

Original article

Comparative Clinical Outcomes and Recurrence Patterns Following Mastectomy versus Breast Conserving Surgery in Female Breast Cancer Patients: A Multicenter Retrospective Cohort Study in Western Libya

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Abstract

Breast cancer is the most common cancer diagnosed in women worldwide. In high-income countries, breast-conserving surgery combined with radiotherapy gives survival similar to mastectomy in early-stage disease. Whether this holds in low-resource settings such as Libya, where radiotherapy access and follow-up are less consistent, is not well documented. We conducted a retrospective cohort study of 122 women treated for histologically confirmed, non-metastatic breast cancer at two centers in Western Libya between 2021 and 2026. Sixty-nine patients underwent breast-conserving surgery and 53 underwent mastectomy. Baseline characteristics, treatment, recurrence, and follow-up adherence were compared between groups using the independent t-test, chi-square test, or Fisher's exact test as appropriate. Logistic regression identified predictors of recurrence. Patients who had mastectomy presented with larger tumors (2.5 ± 0.6 cm vs 2.0 ± 0.7 cm, $p < 0.001$) and more often had positive lymph nodes (64.2% vs 5.8%, $p < 0.001$) than patients who had breast-conserving surgery. Twelve recurrences were recorded overall (9.8%), all distant, occurring more often after mastectomy than breast-conserving surgery (18.9% vs 2.9%, $p = 0.009$). Tumor size was the strongest independent predictor of recurrence (adjusted odds ratio 5.44 per cm, 95% Confidence Interval (CI) 1.79–16.50, $p = 0.003$), and mastectomy remained associated with recurrence after adjustment for tumor size (adjusted odds ratio 5.37, 95% CI 1.04–27.56, $p = 0.044$). About one in five patients who had breast-conserving surgery did not receive documented radiotherapy. Follow-up adherence did not differ between groups (87.0% vs 83.0%, $p = 0.74$). In this Western Libyan cohort, mastectomy was reserved largely for women with larger, node-positive tumors, and the higher recurrence observed after mastectomy appears driven mainly by this underlying disease burden rather than the surgical approach itself. Gaps in radiotherapy delivery after breast-conserving surgery deserve attention. Larger prospective studies with longer follow-up are needed.

Keywords. Breast Cancer, Mastectomy, Breast-Conserving Surgery, Recurrence, Libya

Introduction

Breast cancer remains the most frequently diagnosed cancer among women worldwide and a leading cause of cancer death [1]. Surgical treatment of early-stage disease centers on two approaches, mastectomy and breast-conserving surgery, with breast-conserving surgery typically followed by adjuvant radiotherapy as part of standard combined-modality treatment [2]. Several large studies, including a meta-analysis of more than 1.5 million patients, have found broadly similar long-term survival between the two approaches when patients are appropriately selected [3]. Breast-conserving surgery has therefore become a standard option for early-stage disease in many countries. Whether these findings apply equally well outside high-income settings is less clear.

In Libya and other low-resource settings, women often present with more advanced disease, radiotherapy is not always readily available, and follow-up after surgery can be inconsistent. These circumstances may explain why mastectomy is still performed more often than breast-conserving surgery, even among patients who might otherwise be candidates for breast conservation. Reports from sub-Saharan Africa describe a similar pattern, with mastectomy remaining the more common surgical approach in the region [4]. A recent single-center cohort from eastern Libya reported a comparable imbalance, with modified radical mastectomy performed in nearly two-thirds of patients and breast-conserving surgery in only one in five [5]. Local, multicenter data comparing outcomes after mastectomy and breast-conserving surgery in Libya remain scarce; the few published series to date are single-center and describe a pattern of younger age at diagnosis and more advanced stage at presentation than is typical in high-income settings [6].

Little is known about how recurrence patterns, time to recurrence, and adherence to follow-up differ between the two surgical approaches in this setting. This study compares clinical outcomes and recurrence patterns between mastectomy and breast-conserving surgery among women treated for breast cancer at two centers in Western Libya. Specific objectives were to compare baseline clinicopathological characteristics between the surgical groups, to describe the type and timing of recurrence, to identify predictors of recurrence, to compare adherence to follow-up, and to explore factors associated with the choice of surgical procedure.

Methods

Study design and setting

This is a multicenter retrospective cohort study conducted at two centers that manage breast cancer patients in Western Libya, Alfounas Hospital and Subrata National Cancer Institute (SNCI).

Study population and period

Female patients with histologically confirmed, non-metastatic breast cancer who underwent either mastectomy or breast-conserving surgery between 2021 and 2026 were eligible. Patients were excluded if surgical or baseline clinical records were incomplete or if no follow-up information was available. This analysis includes the 122 patients with a documented surgery type available at the time of analysis, 69 in the breast-conserving surgery group and 53 in the mastectomy group.

Data collection

Demographic, clinicopathological, treatment, and follow-up data were extracted from patient records using a structured data collection form. Variables included age, body mass index, menopausal status, comorbidities, family history of breast cancer, histological type, molecular subtype, tumor size, lymph node involvement, hormone receptor and Human Epidermal growth factor Receptor 2 (HER2) status, Ki-67 proliferation index (Ki-67), type of surgery, adjuvant chemotherapy, radiotherapy and hormonal therapy, treatment response, follow-up adherence, recurrence, type and timing of recurrence, and completion of planned treatment.

Statistical analysis

Continuous variables are presented as mean $\pm$ standard deviation and compared between groups with the independent samples t-test. Categorical variables are presented as counts and percentages and compared with the chi-square test or Fisher's exact test when expected cell counts were below five. Predictors of recurrence were examined with univariate logistic regression, followed by a limited multivariable model restricted to two covariates given the small number of recurrence events. A two-sided p-value below 0.05 was considered statistically significant.

Ethical considerations

The study was conducted according to the ethical principles of the Declaration of Helsinki. Patient data were anonymized before analysis, and confidentiality was maintained throughout the research process.

Results

Baseline characteristics

Of the 122 women included, 69 (56.6%) underwent breast-conserving surgery, and 53 (43.4%) underwent mastectomy. Patients were diagnosed between 2021 and 2026. Mean age at diagnosis for the whole cohort was 52.6 ± 10.3 years, and mean tumor size was 2.2 ± 0.7 cm. Baseline characteristics are summarized in (Table 1). Age did not differ significantly between groups, although patients who had breast-conserving surgery trended older (54.0 ± 11.2 vs 50.7 ± 8.8 years, $p=0.072$). Body mass index, marital status, menopausal status, family history of breast cancer, presence of any comorbidity, histological type, molecular subtype, hormone receptor status, HER2 status, and Ki-67 index were similar between the two groups. Two clinicopathological features differed markedly between groups. Tumor size was larger in the mastectomy group (2.5 ± 0.6 cm vs 2.0 ± 0.7 cm, $p<0.001$), and lymph node involvement was far more common after mastectomy (64.2% vs 5.8%, $p<0.001$). The two treating centers also differed in their surgical practice: breast-conserving surgery accounted for 77.5% of cases at Alfounas Hospital compared with 46.3% at SOC ($p=0.002$).

Table 1. Baseline demographic and clinicopathological characteristics by surgical group

Characteristic	BCS (n=69)	Mastectomy (n=53)	p-value
Age, years, mean $\pm$ SD	54.0 $\pm$ 11.2	50.7 $\pm$ 8.8	0.072
BMI, kg/m ² , mean $\pm$ SD	30.8 $\pm$ 4.1	32.4 $\pm$ 5.9	0.109
Marital status			0.397
Married	44 (63.8%)	37 (69.8%)	
Single	16 (23.2%)	13 (24.5%)	
Widowed	9 (13.0%)	3 (5.7%)	
Menopausal status			0.141
Pre-menopausal	13 (18.8%)	17 (32.1%)	
Post-menopausal	56 (81.2%)	36 (67.9%)	
Family history of breast cancer	24 (34.8%)	14 (26.4%)	0.428
Any comorbidity present	16 (23.2%)	11 (20.8%)	0.919
Histological type			0.073
Invasive ductal carcinoma	59 (85.5%)	51 (96.2%)	
Invasive lobular carcinoma	4 (5.8%)	2 (3.8%)	
Other	6 (8.7%)	0 (0.0%)	

<i>Molecular subtype</i>			0.511
Luminal A	41 (59.4%)	26 (49.1%)	
Luminal B	19 (27.5%)	19 (35.8%)	
Triple-negative	9 (13.0%)	8 (15.1%)	
Tumor size, cm, mean $\pm$ SD	2.0 $\pm$ 0.7	2.5 $\pm$ 0.6	<0.001
Lymph node involvement	4 (5.8%)	34 (64.2%)	<0.001
ER positive	42 (60.9%)	33 (62.3%)	1.000
PR positive	49 (77.8%)	35 (77.8%)	1.000
HER2 positive	11 (15.9%)	12 (23.1%)	0.450
<i>Ki-67 index</i>			0.508
Low	54 (80.6%)	42 (82.4%)	
Intermediate	6 (9.0%)	2 (3.9%)	
High	7 (10.4%)	7 (13.7%)	
Treating center: Alfounas Hospital	31 (44.9%)	9 (17.0%)	0.002

BCS: breast-conserving surgery. SD: standard deviation. ER: estrogen receptor. PR: progesterone receptor. HER2: human epidermal growth factor receptor 2. Percentages are of non-missing values within each group; denominators vary slightly for variables with missing data (BMI, PR status, HER2 status, Ki-67 index).

Treatment and response

Rates of chemotherapy, radiotherapy, and hormonal therapy did not differ significantly between groups (Table 2). Radiotherapy was documented in 78.3% of the breast-conserving surgery group, meaning that around one in five of these patients did not receive the adjuvant radiotherapy usually recommended after breast conservation. Treatment response was rated good in 92.8% of the breast-conserving surgery group compared with 77.4% of the mastectomy group, with more partial responses recorded after mastectomy (18.9% vs 4.3%, $p=0.033$).

Table 2. Treatment and outcomes by surgical group

Characteristic	BCS (n=69)	Mastectomy (n=53)	p-value
Chemotherapy given	45 (68.2%)	35 (66.0%)	0.959
Radiotherapy given	54 (78.3%)	41 (77.4%)	1.000
Hormonal therapy given	48 (88.9%)	37 (86.0%)	0.911
<i>Treatment response</i>			0.033
Good	64 (92.8%)	41 (77.4%)	
Partial	3 (4.3%)	10 (18.9%)	
Poor	2 (2.9%)	2 (3.8%)	
<i>Follow-up status</i>			0.738
Adherent	60 (87.0%)	44 (83.0%)	
Non-adherent	6 (8.7%)	5 (9.4%)	
Lost to follow-up	3 (4.3%)	4 (7.5%)	
Recurrence (any)	2 (2.9%)	10 (18.9%)	0.009
<i>Completed planned treatment</i>			0.462
Yes	61 (88.4%)	43 (81.1%)	
Partially	3 (4.3%)	5 (9.4%)	
No	5 (7.2%)	5 (9.4%)	

BCS: Breast-Conserving Surgery.

Recurrence

Twelve recurrences were recorded in the whole cohort (9.8%), and all were classified as distant recurrences; no purely local or regional recurrence was documented in either group. Recurrence was more frequent after mastectomy than after breast-conserving surgery (18.9%, 10 of 53, vs 2.9%, 2 of 69, $p=0.009$). Among the 11 patients with a recorded time to recurrence, the interval ranged from 1 to 3 years, with a median of 1 year.

Predictors of recurrence

In univariate logistic regression, mastectomy and tumor size were both associated with recurrence (Table 3). Age, body mass index, nodal status, triple-negative subtype, and HER2 status were not significant predictors of recurrence in this cohort.

Table 3. Univariate predictors of recurrence

Predictor	Odds ratio	95% CI	p-value
Mastectomy (vs BCS)	7.79	1.63–37.29	0.010
Tumor size, per cm	6.18	2.15–17.76	<0.001
Age, per year	0.95	0.90–1.02	0.146

BMI, per kg/m ²	1.00	0.89–1.13	0.991
Node positive (vs negative)	1.67	0.49–5.63	0.411
Triple-negative subtype	2.29	0.55–9.47	0.255
HER2 positive	2.39	0.65–8.77	0.187

CI: confidence interval. BCS: breast-conserving surgery. Based on 12 recurrence events among 122 patients.

In a multivariable model combining surgical type and tumor size, tumor size remained a strong independent predictor of recurrence, and mastectomy remained independently associated with recurrence, although with a wider confidence interval (Table 4). This pattern suggests that the higher recurrence rate seen after mastectomy is explained in large part, though perhaps not entirely, by the larger tumor size of the patients selected for mastectomy. Given the small number of recurrence events, these adjusted estimates should be treated as exploratory rather than conclusive.

Table 4. Multivariable model: mastectomy and tumor size as joint predictors of recurrence

Predictor	Adjusted odds ratio	95% CI	p-value
Mastectomy (vs BCS)	5.37	1.04–27.56	0.044
Tumor size, per cm	5.44	1.79–16.50	0.003

CI: confidence interval. BCS: breast-conserving surgery. Both predictors were entered in the same model, based on 12 recurrence events among 122 patients.

Follow-up adherence

Follow-up status did not differ significantly between groups. Overall, 104 patients (85.2%) were classified as adherent to follow-up, 11 (9.0%) as non-adherent, and 7 (5.7%) as lost to follow-up, with similar proportions in both surgical groups ($p=0.74$).

Discussion

In this two-center cohort from Western Libya, mastectomy was reserved largely for women with larger and node-positive tumors, while breast-conserving surgery was used more often in patients with smaller, node-negative disease. This pattern mirrors standard, tumor-based selection criteria for breast conservation set out in current clinical practice guidelines, and suggests that, despite resource constraints, surgeons in this setting are applying selection principles broadly similar to those used elsewhere [2]. Recurrence, all of it distant, was clearly more common after mastectomy. On the surface, this differs from landmark trials and a large meta-analysis reporting broadly equivalent survival between mastectomy and breast-conserving surgery with radiotherapy [3]. The difference observed in this cohort is best explained by confounding by indication rather than a true effect of surgical approach. Tumor size alone was the strongest independent predictor of recurrence, and after adjusting for tumor size the association between mastectomy and recurrence weakened, though it did not disappear entirely.

A larger sample with more recurrence events would be needed to determine whether a true independent effect of surgical modality remains. The recurrence pattern observed here is also notable for what it did not show. Classic comparisons between breast-conserving surgery and mastectomy describe a somewhat higher risk of local recurrence after breast conservation, offset by equivalent overall survival [7]. In this cohort, no purely local recurrence was recorded at all, and every documented recurrence was distant. This may reflect genuinely more advanced tumor biology among the women who underwent mastectomy, consistent with reports of later-stage presentation across the region [4]. A related concern is that about one in five patients who had breast-conserving surgery did not receive documented radiotherapy.

Omitting radiotherapy after breast conservation departs from standard combined-modality treatment and would be expected to raise, not lower, the risk of local recurrence. That local recurrence was nonetheless not recorded in this group raises the possibility that some recurrences went undetected rather than truly not occurring. Limited and inconsistent radiotherapy access has been described as a persistent barrier to completing breast-conserving therapy across resource-limited settings, including geographic, financial, and health-system obstacles [8]; these results add a specific outcome dimension to that concern in the Libyan context. Surgical choice also varied by treating center, with breast-conserving surgery used far more often at one hospital than the other. Hospital-level differences in surgical practice, separate from patient-level clinical factors, have been reported in other settings with variable resources [9], and the pattern seen here suggests that institutional factors, such as surgeon preference, operating theatre access, or referral patterns, may influence surgical decision-making in Western Libya as much as tumor characteristics do. Follow-up adherence was similar between groups, which is reassuring: the higher recurrence rate after mastectomy does not appear to be an artifact of closer surveillance in that group. A numeric duration of follow-up was available for fewer than half of all patients, however, so true differences in surveillance intensity cannot be ruled out with the data at hand.

Limitations

Several limitations should be considered when interpreting these findings. Data availability constrained the analytic sample to 122 patients with a documented surgery type, and this limited statistical power, particularly for the multivariable analysis of recurrence: with only 12 recurrence events recorded, the confidence intervals around the adjusted odds ratios are wide, and no more than two covariates could be entered into any model without overfitting. This constraint was managed, where

possible, using the Fisher exact test for categorical comparisons with small expected cell counts and by deliberately restricting the multivariable model to two covariates; even so, these adjusted estimates should be interpreted as exploratory and hypothesis-generating rather than confirmatory. The analysis also draws on data from only two centers in one region of Libya, which limits generalizability to other settings within the country. A numeric follow-up duration was missing for more than half the cohort, and recorded follow-up periods were relatively short, so later recurrences and long-term survival differences may not yet be captured. Finally, this is a retrospective study drawing on clinical records completed by different staff at different centers, and despite standardization during data cleaning, some misclassification of variables such as comorbidities or treatment response cannot be excluded.

Conclusion

In this Western Libyan cohort, women selected for mastectomy had larger and more often node-positive tumors than those selected for breast-conserving surgery, and this difference in disease burden appears to explain most, though perhaps not all, of the higher recurrence rate observed after mastectomy. All recorded recurrences were distant, and about one in five patients who had breast-conserving surgery did not receive radiotherapy, a gap worth addressing directly. Follow-up adherence was similar across groups. These findings support the continued, careful expansion of breast-conserving surgery for women with early, node-negative disease in Libya, alongside efforts to secure consistent radiotherapy access and systematic recurrence surveillance. Larger, prospective, multicenter studies with longer follow-up are needed to confirm these patterns and to guide surgical decision-making in this setting.

Conflict of interest. Nil

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