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Cole Relaxation Frequency for the Detection of Pancreatic Cancer and Precancerous Conditions

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Background

Pancreatic cancer (PC) accounts for half a million new cases and 4.7% of the world's cancer-related deaths in 2020 with a global survival rate of only 5%. Innovative endoscopic techniques are being studied to improve the accuracy of PC detection, though presently, there is no standard procedure for PC detection. The Cole Relaxation Frequency (CRF) – a derived electrical bioimpedance signature for cancer detection proposed by NovaScan – has proven to quantitatively detect breast, skin, and lung cancers.

Methods

The aim of this pilot study was to determine if NovaScan CRF-based technology can detect cancer and predict the level of fibrosis in PC. CRF was measured in multiple locations on ex vivo pancreas from a cohort of 26 mice (15 KPC, 2 KC, and 9 wild type). NovaScan determined cancer presence when the CRF parameter was measured above 1 MHz and compared to histopathology findings for each sample to assess specificity and sensitivity. Pancreases were scored as percent fibrosis over multiple fields of view and compared to CRF. To determine if CRF can effectively discern fibrosis in mouse PC from noncancerous pancreas, cerulein-induced AP (3 groups at 24, 48, 72 hours, N=6) were compared to saline injection (N=6).

Results

From histology, 12 KPC pancreases were cancerous, 5 pancreases (3 KPC and 2 KC) had PanIN of which 4 were identified as cancerous including all 3 KPC mice, and 9 controls were noncancerous. This NovaScan technology when tested on mouse pancreas had a specificity and sensitivity of 100% and 94%, respectively. Regression analysis demonstrated a positive correlation between CRF and fibrosis ($r(15)= 0.67$, $p = 0.003$). None of the AP samples were detected as cancerous via CRF.

Conclusion

Distinction between AP time points and controls need further evaluation. CRF can decipher PC from normal and AP tissue making it an ideal clinical detection tool.