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Pulsatile pressure conditioning of saphenous veins in a compact and automated *ex vivo* vessel culture system

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The design of a novel ex vivo vessel culture system (EVCS), able to replicate the pulsatile pressure pattern experienced by the saphenous vein (SV) after coronary artery by-pass grafting (CABG), is presented. 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. Preliminary functional tests were performed using SV samples, in order to validate the robustness and the reliability over time of the M/C system, and to verify the sterility maintenance. Afterwards, surplus SV segments were subjected to venous perfusion (3 ml/min steady flow), or CABG-like pressure (80-120 mmHg) conditioning for a preliminary biological validation. The outcomes of the tests indicated a good reliability of the M/C system. The EVCS provided a sterile environment suitable for stimulation experiments and ensured the survival of SVs. Hematoxylin/Eosin staining of transversally-cut sections showed a good integrity of the vessel structure; in all conditions the endothelial and smooth muscle cells and even the adventitia layers appeared well preserved without signs of tissue degeneration nor swelling.

In conclusion, the EVCS is a suitable system for elucidating the mechanisms involved in the SV graft disease, within a controlled and strictly reproducible mechanical environment.