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Biofunctionalization of blood contacting surfaces with homing factor mimetic molecules for induction of *in vivo* stem cell seeding

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Abstract

Inadequate hemocompatibility can lead to the recognition of blood contacting artificial surfaces by the human body as a foreign material and accordingly induce the adhesion and activation of thrombocytes and the activation of blood coagulation and inflammatory response. The consequences are fatal particularly for vascular grafts with a small inner diameter (< 6 mm), which are required for replacement of coronary or peripheral arteries. Despite enormous advances in biomaterials research, the native endothelium still represents the ideal surface for blood contact. Thus, the endothelialization of blood contacting materials is a promising approach in the field of regenerative medicine. Furthermore, in contrast to in vitro endothelialization approaches, the generation of an autologous endothelium inside the body of patients represents an improvement of the concept. Circulating autologous endothelial progenitor cells (EPCs) in the patient´s blood can be used as stem cell pool to induce the in vivo endothelialization of blood contacting implants. Thus, the implant surfaces can be biofunctionalized with EPC specific homing factor mimetic molecules for capturing of stem cells directly from the blood stream to the implant surfaces. For this purpose, different capture molecules, such as aptamers, monoclonal andibodies, peptides, selectins and their ligands, or magnetic molecules can be used. EPCs bound to the surface of implants can differentiate into autologous endothelial cells and generate an endothelium. The in vivo tissue engineering of an endothelium on blood contacting materials prevents the recognition of those as foreign body. This approach allows the coverage of not only vascular grafts but also stents, heart valves, artificial hearts, lungs, and ventricular assist devices with an autologous endothelialium.

Biography

Meltem Avci-Adali holds a Master of Science degree in biomedical engineering and a Diploma degree in pharmaceutical technology. She completed her Ph.D at the University of Tuebingen in 2010. Currently, she is the research group leader of “Aptamer Technology” and “In Vivo Tissue Engineering” at the department of Thoracic, Cardiac, and Vascular Surgery at the University of Tuebingen, Germany. She has published several papers in reputed journals.