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Use of autologous fat grafting for breast reconstruction: A systematic review with meta-analysis of oncological outcomes

Riaz A. Agha ^{a,b,c}, Alexander J. Fowler ^{d,*}, Christian Herlin ^e,
Tim E.E. Goodacre ^f, Dennis P. Orgill ^g

^a Department of Plastic Surgery, Pinderfields Hospital, The Mid Yorkshire Hospitals NHS Trust, Aberford Road, Wakefield, UK

^b Department of Continuing Education, Kellogg College, University of Oxford, UK

^c Nuffield Department of Surgical Sciences, Kellogg College, University of Oxford, UK

^d Barts and The London School of Medicine and Dentistry, QMUL, London E1 4NS, UK

^e Department of Plastic and Reconstructive Surgery, Burns and Wound Healing, Lapeyronie University Hospital, 34295, Montpellier, France

^f Department of Plastic Surgery, John Radcliffe Hospital, Oxford University Hospitals NHS Trust, Headley Way, Headington, Oxford OX3 9DU, UK

^g Division of Plastic Surgery, Brigham and Women's Hospital, Boston, MA 02115, USA

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Summary *Background:* There is growing interest in the use of autologous fat grafting (AFG) for breast reconstruction. Concerns have been raised regarding its effectiveness and safety. *Objective:* The primary objective was to determine the oncological, clinical, aesthetic and functional, patient reported, process and radiological outcomes of AFG. *Methods:* A protocol was published on PROSPERO (CRD42013005254). Types of studies: All original studies. Types of participants: Women undergoing reconstruction after surgery for breast cancer. Types of Interventions: AFG techniques for reconstruction. Types of outcome measures: Oncological, clinical, aesthetic and functional, patient reported, process and radiological. Search terms and keywords: The search strategy was devised to find papers regarding AFG for breast reconstruction. Data sources: Electronic databases were searched from 1st January 1986 to 31st March 2014 including: PubMed, MEDLINE, EMBASE, SCOPUS, The Cochrane Library, and clinical trial registries. Identification and selection of studies: Title and abstract screening and full text assessment undertaken separately by independent researchers. Data extraction, collection and management: Data extracted by two researchers and stored in a standardised database. *Results:* 35 studies were included (3624 patients) with a high degree of patient and surgeon satisfaction over a mean of 1.9 sessions at 18 month follow-up. Fat necrosis was the commonest

* Corresponding author.

E-mail addresses: mail@riazagha.com (R.A. Agha), ha09410@qmul.ac.uk (A.J. Fowler).

reported complication (4.4%), biopsy of a subsequent breast lump was required in 2.7% and an interval mammogram in 11.5%. The weighted mean recurrence rate was 4.4% at 24.6 months. Meta-analysis of comparative studies showed no significant difference in oncological event rates between AFG and non-AFG groups ($p = 0.10$).

Conclusion: AFG is a potentially useful reconstructive tool, has a relatively low complication rate, with the majority of patients and clinicians satisfied or very satisfied with the results. Long term clinical and radiological follow-up is required. Further research is necessary to confirm oncological ramifications.

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Background

Breast cancer is the most common cancer in the United Kingdom (UK) and the most common amongst women with a lifetime incidence of one in eight.¹ Approximately 50,000 women are diagnosed with breast cancer each year in the UK, with 16,000 having mastectomy.²

Treatment typically includes surgery in the form of mastectomy or breast conserving surgery (BCS). This is often combined with radiotherapy (RT) and/or chemotherapy and/or hormonal therapy.² Veronesi showed that long term survival was no different after mastectomy or BCS for those with tumours less than 2 cm in diameter, subsequent work has shown it suitable for tumours up to 4 cm in diameter^{3–5} BCS has therefore become the treatment of choice for this group, increasingly with neoadjuvant chemotherapy to optimise outcomes.^{6–8} Sentinel node biopsy has also been incorporated into modern surgical practice to reduce the need for full axillary clearance.⁹

Autologous fat grafting (AFG) is a technique where the patient's own fat is harvested using a liposuction technique and then transplanted into the breast. Proponents cite its potential reconstructive value – using nature's choice of filler – body fat, which is easily harvestable, often in good supply, avoids risk associated with foreign bodies or large flap procedures, improves skin trophicity and can be performed as a day case procedure.^{10–12}

Detractors argue that the successful implanting of fat is dependent on the recipient site for its blood supply. Fat that doesn't survive may cause morbidity, potentially promote cancer recurrence and interfere with mammography.^{13–18} The greatest concern thus comes in the use of AFG – which stimulates angiogenesis – in the reconstruction of what was a tumour bed.

Following the banning of AFG in 1987 by the American Society of Plastic and Reconstructive Surgeons (ASPRS), Coleman developed the concept of *structural fat grafting*.^{19,20} The principle being that fat must be transplanted in small aliquots using multiple tunnels, inserted in multiple directions and layers, formed by thin cannulas and syringes so maximising the transplanted tissues' contact with an adequate blood supply was found to be more successful.^{21–24}

A number of systematic reviews investigating AFG to the breast have been completed, and a summary of these is presented in Table 1. The quality of the previous systematic reviews was assessed using the validated assessment tool, Assessment of Multiple Systematic Reviews' (AMSTAR) and

is displayed in Table 2.^{25–27} Most looked at cosmetic indications alongside reconstructive uses, we focussed exclusively on reconstructive applications of AFG.

AFG is an active research front. A search of the database Scopus for "fat grafting" by year is outlined in Figure 1.

Since the most recent systematic review looking at the use of AFG in breast reconstruction by Claro Jr et al. concluded its search in June 2011, there have been over 300 more articles published in this area.²⁸ A new systematic review is needed to update our understanding and attempt to answer the questions previous studies have been unable to.

Objectives

Our objective was to perform a comprehensive systematic review of AFG for the purposes of breast reconstruction.

Primary objectives

In the context of using AFG for breast reconstruction in women post-mastectomy or post-BCS, we aimed to determine:

1. Oncological outcomes
2. Clinical outcomes
3. Aesthetic and functional outcomes
4. Patient reported outcomes
5. Process outcomes
6. Radiological outcomes

Secondary objectives

1. To suggest optimal methods of fat harvesting, preparation and injection.
2. To suggest the indications for the procedure in the reconstructive context.
3. To suggest refinements to patient selection for the procedure.

Patient and public involvement in this review

The research team liaised with three patients who had been diagnosed with breast cancer and needed to consider their reconstructive options in recent years. Their involvement included feedback on the draft protocol (where they agreed the objectives and proposed

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