Myocardial Regeneration Potential of Human Induced Pluripotent Stem Cell-Derived Cardiomyocytes

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Background: Myocardial infarction (MI) remains a leading cause of morbidity and mortality worldwide. Current management of MI does not replace lost cardiomyocytes (CMs) with new CMs. Induced pluripotent stem cells (iPSCs) reprogrammed from fibroblasts can differentiate into CMs (iPSC-CMs) and thus hold promise for future clinical use in cardiac repair. The aim of this study was to investigate survival, cardiac repair potential, and safety of injected human iPSC-CMs using tissues from immunodeficient mice. Methods: Human iPSC-CMs were generated by culturing iPSCs in a differentiation medium and characterized to express CM markers using immunofluorescence staining. For tissue study, survival and migration of injected cells in freshly harvested tissues from mice (with MI and receiving intramyocardial injections of iPSC-CMs) were visualized using bioluminescence imaging. Infarct size and teratoma formation were analyzed in Masson Trichrome-stained and hematoxylin and eosin-stained heart slices, respectively. Results: Bioluminescent intensity, which directly relates to CM count, showed no significant difference in cell survival between mouse hearts 1 week and 3 weeks after cell injection. Bioluminescent images of tissues showed that CMs did not migrate to other organs 3 weeks after injection. Injected CMs decreased infarct size and did not form teratomas in hearts. Conclusions: Intramyocardially injected human iPSC-CMs survived in injured hearts and decreased infarct size. They neither formed teratomas nor migrated into other organs, suggesting safety and myocardial regenerative capacity of human iPSC-CMs. The findings from this study provide important information for future applications of patient-specific iPSC-CMs in clinical settings.

Awards Won:

Second Award of $2,000