A multimodal imaging-based classification for pediatric diffuse intrinsic pontine gliomas

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Abstract

Object: Pediatric diffuse intrinsic pontine glioma (DIPG) is a radiologically heterogeneous disease entity, here we aim to establish a multimodal imaging-based radiological classification and evaluate the outcome of different treatment strategies under this classification frame.

Methods: This retrospective study included 103 children diagnosed with DIPGs between January 2015 and August 2018 in Beijing Tiantan Hospital (Beijing, China). Multimodal radiological characteristics, including conventional magnetic resonance imaging (MRI), diffuse tensor imaging/diffuse tensor tractography (DTI/DTT), and positron emission tomography (PET) were reviewed to construct the classification. The outcome of different treatment strategies was compared in each DIPG subgroup using Kaplan-Meier method (log-rank test) to determine the optimal treatment for specific DIPGs.

Results: Four radiological DIPG types were identified: Type A ("homocentric", n=13), Type B ("ventral", n=41), Type C ("eccentric", n=37), and Type D ("dorsal", n=12). Their treatment modalities were grouped as observation (43.7%), cytoreductive surgery (CRS) plus radiotherapy (RT) (24.3%), RT alone (11.7%), and CRS alone (20.4%). CRS+RT mainly fell into type C (29.7%), followed by type B1 (21.9%) and type D (50%). Overall, CRS+RT exhibited a potential survival advantage compared to RT alone, which was more pronounced in specific type, but this did not reach statistical significance, due to limited sample size and unbalanced distribution.

Conclusion: We proposed a multimodality imaging-based radiological classification for pediatric DIPG, which was useful for selecting optimal treatment strategies, especially for identifying candidates who may benefit from CRS plus RT. This classification opened a window into image-guided integrated treatment for pediatric DIPG.

Keywords: classification; cytoreductive surgery; diffuse intrinsic pontine glioma; multimodal imaging; prognosis.