TECHNISCHE HOCHSCHULE DEGGENDORF

DallE

ILLUMINATING PANCREATIC CANCER ANGIOGENESIS: INSIGHTS INTO TUMOR PERFUSION AND MICROVASCULAR ARCHITECTURE USING THE CAM MODEL

Weitere Infos:

Abstract

Projekttitel/ Project title:

Illuminating Pancreatic Cancer Angiogenesis: Insights into Tumor Perfusion and Microvascular Architecture Using the CAM Model

Kurztitel/ Short title:

3D Pancreatic Cancer Perfusion

Einleitung/ Introduction:

Pancreatic ductal adenocarcinoma (PDAC) is a highly aggressive malignancy with a five-year survival rate of just 13%, primarily due to late diagnoses, resistance to conventional treatments, and a hypoxic, fibrotic tumor microenvironment. Key factor to PDAC progression is angiogenesis, mediated by vascular endothelial growth factor A (VEGF-A), which supports nutrient delivery and metastasis within the tumor's hypovascular landscape. This study leverages the chorioallantoic membrane (CAM) model, a dynamic, cost-effective preclinical platform, to unravel the complexities of PDAC biology. The CAM model enables the engraftment of primary PDAC tissues and tumor spheroids, allowing for real-time exploration of tumor growth, vascularization, and angiogenic interactions through imaging modalities, including ultra-high-frequency ultrasound, 3D volumetric assessments, and laser speckle contrast imaging.

Ziel/ Aim:

The aim of this project is a seven-day cultivation period with PDAC tissues exhibiting progressive vascularization, marked by the formation of functional anastomoses between human and chicken blood vessels. Whole-mount staining and immunofluorescence confirm the presence of anastomoses, underscoring active and dynamic angiogenic mechanisms.

Methode/ Method:

To study the tumor's microvascular architecture, human PDAC tissue are engrafted on the chorion allantois membrane (CAM) model, then changes in angiogenesis are monitored by Laser Speckle Contrast Imaging (LSCI), perfusion is visualized via ultra high frequency ultrasound and anastomoses can be visualized via immunohistological staining using isolectin and human CD31.

Tumor spheroids derived from circulating tumor cells display heightened invasiveness and vascular integration, offering critical insights into their metastatic behavior. In this project, PDAC and tumorspheres are cultured on the CAM and histological sections support the findings above, opening a gateway to tumor microvasculature insights and future potential treatment options.

Ergebnis/ Result:

Throughout a seven-day cultivation period, PDAC tissues exhibit progressive vascularization, marked by the formation of functional anastomoses between human and chicken blood vessels within 72 hours post-engraftment. Whole-mount staining and immunofluorescence confirm the presence of anastomoses between both species, underscoring active and dynamic angiogenic mechanisms. Quantitative analyses revealed significant changes in tumor volume and perfusion, supported by histological evaluations and advanced 3D measurements.

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