Delayed diagnosis of diffuse leptomeningeal glioneuronal tumour in a young child presenting with communicating hydrocephalus

Nikhil Kumar, Ali Nael, Mariko Sato, John Ross Crawford

DESCRIPTION
A previously healthy toddler presented with 4 weeks of fatigue, ataxia, headaches and intermittent vomiting without focal neurological deficits on presentation. CT demonstrated ventriculomegaly with communicating hydrocephalus. MRI confirmed findings of communicating hydrocephalus with transependymal oedema (figure 1A,B) and a ventriculoperitoneal shunt was placed.

Six months after initial presentation, the patient presented with 1 day of worsening lethargy and emesis requiring emergent intubation. Examination revealed increased lower extremity tone with hyper-reflexia. Head CT showed interval decompression of the ventricles (not shown). Given the acute encephalopathy, a video electroencephalography was performed demonstrating subclinical electrographic seizures that were successfully treated with levetiracetam. MRI brain revealed diffuse leptomeningeal enhancement (figure 1C,D) that was present in retrospect on initial brain MRI (figure 1B). T2-weighted sequences demonstrated non-enhancing mass-like cystic changes in the mesial temporal lobes and cerebellum with a prominence of cerebellar folia (figure 1E,F). MRI spine demonstrated an intramedullary spinal cord mass at T7–T11 (figure 1G) with patchy enhancement and diffuse spinal cord enhancement. The pattern of neuroradiographic findings were most concerning for a diffuse leptomeningeal glioneuronal tumour (DLGNT). The patient underwent subtotal resection of the thoracic tumour where microscopic findings revealed a low-grade glial tumour with a prominent myxoid pattern consistent with histological diagnosis of pilomyxoid astrocytoma (figure 2A,B). Immunohistochemistry revealed a low K-67 proliferative index and immunoreactivity for Olig 2 (figure 2C,D). Chromosomal analysis demonstrated a 7q34 duplication consistent with a BRAF KIAA-1549 fusion. Methylation studies confirmed the initial neuroradiographic diagnostic impression providing an integrated molecular diagnosis of DLGNT methylation class 1 (MC-1) and chemotherapy was initiated.

DLGNTs typically present in men at a median age of 4 years old. Morphologically, they present as a plaque-like subarachnoid tumour composed of sheets of small round cells. These tumours radiographically present with abnormal nodular leptomeningeal thickening and enhancement of basal cisterns, posterior fossa and spinal cord, typically without a specific intraparenchymal focus.

Figure 1 Neuroimaging features of diffuse leptomeningeal glioneuronal tumour (DLGNT) at initial and subsequent presentation. (A) T1-weighted, postgadolinium MRI sequences at presentation revealed hydrocephalus without obvious leptomeningeal enhancement (A–B). Six months post initial presentation and VP shunt revealed more extensive diffuse leptomeningeal enhancement on post T1 gadolinium three-dimension magnetization-prepared rapid gradient-echo sequences (C–D) that in retrospect was present on the original scan (B arrow). T2-weighted sequences reveal prominent cystic changes in the mesial temporal lobe and cerebellum with prominence of cerebellar folia (E–F, arrows). MRI spine revealed a large cystic intramedullary thoracic tumour (G arrow) that was contrast enhancing and associated with diffuse spinal leptomeningeal enhancement (H arrow) consistent with a neuroradiographic appearance of DLGNT.
however, intraparenchymal lesions can be found in the spinal cord. Immunohistochemical staining is typically positive for OLIG2, MAP2 and S-100. A common chromosomal abnormality is the BRAF KIAA-1549 fusion caused by 7q34 duplication. 5-7 DLGNT MC-1 tumours tend to be diagnosed at a younger age and are less aggressive than DLGNT methylation class 2 (MC-2) tumours. 8 Patients with DLGNTs tend to have a worse prognosis if they have an elevated Ki-67, are over 9 years old, have evidence of hydrocephalus, have an intraparenchymal tumour and anaplastic histology. 9

Therapies for DLGNT are non-standardised and have historically included chemotherapy and/or radiation therapy. 10-13 Carboplatin, vincristine and temozolomide have been among the most commonly used regimens with reported stable disease or minimal response in some patients. 13 Recurrent 1p deletion and MAPK/ERK pathway activation of DLGNT suggests that targeted therapies including MEK inhibitors may be potential therapeutic option and will likely be a focus for future clinical trials.

DLGNT can be easily missed on initial evaluation since patients may not have findings typically attributed to a spinal lesion and may only present with vague symptoms of increased intracranial pressure with hydrocephalus, highlighting the importance of obtaining neuroimaging of the entire cranio-spinal axis in patients with non-communicating hydrocephalus. Previous cases have been reported of DLGNT being misdiagnosed as meningitis or other infectious aetiologies, 14 so it is important to include DLGNT in cases of unusual patterns of leptomeningeal enhancement. Our case adds to the growing literature on DLGNT in association with delayed diagnosis and highlights the role of methylation in tumour diagnosis and classification.

### Learning points

- **Diffuse leptomeningeal glioneuronal tumours (DLGNTs)** typically present with abnormal nodular leptomeningeal thickening and enhancement in the basal cisterns, posterior fossa and along the spinal cord that may mimic infectious aetiologies and lead to delayed diagnosis.
- **Craniospinal neuroimaging should be considered in patients presenting with non-communicating hydrocephalus of unknown aetiology.**
- **Methylation analysis may be useful for DLGNT diagnosis and classification of subtypes.**

### Contributors

NK was responsible for the design and writing of the case report. AN was responsible for the design and writing of the case report. MS was responsible for the design and writing of the case report. IRC was responsible for the design and writing of the case report.

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### Patient consent for publication

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### References
