Development of small-diameter vascular prostheses covered with human endothelial cells: Possibilities and limits of in vitro-tests

Abstract

There is an increasing demand for small-diameter vascular prostheses for the replacement of arteriosclerotic coronary arteries. They may be replaced by autologous blood vessels, usually parts of the saphenous vein. Prostheses of synthetic materials and an inner diameter of less than 4 to 6 mm are unsatisfactory and, therefore, not implanted for coronary arteries. A substantial improvement is, however, expected for prostheses covered with human autologous endothelial cells.

It has to be proved that this new type of vascular prostheses is an adequate replacement for small arteries. Tests of the new prosthesis should comprise cell and tissue compatibility of the synthetic materials as well as normal function of the endothelial cells.

The aim of the present paper was to reduce the number of animal experiments in this development by establishing new in vitro tests for endothelial cell compatibility of synthetic materials and for the adherence of endothelial cell on the prosthesis. Physiologically haemodynamic streaming conditions are in vitro produced by self-constructed circulatory systems. First results demonstrate that physiologic shear stress is achieved. Limits and relevance of the in vitro tests are discussed in relation to animal experiments and clinical studies.