

AMSER Case of the Month

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72-year-old Female with LVAD Presents for Standard Breast Screening Exam

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Patient Presentation

- HPI: 72-year-old female presents for a routine screening mammogram
- PMHx: She had an Abbott HeartMate 3 LVAD device placed about 2 years prior to the mammogram

Pertinent Labs

- No pertinent labs for this patient

What Imaging Should We Order?

Select the Applicable ACR Appropriateness Criteria

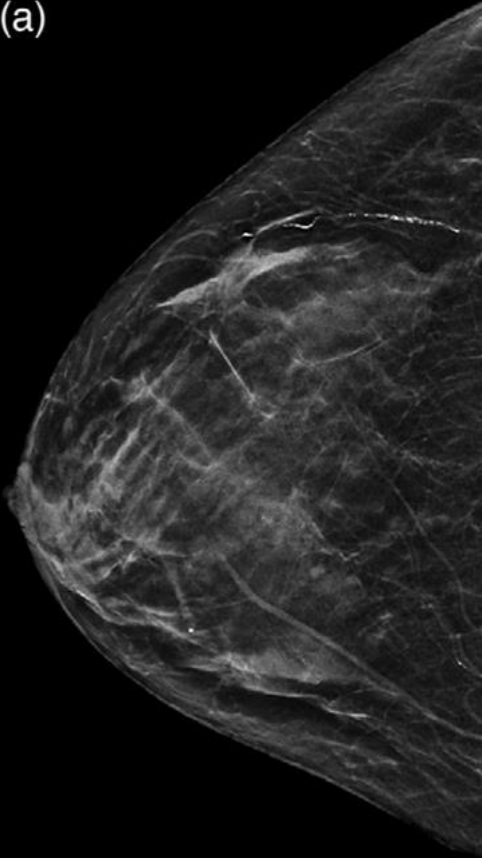
Scenario	Scenario ID	Procedure	Adult RRL	Peds RRL	Appropriateness Category
Breast cancer screening, average risk	3197134	● Digital breast tomosynthesis screening	0.1-1mSv ☢☢☢		Usually appropriate
		● Mammography screening	0.1-1mSv ☢☢☢		Usually appropriate
		● US breast	0 mSv O	0 mSv [ped] O	May be appropriate
		● MRI breast without and with IV contrast	0 mSv O	0 mSv [ped] O	May be appropriate
		● MRI breast without and with IV contrast abbreviated	0 mSv O	0 mSv [ped] O	May be appropriate
		● Mammography with IV contrast	0.1-1mSv ☢☢☢		Usually not appropriate
		● MRI breast without IV contrast	0 mSv O	0 mSv [ped] O	Usually not appropriate
		● MRI breast without IV contrast abbreviated	0 mSv O	0 mSv [ped] O	Usually not appropriate
		● Sestamibi MBI	1-10 mSv ☢☢☢		Usually not appropriate



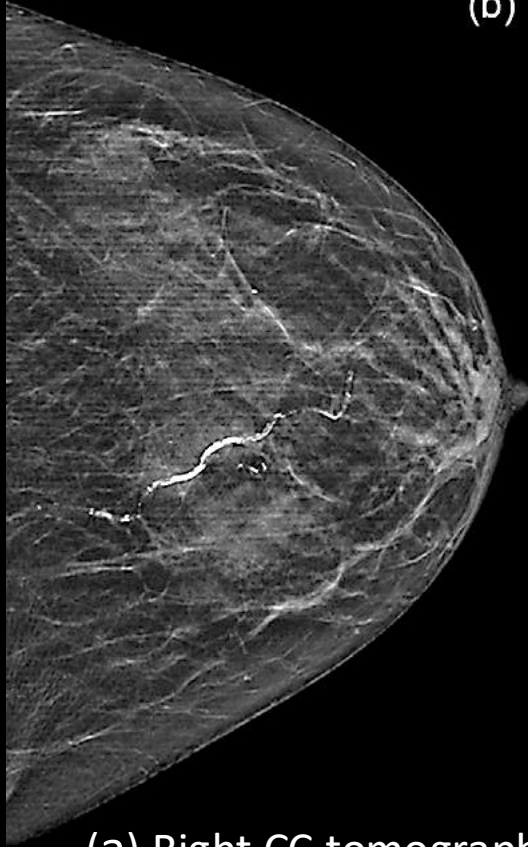
Digital breast tomosynthesis screening was ordered

Findings (unlabeled)

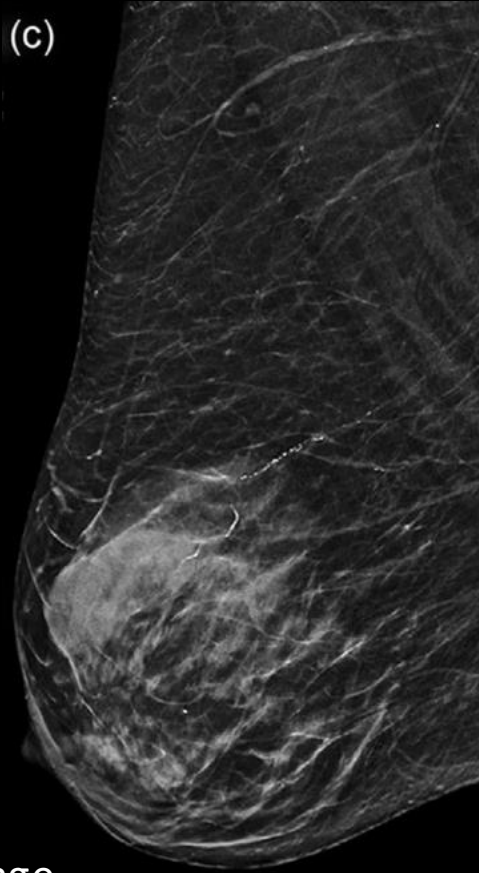
(a)



(b)



(c)



(d)

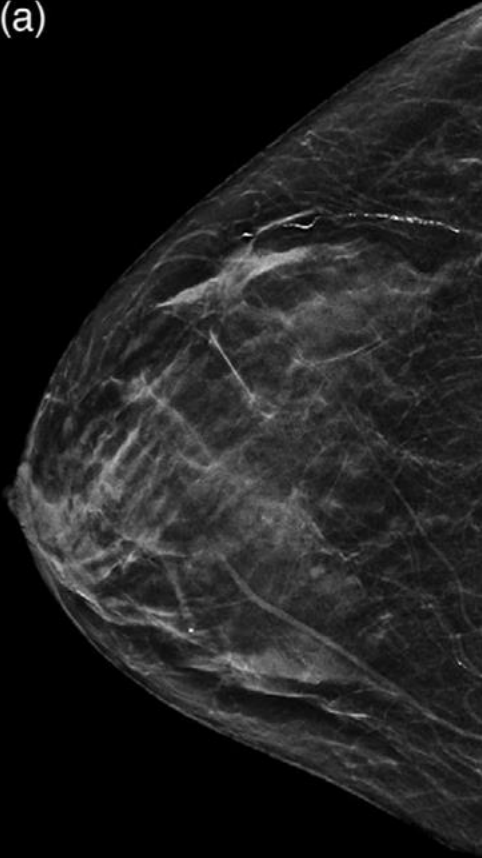


- (a) Right CC tomographic image
- (b) Left CC tomographic image
- (c) Right MLO tomographic image
- (d) Left MLO tomographic image

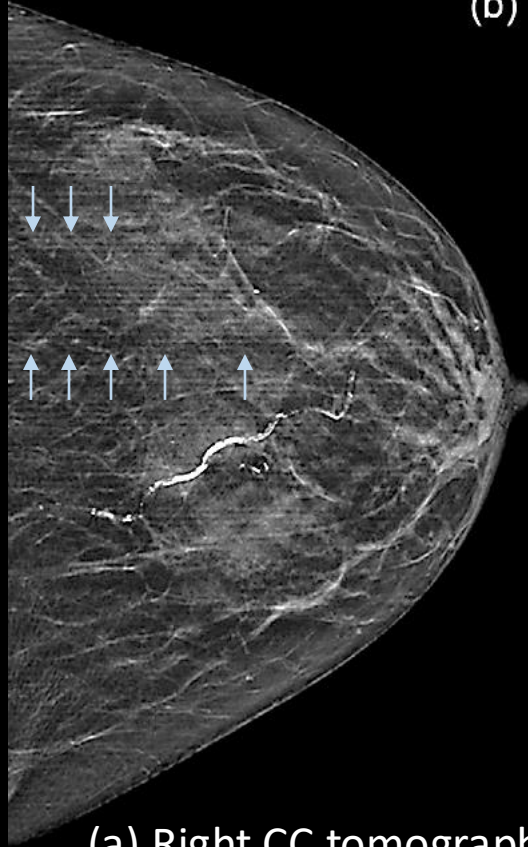
Arrows indicated diffuse linear artifacts throughout the LCC and LMLO projections

Findings (labeled)

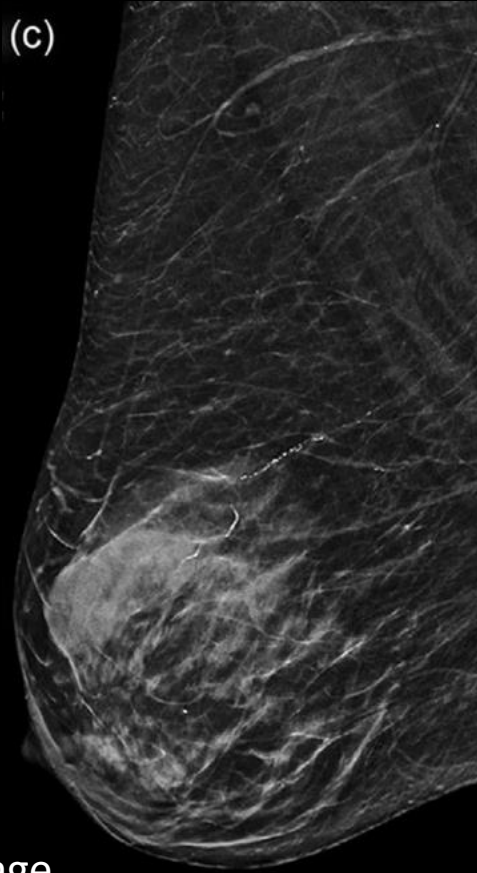
(a)



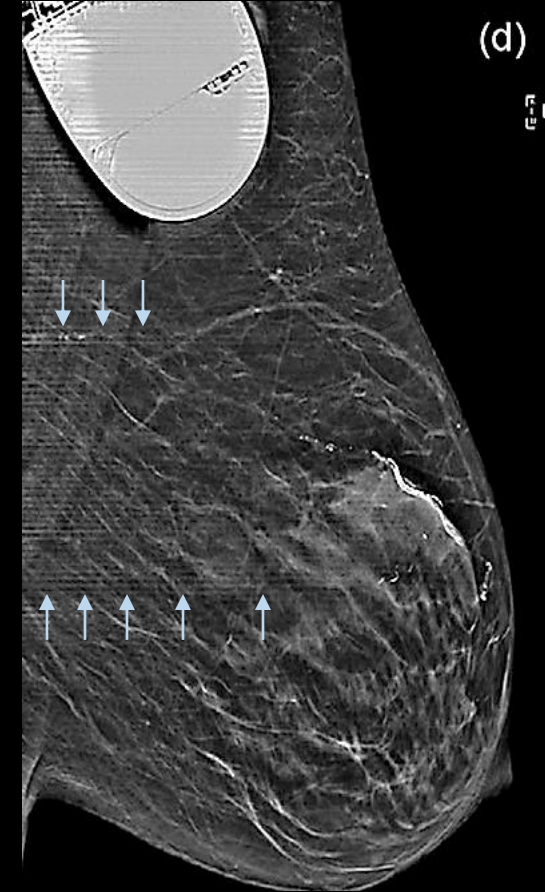
(b)



(c)



(d)



- (a) Right CC tomographic image
- (b) Left CC tomographic image
- (c) Right MLO tomographic image
- (d) Left MLO tomographic image

Impression of Findings

- All imaging of the left breast showed linear artifacts oriented in the AP dimension
 - There were no artifacts demonstrated on the right breast on any images
- The linear artifacts developed in a spatially periodic pattern with a periodicity of around 1.4 mm
- Upon repeat imaging, the same artifacts were found
 - No similar artifacts on other exams were demonstrated that day at the imaging center
- Previous imaging for this patient prior to her LVAD placement disclosed no similar artifacts

Final Diagnosis:

Linear artifact caused by LVAD placement

Case Discussion

- The differential diagnosis includes grid artifact and artifact from the recently placed LVAD.
 - Grid artifact presents as regularly spaced linear artifacts in the image due to malfunction/malposition of the scatter grid. This artifact occurs intermittently, and repeating the image will often resolve this issue.
 - Linear artifact from a LVAD is a rather recent phenomenon due to increased utilization of these devices by cardiologists. The proximity of the device to the left breast, the reproducibility of the artifact, and the absence of the artifact on the right side make artifact from LVAD device the most likely diagnosis.

Case Discussion

- Since the purpose of screening mammography is to detect subtle findings, any artifact that degrades image quality may reduce sensitivity or lead to radiographic misinterpretation
- As the incidence of LVAD placement increases, in part due to higher patient life expectancy, understanding modality-specific imaging limitations becomes increasingly important
 - MRI is contraindicated in patients with LVADs due to the potential for patient harm and damage to the device
 - Ultrasound remains a viable imaging modality for patients with LVADs, although the device can obscure visualization of breast tissue posterior to the device. This limitation can be fixed by angling the transducer.
- Awareness of this emerging issue is pertinent to accurate image interpretation and to avoid unnecessary image repeats as the artifact will not resolve with attainment of additional images
 - Decreased mammography image quality from cardiac devices is not a new discovery. The decreased diagnostic efficacy of imaging has been noted in the literature in patients with pacemakers (2).

Case Discussion

- LVADs create ECG electrical artifacts (3) which further demonstrate the importance of the healthcare team's knowledge of a patient's LVAD status
- As the incidence of LVAD-related screening mammography artifacts increases, it is important to explore additional techniques to reduce these artifacts
 - There are various techniques for decreasing other types of artifacts (4), so there is a possibility to develop specific techniques for LVAD-related artifacts
 - Such suggested techniques include using a notch/bandstop spatial frequency filter on images with artifacts or improving the electronic shielding of LVAD motors to reduce interference on close c

References

1. American College of Radiology. ACR Appropriateness Criteria®. Available at <https://acsearch.acr.org/list> . Accessed <10/24/2025>.
2. Nissan N, Moss Massasa EE, Bauer E, et al. Pacemaker in patients undergoing mammography: A limitation for breast cancer diagnosis?. *J Med Imaging Radiat Oncol*. 2023;67(6):587-594. doi:10.1111/1754-9485.13524
3. Loring Z, Sen S, Black-Maier E, et al. Reducing ECG Artifact From Left Ventricular Assist Device Electromagnetic Interference. *Journal of the American Heart Association*. 2020; 9(16). doi:10.1161/JAHA.20.017563
4. Geiser, W., Einstein, S., & Yang, W.-T. (2018, July 31). *Artifacts in Digital Breast Tomosynthesis / AJR*. American Journal of Roentgenology. doi:10.2214/AJR.17.19271
5. Nisbet, A., Ahmadian, D., Vedantham, S., & Chiang, J.-T. A. (2024, January 5). An unusual artifact observed on screening mammography in a patient with an LVAD. *Journal of Applied Clinical Medical Physics*. doi:10.1002/acm2.14255