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REGULAR ARTICLE

Stromal cells cultured from omentum express pluripotent markers, produce high amounts of VEGF, and engraft to injured sites

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Abstract When rat omentum becomes activated by intraperitoneal injection of inert polydextran particles, these particles are rapidly surrounded by cells that express markers of adult stem cells (SDF–1α, CXCR4, WT–1) and of embryonic pluripotent cells (Oct–4, Nanog, SSEA–1). We have cultured such cells, because they may offer a convenient source of adult stem cells, and have found that they retain stem cell markers and produce high levels of vascular endothelial growth factor for up to ten passages. After systemic or local injection of these cultured cells into rats with acute injury of various organs, the cells specifically engraft at the injured sites. Thus, our experiments show that omental stromal cells can be cultured from activated omentum, and that these cells exhibit stem cell properties enabling them to be used for repair and possibly for the regeneration of damaged tissues.

Keywords Omentum · Stem cells · Oct–4 · Nanog · WT-1 · Rat (Sprague Dawley)

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Introduction

In previous experiments, we have shown that, when inert polydextran particles (size: ~120 μM) are placed in the abdominal cavity of rats, the omentum recognizes them as foreign bodies and expands rapidly to surround and encapsulate them. Once the omentum becomes activated, it greatly increases in size and in mass (>20 fold increase) by producing new tissue that consists mainly of stromal cells, interstitial cells, and blood vessels. Fat cells in the omentum, which in the native state amount to 95% of the total tissue, decrease to less than 30%, so that stromal cells now make up more than 70% of the total omental mass. The non-fat stromal cells in the expanded omental tissue, especially those immediately surrounding the polydextran particles, express markers of stem cell activity, viz., stromal-cell-derived factor (SDF–1α), chemokine receptor 4 (CXCR4), and Wilms' tumor antigen 1 (WT–1; Litbarg et al. 2007; Singh et al. 2007a, b). If such omental cells could be cultured, they would represent a readily available source of adult stem cells that could be used to repair and regenerate damaged tissue. Accordingly, we have cultured cells from the activated omentum, characterized them for stem cell markers during several passages, and tested their