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Review Article

Radiological Changes and Recurrence Rate Following Lipofilling After Oncoplastic Breast Surgery, the Role of Standardized Follow-Up Imaging and Future Aspects

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Abstract

Aim: To provide an overview of lipofilling as a reconstructive option post-mastectomy in breast cancer patients, addressing its adverse events, recurrence rates, and the importance of ongoing vigilance through standardized screening.

Introduction and Conclusion: Breast cancer, the most common cancer in women, benefits from improved detection through screening programs. Lipofilling, an autologous grafting technique, has emerged as a post-mastectomy reconstructive option. This review focuses on lipofilling, addressing its technique, adverse events, and recurrence rates in breast cancer patients. Success depends on careful injection consideration to limit damage to physiological structures. Adverse events, such as fat necrosis and microcalcifications, pose risks, potentially increasing malignancy risk. Lipofilling after oncoplastic surgery exhibits low recurrence rates without evident escalation in locoregional or distant reoccurrence risks. Despite favorable outcomes, radiological observations mandate ongoing vigilance and adherence to standardized screening. A balanced understanding of these factors is crucial for optimizing care in breast cancer survivors choosing lipofilling for reconstruction.

Keywords: *Lipofilling; Breast Cancer; Calcification; Radiological Imaging; Recurrence*

Introduction

Breast cancer is the most commonly diagnosed cancer in women, with its prevalence increase by established screening programs such as self-breast examination and mammography [1]. Over time, societal perspectives on breast cancer have evolved, and the associated stigma has diminished, partially due to the openness of public figures who have courageously shared their own battles with the disease. This shift has fostered a more compassionate understanding and support system for those navigating the complexities of breast cancer diagnosis and treatment.

These screening programs have contributed to early detections and subsequent interventions. There remains a subset of patients diagnosed at advanced stages. In such cases, mastectomy, the surgical removal of the breast, is indicated. Prophylactic mastectomies are acknowledged among patients with a positive BRCA status or a family history of the condition [2].

Following nipple-sparing mastectomy, patients have the option to undergo breast reconstruction facilitated through techniques such as free flap reconstruction, implants, or lipofilling [2].

Lipofilling

Lipofilling is a method for autologous grafting of the breast. It is based on liposuction and using fat grafts to fill into breast for reconstructive or aesthetic reasons, for example to correct breast asymmetry or scars [3]. Major portion of injected fat remains at location and does not get absorbed. Due to important physiological structures such as blood vessels and mammary ducts in patients without breast cancer, subglandular or subcutaneous injections are golden standard in order to limit damage [4]. Injuries of the mammary gland can cause infection, calcification and fat necrosis. Oil cyst might be preserved by the patient as palpable masses, these pathological changes increase risk of malignancy.

In patients post-mastectomy, lipofilling must be injected subcutaneously. However, challenging conditions may arise due to scarring from the mastectomy. Graft survival may be compromised in scarring tissue after mastectomy and the requirement for neo-vascularization can contribute to a lower efficacy compared to lipofilling in a patient with no previous breast disease.

During follow-up in breast cancer patients, radiological imaging of breasts are required [5]. These include mammography and ultrasound [6]. Ultrasonic examination of the breast suits best for evaluating soft tissue as well as cysts and consolidations. Mammography shows calcifications and exact location of pathological findings.

Technique of lipofilling in patients after mastectomy

This procedure is performed under general anesthesia, involving stab incisions for cannulation access using a suction cannula. The surgeon may proceed immediately or perform additional steps, with a preferred combination injection of saline, epinephrine, and local anesthetics to reduce bleeding and pain during and after procedure. "Dry" liposuction, without fluid injection prior to liposuction, was once thought to enhance graft survival, but studies like Agostini., *et al*. disproved this assumption, revealing increased analgesic use [7]. The suction cannula is inserted into incisions, moved back and forth to collect fat cells and destroy them by shear stress [8]. Various methods are employed for fat processing, such as centrifugation, cotton gauze rolling, or washing and filtration [9]. Centrifugation was associated with higher risk of oil cysts. The processed fat is then portioned into syringes for controlled injection into the breast's subcutaneous space, ensuring symmetry and homogenous distribution.

Adverse events of lipofilling

Injecting fat cells into mammary glands may induce fat necrosis and microcalcifications. This location is more prone to fat necrosis since neo-vascularization is more difficult and fat cells in the centre of a graft are prone to hypoxia resulting in fat cell death [10]. Risk of inflammed oil cysts are based on fat necrosis. Fat necrosis can originate from trauma caused by surgery and inflammation such as plasma cell mastitis.

Microcalcifications are common, and are usually benign changes of breast. However, some configurations of microcalcification can evolve to breast cancer like ductal carcinoma of mammary gland (DCIS) [11].

Post-mastectomy patients undergoing lipofilling have an increased risk of fat necrosis due to heightened hypoxia induced by the presence of scar tissue. Hypoxia, scar tissue, and adipocytes within a tissue with a previous tumor provide favorable conditions for recurrence. Adipocytes have the potential to absorb carcinogens, contributing to the possibility of their transformation and the recurrence of cancer.

Recurrence rate after lipofilling in patients with breast cancer

The research conducted by Moliere., *et al*. has provided valuable insights into the reoccurrence rates following lipofilling in breast cancer patients [12]. Their findings suggest that approximately one-quarter of previous breast cancer patients exhibited suspicious mammographic images during follow-up studies, yet there was no increase in the risk of locoregional or distant reoccurrence. Another study focusing on invasive ductal carcinoma, the reported reoccurrence rates were 3.1%, with four local, two regional, and four distant recurrences among 195 individuals [13]. Piffer., *et al*. observed two metastatic reoccurrences in a cohort of 37 patients [14]. Another study revealed a 7.25% rate of locoregional recurrence as stage 2 cancer within 12 years post-lipofilling, and a 7.6% incidence of distant metastases [15]. Additionally, local reoccurrence was noted at 0.7%, with a biopsy rate of 6.5% [16]. Petit., *et al*'s investigation demonstrated a higher rate of local recurrence in carcinoma *in situ* compared to invasive carcinoma after lipofilling, with a local reoccurrence rate of 18% in intraepithelial neoplasia cases versus 3% in those without lipofilling [17].

Radiological findings in postoperative imaging after lipofilling

Radiological findings following lipofilling in breast surgery have been subject to comprehensive investigation, focusing on potential outcomes and complications. Notably, the incidence of oil cysts exceeding 10 mm was reported at 7%, a finding consistent with a study by Moliere., *et al* [12]. In a comparative study reviewing radiographic outcomes in patients without prior breast disease, microcalcifications were observed in 16%, macrocalcifications in 9%, and cystic lesions in 25% [13]. This study highlighted that breast density did not significantly differ before and after lipofilling [18]. Wang., *et al*'s investigation revealed clustered microcalcifications in 16.7% of cases on mammography, corresponding histologically to fat necrosis, a finding consistently demonstrated in a recent case report [19,20]. Another study assessed preoperative, 6-month, and 12-month postoperative imaging and showed that 23 out of 24 cases had oil cysts on ultrasound, with fat necrosis detected in four by ultrasound and eight by magnetic resonance imaging (MRI) [18,21]. Mammography demonstrated calcified fat necrosis in one case. After breast-conserving surgery in a different study, 19% of mammograms identified microcalcifications with a benign appearance, while 57% exhibited the presence of oil cysts [22]. Additional radiological imaging was necessary in 16.4% and biopsy was indicated in 3.2%. In a separate study cohort with postoperative follow-up using ultrasound and mammography, 24% underwent biopsy, all of which were benign [16]. In patients solely monitored with mammography, only 1% of 735 cases required biopsy.

Discussion

The establishment of a standardized screening protocol following lipofilling in patients without breast cancer remains an ongoing challenge. As mentioned, the morphological changes post-lipofilling are influenced by the fat processing method being associated with a higher risk of oil cysts. Some studies have indicated that morphological changes following lipofilling in breast cancer screenings do not overlap significantly, contrasting with findings in patients undergoing breast reduction, where a higher risk of overlap exists [23].

Wang., *et al*. explained the complexity by emphasizing the challenge of interpreting mammograms that reveal clustered macrocalcifications post-lipofilling. This resemblance to malignancy poses a potential source of confusion in radiological assessments. Atia., *et al*. proposed the idea of standardizing mammography in the follow-up after lipofilling, a notion we strongly support [24]. The absence of a mandatory radiological follow-up after lipofilling in patients without breast cancer history raises the possibility of losing correlations between abnormalities in mammograms and the lipofilling procedure. Since radiological follow-up after lipofilling is not required, some correlation between abnormalities in mammograms and lipofilling get lost.

Future Aspects and Conclusion

The presumption that most radiological changes in mammograms post-lipofilling (as in aesthetic and reconstructive reasons) are primarily observed within breast cancer screening programs or breast cancer follow-up highlights a potential gap, particularly concerning

women under 40 years of age who are not included in screening projects e.g. in Austria [25]. Therefore, it would be beneficial to include follow-up mammography and/or ultrasound after reconstructive surgery and aesthetic surgery in "healthy" patients to evaluate postoperative impacts. In younger patients, ultrasound proves to be effective, and there should be no unnecessary radiation exposure, unless it is necessary for additional imaging purposes.

The assessment of fat processing methods can be enhanced by linking each method to specific morphological changes, as exemplified by the increased rates of oil cysts associated with centrifugation. The lack of a universally accepted standard for liposuction and fat processing emphasizes the necessity for additional research on each element. This is crucial to identify the most appropriate procedures that reduce the likelihood of morphological changes in breast tissue and enhance the survival of grafts.

Implementing standardized radiological follow-up after lipofilling for patients with and without breast cancer offers the potential for larger patient cohorts, enabling more accurate assessment of radiological findings. This approach not only includes individuals engaged in breast cancer follow-up or those participating in screening programs, but also those who might not typically undergo breast cancer screening. Furthermore, it contributes to heightened awareness of breast cancer.

Radiological imaging following lipofilling offers surgeons valuable information regarding morphological alterations in breast tissue, both in individuals without prior breast disease and those with a history of breast cancer. This enhances their capacity to interpret and distinguish between benign and malignant lesions.

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