Longitudinally Detecting Collagen Progression Within Multicellular Pancreatic Tumor Spheroids Using Polarization-Sensitive Optical Coherence Tomography

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100-word text abstract

Common two-dimensional (2D) models are ineffective in mimicking solid tumors. Additionally, fibrotic stroma is one of the major characteristics of pancreatic tumors and it is often missing in *in vitro* models. Therefore, there is a need for a better *in vitro* model to accurately mimic the characteristics of tumor and to detect the progression of fibrosis within the tumor model. Here, we utilized polarization-sensitive optical coherence tomography (PS-OCT) to longitudinally detect the collagen progression within multicellular pancreatic tumor spheroids *in vitro*. Spheroids were scanned by PS-OCT every two days, and progression of fibrosis within the spheroids were detected.

250-word text abstract

Pancreatic cancer is currently the third-leading cause of cancer-related deaths in the United States, and it has the highest mortality rate among all major cancers due to its ability to metastasize throughout the body undetected. The overall 5-year relative survival rate for pancreatic cancer patients is 10.8% but once the cancer metastasizes, the survival rate reduces to 3%. One major challenge in pancreatic cancer research is the lack of an accurate model of the pancreatic tumor and its microenvironment. Common two-dimensional (2D) models are ineffective in mimicking solid tumors. Additionally, fibrotic stroma is one of the major characteristics of pancreatic tumors and it is often missing in *in vitro* models. Therefore, there is a need for a better *in vitro* model to accurately mimic the characteristics of pancreatic tumor and to detect the progression of fibrosis within the tumor model. Here, we utilized polarization-sensitive optical coherence tomography (PS-OCT) to longitudinally detect the collagen distribution within multicellular tumor spheroids (MCTSs). We co-cultured mouse-derived pancreatic tumor cells and fibroblasts with different ratios to form the MCTSs. MCTSs were scanned by PS-OCT every two days for over 18 days, and distribution of collagen within the spheroids were detected. This three-dimensional (3D) tumor model better mimics *in vivo* pancreatic tumors, and this study shows the potential of PS-OCT in detecting the progression of fibrosis within MCTSs.

Keywords: Multicellular tumor spheroid, collagen, polarization-sensitive optical coherence tomography, pancreatic tumor, fibrosis