Outcome of the Matrix Rotation Flap in Conservative Breast Surgeries

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Introduction: Achieving free margins and administering adjuvant radiation to the operated breast results in an oncologic outcome that is comparable to a mastectomy. Combining superior aesthetics and oncological safety with tumor removal with free margins is what oncoplastic breast conserving operations are all about.

Aim of work: Our study aimed to assess the safety and reliability of the matrix rotating flap. In difficult situations, the breast can be preserved using this technique, which is usually described for the treatment of facial defects,[16–22] with minor impact on breast size and usually without the need for contralateral breast summarization.

Patients and methods: Twenty patients who had breast-conserving surgery and immediate repair with a matrix rotation flap participated in this study in the Surgical Oncology Unit, from January 2022 to June 2024.

Results: Patients were 54 years old on average when they were diagnosed. The mean removed breast weight was 63.05 gm, and the average initial tumor size was 3.1 cm. Patients did not need to have their nipple-areola complex symmetrical or repositioned. No local issues (Dehiscence of the wound). During follow-up that ranged from 6 months to two years, no local recurrences or distant metastasis was reported. According to the Harris scale, the cosmetic result was considered excellent in 25 % of cases, good in 50 %, fair in 18.75%, and poor in 6.25%.

Conclusion: We support that the matrix rotation flap is a safe and efficient method for treating upper/upper inner malignancies. In addition to contralateral symmetry, good cosmetic outcomes, and acceptable oncological margins, its complications rate is comparable to that of typical conservative surgery.

Key words: Breast conserving, oncoplastic, oncological safety, matrix rotation flap.

Introduction

Mastectomy and breast-conserving surgery (BCS) had comparable oncologic outcomes when adjuvant radiotherapy is given to the operated breast and healthy margins are achieved.[1–5] Two factors are combined in oncoplastic breast procedures: Ideal aesthetics and oncological safety with a cancer removal with free margins.[6-8]

The foundation of BCS success is the removal of the tumor with sufficient margins and post-operative radiation. BCS is now the best treatment for early-stage breast cancer because it has positive clinical results. The ultimate objectives of BCS are to preserve the breast's natural shape while also fully excising the breast tumor with sufficient margins.[7,8]

Contrary as it may seem, it might be challenging to excise a tumor that is huge in relation to the breast's size without compromising appearance. Without the right surgical approach, deformity can frequently arise in medium- to large-sized breasts, which may lead to a referral for a mastectomy. Additionally, 5% to 18% of cases in conventional BCS had positive margins, resulting in significant rates of re-excision.[9,10] In terms of complications, morbidity, and deformity, these high rates of re-excision can be substantial. In order to broaden the range of indications for BCS, Gabka et al.[11] first used the word "oncoplastic" in the literature in 1997.

There is more to oncoplastic surgery (OPS) than merely combining plastic surgery methods with oncologic concepts.[9] Surgeons can lower the rate of re-excision by performing bigger excisions with free margins by modifying the residual breast tissue using different mammoplastic techniques.[12]

The term "Oncoplastic breast surgery" was first used in the 1980s to describe the combination of conservative breast surgery for more advanced illness with chemotherapy and radiotherapy. Its goal was to produce less morbidity and better aesthetic and quality of life results than existing methods. As a result, the origins were multidisciplinary, and early advancements in oncoplastic surgery shown that visible deformity could be prevented even in cases of locally advanced disease.[13]

Despite the availability of many oncoplastic procedures, some patients still require a radical surgery to achieve sufficient esthetic or safe oncological results. Breast thickness is typically replaced by tumors at the upper inner or superior edge of the upper quadrant, which compromises the anterior margin and makes skin preservation difficult. Tumors at these sites provide a problem when conservative surgery is needed to remove the whole breast thickness because it can lead to secondary glandular deformity, the upper deviation of nipple areola complex (NAC), and a high risk of positive tumor margins.[14]

To help surgeons choose the best course of action for each patient, Clough et al. (2010) created an Atlas and OPS guidelines.[15] Lesions in the breast's upper/upper inner quadrant might alter the visible breast line, which can significantly affect the overall quality of the breast form. No normal level II oncoplastic approach created by Clough et al. can effectively treat this challenging location at this time. Here, we outline the benefits of "matrix rotation" for patients with upper/upper inner quadrant breast tumors in terms of improved cosmetic results. To preserve the breast in challenging situations, we offer a matrix

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rotation flap for breast cancer.

Aim of work: Our study aimed to assess the safety and reliability of the matrix rotating flap. In difficult situations, the breast can be preserved using this technique, which is usually described for the treatment of facial defects,[16–22] with minor impact on breast size and usually without the need for contralateral breast summarization.

Patients and methods

Within the Department of General Surgery's Surgical Oncology Unit, twenty patients who had BCS followed by immediate reconstruction using a matrix rotation flap were the subjects of this prospective study, from January 2022 to June 2024. Then they finished adjuvant therapy at Tanta University Hospital's medical oncology department in the medicine faculty.

Patients with breast cancer whose tumors were in the upper/upper inner quadrant and had a transverse diameter of no more than 5 cm met the study's inclusion requirements.

A multidisciplinary breast cancer team treated each patient when they received a breast cancer diagnosis. In order to determine the tumor's position in the breast, its distance from the skin, any potential multicentricity, and any potential axillary involvement, they conducted a routine preoperative clinical examination. They also received immunohistochemistry (IHC) testing for Ki67, HER2, and hormone receptor status, as well as a percutaneous biopsy and histological examination.

Mammograms, breast ultrasounds, magnetic resonance imaging (MRI) of the breast (If necessary), and bone scans (If needed) were among the imaging tests used to determine both local and distant involvement. The tumor/breast ratio and IHC findings served as the basis for the recommendation for primary conservative surgery. For surgical planning, additional considerations were made, such as prior breast surgery that would have impeded the development of glandular flaps by preventing an adequate local blood supply. Diabetes and obesity were identified as risk factors for local problems. Additionally, when assessing the necessity of summarization surgery, contralateral breast shape was considered.

Before undergoing any surgery, a cardiologic and anesthetic consultation was conducted, and each patient completed an informed consent form. After obtaining approval from the institutional ethical committee, any risks that arose throughout the research were disclosed to the participants.

There were adequate provisions to maintain privacy of participants and confidentiality of data. The results of the study were used as a scientific material only and were not be used by any legal authorities.

Surgical technique

The cases were put in a standing posture and had their skin marked before operation. Marks were created for the tumor site, inframammary fold, breast boundaries, and sternal midline. The nipples were still in the same place. The arm was abducted 90 degrees. A line was drawn from the mid-axillary line that was curved and had inferior concavity. Medially parallel to the clavicle, this line extended 1-2 cm above the site of the breast tumor. This line's top base was then used to construct a triangle. The tumor's size determined the base width, which should have a minimum of 1 cm of safe surgical margins on the macroscopic level.

The triangle vertex was drawn far down with respect to the tumor's lateral limit toward the NAC in order to accomplish posterior orderly and harmonic rotation of the breast without distorting the central breast projection. The axilla was made accessible for axillary dissection by drawing a small inverted triangle, called a "Burow's triangle," in the axillary region. The rotation advancement dermo glandular flap surgery allowed for the compensation of skin damage **(Fig. 1).**

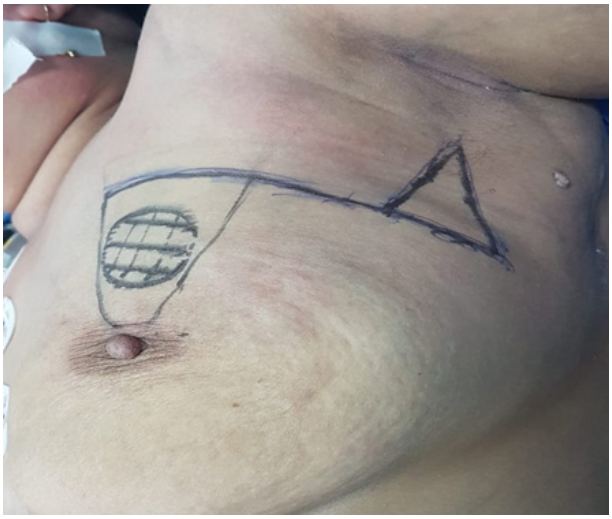

Fig 1: Skin marking of matrix rotation flap.

The primary triangle, comprising the thickness of the entire breast, the tumor, the skin covering it, and the pectoral fascia, was removed through a triangular incision done while under general anesthesia. **(Fig. 2)** A pathologist evaluated the histopathological tumor margins during surgery. A 2 mm margin for ductal carcinoma in situ and the absence of tumor cells at the specimen's inked margin for invasive carcinoma were considered free margins.

Fig 2: Skin incisions of matrix rotation flap.

Vascular clips were used to mark the tumor bed. Through the previously drawn tiny triangle resection, a simultaneous axillary dissection was performed. The pectoralis major muscle was directly reached by the curved line incision made between the two triangles. Then, in order to allow the muscle to move toward the medial edge of the main triangle that had been previously removed, this lateral dermoglandular flap was gently raised from the muscle.

Hemostasis was done accurately. The axilla and breast were fitted with two tube non-suction drains. Two layers of 2-0 interrupted absorbable Vicryl® sutures were used to seal the advancement flap. Skin staplers or 4/0 prolene sutures were used to seal the skin. **(Fig. 3)** Gauze was used to dress wounds. Two to seven days following surgery, the drains were withdrawn.

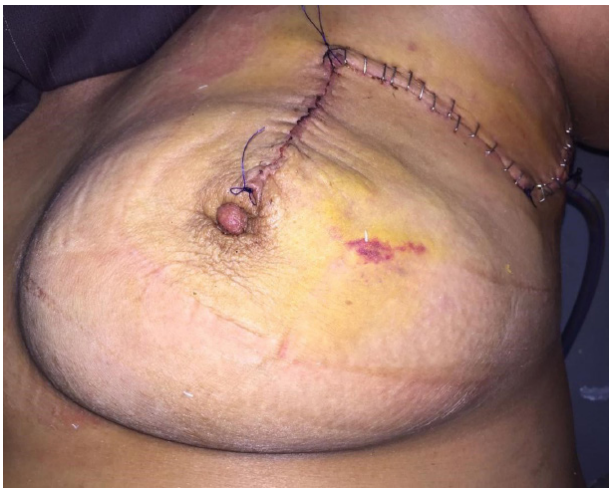

Fig 3: Wound closure using prolene sutures or skin staples.

Postoperative assessment

Prior to receiving the final histology, weekly clinical assessments were conducted **(Fig. 4).** Oncological therapies, including chemotherapy, radiation, biological treatment, and hormone therapy if necessary, were finished in accordance with national regulations. Three months following surgery, and then every three months thereafter, a follow-up surgical consultation was scheduled for each patient, which included breast and axillary palpation. Ultrasonography was performed in accordance with usual procedure, as were mammograms and tumor markers (CA 15-3). As needed, an MRI was performed. Additionally, to assess long-term outcomes like as distant metastases or local recurrence.

Fig 4: One month after surgery.

Cosmetic evaluation

Questionnaire

To determine their subjective degree of satisfaction with the outcomes, 16 out of the 20 patients who received matrix rotation were asked to fill out a questionnaire created by Chan et al.[23] (Four patients were lost to follow-up). Following the completion of their radiation treatments, the patients were handed the surveys. The questionnaire inquired about the patients' satisfaction with the postoperative appearance, whether they would have chosen a different kind of breast surgery, whether they would have thought about any new surgical techniques to reshape the treated breast, and how they felt about the treated breast in comparison to the other breast.

Modified Harvard-Harris Cosmetic Scale

Using preoperative and after operation (Two to six months) photographs of each patient, cosmetic results were evaluated. According to the Modified Harvard-Harris Cosmetic Scale, cosmetic success was assessed by both doctors and patients **(Table 1).**

Results

The twenty patients' ages ranged from 33 to 71 years old, with a mean age of 54 years. Body mass index (BMI) ranged from 25.1-36 kg/m2, with a mean of 30.2 kg/m2. Palpable mass was present in all patients **(Table 2).**

Patients' pathologic stage was invasive ductal carcinoma in all cases **(Table 2).** The 20 patients had a mean resected tissue weight of 63.05 g (Range: 45-83 g); a mean initial tumor size of 3.1 cm (Range: 1.2-4.9 cm); and a mean pathological tumor size of 1.8 cm (Range: 0.6-3.4 cm). Neoadjuvant chemotherapy was administered to ten patients, four of whom experienced a pathological partial response, and the remaining six who did not.

The procedure, which involved surgical suturing and lymph node dissection in addition to breast-conserving surgery, took an average of about 90 minutes. Overall blood loss was quite low. An intraoperative pathologist evaluated the histologic tumor margins (Frozen section). Prior to adjuvant radiation, none of the patients needed re-excision surgery, and all had sufficient histological margins on final pathologic evaluations **(Table 2).**

The hospital stay lasted a mean of 3.7 days, with a range of 2 to 6 days. The follow-up duration was 12 months on average (Range: 6–24 months), and no wound complications, including hematoma or seroma development, were noted during this time. Neither distant metastases nor local recurrence were noted **(Table 2).**

After their radiation treatment was finished, 16 out of 20 patients received questionnaires; four patients were lost to follow-up. Self-reported cosmetic results were rated as satisfactory in 11 cases (68.75%), excellent in 2 cases (12.5%), and acceptable in 3 cases (18.75%). Overall, the postoperative outcome was rated as satisfactory or acceptable by all patients; the treated breast was almost the same as the untreated side, or only slightly altered. Contralateral breast symmetry was not necessary for any of the patients. **(Table 3)** provides an overview of the questions and the findings.

The Harris scale evaluated the cosmetic outcome as excellent in 25% of cases, good in 50%, fair in 18.75%, and poor in 6.25% of cases (Four patients were lost to follow-up). There were no significant complications reports.

Table 1: Modified Harvard-Harris Cosmetic Scale

Poor	Fair	Good	Excellent
There is a noticeable alteration in the breast's look including over 25% of the breast tissue when compared to the baseline photograph. The changes to the skin are rather noticeable. The breast has thickened and scarred severely. A mastectomy would have been a better course of action in hindsight.	There is a noticeable change in the breast's size and shape, along with a mild deformity, when compared to the baseline image. A quarter or less of the breast is affected by this alteration. Skin and breast tissue have considerable thickening or scarring, and there are noticeable color changes.	There is a little variation in the breast's size or shape or moderate asymmetry when compared to the baseline photograph. mild breast darkening or reddening. The breast's thickening or scarring tissue just slightly alters its form.	There is little to no variation in the breast's size, shape, or consistency as compared to the baseline photograph. The skin or breast may have some slight thickening or scarring, but not enough to alter the appearance.

Table 2: Features of patients who had matrix rotation flap breast surgery (N=20)

Median age (Year, range)	54 (33-71)
Mean initial tumor size (cm, range)	3.1 (1.2-4.9)
Mean pathological size (cm, range)	1.8 (0.6-3.4)
Mean excised breast volume (gm, range)	63.05 (45-83)
Mean BMI kg/m2 (Range)	30.2 (25.1-36)
Histological type (Core biopsy)	
Invasive ductal carcinoma	20
Invasive lobular carcinoma	0
Stage at diagnosis	5
Stage I Stage II	15
Mean length of hospital stay (Days)	3.7 (2 – 6)
Median follow-up (Range) months	12 (6-24)

Table 3: Patient questionnaire results after matrix rotation surgery (n=20; 4 patients were lost to follow-up)

Patient questionnaire	Number of patients 16	
Do you think your appearance after surgery meets your needs?		
Dissatisfied		0
Acceptable	3	18.75%
Satisfied	11	68.75%
Very satisfied	2	12.5%
To what extent does the untreated breast differ from the treated breast?		
Seriously distorted	0	0
Clearly different from the untreated breast, but not seriously distorted	2	12.50%
Slightly different from untreated breast	10	62.5%
Nearly identical	4	25%
If you had a second chance, would you have a different type of breast surgery? e.g., breast reconstruction following mastectomy		
Yes	0	0
Uncertain	0	0
No	16	100%
Will you think about getting the treated breast reshaped with additional surgery?		
Yes	0	0
Uncertain	0	0
No	16	100%

Discussion

The indication for BCS is expanded in cases of large tumors or cancers in difficult-to-reach breast regions by oncoplastic surgery, which aims to provide superior aesthetic results and adequate surgical margins.[2,15,24,25]

Tumors in the upper quadrants can be removed and repaired using a variety of oncoplastic procedures, such as inferior pedicle mammoplasty,[26] round-block,[27] racket resection,[15,28] batwing technique,[29] glandular contouring or undermining,[26] and others. Repositioning the areola in the middle of the breast reconstruction and preventing a filling deficit brought on by insufficient tissue after contouring are the primary objectives of all these procedures.

On the other hand, in certain locations, fixing partial mastectomy defects might be quite difficult. Tumors located less than 7 cm from the sternal midline and/or closer than 16 cm from the sternal notch, for instance, are referred to as "no man's land".[30]

Tumors usually leave behind significant filling deficiencies in this area, especially if the skin portion needs to be removed. Included in the solution are the latissimus dorsi flap and other volume replacement strategies,[31] and the more recent instantaneous grafting of fat, which shows good results.[32] Despite the fact that several novel approaches, including modified round-block mammoplasty, batwing, crescent, and hemi-batwing excisions, have been shown to be successful with favorable aesthetic outcomes, Clough et al. have not created a standard level II oncoplastic procedure to deal with this challenging area.[33–36]

Our method is broken down into two steps. The tumor is first removed from a wedge-shaped block of tissue, and then the flap is advanced during repair via matrix rotation. The following benefits make "matrix rotation" an additional viable approach option for upper inner lesions.[1] The operation can be completed in less than 90 minutes,[2] It is simple to remove the overlaying skin and do full-thickness excision,[3] the contralateral nipple does not need to be manipulated,[4] Dissection of the axilla is simple to perform,[5] It is not required for several teams to collaborate closely during the entire procedure,[6] there is minimal blood loss,[7] wound complications like seroma or hematoma formation are not observed, and,[8] Good access to the axilla is made possible by the compensating triangle's ability to be positioned relatively far from the oncological defect and the flap's large, well-vascularized pedicle.

Therefore, if the procedure calls for larger resections or if the breast is primarily made of fatty tissue, matrix rotation might be an appropriate substitute technique. A comparatively lengthy S scar is the procedure's sole disadvantage. But within a few years, the majority of those scars will disappear.

It is believed that between 5% and 25% of individuals may experience poor cosmetic results

following OPS.[37,38] Al-Ghazal and Blamey (1999) published data that showed no correlation between scar length and satisfaction.[39] Many studies have demonstrated that scar length significantly affects overall patient satisfaction; however, not all of these studies directly address OPS. We also assessed aesthetics, particularly from the patient's point of view, to gain a better understanding of medical perception and post-operative comfort. In our research, two cases (12.5%) had great cosmetic results, eleven cases (68.75%) had adequate results, and three cases (18.75%) had acceptable results. Notwithstanding the S-shaped incision and scar, every patient evaluated their overall postoperative outcome as either acceptable or good. We did not observe any local complications in our cohort. Large scars, occasionally in areas that are visible, are a drawback of this method; On the Harris scale, the majority of patients reported excellent or good cosmetic outcomes (75%).

In cases of breast cancer in the upper/upper inner quadrant that require a fairly wide excision, matrix rotation offers a straightforward, safe, and efficient treatment approach. Without changing the overall shape of the breast, this procedure could be used to remove a bigger breast tumor. The breast contour can be maintained without significantly shifting the NAC with a well-designed flap. Operating time is not much longer than with a typical BCS. A second surgical team is not necessary because surgical symmetry is not needed. Not many complications exist.

No patient needed to get a complete mastectomy in our study. The thought that oncoplastic procedures are linked to a decreased incidence of positive margins and subsequent reoperations, the cautious control of surgical margins, and the proper preoperative breast assessment using imaging could all help to explain this.[1,40,41]

The high prevalence of postoperative complications linked to breast reconstruction and posterior radiation can be decreased by using matrix rotation flaps instead of transforming these procedures into total mastectomy and posterior breast reconstruction.[42]

This method makes it possible to do larger excisions and, as a result, achieve sufficient surgical margins. Compared to a traditional partial mastectomy, The rate of breast recurrence in the area should be as low as possible.[1,40] None of them have experienced distant metastases or local recurrences thus far in our study, demonstrating the technique's safety.[9]

For breast cancers placed in the upper quadrant, this matrix rotation approach might become more accessible and even become a regular practice. Prospective studies are needed for long-term evaluation (Oncological safety, aesthetic results), before and after adjuvant treatment (Especially after radiotherapy), and considering the potential for a multicenter study are necessary to support these optimistic data.

Conclusion

Every breast surgeon should be knowledgeable of advancement flaps for the breasts locally which are a crucial component of partial breast reconstruction procedures. One of the many advantages of the matrix rotating flap is its ability to quickly and easily cover upper inner surgical breast abnormalities. This flap often removes the need for a symmetrization treatment since it allows for very similar likeness to the contralateral breast and exact resemblance of the original breast in terms of skin color, texture, thickness, form, volume, and responsiveness.

The axillary region may conceal the compensating triangle. Its primary drawback is the noticeable geometric scar outside the breast's aesthetic landmarks, which the patient must comprehend and accept. Thankfully, with radiotherapy, the scars typically diminish to some extent.

A procedure that can be performed safely in breast surgery, the matrix rotation flap avoids total mastectomy and gives more people the chance to have a breast circumcision. It also has adequate oncological and esthetic results. More patients must be included in long-term studies to evaluate this surgical procedure's long-term survival prognosis.

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