Surface Endothelialization Reduces Thrombogenicity of Poly 4-Methyl-1-Pentene (PMP) Gas Exchange Membranes

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Introduction

Medical devices with blood contacting surfaces such as implants or extracorporeal devices should completely prevent the activation of the coagulation system. Thus, the need for materials with improved blood compatibility is high. Surface endothelialization is considered an important tool to optimize the blood compatibility of artificial materials (1). Here we report on endothelialization of polymethylpentene (PMP) gas exchange membranes. This study is the first step towards the development of a biohybrid lung as long-term replacement of a deceased organ.

Materials and Methods

Endothelial cells were seeded on (PMP) gas exchange membranes (Goodfellow, Germany) mRNA Expression levels were quantified by real-time RT-PCR. Thrombogenicity of the endothelialized material was tested with an in vitro platelet adhesion assay. Gas exchange was measured in a customized test chamber.

Results

Pronounced cell adhesion could be observed on albumin/heparin coated PMP membranes but not on uncoated membranes (Fig. 1.). Real-time-PCR analysis showed a non-thrombogenic state of the cells. This result could be verified with an in vitro platelet adhesion assay. The endothelial cell seeded material showed a significant lower amount of adhered platelets in comparison to the untreated material. (Fig. 2.) Expression of markers relevant for cell activation was also unaffected by the culture on the PMP membrane but could be induced by subsequent stimulation with TNF-α. This suggests that the cells are in a non-activated state but maintain their reactivity while cultivated on the PMP membrane. Of importance, the endothelial layer had no mayor impact on gas permeability of PMP membranes.

Discussion and Conclusions

Here we demonstrate the feasibility to reduce thrombogenicity of PMP membranes due to endothelialisation, without disrupting the gas exchange ability. This is a first and intriguing step towards the development of a biofunctionalized surface for the use in blood contacting medical devices especially artificial lungs.

References

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Acknowledgments

This work was financially supported by the German Federal Ministry of Education and Research (0313754; Development of a Hybrid Lung) as well as by the Excellence Cluster ‘REBIRTH’

Disclosures

The authors have nothing to disclose.