AND METHODS: We retrospectively evaluated 42 patients with histological diagnosis of MB, known molecular subgroup, and diagnostic MRI scan performed in our Institution on a 3 Tesla magnet. For each patient, FLAIR, ADC, T2 and contrast-enhanced MPRAGE sequences were analysed. Solid tumor volumes were segmented semiautomatically. 107 features were extracted for each sequence (Pyradiomics, Python). Features were tested for stability against labelling variations, selecting those presenting Intraclass Correlation Coefficient (ICC)>0.9 across all labelling variations and all sequences. Among the remaining features, relevant features were selected with an all-relevant wrapper algorithm (Boruta, R). Remaining features were used to predict MB subgroup with a Random Forest algorithm(R). The most relevant features were ranked based on Gini index (R). RESULTS: 83/107 features presented ICC >0.9 for all sequences. Boruta selected 10 features. Classification analysis yielded an out-of-bag (OOB) error rate of 0.6%, (99.4% accuracy). The most relevant features for classification were "simple" first-order features such as volume, major axis or shape. CONCLUSION: This radiomic study yielded robust features, which showed high accuracy in predicting the molecular MB subgroups. Random forest algorithms are ideal for multiclass classification (eg. MB subgroups) and are intrinsically suited against overfitting. The most relevant for molecular classification were first-order features.

IMG-20. RADIOMIC FEATURES IMPROVE PROGNOSTICATION OVER CONVENTIONAL MR DERIVED QUALITATIVE DESCRIPTORS IN PEDIATRIC SUPRATENTORIAL HIGH GRADE GLIOMA: COMPARISON OF MACHINE LEARNING TECHNIQUES

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PURPOSE/OBJECTIVES: Pediatric supratentorial high-grade glioma (stHGG) is a biologically heterogeneous disease defined by unique mutations, natural history and prognosis. Prior work by our group outlined a role for qualitative imaging features in aiding prognostication. We build on that work by evaluating the prognostic utility of radiomic features (RM) when paired with clinical factors. MATERIALS/METHODS: Ninety-one patients age < 21 years with stHGG treated between 1980–2007 were retrospectively reviewed. Prognostic clinical, qualitative imaging (Visually AcceSAble Rembrandt Images, VASARI), and treatment characteristics were evaluated in concert with manual and automatically segmented (DeepMedic), tumor-derived semi-quantitative radiomic features (Pyradiomics) extracted from MR images. Prognostic RM were limited to stable imaging features which were subsequently selected using bootstrapped least absolute shrinkage and selection operator (LASSO). Nonparametric descriptive statistics and prognostication model evaluation, incorporating RM and clinical variables, were developed using random forest (RF), Cox proportional hazards (CPH), and deep learning (deepsurv) algorithms and assessed for goodness of fit using (c-index). RESULTS: A subset (N=80) of 386 intensity, shape, and texture derived RM were stable between pre-treatment MR. 28 RM features were independently predictive of survival when compared to models utilizing combinations of clinical, VASARI and had comparable model fit statistics. CPH, RF and deepsurv showed comparable utility in modelling RM features. Combined modelling of clinical, VASARI and RM features using CPH, RF, and deepsurv resulted in c-indices of 0.68, 0.67, 0.68, respectively. CONCLUSION: RM features are stable and independently prognostic. Combined modelling of clinical, VASARI, and RM features improves prognostication in stHGG.

IMG-21. PROSPECTIVE PREOPERATIVE DETERMINATION OF ISOCITRATE DEHYDROGENASE MUTATION IN GLIOMAS USING SPECTRAL EDITING MAGNETIC RESONANCE SPECTROSCOPY

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BACKGROUND: Gliomas are the most common malignant brain tumors in children and adults. A subset of these tumors harbour mutations in the enzyme isocitrate dehydrogenase (IDH) which produces the novel oncometabolite *2-hydroxyglutarate* (2HG). In general, patients with an IDH mutant glioma have a longer survival—often necessitating more re-treatment sessions over the span of a patient's life and surveillance monitoring for tumor recurrence. The need to non-invasively detect early evidence of tumor recurrence is therefore heightened in this unique subset of patients with extended survival. As magnetic resonance spectroscopy (MRS) has been demonstrated to measure biochemical components of intracranial tumors using MRI, we conducted a study in 58 pre-operative adult patients to determine if a diagnosis of IDH mutant glioma could be made confidently using imaging data. METHODS: Patients underwent neuroimaging for diagnosis or preoperative planning on a 3 tesla MR scanner. A MEGA-PRESS spectral editing technique was employed. Imaging findings were directly compared to post-operative histopathologic diagnosis. RESUTLS: For all patients with gliomas from grade II to IV, detection of 2-HG with MEGA-PRESS sequence had a sensitivity between 48% and 81%, specificity between 60% and 100%, PPV between 53% and 100% and NPV between 77% and 85% depending on the CRLB threshold. Among the different metabolite ratios, a 2-HG/NAA ratio >0.034 had the highest sensitivity and specificity, 86% and 73% respectively. DISCUSSION: Magnetic resonance spectroscopy (MRS) is an underused advanced MR technique that deserves consideration in pediatric neuro-oncology given its utility in non-invasively detecting malignant gliomas.

IMG-22. A DEEP LEARNING MODEL FOR AUTOMATIC POSTERIOR FOSSA PEDIATRIC BRAIN TUMOR SEGMENTATION: A MULTI-INSTITUTIONAL STUDY

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BACKGROUND: Brain tumors are the most common solid malignancies in childhood, many of which develop in the posterior fossa (PF). Manual tumor measurements are frequently required to optimize registration into surgical navigation systems or for surveillance of nonresectable tumors after therapy. With recent advances in artificial intelligence (AI), automated MRI-based tumor segmentation is now feasible without requiring manual measurements. Our goal was to create a deep learning model for automated PF tumor segmentation that can register into navigation systems and provide volume output. METHODS: 720 pre-surgical MRI scans from five pediatric centers were divided into training, validation, and testing datasets. The study cohort comprised of four PF tumor types: medulloblastoma, diffuse midline glioma, ependymoma, and brainstem or cerebellar pilocytic astrocytoma. Manual segmentation of the tumors by an attending neuroradiologist served as "ground truth" labels for model training and evaluation. We used 2D Unet, an encoder-decoder convolutional neural network architecture, with a pre-trained ResNet50 encoder. We assessed ventricle segmentation accuracy on a held-out test set using Dice similarity coefficient (0–1) and compared ventricular volume calculation between manual and model-derived segmentations using linear regression. RESULTS: Compared to the ground truth expert human segmentation, overall Dice score for model performance accuracy was 0.83 for automatic delineation of the 4 tumor types. CONCLUSIONS: In this multi-institutional study, we present a deep learning algorithm that automatically delineates PF tumors and outputs volumetric information. Our results demonstrate applied AI that is clinically applicable, potentially augmenting radiologists, neuro-oncologists, and neurosurgeons for tumor evaluation, surveillance, and surgical planning.

IMMUNOTHERAPY

IMMU-01. IMMUNE CHECKPOINT INHIBITION FOR PEDIATRIC CNS TUMORS: A SINGLE INSTITUTION EXPERIENCE

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INTRODUCTION: Immune checkpoint inhibition through PD-1 and CTLA-4 blockade has shown efficacy in some adult malignancies and is being investigated in pediatrics. We describe our institutional experience with immune checkpoint inhibition in pediatric CNS tumors. METHODS: We performed a retrospective chart review of patients with recurrent, progressive, or refractory pediatric CNS tumors treated with immunotherapy at Dana-Farber/Boston Children's Hospital between 2018–2019. RESULTS: Eleven patients were identified, with median age of 11 years (range:3–9). Diagnoses included DIPG (n=3), HGG (n=4), ependymoma (n=1), craniopharyngioma (n=1), HGNET (n=1) and NGGCT (n=1). Eight patients had recurrent disease (5 local; 3 disseminated); three had refractory disease (non-recurrent). Nine patients were treated with combination