Cardiac Stem Cell Regeneration

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ABSTRACT

The heart is one of the five most vital organs in the body needed for survival. So, when something goes wrong, there must be a way to fix the heart's tissue. Cardiovascular diseases are among the most common causes of death and are non-communicable. They are generally caused by one's own health choices, which harm cardiomyocytes, or cardiac muscle cells. Cardiomyocytes have a limited regenerative capacity, so when damaged, can stem cell therapy be used to repair them? There are various types of cardiac stem cells, which each hold a specific function in the heart. They have been tested in preclinical experimental methods, and they generally have supportive and protective roles in the heart. These stem cells are expected to be able to regenerate damaged myocytes, specifically pluripotent stem cells. Pluripotent stem cells have self-regeneration capabilities and can differentiate into any type of cell in the body.

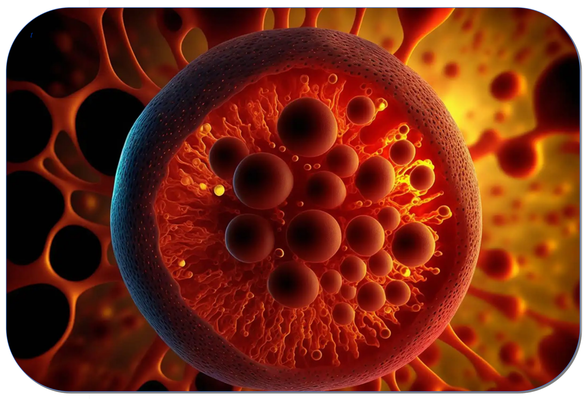

Figure 1. Cardiac stem cell

INTRODUCTION/OBJECTIVES

Stem cells are cells that can differentiate into multiple specialized cell types, but most are incapable of regeneration. Cardiac stem cells (CSCs) are stem cells that are specific to the heart. When a cardiac stem cell is damaged, it is replaced by scar tissue, which weakens the heart and diminishes its ability to circulate blood.

This research study analyzes the function of cardio-myocytes, CSCs, how damaged cardiac cells affect the body, and most importantly, how they are replaced.

METHODS

We analyzed the clinical trials done by the Mayo Clinic and the American Heart Association.
We studied research papers found through Google Scholar
Keywords: cardiac muscle cells, cardiac stem cells (CSCs), stem cell therapy, cell regeneration, heart disease

RESULTS

- The study's focus was to examine if stem cell treatment reduced the amount of hospital visits for treatment of worsening heart failure. In the clinical trial run by the American Heart Association, there were 537 patients divided into two groups. The first group, with 261 adults, were injected with stem cells from healthy donors directly into the heart through a catheter. The second group had 276 adults who received a sham procedure. All participants were discharged from the hospital and monitored for 30 months.
  - While the stem cell treatment did not decrease hospitalizations, researchers did find several other significant results. First, those who received stem cell therapy had a 65% reduction in non-fatal heart attacks and stroke throughout the period of the study. Participants with high levels of inflammation were 79% less likely to have non-fatal heart attack or stroke after being treated with stem cells. Lastly, stem cell treatment reduced cardiac death by 80% in people with high levels of inflammation and less severe heart failure.

- The team from the Mayo Clinic organized a clinical trial where they recruited 315 patients who had advanced heart failure. They were divided into groups of those who received stem cell therapy and those who received the sham treatment. All patients underwent cardiac catheterization and those who were assigned stem cell therapy treatment then had stem cells taken from their own bone marrow programmed to heal damaged heart tissue and delivered to their heart. They were asked to complete a self-assessment questionnaire at the beginning of the study following the treatment after 26, 39, and 52 weeks. After the on-year follow-up, patients had consistently reported an improved quality of life. Lower death and hospitalization rates were recorded for these patients as well, in comparison to those who received the sham treatment.

DISCUSSION/FUTURE WORK

While there has been research involving both autologous (obtained from oneself) and non-autologous (obtained from an outside source) stem cells, non-autologous stem cell therapy is much less extensive and demands heightened precaution. There are ongoing efforts to optimize safety protocols and address the challenges associated with non-autologous stem cells like embryonic stem cells, induced pluripotent stem cells, and several types of adult stem cells. It would be highly beneficial to research this topic further and conduct more clinical trials. Mastering cardiac stem cell therapy has the potential to save many lives and lengthen people's lifespan.

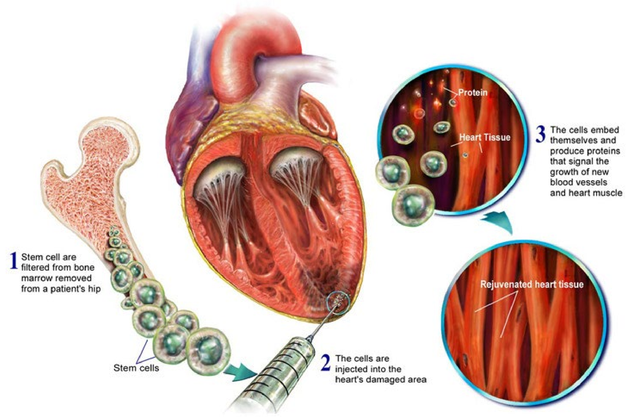

Figure 2. Process of cardiac stem cell injection

CONCLUSIONS

In conclusion, cardiac stem cell regeneration emerges as a major and prominent research topic, pivotal in addressing the challenges posed by heart failure and cardiac diseases. The outcomes of the clinical trials reflect positive results; there was evidence of improvement in patients' health overall and their quality of life. Researchers reflected that the injected stem cells acted locally in the heart and helped in blood vessels throughout the body. However, there is much more that needs to be researched before cardiac stem cell therapy is an official treatment for cardiovascular diseases.

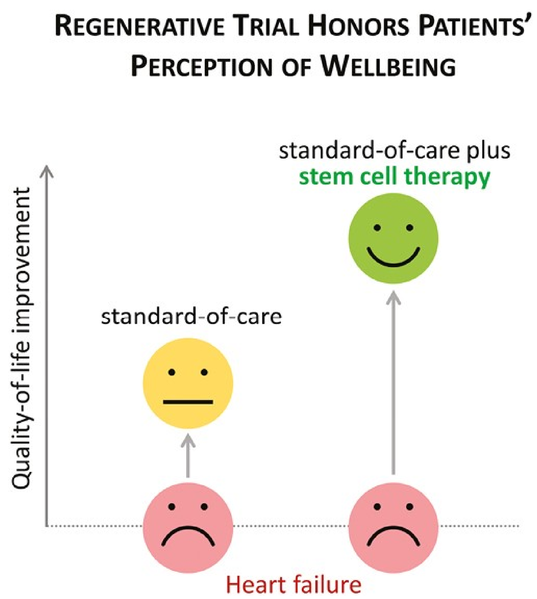

Figure 3. Effect of Stem Cell Therapy on Patients' Quality of Life

References

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Buckles, S. *Clinical trial finds cell therapy improves quality of life in advanced heart failure*. Mayo Clinic News Network.

Acknowledgments

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