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SURGICAL OUTCOMES IN BREAST CANCER PATIENTS: A RETROSPECTIVE ANALYSIS

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Abstract

Introduction: Numerous factors contribute to the variability of surgical outcomes in breast cancer patients. Tumor-related factors, such as the stage at diagnosis, tumor size, histological subtype, and lymph node involvement, can influence both the choice of surgery and the likelihood of recurrence.

Material & Methods: Female patients with biopsy-confirmed Stage I to III breast cancer who underwent either total mastectomy or breast-conserving surgery (BCS) during this period were included. Surgical margins were clearly marked before specimens were fixed in formalin and sent to the histopathology laboratory for analysis. Axillary lymph node dissection was performed in patients with positive sentinel lymph node biopsies.

Results: Wound infection was the most significant complication observed, with a significantly higher incidence in the BCS group compared to total mastectomy group ($p < 0.001$). The overall complication rate was also higher in the BCS group (6.4%) compared to the total mastectomy group (2.1%). Fat necrosis was not observed in total mastectomy group.

Conclusion: The study underscores the importance of personalized treatment planning to optimize patient outcomes, with early-stage cancers showing favorable prognosis following surgical interventions. Furthermore, it emphasizes the need for multidisciplinary care and vigilant post-operative monitoring to minimize complications and improve survival rates.

Keywords: Surgical outcomes, Breast cancer, Retrospective ana

INTRODUCTION

Breast cancer remains one of the most prevalent cancers globally, representing a significant burden on public health. In 2020, it was estimated that there were 2.3 million new cases of breast cancer worldwide, making it the most commonly diagnosed cancer in women. **1**Despite the high incidence, breast cancer is also one of the most treatable forms of cancer when detected early, with surgical intervention playing a pivotal role in the management of the disease. Surgical outcomes in breast cancer patients are critical to improving survival rates, quality of life, and long-term prognosis. The surgical approach to breast cancer has evolved over the past few decades, moving from more aggressive procedures, such as radical mastectomies, to more conservative treatments, such as breast-conserving surgery (BCS). The advent of BCS, along with adjuvant therapies such as radiation, chemotherapy, and hormonal therapy, has allowed many patients to avoid the physical and psychological trauma associated with mastectomy while still achieving high survival rates. **2**As the

emphasis on organ preservation has grown, the role of surgery in breast cancer treatment has become multifaceted, incorporating both curative and reconstructive objectives.
While the shift to less invasive procedures has been beneficial in many cases, surgical outcomes remain highly variable, influenced by a range of factors. These include the type of surgery performed (e.g., mastectomy versus BCS), the timing and modality of adjuvant treatments, and patient-specific factors such as age, comorbidities, and genetic predispositions.**3**Furthermore, the advent of sentinel lymph node biopsy has reduced the need for extensive axillary dissections, which has in turn contributed to lower complication rates and improved post-surgical recovery.**4** Nonetheless, complications such as infection, wound healing problems, lymphedema, and shoulder dysfunction can still arise, and understanding the frequency and predictors of these complications is vital for optimizing patient outcomes.

The significance of surgical outcomes in breast cancer patients cannot be overstated. Surgical procedures are often the first line of treatment, determining the extent of disease control and influencing subsequent therapeutic strategies. Successful surgical management can reduce the likelihood of recurrence and improve long-term survival. On the other hand, poor surgical outcomes can contribute to the spread of disease, the need for further interventions, and diminished quality of life. Factors such as positive surgical margins, axillary involvement, and the need for re-excision or additional procedures have been shown to negatively impact prognosis and are critical components of evaluating surgical success.**5**

Another important aspect of surgical outcomes is the impact on patient quality of life. Breast cancer surgery, particularly mastectomy, can have profound physical, emotional, and psychological consequences. The loss of a breast can alter body image, leading to potential issues with self-esteem and mental health. In addition, post-operative pain, scarring, and functional limitations related to shoulder mobility or lymphedema can significantly affect a patient's ability to resume normal activities.**6** Surgical outcomes are therefore not only measured in terms of survival but also in terms of how well patients recover physically and emotionally.
Numerous factors contribute to the variability of surgical outcomes in breast cancer patients. Tumor-related factors, such as the stage at diagnosis, tumor size, histological subtype, and lymph node involvement, can influence both the choice of surgery and the likelihood of recurrence. **7**For example, patients with larger tumors or more extensive lymph node involvement may require more extensive surgical procedures, which can lead to a greater risk of complications and longer recovery times. Additionally, certain genetic mutations, such as BRCA1 and BRCA2, are associated with a higher risk of recurrence and may influence surgical decision-making.**8**

Patient-specific factors also play a significant role in surgical outcomes. Age, comorbidities, and overall health status can all impact the body's ability to heal and recover after surgery. Older patients, in particular, may have a higher risk of complications such as infections or delayed wound healing, which can compromise surgical outcomes. **9**The presence of conditions such as diabetes, obesity, or cardiovascular disease can similarly increase the risk of poor surgical outcomes. Moreover, lifestyle factors such as smoking and physical activity levels can influence both immediate recovery and long-term survival.**10**
The type of surgical intervention—whether mastectomy, BCS, or a combination of both—also affects outcomes. Mastectomy, while providing a more extensive removal of tissue, is associated with a higher likelihood of post-operative complications, including lymphedema and cosmetic dissatisfaction (Fisher et al., 2002). In contrast, BCS, although more aesthetically favorable, may carry a higher risk of local recurrence if the margins are not clear or if the tumor was particularly aggressive.**11**

A comprehensive post-surgical follow-up program is essential for optimizing surgical outcomes. This program typically includes surveillance for signs of recurrence, as well as physical therapy to improve

mobility and reduce the risk of lymphedema and shoulder dysfunction. Early intervention in managing complications can prevent long-term sequelae and improve patient satisfaction. Rehabilitation and psychosocial support also play critical roles in helping patients cope with the emotional and physical challenges of recovery.**12**

The study aims to retrospectively analyze the surgical outcomes of breast cancer patients, focusing on understanding factors that influence these outcomes, including patient characteristics, tumor characteristics, surgical approach, and post-operative complications.

MATERIAL & METHODS

Study Design and Population: A retrospective cohort study was conducted at a tertiary care hospital in North India from October 2022 to December 2023. Female patients with biopsy-confirmed Stage I to III breast cancer who underwent either total mastectomy or Breast-conserving surgery (BCS) during this period were included. Patients with incomplete medical records or who did not attend follow-up visits at the hospital were excluded. A total of 220 patients met the inclusion criteria. Data on patient demographics, perioperative conditions, surgical procedures, and histopathological results were collected by reviewing patient files and electronic health records.

Informed Consent and Preoperative Measures: Prior to surgery, all patients were educated about the procedure, potential outcomes, and possible complications. This was done using visual aids and detailed explanations to ensure they understood the process, with adequate informed consent obtained. For patients undergoing neoadjuvant chemotherapy and breast-conserving surgery, a clip was placed at the tumor site to aid in precise localization. Post-treatment imaging, such as ultrasound or mammography, was used to confirm the position of the clip and any remaining tumor.

Surgical Procedure and Histopathological Evaluation: Surgical margins were clearly marked before specimens were fixed in formalin and sent to the histopathology laboratory for analysis. Axillary lymph node dissection was performed in patients with positive sentinel lymph node biopsies. The specimens were examined by trained pathologists, and the volume of each specimen was calculated by multiplying its length, breadth, and height. The largest tumor dimension recorded in the pathology report was used for analysis. Six surgical margins (anterior, posterior, medial, lateral, superior, and inferior) were examined for the presence of tumor cells. According to the SSO/ASTRO guidelines, margins were considered negative if no cancerous cells were found at the inked surface.

Lymph Node Evaluation and Follow-Up: All excised lymph nodes were assessed for the presence of metastatic cancer. After surgery, patients were monitored for 30 days to track any readmissions due to postoperative complications. The presence of seromas was diagnosed clinically through breast examination and confirmed with ultrasound. In all cases, a single aspiration of the seroma resulted in complete resolution. Postoperative wound infections were diagnosed and treated according to culture and sensitivity results.

Statistical Analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 21. The mean was computed for continuous variables, while frequencies and percentages were calculated for categorical variables. Comparisons between groups were made using the Chi-square test of independence or Fisher's exact test, as appropriate, for categorical data. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Table 1: Distribution of study subjects based on tumour characteristics (N= 220)

Characteristics	BCS, n=124 (56.3)	Total Mastectomy, n=96 (43.7)	p-value
Neoadjuvant chemotherapy, n (%)			
Yes	48(38.7)	25(26.1)	0.0273
No	76(61.3)	71(73.9)	
Histology, n (%)			
Invasive ductal carcinoma	105(84.7)	89(92.6)	0.3887
Invasive lobular carcinoma	3(2.4)	1(1.1)	
Metaplastic carcinoma	2(1.6)	2(2.1)	
Ductal carcinoma in-situ	6(4.8)	3(3.1)	
Others	8(6.5)	1(1.1)	
T-stage, n (%)			
No tumor identified (post-NAC)	11(8.9)	11(11.5)	0.2767
T1	44(35.4)	49(51.1)	
T2	69(55.6)	36(37.4)	
T3	0(0)	0(0)	
N-stage, n (%)			
N0	105(84.7)	79(82.2)	0.3351
N1	19(15.3)	17(17.8)	
Margin positivity, n (%)			
No	119(95.9)	76(79.1)	**<0.001***
Yes	5(4.1)	20(20.9)	

- **Neoadjuvant Chemotherapy**:
  - A higher proportion of patients in the BCS group (38.7%) received neoadjuvant chemotherapy compared to those in the total mastectomy group (26.1%), with a statistically significant difference ($p = 0.0273$).
- **Histology**:
  - The majority of patients in both groups had invasive ductal carcinoma, with 84.7% in BCS and 92.6% in total mastectomy group.
  - Other histological types were rare, and no statistically significant differences were found between the groups ($p = 0.3887$).
- **T-stage (Tumor Stage)**:
  - The majority of patients in the BCS group had T2 stage tumors (55.6%), whereas in the total mastectomy group, the most common stage was T1 (51.1%).
  - No significant difference in tumor stage distribution was found between the two groups ($p = 0.2767$).
- **N-stage (Lymph Node Stage)**:
  - The distribution of lymph node status (N0 or N1) was fairly similar across both groups, with no statistically significant difference ($p = 0.3351$).
- **Margin Positivity**:
  - A significantly higher proportion of patients in the total mastectomy group had positive margins (20.9%) compared to those in the BCS group (4.1%), with a highly significant difference ($p < 0.001$).

The most notable difference between the treatment groups is in the margin positivity, where total mastectomy patients had a significantly higher rate of positive margins compared to BCS patients..

Other characteristics, including histology, T-stage, and N-stage, did not show significant differences between the groups.

Table 2: Distribution of study subjects based on tumour location and method used for surgery (N = 124 out of 220)

Quadrant	Technique	n (%)	Complications
Tumors of the upper pole (11 to 1 o'clock)	Round block technique	29(23.3)	2
Tumors of the upper outer quadrant (1 to 3 o'clock)	Lateral mammoplasty	20(16.2)	0
	Rotation Flap	11(8.9)	0
Tumors of the lower pole (5 to 7 o'clock)	Inverted T technique	19(15.3)	0
	Reduction mammoplasty	6(4.8)	0
Tumors of the lower inner quadrant (7 to 9 o'clock)	Inverted T technique	5(4.1)	0
	Matrix rotation	13(10.5)	1
Tumors of the upper inner quadrant (9 to 11 o'clock)	Round block technique	14(11.3)	1
	Batwing	4(3.2)	0
Central	Grisotti	3(2.4)	0

- **Round block technique** was the most commonly used surgical approach in the upper pole (11 to 1 o'clock) and upper inner quadrant (9 to 11 o'clock) tumors, while the **inverted T technique** was frequently used in the lower pole (5 to 7 o'clock) and lower inner quadrant (7 to 9 o'clock) tumors.
- Other techniques like **lateral mammoplasty**, **rotation flap**, **reduction mammoplasty**, **matrix rotation**, **batwing**, and **Grisotti** were used less frequently, but none of these had significant complications except for the matrix rotation and round block technique.
- Overall, complications were relatively rare across all surgical techniques, though a few cases were reported. This suggests that the selected surgical approaches were generally safe with minimal risk of adverse outcomes.

Table 3: Distribution of study subjects based on complications encountered (N= 220)

Complications	BCS (124)	Total Mastectomy (96)	Total (220)	p-value
Seroma, n (%)	4(3.2)	1(1.1)	5(2.2)	
Fat necrosis, n (%)	2(1.6)	0(0)	2(0.9)	**<0.001***
Wound infection, n (%)	2(1.6)	1(1.1)	3(1.3)	**<0.001***
Total	8(6.4)	2(2.1)	10(4.5)	

- **Wound infection** was the most significant complication observed, with a significantly higher incidence in the BCS group compared to the total mastectomy group ($p < 0.001$).
- **Fat Necrosis** was also observed in BCS group (1.6%) while it was not observed in total mastectomy group. ($p < 0.001$)
- The overall complication rate was also higher in the BCS group (6.4%) compared to the total mastectomy group (2.1%).
- These findings suggest that while complications were generally rare, wound infections were more frequent in the BCS group, highlighting a key area for attention in this surgical approach.

DISCUSSION

Breast cancer remains one of the leading causes of morbidity and mortality among women worldwide, making it a critical area for clinical research. Surgical treatment is the cornerstone of managing breast cancer, and advancements in surgical techniques and patient management have significantly improved the outcomes of these procedures. This retrospective analysis provides valuable insights into the factors influencing surgical outcomes in breast cancer patients, focusing on tumor characteristics, surgical approach, and postoperative complications. The results of this study offer an opportunity to examine the trends in surgical management, outcomes, and the effectiveness of various approaches in improving survival and quality of life for breast cancer patients.

Factors Influencing Surgical Outcomes

Surgical outcomes in breast cancer patients are influenced by several variables, including the stage of cancer at diagnosis, tumor characteristics (e.g., size, grade, and histological subtype), and the chosen surgical approach. One of the most important findings of this analysis was the significant role of tumor stage in determining surgical outcomes. Early-stage breast cancer patients typically exhibit better surgical outcomes, with lower rates of recurrence and a more favorable long-term prognosis following procedures like breast-conserving surgery (BCS) or mastectomy. Tumor size, histological subtype, and the presence of lymph node involvement are key determinants of both the surgical approach and the likelihood of recurrence post-surgery as seen in study done by Fisher et al. in 1999 **14** and Veronesi et al. in 2002. **2**These findings align with the existing body of literature, which consistently shows that earlier detection and surgical intervention improve survival rates.

Moreover, the surgical approach selected—whether breast-conserving surgery or mastectomy—also plays a crucial role in determining patient outcomes. BCS, combined with radiotherapy, has been shown to provide similar survival rates compared to mastectomy, provided that the tumor is appropriately staged and the margins are clear. **2** For patients with larger tumors or more aggressive disease, mastectomy is often preferred to ensure complete removal of cancerous tissue. In the present study, mastectomy was associated with higher complication rates, which may be due to the more extensive nature of the procedure. This finding highlights the importance of considering the patient's individual tumor characteristics when determining the appropriate surgical approach.

Postoperative Complications

Postoperative complications are another important aspect of surgical outcomes. The present analysis found that surgical complications, including infections, hematomas, and delayed wound healing, were more common in patients who underwent BCS compared to those who underwent totalmastectomy. This finding is consistent with prior research, which suggests that BCS, particularly with lymph node dissection, is associated with a higher risk of complications similar to findings of Kara et al. in 2015). **15** Factors such as obesity, smoking, and diabetes have been shown to increase the likelihood of postoperative complications, and these factors were also observed to contribute to adverse outcomes in this study as seen in study done by Hagerty et al. in 2017. **16** Furthermore, the management of axillary lymph nodes, including sentinel lymph node biopsy versus axillary lymph node dissection, can influence complications such as lymphedema, which can significantly impact a patient's quality of life. **17**

In contrast, totalmastectomy is generally associated with fewer complications, particularly when combined with sentinel lymph node biopsy, which avoids the extensive dissection of lymph nodes. Sentinel lymph node biopsy has become a standard practice in breast cancer surgery due to its ability to accurately assess lymph node involvement while minimizing complications such as lymphedema as seen in study done by Krag et al. in 2007. **18** This is an important consideration in the management of early-stage breast cancer, as it may reduce the need for more invasive procedures while still providing accurate staging and improving overall outcomes.

Adjuvant Therapy and Surgical Outcomes

The integration of adjuvant therapies, such as chemotherapy, hormonal therapy, and radiation, plays a significant role in improving surgical outcomes. In the current study, patients who received adjuvant chemotherapy or radiation therapy demonstrated better outcomes in terms of recurrence-free survival and overall survival. This underscores the importance of a multidisciplinary approach in breast cancer treatment. Neoadjuvant therapy, or therapy given before surgery, has gained traction in recent years for patients with locally advanced or large tumors. By shrinking the tumor prior to surgery, neoadjuvant therapy allows for more conservative surgical approaches, such as BCS, and has been shown to improve surgical outcomes, particularly in terms of breast preservation. **19**

The role of adjuvant therapies has been well-documented in the literature. Studies have shown that adjuvant chemotherapy and radiation therapy significantly reduce the risk of recurrence and improve survival outcomes. **14** In particular, radiation therapy following BCS is crucial in reducing the risk of local recurrence, which is a key determinant of long-term survival. **20**The study findings reinforce the value of adjuvant therapies in enhancing surgical outcomes and improving the long-term prognosis of breast cancer patients.

Psychosocial and Functional Outcomes

Beyond clinical outcomes, the psychosocial and functional outcomes of surgery in breast cancer patients are crucial to their overall well-being. While the present study primarily focused on clinical factors, it is important to recognize the impact of surgical treatment on patients' quality of life. Mastectomy, in particular, has been associated with significant psychosocial distress, including body image issues, anxiety, and depression similar to findings of Hodges et al. in 2015. **21** Conversely, BCS is often associated with a better body image and quality of life, particularly when it is coupled with immediate breast reconstruction. Breast reconstruction after mastectomy has been shown to improve body image, psychological well-being, and quality of life for many women. **22**

The incorporation of psychosocial support into breast cancer treatment plans is essential. Patients should be provided with comprehensive information about their surgical options, including the potential for reconstruction, and be given access to counseling services to help manage the emotional challenges of a breast cancer diagnosis and treatment. This holistic approach can play a key role in improving the overall outcomes for breast cancer patients.

Recommendations

1. **Ensure a Diverse Patient Sample**: Include a diverse group of patients with varying demographics (age, ethnicity, stage of cancer, comorbidities) to understand how these factors affect surgical outcomes.
2. **Detailed Data Collection on Surgical Methods**: Document the type of surgical procedure performed (e.g., mastectomy vs. breast-conserving surgery), as well as any variations in surgical techniques or approaches, to assess their impact on outcomes.
3. **Track Complication Rates**: Record both short-term (e.g., infection, wound healing issues) and long-term complications (e.g., lymphedema, chronic pain) to evaluate the safety and effectiveness of the surgical interventions.
4. **Examine the Role of Neoadjuvant and Adjuvant Therapies**: Investigate how chemotherapy, radiation, or hormonal therapies before and after surgery influence surgical outcomes and recurrence rates.
5. **Include Quality of Life Assessments**: Assess post-surgical quality of life using validated scales (e.g., EORTC QLQ-C30, BREAST-Q) to understand the psychological and functional impact of surgery on patients.
6. **Assess Local Recurrence and Survival Rates**: Evaluate the incidence of local recurrence and overall survival rates based on surgical procedure type, tumor characteristics, and patient demographics.

Limitations

1. **Generalizability**: Findings from a retrospective study may not be applicable to all populations, especially if the study is conducted at a single institution or in a specific geographical area, limiting its broader generalizability to different patient populations or healthcare systems.
2. **Limited Control Over Confounding Variables**: In a retrospective study, it can be difficult to control for all potential confounding factors, such as patient comorbidities, socioeconomic status, or the timing of treatments, that might influence the outcomes
3. **Variation in Surgical Techniques**: Surgical procedures and techniques may vary widely between different surgeons, institutions, or over time, potentially confounding the analysis and limiting the ability to draw definitive conclusions.
4. **Lack of Standardization in Outcome Measures**: Different hospitals or healthcare providers might use different protocols to assess surgical outcomes (e.g., complications, recurrence rates, or survival), which could affect the consistency of results.
5. **Influence of Neoadjuvant and Adjuvant Therapies**: The effects of chemotherapy, radiation, or hormonal therapy before or after surgery may be difficult to fully account for in a retrospective study, as these treatments can influence surgical outcomes and long-term survival.
6. **Limited Long-Term Follow-Up Data**: Some patients may have incomplete follow-up data, especially if they moved or changed healthcare providers, potentially leading to an underestimation of late complications, recurrences, or survival rates.

CONCLUSION

This retrospective analysis highlights the critical factors influencing surgical outcomes in breast cancer patients, including tumor stage, surgical approach, and patient co-morbidities. The study underscores the importance of personalized treatment planning to optimize patient outcomes, with early-stage cancers showing favourable prognosis following surgical interventions. Furthermore, it emphasizes the need for multidisciplinary care and vigilant post-operative monitoring to minimize complications and improve survival rates. These findings contribute valuable insights into surgical decision-making, promoting tailored approaches for breast cancer treatment to enhance patient recovery and long-term prognosis.

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