Correlation between pathology and optical coherence tomography imaging of esophageal tumor extent: an ex-vivo study

A master's thesis position is available at the department of Biomedical Engineering & Physics and the department of Radiation Oncology of the Academic Medical Center (AMC). The research will be performed in collaboration with the Netherlands Cancer Institute (NKI) and the LaserLaB Amsterdam.

In this collaboration we investigate the application of advanced optical imaging of the esophagus in cancer therapy. Our researches are performed in a multidisciplinary team of physicists, computer scientists, engineers, biologists, and medical doctors as well as chemists and mathematicians. The candidate will get the chance to get familiar with the state-of-the-art of optical imaging as well as designing and performing ex-vivo clinical experiments in a multidisciplinary environment. We will provide lessons on how to work with the OCT console. Pathology analysis will be carried out by our highly skilled group members.

Background:

In the treatment of esophageal cancer with radiotherapy, it is still a challenge to deliver the radiation dose accurately to the tumor and tumor-involved lymph nodes while sparing the radiosensitive surrounding healthy tissues. The macroscopical disease extent is currently determined by use of endoscopic ultrasound (EUS). Currently, there is limited knowledge of the disease extend beyond the EUS findings. This is due to the poor soft-tissue contrast of the presently used clinical imaging techniques such as CT and EUS. This uncertainty leads to the use of large safety margins to ensure the tumor coverage and to reduce the risk of geographic miss during irradiation.

Optical coherence tomography (OCT) is a minimally invasive and high resolution (1-10µm) imaging technique that obtains cross-sectional images of tissue based on the backscattering of light. OCT has potential for guiding diagnosis and treatment of esophageal cancer, as cylindrical catheters exist that are able to scan the surface to an approximate depth of 3mm using a single rotating optical fiber.

In this study, we will investigate the feasibility of using OCT to detect esophageal tumor borders. Our aim is to differentiate between cancerous and healthy tissues and thereby detect upper and lower tumor boundaries accurately prior to radiotherapy treatment planning to improve knowledge of the disease extent beyond the EUS findings; this is of interest since EUS is known to understage the disease extent. We will compare our results with pathology as the gold standard.

Materials and Methods:

In this ex-vivo study, we will use the excision specimen from 10 esophageal cancer patients who underwent a combination of chemotherapy and radiotherapy prior to surgery. We will scan the excision specimens with a first generation endoscopic OCT imaging system (Nvision VLE (volumetric Laser endomicroscopy) Imaging System, NinePoint Medical Inc., Cambridge, MA) equipped with a balloon-based catheter. We will also mark a few locations of the excision specimen in such a way that these are visible in the OCT images. Further, the pathologist will report his/her findings relative to these marks facilitating a correlation between OCT and pathology findings.

We are looking for:

We are looking for a highly motivated master student in the field of (medical) physics, (medical/biomedical) engineering, technical medicine, or similar majors. The candidate should have a very good command of English. Further, the candidate should have affinity with research and have good communicative skills. The candidate is willing to spend ~6 to 10 months on her/his master thesis.
In case you require any further information/questions, please do not hesitate to contact us.

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