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TRANSMYOCARDIAL REVASCULARIZATION: A NEW APPROACH USING STENTS IN SWINE

Aaron M. Abarbanell, M.D.¹

¹Department of Surgery, Indiana University School of Medicine, Indianapolis, Indiana

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Liu and colleagues present a novel approach to transmyocardial revascularization (TMR) using stents instead of lasers to form conduits in a miniswine model. The authors developed stents that could be impregnated with heparin and basic fibroblast growth factor (bFGF). The stents were designed from two polymers that provided sufficient elasticity to withstand the contraction of the left ventricle and allowed the controlled release of heparin and bFGF. Immediately following ligation of the left coronary descending artery, the miniswine were assigned to one of three treatments—bare stents, heparin impregnated stents (HS), or heparin and bFGF impregnated stents (HBS). Under echo guidance two transmyocardial channels were made using a drill, and a 3-mm diameter stent was then placed into each channel. Six weeks post-operatively, the authors used 2D echo to calculate the fractional shortening (FS) of the heart. In addition, myocardial perfusion was measured, and the stented areas of myocardium were assessed for angiogenesis, proliferation and mRNA levels of pro-angiogenic cytokines.

The authors observed that the FS in the HBS and HS groups was greater than in the bare stent group (31% and 30% vs. 27% respectively). With respect to myocardial perfusion, the authors reported that the HBS group had the smallest mass perfusion defect percentage. Histologically the bare stents were occluded, and there was significantly greater angiogenesis and cell proliferation in the HS and HBS groups. Supporting this latter finding, mRNA levels of VEGF, vWF and TGF-beta3 were greatest in the HBS group as compared to the HS and bare stent groups. Based on their data, the authors proposed that the use of impregnated stents may avoid the thermal injury from laser TMR (TMLR) and allow the controlled delivery of drugs, stem cells or proangiogenic factors that may benefit the failing heart.

Clinically TMLR is the approved modality to treat patients with diffuse coronary artery disease and refractory angina despite maximal medical therapy. In this select group of patients, the disease is not amenable to coronary artery bypass grafting (CABG) or percutaneous coronary interventions (PCI) [1,2]. TMLR channels are 1-mm in diameter and

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Correspondence address: Aaron M. Abarbanell, M.D., 2017 Van Nuys Medical Science Building, 635 Barnhill Drive, Indianapolis, Indiana 46202, Email: aabarban@iupui.edu Phone: 317-278-8625, Fax: 317-274-6896.

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distributed one channel/square centimeter depending on the heart size and ischemic area [1]. Despite, the differences in channel size, the current study's results mesh nicely with those who advocate that improving angiogenesis will likely improve the efficacy of TMR. However, caution is merited as the FS improvement seen in this experimental model is modest and may not be clinically significant despite the molecular and histological data presented. In addition, a recent Cochrane Review of TMLR randomized control trials indicated that the procedure was associated with significant early mortality [3]. The authors of the review went so far as to recommend TMLR be restricted to "research or special situations". Thus, TMR by stents will likely require a large amount of evidence before being translating into a clinical reality.

Despite the mortality data associated with TMLR, 43.8% of patients who underwent TMLR had significantly improved chest pain versus 14.8% in the medical therapy arm in the Cochrane Review [3]. Given these encouraging results, continued research at the basic science level is merited to improve this therapy for patients with end-stage coronary artery disease. New ideas such as transmyocardial stents that control delivery of drugs, cytokines or stem cells may eventually be part of the future solution. Nevertheless as has been the case since the inception of the field, the cardiothoracic surgeon must ultimately weigh the available data and decide on the most appropriate course for the individual patient.

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