

## Stem Cell as a Novel Therapy for Diabetic Cardiomyopathy

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Islets transplantation has recently been shown to ameliorate hyperglycemia in Diabetes Mellitus (DM) [1]; however the usage of this therapy has been restrained due to the limited supply of human islets tissue and the associated use of immune suppression to prevent graft rejection [2]. The employment of renewable supply of stem cells capable of differentiation into useful islet secreting cells is among the substitutions for islet cell transplantation. The open journal of endocrinology and metabolic syndrome and OMICS conferences have recently given a considerable distinction within the field of medical specialty to extend the depth of material on endocrine diseases and emphasize the metabolic syndrome as a predisposing factor for the development of diabetes.

Diabetes Mellitus (DM), one among the leading causes of morbidity and mortality in several countries, is instigated either by absolute insulin deficiency because of destruction of the pancreatic insulin secreting cells (DMT1) or by relative hormone deficiency due to the decrease in hormone sensitivity (DMT2). In both types, the insufficient functional islet cell mass would determine the onset of symptoms and the development of obvious diabetes [1].

Diabetic cardiomyopathy has been defined as the development of ventricular dysfunction in the absence of coronary artery diseases, valvular heart disease, or hypertension in diabetic patients (DCM) [3]. It has also been seen that dominant features within the advancement of DCM are chronic hyperglycemia and increased oxidative stress [4,5].

Mesenchymal Stem Cells (MSCs) are considered enticing as therapeutic agents for variety of diseases as well as diabetes due to their ability to differentiate into many cells. MSCs were found to induce myogenesis through release of different angiogenic, mitogenic, and antiapoptotic factors as well as Vascular Epithelium Protein (VEGF) and insulin-like growth factor-1 (IGF-1). Differentiation of MSCs into cardiomyocytes improved cardiac function in DCM rat model [6].

The release of MSC-derived paracrine factors capable of cardio protection has proven to lead to improvement of cardiac function following MSCs therapy [7]. It has been previously suggested that these factors have an effect on remodeling, regeneration, and neo vascularization resulting in enhancement of myocardium contractility and amelioration of infarction [8].

Our work indicates that rat bone marrow-derived MSCs have the capability to differentiate into insulin-producing cells that represents a cell-based treatment for DM. We additionally proved that MSCs transplantation improved cardiac function in streptozotocin-induced diabetic rats [9]. Moreover, Oh et al. [10] showed that in a particular in-vitro culture condition MSCs derived from bone marrow can be transformed into islet cells with restoration of blood glucose level back to control level in diabetic animal model.

Based on the mentioned findings, questions are raised to match the effectiveness of differentiated versus undifferentiated MSCs in treatment of diabetic cardiovascular complications. Hence, we extended our work (Unpublished data) where we proved that infusion of either undifferentiated or differentiated MSCs ameliorated diabetic cardiovascular complications.

It has also been proven that among the central obstacles for efficient therapeutic use of MSCs are poor engraftment and restricted

differentiation. The frequency of spontaneous differentiation of MSCs within the host tissue is rare; therefore, therapeutic use of MSCs depends on the ability to control their in vivo differentiation into committed cells with high potency and purity [11]. A further drawback is the potential of MSCs to differentiate into unwanted mesenchymal lineages [12] that might impair their therapeutic use. Additional possible limitations are malignant transformation and cytogenetic aberrations of MSCs [11].

### Conclusion

MSCs were proved to be a promising therapeutic agent for improvement of cardiac function of diabetic cardiomyopathy. However, there are many limitations, which include the potential risk of malignant transformation of MSCs and unwanted mesenchymal lineages differentiation. Such risks are ought to be thought before MSCs can be outlined as a novel and unique therapeutic agent in the treatment of diabetic cardiovascular complications.

### References

1. Atkinson MA, Eisenbarth GS (2001) Type 1 diabetes: new perspectives on disease pathogenesis and treatment. *Lancet* 358: 221-229.
2. Shapiro AM, Lakey JR, Ryan EA, Korbutt GS, Toth E, et al. (2000) Islet transplantation in seven patients with type 1 diabetes mellitus using a glucocorticoid-free immunosuppressive regimen. *N Engl J Med* 343: 230-238.
3. Poornima IG, Parikh P, Shannon RP (2006) Diabetic cardiomyopathy: the search for a unifying hypothesis. *Circ Res* 98: 596-605.
4. Jesmin S, Sakuma I, Hattori Y, Kitabatake A (2003) Role of angiotensin II in altered expression of molecules responsible for coronary matrix remodeling in insulin-resistant diabetic rats. *Arterioscler Thromb Vasc Biol* 23: 2021-2026.
5. Haidara MA, Yassin HZ, Rateb M, Ammar H, Zorkani MA (2006) Role of oxidative stress in development of cardiovascular complications in diabetes mellitus. *Curr Vasc Pharmacol* 4: 215-227.
6. Zhang N, Li J, Luo R, Jiang J, Wang JA (2008) Bone marrow mesenchymal stem cells induce angiogenesis and attenuate the remodeling of diabetic cardiomyopathy. *Exp Clin Endocrinol Diabetes* 116: 104-111.
7. Wang X, Zhao T, Huang W, Wang T, Qian J, et al. (2009) Hsp20-engineered mesenchymal stem cells are resistant to oxidative stress via enhanced activation of Akt and increased secretion of growth factors. *Stem Cells* 27: 3021-3031.
8. Hare JM, Traverse JH, Henry TD, Dib N, Strumpf RK, et al. (2009) A randomized, double-blind, placebo-controlled, dose-escalation study of intravenous adult human mesenchymal stem cells (prochymal) after acute myocardial infarction. *J Am Coll Cardiol* 54: 2277-2286.
9. Abdel Aziz MT, El-Asmar MF, Haidara M, Atta HM, Roshdy NK, et al. (2008) Effect of bone marrow-derived mesenchymal stem cells on cardiovascular complications in diabetic rats. *Med Sci Monit* 14: BR249-255.
10. Oh SH, Muzzonigro TM, Bae SH, LaPlante JM, Hatch HM, et al. (2004) Adult bone marrow-derived cells trans-differentiating into insulin-producing cells for the treatment of type I diabetes. *Lab Invest* 84: 607-617.

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11. Tolar J, Nauta AJ, Osborn MJ, Panoskaltis Mortari A, McElmurry RT, et al. (2007) Sarcoma derived from cultured mesenchymal stem cells. *Stem Cells* 25: 371-379.
12. Le Blanc K, Pittenger M (2005) Mesenchymal stem cells: progress toward promise. *Cytotherapy* 7: 36-45.