What Is Happening in Myocyte and Stem Cell Transplantation: Progress and Limitations

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Congestive heart failure (CHF) is recognized as the leading cause of hospitalization in the United States. Although medical therapy has offered significant improvement in patient's symptoms, high morbidity and mortality continue to be associated with this disease. There are a myriad of etiologies responsible for CHF, including valvular and congential heart disease, coronary heart disease, cardiomyopathies of varying etiologies and post myocardial infarction ventricular dysfunction. In addition to medical management, numerous mechanical methods and devices have been applied as treatment modalities with varying success. The ultimate solution of cardiac transplantation is realistically impractical due to the paucity of available donors.

Recently a new form of treatment has entered the investigative stage in an effort to expand potential therapies and positively affect long-term survival particularly in patients suffering from ischemic cardiomyopathy. Acute myocardial infarction (MI) resulting from narrowing or occlusion of a coronary artery with resultant decrease in blood supply to the heart muscle has two important sequelae; loss of left ventricular function as a result of cellular death, or compromised myocardium observed during the early post infarct period. A second phenomenon occurs during the healing process following MI. Imagine the normal configuration of the heart as a football where contraction occurs in a spiraling fashion. With the compromised myocardium, that configuration changes to resemble more a volleyball or basketball with a rounded or circular appearance. This process following MI is called "remodeling" and is the etiology for congestive heart failure in these patients. The "rounded" heart can no longer effectively pump blood out through the aortic valve. Intracardiac pressure increases, fluid accumulates in the lungs and the typical clinical picture of congestive heart failure appears. A concept is being studied that could enable the negative aspects of this remodeling process to be either completely (very unlikely) or partially (more probable) reversed. A variety of these processes including genes and cells are being evaluated. This particular presentation will discuss several of the cell types under study projecting the positive and negative aspects and the likelihood of success in the future. Our concentration has been on myoblast transplantation using skeletal muscle biopsy from the upper thigh, cell culturing until up to 300 million myoblasts with subsequent injection in the compromised area of the myocardium. Since these are cells from the same patient, there is no rejection process (autologous). The first study has been completed where cells were injected at the time of coronary artery bypass grafting. The findings and results will be presented along with data where cells were injected into patients with LVADs awaiting cardiac transplantation. This latter group provided a unique opportunity to study cell response in hearts without the influence of coronary artery bypass grafting.

Current studies have moved the technique from open chest to percutaneous approaches. Since these patients are inherently extremely ill, classical surgery in itself creates morbidity and mortality. Ability to deliver millions of cells through a retrograde femoral approach using the NOGA mapping system to precisely pinpoint the areas of ischemia with subsequent needle delivery has proven in the first three patients to be highly successful from the safety and application aspects. Examples of typical patients, operative details, and a concluding video of synchronous contraction of growing myoblast will be presented.