The Different c-kit Expression in Human Induced Pluripotent Stem (iPS) Cells Between With Feeder Cells and Without Feeder Cells

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Keywords

c-kit · Induced pluripotent stem cell · iPS · Cardiomyocyte differentiation · Gene expression

c-kit is a stem cell factor (SCF) receptor and is known to be expressed in hematopoietic stem cells, prostate stem cells, mast cells, and melanocytes. Since c-kit was reportedly expressed in cardiac stem cells, which are believed to have the ability to become cardiac myocytes or to support cardiac myocyte survival [1, 2], this protein has been used as a marker for cardiac regeneration [3].

iPS cells have been established and used for cardiac regenerative medicine and for developing disease models [4]. However, c-kit expression during cardiomyocyte differentiation using human iPS cells has not yet been studied. Therefore, we characterized the gene expression levels in cultured iPS cells and the change in expression levels during cardiomyocyte differentiation by reverse transcription quantitative polymerase chain reaction (RT-qPCR).

c-kit expression was positive, and its level was much higher in iPS cells cultured with feeder cells than in iPS cells cultured without feeder cells. The RNA from feeder cells was extremely low, and the primer for c-kit expression did not contain the murine-specific sequence, suggesting that c-kit expression in the iPS cells cultured with feeder cells was from the iPS cells. c-kit expression was not detected or was detected at extremely low levels in the feeder-free iPS cells. In both cell conditions (with or without feeder), c-kit expression was detected in the early phase of

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T. Nakanishi et al. (eds.), *Molecular Mechanism of Congenital Heart Disease and Pulmonary Hypertension*, https://doi.org/10.1007/978-981-15-1185-1_61

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cardiomyocyte differentiation (1–3 days after iPS cells were treated with differentiation medium) before Brachyury was expressed. Brachyury is the transcription factor that is essential for mesoderm formation. c-kit was not expressed thereafter. We examined the SCF expression level in iPS cells cultured with or without feeder cells, but SCF was not detected in either condition.

These results suggest that SCF is independent of c-kit expression, and c-kit might affect the early stage of cardiac differentiation.

References

1. Miyamoto S, Kawaguchi N, Ellison GM, Matsuoka R, Shin'oka T, Kurosawa H. Characterization of long-term cultured cardiac stem cells (CSCs) derived from adult rat hearts. *Stem Cells Dev.* 2010;19(1):105–16.
2. Kawaguchi N, Smith A, Waring C, Hasan K, Miyamoto S, Matsuoka R, Ellison GM. Gata4^{high} CSCs foster cardiac myocyte survival. *PLoS One.* 2010;5(12):e14297.
3. Kawaguchi N, Nakanishi T. Cardiomyocyte regeneration using stem cells. *Cells.* 2013;2(1):6782. <https://doi.org/10.3390/cells2010067>.
4. Kawaguchi N, Hayama E, Furutani Y, Nakanishi T. Prospect of in vitro heart disease model. *Stem Cell Int.* 2012:e439219.

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