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Human umbilical cord derived CD73, CD90 and CD105 positive mesenchymal stem cells differentiated into pancreatic β cells: Implications in diabetic therapy

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Pancreatic β-cells are the predominant insulin producing cell types, within the Islets of Langerhans and insulin is the primary hormone which regulates carbohydrate and fat metabolism. Apoptosis of β-cells or insufficient insulin production leads to Diabetes Miletus (DM). Current therapy for diabetes includes either medical management or insulin replacement. Cell based therapies are being developed as a possible therapeutic option for Diabetes. Replacement of β- cells is an attractive treatment option for both Type-1 and Type-2 DM in view of the recent paper which indicates that β-cell apoptosis is the common underlying cause for both types of DM. In the present study, Human Umbilical Cord (HUC) samples were obtained after delivery with prior informed consent as approved by the Institutional Ethical Committee. Mesenchymal Stem Cells (MSCs) were successfully isolated from HUC (n=26) using a combination of mechanical and enzymatic, Collagenase-II treatment. Culturing in-vitro was done in L-DMEM with 10% FBS and 5% CO2 at 37oC. Cultured cells were characterized as MSC with flow-cytometry after reaching 80-90% confluency as they were CD90+, CD73+, CD105+, CD34-, CD45, HLA-DR-/Low and vimentin+ (Immunohistochemistry). These were differentiated to β-cells in 15 days using H-DMEM (Gibco), β-Mercaptoethanol (0.1mM, HiMedia), basic-fibroblast growth factor (10µg/L, Gibco) and Nicotinamide (10mmol/L HiMedia). Differentiated cells stained positive for Dithizone, a specific marker for pancreatic beta cells and their functionality was evaluated by insulin production with glucose stimulation (50mM/L). Amount of insulin released was four-fold higher when stimulated (8 IU/ml) compared with unstimulated (2 IU/ml) this is extremely promising for β-cell replacement therapy in diabetics.

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