The increasing number of patients with severe, diffuse, distal vessel coronary artery disease is a growing challenge for cardiology care. Previous advancements in treatment have allowed survival for older, chronic cardiac patients. Coupled with the increasing frequency of diabetes, there is a large population of patients refractory to medical therapy who are no longer suitable for more conventional invasive treatment, such as bypass surgery or angioplasty. This growing need has helped foster more unique therapies, such as direct myocardial revascularization. Epicardial- and catheter-based endocardial techniques to create channels with lasers, mechanical and radio frequency injury have been utilized.

At Florida Hospital in Orlando, Florida, we have participated in the evaluation of the percutaneous transmyocardial revascularization (PTMR) technique employing a holmium laser device. Twenty patients were randomized to receive a series of holmium-laser created endocardial channels to compare with maximal medical treatment. This high-risk group had triple-vessel coronary involvement in 80%, diabetes mellitus in 50%, hyperlipidemia in 95% and a history of tobacco use in 50% of the patients. Coronary bypass graft surgery had been previously performed in 90% of the patients and intravascular cardiac intervention, such as percutaneous transluminal coronary angioplasty, was performed in 55% of the patients. The average Canadian Heart Association anginal class was 3.4. A previous myocardial infarction was noted in 60% of patients and 30% had a documented history of congestive heart failure. Twelve patients were treated with PTMR during this trial, receiving an average of 14.2 channels per procedure via the ECLIPSE holmium laser (Eclipse Surgical Technologies, Inc., Sunnyvale, California). The majority of the patients were treated in the anterior and anterolateral segments of the left ventricle. Average length of stay following the procedure was 1.5 days. Baseline and 6-month follow-up ECG stress tests were available in 7 patients. Six of these showed significant improvement in exercise duration from a minimum of 19% to a maximum of 155% increase over the baseline exercise duration. Twenty-five percent of the patients had dramatic improvement in the symptoms to a Canadian Heart Association classification of 0 at the 6-month follow-up exam. Before therapy, thirty-three percent of the patients had class IV angina, whereas only 12% of the patients had class IV angina at the 6-month follow-up exam.

Despite some individual cases of dramatic improvement in angina control, several questions remain about direct myocardial revascularization and PTMR. The mechanism of action remains unclear. Proposals of continued new channel patency do not appear viable at this time. Potential stimulation of angiogenesis and the possible role of denervation may also contribute to the clinical improvement seen in some patients. Placebo effect may also be a factor. No significant improvement in myocardial perfusion has been confirmed and long-term prognosis remains unclear in this group of patients.

Several procedural questions also remain. What mechanism of channel creation is optimal? How many channels are optimal, and what depth and interval between the channels is optimal? How will improvement in delivery and guidance improve the outcome and safety of this procedure?

The growing need to develop treatment options for patients with diffuse, distal and small vessel coronary artery disease continues to stimulate research. The role and full potential of direct myocardial revascularization remains unknown at this time.