AMJ
ISSN: 0005-2523

ISSN: 0005-2523
Volume 69, Issue 10, 2024

Bioprinted Vascularized Cardiac Patches Using Patient-Specific Induced Pluripotent Stem Cells for Pediatric Congenital Heart Defect Repair

Dr. Emily Roberts[1*]

[1]Department of Cardiothoracic Surgery, Boston Children's Hospital, Boston, MA, USA

*Corresponding Author: emily.roberts@childrens.harvard.edu

Abstract

Surgical repair of congenital heart defects (CHD) in neonates is limited by donor tissue availability. We bioprinted vascularized cardiac patches using patient-specific iPSC-derived cardiomyocytes, fibroblasts, and endothelial cells embedded in a decellularized myocardial matrix. Sacrificial Pluronic F127 channels enabled spontaneous microvascular network formation perfusable within 7 days. Patches exhibited synchronous contraction, electrophysiological coupling, and calcium handling comparable to native pediatric myocardium. Implantation in a porcine model of right ventricular outflow tract repair demonstrated integration, neovascularization, and ejection fraction preservation at 6 months. Patient-specific bioprinting offers a regenerative solution for pediatric cardiac surgery.

Keywords: 3D bioprinting, cardiac patches, congenital heart defects, iPSC-derived cardiomyocytes, vascularization, regenerative surgery