Letter to the Editor

Guided Tissue Regeneration of Vascular
Grafts in the Peritoneal Cavity

To the Editor:

Tissue engineering represents an upcoming alternative source for vascular substitutes to create viable and biologically active grafts. Two different concepts are followed: grafts are either reseeded in vitro before implantation (tissue engineering) or the scaffolds are implanted as acellular matrices for intrinsic reseeding in vivo (guided tissue regeneration). The scaffold matrices are fashioned from natural materials or synthetic polymers. Despite considerable clinical research, no biological or synthetic grafts have been produced so far as an ideal substitute for a small-diameter artery.

Recently, our group focused research on the creation of bioartificial blood vessel grafts. Therefore, we read with interest the study in *Circulation Research* by Campbell et al on the creation of an “artificial blood conduit . . . from the cells of the host for autologous transplantation” (page 1173) in the peritoneal cavity: Silastic tubes implanted into the peritoneal cavity of rat and rabbit became completely encased into granulation tissue by 2 weeks. Histology revealed this myofibroblast capsule to be covered with a single layer of mesothelium, which formed the inner surface of the “designer” (page 1174) artery after the silastic tubing was removed and the capsule was everted. Implantation into the hosts showed impressive patency rates after 4 months of follow-up. Furthermore, the grafts showed 10% to 20% contractility of host aortas in organ bath experiments. The authors hypothesize that after implantation the “mesothelium is sloughed off the grafts and replaced by local endothelium” (page 1177) and stated that the “source of the lining cells was not considered essential information” (page 1177).

Stimulated by their data, we applied their principle to create bioartificial vessels, but using a decellularized allogenic vascular scaffold. We also found a repopulation of our implanted graft scaffolds in the given time period. In contrast to Campbell et al, we tried to characterize the inner lining of our artificial graft by immunohistology and biological cell metabolism. The supposed endothelial cells stained positive for CD31 and CD18, two specific markers for leukocytes. Additionally, reseeded cells were isolated from the scaffold and functionally characterized for specific endothelial cell metabolism by acetylated LDL uptake measurement.

In the study of Campbell et al, the cells covering the surface of silastic tubes stained positive for von Willebrand factor and were characterized by the authors as mesothelial (endothelial-like) cells. Considering our data, we suppose that they documented a typical inflammatory reaction to the foreign body, and the cells present on the silastic tube surface are in fact inflammatory cells and do not carry a typical endothelial function.

Like the Campbell group, we were able to detect preserved collagen and elastic fibers. However, von Kossa staining revealed denaturation of the collagen fibers inside the matrix and multiple areas of calcification after 21 days, indicating graft degeneration.

Important determinants for long-term function of tissue-engineered cardiovascular grafts are cell types, cell density, and the preservation and remodeling of extracellular matrix components. The endothelium as inner lining of biological vessels plays a key role in physiological vessel function. Campbell et al proposed the attractive idea of creating an autologous vascular graft in the peritoneal cavity. However, they fail to characterize the cells seeding their synthetic scaffold and forming their “artificial artery” (page 1177). Our results demonstrate the absence of endothelial function. Moreover, we show first evidence of graft degeneration 3 weeks after implantation.

Hence, we are convinced that the peritoneal cavity is no feasible environment for growing functional bioartificial vascular grafts.

S. Cebotari
Leibniz Institute for Biotechnology and Artificial Organs (LEBAO)
Hannover Medical School
Hannover, Germany

S. Sorrentino
LEBAO
Hannover, Germany

A. Haverich
Division of Thoracic and Cardiovascular Surgery
Hannover Medical School
Hannover, Germany

H. Mertsching
LEBAO
Hannover, Germany


Guided Tissue Regeneration of Vascular Grafts in the Peritoneal Cavity
S. Cebotari, T. Walles, S. Sorrentino, A. Haverich and H. Mertsching

Circ Res. 2002;90:e71
doi: 10.1161/01.RES.0000017729.02720.6F
Circulation Research is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2002 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7330. Online ISSN: 1524-4571

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circres.ahajournals.org/content/90/8/e71

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation Research can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation Research is online at:
http://circres.ahajournals.org//subscriptions/