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CASE REPORT

A case of central nervous system vasculitis presenting as a mass-like lesion

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Abstract

Vasculitis of the central nervous system presenting as a mass lesion is a relatively uncommon occurrence. Even more uncommon is a vasculitis mimicking a demyelinating lesion. We present here an interesting case of a 15-year-old boy who was found to have a mass-like lesion on neuroimaging involving the left subcortical white matter and deep gray matter. The differential diagnosis for this lesion was primary demyelination versus a glial tumor, the former being more favored over the latter. Biopsy of this lesion however revealed findings compatible with a vasculitis, which was unexpected given the neuroimaging findings. To the authors' knowledge, case reports in the English literature of a vasculitic lesion mimicking demyelination are scarce. This case also serves as a reminder of the diagnostic difficulty that arises in a pediatric patient with an initial presentation of mass-like lesion.

Keywords Primary angiitis of the central nervous system (PACNS) · Vasculitis · Mass lesion · Tumor-like lesion · Demyelinating

Introduction

Central nervous system vasculitis is an inflammatory disorder that involves the walls of cerebral blood vessels. When this occurs in isolation (i.e., limited to the brain), the term primary angiitis of the central nervous system (PACNS) is applied [1]. Childhood vasculitis is relatively uncommon. Clinical presentation can be non-specific with both diffuse and focal symptoms such as cognitive decline, seizures, behavior changes, headache, hemiparesis, and sensory loss. The most common presenting features in pediatric PACNS are severe headache and stroke [2, 3]. The magnetic resonance imaging (MRI) brain of PACNS most commonly shows multiple vascular infarcts in multiple vascular territories that are also in various stages of healing; however, there is also a less well-recognized group of patients that present with mass-like lesions on MRI [4, 5]. This latter group represents approximately 5% of PACNS patients and requires clinical suspicion in order to carry out the appropriate investigations necessary in making the diagnosis and providing appropriate prompt treatment [4]. We present here an unusual example of a vasculitic lesion in the central nervous system that not only presented as a mass-like lesion but also appeared to mimic an acute demyelinating process.

Case report

A 15-year-old right hand dominant male presented with 2-month history of progressive right hemibody weakness. The weakness initially began with a right facial droop but then progressed over the course of 1 week to involve the right upper and lower extremity. The family decided to seek medical attention once the weakness began to affect his gait. Further questioning revealed that the patient was also experiencing right hemibody numbness and word finding difficulties. No associated headache, fever, rash, or other systemic features were reported. Past medical history and development history was unremarkable.

Neurological exam was significant for decreased fluency of speech, mild facial asymmetry with flattening of the nasolabial fold and decreased sensation on the right side of his face. Motor exam revealed hyper-reflexia of the right leg, right babinski, and weakness most notably affecting the right elbow extension, wrist extension, and finger abduction/adduction. Sensation to pinprick was decreased on the right arm and leg.

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MRI brain (Fig. 1) revealed a large intra-axial mass (7 cm × 7.1 cm × 7.9 cm), involving the deep gray and white matter structures of the left frontal lobe. The mass demonstrated linear striated enhancement (Fig. 1c) as well as some surrounding vasogenic edema without restricted diffusion. Following the MRI brain, the clinical differential diagnosis included a low-grade glioma, lymphoma, or demyelinating lesion, the latter being favored over the other two. Stealth-guided left frontal craniotomy was therefore performed for open biopsy of the left hemispheric mass.

Histopathological examination (Fig. 2) of the biopsy revealed significant angiocentric collection of chronic inflammatory cells involving the walls of blood vessels. The inflammatory infiltrate was comprised predominantly of CD3 positive T cells (CD4 > CD8) with much fewer CD20 positive B cells along with some histiocytes and a few plasma cells (mix of kappa and lambda immunopositivity). The surrounding parenchyma also consisted of scattered inflammatory cells along with reactive gliosis. Immunohistochemical studies for HSV1, HSV2, CMV, polyomavirus, and VZV and EBV did not reveal any viral inclusions. Luxol Fast Blue staining did not reveal any demarcated areas of demyelination in this biopsy specimen. The biopsy was reviewed independently by three neuropathologists without any influence from one another, and all of concluded that the histological findings were consistent with a vasculitis.

Inflammatory markers (ESR and CRP) were normal at the time of presentation. Positron emission tomography (PET) scan of the body showed no abnormal uptake. PET scan of the brain showed diffuse left cerebral hypometabolism, most in keeping with demyelination or vasculitis/ischemic injury of multiple vascular territories. Additional investigations including CSF analysis, and blood work for autoimmune antibodies were suggested but were declined by the patient and his family. During this acute presentation, the patient was treated primarily as having an acute demyelinating lesion and therefore managed with 5 days of pulse steroids (methylprednisolone 1 g IV daily) followed by tapering with oral steroids. The final biopsy result was available after the patient had been discharged from hospital and prompted further investigations as an outpatient, including CT angiogram (CTA) of the head and neck which was unremarkable, and a repeat MRI brain done at 4, 8, and 10 months post-initial presentation. Despite the patient not being started on any further immunosuppressive therapy, follow-up MRIs continued to show ongoing improvement with reduction of signal changes and no new lesions (Fig. 3).

Discussion

To our knowledge, a central nervous system vasculitis presenting as a mass-like lesion is uncommon, with only rare known case reports in the literature [6, 7]. A mass lesion on neuro-imaging is often feared to be neoplastic in nature, potentially leading to unnecessary surgical resection procedures. Our case is a reminder of non-neoplastic etiologies of mass-like lesions including infectious and inflammatory causes. Our case also demonstrates that a vasculitis involving the central nervous system can be one of these mimickers [8]. The non-specific signs and symptoms of a central nervous system vasculitis can create a diagnostic dilemma for clinicians and potentially lead to diagnostic delay. To make the diagnosis of PACNS, the Calabrese criteria are utilized and include all of the following: an acquired neurological and or psychological symptom, angiographic and/or histological features of vasculitis and the absence of systemic disease that could attribute the findings to a secondary vasculitis [9, 10]. Given the low specificity and sensitivity of vascular imaging (angiography), brain biopsy remains the gold standard to establish a diagnosis [11]. An acute demyelinating lesion was a

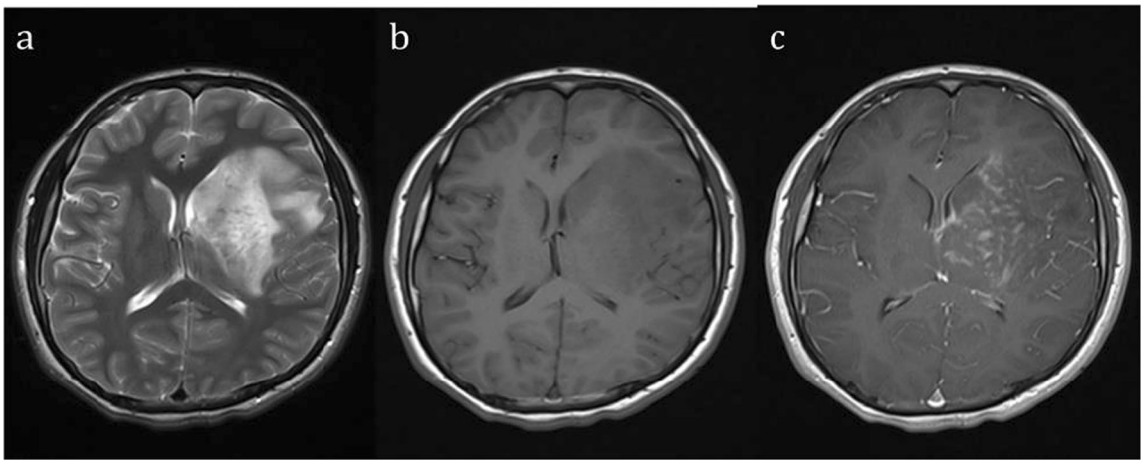

Fig. 1 Initial MRI of the brain. Axial T2-weighted (**a**), axial T1-weighted (**b**), and axial T1-weighted post-gadolinium (**c**) demonstrating a large predominantly intra-axial mass lesion centered around the deep gray and white matter structures of the left frontal lobe. The mass demonstrates linear striated enhancement as well as surrounding vasogenic edema

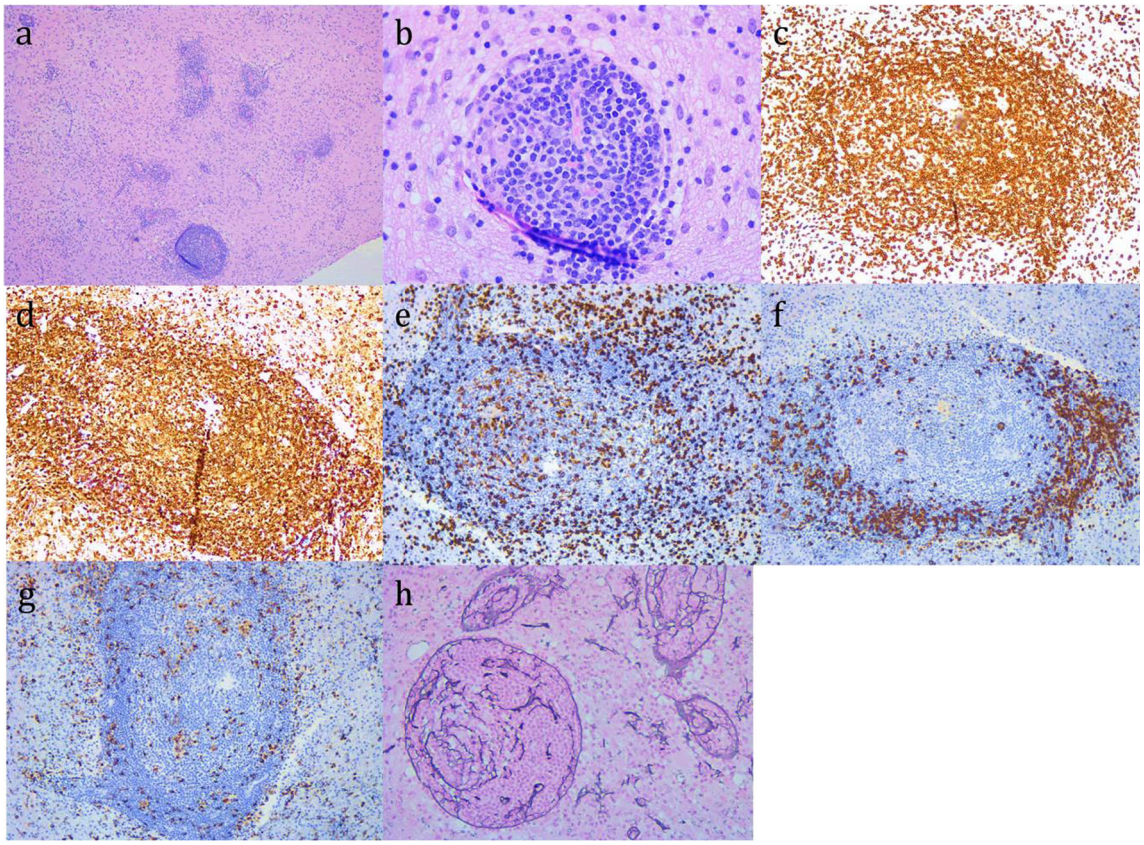

Fig. 2 Low (**a**) and high (**b**) magnification views of blood vessels involved by chronic inflammatory infiltrate comprised primarily CD3-positive T cells (**c**) including both CD4 (**d**) and CD8 (**e**) positive cells as well as CD20-positive B cells (**f**) and CD68-positive macrophages (**g**). Reticulin staining (**h**) confirmed the involvement of the vessels walls by inflammation

major diagnostic consideration in our patient in light of the neuroimaging findings but the biopsy specimen did not reveal evidence of a primary demyelinating lesion.

Childhood PACNS can be categorized in to large-medium vessel and small vessel vasculitis. The former is also referred to by some as angiography-positive vasculitis and said to involve the proximal segment of large cerebral vessels such as the middle cerebral artery, leading to inflammation and edema of the vessel wall and activation of endothelium with subsequent decrease in vessel lumen diameter and decreased blood flow [12, 13]. On angiogram, these blood vessels appear irregular, referred to as "beading" and the lumen of the inflamed segment of vessel narrows. Small vessel vasculitis on the other hand typically involves small muscular arteries,

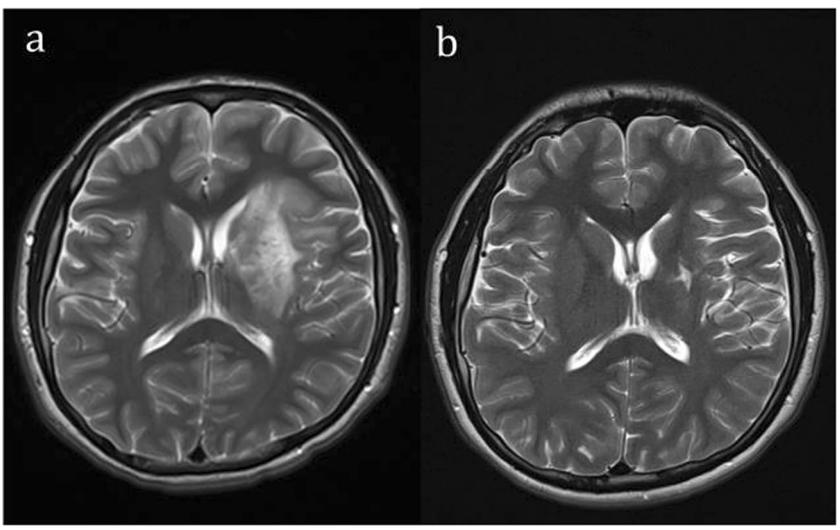

Fig. 3 Follow-up axial T2-weighted MRI 4-months post-op (**a**) demonstrating a decrease in size and mass effect of the lesion. 10-months post-op axial T2-weighted MRI (**b**) demonstrating further decrease in the size of the lesion and volume loss at the previous sight of signal changes

capillaries, and venules and is known as angiography-negative vasculitis since the diameter of these vessels are too small to be detected by conventional magnetic resonance angiography (MRA) or CTA. The imaging modality of choice to detect inflammatory lesions in the brain in this context is MRI although findings can be variable. Lesions are best viewed on T2/FLAIR sequences and may enhance with gadolinium [14]. Neuroimaging findings can be variable and non-specific, thereby making prompt diagnosis difficult. Detailed discussion of the clinical approach and management of the differential diagnoses of CNS vasculitis is beyond the scope of this paper but the interested reader may refer to the excellent reviews by Molloy et al. (2007) and Byram (2018) [15, 16].

Children with PACNS may present with headaches, acute stroke, hemiparesis, gait abnormalities, hemisensory loss and/or fine motor deficits. Inflammatory markers (e.g., ESR, CRP) and CSF findings may be unremarkable. In fact, only up to one third of children with large-medium vessel vasculitis show elevated CSF protein and pleocytosis [17]. Since the diagnosis of vasculitis was unexpected in our patient, other investigations as part of the vasculitic work-up including CTA were performed after the tissue diagnosis. CTA was unremarkable, but additional investigations beyond the CTA were declined by our patient and his family.

Follow-up neuroimaging performed 4, 8, and 10 months post-op in our patient demonstrated successive decreases in size of the left frontal lesion when compared to his pre-operative MRI. Continued improvement was noted with reduction in signal changes within the left frontal white matter, basal ganglia, internal and external capsules, and cerebral peduncles. The patient continues to be followed clinically by neurology and in follow-up he has expressed issues with both his speech and right arm being slower than prior to the initial presentation. These deficits tend to wax and wane in severity and his neurological examination is significant only for mildly dysarthric speech and reduced sensation on the right side of his face. He has not developed any new neurological deficits, nor has he developed any other systemic symptoms.

Differentiating vasculitis from demyelination is of particular importance when it comes to ongoing management of the patient. Both conditions are typically treated with high-dose glucocorticoids in the acute period; however, in progressive PACNS, this is often combined with another immunosuppressant such as cyclophosphamide. Fortunately, our patient responded incredibly well to a course of pulse methylprednisolone, followed by a prednisone taper. His follow-up MRIs demonstrating decrease in size of the left frontal lesion compared to his pre-operative MRI is likely related to the fact that some cases of PACNS are non-progressive monophasic presentations that require a course of steroid treatment alone [3].

Compliance with ethical standards

Conflict of interest The authors have no conflicts of interest to report.

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