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LGG-41. DECODING PEDIATRIC LOW-GRADE GLIOMA TRAJECTORIES: DEEP LEARNING-BASED VOLUMETRICS FOR PATIENTS UNDER SURVEILLANCE
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BACKGROUND: Pediatric low-grade gliomas (pLGGs) have heterogeneous clinical presentations and prognoses. Given the morbidity of treatment, suspected pLGGs are surveilled without treatment, though the natural histories of these tumors have yet to be systematically studied. METHODS: We conducted a pooled, retrospective study of pLGG patients diagnosed between 1992 and 2020 from two sources (Dana-Farber Cancer Institute/ Boston Children’s Hospital and the Children’s Brain Tumor Network), who were surveilled untreated for at least one-year post-diagnosis and who had linked clinical data and longitudinal MRI available. We applied a validated pLGG deep learning segmentation algorithm to longitudinal T2-weighted MRIs and calculated the 3-dimensional volumes at each timepoint. We evaluated individual tumor trajectories, treatment initiation, and clinical risk factors for radiographic progression and regression (defined as volumetric change >25% and <=-25% respectively) with univariable and multivariable logistic regression. Unsupervised time-series K-means and density-based spatial clustering with dynamic time wrapping were conducted to uncover volumetric phenotypes and a statistical time-series algorithm with auto-regressive integrated moving average was evaluated to predict future volumetric changes. RESULTS: Of 1774 scans from 129 patients (median follow-up of 4.0 years), baseline tumor median volume was 5.8 cm³ (range: 0.01-108.1), with 33 cortical (25.5%), 21 brainstem (16.2%), and 21 (16.2%) cerebellar locations. At the last follow-up, 33.8% of tumors progressed, 35.8% were stable, and 30.2% had regressed. Treatment was initiated for 46.5% of the tumors, of which 70.4% underwent surgery. Risk factors such as adolescent age, larger baseline volume size, cortical location and symptomatic presentation were most associated with progression (p<0.05 for each). Clustering revealed three distinct volumetric phenotypes with divergent natural histories, corresponding to progression, stability or regression. The forecasting showed average root-mean-squared error values of >1 cm³ at testing. CONCLUSIONS: Deep learning auto-segmentation enables longitudinal, volumetric tracking of pLGG, yielding novel insights into the clinical trajectories of untreated tumors on surveillance.