

Eur Radiol. 2024 Dec 10. doi: 10.1007/s00330-024-11264-8. Online ahead of print.

A predictive model for cerebellar mutism syndrome based on lesion map in children with medulloblastoma

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PMID: 39658685 DOI: [10.1007/s00330-024-11264-8](https://doi.org/10.1007/s00330-024-11264-8)

Abstract

Background: This study aimed to establish a voxel-based map to predict the occurrence of cerebellar mutism syndrome (CMS) and investigate the relationship between CMS and motor dysfunction.

Method: This multicenter study cohort included 224 patients diagnosed with medulloblastoma at Beijing Children's Hospital (n = 88) and Beijing Tiantan Hospital (n = 136). The dataset was randomly divided into training (n = 95), test (n = 41), and validation (n = 88) datasets. Voxel-based lesion-symptom mapping (VLSM) was used to identify the corresponding tumoral voxels for CMS and motor dysfunction. A prediction model was constructed based on the VLSM results.

Results: The two cohorts showed significant differences in hydrocephalus (58.0 vs. 32.4%, $p < 0.001$), paraventricular edema (83.0 vs. 59.6%, $p < 0.001$), and presurgical ventricular-peritoneal shunt placement (53.7 vs. 10.2%, $p < 0.001$). The CMS group had a significantly higher rate of hydrocephalus than the non-CMS group (54.6 vs. 33.1%; $p = 0.002$). VLSM revealed that the left inferior cerebellar peduncle (32.26%), right dentate gyrus (24.23%), and right X lobule (21.79%) were the most impaired structures associated with CMS. CMS-related areas overlapped with motor planning and verbal fluency regions, while areas associated with motor dysfunction overlapped with motor planning. The prediction model achieved areas under the curve of 0.733, and 0.702 for the testing and external validation datasets, respectively.

Conclusions: VLSM-based models are used to predict CMS occurrence prior to surgery. CMS was related to motor planning and verbal fluency regions of the cerebellum. Motor dysfunction was associated with CMS functionally.

Key points: Question Cerebellar mutism syndrome (CMS) is a severe postoperative complication of medulloblastoma for which the specific responsible anatomical correlates remain unclear. Findings We identified areas associated with CMS in Voxel-based Lesion-Symptom Mapping (VLSM), which were used to establish the CMS predicting model. Clinical relevance VLSM analysis helps develop a reliable predictive model for CMS and explore its association with motor dysfunction, The establishment of this model will facilitate the prediction of CMS in clinical practice.

Keywords: Akinetic mutism; Cerebellum; Medulloblastoma; Models.

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