

The Influence of Age and Disease Type on Reoperation Rates After Breast-Conserving Surgery

Summary

Breast cancer, the second most common cancer among women, has seen notable advances in treatment over recent years, with breast-conserving surgery (BCS) becoming a preferred approach. Although BCS is less invasive than full mastectomy, it has historically been associated with high reoperation rates, which profoundly impact patients' lives and pose complex challenges for healthcare systems and providers. This article reviews key findings from a recent retrospective cohort study, comparing them with previous population-based research to examine how age and breast cancer type influence reoperation rates after initial BCS, and offers potential solutions to reduce these rates.

1. Introduction

Breast cancer is the most commonly diagnosed cancer among women, excluding nonmelanoma skin cancer, and it is the second leading cause of cancer-related death in women in the U.S.¹ In 2024, an estimated 310,720 women in the U.S. are expected to be diagnosed with invasive breast cancer, with another 56,500 anticipated to be diagnosed with ductal carcinoma in situ (DCIS).²

Approximately 60-70% of patients with early-stage breast cancer undergo BCS³⁻⁶, which aims to excise malignant tissue while preserving as much of the healthy breast tissue as possible. Reoperation rates following primary BCS vary widely across surgeons and institutions, with approximately 20% of patients (range 10-60%) requiring additional surgery to achieve complete tumor removal.⁷

Although DCIS is a non-invasive malignancy, invasive carcinoma develops in 14-53% of DCIS patients.⁹ These figures are based on studies with follow-up periods of ten or more years, often involving cases initially misdiagnosed as benign lesions that were inadequately excised.⁸ BCS, with or without radiation, is considered the optimal treatment for DCIS. Other options include mastectomy and/or hormonal therapy.⁹

Treatment for invasive ductal carcinoma (IDC), which accounts for 80% of breast cancer diagnoses, typically begins with the same surgical options as

DCIS, namely BCS with or without radiation, or mastectomy.¹⁰ However, due to IDC's invasive nature, additional treatments like chemotherapy, hormone therapy, and targeted (biologic) therapies are often employed, with the approach tailored to the specific characteristics of the cancer cells.¹⁰

2. An Adverse Outcome of Current BCS Methodology

BCS is widely preferred for treating early-stage breast cancer, offering a less invasive alternative to mastectomy while preserving breast tissue. However, despite its advantages, high reoperation rates—particularly for patients with DCIS—remain a significant barrier to achieving optimal outcomes. This paper investigates the relationship between reoperation rates, age, and disease type, while proposing the use of real-time intraoperative margin assessment technologies as a strategy to reduce these rates.

Previous research has largely focused on the impact of medical guidelines for excision margins in DCIS¹¹ which accounts for 15-40% of new breast cancer diagnoses.¹²⁻¹⁵ Achieving clear margins in DCIS patients is particularly challenging due to its nonpalpable nature and the difficulty of accurately delineating the extent of the disease through preoperative imaging.^{12,13}

Likewise, many conventional intraoperative imaging techniques have their challenges by relying on the interpretation of microcalcifications in breast tissue. While breast calcifications are common on mammograms and usually benign, certain patterns may indicate breast cancer or precancerous changes.¹⁶ However, DCIS may be present without calcifications in 10%-20% of cases¹⁷, which can lead to positive margins on final pathology and the need for reoperation. These elevated reoperation rates contribute to increased healthcare costs, prolonged treatment durations, and heightened psychological distress for patients.^{18,19}

3. The Impact of Age and Disease Type on Reoperation Rates

Understanding how age and disease type affect reoperation rates is critical for both patient outcomes and healthcare resource management. A 2024 retrospective cohort study by Kim et al.²⁰ examined population-level reoperation rates using data from both commercial insurance and Medicare claims encompassing 24,106 patients who underwent BCS. The study divided the population into two cohorts: a commercial insurance group (n=17,129), comprising females aged 18-64 years, and a Medicare group (n=6,977), comprising females aged 18 years and older.

3.1 Age-Related Trends in Reoperation Rates

The study demonstrated a downward trend in reoperation rates with increasing age in the commercial cohort (Figure 1).²⁰ Although a similar decline was observed in the Medicare cohort, it did not reach statistical significance. When the analysis was stratified by both cancer diagnosis and age, this downward trend of increasing age in reoperation rates persisted across various cancer types.

3.2 Disease-Specific Reoperation Trends: DCIS vs. Invasive Breast Cancer

This study also identified significant differences in reoperation rates between patients with DCIS and those with invasive breast cancer.²⁰ In the commercial cohort, reoperation rates were 30.8% for patients with DCIS compared to 18.0% for those with invasive breast cancer. In the Medicare cohort, reoperation rates were 24.0% for DCIS patients and 12.7% for invasive breast cancer patients.

Notably, in the commercial cohort, younger women (18-44 years) with DCIS had a substantially higher rate of reoperation rate (40.0%) and were more likely to convert to mastectomy (18.5%) than patients with invasive breast cancer, who had a 21.8% reoperation rate and 9.0% rate of conversion to mastectomy. Conversely, in the Medicare cohort, older patients, particularly those aged 65 years and older, exhibited lower reoperation rates, especially those with DCIS.

These data points are somewhat consistent with historical data from other population-based studies, although there are differences. A 2017 study by Langhans⁷ reported a threefold higher risk of reoperation for DCIS patients compared to those with invasive breast cancer. A 2020 retrospective study by Lamb et al. reported a reoperation rate of 31.6% for DCIS undergoing BCS²¹, and a regional study in England showed that DCIS patients aged 40-49 years had a reoperation rate of 25.2%.²²

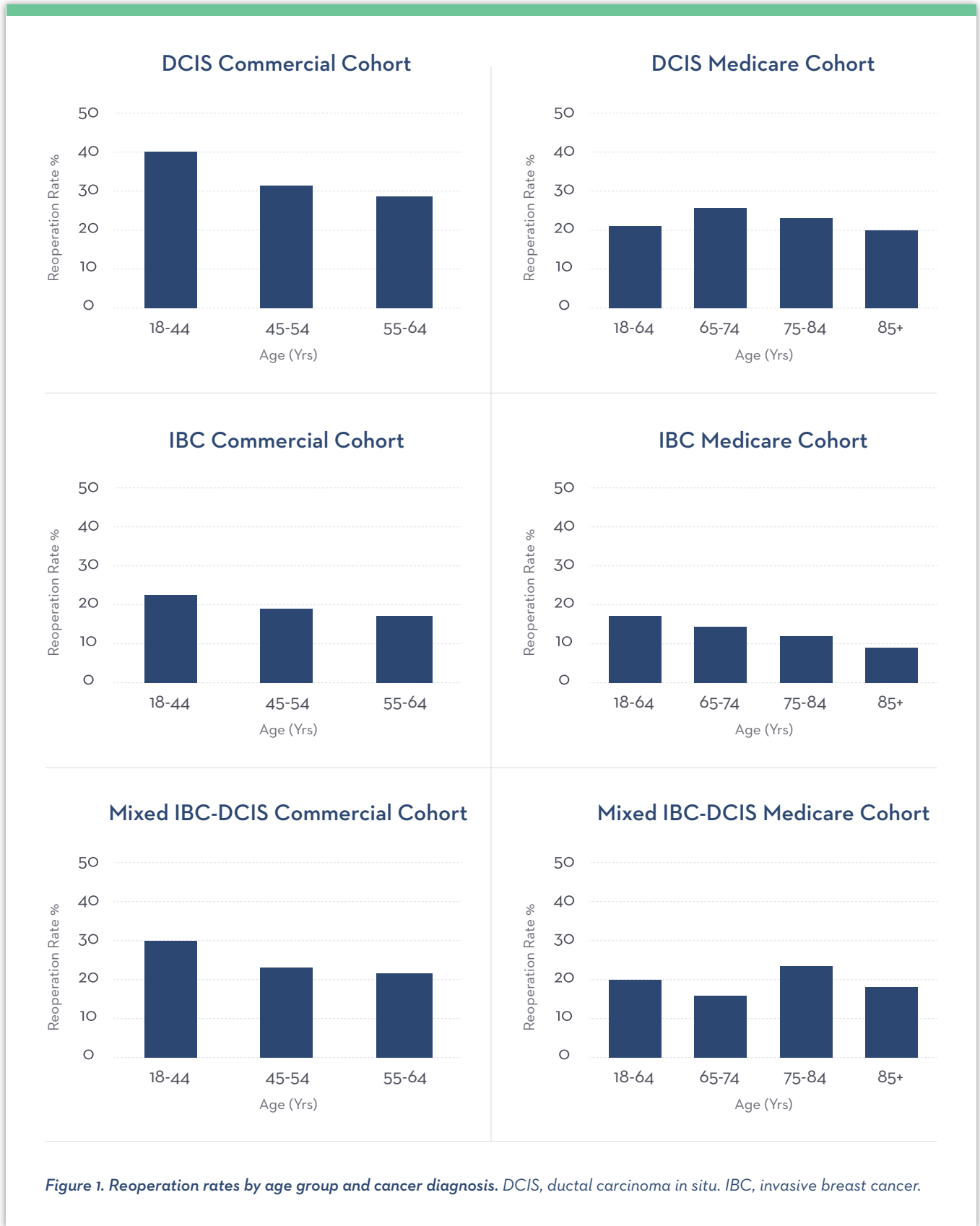


Figure 1. Reoperation rates by age group and cancer diagnosis. DCIS, ductal carcinoma in situ. IBC, invasive breast cancer.

3.3 Reoperation Rates Following Oncoplastic Surgery (OPS)

In the study by Kim et al., 17.8% of patients in the commercial cohort who underwent immediate OPS after BCS required reoperation.²⁰ In the Medicare cohort, the reoperation rate was 14.1%. Both cohorts showed slightly higher reoperation rates for the OPS groups compared to the non-OPS groups, with rates of 22.0% for the commercial cohort and 15.1% for the Medicare cohort.

4. Challenges in Reducing Reoperation Rates

The data supports that younger age and DCIS diagnosis are associated with higher reoperation rates following BCS. Reoperations following OPS introduce additional challenges because the rearranged breast tissue can complicate subsequent surgeries, potentially leading to aesthetic issues or further complications.²³ Achieving clear surgical margins remains particularly challenging for DCIS patients, with 20-40% having positive margins on final pathology and requiring further excisions.²⁴ The lack of real-time visualization of tumors during surgery contributes to these high reoperation rates and is driving significant interest in imaging techniques for visualizing tumors during surgery.²⁵

5. Innovative Solutions: Real-Time Intraoperative Margin Assessment Technologies

Recent advances in real-time intraoperative margin assessment technologies hold promise for reducing reoperation rates. These technologies provide immediate feedback on surgical margins, enabling surgeons to excise additional tissue during the initial surgery when needed. The potential benefits include:

- **Enhanced Accuracy:** Real-time visual feedback on margin status enables immediate corrective action.
- **Reduced Reoperation Rates:** A reduction in positive margins decreases the likelihood of subsequent surgeries, leading to lower healthcare costs and improved patient satisfaction.

- **Streamlined Workflow:** These technologies can improve treatment efficiency by eliminating the wait for postoperative pathology and the need for additional surgeries.

- **Increased Use of OPS:** The improved ability to achieve clear margins during tumor excision can give surgeons and patients increased confidence in the success of the primary surgery that may allow more patients to have OPS.

6. Conclusion

Several key trends influence reoperation rates following BCS. Age and disease type emerge as crucial factors, with younger women, particularly those diagnosed with DCIS, experiencing significantly higher reoperation rates than older patients or those with invasive breast cancer. Moreover, reoperation rates vary widely across surgeons and institutions, suggesting that surgical expertise, institutional practices, and access to advanced technologies all play a role in patient outcomes. OPS, though beneficial for aesthetic results, presents additional complexities that contribute to slightly higher reoperation rates due to the challenges of margin assessment in rearranged breast tissue.

The persistent challenge of achieving clear surgical margins, particularly for DCIS patients, underscores the need for more accurate intraoperative assessment techniques. Real-time intraoperative margin assessment technologies offer a transformative approach to address this issue, with the potential to improve patient outcomes and treatment efficiency. Collaboration among healthcare stakeholders—such as hospital administrators and surgeons—will be key to integrating these technologies into standard care and ensuring their accessibility for women undergoing BCS.

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