

Real-time monitoring of microwave ablation zones for personalised oncological treatment

XM -TÜBİTAK 2024 Joint Call for R&I

Özet

ABLAZE aims to address technological challenges associated with microwave ablation (MWA) technologies. MWA is a minimally invasive technology, used since the late 1990s to treat tumors in organs such as the liver, kidneys, lungs, and bones. It uses microwave energy to generate heat within the tumor, causing thermal ablation of diseased tissues. Despite the great potential of MWA, its clinical applications are limited because of technological challenges, particularly the lack of accurate knowledge of the tissue's dielectric properties and the impact of blood perfusion on treatment outcomes. ABLAZE addresses these challenges by implementing an innovative method to measure accurate temperature-dependent dielectric properties of tissues which encompass changes in the microenvironment surrounding the antenna during ablation and blood perfusion effects. Understanding these dynamics will help optimize current MWA protocols, improving treatment precision and effectiveness. Additionally, this data will serve as reference data for the dielectric community and will be made available on the open-access dielectric repository maintained by UM, assisting the electromagnetic hyperthermic technology community to further advance these technologies. ABLAZE will merge this knowledge to create a standardized, thermo-sensitive liver phantom that models accurate dielectric properties and perfusion effects. This phantom will use temperature-sensitive materials, which facilitate temperature measurement. It will serve as a quality assurance benchmark and a valuable tool for the broader research community. Finally, a further advancement of the current MWA system at UM will be implemented by incorporating multiple antennas in the system to monitor in real-time the ablation zone. This will provide immediate feedback, allowing clinicians to make swift adjustments, thereby improving procedural outcomes. Therefore, ABLAZE will adopt a comprehensive strategy by incorporating foundational knowledge into the design of an experimental phantom. This phantom will be used to evaluate a real-time monitoring method for MWA.