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Review Article

Transmyocardial Laser Revascularization: A Review of Basic and Clinical Aspects

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Abstract

Transmyocardial laser revascularization (TMR or TMLR) is a surgical therapy developed to treat patients with debilitating, medically refractory angina pectoris due to epicardial coronary artery disease that is not amenable to treatment using the traditional methods of percutaneous coronary intervention (PCI) or coronary artery bypass graft surgery (CABG). This technique can also be applied percutaneously [percutaneous myocardial revascularization (PMR) or direct myocardial revascularization (DMR)]. The original hypotheses which motivated development of TMR were that: (i) oxygenated blood could flow directly from the left ventricle and perfuse the myocardium; and (ii) such artificially created channels would remain patent. However, experimental data have refuted both hypotheses.

In the face of early reports of marked clinical benefits in terms of relief of anginal symptoms, alternate hypotheses to explain the mechanism have been pursued, including TMR-associated neoangiogenesis and cardiac denervation. Clinically, numerous reports of reduction in frequency and severity of anginal symptoms, improved exercise tolerance and improved quality of life have appeared from nonblind registry-type studies as well as nonblind randomized clinical trials of TMR or PMR versus continued medical therapy. TMR was not associated with a significant improvement in survival compared with medical therapy alone in randomized trials. For example, the prospective, randomized Angina Treatments-Lasers and Normal Therapies in Comparison (ATLANTIC) trial found a 1-year mortality of 5% in 92 TMR-treated patients and 10% in 90 patients treated with medication only. No proof of improved myocardial blood flow in hearts of treated patients is currently available.

The first randomized study of PMR was the Potential Angina Class Improvement From Intramyocardial Channels (PACIFIC) trial which found significantly greater improvements in anginal symptoms and exercise tolerance with PMR plus medical therapy, compared with medical therapy alone. The preliminary results of two double-blind studies with PMR/DMR have been presented but have not yet been published in full. Whereas PMR-treated patients did significantly better than sham-treated control groups after 6 months in the Blinded Evaluation of Laser Intervention Electively For angina pectoris (BELIEF) trial, there was no difference after 1 year between DMR-treated patients and those treated with medication only in the DMR In Regeneration of Endomyocardial Channels Trial (DIRECT). Different devices used for

revascularization in these two trials may explain the disparity in the results, and therefore the efficacy and tolerability of each device should be judged upon data collected with that particular device.

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