Asclepius

Breast Reconstruction using Reverse Expansion and Autologous Fat Grafting - A Case Report

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ABSTRACT

Breast reconstruction using solely autologous fat grafting (AFG) has become an option in breast reconstructive surgery. External pre-expansion using the BRAVA system has been thoroughly described as a means to allow large volume fat grafting in breasts, but breast reconstruction without pre-expansion has also been reported in the literature. Reverse expansion with AFG is a newer method that consists of an internal pre-expansion followed by gradual deflation combined with lipofilling. It is a safe method of breast reconstruction in the selected patient, giving a natural and, presumably, enduring appearance of the reconstructed breast. Since the procedure is quite new, literature on the matter is important to guide others on how and when to apply it. We present a case of complete breast reconstruction using reverse expansion and AFG from Copenhagen University Hospital with excellent results and no major complications. We believe this method to be more convenient to the patient than the BRAVA-method. Drawbacks from both patients' and a socioeconomic point of view are the need for several procedures in general anesthesia and, thus, hospitalization and days absent from work for the patient. Theoretically, this is outbalanced by a reduced risk of future corrective surgeries as compared to an implant-based reconstruction. In the future, the addition of adipose-derived stem cells to the fat graft may increase fat survival and thus make breast reconstruction using AFG alone even more advantageous.

Key words: Autologous fat grafting, breast reconstruction, case report, expander, lipofilling

INTRODUCTION

Breast reconstruction after mastectomy entails the use of implants, autologous tissue or a combination of both with or without the use of the acellular dermal matrix.[1] Not all methods are applicable for all patients due to, i.e., radiation therapy or lack of donor tissue. Autologous fat grafting (AFG) has become increasingly popular as an adjuvant to breast reconstruction after breast-conserving surgery or mastectomy, providing soft volume, and smooth tissue coverage.[2,3] Reconstructing a whole breast using lipofilling only is a newer tendency that has begun within the past decades, i.e. using the BRAVA-system,[4] or without any scaffold at all.[5,6] In 2016, Stillaert et al. described a method for breast reconstruction with AFG and reversed expansion in 7 patients.[7] In 2017, Fabiocchi et al. presented 57 patients (125 breasts) reconstructed in this way with excellent results.[8]

We present a case of breast reconstruction with AFG and reverse expansion from the University Hospital of Copenhagen, Rigshospitalet in Denmark.

CASE REPORT

A 53-year old Caucasian woman with a body mass index of 23 kg/m² and no major comorbidities was planned for mastectomy and immediate breast reconstruction to her right breast due to invasive breast cancer. She had received chemotherapy before the surgery, but no radiotherapy. The patient had a strong wish not to have implanted any foreign bodies, and it was, therefore, decided to reconstruct her purely with lipofilling preceded by a pre-expansion of the breast to support the skin envelope and create a scaffold for the fat to take on - the reverse expansion technique. Her left breast had a volume of 375 cc.

After the skin-sparing mastectomy, a 350 cc expander was placed in the subpectoral space and filled with 50 cc of saline water. 100 cc of fat was harvested and injected into the mastectomy flaps and the major pectoralis muscle. 2.5 weeks after full expansion to 275 cc in the outpatient clinic, the reverse expansion process began. During each procedure, an amount of saline was tapped from the expander and fat was injected into the subcutaneous layer, the major pectoralis muscle, and, after removal of the expander in the fourth surgery, the capsule. The fat was harvested using the body jet system, and all surgeries were performed by an experienced plastic surgeon.

The patient had a total of 5 lipo injections with an average fat graft volume of 196 cc (range 90–330 cc). Donor sites were abdomen, flanks, and outer and inner thighs and knees. The time between the operations ranged from 2.5 to 12 months (average 5,4). Finally, she had her nipple reconstructed and her areola tattooed. See Figures 1 and 2 for photographs of the reconstruction process.

The patient endured two minor complications. First, a 100 cc seroma that had to be removed after the mastectomy and expander placement, and second, fat necrosis presenting as a grain-sized lump after complete reconstruction. The consistency of the reconstructed breast was soft, and she was very satisfied with the result, the body contouring, and the fact that she avoided an implant insertion.

DISCUSSION AND CONCLUSION

The reverse expansion is suitable for reconstruction of small to medium sized breasts and can be assisted by a small implant to achieve larger volume and a similar smooth and soft coverage if needed.[7-9] The expander can be placed pre-pectoral or, as in our case, sub-pectoral, and it is critical that the patient has sufficient donor areas. The patient must be willing to go through several operations in general anesthesia to gain enough volume. This can be difficult for some women due to absence from work or family. Furthermore, several sessions of general anesthesia have an inherent risk, and some patients may need to be excluded on this account. Patients should be informed to keep a stabile weight after reconstruction since the fat tissue will shrink and grow according to weight changes. Unfortunately, we only present a single case and not a larger case series, which is a limitation to the work and makes it difficult to summit general conclusions.

In a systematic review of 6260 patients by Groen *et al.*, the total rate of complications for AFG to breasts is 8.4% (95% CI 7.6–9.1), of which minor complications comprise the majority.[10] De Decker *et al.* analyzed 23 articles and reported minor complications, i.e., fat necrosis in 5.31% or benign lesions such as oils cysts, micro- or macro-calcifications, seromas,

Figure 1: Frontal view of the 53-year-old patient's breasts reconstructed with reverse expansion and autologous fat grafting. Different stages in the process are shown. (a) Before mastectomy and expander placement. Lumpectomy scar present at the lateral aspect of the right breast. (b) 3 months after the fourth lipo injection and removal of the expander. Total fat graft is 650 cc. (c) 3 months after the fifth and final lipo injection with additional 330 cc. (d) Final result 3 months after reconstruction of the nipple-areola complex. Photographers: Tina Rasmussen and Trille C. B. Skjelborg
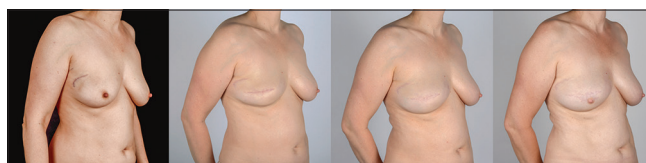

Figure 2: Oblique view of the 53-year-old patient's breasts reconstructed with reverse expansion and autologous fat grafting. Different stages in the process are shown. See Figure 1 for a description

and hematomas in 8.78%.[2] Infection at the recipient site was 0.80% and 0.96%, respectively, in the two studies.[2,10] Silva-Vergara *et al.* have found similar results in 319 reconstructive lipofilling procedures.[11] In regard of the oncological safety of AFG, the rate of local recurrence ranges from 1.69 to 3.1%, and it is considered a safe technique without increased risk of local recurrence of breast cancer.[2,10,11]

The theory of pre-expansion is that an ischemic reduction in the subcutaneous tissue gives rise to neovascularization while creating a well-vascularized mega-volume scaffold allowing for large volume fat grafts.[12,13] Since the survival of the fat graft depends mainly on oxygen diffusion,[3,14] it makes sense to optimize the recipient site in this regard. Furthermore, deflation of the expander reduces the interstitial fluid pressure, which in theory increases the oxygen diffusion.[14]

The BRAVA method also consists of pre-expansion, only here the expansion is external. The patient should wear the BRAVA device for 10 h a day in 2–4 weeks before lipofilling and for some time after as well. This is repeated on average 2.8 times in non-irradiated breasts.[12] In comparison to the BRAVA method, the reverse expansion is less troublesome, not having to wear an external device, which requires a great deal of compliance from the patient.

Our average graft volume per surgery of 196 cc is comparable to previous reported volumes ranging from 159 to 318 cc-[5,7,8] In the study by Hoppe *et al.*, only 5/28patients

had pre-expansion, and a difference in the graft volume per surgery with or without pre-expansion is not reported, nor is the percentage of graft survival.[5] In theory, pre-expansion should allow for larger graft volume and higher retention rates. The average total volume of grafted fat per breast in Hoppe *et al.'s* study (1000 cc) does not differ much from our case (980 cc), but since the average final breast size is not reported, and since the 5/28 patients with pre-expansion are included in Hoppe *et al.'s* calculation it is not possible to compare retention rates.

The total span of reconstruction for our patient was 3 years, which is a long period of time and expensive in a socioeconomic point of view. Optimal, the lipo injections could possibly be done 3–4 months apart, thus a total span of approximately 1.5–2 years (including areola-papilla reconstruction). On the other hand, an autologous reconstruction entails a lower risk of risk of complications and corrections and, ultimately, hospitalization, compared to implant-based reconstruction.

Survival percentage of the fat graft is an uncertain factor in AFG, resorption rates ranging from 25% to 80%.[15] Data from Stillaert *et al*. show a graft survival rate of 60% measured with pre- and post-operative magnetic resonance imaging -scans in 5 patients.[7] The number of surgeries to reconstruct a whole breast with AFG ranges from 3.6 to 4.8 on average. [5,7,8,12] Previously radiated patients need more surgeries and a larger total volume of injected fat than those who have not been radiated.[5,6,8] A plausible explanation for this is a higher fat loss due to decreased vascularity and more fibrosis in radiated tissue.[8] Therefore, previous radiation should be taken into consideration in the planning and information of the patient. The downside of several operations in AFG may be obliterated in the future through the use of adipose-derived stem cells (ASC). The survival rate when adding ASC to the fat graft is significantly larger (80.9% vs. 16.3%) after 4 months when injected into the arm.[15] A study by Kamakura and Ito showed that the increased breast size after a single ASC-enriched lipofilling surgery for breast augmentation remained relatively stable after 12 months.[16] Recently, a Danish randomized clinical trial testing the use of ASC for breast augmentation in 12 patients showed a significantly larger survival rate in the ASC-group.[17]

In conclusion, reverse expansion with AFG can be an option in breast reconstructive surgery in the selected patient. In the future, ASC may play a role reducing the number of surgeries needed to obtain sufficient volume.

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