Original Article

Current Research in MRI
Curr Res MRI

Anatomical Variations of Axillary Lymph Nodes Affect the Accuracy of Preoperative Breast MRI Nodal Staging

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Cite this article as: Bingöl K, Acar TB. Anatomical variations of axillary lymph nodes affect the accuracy of preoperative breast MRI nodal staging. *Curr Res MRI*. [Epub Ahead of Print]

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Received: July 02, 2026 **Revision Requested:** July 05, 2026 **Last Revision Received:** July 21, 2026
Accepted: July 23, 2026 **Epub:** 17.08.2026

DOI: 10.4274/CurrResMRI.2026.26154

Abstract

Objective: To determine whether anatomical nodal distribution patterns of axillary lymph nodes influence the accuracy of breast magnetic resonance imaging (MRI) nodal staging in patients with breast cancer.

Methods: This retrospective study included 156 consecutive patients with newly diagnosed breast cancer who underwent contrast-enhanced breast MRI followed by histopathological nodal evaluation. Two experienced breast radiologists, blinded to pathology results, independently reviewed all MRI examinations. The axillary nodal distribution pattern, the presence of interpectoral (Rotter) lymph nodes, the presence of internal mammary lymph nodes, and the clustered nodal pattern were recorded. MRI-based clinical nodal staging was compared with histopathological nodal status. Multivariable logistic regression identified independent predictors of false-negative MRI nodal staging.

Results: Histopathological nodal metastases were identified in 58 patients (37.2%). Breast MRI demonstrated a sensitivity of 70.7% [95% confidence interval (CI), 57.3-81.9%] and a specificity of 84.7% (95% CI, 76.0-91.2%) for detecting nodal metastases. False-negative MRI staging was significantly more frequent among patients with a level II/III-dominant nodal distribution than among those with a level I-dominant pattern (33.3% vs. 25%, P=0.02). Patients with interpectoral (Rotter) lymph nodes had a higher false-negative rate than patients without Rotter lymph nodes (50% vs. 20%, P=0.01). Both a level II/III-dominant nodal distribution [adjusted odds ratio (OR), 2.6; 95% CI, 1.1-6.4] and the presence of interpectoral (Rotter) lymph nodes (adjusted OR, 2.9; 95% CI, 1.2-7.1) independently predicted false-negative MRI nodal staging.

Conclusion: Anatomical distribution patterns of axillary lymph nodes influence the accuracy of MRI nodal staging. Assessing nodal distribution, particularly a level II/III-dominant pattern and interpectoral (Rotter) lymph nodes, may improve nodal evaluation and reduce false-negative rates in MRI staging.

Keywords: Breast neoplasms, magnetic resonance imaging, axilla, lymph nodes, neoplasm staging, sentinel lymph node biopsy

INTRODUCTION

Breast cancer is common worldwide.[1,2] Preoperative nodal assessment affects the choice and extent of axillary surgery and adjuvant treatment.[3,4] The practical limitation of axillary imaging is not simply whether lymph nodes can be visualized, but whether metastatic nodes are missed when they retain benign morphological features or are located in less routinely scrutinized nodal basins.

Ultrasonography is widely used for axillary evaluation, whereas breast magnetic resonance imaging (MRI) provides multiplanar coverage of axillary levels I-III and regional nodal basins.[5-8] Most MRI studies, however, have focused on nodal size, cortical thickness, hilar morphology, shape, and enhancement rather than on the spatial distribution of lymph nodes.[8-10]

Yoshimura et al.[11] reported that 16 of 17 false-negative axillae contained only normally sized nodes, highlighting the limitation of morphology-based assessment for small-volume disease. Hyun et al.[12] examined whether cN0 MRI could exclude advanced pN2-3 disease, whereas Yun et al.[13] evaluated clinicopathological factors associated with false MR computer-aided nodal assessments. More recent work has emphasized complete regional nodal coverage and the ability of MRI to exclude substantial nodal burden.[14]

By contrast, the effect of the distribution of lymph nodes within the axillary and regional nodal basins has been less directly examined. Surgical studies have established that interpectoral (Rotter) nodes may harbor metastases and occasionally represent an isolated site of recurrence, but these studies were not designed to evaluate false-negative MRI nodal staging.[15,16]

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Taken together, the available literature addresses nodal morphology, overall MRI performance, field-of-view coverage, and the clinical significance of atypical nodal basins but does not appear to have tested prespecified anatomical distribution phenotypes as predictors of false-negative MRI staging. Accordingly, the present study is positioned to evaluate this narrowly defined gap and appears to be among the first to examine axillary-level dominance, interpectoral nodes, internal mammary nodes, and clustered nodal distribution in relation to MRI staging errors.

These observations suggest that assessment of the axilla should consider not only the morphological characteristics of lymph nodes but also their anatomical distribution patterns.

Therefore, the aim of the present study was to investigate whether anatomical nodal distribution patterns of axillary lymph nodes identified on preoperative breast MRI affect the accuracy of radiological nodal staging.

MATERIAL AND METHODS

The study protocol was approved by the Erzincan Binali Yıldırım University Non-Interventional Clinical Research Ethics Committee (approval no: 2026-13/10, date: 09.07.2026). Because of the retrospective study design, the requirement for written informed consent was waived.

This retrospective study included consecutive patients with newly diagnosed breast cancer who underwent preoperative dynamic contrast-enhanced breast MRI covering axillary levels I-III, followed by sentinel lymph node biopsy, and axillary lymph node dissection when clinically indicated. Patients who received neoadjuvant treatment were included in the study. Histopathological nodal status was established by sentinel lymph node biopsy alone in 112 patients (71.8%) and by sentinel lymph node biopsy followed by axillary lymph node dissection in 44 patients (28.2%). Axillary lymph node dissection was performed in patients with a positive sentinel lymph node biopsy or biopsy-proven axillary metastasis. Patient age was also recorded. The anatomical distribution of lymph nodes is shown in detail in Figure 1.

Patients were excluded if the axillary lymph node regions of interest were not included in the MRI field of view, histopathological confirmation of lymph node status was unavailable, or MRI examinations were of suboptimal image quality because of severe motion artifacts or technical inadequacies.

Dynamic contrast-enhanced breast MRI examinations performed between January 2024 and April 2026 were retrospectively reviewed. A search of the institutional radiology information system identified 260 consecutive patients with newly diagnosed breast cancer who underwent dynamic contrast-enhanced breast MRI during the study period. Of these patients, 25 were excluded because the axillary lymph node regions of interest were outside the imaging field of view; 36 were excluded because histopathological confirmation of lymph node status was unavailable; and 43 were excluded because of suboptimal image quality resulting from significant artifacts or technical limitations. The patient inclusion and exclusion process, together with MRI-based nodal classification and histopathological confirmation, is summarized in Figure 2.

All breast MRI examinations were performed using a 1.5-T whole-body MRI system (Magnetom Avanto; Siemens Healthineers, Erlangen, Germany) with a dedicated four-channel, receive-only, circularly polarized breast array coil supplied by the manufacturer. The standard imaging protocol included axial T2-weighted fast/turbo spin-echo

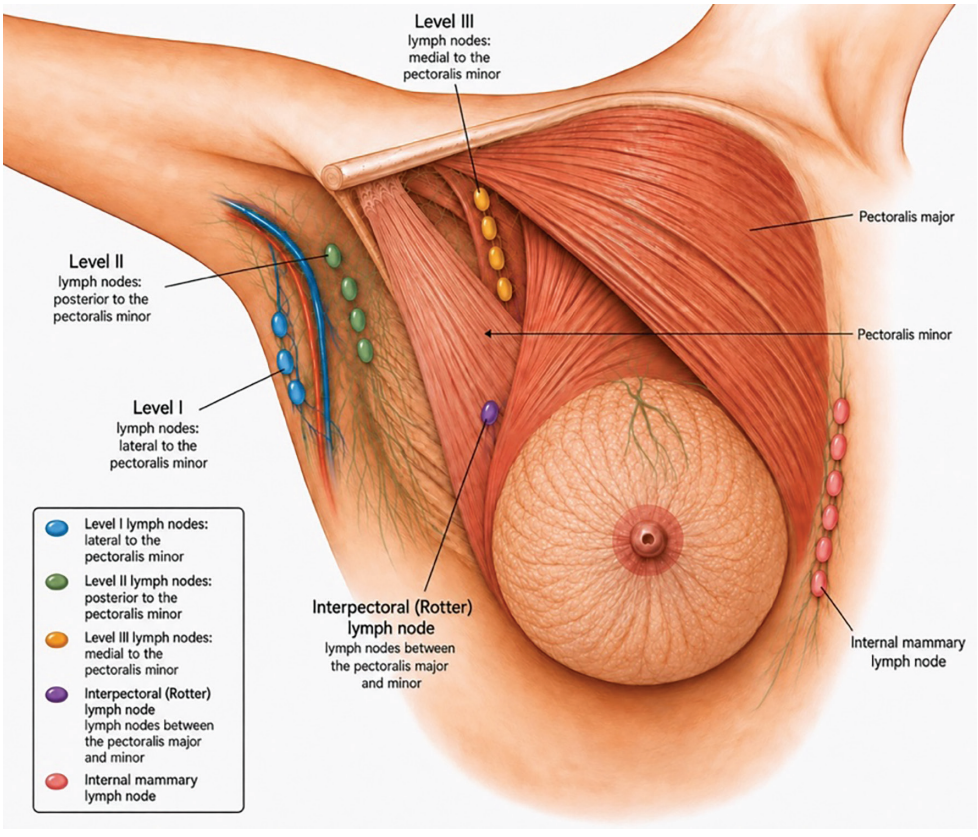


Figure 1. Schematic representation of axillary lymph node levels, interpectoral (Rotter) lymph nodes, and internal mammary lymph nodes. This figure was created entirely by the authors and represents original work; therefore, no third-party permission was required.

sequences [repetition time (TR), 4000 ms; echo time (TE), 90 ms; slice thickness ≤4 mm] and three-dimensional T1-weighted gradient-echo sequences obtained before and after intravenous administration of gadolinium-based contrast material (TR/TE, 20/4.5 ms; flip angle, 30°-45°; slice thickness ≤3 mm).

Gadolinium-based contrast material was administered as an intravenous bolus at a standard dose of 0.1 mmol/kg, followed by a 10-20 mL saline flush. Sagittal imaging was performed using a 256 × 192 acquisition matrix with zero-filled interpolation to 512 × 512, a small field of view (16-18 cm), and chemical fat suppression. Bilateral axial imaging was acquired with an expanded field of view of approximately 30 cm and high-resolution imaging matrices ranging from 256 to 512.

Breast MRI examinations were independently re-evaluated by two board-certified radiologists who were blinded to the histopathological findings. Both radiologists had more than 8 years of experience in breast MRI interpretation. Each radiologist initially evaluated the MRI examinations independently. Disagreements regarding anatomical nodal distribution patterns or MRI-based clinical nodal staging were subsequently reviewed jointly and resolved by consensus. The consensus assessment was used as the final MRI interpretation for all statistical analyses. Interobserver agreement between the two radiologists was assessed based on their initial independent evaluations prior to consensus review. Cohen's kappa (κ) coefficients with 95% confidence intervals (CIs) were calculated for the nodal distribution pattern, the detection of interpectoral (Rotter) lymph nodes, the clustered nodal pattern, the internal mammary lymph nodes, and the final MRI-based nodal staging. The observed percentage agreement was also reported for each imaging variable.

Anatomical nodal distribution patterns were prospectively defined for image review as four prespecified MRI features: axillary-level dominance, interpectoral (Rotter) lymph nodes, internal mammary lymph nodes, and clustered nodal pattern. Axillary levels were determined in relation to the pectoralis minor muscle: level I nodes were lateral to its lateral border, level II nodes were posterior to the muscle, and level III nodes were medial to its medial border. A level II/III-dominant distribution was defined when more than 50% of all visible axillary lymph nodes were located in levels II and III; cases with 50% or fewer of all visible axillary

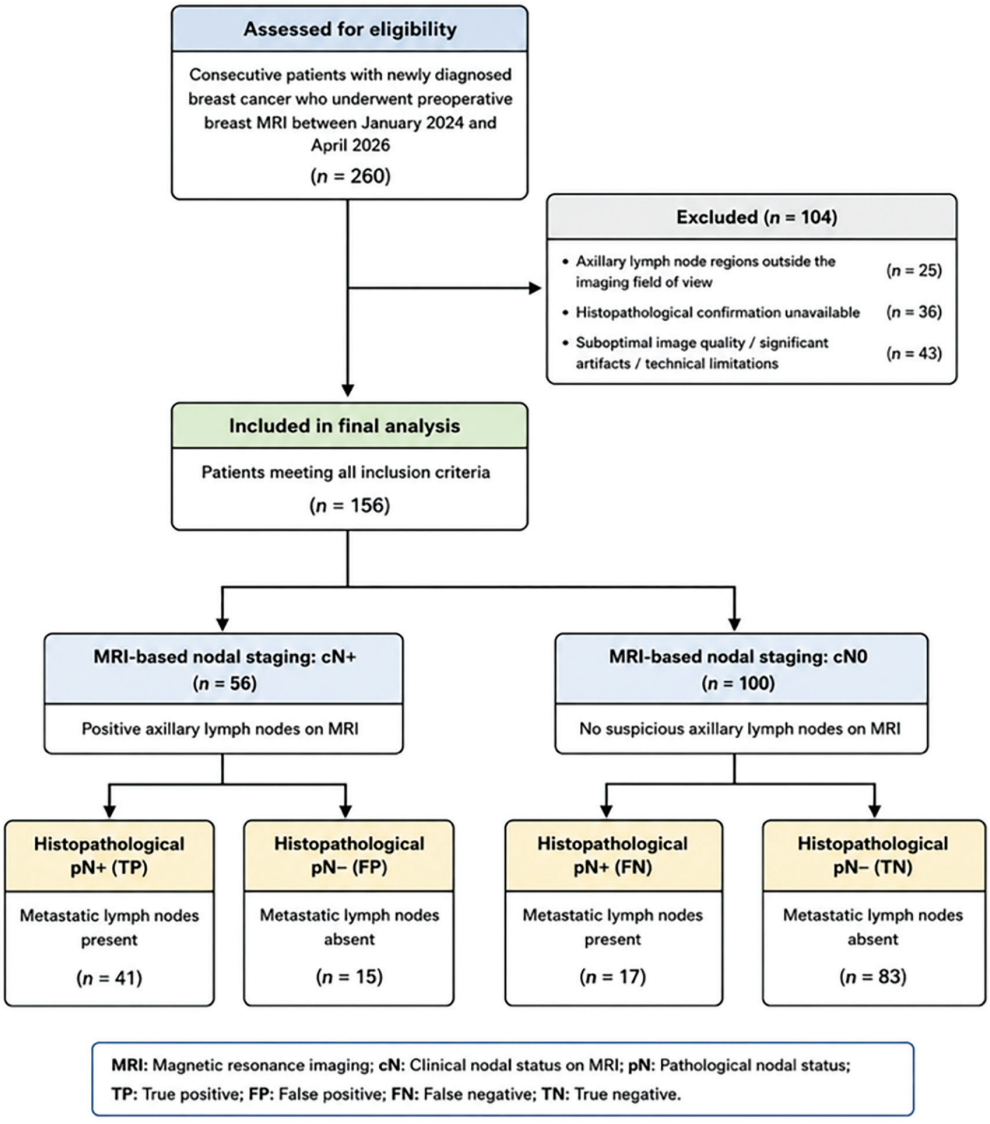


Figure 2. Patient-flow diagram of study inclusion, exclusions, MRI-based nodal classification, and histopathological confirmation.
MRI, magnetic resonance imaging; pN+, pathological nodal positivity.

lymph nodes were classified as level I-dominant. Interpectoral (Rotter) lymph nodes are defined as nodes located in the fat plane between the pectoralis major and pectoralis minor muscles. Internal mammary lymph nodes were defined as lymph nodes located along the internal thoracic vessels within the parasternal intercostal spaces. A clustered nodal pattern was defined as three or more distinct lymph nodes located in close proximity and forming a discrete nodal group with minimal intervening fat. These features were recorded irrespective of nodal size or morphological suspicion of metastasis.

For the purposes of this study, MRI-based nodal status was recorded as a binary classification (cN0 or cN+). Regional lymph nodes were evaluated on T2-weighted and pre- and postcontrast T1-weighted images. The morphological features assessed included cortical thickness, hilar morphology, nodal size, nodal shape, margins, contrast-enhancement characteristics, and asymmetry relative to adjacent ipsilateral or corresponding contralateral lymph nodes. Findings considered suspicious for metastatic involvement included cortical thickening greater than 3 mm, focal or eccentric cortical bulging, partial or complete loss of the fatty hilum, a short-axis diameter of 10 mm or greater, a rounded configuration defined as a long-to-short-axis diameter ratio of less than 1.5, irregular nodal margins, heterogeneous or markedly increased contrast enhancement, and asymmetry in nodal size or morphology. Nodal size was interpreted in conjunction with the other morphological features and was not used as the sole criterion for metastatic involvement. Patients were classified as cN+ if at least one regional lymph node was considered suspicious by integrated morphological assessment, and as cN0 if no regional lymph nodes were identified as suspicious. The presence of a level II/III-dominant distribution, interpectoral or internal mammary lymph nodes, or a clustered nodal pattern, alone, was not considered sufficient for cN+ classification in the absence of suspicious morphological findings. MRI-based clinical nodal staging (cN0 or cN+) was compared with histopathological nodal staging [pN0 or pathological nodal positivity (pN+)]. A false-negative MRI finding was defined as MRI-based cN0 staging in a patient with histopathologically confirmed nodal metastasis (pN+). The false-negative rate was calculated as the number of false-negative findings divided by the total number of histopathologically node-positive patients [FN/(TP + FN)]. Subgroup-specific false-negative rates were calculated using the number of pN+ patients within each subgroup as the denominator.

The primary study endpoint was the false-negative rate among patients with histopathologically confirmed nodal positivity. Among patients with histopathologically confirmed nodal positivity, multivariable logistic regression analysis was performed to identify independent predictors of false-negative MRI nodal staging.

Sample size was determined for the primary diagnostic comparison between MRI-based nodal staging and histopathological nodal status; the false-negative rate among histopathologically node-positive (pN+) patients was specified as the primary endpoint. An expected false-negative rate of 30% (corresponding to an anticipated sensitivity of 70%) was assumed. The assumed effect size was defined as an absolute precision (half-width) of 12 percentage points around the expected false-negative rate for a two-sided 95% CI. Using the single-proportion sample-size formula, we estimated that at least 56 pN+ patients were required. Assuming an expected pN+ prevalence of 37%, the minimum total analyzable sample size was 152 patients. The final cohort of 156 patients, including 58 pN+ patients, therefore met the prespecified sample-size requirement.

Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows, version 25.0 (IBM Corp., Armonk, NY, USA). Data distribution was assessed using the Kolmogorov-Smirnov test. Continuous variables are presented as mean ± standard deviation, whereas categorical variables are expressed as frequencies and percentages. Descriptive statistics were used to determine the frequencies of false-negative and false-positive MRI findings. The association between lymph node distribution patterns and false-negative MRI staging was evaluated using multivariable logistic regression analysis. Interobserver agreement between the two radiologists for categorical imaging variables was evaluated using Cohen's kappa (κ) statistic based on their initial independent assessments before consensus review. Kappa coefficients were reported with corresponding 95% CIs. Sensitivity, specificity, positive predictive value, negative predictive value, accuracy, and false-negative rate were calculated from the 2 × 2 contingency table, and their 95% CIs. were estimated using the exact binomial (Clopper-Pearson) method. A two-sided *P*-value <0.05 was considered statistically significant.

RESULTS

A total of 156 patients were included in the study. The mean age of the patients was 52.6 ± 11.3 years. Histopathological nodal positivity (pN+) was identified in 58 patients (37.2%). Of the 156 patients, 112 (71.8%) underwent sentinel lymph node biopsy alone, whereas 44 (28.2%) underwent sentinel lymph node biopsy followed by axillary lymph node dissection.

Interobserver agreement between the two radiologists ranged from substantial to almost perfect for all assessed imaging variables. The kappa coefficients were 0.839 (95% CI, 0.747-0.931; observed agreement, 96.8%) for axillary nodal distribution pattern, 0.831 (95% CI, 0.709-0.952; observed agreement, 95.5%) for interpectoral (Rotter) lymph node detection, 0.882 (95% CI, 0.790-0.974; observed agreement, 96.2%) for clustered nodal pattern, 0.716 (95% CI, 0.517-0.916; observed agreement, 95.5%) for internal mammary lymph node detection, and 0.818 (95% CI, 0.724-0.913; observed agreement, 91.7%) for final MRI-based nodal staging.

Overall, breast MRI demonstrated a sensitivity of 70.7% (95% CI, 57.3-81.9%), specificity of 84.7% (95% CI, 76.0-91.2%), positive predictive value of 73.2% (95% CI, 59.7-84.2%), negative predictive value of 83.0% (95% CI, 74.2-89.8%), accuracy of 79.5% (95% CI, 72.3-85.5%), and a false-negative rate of 29.3% (95% CI, 18.1-42.7%) for the detection of pathological nodal metastasis. The corresponding 2 × 2

Table 1. Diagnostic Contingency Table of Breast MRI for Axillary Nodal Staging Compared with Histopathological Findings

MRI Nodal Staging	Histopathological pN+	Histopathological pN−	Total
cN+	41 (TP)	15 (FP)	56
cN0	17 (FN)	83 (TN)	100
Total	58	98	156

MRI, magnetic resonance imaging; pN+, pathological nodal positivity.

diagnostic contingency table is presented in Table 1, and the diagnostic performance measures are summarized in Table 2.

The false-negative MRI nodal staging rate was significantly higher in patients with a level II/III-dominant nodal distribution pattern than in those with a level I-dominant pattern (33.3% vs. 25%, *P*=0.02) (Table 3). Likewise, patients with interpectoral (Rotter) lymph nodes had a significantly higher false-negative MRI staging rate than those without Rotter lymph nodes (50% vs. 20%, *P*=0.01) (Table 3; Figures 3 and 4).

Although higher rates of pN+ were also observed in patients with internal mammary lymph nodes and those with a clustered nodal pattern, these associations did not reach statistical significance.

In multivariable logistic regression analysis, both a level II/III-dominant nodal distribution pattern [adjusted odds ratio (OR), 2.6; 95% CI, 1.1-6.4] and the presence of interpectoral (Rotter) lymph nodes (adjusted OR, 2.9; 95% CI, 1.2-7.1) were identified as independent predictors of false-negative MRI nodal staging.

DISCUSSION

In the present study, we investigated the impact of anatomical distribution patterns of axillary lymph nodes identified on preoperative breast MRI on the accuracy of radiological nodal staging. Histopathological nodal positivity was observed in 37.2% of the study population, while breast MRI demonstrated an overall sensitivity of 70.7% and a specificity of 84.7% for predicting nodal metastasis. Patients with a level II/III-dominant nodal distribution pattern had a significantly higher false-negative MRI staging rate than those with a level I-dominant pattern. Similarly, the presence of interpectoral (Rotter) lymph nodes was associated with an increased rate of false-negative MRI staging. Furthermore, multivariable logistic regression analysis identified both a level II/III-dominant nodal distribution pattern and the presence of interpectoral (Rotter) lymph nodes as independent predictors of false-negative MRI nodal staging. In contrast, neither the presence of internal mammary lymph nodes nor a clustered nodal pattern was significantly associated with false-negative MRI staging. These findings extend conventional morphology-based nodal assessment by indicating that nodal location may also contribute to MRI staging errors.

In our study, breast MRI demonstrated a sensitivity of 70.7% and a specificity of 84.7% for detecting axillary lymph node metastases. Chayakulkheeree et al.[9] reported a substantially higher sensitivity (98.5%) but a lower specificity (57.8%) for breast MRI in the detection of axillary metastases. In addition, the meta-analysis by Zhang et al.[17] reported a pooled sensitivity of 55% and a pooled specificity of 86% for MRI in identifying axillary lymph node metastases. Compared with our findings, the lower sensitivity reported by Zhang et al.[17] and the lower specificity reported by Chayakulkheeree et al.[9] may be attributable to differences in study populations and imaging criteria used to define metastatic lymph nodes.

Furthermore, a systematic review and meta-analysis by Le Boulc'h et al.[18] demonstrated that MRI provides higher sensitivity for axillary nodal staging than ultrasonography and 18F-fluorodeoxyglucose-positron emission tomography. However, the present findings suggest that MRI performance depends not only on the morphological characteristics of lymph nodes but also on their anatomical distribution within the axilla.

Ultrasonography is one of the most widely used imaging modalities for the assessment of axillary lymph nodes in patients with breast cancer because of its low cost, wide availability, and ability to provide real-time evaluation. However, the technique is inherently operator-dependent and may be limited by its restricted field of view. In contrast, breast MRI provides a more comprehensive evaluation of the axillary region owing to its superior soft-tissue contrast and broader anatomical coverage. In particular, MRI offers significant advantages in the assessment of deeply located level II and III lymph nodes, as well as of interpectoral (Rotter) and internal mammary lymph nodes. These advantages are especially relevant to the present study, which aimed to investigate how anatomical distribution patterns of axillary lymph nodes influence the diagnostic performance of MRI.

Previous MRI studies have established the importance of morphological

Table 2. Diagnostic Performance of Breast MRI for Axillary Nodal Staging Using Histopathology as the Reference Standard

Diagnostic Metric	Numerator/ Denominator	Estimate, %	95% CI
Sensitivity	41/58	70.7	57.3-81.9
Specificity	83/98	84.7	76.0-91.2
Positive predictive value	41/56	73.2	59.7-84.2
Negative predictive value	83/100	83.0	74.2-89.8
Accuracy	124/156	79.5	72.3-85.5
False-negative rate	17/58	29.3	18.1-42.7

Values are percentages with Clopper-Pearson exact binomial 95% confidence intervals. False-negative rate was calculated as FN/(TP + FN).
TP, true positive; FP, false positive; FN, false negative; TN, true negative; CI, confidence interval; MRI, magnetic resonance imaging.

Table 3. Association Between MRI-Detected Nodal Distribution Patterns, Pathological Nodal Positivity, and False-Negative MRI Nodal Staging

MRI Finding	Patients, n	pN+, n/N (%)	False-Negative MRI Staging Among pN+ Patients, n/N (%)
Level I-dominant nodal distribution	103	28/103 (27.2%)	7/28 (25.0%)
Level II/III-dominant nodal distribution	53	30/53 (56.6%)	10/30 (33.3%)
Presence of interpectoral (Rotter) lymph nodes	25	18/25 (72.0%)	9/18 (50.0%)
Absence of interpectoral (Rotter) lymph nodes	131	40/131 (30.5%)	8/40 (20.0%)
Presence of internal mammary lymph nodes	14	10/14 (71.4%)	4/10 (40.0%)
Presence of a clustered nodal pattern	34	22/34 (64.7%)	9/22 (40.9%)

False-negative MRI staging was defined as cN0 on MRI in a patient with pN+ histopathology. Percentages in the false-negative column were calculated using the number of pN+ patients within each subgroup as the denominator.
MRI, magnetic resonance imaging; pN+, pathological nodal positivity.

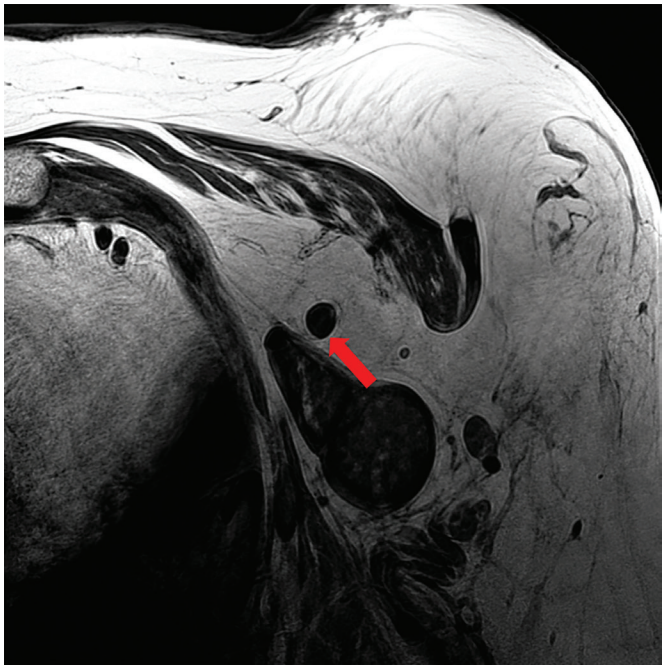


Figure 3. Axial T1-weighted non-fat-suppressed MR image of a 64-year-old woman demonstrating a 7 x 6 mm interpectoral (Rotter) lymph node in the left axilla (red arrow). The lymph node was interpreted as cN0 by the radiologists during MRI assessment. However, histopathological examination following axillary lymph node dissection revealed metastatic invasive ductal carcinoma involving the Rotter lymph node.

MRI, magnetic resonance imaging.

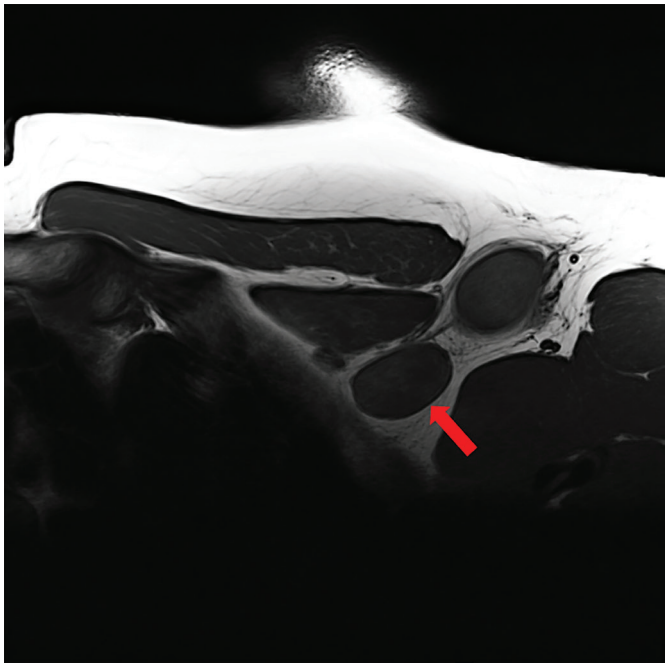


Figure 4. Non-fat-suppressed T1-weighted MR image of a 36-year-old woman demonstrating a 26 x 18 mm enlarged lymph node at left axillary level II (red arrow). The lymph node was classified as cN+ by the radiologists based on MRI findings. Histopathological examination of the level II lymph node confirmed metastatic invasive ductal carcinoma (pN+).

MRI, magnetic resonance imaging; pN+, pathological nodal positivity.

criteria, quantified overall diagnostic performance, and explored false-negative findings in relation to small nodal size, disease burden, technical coverage, or clinicopathological characteristics.[9-14] Surgical literature demonstrates the relevance of interpectoral nodes to metastasis and recurrence.[15,16] Thus, the originality of the present work does not lie in describing axillary anatomy or in demonstrating that MRI can stage regional nodes. Rather, it involves treating prespecified anatomical distribution phenotypes—axillary-level dominance, interpectoral nodes, internal mammary nodes, and clustered distribution—as candidate predictors of false-negative MRI staging. Within the reviewed literature, we did not identify any prior study that evaluated this exact combination of distribution features against histopathological nodal status. The present study should therefore be interpreted as addressing a specific and underexplored aspect of MRI nodal staging, rather than as an absolute first in the broader field of axillary imaging.

Both a level II/III-dominant nodal distribution pattern and the presence of interpectoral (Rotter) lymph nodes were identified as independent predictors of false-negative MRI nodal staging. Although the underlying mechanisms remain uncertain, several explanations may account for these findings. Level II and III lymph nodes are located within the deeper anatomical compartments of the axilla, making their evaluation inherently more challenging, particularly when metastatic involvement is predominantly confined to these regions. Furthermore, radiological assessment of the axilla often focuses on level I lymph nodes, increasing the likelihood that metastatic nodes at higher axillary levels are overlooked.

Similarly, interpectoral (Rotter) lymph nodes occupy an atypical location between the pectoralis major and pectoralis minor muscles, and may therefore receive less attention during routine axillary evaluation. Previous studies have demonstrated the clinical importance of Rotter lymph nodes in metastatic spread and have suggested that they may be involved independently of the conventional axillary lymphatic drainage pathway.[15,16] Consequently, when metastatic disease predominantly involves level II/III or interpectoral (Rotter) lymph nodes, morphologically suspicious nodes may be overlooked more easily, increasing the likelihood of false-negative MRI nodal staging.

Study Limitations

The present study has several limitations. First, the retrospective, single-center design may have introduced selection bias and may have limited the generalizability of the findings. Second, 25 patients were excluded because the axillary lymph node regions of interest were not fully included in the MRI field of view. This exclusion may have preferentially selected technically adequate examinations, thereby influencing the estimated diagnostic performance of MRI. Third, the extent of histopathological nodal evaluation varied across the study population: some patients underwent sentinel lymph node biopsy alone, whereas others underwent axillary lymph node dissection. Therefore, differential verification bias cannot be excluded, and occult non-sentinel nodal metastases may have remained undetected in patients evaluated by sentinel lymph node biopsy alone. Finally, the diagnostic and regression findings were not validated in an independent cohort. Prospective multicenter studies using standardized axillary MRI coverage and external validation cohorts are warranted to confirm these findings.

CONCLUSION

Anatomical distribution patterns of axillary lymph nodes identified on breast MRI may influence the accuracy of nodal staging. In particular, a level II/III-dominant nodal distribution pattern and the presence of interpectoral (Rotter) lymph nodes were associated with an increased likelihood of false-negative MRI nodal staging. These findings suggest

that, in addition to morphological characteristics, the anatomical distribution of axillary lymph nodes should be considered during MRI-based nodal assessment. Incorporating structured axillary mapping into routine breast MRI interpretation may improve the reliability of nodal staging and facilitate the development of more individualized imaging strategies for patients with breast cancer.

Data Availability Statement: The datasets generated and/or analyzed during the current study are not publicly available due to patient privacy and confidentiality considerations.

Ethics Committee Approval: The study protocol was approved by the Erzincan Binali Yıldırım University Non-Interventional Clinical Research Ethics Committee (approval no: 2026-13/10, date: 09.07.2026).

Informed Consent: As the study was designed retrospectively, informed consent was not obtained.

Author Contributions: Surgical and Medical Practices – K.B., T.B.A.; Concept – K.B.; Design – K.B.; Data Collection or Processing – K.B.; Analysis or Interpretation – K.B., T.B.A.; Literature Search – T.B.A.; Writing – K.B., T.B.A.

Declaration of Interests: The authors declare that there is no conflict of interest

Funding: The authors declare that this study did not receive any financial support.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process: During the preparation of this work, the author(s) used ChatGPT to improve "readability" and "language". After using this tool/service, the author(s) reviewed and edited the content as needed and took full responsibility for the content of the publication. Artificial intelligence has been used to assist with "text editing".

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