Isolation of Human Mesenchymal Stem Cells from Amniotic Fluid: Comparison with Bone Marrow and Cord Blood Mesenchymal Stem Cells

Yun Hee Shon, Ji Min Seo, Mi Yeung Sohn, Jang Soo Suh, James J. Yoo

Joint Institute for Regenerative Medicine, Kyungpook National University Hospital, Daegu, 700-721 Republic of Korea

Introduction

Human mesenchymal stem cells (MSCs) constitute a population of multipotent adherent cells able to differentiate into multiple mesenchymal lineages including bone, cartilage, fat, muscle, nerve, glial, and stromal cells. MSCs are considered to be of great promise for use in regenerative medicine. Although bone marrow has been the most common source for MSCs, bone marrow-MSCs harvesting and processing exhibit major drawbacks and limitations. Thus, identification and characterization of alternative sources of MSCs are of great importance.

Materials and Methods

In the study presented here, we isolated fetal MSCs from second-trimester amniotic fluid and examined these cells for morphology, growth rate, surface antigen markers, stem cell markers, and differentiation potential.

Results

Optical microscopy examination of amniotic fluid-MSCs, bone marrow-MSCs and cord blood-MSCs showed the cells to be fibroblast-like. When compared with bone marrow-MSCs and cord blood-MSCs, amniotic fluid-MSCs showed better growth rate. Surface antigens were analysed in flow cytometry analysis. Amniotic fluid-MSCs were positive for mesenchymal markers such as CD90, CD105 or CD73 but negative for the hematopoietic marker such as CD45. Human amniotic fluid-MSCs were also positive for CD44, class I major histocompatibility (MHC) antigen (HLA-ABC), and stage-specific embryonic antigen (SSEA)-4. Amniotic fluid stem cells did not express class II MHC antigen (HLA-DR). Direct comparison of the phenotypes to those derived from cultured bone marrow-MSCs and cord blood-MSCs demonstrated that cultured MSCs from those sources exhibit similar expression patterns. Reverse transcription-polymerase chain reaction analysis of amniotic fluid-MSCs from passages 5-10 showed consistent expression of Oct-4, SCF, FGF-5, vimentin, and CK-18 genes. Amniotic fluid-MSCs also showed myogenic differentiation potential under appropriate conditions.

Conclusions

These results suggest that the ready availability of abundant source and extensive expansion potential makes amniotic fluid-MSCs as potential source of MSCs for future therapeutic applications.

Acknowledgments

This study was supported by a grant of the Korea Healthcare technology R&D Project, Ministry for Health, Welfare & Family Affairs, Republic of Korea. (A091224)