

Biological Sutures for Cell Delivery to the Heart: Assessment of Delivery Scaffold

S. Rowlinson¹, J. Guyette², S. Shaw², D. Sood², K. Minn², A. DeMartino², B. Choate², A. Kazanovicz², M. Rolle², G. Pins², and G. Gaudette²

¹University of Miami, Coral Gables, FL, ²Worcester Polytechnic Institute, Worcester, MA

Replacing necrotic myocardium with new, contractile myocytes using cell therapy has the potential to improve the quality of life for patients with myocardial infarction and heart failure. Our lab has shown that biological sutures provide efficient human mesenchymal stem cell (hMSC) delivery and engraftment in the heart. However, the inflammatory response in the heart due to the biological suture has not been evaluated. We hypothesize that biological sutures made of different combinations of extracellular matrix (ECM) proteins may elicit different measurable inflammatory responses after one week of implantation in the heart. To test this, biological sutures were composed of bundles of 12 microthreads, made of either 12-fibrin alone or 8-fibrin/4-collagen hybrids. The sutures were implanted into a beating rat heart, which were then harvested and analyzed after one week. Heart sections were stained with Masson's trichrome to analyze the region of inflammation, indicated by disorganized myocardium and ECM remodeling. By measuring the area of the left ventricle (minus the ventricular cavity) and the region of inflammation, the percentage of inflammation was 20.3% for the fibrin/collagen hybrid sutures and 6.5% for the fibrin sutures. The hybrid biological sutures demonstrated a broad region of fibrosis, whereas the fibrin biological sutures demonstrated a more localized fibrosis only around the threads. These data suggest that sutures composed of fibrin elicit less inflammation compared to sutures of fibrin/collagen, making them more optimal for hMSC delivery.