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Reprogramming of Expanded Cord Blood-Derived CD34$^+$ Cells from Umbilical Cord-Mesenchymal Stromal Cell Co-Culture to Generate Human-Induced Pluripotent Stem Cells

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Abstract

Cord blood (CB) is widely stored as a source of hematopoietic stem cells for potential future use, though its application for autologous purposes remains limited. Repurposing CB into human-induced pluripotent stem cells (hiPSCs) can broaden its utility beyond hematological conditions. This study investigated the effects of umbilical cord-mesenchymal stromal cell (UC-MSC) co-culture on CB CD34$^+$ cells and the characteristics of the resulting hiPSCs. CD34$^+$ cells were isolated, expanded in UC-MSC co-culture for 3 days, and reprogrammed into hiPSCs using episomal vectors. Results showed that UC-MSC co-culture significantly increased CD34$^+$ cell numbers ($p < 0.0001$, $n = 6$), with a reduced population doubling time of 25.1 ± 2.1 hours compared with the control ($p < 0.0004$, $n = 6$). The yield of CD34$^+$ cells was substantially higher in the UC-MSC co-culture group. The hiPSCs exhibited comparable reprogramming efficiency, pluripotency marker expression, trilineage differentiation potential, and genomic stability to CD34$^+$ cells expanded under standard culture conditions. These findings suggest that CD34$^+$ cells from CB, expanded in UC-MSC co-culture, can be reprogrammed into functional hiPSCs without compromising cell quality or genetic stability.

Keywords: cord blood; human-induced pluripotent stem cells; mesenchymal stromal cell co-culture; reprogramming.