Breast Ultrasound. Radiologic Clinics, 2014, Vol 52(3)539-546. **Kelly KM**, Dean J, Comulada WS, Lee SJ. Breast cancer detection using automated whole breast ultrasound and mammography in radiographically dense breasts. Eur Radiol 2010; 20:734-42.

### Magnetic Resonance Imaging (MRI)

**McLaughlin, SA**. Current controversies surrounding MRI screening for breast cancer. American Journal of Hematology/Oncology. 2015. American Journal of Hematology/Oncology. **Schrading, S** & Kuhl, C. MRI screening of women at average risk of breast cancer. Journal of Clinical Oncology 2013 31:26. **Warner E**, Plewes DB, Hill KA, et al: Surveillance of BRCA1 and BRCA2 mutation carriers with magnetic resonance imaging, ultrasound, mammography, and clinical breast examination. JAMA 2004,292 (11): 1317-25.

### Abbreviated/Fast MRI

**Chen SQ**, Huang M, Shen Y-Y, et al. Abbreviated MRI protocols for detecting breast cancer in women with dense breasts. Korean Journal of Radiology. 2017;18(3):470-475. **Harvey SC**, Di Carlo PA, Lee et al. An abbreviated protocol for high-risk screening breast MRI saves time and resources. J Am Coll Radiol. 2016, R74-R80. **Kuhl CK**. Abbreviated breast MRI for screening women with dense breast: The EA1141 Trial. Br J Radiol. 2017. **Strahle DA**, Pathak DR, Sierra A, et al. Systematic development of an abbreviated protocol for screening breast magnetic resonance imaging. Breast Cancer Res Treat. 2017 Apr;162(2):283-295.

### Molecular Breast Imaging

**Rhodes DJ**, Hruska CB, Connors AL, et al. Journal Club. Molecular breast imaging at reduced radiation dose for supplemental screening in mammographically dense breasts. Am J Roentgenol. 2015, 204(2):241-51. **Shermis RB**, Redfern RE, Burns J, Kudrolli H. Molecular breast imaging in breast cancer screening and problem solving. Radiographics. 2017 Sep-Oct;37(5):1309

### Dense Breast Tissue

**Boyd N**, Guo H, Martin L et al. Mammographic density and the risk and detection of breast cancer. N Engl J Med 2007; 356:227-36. **Cappello, NM** Decade of normal mammography reports-The happygram. J Am Coll Radiol 2013;10:903-908. **Engmann, N**, Goldmakani, M, Miglioretti, D. Population-Attributable Risk Proportion of Clinical Risk Factors for Breast Cancer. AMA Oncol 2017;3(9):1228-1236. **Mandelson MT**, Oestreicher N, Porter PL, et al. Breast density as a predictor of mammographic detection: comparison of interval and screen-detected cancers. J Natl Cancer Inst 2000;92:1081-7. **Wolfe JN**. Breast patterns as an index for risk for developing breast cancer. AJR Am J Roentgenol 1976;126:1130-7.