Evaluating the Role of Preoperative Magnetic Resonance Imaging and Intraoperative 3D Tomosynthesis in Achieving Negative Resection Margins in DCIS

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Abstract

Background: The increased detection of ductal carcinoma in situ (DCIS) through screening has highlighted challenges in surgical management, particularly in securing negative margins. The contribution of preoperative MRI is debated, while intraoperative 3D tomosynthesis has emerged as a tool for margin assessment.
Methods: We reviewed 280 DCIS patients treated from 2017–2024. Variables included age, grade, breast density, family history, use of preoperative MRI, and intraoperative 2D vs. 3D tomosynthesis. Reoperation rates were compared between groups.
Results: Preoperative MRI did not significantly reduce overall reoperations, though subgroup analysis showed benefit in younger women with dense breasts (p=0.005). Intraoperative 3D tomosynthesis was strongly associated with improved margin status (p=0.002).
Conclusions: MRI provides selective benefit in dense breast tissue, while 3D tomosynthesis enhances intraoperative margin evaluation. Their combined application may represent an effective strategy to reduce reoperations in DCIS surgery.

Introduction

Ductal carcinoma in situ (DCIS) represents about 20% of breast cancer diagnoses due to widespread mammographic screening. Its management is challenging, as complete excision with negative margins must be balanced with cosmetic outcomes. Mammography alone is often insufficient for accurate assessment, making the role of breast MRI controversial—while some question its benefit, others support its value in defining disease extent and reducing reoperations. Intraoperative specimen imaging is standard, but 2D mammography shows limited sensitivity. Emerging 3D tomosynthesis may improve margin evaluation and decrease reoperation rates. This study investigates the role of preoperative MRI and 3D specimen mammography in surgical management of DCIS.

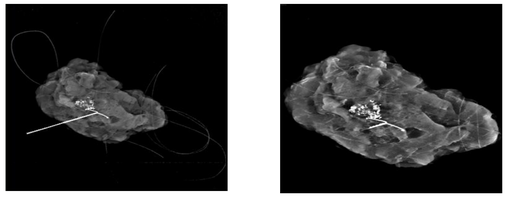


Figure 1. 2D and 3D specimen mammography in DCIS.

Methods and Materials

- **Design & Setting**: Retrospective study of 280 women with DCIS (2017–2024), Anticancer Hospital Theageneio.
- **Imaging**: All underwent digital mammography; suspicious BIRADS 4 microcalcifications assessed with magnification ± MRI (multiparametric, BIRADS-based).
- **Surgery**: Breast-conserving surgery with hook-wire localization; specimen assessment with 2D mammography, and from 2020, intraoperative 3D tomosynthesis.
- **Variables**: Age (<50/≥50), breast density (ACR A–D), DCIS grade (1–3), family history, MRI use, and reoperation rates.

Variable	Category	n
Age	<50years	87
	≥50years	193
Breast Density (ACR)	A+B	180
	C+D	100
Nuclear Grade	Grade 1	137
	Grade2	102
	Grade 3	41
Family History	Positive	101
	Negative	179
Specimen Mammography	2D	150
	3D	130

Table 1. Patient Demographics

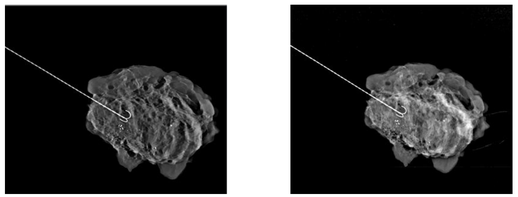


Figure 2. 2D and 3D specimen mammography in DCIS

Results

Between 2017–2024, 280 patients with DCIS were treated; 31% were <50 years and 69% ≥50 years. Dense breasts (ACR C–D) were present in 36%, and 36% had a positive family history. Nuclear grade distribution was 49% grade 1, 36% grade 2, and 15% grade 3.(Table 1)
Preoperative MRI was performed in 144 patients and showed fewer reoperations compared to no MRI (6.3% vs. 11.8%), though not statistically significant. Younger age and higher breast density were significantly associated with reoperation. (Chart 1)
Intraoperative 3D tomosynthesis was superior to 2D mammography in margin assessment. (Chart 2)
Multivariate analysis confirmed breast density, MRI, and 3D tomosynthesis as independent predictors of reoperation, while nuclear grade and family history had no effect. (Table 2, Figures 1-2)

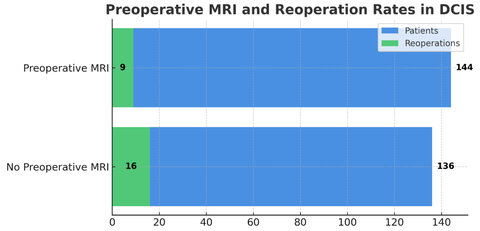


Chart 1. Reoperations by preoperative MRI status

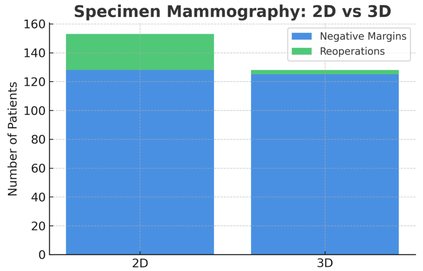


Chart 2. Reoperations by 2D vs 3D specimen imaging

Discussion

This study assessed the role of preoperative breast MRI and intraoperative specimen imaging in the surgical management of DCIS. Our findings showed that MRI did not significantly reduce reoperation rates overall, though it demonstrated benefit in younger women with dense breasts, where accurate disease mapping is particularly challenging. Breast density emerged as a strong predictor of re-excision, highlighting the importance of individualized preoperative imaging strategies. Intraoperative 3D tomosynthesis significantly improved margin assessment compared to conventional 2D mammography, supporting its use as a practical intraoperative tool to minimize positive margins. Multivariate analysis confirmed breast density, preoperative MRI, and 3D tomosynthesis as independent predictors of reoperation rates, while nuclear grade and family history were not associated with surgical outcomes. Age acted as a confounding factor, largely due to its correlation with breast density.

Conclusions

Preoperative breast MRI does not consistently reduce reoperation rates in DCIS, but it shows benefit in younger women with dense breasts. Intraoperative 3D tomosynthesis significantly improves margin assessment compared to 2D mammography. The combined use of these tools may optimize surgical management and lower the need for re-excision. Their complementary roles support a more accurate evaluation of tumor extent and margin status, contributing to improved surgical confidence and potentially better cosmetic and oncologic outcomes.

Variable	Univariate Model (p)	Multivariate Model (p)
Age	**0.018**	0.065
Breast Density	**0.001**	**0.001**
Family History	0.668	0.368
Preoperative MRI	0.106	**0.005**
Specimen mammography	**0.003**	**0.002**

Table 2. Univariate and multivariate analysis

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References

1. Kuhl, C. K., Schrading, S., Bieling, H. B., Wardelmann, E., Leutner, C. C., Koenig, R., Kuhn, W., & Schild, H. H. (2007). MRI for diagnosis of pure ductal carcinoma in situ: a prospective observational study. Lancet, 370(9586), 485–492. https://doi.org/10.1016/S0140-6736(07)61232-X
2. Lam, D. L., Smith, J., Partridge, S. C., Kim, A., Javid, S. H., Hippe, D. S., Lehman, C. D., Lee, J. M., & Rahbar, H. (2020). The Impact of Preoperative Breast MRI on Surgical Management of Women with Newly Diagnosed Ductal Carcinoma In Situ. Academic Radiology, 27(4), 478–486. https://doi.org/10.1016/j.acra.2019.05.013
3. Lamb, L. R., Oseni, T. O., Lehman, C. D., & Bahl, M. (2020). Pre-operative MRI in patients with ductal carcinoma in situ: Is MRI useful for identifying additional disease? European Journal of Radiology, 129. https://doi.org/10.1016/j.ejrad.2020.109130
4. Lehman, C. D. (2010). Magnetic resonance imaging in the evaluation of ductal carcinoma in situ. Journal of the National Cancer Institute - Monographs, 41, 150–151. https://doi.org/10.1093/jncimonographs/lgq030
5. Leithner, D., Wengert, G. J., Helbich, T. H., Thakur, S., Ochoa-Albiztegui, R. E., Morris, E. A., & Pinker, K. (2018). Clinical role of breast MRI now and going forward. In Clinical Radiology (Vol. 73, Issue 8, pp. 700–714). W.B. Saunders Ltd. https://doi.org/10.1016/j.crad.2017.10.021
6. Park, K. U., Kuerer, H. M., Rauch, G. M., Leung, J. W. T., Sahin, A. A., Wei, W., Li, Y., & Black, D. M. (2019). Digital Breast Tomosynthesis for Intraoperative Margin Assessment during Breast-Conserving Surgery. Annals of Surgical Oncology. https://doi.org/10.1245/s10434-019-07226-w
7. Partain, N., Calvo, C., Mokdad, A., Colton, A., Pouns, K., Clifford, E., Farr, D., Huth, J., Wooldridge, R., & Leitch, A. M. (2020). Differences in Re-excision Rates for Breast-Conserving Surgery Using Intraoperative 2D Versus 3D Tomosynthesis Specimen Radiograph. Annals of Surgical Oncology, 27(12), 4767–4776. https://doi.org/10.1245/s10434-020-08877-w

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