Diffuse astrocytoma with protoplasmic pattern: MR imaging features of low grade infiltrative glial tumours

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Section: Neuroradiology
Area of Interest: Neuroradiology brain
Procedure: Imaging sequences
Imaging Technique: MR
Imaging Technique: CT
Special Focus: Neoplasia Case Type: Clinical Cases
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Patient: 56 years, male

Clinical History:

56-year-old male patient presented with partial seizures and progressive onset of focal neurological deficits over the last 8 months. No relevant past medical history.

Imaging Findings:

Axial CT image demonstrated a hypoattenuating mass lesion in the right cerebral hemisphere, with discrete mass effect on the adjacent falx cerebri and the ipsilateral cortical sulci (Fig 1a, b).

MRI confirmed the presence of an inhomogeneous T1 hypointense, T2 hyperintense intraaxial expansile mass lesion, with broad cortical involvement and subcortical extension towards the deep white matter. There was a prominent central cystic component that suppressed signal on the FLAIR sequence. No significant contrast enhancement was noticed (Fig 2a-e).

Advanced MRI showed no restricted diffusion of the solid component, no elevated perfusion and no evidence of intralesional susceptibility signal on SWI mIP. MR spectroscopy revealed a mildly elevated choline: creatine ratio, preserved MII and NAA peaks, and relative absence of lipids and lactate peaks (Fig. 3a, b, 4, 5, 6).

Conventional and advanced MRI sequences were highly suggestive of a low-grade cystic neoplasm. Diffuse astrocytoma was favoured over oligodendroglioma.

Histopathological analysis revealed diffuse astrocytoma with protoplasmic features.

Discussion:

Diffuse astrocytomas are well differentiated, slow-growing primary brain neoplasms that tend to invade surrounding tissues. [5] They are grade II (2016 WHO Classification) and encompass 3 main subtypes: fibrillary, protoplasmic and gemistocytic. Protoplasmic astrocytoma represents a rare pattern of diffuse astrocytoma (6%). According to the
2016 update of the WHO classification of CNS tumours, however, protoplasmic and fibrillary astrocytomas are no longer recognised as distinct entities. [11]

Low-grade infiltrative astrocytomas have a higher incidence in younger adults. [5] Clinical symptoms are usually nonspecific and relate to tumour location, parenchymal mass effect and changes in the intracranial pressure, ranging from focal seizures (40%) to headaches and personality changes. [8]

On histology, diffuse astrocytomas show low cellularity composed of neoplastic astrocytes with prominent nuclei and mild atypia, that appear embedded in a matrix of microcystic spaces and mucoid degeneration. [8] Typically, there is no necrosis or microvascular proliferation. [7]

IDH status determination is important. [10] Absence of mutation (IDH wild type) correlates with a worse prognosis. 1p19q co-deletion is seen in oligodendroglioma. [10]

At CT, lesions appear of low attenuation, have little mass effect on adjacent structures and typically show no significant contrast enhancement. [9] Calcifications are not frequent (15-20%) and when present suggest an associated oligodendrogial component.

MRI is the imaging method of choice. T2 hyperintense mass lesions with prominent cortical involvement and associated multiseptated microcystic spaces that suppress signal on the FLAIR sequence, are characteristic features of diffuse astrocytoma with protoplasmic pattern, that however overlap with other entities (oligodendroglioma, DNET). [9]

Advanced MR techniques are crucial in the preoperative tumour staging. Absence of restricted diffusion suggests low cellularity. SWI can demonstrate the presence of internal vasculature, microhaemorrhage and calcifications. [2] Intravoxel susceptibility signal correlates with perfusion imaging parameters and with the histological grade of gliomas. [3] Absence of hypointense signal on the SWI is a typical feature of low grade gliomas. [4]

DSC perfusion imaging relates to the microvascular density of lesions. [3] CBV is typically low, in keeping with absent neovascularity in low grade tumours. [1]

MR spectroscopy demonstrates a typical pattern of a mildly elevated choline peak, preserved MI and NAA peaks, and absence of lipids and lactate. [9]

Surgical resection with or without adjuvant chemoradiotherapy is the treatment of choice and may be curative. Low grade gliomas overall have a good prognosis. [6] The gemistocytic form is more prone to progress to higher grades, and therefore entails a worse prognosis than the fibrillary and protoplasmic forms.

Differential Diagnosis List: Diffuse astrocytoma NOS with protoplasmic pattern, Diffuse astrocytoma, Cystic oligodendroglioma, Dysembryoplastic neuroepithelial tumour (DNET)

Final Diagnosis: Diffuse astrocytoma NOS with protoplasmic pattern

References:


Description: Axial NECT: hypodense lesion in the right cerebral hemisphere, with discrete mass effect on the adjacent falx cerebri and the ipsilateral cortical sulci. Origin: University Hospital Salamanca
Description: CECT: no significant enhancement. No evidence signs of acute haemorrhage or calcification. Origin: University Hospital Salamanca
Description: T1-W FSE: heterogeneous hypointense signal. Origin: University Hospital Salamanca
Description: Axial T2-W: Hyperintense intraaxial expansile mass lesion with broad cortical involvement. There is a prominent central cystic component with dark linear septations. Origin: University Hospital Salamanca
Description: The central cystic component completely suppresses signal intensity on the FLAIR sequence. Origin: University Hospital Salamanca
Description: Sagittal T1 FSE: the lesion is located in the right parietal lobe. Origin: University Hospital Salamanca
Description: Axial T1-W PostGd:
No evidence of enhancement. Origin: University Hospital Salamanca
Figure 3

Description: DWI (b1000) Origin: University Hospital Salamanca
Description: Apparent Diffusion Coefficient (ADC): No signs of restricted diffusion of the solid component. Central cystic component with facilitated diffusion. Origin: University Hospital Salamanca
Description: Postprocessed SWI with mIP reconstruction: No hypointense intralesional signal intensity to suggest calcification, haemosiderin or iron deposition. Origin: University Hospital Salamanca
**Description:** CBV Map (DSC) coregistration with T2: no elevated perfusion. **Origin:** University Hospital Salamanca
Description: HMRS: Mildly elevated choline: creatin ratio, absence of lipids and lactate. Origin: University Hospital Salamanca