AJR Accepted Manuscript

Lymphadenopathy on Extent-of-Disease Breast MRI: Proposed Audit Metrics

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https://doi.org/10.2214/AJR.25.34159
Accepted: December 15, 2025
Article Type: Research Letter
Article Section: Breast Imaging

The complete title page, as provided by the authors, is available at the end of this article.

Recommended citation:
Cohen EO, Tso HH, Shin K, et al. Lymphadenopathy on Extent-of-Disease Breast MRI: Proposed Audit Metrics. *AJR* 2025 Dec 24 [published online]. Accepted manuscript. doi:10.2214/AJR.25.34159

A supplement to this article is available at:
https://www.ajronline.org/doi/suppl/10.2214/AJR.25.34159/suppl_file/25_34159_suppl.pdf

Preoperative breast MRI performed for extent-of-disease (EOD) evaluation not only helps detect occult synchronous breast malignancy but also provides detailed assessment for potential lymph node (LN) metastases [1]. The BI-RADS v2025 Manual recommends auditing EOD MRI examinations for abnormal interpretation rate (AIR), PPV, and additional cancer detection rate (CDR) [2]. Such audits are not recommended to evaluate performance in detecting abnormal axillary and internal mammary (IM) LNs (hereafter, lymphadenopathy), which may represent false-positive results. However, lymphadenopathy on EOD MRI is clinically relevant, for example upstaging disease and/or guiding treatment decisions. This study aimed to use BI-RADS-based audit metrics to evaluate the performance of EOD MRI in detecting lymphadenopathy.

The institutional review board approved this HIPAA-compliant retrospective study, waiving written informed consent. The reports of all breast MRI examinations from January 1, 2021 to December 31, 2022 were reviewed to identify EOD MRI examinations performed in patients with newly diagnosed breast cancer; such patients formed the final study sample. All patients were included in another study evaluating feasibility of EOD MRI audits [3]. The institution performs EOD MRI only after diagnostic mammography and, in patients with invasive breast cancer, staging whole-breast ultrasound that includes evaluation of ipsilateral regional (i.e., axillary levels 1-3 and IM) nodal basins. Axillary or IM lymphadenopathy detected on ultrasound undergoes image-guided biopsy before EOD MRI.

The reports of the EOD MRI examinations were reviewed to identify those reporting lymphadenopathy. The presence of one or more reported abnormal LNs at a given nodal basin was considered to represent a single finding of lymphadenopathy for that basin. The EMR was reviewed to identify 1-year lymphadenopathy outcomes. The following metrics were calculated to parallel the BI-RADS v2025 EOD MRI audit [2]: AIR for lymphadenopathy (AIR_{LN}), PPV2 for lymphadenopathy (PPV_{2LN}, percentage of lymphadenopathy classified as metastatic by image-guided biopsy or imaging follow-up), PPV3 for lymphadenopathy (PPV_{3LN}, percentage of biopsied lymphadenopathy yielding metastatic results), and additional CDR for lymphadenopathy (additional CDR_{LN}, metastatic

lymphadenopathy diagnosed beyond pre-examination known disease per 1000 examinations). The Supplemental Methods provide additional details.

Of 7196 breast MRI examinations performed during the study period, 1533 were EOD examinations. These examinations were performed in 1533 unique patients (mean age, 55.2 years), forming the final study sample. Of the EOD MRI examinations, 53 (3.5%) revealed lymphadenopathy. Table S1 summarizes patient and tumor characteristics for all cases and those with lymphadenopathy; Table 1 summarizes lymphadenopathy characteristics and outcomes; Figure 1 summarizes patient selection and outcomes stratified by overall BI-RADS categories on EOD MRI. Forty-six cases of lymphadenopathy were characterized by biopsy or further imaging; seven were lost to follow-up. AIR_{LN} was 3.46% (53/1533 [95% CI: 2.55-4.37%]), PPV_{2LN} was 13.21% (7/53 [95% CI: 4.10-22.32%]), PPV_{3LN} was 26.09% (6/23 [95% CI: 8.14-44.04%]), and additional CDR_{LN} was 4.57 per 1000 (1000*7/1533 [95% CI: 1.20-7.94]).

Universally adopted and validated criteria for LN evaluation on breast MRI are lacking, contributing to interreader variability and potentially suboptimal diagnostic performance. One study reported varying reader accuracy in detecting LN metastases on breast MRI using the Node Reporting and Data System [1]. Another study reported lower radiologist performance in detecting lymphadenopathy than in detecting the primary lesion's quadrant or multiplicity for an abbreviated MRI protocol [6]. Such challenges support the utility of including lymphadenopathy-related metrics within quality improvement efforts.

The observed PPV_{3LN} was within the suggested range for PPV3 for screening mammography audits [2]. However, low percentages of EOD MRI examinations showed lymphadenopathy or yielded pathologically confirmed LN metastases. We believe that such results are acceptable given the management impact of precise nodal staging. Benchmarks are unavailable for lymphadenopathy-focused performance reviews as have been established for screening mammography audits [2]. Thus, thresholds would need to be determined if EOD MRI audits were to include lymphadenopathy-related metrics.

Study limitations include the paucity of lymphadenopathy on EOD MRI, review of only MRI reports, cases of lymphadenopathy lost to follow-up, and institutional workflow incorporating regional nodal staging with ultrasound before EOD MRI, limiting generalizability.

In conclusion, on EOD MRI examinations, AIR for lymphadenopathy was 3.46%, PPV of biopsied lymphadenopathy was 26.09%, and 4.57 cases of additional metastatic lymphadenopathy were diagnosed per 1000 examinations. Inclusion of lymphadenopathy-related metrics could aid quality improvement efforts and warrants consideration for future revisions to EOD MRI audit recommendations.

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Table 1. Lymphadenopathy characteristics and outcomes among 53 EOD MRI examinations showing abnormal lymph nodes

Characteristic	Value
Location	
Ipsilateral axillary level 1	30
Ipsilateral axillary level 2	1
Ipsilateral axillary level 3	2
Ipsilateral axillary levels 1 and 2	1
Ipsilateral axillary levels 1 and 3	1
Ipsilateral internal mammary	8
Contralateral axillary level 1	7
Contralateral internal mammary	3
Outcome	
Benign by biopsy	17
Benign by 1-year ultrasound follow-up	22
Metastatic by biopsy[a]	6
Metastatic by FDG PET/CT[b]	1
Lost to follow-up	7
Treatment impact from detection of metastatic lymph nodes by EOD MRI	
Additional chest wall radiation	3
ALND rather than SLNB	1
No change	2
Not applicable (patient death before treatment)	1

Note—ALND = axillary LN dissection, EOD = extent-of-disease, LN = lymph node, SLNB = sentinel LN biopsy.

[a]Four cases of ipsilateral axillary lymphadenopathy and two cases of ipsilateral internal mammary lymphadenopathy

[b]Single case of ipsilateral internal mammary lymphadenopathy

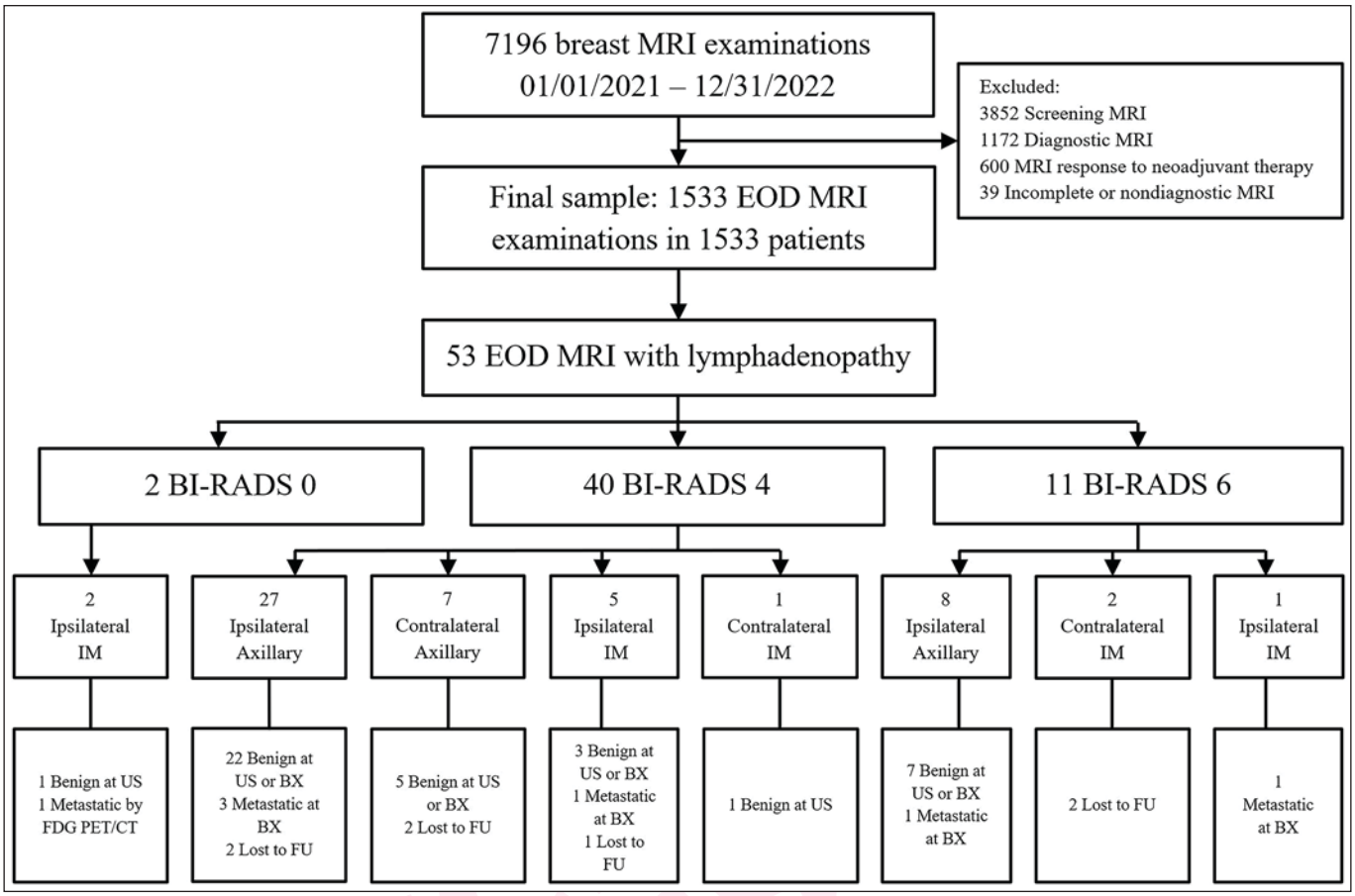

Fig. 1—Flowchart demonstrating patient selection process and outcomes for lymphadenopathy reported on EOD MRI stratified by examination's overall BI-RADS assessment category (assigned at discretion of interpreting radiologist). DCIS = ductal carcinoma in situ, EOD = extent-of-disease, IDC = invasive ductal carcinoma, ILC = invasive lobular carcinoma, IM = internal mammary, IMC = invasive mammary carcinoma; US = ultrasound; FU = follow-up.

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Perry: None
Sun: None
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ARTICLE TYPE: Research Letter

FUNDING: None

DISCLOSURES: No disclosures relevant to the subject matter of this article.

ACKNOWLEDGEMENTS: The authors would like to acknowledge support by the NIH/NCI under award number P30 CA016672.