

## Transmyocardial Laser Revascularization as Sole Reoperative Therapy following Late Anginal Recurrence: Case Report

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### ABSTRACT

A case of recurrent angina 3 years following sole therapy transmyocardial laser revascularization (TMR) is described. Repeat sole therapy TMR with the Holmium:YAG system was performed and resulted in complete and immediate angina relief. Repeat TMR should be considered in patients with angina recurrence who underwent primary TMR.

### INTRODUCTION

The use of transmyocardial laser revascularization (TMR) has been shown to be efficacious in patients with refractory angina [Allen 1999]. Recent reports of 5-year follow-up have shown TMR to be beneficial as sole therapy [Allen 2003] and adjunctive therapy [Allen 2004]. Although the mechanism of TMR remains debatable, prevailing theories include angiogenesis and denervation. The purpose of this report is to describe a case of repeat sole therapy TMR following initial treatment 3 years earlier.

### CASE

A 52-year-old woman went to her primary care physician because of disabling angina. She had a history of diabetes mellitus, hypertension, and hypercholesterolemia. Several years prior to her admission, she underwent coronary artery bypass grafting with subsequent angioplasty and stenting of native coronary arteries as well as saphenous vein and radial artery bypass conduits. Her medical therapy was increased to maximal levels with  $\beta$ -blockade, oral nitrates, and antihypertensive agents. Repeat angiography demonstrated severe native left coronary circulation and a large dominant right coronary artery with distal disease. A patent left internal

mammary artery graft to the left anterior descending artery, a highly diseased but patent saphenous vein graft to the diagonal branch, and a patent but string-like radial artery bypass graft to the posterior descending coronary artery were present. Echocardiographic and ventriculographic analyses showed that her left ventricular ejection fraction was approximately 45%. Despite medical efforts to relieve her angina, the patient was consuming nitroglycerine tablets with increasing frequency-Canadian Cardiovascular Society (CCS) anginal class IV. It was the opinion of several surgeons and interventionalists that there were no standard revascularization options except for TMR.

The patient was taken to the operating room where she underwent a limited left anterolateral thoracotomy and application of 40 channels to the left ventricle-approximately 10 channels to each of the anterior, lateral, posterior, and inferior segments-using the Holmium:YAG laser system (Cardiogenesis, Foothill Ranch, CA, USA). The patient made an uneventful recovery and was discharged in 4 days with no angina-CCS angina class I.

Approximately 3 years later, the patient suffered the onset of angina similar to the pain she experienced prior to the TMR treatment. She was reevaluated with echocardiography, nuclear scintigraphy (ie, PET scan), and cardiac catheterization. These studies showed low-normal left ventricular function, viable myocardium in all segmental territories, and identical coronary angiography. Further review of the catheterization suggested right coronary lesions that were now amenable to interventional therapy. Angioplasty and drug-eluting stents were placed in the posterior descending artery branch and in the proximal right coronary artery (RCA). Following the procedure, the patient's angina was still present. Additional angioplasty and stenting of the ostial RCA were performed with excellent angiographic results but no change in the clinical symptomatology. Repeat TMR was offered.

A redo left thoracotomy was performed and 55 channels placed into all segments of the left ventricle with the Holmium:YAG laser system. Except for incisional pain, the patient's angina relief was immediate. The patient was discharged in 4 days and at the time of this report had remained symptom free for 4 months.

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## DISCUSSION

The role of TMR in refractory cases of angina is well documented [Allen 1999]. Five-year follow-up studies of patients treated with sole therapy and adjunctive therapy have demonstrated symptomatic relief [Allen 2003, 2004]. The role of repeat TMR, however, has not been defined. A limited number of case reports have described the use of TMR following an initial treatment. Krabatsch and colleagues reported 3 cases of repeat TMR between 12 and 14 months following the first treatment with a CO<sub>2</sub> laser (PLC Systems, Milford, MA, USA). These 3 patients were among 165 cases at a single institution. Two of the 3 experienced significantly less angina [Krabatsch 1998]. The third patient was improved for 6 months and then relapsed to a CCS class IV state. Lee and others [2002] reported a single case of repeat TMR in a 72-year-old man who had been treated 3 years earlier. The initial therapy was performed with the CO<sub>2</sub> laser system and the redo procedure with the Holmium:YAG unit. The patient felt immediate relief of angina and remained angina free for 3 months. In our case, the patient was treated with the Holmium:YAG laser and experienced immediate angina relief on both occasions.

The mechanism of angina relief in these cases suggests that denervation with disruption in neural pathways may explain the immediate effects of TMR. Alternatively, an alteration in local nerve control over coronary capillary vasodilatation and vasoconstriction may be contributing to the angina relief in ischemic patients. Irrespective of the mechanism, the reproducible benefits of repeat TMR cannot be denied. In all the cases reported, there was less angina following repeat therapy. The 1 patient in the Krabatsch report who experienced angina recurrence following a second treat-

ment had 6 postoperative months of improved symptomatology. Further perfusion scanning revealed that this patient had septal ischemia. Relief of septal ischemia with a modified TMR probe is now being considered (Cardiogenesis, personal communication).

The findings in this case report and the few earlier ones suggest that the effects of denervation may be the most important mechanism for the immediate relief observed, with angiogenesis as a background phenomenon. The recurrence of angina in patients who have been symptom free for years existence raises the question of reinnervation. Further tracking of patients with recurrent angina following TMR and assessment of the efficacy of repeat TMR are necessary.

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