Cytotherapy 2011 Sep;13(8):933-43 Epub 2011 May 30

PMID: 21623669 DOI: 10.3109/14653249.2011.583232

Epidermal growth factor, basic fibroblast growth factor and platelet-derived growth factor-bb can substitute for fetal bovine serum and compete with human platelet-rich plasma in the ex vivo expansion of mesenchymal stromal cells derived from adipose tissue

Katia Chieregato, Silvia Castegnaro, Domenico Madeo, Giuseppe Astori, Maurizio Pegoraro, Francesco Rodeghiero

Abstract

Background aims: Human mesenchymal stromal cells (MSC) are multipotent cells possessing self-renewal capacity, long-term viability and multilineage potential. We analyzed the effect of four different medium supplements on the expansion and differentiation of adipose tissue-derived MSC (ADSC) in order to avoid the use of xenogeneic serum.

Methods: We compared fetal bovine serum (FBS) with 10% human platelet-rich plasma (hPRP), 3% human platelet-poor plasma (hPPP) and with a cytokine cocktail composed of epidermal growth factor (EGF), basic fibroblast growth factor (bFGF) and platelet-derived growth factor-bb (PDGFbb) added to 3% hPPP. This mixture was developed testing EGF, bFGF, granulocyte-colony-stimulating factor (G-CSF), hepatocyte growth factor (HGF), insulin-like growth factor (IGF-I), PDGFbb and transforming growth factor (TGF)-β1 added alone or in combination with hPPP.

Results: Our data demonstrate that the addition of EGF, bFGF and PDGFbb, in a medium supplemented with hPPP, obtainable from 150-200 mL whole autologous blood, supports ADSC expansion better than FBS, as confirmed by cumulative population doublings (cPD; 15.0 ± 0.5 versus 9.4 ± 2.8). The addition of human platelet-rich plasma (hPRP) further improved ADSC proliferation (cPD 20.0 ± 1.2), but the achievement of hPRP presented a major drawback, requiring 1000-1200 mL autologous or donor whole blood. The medium supplements did not influence ADSC phenotype: they expressed CD105, CD90 and CD44 lacking hematopoietic antigens. The exposure to the proposed cocktail or to hPRP increased adipogenic and osteogenic differentiation.

Conclusions: The addition of EGF, bFGF and PDGFbb to hPPP could ensure a sufficient number of ADSC for clinical applications, avoiding the use of animal serum and representing a novel approach in regenerative medicine.