Early detection of colorectal cancer using non-invasive technology

Objective:

In the recent medicine world the one of the major challenges are screening and early detection of tumors (since the adenoma stage) in order to prevent their degeneration into malignant cancer and/or metastases. To be more specific, the colorectal cancer shows a high curability rate, up to 90%, if identified in the initial stage. [1] The Protocol discussed here is proposed to design of an Optical Sensor for Early Detection of Colorectal Cancer; it will be capable of identifying the difference between fecal exhalation of healthy subjects and of subjects suffering from high-risk colorectal polyps or tumors. The tests are compared to the results of fecal occult blood test and colonoscopy as a gold standard. Detection of colorectal cancer with help of optical sensor is highly compatible to human body, more specifically a non destructive method.

Proposed Methodology:

Optical imaging is an inexpensive, fast, and sensitive imaging approach for the non-invasive detection of human cancers in locations that are accessible by an optical imaging device. Light is used to probe cellular and molecular function in the context of cancer in the living body.[2] Recent advances in the development of optical instrumentation make it possible to detect optical signals produced at a tissue depth of several centimeters. The optical signals can be endogenous contrasts that capture the heterogeneity and biological status of different tissues including tumors, or extrinsic optical contrasts that selectively accumulate in tumors to be imaged after local or systemic delivery. The use of optical imaging is now being applied in the clinic and operating room for the localization and resection of malignant tumors in addition to screening for cancer.

Optical Imaging of Endogenous Tissue Contrasts:

At present, various optical imaging devices are used in human clinical trials for the detection of changes in endogenous tissue fluorescent signals, such as hemoglobin concentration, oxygenation status of heme molecules, and cytochrome oxidation changes. In addition, alterations in light scatter of tissues can be detected due to cell swelling, changes in tissue components, and blood volume and flow rates.1 Since tumor tissues have altered blood flow and are highly hypoxic, differential optical absorbances of oxy- and deoxyhemoglobin in the tumor and normal tissues have been used as an intrinsic indicator for the presence of a cancer lesion.[3-4] Endogenous optical contrast for cancer detection can be applied with the optical imaging of melanoma tumor margins and circulating melanoma cells in the blood

since melanin pigments in those cancer cells have a strong absorption in a near infrared (NIR) range.[5, 6]

Outcomes:

Optical imaging is a noninvasive, relatively low-cost technology that uses light to probe cellular and molecular function in the setting of cancer. Advances in optical instrumentation allow the detection of endogenous tissue contrasts between normal and malignant tissues, while administration of optical contrast agents further enhances sensitive and specificity of the detection of cancer cells. Optical imaging of contrast agents makes it possible for the surgeon to visualize cancer margins and more effectively resect malignant gliomas and bladder cancer. The use of near infrared optical imaging permits greater tissue depth penetration and has become very important for the screening of breast cancer. Newer, targeted optical imaging probes that have been conjugated to cancer cell specific ligands have been developed in preclinical animal models and can provide for better cancer detection.

Reference:

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