Assessment of Different Oncoplastic Techniques in The Management of Centrally Located Breast Cancer

Original Article

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ABSTRACT

Background: Centrally located breast cancer poses unique challenges due to its proximity to the nipple–areola complex, impacting both oncological safety and cosmetic outcomes. This study evaluates the efficacy of various oncoplastic surgical techniques in achieving optimal oncological and esthetic results.

Patients and Methods: A prospective study was conducted on 40 female patients with stage I or II centrally located breast cancer at Alexandria Main University Hospital. Patients underwent tailored oncoplastic surgeries, including Grisotti mastopexy, anterior intercostal artery perforator flap, central quadrantectomy, crescent mastopexy, and batwing resections. Outcomes were assessed through oncological measures (surgical margins, local recurrence) and cosmetic evaluations (BREAST-Q and Harris scale).

Results: Clear surgical margins were achieved in 100% of cases. No local recurrences were reported during follow-up. Cosmetic outcomes were highly satisfactory, with 85% scoring above 8 on the Harris scale and 92% reporting improvements in body image via the BREAST-Q. Complications were minimal, with flap necrosis in 5% and seroma formation in 10% of cases, and no delays in adjuvant therapy initiation. The anterior intercostal artery perforator flap and Grisotti mastopexy provided the best cosmetic outcomes.

Conclusion: Oncoplastic techniques effectively balance oncological safety with superior esthetic results, significantly enhancing patient satisfaction and psychological well-being. These findings emphasize the need for individualized surgical approaches in centrally located breast cancer management.

Key Words: Breast-conserving surgery, Centrally located breast cancer, Cosmetic outcomes, Grisotti mastopexy, Oncoplastic surgery.

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INTRODUCTION

Centrally located breast cancer remains a significant clinical challenge due to its proximity to the nipple–areola complex (NAC), which complicates surgical management and impacts esthetic outcomes. Globally, breast cancer is the most common malignancy among women, accounting for over 2.3 million new cases and 670.000 deaths in (2022)[1]. In Egypt, breast cancer constitutes 32.4% of female cancers and is the second leading cause of cancer-related mortality[2]. The incidence is expected to double by (2050), necessitating advancements in surgical techniques that balance oncological safety with patient quality of life[3].

Historically, surgical approaches to breast cancer, such as radical mastectomies, were effective in disease control but left patients with significant physical and psychological burdens[4]. The advent of breast-conserving surgery (BCS) and oncoplastic techniques has revolutionized the management of centrally located breast cancer, allowing for effective tumor resection while preserving or reconstructing the breast's natural appearance. This evolution was driven by pioneering studies demonstrating that BCS combined with radiotherapy provides oncological outcomes comparable to mastectomy[5,6]. Landmark trials, including the Milan trial and the National Surgical Adjuvant Breast and Bowel Project (NSABP) B-06, established the efficacy of BCS, further supported by advancements in imaging, pathology, and surgical techniques[7,8].

Oncoplastic surgery, introduced in the 1990s, integrates oncological principles with plastic surgery techniques to address the dual goals of cancer control and

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cosmetic outcomes[9]. This approach has been particularly transformative for centrally located breast cancer, where maintaining the NAC and overall breast contour is challenging. Techniques such as Grisotti mastopexy and anterior intercostal artery perforator (AICAP) flaps have emerged as effective solutions, offering reliable oncological safety and improved quality of life for patients[10].

The psychological impact of breast cancer surgery cannot be understated. Studies have shown that preserving breast esthetics significantly improves patient satisfaction and psychosocial well-being[11]. The development of oncoplastic techniques reflects a patient-centered approach to breast cancer treatment, emphasizing the importance of both physical and emotional recovery[12].

PATIENTS AND METHODS:

Study design

This prospective study was conducted at the Surgical Oncology Unit, Alexandria Main University Hospital, involving 40 female patients diagnosed with centrally located breast cancer. Ethical approval was obtained from the institutional review board, and written informed consent was secured from all participants[13].

Patient selection criteria

1. Inclusion criteria: female patients with stage I or II operable breast cancer located centrally, confirmed via imaging and biopsy. Patients were required to be candidates for BCS and amenable to oncoplastic techniques.

2. Exclusion criteria: diffuse ductal carcinoma in situ, inflammatory breast cancer, recurrent tumors after prior BCS, previous breast radiation therapy, and progressive disease following neoadjuvant chemotherapy. Patients with locally advanced breast cancer with skin involvement were also excluded[14].

Preoperative assessment

All patients underwent a thorough preoperative evaluation, including:

1. *Clinical examination:* comprehensive physical assessment focusing on tumor size, location, and nodal status.

2. *Imaging studies:* mammography, breast ultrasonography, and MRI as needed.

3. *Histopathological confirmation:* core needle biopsy of the breast lesion and fine-needle aspiration cytology for any suspicious axillary lymph nodes.

4. *Immunohistochemistry:* assessment of estrogen receptor (ER), progesterone receptor (PR), HER2/neu status, and Ki-67 proliferation index[15].

Surgical techniques

A range of oncoplastic procedures was employed, tailored to tumor size, location, and patient preference:

1. *Grisotti mastopexy:* the Grisotti mastopexy technique involves the central excision of the NAC due to tumor involvement or other indications. The reconstruction is achieved by utilizing a rotational flap derived from the lower pole of the breast, which is well-vascularized and can maintain the shape and contour of the breast (Figure 1). This technique is particularly useful when the NAC needs to be removed while aiming to preserve a natural breast contour. The flap rotation allows for functional and esthetic reconstruction without compromising oncological safety (Figure 2). It is often employed in cases of central tumors or significant deformities that necessitate NAC removal[16].

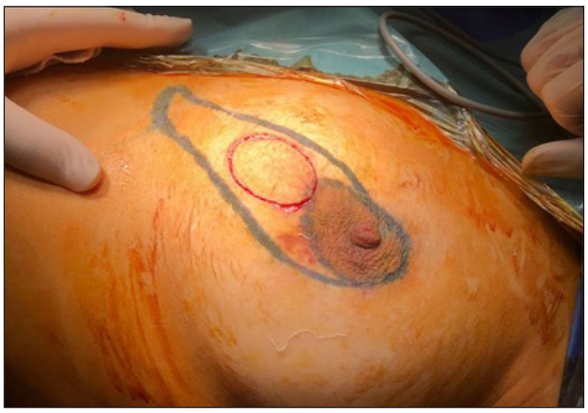

Figure 1: Marking of the tumor behind the nipple–areola complex and planned B Grisotti flap.

Figure 2: Esthetic outcome of Grisotti flap after 1 week.

2. *AICAP flap:* the AICAP flap involves the harvest and transposition of flaps based on the AICAP, which are well-vascularized (Figure 3). This flap is taken from the chest wall, and its robust blood supply ensures viability for reconstructing defects in the breast. The flap can be rotated or transposed to fill moderate to large defects, preserving the natural contour of the breast. This technique is particularly valuable for cases where adjacent tissue may not be suitable for reconstruction. It is a versatile option that minimizes donor site morbidity while achieving functional and esthetic results[10].

Figure 3: The final outcome of the AICAP flap immediately after surgery. AICAP, anterior intercostal artery perforator.

3. *Central quadrantectomy:* in central quadrantectomy, the central quadrant of the breast, including the NAC, is excised to remove malignant or other problematic tissue. Closure techniques are meticulously performed to maintain the contour and symmetry of the breast postsurgery (Figure 4). This method is typically employed for tumors located centrally within the breast. Careful surgical planning ensures that the breast retains a natural shape despite the removal of a significant portion of tissue. This technique balances oncological clearance with cosmetic outcomes, making it a preferred option in central breast tumor management[17].

Figure 4: Central quadrantectomy and axillary clearance after surgery immediately.

4. *Crescent mastopexy:* the crescent mastopexy involves the resection of a tumor while simultaneously repositioning the nipple upward to maintain esthetic integrity. This technique preserves the breast's natural appearance by removing only the necessary tissue and using the crescent-shaped excision to elevate the NAC. It is particularly beneficial in cases where tumors are located in a way that allows for conservation of breast esthetics (Figure 5). This method can be combined with other procedures to enhance symmetry and contour while ensuring complete tumor removal[9].

Figure 5: Closure of the crescent mastopexy technique 1 week after surgery in the lying flat position.

5. *Batwing and hemi-batwing resections:* the batwing resection utilizes semicircular incisions around the NAC, creating a "batwing" shape that allows for effective tumor excision while maintaining breast symmetry. This technique provides wide access to the tumor site while minimizing visible scarring (Figure 6). The hemi-batwing variation is a modification where only one side of the "batwing" is utilized, depending on the tumor's location. These approaches ensure oncological safety and esthetic outcomes by enabling precise tumor removal while preserving as much normal tissue as possible. The design of the incision also facilitates symmetry in the final breast shape[18].

Figure 6: Steps and immediate postoperative outcome of the batwing technique.

Intraoperative considerations

1. ***Margin assessment:*** frozen section analysis was performed intraoperatively to ensure clear margins. If margins were positive, additional tissue was resected.

2. ***Flap viability:*** careful handling of tissues and preservation of vascular pedicles were prioritized to avoid ischemia[19].

3. ***Cosmetic outcomes:*** surgical planning emphasized natural contour preservation and symmetry with the contralateral breast.

Postoperative evaluation outcomes were assessed using the BREAST-Q and Harris scale to measure patient satisfaction and esthetic results. Oncological safety was evaluated based on margin status by paraffin section and local recurrence rates during follow-up[20,21].

RESULTS:

The study included 40 patients, with a mean age of 49.4±7.8 years. The majority (87.5%) were older than 40 years. Notable risk factors observed within the cohort included oral contraceptive use (85%), hypertension (44.4%), and diabetes mellitus (30%). Breast cup size distribution revealed that most patients had large breasts (Cup C, 57.5%), followed by moderate-sized breasts (Cup B, 40%), and small breasts (Cup A, 2.5%).

Preoperative assessment

Tumor sizes ranged from 0.9 to 3.3cm, with 60% classified as T2, 35% as T1, and 5% as Tis. Lymph node involvement was observed in 65% of cases (N1), while all patients were M0. Histopathological analysis indicated that 92.5% of patients had invasive ductal carcinoma, 5% had ductal carcinoma in situ, and 2.5% had invasive lobular carcinoma. Tumor grading revealed 67.5% were grade II, 20% grade III, and 12.5% grade I. Of the cases with axillary lymph node involvement, 76.9% underwent upfront axillary clearance, while 23.1% required axillary clearance following a positive sentinel lymph node biopsy. Neoadjuvant chemotherapy was administered to 25% of patients, primarily for HER2-positive (15%) and triple-negative (10%) cases. Immunohistochemical analysis showed that 77.5% were ER/PR-positive, 22.5% were ER/PR-negative, and 15% were HER2-positive. Notably, 70% of cases exhibited Ki-67 more than 14%, indicating a high proliferation index.

Operative data

The most commonly performed oncoplastic technique was the Grisotti flap (35%), followed by the AICAP flap (30%), central quadrantectomy (20%), and Batwing and Crescent mastopexy techniques (7.5% each). The mean operative time was 111.6±29.32min, with 67.5% of surgeries completed within 2h.

Postoperative and oncological outcomes

Postoperative histopathological findings confirmed invasive ductal carcinoma in 92.5% of cases. All patients achieved clear surgical margins, with no re-excisions required (0%), and no instances of local recurrence were reported during the follow-up period (6–12 months) (Table 1). Complications were observed in 17.5% of patients, including flap and wound necrosis (10%), seroma formation and wound dehiscence (7.5%). Despite these complications, there were no delays in therapy or systemic metastases during follow-up (Table 2).

Cosmetic outcomes

Cosmetic results demonstrated high levels of success with oncoplastic techniques. Patient satisfaction, as measured by the Harris score, showed that 85% of patients rated their satisfaction at 8 or higher. Additionally, the BREAST-Q assessment indicated that 2% of patients reported significant improvements in body image (Table 1). The most effective techniques for optimal cosmetic and functional outcomes were the AICAP flap and Grisotti mastopexy. These findings underscore the efficacy of tailored oncoplastic techniques for centrally located breast cancer. Incorporating patient testimonials or visual assessments could provide additional validation and a more comprehensive understanding of outcomes.

Complications

The observed postoperative complications are summarized below:

Providing strategies for managing or preventing complications could further enhance clinical relevance and guide practice improvements.

Table 1: Postoperative oncological and cosmetic outcome:

Oncological and cosmetic outcomes	Result (%)
Clear surgical margins	100
Local recurrence	0
Harris score ≥8 (patient satisfaction)	85
Body image improvement (BREAST-Q)	92

Table 2: Postoperative complications:

Complications	Incidence (%)
Partial flap necrosis	2.5
Wound necrosis	5.0
Wound seroma	7.5
Wound dehiscence	2.5

DISCUSSION

The findings of this study provide robust evidence supporting the utility of oncoplastic techniques in managing centrally located breast cancer. Central breast tumors pose unique challenges due to their proximity to the NAC, a critical esthetic and functional structure.

Despite these challenges, the study demonstrated a 100% rate of clear surgical margins, emphasizing the oncological safety of these techniques. This aligns with previous studies, such as those by Clough *et al.*,[9], which highlight the efficacy of oncoplastic methods in achieving tumor-free margins without compromising breast contour.

The study also highlights significant cosmetic successes, as evidenced by high patient satisfaction and improvements in body image. The BREAST-Q questionnaire showed that 92% of patients reported better body image, and 85% rated their satisfaction at 8 or higher on the Harris scale. Techniques like the AICAP flap and Grisotti mastopexy played a pivotal role in achieving these results. The integration of functional and esthetic outcomes is consistent with findings by Alderman *et al.,*[11], who noted the psychosocial benefits of preserving breast esthetics during cancer treatment.

Importantly, the study reported low complication rates, further validating the safety of these approaches. The flap necrosis rate was only 5%, and seroma formation occurred in 10% of cases, which are comparable to or better than previously reported rates in similar studies. Hamdi *et al.,*[10] highlighted the importance of pedicled perforator flaps in minimizing complications while preserving vascular integrity, findings echoed in this study. Moreover, the absence of delays in adjuvant therapy demonstrates that oncoplastic surgery integrates seamlessly with comprehensive cancer treatment protocols.

Oncoplastic surgery's ability to balance oncological safety with esthetic outcomes addresses both physical and emotional aspects of breast cancer management. The dual focus ensures patients not only achieve tumor clearance but also retain their sense of femininity and self-esteem. Such outcomes contribute to improved overall quality of life, as previously reported in the literature, emphasizing the critical role of oncoplastic techniques in modern breast cancer care.

Despite these successes, the study acknowledges challenges in managing more complex cases, such as those involving larger tumors or requiring extensive reconstructions. Large tumor size may necessitate the removal of significant breast tissue, potentially complicating reconstruction. While this study focused on centrally located tumors, future research should explore innovative techniques to address these limitations. For instance, advances in tissue engineering and the use of biomaterials may enhance the versatility and outcomes of oncoplastic reconstructions.

In addition to technical challenges, patient-reported outcomes could be enriched through qualitative assessments. Tools like the BREAST-Q and Harris scale provide valuable quantitative data, but incorporating patient testimonials and photographic evaluations would offer deeper insights into the long-term impact of these procedures. Such approaches would not only validate the findings of this study but also refine the criteria for evaluating esthetic success.

The multidisciplinary nature of oncoplastic surgery is another critical factor in its success. Collaboration among oncologists, breast surgeons, and plastic surgeons ensures a comprehensive treatment plan that addresses oncological, functional, and esthetic goals. Training programs and workshops that emphasize this collaboration are essential for the continued evolution of the field.

Long-term follow-up studies are also needed to evaluate the durability of outcomes. Recurrence rates, patient satisfaction, and quality of life metrics over extended periods would provide critical insights into the sustainability of oncoplastic surgery. Comparative studies examining different techniques could further refine the selection process, allowing surgeons to tailor procedures to individual patient needs.

CONCLUSION

In conclusion, oncoplastic surgery represents a significant advancement in the management of centrally located breast cancer, offering a patient-centered approach that balances oncological safety with cosmetic excellence. By achieving these dual goals, oncoplastic techniques not only improve clinical outcomes but also enhance patients' psychological and emotional well-being. The findings of this study underscore the need for continued innovation, research, and multidisciplinary collaboration to advance the field further and address the challenges of complex cases. This approach should be considered a cornerstone of modern breast cancer management.

AUTHORS ' CONTRIBUTIONS

AS: software, writing the original draft. RT: supervision, conceptualization. HA: conceptualization, methodology. RE and SA: methodology, resources. All authors read and approved the final manuscript. FC analyzed and interpreted the patient data regarding the hematological disease and the transplant. RH performed the histological examination of the kidney, and was a major contributor in writing the manuscript. All authors read and approved the final manuscript

CONFLICT OF INTEREST

There are no conflicts of interest.

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