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Multimodal Device and Computer Algorithm-Based Monitoring of Pancreatic Microcirculation Profiles In Vivo

Yuan Li[1], Xiaohong Song[1], Mingming Liu[1,2], Bing Wang[1], Jian Zhang[1,2], Ailing Li[1], Honggang Zhang[1] and Ruijuan Xiu[1]
[1]Institute of Microcirculation, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China
[2]Diabetes Research Center, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, China

Abstract:

Objectives: Pancreatic microcirculation has an essential role in orchestrating pancreatic homeostasis. Inherent complexity and technological limitation lead to interobserver variability and 1-sided microcirculatory data. Here, we introduce a multimodal device and computer algorithm-based platform for monitoring and visualizing integrated pancreatic microcirculation profiles.
Methods: After anesthetizing and exposing pancreas tissue of BALB/c mice, probes of Oxygen to See, Microx TX3 , and MoorVMS/LDF2 were positioned and pancreas in situ to capture the pancreatic microcirculatory oxygen (hemoglobin oxygen saturation, relative amount of hemoglobin, and oxygen partial pressure) and microhemodynamic data (microvascular blood perfusion and velocity). To assess and visualize pancreatic microcirculation profiles, raw data of pancreatic microcirculation profiles were processed and transformed using interquartile range and min-max normalization by Python and Apache ECharts.
Results: The multimodal device-based platform was established and 3-dimensional microcirculatory modules were constructed. Raw data sets of pancreatic microcirculatory oxygen and microhemodynamic were collected. The outlier of data set was adjusted to the boundary value and raw data set was preprocessed. Normalized pancreatic microcirculation profiles were integrated into the 3-dimensional histogram and scatter modules, respectively. The 3-dimensional modules of pancreatic microcirculation profiles were then generated.
Conclusion: We established a multimodal device and computer algorithm-based monitoring platform for visualizing integrated pancreatic microcirculation profiles.

Keywords: pancreatic microcirculation profiles, hemoglobin oxygen saturation, relative amount of hemoglobin, partial oxygen pressure, blood perfusion