

# Stem cell therapy in cardiovascular diseases

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Despite the major efforts to prevent and treat cardiovascular diseases, they remain the most common cause of death in the western world and China. The main culprit is congestive heart failure, which can be caused by myocardial infarction, hypertension or any other insults to the heart. Human heart loses most of their regeneration capacity in the postnatal development, and is not able to replace any defects after damage with functional myocardium. Currently, the only available curative therapy for patients with end-stage heart failure is heart transplantation, but is limited by the severe shortage of donor organs and transplant rejection. Stem cell transplantation has been explored as potential therapy to limit the progression of heart failure. Our recent clinical studies have highlighted the potential capacity to regenerate new blood vessels for the heart by intramyocardial injection of bone marrow stem cells. However, due to the limited developmental plasticity of these adult bone marrow stem cells, this approach may not be sufficient to replace cardiomyocyte (CM) loss due to heart attack. Direct CM replacement therapy is an obvious and promising option but is also limited by the availability of transplantable human CMs. Human embryonic stem cells (hESCs), isolated from the inner cell mass of human blastocysts, can propagate indefinitely in culture while maintaining their pluripotency, including the ability to differentiate into CMs; therefore, hESCs may provide an unlimited ex vivo source of CMs for transplantation and other cell-based therapies. In combination with recent advances in biomedical engineering techniques, hESCs have therefore enabled researchers to pursue the revolutionary paradigm of regenerative medicine for repairing, replacing or enhancing organ function in such aging-related diseases as heart failure.

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