TISSUE ENGINEERING: Part A
Volume 18, Numbers 15 and 16, 2012
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DOI: 10.1089/ten.tea.2011.0386

Osteogenic Differentiation of Stem Cells Derived from Menstrual Blood Versus Bone Marrow in the Presence of Human Platelet Releasate

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In recent decades, stem cell therapy has been introduced as a novel therapeutic approach for patients suffering from bone disorders. Recently, menstrual blood has been identified as an easily accessible and recycled stem cell source. However, the osteogenic differentiation capacity of menstrual blood-derived stem cells (MenSCs) compared with other adult stem cells remained unsolved. The aim of this study was to investigate the osteogenic differentiation capacity of MenSCs compared to bone marrow-derived mesenchymal stem cells (BMSCs) in the presence of human platelet releasate (HPR). Our results showed that MenSCs were strongly positive for mesenchymal and negative for hematopoietic stem cell markers in a similar manner to BMSCs. In contrary to BMSCs, MenSCs exhibited marked expression of OCT-4 and a significantly higher proliferative capacity. Mineralization, as judged by alizarin red staining, was more pronounced in differentiated BMSCs than in differentiated MenSCs in an osteogenic medium fortified with fetal bovine serum (FBS). However, FBS substitution with HPR in a differentiation medium resulted in typical impact on intensity of MenSC mineralization. The results of semiquantitative reverse transcription–polymerase chain reaction showed comparable levels of parathyroid hormone receptor and osteocalcin transcripts in both types of differentiated stem cells in an HPR medium supplemented with osteogenic inducers. However, the upregulation level of alkaline phosphatase was relatively lower in differentiated MenSCs than that in differentiated BMSCs. We concluded that despite lower osteogenic differentiation capacity of MenSCs compared to BMSCs, substitution of FBS with HPR could equalize the osteogenic differentiation of MenSCs. Therefore, by taking advantage of osteogenic driving potential of HPR, MenSCs could be introduced as an apt and safe alternative to BMSCs for bone tissue-engineering purposes.

Introduction

Bone diseases are common worldwide and take a large toll on the nation's overall health status. Nowadays, due to potential complications of the invasive technique of autologous bone grafting, including chronic pain, risk of infection, and limited amount of bone available, stem cell therapy has been interested as an alternative therapeutic approach for treating bone defects.[1]

Adult bone marrow-derived mesenchymal stem cells (BMSCs) are considered the gold standard stem cell source in bone regeneration, because they present no ethical problems of embryonic stem cells (ESCs), have bone generation ability in vitro and in vivo,[2,3] and also exhibit immunosuppressive capabilities.[4,5] However, problems such as less availability, invasive methods for sample collection, and lower proliferation capacity compared with ESCs limit BMSCs' applicability for research and clinical use.

Several studies have reported that menstrual blood (MB) contains a unique population of cells with properties similar to adult stem cells.[6–8] Apparent evidence to support this assumption is high regenerative ability of human

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