

Abstract: 409

Cell Therapy with Human Umbilical Cord Blood-derived Mesenchymal Stem Cells for Intervertebral Disc Repair in Cultured Rabbit Disc Explants

Y. Zhang¹, D. Markova², B. Saitta³, V. Markov¹, M. Enomoto-Iwamoto², H. An¹, A. Chee¹, D.G. Anderson²

¹Rush University Medical Center, Chicago, IL, USA, ²Thomas Jefferson University, Philadelphia, PA, USA, ³Corriell Institute, Camden, NJ, USA

Introduction: Back pain associated with symptomatic disc degeneration is a common clinical condition. Injection of mesenchymal stem cells into the intervertebral disc is an attractive therapy to regenerate the disc and restore function.

Purpose: The purpose of this study is to determine the effectiveness of mesenchymal stem cell therapy for the repair of intervertebral discs *in vitro*. Human umbilical cord blood-derived mesenchymal stem cells (hUCB-MSC) were injected into cultured rabbit intervertebral disc explants. Survival of the injected cells and expression of the collagen type II gene were assessed.

Methods: hUCB-MSCs were injected into rabbit whole disc explants, which were maintained in culture for one month. Cell survival was then assessed by fluorescence microscopy and collagen type II expression was assessed by RT-PCR.

Results: In this study, hUCB-MSCs have been shown to survive in rabbit explant cultures and to differentiate into cells of the adipogenic, osteogenic, and chondrogenic lineages. Thus, hUCB-MSCs have the same full potential to differentiate into these lineages as mesenchymal stem cells derived from other origins. In addition, these stem cells cultured in micromass stain blue with Alcian blue dye, which suggests that proteoglycan-rich extracellular matrix are produced, further indicating the ability for these cells to differentiate into the chondrocyte lineage. hUCB-MSC achieved long-term survival in the cultured disc explants, and expressed the human collagen type II gene, which indicates that the injected stem cells are differentiating into a chondrocyte-like lineage.

Conclusions: Our study demonstrates the ability of hUCB-MSC to survive and express the human collagen type II gene when transplanted into rabbit intervertebral discs. These data support the potential of a cell therapy approach for disc repair. Further studies of extracellular matrix (e.g., proteoglycan and collagen) accumulation in the organ culture system *in vitro*, and in animal models *in vivo* are indicated as a step towards achieving disc repair in humans.