

The Stromal Vascular Fraction of Autologous Fat Graft Induces Proliferation of Epithelial Progenitor Cells in Healthy and Cancer-Containing Breast Tissue *in Vitro*

Imran Ratanshi, MD, MSc, Sumanta Chatterjee, PhD, Michael Laliberte, MD, Sarah Blelloch, BSc, Blair Peters, MD, Janice Safneck, MD, Afshin Raouf, PhD, Edward W. Buchel, MD

Abstract

Background: Autologous fat grafting is widely used for managing contour asymmetries in breast reconstruction. Adipose tissue contains a rich population of both multipotent mesenchymal stem cells and vascular progenitor cells (collectively referred to as adipose-derived stem cells, or ASCs) (1). When isolated, the cellular fraction of adipose tissue containing ASCs is referred to as stromal vascular fraction (SVF). Despite widespread clinical use, interactions between the SVF of lipoaspirate and breast parenchyma remain poorly understood. Our study investigated the effect of progenitor-rich SVF on the behavior of mammary epithelial progenitor cells derived from two sources: (i) healthy breast tissue and (ii) cancer adjacent breast tissue.

Methods: Healthy breast tissue and abdominal lipoaspirate were obtained from patients undergoing elective reduction mammoplasty and liposuction. Breast tissue from *outside the tumor-free margins* of mastectomy specimens (termed 'cancer-adjacent breast tissue') was obtained from patients undergoing primary free-flap reconstruction. Samples of SVF (from lipoaspirate) and breast parenchymal cells were then isolated using established cell digestion protocols. ASCs within the SVF were characterized using established differentiation, colony-forming unit-fibroblast (CFU-f), and cell surface marker assays (1). Finally, SVF cells were co-cultured with breast parenchymal cells from (i) healthy and (ii) cancer-adjacent sources were co-cultured using a three-dimensional matrix called Matrigel. Control cultures consisted of breast cells from (i) healthy and (ii) cancer-adjacent tissue in the absence of SVF. After 14 days, the total cell numbers and mammary epithelial progenitor cell populations from each culture group were quantified using colony forming cell (CFC) assays.

Results: Differentiation, CFU-f, and surface marker assays demonstrated the presence of ASCs in SVF samples. Co-cultures of cancer-adjacent breast parenchymal cells with SVF showed a 9-fold expansion of mammary epithelial progenitor cells (control = 3-fold) compared to a 5.5-fold expansion in co-cultures of healthy breast parenchymal cells (control = 2-fold) with SVF based on CFC assays.

Conclusions: SVF is capable of increasing the proliferation of mammary epithelial progenitor cells in both healthy and cancer-adjacent breast tissue. As a result, this study demonstrates the potential for interaction between the SVF within autologous fat graft and progenitor cells contained within breast parenchymal tissue.

References

1. Bourin, P. Bunnell, B.A., Casteilla, L., Dominici, M., Katz, A.J., March, K.L., Redl, H., Rubin, J.P., Yoshimura, K., Gimble, J.M. Stromal cells from the adipose tissue-derived stromal vascular fraction and culture expanded adipose tissue-derived stromal/stem cells: a joint statement of the International Federation for Adipose Therapeutics and Science (IFATS) and the International Society for Cellular Therapy (ISCT). *Cytotherapy* 15: 641-648, 2013.

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