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Umbilical Cord Wharton's Jelly-Derived Mesenchymal Stem Cells: A Potential Cell Source for Infarct Repair?

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Background: Tissue adult stem cells are rare and their number and potency significantly decrease with age and concomitant diseases. These problems stimulate the search for alternative cell sources for infarct repair. The umbilical cord stroma can provide an attractive source since it contains a high number of fresh allogeneic mesenchymal stem cells (MSCs).

Objective: To examine whether MSCs from umbilical cord stroma are able to repair or regenerate the infarcted myocardium in rat.

Methods and Results: We developed a method that can be readily used to isolate and expand MSCs (Wharton's jelly cells) from human umbilical cord tissue. These cells display a fibroblast-like morphology, express mesenchymal markers, and have the potential to differentiate into osteogenic and myogenic cells. The in vitro study focused on their differentiation potential into cardiomyocytes using medium culture with 5-azacytidine. The in vivo study was performed in a rat model of MI: 7 days after MI, Wharton's jelly, bone marrow-derived MSCs (1*106 cells in 150µl sodium chloride) and saline were injected into the scar tissue, rats were injected with cyclosporine-A (15mg per 1kg) for a period of 30 days after cell transplantation. Serial echocardiography studies before and 60 days after injection showed that injection of Wharton's jelly stromal cells or bone marrow MSCs into a 7-day old infarct did not attenuate left ventricular (LV) systolic and diastolic dilatation and dysfunction. Postmortem morphometric analysis of the hearts showed a significant increase in wall thickness in the bone marrow MSCs treated group compared with control group (2.2±0.6 vs. 1.6±0.3, P=0.02).

Conclusions: The present work suggests that human MSCs (Wharton's jelly or bone marrow) transplantation does not prevent LV remodeling and dysfunction after MI in rat. However, further research is warranted to determine the optimal dose, timing and mode of delivery of Warrton jelly-derived MSCs for infarct repair.