BME464L Project (Fall 2013, Palmeri)

Liver Bile Duct Biopsy Guidance Device (Interventional Radiology)

Clinical Problem

Gaining needle access to the bile ducts in human liver is currently plagued by high radiation dose to the operator (interventional radiologist) and patient from the use of x-ray fluoroscopy to visualize the needles in situ. Bile ducts, though, have different physiologic properties (e.g., electrical conductivity and pH) [1-6] that could allow them to be localized using electronic devices instead of ionizing radiation.

Project Objective

Design a device that can be attached to a bile duct biopsy needle that can indicate when the needle tip has pierced into, but not through, a bile duct surrounded by liver parenchyma.

Research Contact

Dr. Paul Suhocki, M.D. (paul.suhocki@duke.edu)

References

[1] Electrical conductivity of tissue at frequencies below 1 MHz, Physics in Medicine and Biology 2009;54:4863-4878

[2] Penetration of electromagnetic fields of an open-ended coaxial probe between 1 MHz and 1 GHz in dielectric skin measurements, Physics in Medicine and Biology 1999;44:N169-N176

[3] Bile in the Esophagus – Model for a Bile Acid Sensor, J Gastrointestin Surg 2010;14:S6-S8

[4] In Vivo Microdialysis Sampling in the Bile, Blood and Liver of Rats to Study the Disposition of Phenol, Pharmaceutical Research 1993;10: 335-342

[5] Validation studies of Bilitec 2000: an ambulatory duodenogastric reflux monitoring system

[6] Related patent: "A catheter for measurement of electrochemical properties of bodily fluids"