



UMEÅ UNIVERSITET

Umeå University Medical Dissertations, New Series No 2281

OPTIMIZING STEM CELLS FOR RECONSTRUCTIVE SURGERY

Anne Therese Lauvrud

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av medicine doktorexamen framläggs till offentligt försvar i Naturvetarhuset Sal N410, Umeå Universitet, 23 februari 2024 kl 09.00.

Avhandlingen kommer att försvaras på engelska.

Fakultetsopponent: Docent Susanna Kauhanen

Plastic Surgery, Uppsala University Hospital, Sweden and Plastic Surgery, Helsinki University Hospital, Finland

Department of Medical and Translational Biology & Department of
Diagnostics and Intervention

Organization

Umeå University
Department of Medical and
Translational Biology &
Department of Diagnostics and
Intervention

Document type

Doctoral thesis

Date of publication

02 February 2024

Author

Anne Therese Lauvrud

Title

Optimizing Stem Cells for Reconstructive Surgery

Abstract

Fat grafting has become an established method in plastic surgery for treating soft tissue defects. The results for survival of the fat being transplanted is unpredictable and supplementation of the graft with the Stromal Vascular Fraction (SVF) or cultured Adipose tissue-derived stem Cells (ASCs) can enhance graft viability. The ASCs are a heterogenous group of cells with various cell membrane markers, and differing growth promoting and differentiation characteristics. The methods of harvesting the fat can influence the survival and characteristics of the stem cells derived from the fat. It is of high importance when expanding cells prior to the transplantation of the cells into patients, that the culture conditions are well defined and ideally are xenofree, avoiding use of animal-derived products. Furthermore, the procedures must be safe and not increase the risk for recurrence of cancer after reconstructive surgeries. This thesis explores the phenotypic properties of a selected population of ASCs, with a view to determining their suitability for transplantation into fat grafts. ASCs were isolated from the SVF of human abdominal fat and CD146+ cells were selected using immunomagnetic beads. The proliferation, angiogenic and adipogenic properties were significantly higher in the CD146+ cells. Stem cells were also isolated from lipoaspirate obtained using two different liposuction methods. Waterjet lipoaspirates yielded the greatest number of CD146+ cells with high adipogenic potential and angiogenic activity. The cells could also be successfully isolated using a closed processing system. Cells were expanded in either foetal bovine serum, platelet lysate or a chemically defined xenofree (XV) medium. Cultures in XV medium proliferated the fastest, expressed the highest number of CD146+ cells, and showed the best adipogenic and angiogenic properties. To test possible ASCs interactions with cancer cells, co-cultures with MCF-7 breast cancer cells were established. Conditioned medium from co-cultures significantly increased the migration of the cancer cells but not their proliferation, and there was increased expression of Tenascin-C in these cultures. The research in this thesis work has shown more optimal ways to isolate and expand ASCs, potentially offering new therapeutic reconstructive treatment options for a variety of medical conditions.

Keywords

Adipose tissue-derived stem cells, liposuction, oncological safety, xenofree growth medium

Language

English

ISBN

print: 978-91-8070-262-1
PDF: 978-91-8070-263-8

ISSN

0346-6612

Number of pages

65 + 4 papers