'Umbrella' technique: An alternative approach to overcoming challenges in breast-conserving surgery

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Abstract. Breast-oncoplastic surgery can cause deformities, particularly following large excisions or radiotherapy. While oncoplastic techniques enhance patient outcomes, they have limitations in complex cases. The present study aimed to introduce the 'umbrella' technique to overcome these limitations and optimize both oncologic and aesthetic results. The present single-center retrospective study, conducted from January, 2022 to December, 2023, evaluated the 'umbrella' technique for breast cancer treatment. It included patients with early-stage breast cancer, primarily those who had undergone neoadjuvant chemotherapy. Exclusion criteria included prior breast surgery for unrelated reasons, central tumors and aggressive cancers. Data on demographics, treatments, imaging, tumor characteristics and post-operative outcomes were collected. Patient satisfaction and follow-up lasted from 1 month to 2 years, with no documented recurrences. A total of 107 patients participated, with a mean age of 48.49±9.22 years. Of these patients, 95 (88.8%) were <60 years of age, 97 (90.65%) were married and 77 (72%) were non-smokers. The majority of patients (90, 84.11%) had received chemotherapy. Tumor laterality was almost even, with 54 (50.47%) tumors on the right. Invasive ductal carcinoma was the most common diagnosis (n=61, 57%). The majority of tumors were grade II (n=73, 68.22%). Post-operative complications included shoulder stiffness (n=27, 25.23%) and infection (n=26, 24.30%). Reoperation was required in 10 (9.35%) patients. All assessed variables had high mean satisfaction scores, >8.0. On the whole, the present study demonstrates that the 'umbrella' technique improves breast-conserving surgery by addressing limitations in sensitive tumor areas, providing clear margins, superior cosmetic outcomes and high patient satisfaction, particularly in early-stage cases. However, the short follow-up limits oncological conclusions, and long-term outcomes require further study.

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Introduction

Breast cancer remains a global health challenge, with 2.3 million new cases and 666,000 deaths in 2022. High-income countries exhibit the highest incidence rates, while low- and middle-income nations bear a disproportionate mortality burden (1,2). Breast cancer surgery falls into two main categories: mastectomy and breast-conserving surgery. While mastectomy is effective, it can adversely affect body image, attractiveness and sexuality (3). Standard breast conserving surgical training advocates leaving the lumpectomy cavity open, allowing a seroma to maintain breast contour before scar tissue forms (4). This approach suffices for small resections; however, it is inadequate for larger excisions or tumors in cosmetically sensitive areas, often resulting in deformities or nipple displacement, exacerbated by radiotherapy (5).

The term 'oncoplastic surgery' was coined by Dr Werner Audretsh in 1996 and has gained widespread recognition, for allowing larger tissue resections, while maintaining aesthetic results. Oncoplastic breast surgery has revolutionized the management of breast cancer by harmonizing oncologic efficacy with aesthetic preservation, enabling tumor excision while maintaining natural breast contour and symmetry (6).

Oncoplastic breast surgery is classified into volume-displacement and volume-replacement techniques. Volume-displacement approaches involve dermoglandular or glandular transposition, redistribution and the rotation of breast tissue to fill the

lumpectomy defect, whereas volume-replacement techniques utilize autologous flaps to restore volume following tumor excision (7). Over the past two decades, both strategies, including round block, racket-shape and omega-shape volume-displacement methods, have become integral to breast-conserving surgery for early-stage disease, effectively achieving clear margins, while minimizing post-operative deformity, with cosmetic satisfaction >90% and low recurrence rates reported (6).

The increasing global burden of breast cancer, alongside persistent outcome disparities, necessitates innovative surgical approaches that balance oncologic precision with individualized reconstruction. Existing techniques often fall short, particularly in resource-limited settings with advanced-stage tumors and in high-income populations where aesthetic outcomes are prioritized. The present study aimed to introduce the 'umbrella' technique, an alternative approach integrating wide local excision, defect remodeling and intrinsic breast support into a single procedure. By combining dermo glandular redistribution with internal stabilization, this method seeks to enhance both oncologic safety and cosmetic outcomes, while reducing surgical complexity.

Patients and methods

Study design and setting. The present study was a single-center retrospective study conducted from January, 2022 to December, 2023. The present study included consecutive patients who underwent the 'umbrella' technique for breast cancer treatment. A total of 107 patients were enrolled, with a median age of 48 years (range, 29-70 years). All patients provided informed consent, permitting the use of their medical records, images and figures for research and publication purposes. As a retrospective study utilizing existing clinical data collected during routine surgical care, formal Institutional Review Board (IRB) or Ethics Committee approval was not required under the applicable institutional and national regulations. The requirement for prospective ethical approval was formally waived by the Institutional Review Board of Smart Health Tower, Sulaymaniyah, Iraq given the retrospective observational design of the study.

Inclusion and exclusion criteria. The present study included patients diagnosed with early-stage breast cancer, as determined by tumor grading. Younger and middle-aged individuals were prioritized, particularly those who had undergone neoadjuvant chemotherapy prior to surgery. Eligible patients had a single, localized tumor without distant metastasis and a tumor size of ≤6 cm, particularly in those with larger breasts. Tumors were histopathologically classified as grade I or II, with some grade III tumors included based on clinical judgment.

Patients were excluded if they had a history of prior breast surgery for unrelated reasons or presented with central breast tumors, multiple malignant masses, or multicentric tumors. Individuals with a history of breast radiation therapy or metastatic breast cancer at diagnosis were also excluded. Tumors >6 cm in size or cases where insufficient breast tissue was available for excision, particularly in small-breasted patients, were deemed ineligible to prevent recurrence. Additionally, patients with highly aggressive tumors, such as grade III cancers with chest wall invasion or poorly differentiated malignancies, were not included. Those requiring breast revision surgery due to chemotherapy-related complications were also excluded from the study.

Data collection. Data were retrospectively collected from the medical records of patients treated at Smart Health Tower. Data collection commenced in February, 2024 and included records from patients treated between January 1, 2022 and December 31, 2023. Demographic details, including age, sex and medical history, were documented. Information on previous treatments, such as radiotherapy and chemotherapy, was obtained. Imaging findings, including breast ultrasound results, were reviewed alongside breast core needle biopsy and axillary fine-needle aspiration cytology reports. Tumor characteristics, including size (as assessed by ultrasound and histopathological examination), histopathological grade and staging data, were recorded. Post-operative outcomes were analyzed, including surgical complications, follow-up duration and recurrence rates.

Surgical intervention. The 'umbrella' technique was performed under general anesthesia in a sterile operating room. Breast cancer diagnosis was confirmed through a combination of medical history, a physical examination and tissue sampling. Patients with infection risk factors were administered pre-operative antibiotics as needed. The surgical site was disinfected using iodine-based antiseptic solutions prior to the procedure. The patient was positioned in the prone position to facilitate proper access to the breast tissue, and the arm abducted 90 degrees on and arm board. The incision was planned based on the size, location and characteristics of the tumor. The incision often extended from the areola towards the periphery of breast or was adjusted according to the recommendations of the surgeon (Fig. 1). Tissue dissection was carried out in three anatomically defined planes, collectively resembling an umbrella structure. The first (superficial) plane was developed in the subdermal/prepectoral plane, preserving skin vascularity. The second plane corresponded to intraglandular dissection, enabling tumor-centered wide local excision with adequate oncologic margins. The third (deep) plane was created in the retromammary space over the pectoralis major fascia, facilitating mobilization of the breast parenchyma; during the development of this plane, the fascia was elevated with the flap to preserve the perforator blood supply, thereby enhancing flap vascularity and viability. A random-pattern dermo-glandular pedicle was preserved based on the surrounding vascularized breast tissue to maintain flap viability. The tumor was palpated intraoperatively, ensuring precise excision with wide local excision performed using electrocautery (Fig. 2).

Following tumor removal, the rotational flap technique was used to reconstruct the defect, preserving breast contour and symmetry. The incision was closed in multiple layers, starting with 2-0 Vicryl sutures for deep layers, followed by 3-0 Vicryl sutures for subcutaneous tissue, and finally, 3-0 Prolene sutures for the fascia and skin. In certain cases, a drain was placed to manage post-operative fluid accumulation, mainly in cases that underwent axillary dissection through same incision. The excised tissue was sent for histological evaluation to confirm clear margins and tumor characteristics.

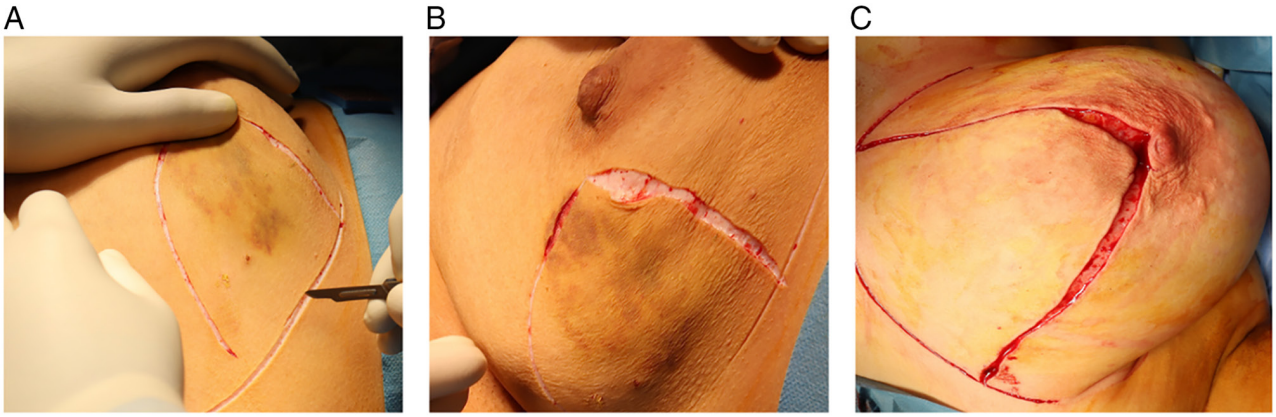

Figure 1. (A and B) Images of a 51-year-old female patient with grade II invasive ductal carcinoma presenting with a mass (36x20 mm) in the upper outer quadrant of the breast. (A) Pre-operative markings based on breast size, orientation and surgical planning. (B) Initiation of the incision with exposure of the subcutaneous tissue while maintaining hemostasis. (C) A different 48-year-old female patient with grade II breast carcinoma presenting with a mass (23x20 mm) in the upper inner quadrans of the breast, showing the fully developed incision with tissue mobilization and surgical access for resection or reconstruction.

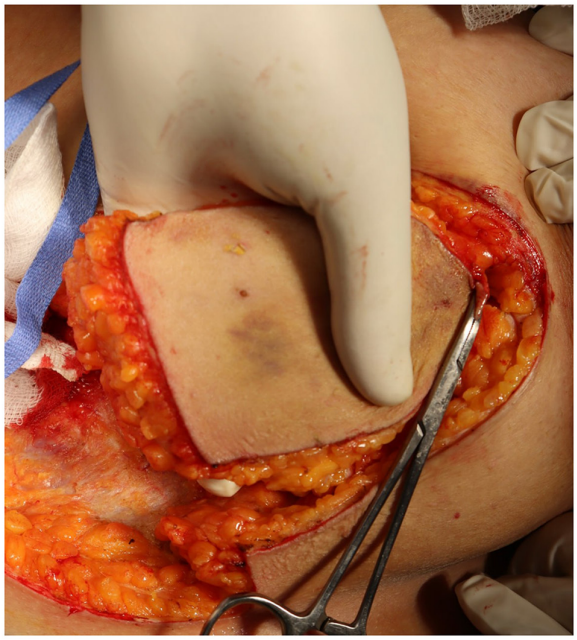

Figure 2. Image of a 51-year-old female patient with grade II invasive ductal carcinoma presenting with a mass (36x20 mm) in the upper outer quadrant of the breast. The mass, along with the surrounding margins and breast tissue, was excised using cauterization, followed by the application of a rotational flap.

Satisfaction measurement. Patient satisfaction was assessed using a comprehensive evaluation system that focused on several key aspects of breast surgery outcomes. The variables included size, shape, nipple-areolar position, nipple-areolar appearance, breast symmetry, appearance of the breast, appearance of the scar and skin sensitivity. Each variable was scored on a scale of 1 to 10, with higher scores indicating greater satisfaction.

Follow-up. Patients were followed-up for an average period ranging from 1 month to 2 years (Fig. 3). The majority of the patients had their stitches removed at 10 days post-operatively, and drains were removed within 12 days, particularly in patients with larger breasts who had a higher risk of fluid collection. Antibiotic therapy was administered based on drainage volume and surgical site assessment. Post-operative healing was generally uneventful, with minimal scarring observed in the majority of patients. Patients were encouraged to engage in regular physical activity to support recovery. Regular oncology follow-ups were scheduled to monitor clinical progress. During the follow-up period, no recurrences were documented.

Statistical analysis. Data were systematically entered into Microsoft Excel and analyzed using SPSS software (IBM SPSS Statistics, version 27.0; IBM Corp.). Quantitative data are presented as the mean ± standard deviations (SD) or as the median with quartile range (QR), as appropriate. Categorical data are expressed as frequency and percentages. A two-tailed alpha level of 0.05 was set as the threshold for statistical significance for all analyses. The association between tumor grade (grades 0, I, II, III and NA; n=107) and post-operative complications (categorical variables) was assessed using Fisher's exact test, comparing complication rates across all tumor grade groups. The association between tumor grade and patient-reported satisfaction outcomes (ordinal variables, scored 1-10) was assessed using the Kruskal-Wallis H test, with satisfaction scores reported as medians with quartile ranges. Post hoc pairwise comparisons using Dunn's test with the Bonferroni correction were planned following the Kruskal-Wallis test; however, as no statistically significant differences were observed, post hoc analyses were not performed. In all analyses, a value of $P<0.05$ was considered to indicate a statistically significant difference.

Results

In the present study, 107 patients were enrolled. The mean age of the study population was 48.49±9.22 years, with the majority 95 (88.8%) being <60 years of age. The majority of the patients were married 97 (90.65%), and a substantial proportion 77 (72.0%) were non-smokers. As regards surgical history, 8 (7.5%) patients had previously undergone breast

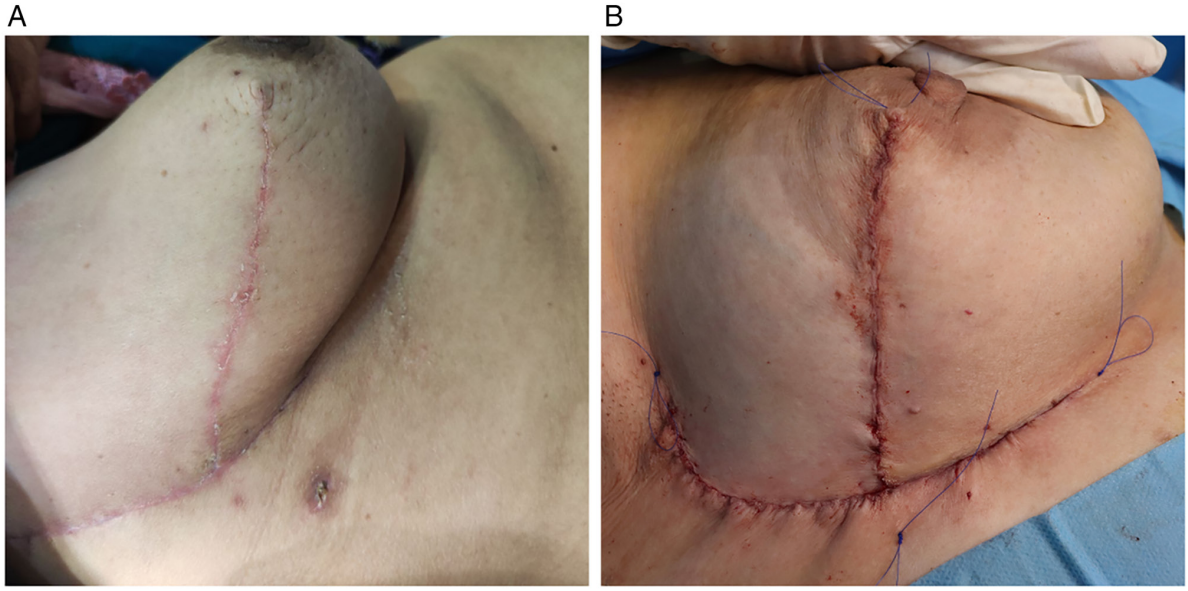

Figure 3. (A) Image of a 44-year-old female patient with grade III breast carcinoma presenting with a breast mass (25x16 mm), demonstrating the post-operative appearance of the scar at 1-month follow-up after surgery. (B) Image of a 51-year-old female patient with grade II invasive ductal carcinoma presenting with a mass (36x20 mm) in the upper outer quadrant of the breast, showing intraoperative skin closure immediately following surgery.

surgery, while 99 (92.5%) had not. In terms of occupation status, 20 (18.69%) were employed, whereas 82 (76.64%) were housewives. The majority of the patients (n=90, 84.11%) had received chemotherapy (Table I).

Tumor laterality was virtually evenly distributed, with 54 (50.47%) of tumors occurring on the right side and 52 (48.60%) in the left. The most common tumor location, as determined by ultrasound, was the upper outer quadrant 56 (52.34%), followed by the upper inner quadrant 20 (18.69%). As regards tumor size, the majority 56 (52.3%) of tumors measured between 10-20 mm. Pathologically, invasive ductal carcinoma was the predominant diagnosis, accounting for 61 (57.0%) of cases. Fine needle aspiration results revealed that 36 (33.64%) of cases were positive, whereas 71 (66.36%) were negative (Table II).

The median tumor size was 2.0 cm (range, 1.5-2.7 cm). The majority of tumors were classified as grade II 73(68.22%), followed by grade III 26(24.30%). Reoperative surgery was required in 10 (9.35%) of cases, with a wide local excision being the most common reoperation 7 (70.0%). As regards post-operative surgical margins, 95 (88.78) of the patients had negative margins. TNM staging revealed that the majority of patients were classified as stage II 61 (57.0%). Among the post-operative complications, shoulder stiffness was the most common complication reported in 27 (25.23%) of the patients, followed by infection in 26 (24.30%) cases (Table III). All assessed variables had high mean satisfaction scores, >8.0. The highest overall mean score was for shape (8.87±1.50), followed by size (8.76±1.78). Among the quadrants, the lower inner quadrant had the highest mean scores for both size (9.83±0.41) and shape (9.83±0.41). Nipple-areolar position and appearance had mean scores of 8.45±1.78 and 8.42±1.75, respectively (Table IV).

Across tumor grades (grade 0, n=3; grade I, n=4; grade II, n=73; grade III, n=26; NA, n=1; total n=107), post-operative complications were generally infrequent, and Fisher's exact test revealed no statistically significantly differences between the groups. Bleeding was absent in patients with grade 0 and I (0.0%) tumors, and occurred in 4.1% (3/73) of patients with grade II and 7.7% (2/26) of patients with grade III tumors (P=0.734). Hematoma exhibited a similar pattern, being absent in patients with grade 0 and I tumors, and present in 8.2% (6/73) and 7.7% (2/26) of patient with grade II and III tumors, respectively (Fisher's exact test, P=0.951). Patient satisfaction scores remained high across all tumor grades without significant differences. Median breast shape scores ranged from 8.0 to 10.0, with 10.0 (8-10) in patients with grade II and 9.0 (8-10) in patients with grade III tumors (P=0.289). Nipple-areolar position and appearance scores were similarly high, with medians of 9.0-10.0 in patients with grade II-III tumors compared to slightly lower values in those with grade I tumors (P=0.702 and P=0.925, respectively). Breast symmetry and overall breast appearance exhibited median scores between 8.0 and 10.0 across groups (P=0.838 and P=0.595, respectively), while scar appearance and skin sensitivity also remained favorable, with median values predominantly between 8.0 and 9.0 (P=0.773 and P=0.645, respectively) (Table V).

Discussion

The incidence of breast cancer among younger populations has been steadily increasing, with the American Cancer Society reporting an annual increase of ~0.6-1%, particularly among young adults (8). This trend underscores the need for further research into the underlying causes, risk factors and innovative surgical strategies for the disease. Recent studies have introduced novel oncoplastic breast-conserving techniques targeting younger patients. Shi *et al* (9) reported that 86.5% of patients undergoing the folding flap technique were <60 years of age, while Chen *et al* (10) found that 67.2% of patients treated with the spoon-shape technique were <60 years. Consistent with these findings, the present study evaluating

Table I. Baseline characteristics of the study population.

Variables	Overall (n=107)	
	Number, mean or median	%, SD or range
Age, median and range	48.00	29.0-70.0
Age (years), mean ± SD	48.49	9.22
Age group, no. and %		
<60	95	88.8
>60	12	11.2
Marital status, no. and %		
Single	7	6.54
Married	97	90.65
Widowed	2	1.87
Divorced	1	0.93
Lactation duration (years), no. and %		
<2 years	26	24.30
>2 years	68	63.55
Not lactating	13	12.15
Smoking status, no. and %		
Non-smoker	77	72.0
Passive smoker	30	28.0
Past medical history, no. and %		
Negative	74	69.16
Hypertension	11	10.28
Diabetes mellitus	7	6.54
Hypertension + diabetes mellitus	5	4.67
Hypothyroidism	2	1.87
Anemia	1	0.93
Favism	1	0.93
Hodgkin lymphoma	1	0.93
Migraines	1	0.93
Rheumatoid arthritis	1	0.93
Diabetes mellitus + heart disease	1	0.93
Hypertension + breast cancer	1	0.93
Hypertension + hypothyroidism	1	0.93
Previous breast surgery, no. and %		
Yes	8	7.5
No	99	92.5
Occupation status, no. and %		
Employed	20	18.69
Housewife	82	76.64
Jobless	4	3.74
Retired	1	0.93
Received chemotherapy, no. and %		
Yes	90	84.11
No	17	15.89
Cancer recurrence, no. and %		
Yes	1	0.93
No	106	99.07

SD, standard deviation.

Table II. Clinicopathological characteristics of breast tumors in the present study cohort.

	Overall (n=107)	
Variables	No. or median	% or range
Tumor laterality, no. and %		
Right	54	50.47
Left	52	48.60
Both	1	0.93
Tumor location (US), no. and %		
Lower inner quadrant	6	5.61
Lower outer quadrant	15	14.02
Lower central	4	3.74
Upper inner quadrant	20	18.69
Upper outer quadrant	56	52.34
Upper central	6	5.61
Tumor size (US) (mm), no. and %		
1-10	9	8.4
10-20	56	52.3
20-30	28	26.2
30-40	6	5.6
>40	6	5.6
NA	2	1.9
Pathological characteristic of the tumor, no. and %		
Ductal carcinoma *in situ* without invasion	1	0.93
Invasive ductal carcinoma	61	57.0
Invasive ductal carcinoma with ductal carcinoma *in situ*	34	31.78
Invasive Ductal carcinoma with invasive lobular carcinoma	1	0.93
Invasive lobular carcinoma	4	3.74
Invasive lobular carcinoma with ductal carcinoma *in situ*	3	2.80
Pleomorphic invasive lobular carcinoma	1	0.93
Invasive adenoid cystic carcinoma	1	0.93
Metaplastic breast cancer	1	0.93
Fine needle aspiration, no. and %		
Positive	36	33.64
Negative	71	66.36
Axillary procedure type, no. and %		
Axillary sampling	73	68.22
Axillary lymph node dissection	34	31.78
Operation duration (min), median and range	90	70-100

US, ultrasound; NA, not available.

the 'umbrella' technique demonstrated that 88.8% of the 107 enrolled patients were <60 years of age, with a mean age of 48.49 years, highlighting the growing relevance of oncoplastic innovations for younger breast cancer populations.

The Surveillance, Epidemiology, and End Results program reports a slight predominance of left-sided breast cancer, with a laterality ratio of 1.041 (11), a pattern also observed in triple-negative breast cancer, where left-sided tumors accounted for 69.12% of cases (12). By contrast, a retrospective study evaluating a retroglandular oncoplastic technique reported a predominance of right-sided tumors (57.8%) (13). In the present study, tumor laterality was almost balanced, with 50.47% occurring in the right breast and 48.60% in the left. As regards tumor size, previous studies using ultrasound-based evaluation reported that the majority of tumors measured 20-45 mm (55.2%) or 20-40 mm (65.4%) (9,10). Conversely, the present study found that 60.75% of tumors were <20 mm in size, including 8.4% measuring 1-10 mm and 52.3% measuring 10-20 mm.

Oncoplastic breast surgery expands the indications for reconstructive breast cancer procedures and provides an alternative to mastectomy; however, aesthetic outcomes may not

Table III. Tumor features, surgical interventions and post-operative complications.

Variables	Overall (n=107)	
	No. or median	% or range
Tumor size (cm), median and range	2.0	1.5-2.7
Tumor grade, no. and %		
0	3	2.80
I	4	3.74
II	73	68.22
III	26	24.30
NA	1	0.93
Reoperative surgery, no. and %		
No	97	90.65
Yes	10	9.35
Type of reoperation, no. and %		
Wide local excision	7	70.0
Mastectomy	3	30.0
Postoperative surgical margin status, no. and %		
Positive	8	7.48
Close	2	1.87
Negative	95	88.78
NA	2	1.87
TNM staging, no. and %		
0	10	9.35
I	23	21.50
II	61	57.0
III	13	12.15
Drain removal time (days), median and range	14	10-14
Complications, no. and %		
Bleeding		
Yes	5	4.67
No	102	95.33
Hematoma		
Yes	8	7.48
No	99	92.52
Seroma		
Yes	18	16.82
No	89	83.18
Necrosis		
Yes	16	15.0
No	91	85.0
Wound dehiscence		
Yes	16	15.0
No	91	85.0
Infection		
Yes	26	24.30
No	81	75.70
Epidermolysis		
Yes	2	1.87
No	105	98.13
Lymphedema		
Yes	22	20.56
No	85	79.44
Shoulder stiffness		
Yes	27	25.23
No	80	74.77
Hypertrophic scar		
Yes	13	12.15
No	94	87.85

be satisfactory for all patients (14). Of note, >80% of patients undergoing oncoplastic surgery report they would opt for the same procedure again, reflecting greater satisfaction with cosmetic outcomes and self-esteem compared with traditional surgical approaches. Nevertheless, patients treated with oncoplastic techniques often have greater expectations than those undergoing conventional breast-conserving surgery, largely due to the reduced risk of post-operative deformities (15,16). Tumor excision in areas covered by classic surgical patterns remains challenging. Previous studies have demonstrated that 51.5% of tumors are located in the upper-outer quadrant, followed by the upper-inner (15.6%), lower-outer (14.2%), central (10.6%) and lower-inner (8.1%) quadrants (17), with tumors occurring more frequently in the upper and far breast regions (16). Consistent with these reports, the majority of tumors in the present study were located in the upper breast regions, where existing oncoplastic techniques, despite their availability, continue to present technical challenges.

Breast size plays a crucial role in determining the appropriate oncoplastic surgical approach. For patients with relatively large breasts, level II oncoplastic breast surgery, which follows a reduction-based technique, is often the preferred option. However, in cases where patients wish to maintain their breast size, preserve symmetry, or avoid extensive surgery, level I is more suitable. In such instances, as well as in patients with medium-sized breasts, volume displacement techniques generally provide sufficient residual tissue to achieve favorable cosmetic outcomes (16,18). Even under these conditions, the 'Umbrella' Technique may be a preferable option, as it minimizes the extent of the procedure, while reducing the risk of post-operative asymmetry.

The distribution of glandular tissue varies across breast quadrants, which has led to the development of surgical incisions tailored to tumor location. Resecting tumors in the upper inner quadrant of the breast presents critical challenges due to the aesthetic importance of this area to patients. Consequently, there is a pressing need for innovative surgical approaches that mitigate the limitations of existing techniques (16). The findings of the present study indicate that the 'umbrella' technique provides multiple advantages, positioning it as a viable alternative to conventional surgical methods for upper inner quadrant tumors, while preserving the nipple-areolar complex.

Table IV. Post-operative aesthetic and sensory outcomes: Patient-reported scores.

Variables	Median	Min	Max
Size	8.76±1.78	1.0	10
Lower inner quadrant	9.83±0.41	9.0	10.0
Lower outer quadrant	9.33±1.11	7.0	10.0
Lower central	8.50±1.29	7.0	10.0
Upper inner quadrant	7.85±2.32	1.0	10.0
Upper outer quadrant	8.83±1.77	2.0	10.0
Upper central	8.83±1.33	7.0	10.0
Shape	8.87±1.50	3.0	10.0
Lower inner quadrant	9.83±0.41	9.0	10.0
Lower outer quadrant	9.27±1.03	7.0	10.0
Lower central	8.50±1.0	7.0	10.0
Upper inner quadrant	8.65±1.35	7.0	10.0
Upper outer quadrant	8.72±1.76	3.0	10.0
Upper central	9.17±0.98	8.0	10.0
Nipple-areolar position	8.45±1.78	1.0	10.0
Lower inner quadrant	9.50±0.55	9.0	10.0
Lower outer quadrant	8.87±1.51	6.0	10.0
Lower central	8.75±0.50	8.0	9.0
Upper inner quadrant	8.05±1.73	5.0	10.0
Upper outer quadrant	8.40±1.91	1.0	10.0
Upper central	8.0±2.45	5.0	10.0
Nipple-areolar appearance	8.42±1.75	1.0	10.0
Lower inner quadrant	9.50±0.55	9.0	10.0
Lower outer quadrant	9.07±1.39	6.0	10.0
Lower central	8.75±0.50	8.0	9.0
Upper inner quadrant	7.90±1.65	5.0	10.0
Upper outer quadrant	8.34±1.88	1.0	10.0
Upper central	8.0±2.45	5.0	10.0
Breast symmetry	8.12±1.81	2.0	10.0
Lower inner quadrant	9.33±0.82	8.0	10.0
Lower outer quadrant	8.73±1.58	6.0	10.0
Lower central	8.50±0.58	8.0	9.0
Upper inner quadrant	7.95±1.73	4.0	10.0
Upper outer quadrant	7.81±1.98	2.0	10.0
Upper central	8.33±1.86	5.0	10.0
Appearance of the breast	8.27±1.48	3.0	10.0
Lower inner quadrant	9.17±0.75	8.0	10.0
Lower outer quadrant	8.73±1.58	6.0	10.0
Lower central	8.25±0.96	7.0	9.0
Upper inner quadrant	7.90±1.41	6.0	10.0
Upper outer quadrant	8.15±1.55	3.0	10.0
Upper central	8.50±1.52	6.0	10.0
Appearance of the sc	8.60±1.49	4.0	10.0
Lower inner quadrant	9.0±1.26	7.0	10.0
Lower outer quadrant	9.13±1.25	6.0	10.0
Lower central	8.50±0.58	8.0	9.0
Upper inner quadrant	8.10±1.92	5.0	10.0
Upper outer quadrant	8.55±1.46	4.0	10.0
Upper central	9.0±0.89	8.0	10.0
Skin sensitivity	8.41±1.12	4.0	10.0
Lower inner quadrant	9.0±0.89	8.0	10.0
Lower outer quadrant	8.93±1.03	7.0	10.0
Lower central	8.75±0.50	8.0	9.0
Upper inner quadrant	8.15±1.18	6.0	10.0
Upper outer quadrant	8.26±1.10	4.0	10.0
Upper central	8.50±1.52	6.0	10.0

The batwing incision, commonly used for tumors in the upper-inner quadrant, involves two circular incisions, de-epithelialization, and repositioning of the nipple-areola complex. This approach carries the risk of shifting the nipple-areola complex to one side or causing asymmetry in the breast (19). Although several other innovative approaches, such as crescent, hemi-batwing excisions and modified round-block mammoplasty, have been reported to be effective with good esthetic results (20), there has not been a standard oncoplastic procedure for this area, at least to the best of our knowledge. In the present study, 20 tumors (18.69%) were located in the upper-inner quadrant. Following the procedure, patient satisfaction was evaluated based on nipple-areola positioning, nipple-areola appearance and overall breast symmetry. All patients reported high satisfaction, with mean scores of 8.05, 7.90 and 7.95, respectively. These positive outcomes highlight the effectiveness of the 'umbrella' technique, which was employed in the present study. The 'umbrella' technique features a more versatile incision that extends towards the periphery of the breast, providing several advantages over traditional methods. This incision design allows for more controlled tumor resection, enabling precise excision, while preserving the nipple-areola complex and overall breast symmetry. This technique also minimizes tissue disruption, reducing the risk of complications such as nipple displacement. By maintaining the natural contour of the breast, this technique markedly improves aesthetic outcomes.

The fusiform incision is commonly used for tumors in the upper-outer quadrant, as it follows natural skin folds. Its tapered corners minimize wound tension, promoting better healing. However, in the event that the defect is not adequately filled, skin retraction may occur. Additionally, in cases of peri-areolar tumors, this technique can lead to significant asymmetry with the contralateral breast (21). By contrast, the 'umbrella' technique, employed in the present study, provides several advantages, particularly in terms of aesthetic outcomes and reconstruction. By using controlled tissue dissection and a rotational flap, the 'umbrella' technique provides better symmetry and contour restoration, even for more complex tumor locations, such as the upper-inner quadrant, where 52.3% of the tumors in the present study were located. This technique effectively reduces skin tension, minimizing the risk of wound dehiscence and promoting improved healing. Furthermore, it adapts well to larger or more central defects, providing superior cosmetic results compared to the fusiform

Table V. Association between tumor grade and postoperative complications and patient-reported satisfaction outcomes.

	Tumor grade					
Complications, n (%)	0	I	II	III	NA	P-value
Bleeding						0.734
Yes	0 (0.0)	0 (0.0)	3 (4.1)	2 (7.7)	0 (0.0)	
No	3 (100.0)	4 (100.0)	70 (95.9)	24 (92.3)	1 (100.0)	
Hematoma						0.951
Yes	0 (0.0)	0 (0.0)	6 (8.2)	2 (7.7)	0 (0.0)	
No	3 (100.0)	4 (100.0)	67 (91.8)	24 (92.3)	1 (100.0)	
Seroma						0.381
Yes	0 (0.0)	2 (50.0)	11 (15.1)	5 (19.2)	0 (0.0)	
No	3 (100.0)	2 (50.0)	62 (84.9)	21 (80.8)	1 (100.0)	
Necrosis						0.818
Yes	0 (0.0)	0 (0.0)	12 (16.4)	4 (15.4)	0 (0.0)	
No	3 (100.0)	4 (100.0)	61 (83.6)	22 (84.6)	1 (100.0)	
Wound dehiscence						0.390
Yes	1 (33.3)	0 (0.0)	9 (12.3)	6 (23.1)	0 (0.0)	
No	2 (66.7)	4 (100.0)	64 (87.7)	20 (76.9)	1 (100.0)	
Infection						0.164
Yes	1 (33.3)	3 (75.0)	16 (21.9)	6 (23.1)	0 (0.0)	
No	2 (66.7)	1 (25.0)	57 (78.1)	20 (76.9)	1 (100.0)	
Epidermolysis						0.093
Yes	1 (33.3)	0 (0.0)	1 (1.4)	0 (0.0)	0 (0.0)	
No	2 (66.7)	4 (100.0)	72 (98.6)	26 (100.0)	1 (100.0)	
Lymphedema						0.839
Yes	0 (0.0)	1 (25.0)	17 (23.3)	4 (15.4)	0 (0.0)	
No	3 (100.0)	3 (75.0)	56 (76.7)	22 (84.6)	1 (100.0)	
Shoulder stiffness						0.789
Yes	0 (0.0)	1 (25.0)	21 (28.8)	5 (19.2)	0 (0.0)	
No	3 (100.0)	3 (75.0)	52 (71.2)	21 (80.8)	1 (100.0)	
Hypertrophic scar						0.126
Yes	0 (0.0)	1 (25.0)	5 (6.8)	7 (26.9)	0 (0.0)	
No	3 (100.0)	3 (75.0)	68 (93.2)	19 (73.1)	1 (100.0)	
Shape, median (QR)	10.0 (7-10)	8.0 (5-10)	10.0 (8-10)	9.0 (8-10)	10 (10-10)	0.289
Nipple-areolar position, median (QR)	10.0 (9-10)	7.0 (5-10)	9.0 (8-10)	9.0 (8-10)	5.0 (5-5)	0.702
Nipple-areolar appearance, median (QR)	9.0 (8-10)	7.0 (5-10)	9.0 (8-10)	9.0 (8-10)	5.0 (5-5)	0.925
Breast symmetry, median (QR)	10.0 (8-10)	9.0 (7-10)	8.0 (7-10)	8.0 (7-10)	8.0 (8-8)	0.838
Appearance of the breast, median (QR)	9.0 (8-10)	7.0 (6-9)	9.0 (7-10)	8.0 (7-9)	6.0 (6-6)	0.595
Appearance of the scar, median (QR)	9.0 (7-10)	8.0 (7-10)	9.0 (8-10)	9.0 (7-10)	9.0 (9-9)	0.773
Skin sensitivity, median (QR)	9.0 (8-10)	8.0 (7-9)	9.0 (8-9)	8.0 (8-9)	6.0 (6-6)	0.645

QR, quartile range.

incision. Patient satisfaction for tumors in the upper outer quadrant in the present study was evaluated based on shape, nipple-areola positioning, breast symmetry and scar appearance. The results revealed high patient satisfaction with the 'umbrella' technique, reflected by mean scores of 8.72, 8.40, 7.81, and 8.55, respectively.

The fish-hook-shaped incision is generally preferred for tumors in the lower-inner quadrant, particularly in patients with larger breasts; however, it often results in long scars that may compromise cosmetic outcomes (22). The J incision is commonly applied to lower-outer quadrant tumors; however, it may produce characteristic 'bird's beak' deformities (23). By contrast, the 'umbrella' technique provides greater versatility across multiple tumor locations, including the upper-inner and central quadrants and facilitates improved symmetry restoration. By minimizing skin tension through controlled dissection and rotational flap design, this technique enhances contour preservation and

scar management, resulting in superior aesthetic outcomes compared with fish-hook and J incisions, which are more limited in achieving optimal cosmetic results. In the present study, 21 tumors (19.63%) were located in the lower-inner or lower-outer quadrants, where fish-hook and J incisions are typically employed. Patient satisfaction with the 'umbrella' technique, assessed in terms of breast shape, nipple-areola position, symmetry, overall appearance and scar quality, was high. The mean satisfaction scores for the lower-inner quadrant were 9.83, 9.50, 9.33, 9.17 and 9.00, respectively, while corresponding scores for the lower-outer quadrant were 9.27, 8.87, 8.73, 8.73 and 9.13. These findings highlight the 'umbrella' technique's superior aesthetic performance and patient satisfaction compared with conventional fish-hook and J incisions.

Breast-conserving surgery carries an inherent risk of incomplete resection and positive margins. When post-operative pathological examination reveals a positive margin, re-excision and further resections become necessary. Previous studies have indicated that the incidence of positive margins following oncoplastic breast surgery ranges from 7 to 12% (23,24). In the present study, post-operative surgical margin analysis revealed that only 7.48% of cases exhibited positive margins, which aligns with the lower end of the reported range (7-12%) in the literature (23,24). Due to the considerable displacement of breast tissue often observed in oncoplastic procedures, precisely identifying the involved margin during re-excision can be technically challenging (16). However, with the technique introduced, if additional surgery is required to achieve clear margins, reopening the breast and performing the re-excision is not a particularly difficult procedure.

The complication rates observed in the present study, including an infection rate of 24.3% and a tissue necrosis rate of 15.0%, are higher than those typically reported for standard breast-conserving surgery (<5%) and warrant careful consideration. Several patient- and technique-related factors likely contributed to these findings. First, the majority of patients in the present study cohort (84.1%) received neoadjuvant chemotherapy prior to surgery, a well-established risk factor for impaired wound healing and increased susceptibility to post-operative infection (25). Second, the 'umbrella' technique was preferentially applied to technically demanding cases, including tumors in the upper-inner quadrant, larger resections and lesions in proximity to the axilla; the latter location is associated with higher rates of local bacterial colonization and infection (26). Third, the technique involves extensive three-plane glandular dissection and flap redistribution, which inherently increases the risk of seroma formation, local ischemia, and partial tissue necrosis. Notably, the majority of complications were minor and managed conservatively, without compromising the overall reoperation rate (9.35%) or patient satisfaction scores, which remained consistently high across all evaluated domains.

The elevated infection and tissue necrosis rates observed in the present study cohort, although higher than those typically reported for standard breast-conserving surgery, are consistent with the increased technical complexity and patient-related risk factors inherent to oncoplastic procedures. Upper-inner quadrant oncoplastic surgery, which accounted for 18.69% of cases, has been shown to be associated with complication rates of up to 25%, including wound dehiscence, seroma, infection and marginal skin necrosis (27). Similarly, another study reported a complication rate of 10.8% in the upper-inner quadrant resections, even in the absence of neoadjuvant chemotherapy (28). In higher-complexity level II oncoplastic procedures, complication rates of ~25% have been described, with major complications occurring in 5-9% of cases, which aligns with the current reoperation rate of 9.35% (29). As regards neoadjuvant chemotherapy, the systematic review and meta-analysis by Lorentzen *et al* (30) reported a consistent, although non-significant, trend toward higher rates of wound complications, skin/nipple necrosis and flap ischemia in neoadjuvant chemotherapy-treated patients. In addition, another study with a large patient series identified neoadjuvant chemotherapy as an independent predictor of wound healing complications (odds ratio, 2.9; P=0.02) and fat necrosis (odds ratio, 2.8; P<0.01) following breast reconstruction (31), supporting the morbidity pattern observed in the present study cohort.

To reduce complications in future applications of the 'umbrella' technique, several measures may be considered. These include strict preoperative optimization (nutritional status, glycemic control and smoking cessation), the appropriate timing of surgery following neoadjuvant chemotherapy (minimum 4-6 weeks), tailored antibiotic prophylaxis in axillary-adjacent dissections, the routine use of closed-suction drains in extensive glandular mobilization, and selective intraoperative perfusion assessment using indocyanine green angiography to identify poorly vascularized tissue prior to closure. These strategies may help reduce infection, seroma formation and tissue necrosis in future series.

The present study has several limitations that should be acknowledged. First, the retrospective design and single-institution setting may introduce selection bias and limit the generalizability of the findings to other centers. Second, the study period of 1 year and the restriction to patients with early-stage breast cancer may not fully represent the broader spectrum of patients who could benefit from the 'umbrella' technique. Third, although post-operative complications and patient-reported aesthetic satisfaction were systematically recorded, the use of a non-validated 1-10 satisfaction scale instead of established Patient-Reported Outcome Measures (PROMs), such as the BREAST-Q, represents a methodological limitation and may introduce subjective bias; future prospective studies are thus required to incorporate such instruments to provide a more comprehensive evaluation of patient outcomes. Fourth, the 'umbrella' technique requires a high level of surgical expertise and familiarity with both oncological and reconstructive principles; therefore, its adoption in other institutions should be accompanied by structured training programs and mentorship to ensure safe and effective implementation. Fifth, the technique presents inherent challenges in specific patient subgroups, including those with centrally located tumors, highly aggressive cancer subtypes, or a prior history of breast surgery, and these should be considered carefully during patient selection. Finally, the absence of long-term follow-up represents

a notable limitation, as the long-term prognosis, including recurrence rates, survival outcomes and potential metastasis, was not assessed. Future studies are thus warranted to incorporate extended follow-up periods to more comprehensively evaluate the oncological impact of the procedure and provide a more complete understanding of its effect on patient prognosis.

In conclusion, the present study demonstrates that the 'umbrella' technique overcomes limitations of traditional breast-conserving procedures, particularly for tumors in sensitive areas. It provides clear margins, superior cosmetic results and high patient satisfaction, particularly in younger patients with early-stage breast cancer. This technique improves outcomes and reduces deformities. However, further research is required to evaluate its long-term oncologic safety and efficacy across diverse populations.

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Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

AMS, SLT and HOB conceptualized and designed the study. AMS, ROM, HOA, ZDH, FHK and LRAP were involved in the conception and design of the study, as well as surgical technique development and clinical implementation. AMS, LRAP, FHK and AMM supervised the study. Data collection was performed by AMS, VIJ, BOH, HHF, SRQ and AAQ. Data analysis and interpretation were conducted by AMS, ZDH, SHH and AMM. Manuscript drafting was carried out by AMS, LRAP, FHK and AMM. Critical revision of the manuscript for important intellectual content was performed by all authors. AMM and FHK confirm the authenticity of all raw data. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

The present study was conducted in accordance with the Declaration of Helsinki. As a retrospective study utilizing existing clinical data collected during routine surgical care, formal Institutional Review Board (IRB) or Ethics Committee approval was not required under the applicable institutional and national regulations. The requirement for prospective ethical approval was formally waived by the Institutional Review Board of Smart Health Tower, Sulaymaniyah, Iraq given the retrospective observational design of the study. All patients provided informed consent, permitting the use of their medical records, images and figures for research and publication purposes.

Patient consent for publication

Written informed consent for publication (including images) was obtained from all patients. All patients were adults who provided consent personally.

Competing interests

The authors declare that they have no competing interests.

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