NEURO-Oncology

ORAL PRESENTATIONS

PL01 ARTIFICIAL INTELLIGENCE IN NEURO-Oncology (AND BEYOND)

PL01.3.A. RADIOMIC FEATURES AND DNA METHYLATION ATTRIBUTES IN PRIMARY CNS Lymphoma

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BACKGROUND: Clinical and laboratory markers have been exploited to model risk in patients with primary CNS lymphoma (PCNSL), but the development of risk models does not fully exploit this potential. Here we present an extended framework of phenotype-epigenotype correlations that reveal novel prognostic constellations and enable prioritizing epigenetic therapy. MATERIAL AND METHODS: In this prospective discovery and validation study, we leverage radiomic features and analysis of medical images and supervised bioinformatic integration of DNA methylation profiles. We integrate both data modalities synergistically using machine learning-based prediction and cross-domain alignment. Ultimately, we validate the most relevant biological associations in tumor tissues of cell line. RESULTS: We leverage a cohort of 191 patients across 9 sites in Austria and an external validation site in South Korea, and use T1-weighted contrast-enhanced magnetic resonance imaging to derive a radiomic score that consists of 20 mostly textural features. We determine the risk score as strong and independent predictive factor (multivariate HR=6.56), and confirm its prognostic value in an external validation cohort. Radiomic features align with DNA methylation sites in distinct, biologically meaningful ways. Integrating radiomic risk with DNA methylation risk results in improved survival and is reflected at the level of DNA methylation in PCNSL. Assessing risk and selecting epigenetic treatment based on imaging phenotypes represents a huge step forward, and the ability to define radiomic risk groups provides a concept on which to advance prognostic modeling and precision therapy for this aggressive brain cancer.

PL01.4.A. THE RELATIONSHIP BETWEEN NEURONAL ACTIVITY AND FUNCTIONAL NETWORK PROPERTIES IN GLIOMA PATIENTS


BACKGROUND: Glioma is associated with pathologically high neuronal activity around the tumor, which associates with faster tumor progression in patients. Concurrently, patients with glioma have local and contralateral homologue regions in patients and compared these to averaged values in HC. Linear mixed models were used to relate nodal CC and EC to local BRP. Results were corrected for multiple comparisons and deemed significant at alpha 0.05. RESULTS: The peritumoral area was significantly more active than the non-peritumoral homologue in patients, and showed pathologically higher activity compared to HC. Pathologically high neuronal activity was restricted to the peritumoral areas and not found in the contralateral homologue. However, patients’ functional network was disturbed throughout the tumor in terms of pathologically high clustering, but not with regards to centrality. Furthermore, functional network properties relate to each other has yet to be investigated. CONCLUSION: How local neuronal activity and nodal network properties relate to each other and locally altered integrative connectivity (for instance assessed using conventional techniques of intraoperative fresh frozen section, Stimulated Raman Histology (SRH) was introduced as novel technique providing high-resolution digital images of unprocessed tissue samples directly in the operating room comparable to conventional histopathological images. Additionally, SRH images are fast and easily accessible by neuropathologists. Recently, first data showed promising results on the accuracy and feasibility of SRH in comparison to conventional H&E staining. MATERIAL AND METHODS: In a time period of 4 months, patients with different brain or spinal tumors who underwent neurosurgical resection or open/stereotactic biopsy at the Dept. of Neurosurgery, Medical University Vienna were included in this study. Tumor tissue samples were collected intraoperatively whenever safely possible for analyses with SRH. Subsequently, unprocessed tissue samples were scanned by SRH, and intraoperative histopathological images were created directly in the operating room within a few minutes. All collected tissue samples were then sent for routine neuropathological workup. In an overall analysis, SRH images and H&E staining of all patients were analyzed separately by two board certified neuropathologists. Information on age, localization and suspected diagnosis was provided in each case in order to simulate the situation of intraoperative fresh frozen section. In a next step the technical feasibility and diagnostic accuracy of SRH was calculated. RESULTS: In this study, tissue samples of 95 patients who underwent neurosurgical resection or open/stereotactic biopsy of different brain and spinal tumors were collected intraoperatively and analyzed by SRH. In total, 31 gliomas, 30 meningiomas, 19 metastases, 7 neurinomas and 8 rare tumors were analyzed. In the present study the use of SRH was technically feasible in all cases and could be easily integrated in the neurosurgical workflow to provide rapid digital histopathological images for the analyzing neuropathologists. According to our data, SRH provided high diagnostic accuracy (>95%) in the investigated different brain and spinal tumors. CONCLUSION: Based on our preliminary data the technical use of SRH is feasible and showed a high rate of diagnostic accuracy in a large series of different brain and spinal tumors. By using this promising technique, we intend to modernize intraoperative histopathological assessment by providing rapid digital images of brain and spinal tumors to optimize the management of these patients.

PL01.5.A. TOWARDS MODERNIZING INTRAOPERATIVE HISTOPATHOLOGICAL ASSESSMENT IN BRAIN AND SPINAL TUMORS - COMPARISON OF THE NOVEL STIMULATED RAMAN HISTOLOGY WITH CONVENTIONAL H&E STAINING


BACKGROUND: By intraoperative analysis of fresh frozen sections, neuropathologists provide important information of different brain and spinal tumors to the neurosurgeon during surgery. This facilitates characterization of these tumors intraoperatively to optimize the surgical strategy and patient management. However, intraoperative histopathological assessment using conventional techniques of intraoperative fresh frozen section, Stimulated Raman Histology (SRH) was introduced as novel technique providing high-resolution digital images of unprocessed tissue samples directly in the operating room comparable to conventional histopathological images. Additionally, SRH images are fast and easily accessible by neuropathologists. Recently, first data showed promising results on the accuracy and feasibility of SRH in comparison to conventional H&E staining. MATERIAL AND METHODS: In a time period of 4 months, patients with different brain or spinal tumors who underwent neurosurgical resection or open/stereotactic biopsy at the Dept. of Neurosurgery, Medical University Vienna were included in this study. Tumor tissue samples were collected intraoperatively whenever safely possible for analyses with SRH. Subsequently, unprocessed tissue samples were scanned by SRH, and intraoperative histopathological images were created directly in the operating room within a few minutes. All collected tissue samples were then sent for routine neuropathological workup. In an overall analysis, SRH images and H&E staining of all patients were analyzed separately by two board certified neuropathologists. Information on age, localization and suspected diagnosis was provided in each case in order to simulate the situation of intraoperative fresh frozen section. In a next step the technical feasibility and diagnostic accuracy of SRH was calculated. RESULTS: In this study, tissue samples of 95 patients who underwent neurosurgical resection or open/stereotactic biopsy of different brain and spinal tumors were collected intraoperatively and analyzed by SRH. In total, 31 gliomas, 30 meningiomas, 19 metastases, 7 neurinomas and 8 rare tumors were analyzed. In the present study the use of SRH was technically feasible in all cases and could be easily integrated in the neurosurgical workflow to provide rapid digital histopathological images for the analyzing neuropathologists. According to our data, SRH provided high diagnostic accuracy (>95%) in the investigated different brain and spinal tumors. CONCLUSION: Based on our preliminary data the technical use of SRH is feasible and showed a high rate of diagnostic accuracy in a large series of different brain and spinal tumors. By using this promising technique, we intend to modernize intraoperative histopathological assessment by providing rapid digital images of brain and spinal tumors to optimize the management of these patients.

PL01.6.A. RADIOIMICS OUTPERFORMS SEMANTIC FEATURES FOR PREDICTION OF RESPONSE TO STEREOTACTIC RADIOSURGERY IN BRAIN METASTASES

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BACKGROUND: Brain metastases show different patterns of contrast enhancement, potentially reflecting hypoxic and necrotic tumor regions with reduced radiosensitivity. An objective evaluation of these patterns might