

Intraoperative molecular analysis to guide brain tumor surgery

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Mass spectrometry provides multiple options for the direct characterization of tissue to support surgical decision-making. Using ambient ionization mass spectrometry (MS), we rapidly detect tumor metabolites such as 2-hydroxyglutarate, fatty acids, and lipids from surgical tissue without complex or time-consuming preparation. The method was validated by correlating 2D mass spectrometry imaging (MSI) of brain tumor specimens with histopathology and MRI, and used to detect tumor tissue within seconds to minutes. Imaging tissue sections with ambient MS shows that molecular signatures overlap with areas of tumor, and reveal diagnostic features in gliomas and meningiomas. We have installed a mass spectrometer in the Advanced Multimodality Image Guided Operating (AMIGO) suite at Brigham and Women's Hospital and validate the molecular characterization of surgical tissue during brain tumor surgery, and more recently breast conserving surgery for the management of breast cancer. Using matrix assisted laser desorption ionization (MALDI) MSI we can further detect specific peptide and protein hormones in tumors of the pituitary gland during surgery for the lateralization and more specific localization of functioning and non-functioning adenomas.