

tion. We found that implanted cells survived in the implanted area and altered myocardial matrix metabolism both within and remote from the region of implantation. Matrix metalloproteinase activity decreased in the transplanted group as compared with control group. The matrix structure was maintained and ventricular dilatation was prevented. These data suggest that implanted cells prevented ventricular dilatation through the alteration of matrix metabolism, which is a possible mechanism for implanted cells to improve heart function.

**Key Words:** Cell transplantation, myocardial infarction, extracellular matrix, myocardial regeneration, heart function

## Autologous Bone Marrow Cell Transplantation Combined with Off-Pump Coronary Artery Bypass Grafting in Human Ischemic Myocardium

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Recently, autologous bone marrow cell transplantation (CTx) for angiogenesis and myogenesis in ischemic myocardium has been extensively investigated to improve heart function. This study was designed to evaluate the effects of CTx with off-pump coronary artery bypass grafting (OPCAB) in patients who were not feasible for complete revascularization. Seven male patients underwent CTx combined with OPCAB in 5, CTx only in 1, and mitral valve repair in 1 patient simultaneously. Bone marrow was aspirated from iliac bone. Mean  $1.5 \times 10^9$  mononuclear cells including mean  $7.3 \times 10^6$  CD34+ cells and  $2.4 \times 10^6$  AC133+ cells were obtained and concentrated with 10cc. These cells were transplanted into non-graftable ischemic myocardium. Heart function was

evaluated in all patients using MIBI scan, echocardiogram and heart magnetic resonance imaging (MRI) preoperatively. The effect of CTx was evaluated using MIBI scan, echocardiogram, and MRI postoperatively. An average of 2 grafts were bypassed. Other territories were transplanted with isolated mononuclear cell. All patients had an uncomplicated postoperative course. After 2 to 7 months follow-up, there was improvement in symptom, ejection fraction (from 43% to 47%) on echocardiogram and myocardial perfusion on MIBI scan and MRI in all patients. These preliminary data showed improvement of heart function and myocardial perfusion and also showed the feasibility and safety of combined therapy with OPCAB and CTx in ischemic myocardium. However, the effectiveness of CTx alone cannot be readily assessed. Further randomized, controlled studies are required to evaluate the effectiveness of CTx alone.

**Key Words:** Autologous bone marrow cell transplantation, off-pump coronary artery bypass grafting, ischemic myocardium

## Mid-term Clinical Results of Tissue-Engineered Vascular Autografts Seeded with Autologous Bone Marrow Cells

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**Objective:** Prosthetic and bioprosthetic materials currently in use lack growth potential and therefore must be repeatedly replaced in pediatric patients as they develop. Tissue engineering (TE) is a new discipline that offers the potential for creating replacement structures from autologous cells and biodegradable polymer scaffolds. In May 2000 we initiated clinical application of tissue-engineered vascular grafts seeded with cultured cells. However, cell culturing is time-consuming and xeno-serum must be used. To overcome these disadvantages, we started the usage of bone marrow cells (BMCs), readily available on the day of surgery, as a cell source. The aim of the study was to assess the safety and feasibility of this technique for creating pulmonary artery conduits. **Methods:** Since August 2000, TE grafts seeded with autologous BMCs have been implanted in thirty-five patients. The patients and/or their parents were fully informed and had given consent to the procedure. Five ml/kg of bone-marrow was aspirated under