Low-Volume Nodal Disease in Microinvasive Breast Cancer: Implications for Selective Sentinel Lymph Node Biopsy

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Abstract

Background: Microinvasive breast cancer (T1mi) represents a transitional entity between ductal carcinoma in situ and invasive disease, with an unclear role for sentinel lymph node biopsy (SLNB).

Objective: To evaluate the prevalence and characteristics of sentinel lymph node involvement in T1mi.

Methods: Systematic review and random-effects meta-analysis of 7 studies (n = 11,243) reporting SLNB outcomes in T1mi.

Results: The pooled SLN positivity rate was 9% (95% CI, 6–13%). Among positive nodes, low-volume disease predominated, with pooled proportions of 39% for isolated tumor cells, 40% for micrometastasis, and 29% for macrometastasis.

Conclusions: SLN involvement in T1mi is uncommon but clinically relevant. These findings support a selective, risk-adapted approach to SLNB.

Introduction

Microinvasive breast cancer (T1mi), invasive carcinoma with ≤1 mm of stromal invasion, sits at the biological boundary between ductal carcinoma in situ (DCIS) and invasive disease. Despite its invasive classification, T1mi carries favorable outcomes more consistent with DCIS than larger invasive tumors.

While stromal invasion raises the possibility of lymphatic spread, the clinical significance of nodal involvement in T1mi remains poorly defined. Sentinel lymph node biopsy (SLNB) is standard in invasive breast cancer but is not routinely recommended for DCIS — leaving its role in T1mi uncertain.

Reported nodal positivity rates are low but highly variable, with most detected disease being low-volume. Without pooled evidence to guide practice, clinical decision-making remains inconsistent and individualized.

Methods

Study Design - Systematic review and single-arm meta-analysis (PRISMA-guided)

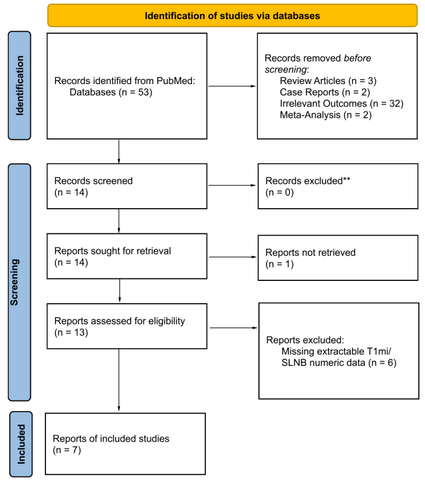
Data Source - PubMed search (Nov 2025) using keywords: “T1mi,” “microinvasive breast cancer,” “SLNB”

Inclusion Criteria - Histologically confirmed T1mi (≤1 mm invasion), reported SLNB outcomes, and provided SLNB positivity data

Outcomes - Primary: SLN positivity rate; Secondary: ITC, micrometastasis, macrometastasis

Analysis - Random-effects meta-analysis with heterogeneity assessed using I^2

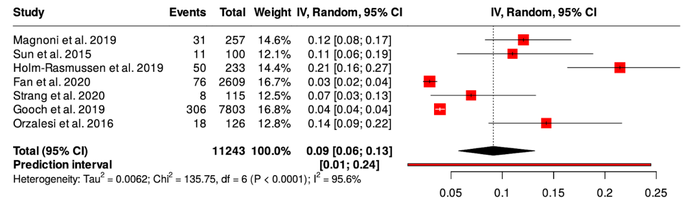
Sample - 7 included studies with n = 11,243 patients



Results

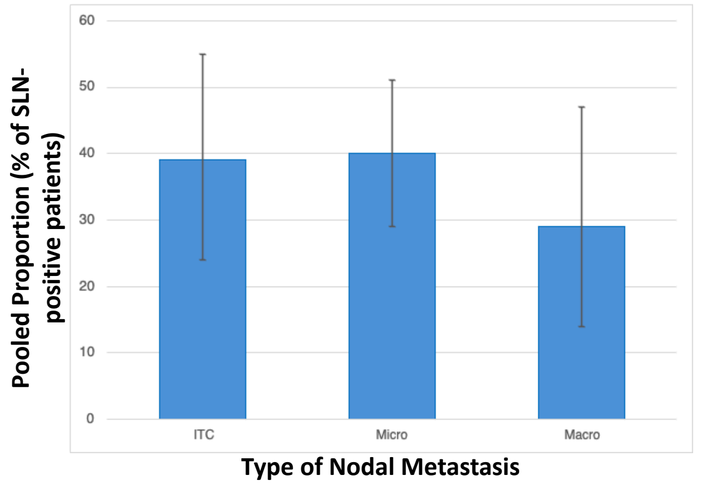
Pooled Sentinel Lymph Node Positivity in Microinvasive Breast Cancer (T1mi)

Random-effects meta-analysis (n = 11,243)



Low-Volume Nodal Disease Predominates in SLN-Positive T1mi

Pooled proportions from reported subsets (ITC, micrometastasis, macrometastasis)



Key Findings:

- SLN positivity is uncommon but clinically relevant (~1 in 11 patients)
- Low-volume nodal disease predominates (ITCs & micrometastases), supporting selective SLNB
- High heterogeneity (I^2 = 95.6%) reflects variability in patient selection and pathologic reporting

Discussion

Discussion:

In over 11,000 T1mi patients, the pooled SLN positivity rate was 9% (95% CI, 6–13%). Nodal disease, when present, is predominantly low-volume (ITCs & micrometastases), consistent with T1mi's biologic behavior resembling DCIS more than invasive cancer. Notably, macrometastatic disease was identified in 29% of SLN-positive patients, confirming that nodal positivity in T1mi cannot be dismissed as artifact or displaced epithelium. Substantial heterogeneity (I^2 = 95.6%) reflects variability in patient selection, pathologic assessment, and practice patterns, underscoring the need for a selective, individualized approach over routine SLNB.

Importance

These findings support a **risk-adapted, patient-centered approach** to axillary staging in T1mi, minimizing surgical morbidity without compromising oncologic safety. Multidisciplinary evaluation that integrates pathologic features, surgical approach, and patient preference should guide axillary biopsy decision-making. This reflects the osteopathic principle of treating the whole patient rather than the disease alone.

Limitations:

- All studies were retrospective & non-randomized, introducing inherent risk of selection bias.
- Heterogeneity in pathologic protocols & IHC use limits generalizability of our findings.
- Patient-level data was not available; tumor biology factors (HER2, grade) could not be assessed.
- Publication bias could not be formally assessed given the limited number of eligible studies.

Future Directions:

- Prospective studies should standardize T1mi definitions and SLNB indications.
- Risk-stratification tools incorporating clinicopathologic and molecular features require validation.
- Further investigation into biologic distinctions between DCIS, T1mi, and small invasive cancers is needed.

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