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Improving Early Diagnosis of Pancreatic Cancer

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In 2010, my grandpa was diagnosed with Stage 4 pancreatic cancer. He died two months later due to the tumor spreading throughout his body. By the time people like my grandpa start showing symptoms of pancreatic cancer, the tumor has often spread to other parts of the body, and is usually very difficult to treat.[1] As a result of this, 85% of 45,220 people that are diagnosed in the U.S. with pancreatic cancer each year, die within the same year of diagnosis.[2] There are many recent studies working to improve the current survival rate for pancreatic cancer.

One new diagnostic tool is a process called microfluidics, which is a technology that can control small amounts of fluid.[3] One study used this process to detect circulating pancreas epithelial cells (CPEC) in the bloodstream of test subjects (pancreatic cells are suppose to be in your pancreas, not your bloodstream). Scientists found three different groups of patients, one group with cystic lesions, possible cancer, but no diagnosis of cancer; a second group currently with pancreatic cancer; and the third group with no pancreatic cancer. Scientists found that 33% of test subjects with cystic lesions had more than three CPEC in their bloodstream, 73% of patients with pancreatic cancer had more than three CPEC in their bloodstream, and that none of the patients in group three had CPEC in their bloodstream.[4] Using this microfluidic method to find CPEC in the bloodstream, might become a new way to detect pancreatic cancer before the tumor has even developed in the body.

Even though this method could revolutionize the way pancreatic cancer can be detected, there are still some challenges with this detection method. Cancer specialists like Dr. Robert Takamiya are seeing challenges in methods like these, "At this time, we (as far as I know) are not using microfluidics in screening for

pancreatic cancer in practice. It would need to be thoroughly evaluated in clinical trials before being approved."[5] These experiments would need to be checked to make sure they're a clear and safe way to detect pancreatic cancer before being used in everyday lives.

Another big breakthrough was discovered by Jack Andraka, a 15 year-old scientist who developed a method to detect pancreatic cancer that is 168 times faster, 26,000 times less expensive, and 400 times more sensitive than the current way to detect pancreatic cancer.[2] The method he developed is a network of carbon nanotubes (which are conductive), connected by antibodies that are receptive to mesothelin.[2] Mesothelin is a protein that is overexpressed in the blood when there is a cancer in the body, specifically pancreatic cancer.[6] When the mesothelin connects to the antibody, it weakens the electric connection between the nanotubes, and sends a signal of the weakening connection.[6] This weakening connection is easily detectable with an ohmmeter, and would theoretically make pancreatic cancer easier to detect in its early stages.

Another possible early detection method for pancreatic cancer is magnetic resonance cholangiopancreatography (MRCP). MRCP is a special type of magnetic resonance imaging that produces detailed images of the bile and pancreatic systems.[7] In July of 2000, a study was lead by Dr. Adamek that used MRCP to detect pancreatic related diseases. In this study, 124 patients with a strong suspicion of pancreatic cancer were tested using MRCP.[8] As a result of this experiment, 46% had chronic pancreatitis, 30% of test subjects had pancreatic carcinoma, 14% had other neoplastic pancreatic diseases, and 10% of patients didn't have any diseases related to the pancreas.[8]

Over the years, the survival rate for pancreatic cancer has slowly gone up thanks to studies and methods like these. However, being relatively new, they aren't currently being used in clinics and hospitals. Once they're further developed and researched, they will hopefully be used everyday in hospitals and clinics, taking the place of current methods.

Reflective Paragraph

Before doing this project, I didn't realize how inaccurate the current detection for pancreatic cancer is, and how low the survival rate is. Doing this research made me realize how important doing biomedical research is, and how much of an impact it has on our everyday lives. All medications that we take were once a biomedical research project. Now, these medications and treatments are everyday things that we use to get better. Biomedical research is important, interesting, and it is life changing research that everyone should know about.

Bibliography

1. "Pancreatic Cancer Diagnosis and Early Detection." WebMD. 2015. Web. February 22, 2015.<http://www.webmd.com/cancer/pancreatic-cancer/pancreatic-cancer-diagnosis>
2. Mercola, Joseph. "15-Year-Old Invents New Test for Early, Reliable Detection of Pancreatic Cancer." Mercola.com. March 4, 2013. Web. February 25, 2015. <http://articles.mercola.com/sites/articles/archive/2013/03/04/andraka-new-pancreatic-cancer-test.aspx>
3. Whitesides, George M. "The Origins and the Future of Microfluidics." NATURE. July, 2006. Web. March 2, 2015. <https://gmwgroup.harvard.edu/pubs/pdf/960.pdf>

4. Rhim, Andrew D., et. al. "Detection of Circulating Pancreas Epithelial Cells in Patients with Pancreatic Cystic Lesions." Gastroenterology. 146. (2014). 647-651. <http://www.ncbi.nlm.nih.gov/pubmed/24333829#>
5. Takamiya, Robert. Email Interview. February 25, 2015.
6. Cossins, Dan. "The Cancer-Test Kid." The Scientist. April 1, 2013. Web. February 24, 2015. <http://www.the-scientist.com/?articles.view/articleNo/34759/title/The-Cancer-Test-Kid/>
7. "Magnetic Resonance Cholangiopancreatography." RadiologyInfo.org. May, 2013. Web. February 25, 2015. <http://www.radiologyinfo.org/en/info.cfm?pg=mrcp>
8. Adamek, Henning E., et. al. "Pancreatic Cancer Detection with Magnetic Resonance Cholangiopancreatography and Endoscopic Retrograde Cholangiopancreatography: a Prospective Controlled Study." The Lancet. 356 (2000). 190-193. <http://www.sciencedirect.com/science/article/pii/S014067360002479X>