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Original article

Patient reported outcomes of autologous fat grafting after breast cancer surgery

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ABSTRACT

Introduction: Autologous fat grafting (AFG) can be used as an adjunct in breast cancer surgery to improve contour defects. Few previous studies have assessed patient reported outcomes (PROs) for AFG. This study analysed AFG use and assessed PROs in terms of physical and psychosocial well-being.
Materials and methods: All patients undergoing AFG were identified from a prospective database and asked to complete the validated BREAST-Q questionnaire and a tool to assess patient-perceived change after AFG (5-point Likert-type scale). Descriptive statistics were computed for all BREAST-Q and perceived change subscales. Independent sample t-tests were conducted to compare scores on each of the BREAST-Q and perceived change subscales by type of breast cancer surgery and radiotherapy status.
Results: 156 AFG sessions were performed over 4 years on 119 breasts in 88 patients. Fifty-seven patients received AFG after reconstruction and 19 after breast conserving surgery. Forty-six patients (52%) completed the questionnaire. BREAST-Q scores (out of 100) and patient-perceived change after AFG (out of 5) were respectively: 54 and 4.0 for Breast satisfaction, 69 and 3.3 for Physical well-being and 60 and 3.6 for Psychosocial well-being. Radiotherapy status and type of surgery made little difference. Number of AFG procedures positively correlated with perceived improvement.
Discussion: Autologous fat grafting was associated with improved patient satisfaction despite small volumes transferred. BREAST-Q scores were comparable with previously published series on reconstructive breast surgery. Perceived change after AFG was no different in patients receiving radiotherapy.

1. Introduction

Autologous fat grafting (AFG) is a technique used to correct contour defects by harvesting fat from a donor site (usually the abdomen or thighs) and re-injecting purified adipocytes at the required recipient site. Its use has gradually increased since the 1997 publication by Coleman of his technique for harvesting and processing fat for aesthetic improvement of the nasolabial fold [1].

AFG to the breast has also gained in popularity during this time. As well as its use in cosmetic autologous breast augmentation [2], it has become a useful tool in the management of breast defects after both breast conservation surgery and mastectomy and reconstruction. Historical concerns about the potential for AFG to mask detection of future breast cancer [3] have been addressed by the observation that breast reduction surgery causes more scarring to the breast than fat grafting [4]. A recent systematic review by Waked et al. [5] assessed the evidence of the oncological safety of fat grafting, and concluded that experimental concerns about the potential for grafted fat to promote a tumorigenic environment have not translated into clinical experience, although evidence is inadequate to conclusively confirm the procedure's oncological safety.

There has also been much interest in the potential for AFG to reverse radiotherapy-induced tissue damage and improve chronic pain [6–8]. This is thought to be related to the function of adipose derived stem cells (ADSCs) and possible mechanisms include their effects on extracellular matrix, angiogenesis and the inflammatory response [9].

Numerous previous studies have reported the use of AFG after breast cancer surgery, with descriptions of techniques, volumes transferred and complications. These are well summarised in a recent systematic review by Groen et al. [10], demonstrating variability in mean volumes transferred (24–760 cc) and follow up

Abbreviations: AFG, Autologous fat grafting; PROs, Patient reported outcomes; BCS, Breast conservation surgery; DTI, Direct to implant.

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period (5–90 months). Many studies have described patient reported outcomes (PROs) after cosmetic and oncologic breast cancer surgery, including breast conservation surgery [11] and prosthetic reconstruction [12–18], but few studies have assessed PROs after fat grafting [19–21].

This study analysed the use and PROs of AFG at a tertiary referral hospital since its introduction in 2011.

2. Materials and methods

Ethical approval was granted by the Western Sydney Local Health District Research Ethics Committee. Patients undergoing autologous fat grafting at our institution have been recorded in a prospective database since the procedure's introduction. These data fields were checked and supplemented with a retrospective chart review. The final dataset included patient demographics, cancer and treatment details as well as any early or late complications.

2.1. Operative technique

Most patients underwent AFG using the technique described by Coleman [1]. The donor site was first infiltrated with 40 ml 0.25% bupivacaine with 1:100 000 adrenaline. After 5–10 min, lipoharvesting was commenced using a 4 mm 'bucket handle' cannula, usually through an infra-umbilical incision for abdominal harvest or a mid-medial thigh incision for thigh harvest. A 10 cc syringe was used with manual negative pressure applied. Aspirated fat was then centrifuged in batches at 3000 rpm for 3 min. Over the course of the study period, the duration and intensity of centrifugation reduced to 1–2 min at 2000 rpm, and the infiltration volume increased as progressively larger volumes of fat were harvested. The natant (mainly aspirated infusate and blood) was allowed to drain and the supernatant (oil from ruptured adipocytes) was poured or wicked out of the syringes. The remaining harvested adipocytes were then transferred to 1 cc syringes for reinjection through a blunt tipped Coleman cannula. Rigotomy (ie. release of subcutaneous fibrous strands using a 19 g sharp tipped needle) was performed prior to injection of fat when needed. Later in the study period purified fat was re-injected using 10 cc syringes and the same Coleman cannula.

2.2. Alternative technique

After informal discussions with world AFG experts, in a few cases an alternative lipo-harvesting technique was used to facilitate the transfer of greater volumes of fat, using the MacroFill® kit (Adip'Sculpt, Stemcis Australia Pty Ltd). This technique differs from Coleman's technique in the following ways:

1. Avoidance of local anaesthetic in infusate prior to harvesting (LA is administered after completion of fat harvest);
2. Tumescent infiltration with greater volumes of saline with adrenaline – 200–400 cc;
3. Harvest using 4 ml multi-sidehole cannula and 60 cc syringe;
4. Washing of aspirated fat twice with 0.9% sodium chloride solution;
5. Centrifugation at 1000 rpm for 1 s after each wash;
6. Final centrifugation at 2000 rpm for 1 min;
7. Transfer to 10 cc syringes for re-injection.

The developers of this technique have suggested higher graft volumes are possible with superior graft survival [22–24].

2.3. Patient reported outcomes

The validated BREAST-Q (v1.0) questionnaire was used to assess PROs [25]. The relevant post-operative modules were used for breast conserving surgery or post-mastectomy reconstruction according to patients' previous surgery. The scales for satisfaction with breasts, physical well-being of chest and upper body and psychosocial well-being were used.

A tool was developed by the authors to establish patient-perceived change after AFG. A 5-point Likert-type scale was used from "A lot worse", through "No change" to "A lot better". For each BREAST-Q item, patients were asked to select a response from the scale. BREAST-Q items are grouped into their relevant domains and the perceived change for each domain was calculated using the mean change for items in that domain.

All patients in the institutional AFG database were sent patient information sheets and invited to participate in the study by completing the BREAST-Q and Perceived Change after AFG questionnaires. Non-responders were contacted by a research nurse after one month and again at three months.

2.4. Statistical analysis

Data were analysed using Microsoft® Excel and SPSS version 23. Descriptive statistics were computed for patient demographics, reasons for undergoing AFG, volumes and sites of fat harvest and reinjection as well as time intervals between autologous fat grafting sessions and any additional procedures performed in conjunction with AFG, as well as the BREAST-Q and Perceived Change subscales. Independent sample *t*-tests (two-tailed) were conducted to compare groups where relevant, including radiation therapy status and type of prior surgery. Critical alpha of 0.05 was applied for all data analyses.

3. Results

156 AFG sessions were performed on 119 breasts in 88 patients between June 2011 and November 2015. Patients were categorized according to the indication for their AFG:

1) Contour defect after prosthetic breast reconstruction (n = 57)
   a. Direct to implant (DTI – n = 39)
   b. Expander/implant (n = 18)
2) Contour defect after breast conservation surgery (BCS) (n = 19)
3) Contour defect/salvage of prosthetic reconstruction after wound complications (n = 6)
4) Other (n = 6).

The 'other' reasons were: pain after radiotherapy (n = 2), capsular contracture after BCS and radiotherapy with previous breast augmentation (n = 2), reversal of radiotherapy effects before mastectomy and prosthetic reconstruction (n = 1) and contour defect after autologous breast reconstruction (n = 1). Median follow up after first AFG session was 16 months (range 1–50). Reconstruction patients were younger than BCS patients (mean age 46 vs 53, Table 1).

The number of AFG sessions per patient ranged from 1 to 5, with a median of 2 (mean 1.77). Patients undergoing contour corrections after BCS underwent more sessions (mean 2.2) than those after breast reconstruction (mean 1.6, Table 2), although this did not reach statistical significance (p = 0.06).

The interval between primary cancer surgery and first fat grafting varied widely, from one week (AFG performed at the time of margin re-excision) to 16 years. The median intervals were 17 and 32 months for reconstruction and BCS patients respectively