M. PIOLA [1], F. PRANDI [2], M. SONCINI [1], E. PENZA [3],
M. AGRIFOGLIO [4], G. POLVANI [4], G. B. FIORE [1], M. PESCE [2]

The role of pulsatile pressure in the arterialization of human saphenous vein after coronary artery bypass grafting surgery

[1] *Dipartimento di Elettronica, Informazione e Bioingegneria, Politecnico di Milano, Italy*
[2] *Laboratorio di Ingegneria Tissutale Cardiovascolare, Centro Cardiologico Monzino-IRCCS, Milan, Italy*
[3] *II Divisione di Cardiochirurgia, Centro Cardiologico Monzino-IRCCS, Milan, Italy*
[4] *Dipartimento di Scienze Cliniche e di Comunità, Università di Milano, Italy*
E-mail: marco.piola@mail.polimi.it

Saphenous vein (SV) graft disease represents an unsolved problem in coronary artery bypass grafting (CABG). After CABG, progressive structural modifications of the SV wall lead to the occlusion of the graft lumen. In the present contribution, we investigated in vitro the effects of physiological pressure patterns of the coronary circulation on human SV samples. This is indicated as one of the major causes of stress for SV segments after implantation. To this aim, we used an ex vivo vessel culture system (EVCS), developed in our Laboratories, able to apply the desired pressure patterns to SV segments and to maintain the vessels viability. The EVCS consists of a culture chamber, which integrates the medium reservoir, and hydraulic circuit and actuators. The hydraulic actuators are managed by a programmable monitoring and control system (M/C). The pulsatile pressure stimulation cycle consists of: a loading step (the luminal pressure reaches 80 mmHg); a pulsatile stimulation step (pressure oscillates between 80-120 mmHg at a desired pressure rate); an unloading step (pressure is lowered to zero); and a recirculation phase. Afterwards, we used 24 human SV segments: 12 samples were subjected to CABG-like pressure stimulation (CABG-PS, 80-120 mmHg), while 12 samples were cultured under venous perfusion conditions (3 ml/min steady flow, and 5 mmHg). Native SV segments served as control. After 7-days CABG-PS, the main findings were: i)

distension and reorganization of the vessel wall components with partial endothelial denudation, smooth muscle cells rearrangement and disarrangement of the vasa vasorum; ii) decrease of SVs wall thickness; iii) enlargement of the SVs luminal perimeter; iv) increased proliferation rate; v) increased up-regulation of MMP-2; and vi) basal level of TIMP-1 expression. These results suggested that the CABG-like pressure has an important role in the early events associated with the remodelling of the SV wall. Studies are currently performed in our Laboratories to correlate each of these changes to the establishment of cellular and molecular pro-pathologic pathways involved in the SV graft disease.