ENHANCING SURGICAL PRECISION: AUTOMATED SESORRS FOR IMPROVED TUMOR DETECTION AND RESECTION– EXECUTIVE SUMMARY (HEALTH)

CHALLENGE

Glioblastoma multiforme (GBM) is one of the most formidable challenges in oncology. GBMs are the most aggressive forms of brain tumors and are associated with a poor median survival rate of only 14–16 months post-diagnosis and a 5-year survival rate of less than 5%. Due to the infiltrating nature of GBM, as well as the challenges associated with drug delivery and late-stage diagnosis, treatment of the disease is challenging. Surgical resection followed by adjuvant radio-chemotherapy the is the main therapeutic option with very few alternative treatment options. Studies have shown that more efficient tumor resection can lead to better prognosis, however current image-guided surgical techniques such as fluorescence-guided surgery (FGS) are limited in their ability to evaluate the required resection margin, or depth of tumor invasion. Surface enhanced spatially offset resonance Raman spectroscopy (SESORRS) is an emerging optical approach which can image through depths far superior to current optical imaging approaches such as fluorescence. SESORRS can acquire high spatial and spectral information through depths not currently possible in clinical image-guided surgery.

PROPOSED PROJECT AND CATEGORY

Central hypothesis: While FGS is showing promise in the clinic for supporting image-guided resection of tumors including GBM, its ability to detect deeper seated tumors is limited. **Overall goal:** The goal of this project is to establish and provide a new automated technological approach for the detection, evaluation of tumor invasion, and identification of residual tumor cells on or beneath the resection bed. Ultimately, patients with GBM could benefit from portable, low-cost, biopsy free imaging, and improved image-guided evaluation and resection of GBM in real-time. We will address this health-related challenge through three specific aims (SAs) as outlined below.

SA1: Integrate an *xyz* automated translation stage and CMOS camera with imaging spectrometer and SORS probe.

SA2: Validate automated SORS imaging using calibration standards and optical phantoms.

SA3: Evaluate the benefit using of automated SESORS for image-guided surgical resection of GBM in comparison with clinically approved approaches.

IMPACT

While progress in the image-guided resection of GBM has been achieved, there is still an urgent need to develop more efficient surgical navigational tools to improve progression-free survival in patients. To the best of our knowledge, automated SORS imaging, with or without the use of SERRS contrast agents, has not been published. More importantly, no one has applied SESORRS imaging for image-guided resection of tumors or compared it with clinically approved optical surgical navigation approaches such as fluorescence. We expect that the research outlined here will provide proof-of-concept data demonstrating the potential benefit of SESORRS imaging in comparison to FGS, for image guided resection of tumors on, or beneath the resection bed, in mouse models harboring GBMs. It is well established that early detection, as well efficient tumor resection, correlates with improved prognosis in patients. Although we have chosen to focus on developing an approach for image-guided resection of GBM, the development of more effective imaging technologies and contrast agents is vital for the treatment, and management, of all types of cancer. Taken together, we will build a tool that has the potential to drastically improve cancer detection in a clinical setting and lay the foundation for future development and application of automated SESORRS imaging for the assessment of additional solid tumors, e.g., breast cancer. I am highly qualified to lead and execute this research project however I also am hopeful that the unique environment of Dana-Farber Cancer Institute, as well as the novelty, and clinical relevance of this research area, will appeal to the next generation of scientists of whom I am eager to train.