The Utility of Stem Cell Derived Cardiac Patches in Improving Left Ventricular Function in Ischemic Cardiomyopathy

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Objective:

Ischemic cardiomyopathy is the leading cause of death worldwide, and few options exist for the treatment of severe ischemic cardiomyopathy refractory to maximal medical therapy, revascularization, and structural interventions. Novel applications of stem cell therapy aim to repair myocardium damaged by ischemia via cell transplant. This research aims to characterize trends in the surgical use of stem cell derived cardiac patches and identify improvements in management.

Methods:

A literature review was conducted by identifying cases of transplanted human induced pluripotent stem cells (hiPSC-CM) and human embryonic stem cells (hESC-CM) committed to the cardiomyocyte lineage used for patches in patients with ischemic cardiomyopathy published to PubMed. Studies were analyzed for patient demographics, operative techniques, left ventricular function, and recovery.

Results:

The analysis included 11 identified cases across 3 papers. Most cases were reported in men (10 patients; 91%) with an average age of 64.5 years. Patients underwent patch transplantation of hESC-CM within a pericardial pouch (7 cases; 64%) or hiPSC-CM within epicardial tissue (4 cases: 36%) consisting of an average of $1.95 * 10^7$ cells at 86% purity on the LV anterior wall. 5 (45%) operations were conducted under cardioplegia and 7 operations (64%) included concomitant CABG procedure. Left ventricular ejection fraction (LVEF) improved an average of 8%, left ventricular end diastolic volume (LVEDV) increased by 9.7 mL, and left ventricular end systolic volume (LVESV) decreased by 20.5 mL. 10 (91%) patients did not have any remaining akinetic region on the left ventricle, and 3 (27%) had revascularization of the treated segments. Post-operatively, all patients were treated with corticosteroids and mycophenolate mofetil, 7 (64%) with cyclosporine, and 4 (36%) with tacrolimus for an average of 2.25 months. All patients began with a New York Heart Association (NYHA) classification of III which decreased to II/I by 12 month follow-up. 6 (54%) patients experienced complications, of which the most common was heart failure (2 cases). The 1 year mortality rate was 18% (2 cases).

Conclusion:

Stem cell derived cardiac patches can modestly improve left ventricular function in patients with ischemic cardiomyopathy refractory to medical management. Post-operative care should include an immunosuppressive regimen and close monitoring for cardiac complications, including heart failure.