Many patients with chronic angina related to coronary artery disease respond to medical management or can be completely revascularized using percutaneous coronary interventions or coronary artery bypass grafting (CABG). Cardiac surgeons, however, are increasingly faced with a more complex patient who has developed a pattern of diffuse coronary artery disease and who cannot be completely revascularized by CABG alone (Figure 1). Incomplete revascularization with CABG occurs in 10-25% of patients and is a risk factor for both early and late death as well as late adverse events such as recurrent chest pain. Transmyocardial laser revascularization (TMR) is an approved surgical option for patients with debilitating angina due to diffuse coronary artery disease which makes complete revascularization using CABG alone unlikely. Based on the results of seven randomized trials the American Heart Association/American College of Cardiology (2002), the Society of Thoracic Surgeons (2004) and the International Society for Minimally Invasive Cardiothoracic Surgery (2006) have established national practice guidelines recommending TMR as sole therapy or as an adjunct to CABG in this difficult patient group.

The mechanism for TMR’s benefit is likely multifactorial but the laser channel creates a localized area of injured heart muscle cells which during their repair stimulates new blood vessel growth or angiogenesis. It has been demonstrated that injection of biologics such as stem cells or growth factors at the time of creating the laser channel enhances angiogenesis beyond the affect that either TMR or stem cells would have by themselves. It is hypothesized that the inflammation caused by the TMR channel provides a ‘fertile’ area for enhanced stem cell uptake and angiogenesis.

The use of stem cells in surgery, however, has been hampered by ethical concerns as well the inability to efficiently culture or isolate them outside the laboratory. The approval by the FDA of an autologous bone marrow stem cell isolator (HARVEST, Inc, Boston, MA) has removed these barriers. The bone marrow is collected in the operating room at the time of surgery and using the HARVEST system it is separated into its different parts in a process that is ‘point of care’ and takes only 15-20 minutes. The patients own sterilely concentrated stem cells can then be utilized in an efficient and timely manner during surgery. Stem cells concentrated using this system is already effectively and safely utilized clinically in orthopedic surgery with clinical trials underway to treat peripheral vascular disease. The ability to efficiently concentrate a patient’s own bone marrow derived stem cells now makes clinical application possible.