Adsorption of high-density-lipoprotein (HDL) to polymeric surfaces improves blood-compatibility and enhances endothelialization: towards a synthetic small-diameter vascular prosthesis

La adsorción de lipoproteínas de alta densidad (HDL) en superficies poliméricas aumenta la compatibilidad con la sangre y la endotelialización: hacia prótesis vasculares sintéticas de pequeño diámetro

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Abstract

Introduction: Synthetic small-diameter vascular prostheses fail frequently because of thrombotic complications or inflammation. The underlying problem is the lack of endothelialization, formation of a functional endothelial cell layer on the luminal surface of the prosthesis. *In situ* endothelialization has proven difficult to achieve in animal models and human patients. Often surfaces that favour adhesion and growth of endothelial cells, e.g. collagen and RGD-exposing polymers, are thrombogenic which can eventually lead to failure of the vascular graft. ***Materials and Methods:*** As model synthetic vascular graft we use a tube that is formed from metallic thin wires that are coated with a hydrophilic copolymer (N-vinyl-pyrrolidinone / n-butyl-methacrylate molar-ratio 90/10) and subsequently coiled into a tube. Plasma proteins were adsorbed onto the surface and blood compatibility, endothelial cell adhesion and growth were determined *in vitro*. Additionally, the model graft was implanted in the carotid arteries of several goats, to assess in vivo thrombogenicity and coverage of the luminal surface with endothelial cells. ***Results and Discussion:*** Our hydrophilic polymeric surfaces preferentially adsorbed high-density-lipoprotein. These HDL-hydrogel surfaces demonstrated dramatically improved blood-compatibility and endothelialization. Furthermore adhesion of leukocytes was decreased. The model vascular grafts that were implanted in goats showed formation of a cell layer on the luminal surface. The positive identification of these cells as endothelial cells is ongoing, but preliminary results demonstrate the typical endothelial cobblestone morphology. ***Conclusion:*** Modification of blood-contacting surfaces with HDL, either by adsorption of by covalent modification, leads to strongly improved blood-compatibility and endothelialization.

Keywords: Vascular prosthesis; blood-compatibility; endothelialization; high-density-lipoprotein; protein adsorption, hydrogel