

Porcine Islet Xenotransplantation: A New Source of Endocrine Tissue for the Treatment of Type 1 Diabetes - Does the Co-Transplantation of Porcine Islet Cells with Porcine Mesenchymal Stem Cells Have an Impact on Islet Function and Graft Survival?

Naomi Georgia Köhler

Master thesis in Medicine

Type 1 diabetes is a widespread disease, affecting approximately 41.5 million people worldwide. It is generally treated with exogenous insulin, maintaining physiological blood glucose levels but also leading to long-term vascular complications in a significant proportion of patients. Pancreatic islet cell transplantation offers a potential alternative treatment to insulin injections. However, the shortage of human organ donors remains a limiting factor which is why xenotransplantation of porcine islet cells has recently attracted strong interest.

The first part of this work describes the general aspects of type 1 diabetes and its current treatment modalities. It also gives an overview of recent animal studies investigating transplantation of encapsulated porcine islet cells combined with mesenchymal stem cells (MSCs) as a novel therapy and points out its current limitations.

The second part of this work reports the practical part that I performed at the Surgical Research Unit of the University of Fribourg. During my master thesis, I have been introduced to the technical aspects of MSC culture and differentiation and participated in the finalization of an ongoing study investigating whether co-transplantation of porcine islet cells together with porcine MSCs could enhance the viability and function of encapsulated porcine islets, resulting in an improved graft outcome. This study demonstrates that porcine MSC obtained from the exocrine pancreas do have a beneficial effect on insulin secretion of juvenile pig islets, however it also showed the limits of MSCs in reducing immune and inflammatory reactions against encapsulated porcine islets.

In conclusion, the current state of research emphasizes the potential of co-culture and cotransplantation of porcine islet cells with porcine MSCs. However, several challenges remain, especially progresses in the field of encapsulation techniques are required before this therapeutic approach becomes a clinical reality.

Leiter: Prof. Dr. med. Bernhard Egger, Universität Fribourg