Commentary: The Power of a Patch: Utilizing Exosome Therapy to Treat Heart Disease

Michael Tyler Guinn, MD, PhD, Todd K. Rosengart, MD

PII: S0022-5223(23)00673-6
DOI: https://doi.org/10.1016/j.jtcvs.2023.08.008
Reference: YMTC 19178

To appear in: The Journal of Thoracic and Cardiovascular Surgery

Received Date: 6 August 2023
Accepted Date: 7 August 2023

Please cite this article as: Guinn MT, Rosengart TK, Commentary: The Power of a Patch: Utilizing Exosome Therapy to Treat Heart Disease, The Journal of Thoracic and Cardiovascular Surgery (2023), doi: https://doi.org/10.1016/j.jtcvs.2023.08.008.

This is a PDF file of an article that has undergone enhancements after acceptance, such as the addition of a cover page and metadata, and formatting for readability, but it is not yet the definitive version of record. This version will undergo additional copyediting, typesetting and review before it is published in its final form, but we are providing this version to give early visibility of the article. Please note that, during the production process, errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Copyright © 2023 Published by Elsevier Inc. on behalf of The American Association for Thoracic Surgery
Commentary: The Power of a Patch: Utilizing Exosome Therapy to Treat Heart Disease

Author: Michael Tyler Guinn¹ MD, PhD and Todd K. Rosengart¹,* MD

Department and Institution:
¹Michael E. DeBakey Department of Surgery, Baylor College of Medicine, Houston, TX, United States.

Word Count: 322

Disclosures: MTG has no disclosures. TKR is co-founder, board member, consultant and has an equity interest in XyloCor Therapeutics

*Correspondence:

Todd K. Rosengart, MD

Michael E. DeBakey Department of Surgery

Baylor College of Medicine

Houston, TX, United State

todd.rosengart@bcm.edu
Central Message: Local delivery of acellular exosomes via implantable patches has been shown to increase mitochondrial size, reduce inflammation and fibrosis, and improve diastolic relaxation and systolic function in ischemic hearts.

Central Picture Legend: Michael Tyler Guinn¹ MD, PhD and Todd K. Rosengart¹,* MD

Figure 1 Legend: Exosome patches can increase systolic and diastolic heart function in hibernating myocardium.

Ischemic heart disease presents as a spectrum of myocardial pathophysiology ranging from chronic contractile dysfunction to infarction of heart tissue.¹⁻³ Literature on myocardial hibernation has shown that while revascularization strategies can induce myocardial functional improvement, incomplete revascularization can lead to persistent ischemia and abnormal myocardial function and decreased long-term survival.⁴ It is therefore important to explore adjunctive therapies that can be coupled with revascularization to improve outcomes.

The delivery of membrane-bound, microRNA-carrying extracellular vesicles termed exosomes that are secreted by mesenchymal stem cells appears to represent one means of enhancing ischemic myocardial function.⁵ Compared to “traditional” stem cell therapy, the potential benefit of exosome therapy is that it avoids the challenges in the retention and survival of exogenous stem cells delivery to ischemic or infarcted myocardium.⁶ In this issue of the journal, Aggarwal et al. perform low-dose dobutamine MRI experiments in chronically ischemic porcine models to demonstrate improved systolic function and diastolic relaxation in animals treated with exosome-
laden patch onlays and coronary artery bypass grafting (CABG) compared to animals treated with CABG alone or no-intervention control groups.\(^7\)

Aggarwal et al. further show that this improvement is associated with improved (in vitro) mitochondrial respiration and reduced in vivo inflammation and fibrosis. The authors conclude that these improvements may be induced via paracrine microRNA expression effects. These authors found that varying the environmental conditions of cardiomyocytes co-cultured with mesenchymal stems cells (e.g., hypoxia versus normoxia) induced different exosomal microRNA transcriptomic signatures which they theorized could provide differential paracrine effects when implanted into the cardiac patch. These variable transcriptomic signatures could provide an avenue for targeted acellular therapy to improve pathological processes (e.g. ischemic injury).\(^8\)

The work of Aggarwal et al. advances the possibility for acellular therapy to become an important means to improve functionality of persistently ischemic myocardium. Their identification of specific microRNA exosomal mediators suggest the further possibility of using genetic engineering to generate exosomes providing tailored microRNA modifiers of myocardial function.

References:


