
Neuroimaging Highlight

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Concurrence of High-Grade Brainstem Glioma and Multiple Sclerosis

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A 50-year-old woman presented with subacute onset of headache, tinnitus, vertigo, emesis, diplopia and right-sided limb paresthesias. She had a known diagnosis of relapsing remitting multiple sclerosis (MS) but had remained stable after her first attack seven years earlier. She was on no disease modifying agents or immunosuppressants. Examination disclosed right gaze-evoked nystagmus, partial right sixth nerve palsy, right facial hypoesthesia, left-sided hyperreflexia and spasticity, and

an ataxic gait. Magnetic resonance imaging (MRI) demonstrated a ponto-medullary-cervical lesion that, on review, was present six years prior (Figure 1). Given the patient's history and the radiographic appearance of the lesion, the differential diagnosis included a demyelinating plaque or a brainstem neoplasm. The patient improved clinically with high-dose steroid therapy and was discharged home asymptomatic. Biopsy was deferred given the lesion location. Three months after discharge, she had

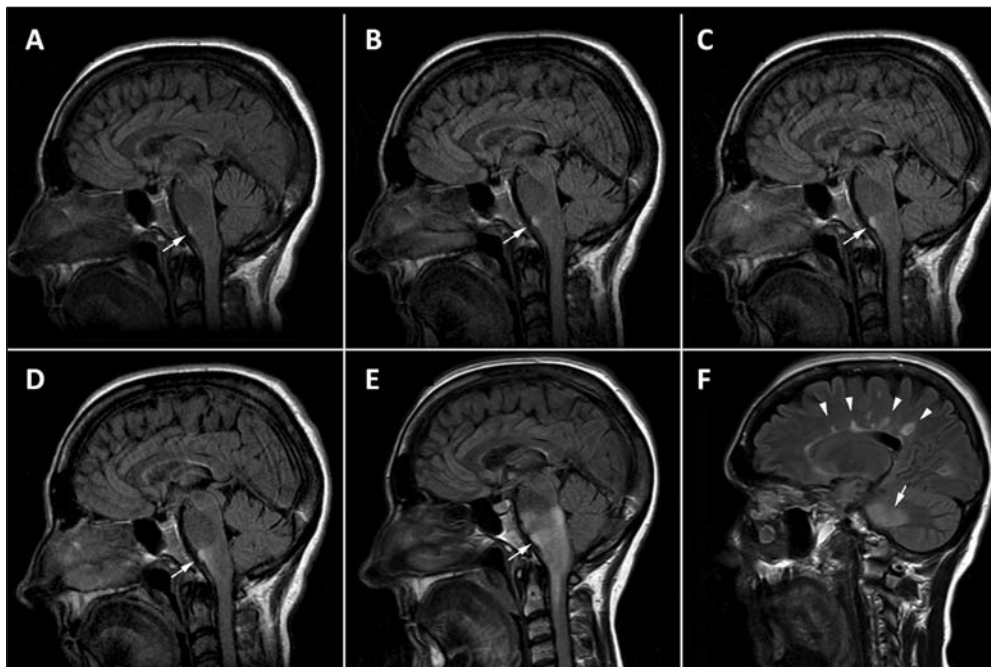


Figure 1: Axial FLAIR brain MR images from 2002 (A), 2003 (B), 2004 (C), 2005 (D) and 2008 (E,F) demonstrate the progression of the ponto-medullary-cervical lesion (arrows). MS changes are seen in the corpus callosum (arrowheads, F). The patient initially presented with a clinically isolated syndrome and multiple scans were performed early in the course to assess for MRI criteria for MS and to facilitate decision making regarding disease modifying therapy.

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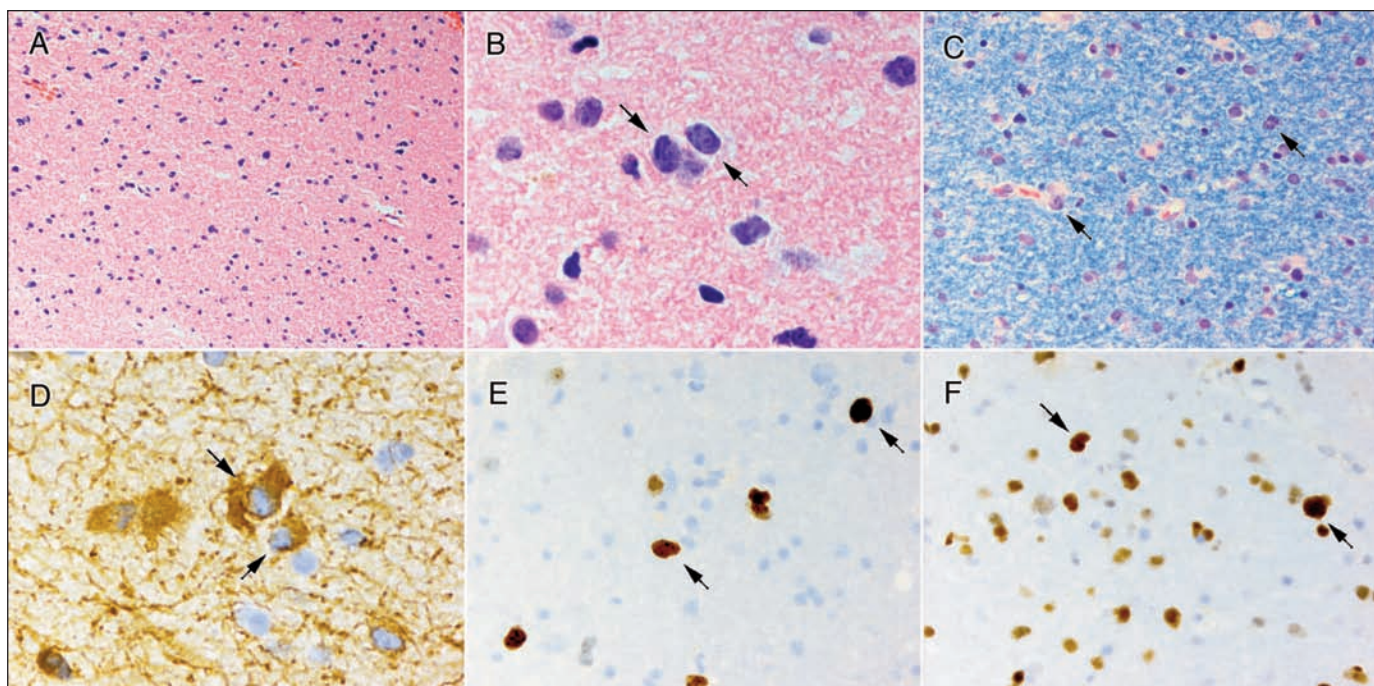


Figure 2: Middle cerebellar peduncle biopsy reveals hypercellularity (A), no demyelination (C) and frequent atypical nuclei (B-F, arrows) of glial origin (D) having increased proliferation (E) and expressing p53 (F), establishing the diagnosis of WHO grade III anaplastic astrocytoma. A,B – hematoxylin and eosin stain; C – Luxol fast blue stain; D – glial fibrillary acidic protein immunostain; E – Ki67 immunostain; F – immunostain for p53 expression.

recurrence of her initial symptoms. However, her symptoms now worsened with valsalva maneuvers. Examination was similar to her initial presentation. Repeat MRI demonstrated increased pontine diameter and slight enhancement of the lesion centrally. Given concerns of raised intracranial pressure, she underwent a posterior fossa decompression and simultaneous biopsy of the middle cerebellar peduncle. Biopsy demonstrated anaplastic astrocytoma (WHO grade III) (Figure 2). She was referred to oncology and treatment was initiated with radiation therapy and concurrent temozolomide.

Concurrence of MS and glioma is uncommon although well documented.¹⁻³ Brainstem gliomas in adults are infrequent, accounting for less than 2% of gliomas.^{4,5} Our case of concurrent high-grade brainstem glioma and MS is unique in the literature. Reported cases of concurrence have described gliomas involving all lobes of the brain, the deep gray matter and the corpus callosum.² Two cases have reported cerebral gliomas extending into the pons but neither were primary brainstem gliomas.^{6,7} Accurate diagnosis is essential as treatment and prognoses differ. Acute MS plaques are treated conservatively with steroids while high-grade gliomas require maximally tolerated radiotherapy and chemotherapy. Overall median survival for brainstem gliomas is 5.4 years; however, malignant brainstem gliomas are resistant to treatment and median survival time is only 11.2 months.^{4,5} Favorable prognostic factors in brainstem gliomas include: age of onset less than 40 years, duration of symptoms before diagnosis greater than three months, Karnofski performance status greater than 70, low-grade histology and absence of contrast enhancement and necrosis on MRI.⁴

As in this case, radiographic differentiation can be difficult and the diagnosis may only become evident with time. Low-grade brainstem gliomas tend to diffusely enlarge the brainstem on MRI, do not show contrast enhancement on T1-weighted images (T1WI) and are hyperintense on T2-weighted images (T2WI).⁴ High-grade gliomas, also hyperintense on T2WI, show contrast enhancement and evidence of necrosis.^{4,8} Acute MS lesions are well-defined hyperintensities on T2WI and are often accompanied by enhancement on T1WI due to blood-brain barrier breakdown.⁹ Anatomic distortion of the brainstem is more common in gliomas than in demyelinating lesions.⁹

Whether the concurrence of multiple sclerosis and glioma represents coincidence or a common etiology remains unclear.¹⁻³ It has been hypothesized that chronic inflammation may lead to destruction of the myelin sheath of nerve fibers and to hyperproliferation of oligodendrocytes and astrocytes.² Hyperplastic astrocytes at the edge of a plaque might result in astrocytic tumor development. However, tumor and plaque are not contiguous in all reported cases.¹

Our case emphasizes the need to evaluate clinical presentation and brain MRI carefully, even in patients with well-documented MS.

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