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ORIGINAL RESEARCH

A rare case of vasculitis mimicking meningoencephalitis

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Abstract
This case report describes a 47-year-old male presenting with headache, fever, and limb weakness, initially suggestive of meningoencephalitis. Despite comprehensive investigations, including cerebrospinal fluid (CSF) analysis and neuroimaging, infectious and autoimmune causes were ruled out. Magnetic resonance imaging (MRI) revealed multifocal hyperintensities in the brainstem, gangliocapsular regions, and bilateral cerebellar hemispheres, indicative of an inflammatory process. With a negative autoimmune profile and the absence of systemic symptoms, primary angiitis of the central nervous system (PACNS) was suspected. The patient was treated with high-dose intravenous corticosteroids followed by oral prednisone and azathioprine for long-term immunosuppression. Significant clinical improvement was observed, with resolution of headache fever, and marked improvement in limb strength and ocular symptoms. This case underscores the diagnostic complexity of CNS vasculitis, particularly when mimicking meningoencephalitis, and highlights the importance of considering CNS vasculitis as the differential diagnosis. Early recognition and aggressive immunosuppressive therapy are critical in managing this rare condition and preventing irreversible neurological damage.
Keywords: Central Nervous System Vasculitis, Meningoencephalitis, Primary Angiitis of the Central Nervous System (PACNS), Immunosuppressive Therapy, Diagnostic Challenges

Introduction
Central nervous system (CNS) vasculitis is a rare but serious condition characterized by inflammation of the blood vessels within the brain and spinal cord. This inflammation can lead to vessel wall damage, narrowing, or occlusion, resulting in ischemia, hemorrhage, or infarction of the CNS tissue. The clinical presentation of CNS vasculitis is highly variable and can mimic a range of other neurological conditions, making diagnosis particularly challenging. Among these, its presentation can closely resemble that of meningoencephalitis, which is inflammation of the brain and meninges often caused by infectious agents or autoimmune processes. This overlap in clinical presentation can lead to diagnostic confusion and potential delays in appropriate treatment [1,2]. CNS vasculitis can be primary, confined to the CNS, or secondary to systemic vasculitides such as systemic lupus erythematosus (SLE), Behçet's disease, or granulomatosis with polyangiitis. Primary angiitis of the central

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nervous system (PACNS) is particularly rare and often presents with non-specific symptoms such as headache, cognitive dysfunction, focal neurological deficits, and seizures [3]. Secondary CNS vasculitis, on the other hand, arises as a complication of a systemic condition and can present similarly but often with additional systemic symptoms that guide the diagnosis. Meningoencephalitis, an inflammatory process involving the brain parenchyma and meninges, is typically associated with infectious etiologies, such as bacterial, viral, fungal, or parasitic infections, or non-infectious causes like autoimmune disorders and malignancies. The clinical symptoms of meningoencephalitis include fever, headache, neck stiffness, altered mental status, seizures, and focal neurological deficits. Given this overlap, distinguishing between CNS vasculitis and meningoencephalitis solely based on clinical presentation can be extremely difficult [4,5]. The diagnosis of CNS vasculitis involves a combination of clinical evaluation, neuroimaging, laboratory studies, and often brain tissue biopsy. Magnetic resonance imaging (MRI) of the brain is the preferred imaging modality and typically shows multifocal areas of ischemia, hemorrhage, or enhancement corresponding to inflamed vessels. Cerebrospinal fluid (CSF) analysis may reveal inflammatory markers such as elevated white blood cell count and protein concentration, but these findings are non-specific. Angiography can demonstrate vessel irregularities, but its sensitivity and specificity are limited. A definitive diagnosis often requires brain biopsy, which can reveal transmural inflammation of small and medium-sized arteries, fibrinoid necrosis, and granuloma formation in the case of granulomatous angiitis [6,7]. Given the rarity of CNS vasculitis and its potential to mimic other conditions like meningoencephalitis, a high index of suspicion is required for timely diagnosis. The differential diagnosis should be comprehensive, considering both infectious and non-infectious causes. The initial approach should include ruling out common infectious etiologies through appropriate cultures, PCR assays, and serological tests. Autoimmune and systemic inflammatory markers, such as antinuclear antibodies (ANA), anti-neutrophil cytoplasmic antibodies (ANCA), and rheumatoid factor (RF), should also be assessed to identify potential secondary causes [8]. Management of CNS vasculitis typically involves high-dose corticosteroids to reduce inflammation and immune-mediated damage. In cases where corticosteroids alone are insufficient or where long-term therapy is required, immunosuppressive agents such as cyclophosphamide, azathioprine, or methotrexate may be employed. For patients with CNS vasculitis secondary to an underlying systemic condition, treatment of the primary disease is essential. Anti-epileptic drugs may be necessary for seizure control. Supportive care, including neurorehabilitation, can aid in recovery of neurological function [9].

Case Presentation

This case report presents a 47-year-old male patient who exhibited symptoms indicative of meningoencephalitis but was ultimately diagnosed with CNS vasculitis. The case underscores the importance of considering CNS vasculitis in the differential diagnosis of meningoencephalitis, especially when initial investigations do not confirm an infectious etiology. Through a detailed account of the patient's presentation, diagnostic workup, and management, this report aims to highlight the diagnostic challenges and therapeutic strategies associated with CNS vasculitis. By sharing this rare case, we hope to increase awareness and improve recognition of CNS vasculitis among clinicians, ultimately enhancing patient outcomes through timely and appropriate intervention [10,11]. A 47-year-old male presented to our clinic with a one-month history of progressively worsening headache and a three-week history of intermittent fever. The patient also reported experiencing weakness in all four limbs for the past 15 days. He had no significant past medical history and was not on any regular medications. On initial evaluation, the patient appeared alert and oriented but was visibly distressed due to the severity of his headache. His vital signs were stable, with a

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temperature of 38.2°C, heart rate of 88 beats per minute, blood pressure of 130/85 mmHg, and respiratory rate of 16 breaths per minute. Physical examination revealed no signs of meningeal irritation such as neck stiffness or photophobia.

Neurological Examination

The neurological examination was remarkable for bilateral weakness of the upper and lower limbs, graded as 3/5 on the Medical Research Council (MRC) scale. Cranial nerve examination revealed bilateral lateral rectus palsies, indicated by the patient's inability to abduct both eyes fully. Other cranial nerve functions were intact. There were no signs of meningitis and Kernig's and Brudzinski's signs were negative. Sensory examination was normal, and deep tendon reflexes were diminished in all four limbs. The patient demonstrated no cerebellar signs, and his gait could not be assessed due to weakness.

Diagnostic Workup

Given the patient's presenting symptoms of headache, fever, and limb weakness, an extensive diagnostic workup was initiated to identify the underlying cause.

Initial Laboratory Tests

The initial laboratory tests included:

- **Complete Blood Count (CBC)**: Mild leukocytosis with a white blood cell count of 12,000/µL.
- **C-reactive Protein (CRP)**: Elevated at 25 mg/L.
- **Erythrocyte Sedimentation Rate (ESR)**: Elevated at 40 mm/hr.
  These results indicated an inflammatory process, prompting further investigations.
- **Neuroimaging**
- **Magnetic Resonance Imaging (MRI)**: MRI of the brain revealed multifocal areas of hyperintensity on T2-weighted images involving the brainstem, gangliocapsular regions, and bilateral cerebellar hemispheres. There were no signs of abscesses or significant mass effect, which ruled out space-occupying lesions but pointed towards an inflammatory or infectious process.

Cerebrospinal Fluid (CSF) Analysis

A lumbar puncture was performed to obtain CSF for analysis:

- **CSF Cell Count**: Mildly elevated white blood cell count of 15 cells/µL with a predominance of lymphocytes.
- **CSF Protein**: Elevated at 85 mg/dL.
- **CSF Glucose**: Normal levels.
- **CSF Cultures and PCR**: Negative for bacterial, viral, and fungal pathogens.
- **AFB Stain and Culture**: Negative for Mycobacterium tuberculosis.

These findings indicated an inflammatory process but were non-specific, leading to further evaluation for autoimmune and other non-infectious causes.

Autoimmune Profile

- **Antinuclear Antibody (ANA)**: Negative.
- **Anti-Neutrophil Cytoplasmic Antibodies (ANCA)**: Negative.
- **Rheumatoid Factor (RF)**: Negative.

The negative results for these common autoimmune markers helped rule out systemic autoimmune diseases such as lupus or granulomatosis with polyangiitis.

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Additional Investigations

- **Chest and Abdominal Imaging**: Negative for signs of tuberculosis or other systemic infections.
- **Brain Biopsy**: Although recommended for definitive diagnosis of CNS vasculitis, the patient declined this invasive procedure.

Differential Diagnosis

The differential diagnosis for this patient included a wide range of conditions due to the non-specific nature of his symptoms. Initial considerations included:

1. **Meningoencephalitis**: Infectious etiologies such as bacterial, viral, fungal, and parasitic infections were considered. Negative CSF cultures and PCR ruled out common infectious agents.
2. **Autoimmune Encephalitis**: Conditions such as lupus cerebritis, ANCA-associated vasculitis, and other systemic autoimmune diseases were considered but ruled out based on negative autoimmune profiles.
3. **Primary CNS Vasculitis (PACNS)**: Given the absence of systemic symptoms and negative systemic autoimmune markers, PACNS became a leading consideration. This was supported by MRI findings and the lack of an infectious etiology.
4. **Secondary CNS Vasculitis**: Although less likely due to the absence of systemic involvement, this was considered and ruled out through comprehensive systemic evaluations.

Management

Given the suspected diagnosis of CNS vasculitis, the patient was started on an aggressive immunosuppressive regimen to control the inflammation and prevent further neurological damage.

Initial Therapy

- **Intravenous Corticosteroids**: Methylprednisolone 1 gram daily for three days. This high-dose regimen was chosen to rapidly reduce inflammation.
- **Oral Corticosteroids**: Following the IV course, a tapering dose of oral prednisone was initiated to maintain the anti-inflammatory effect.

Immunosuppressive Therapy

Azathioprine: Initiated at 1.5 mg/kg body weight for long-term immunosuppression. Azathioprine was selected due to its efficacy in treating vasculitis and its relatively favorable side effect profile.

Symptomatic Treatment

- **Anti-Epileptic Drugs**: Levetiracetam was prescribed prophylactically to prevent seizures, a common complication of CNS vasculitis.
- **Neurorehabilitation**: Supportive measures were provided to aid in the recovery of neurological function, including physical and occupational therapy.

Outcome and Follow-Up

Hospital Course

During his hospital stay, the patient showed significant clinical improvement:

- **Headache and Fever**: Both symptoms resolved within days of starting corticosteroid therapy.

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- **Limb Weakness**: Notable improvement in muscle strength, with power increasing from 3/5 to 4/5 on the Medical Research Council (MRC) scale.
- **Ocular Symptoms**: The bilateral lateral rectus palsies showed gradual improvement.

Discharge and Follow-Up Plan

The patient was discharged with a comprehensive outpatient follow-up plan:

- **Maintenance Therapy**: Continued on a tapering dose of oral corticosteroids and azathioprine.
- **Neurology Clinic**: Regular follow-up appointments were scheduled to monitor disease progression and adjust immunosuppressive therapy as needed.
- **Repeat MRI**: Planned at regular intervals to assess the effectiveness of treatment and detect any new areas of inflammation or damage.
- **Laboratory Monitoring**: Regular blood tests to monitor for potential side effects of immunosuppressive therapy and track inflammatory markers.

Long-Term Management

The patient continued to improve clinically, with no new neurological deficits noted on follow-up visits. His treatment regimen was adjusted based on his response and side effect profile. Long-term monitoring for potential complications of immunosuppressive therapy, such as infections and malignancies, was also initiated.

Discussion

Central nervous system (CNS) vasculitis is an uncommon and often challenging diagnosis due to its nonspecific presentation and the broad differential diagnoses it encompasses. This case highlights the diagnostic complexity and management of CNS vasculitis, particularly when it presents with features mimicking meningoencephalitis.

Diagnostic Challenges

The initial presentation of headache, fever, and limb weakness led to a broad differential diagnosis that included meningoencephalitis, a condition commonly associated with infectious etiologies. The diagnostic challenge in this case was compounded by the overlapping symptoms of CNS vasculitis and meningoencephalitis. Infectious meningoencephalitis, typically caused by bacteria, viruses, fungi, or parasites, often presents with fever, headache, and neurological deficits, which were prominent in our patient. However, despite extensive investigations, including cerebrospinal fluid (CSF) analysis and polymerase chain reaction (PCR) assays for infectious agents, no pathogens were identified [1,2]. Neuroimaging played a pivotal role in advancing the diagnosis. Magnetic resonance imaging (MRI) of the brain revealed multifocal hyperintensities in the brainstem, gangliocapsular regions, and bilateral cerebellar hemispheres, indicative of an inflammatory process rather than a localized infectious one. These findings were consistent with CNS vasculitis, which often shows such multifocal lesions on MRI due to vessel inflammation leading to ischemia or hemorrhage [3]. The absence of mass effect and the non-specific inflammatory markers further supported a non-infectious etiology. The negative autoimmune profile, including tests for antinuclear antibody (ANA), anti-neutrophil cytoplasmic antibodies (ANCA), and rheumatoid factor (RF), ruled out common systemic autoimmune diseases that could present with secondary CNS vasculitis. Despite the extensive workup, a definitive diagnosis of primary angiitis of the central nervous system (PACNS) required consideration due to the lack of systemic involvement and the MRI findings. PACNS is a rare, isolated vasculitis affecting the CNS without systemic vasculitis, and its diagnosis is often one of exclusion [4,5].

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Differential Diagnosis

In this patient, the differential diagnosis included:

1. **Infectious Meningoencephalitis**: Ruled out by negative CSF cultures and PCR.
2. **Autoimmune Encephalitis**: Ruled out by negative autoimmune markers.
3. **Primary CNS Vasculitis (PACNS)**: Strongly considered based on clinical presentation and MRI findings.
4. **Secondary CNS Vasculitis**: Considered less likely due to the absence of systemic symptoms.

The diagnosis of PACNS was favored due to the negative infectious and systemic workup combined with the characteristic MRI findings. However, obtaining a brain biopsy, which could provide histopathological confirmation of vasculitis, was not performed as the patient declined the procedure. Brain biopsy remains the gold standard for diagnosing PACNS, demonstrating vessel wall inflammation, fibrinoid necrosis, and granuloma formation in the case of granulomatous angiitis [6].

Management Strategies

The management of CNS vasculitis involves aggressive immunosuppressive therapy to control the inflammation and prevent further neurological damage. Our patient was started on high-dose intravenous corticosteroids (methylprednisolone 1 gram daily for three days), followed by a tapering course of oral prednisone. This initial therapy aimed to rapidly reduce inflammation and control acute symptoms. Intravenous methylprednisolone is a commonly used first-line treatment for suspected CNS vasculitis due to its potent anti-inflammatory effects [7]. For long-term immunosuppression, azathioprine was chosen and administered at a dose of 1.5 mg/kg body weight. Azathioprine is effective in maintaining remission and preventing relapses in CNS vasculitis. Alternative immunosuppressive agents, such as cyclophosphamide or methotrexate, may also be used depending on the patient's response and side effect profile. The decision to use azathioprine in this case was based on its relatively favorable safety profile and the patient's clinical response [8]. Symptomatic treatment included anti-epileptic drugs (levetiracetam) to manage and prevent seizures, a common complication of CNS vasculitis. Supportive neurorehabilitation measures were also crucial in aiding the recovery of neurological function. This multidisciplinary approach ensured comprehensive care, addressing both the underlying disease process and its manifestations.

Long-Term Management and Prognosis

The patient's clinical improvement with corticosteroid therapy was encouraging. His headache and fever resolved, and there was significant improvement in limb strength and ocular symptoms. This positive response underscored the importance of early recognition and aggressive treatment in CNS vasculitis. Long-term management included maintaining immunosuppression with azathioprine and a tapering dose of oral corticosteroids, regular follow-up visits in the neurology clinic, and periodic MRI scans to monitor disease progression or resolution. This ongoing monitoring is essential to adjust therapy based on disease activity and to detect potential complications, such as infections due to immunosuppression [9]. The prognosis of CNS vasculitis varies depending on the promptness of diagnosis and initiation of appropriate therapy. Early and aggressive treatment is associated with better outcomes, while delays in diagnosis and treatment can lead to significant neurological deficits and poor prognosis. In this case, the timely initiation of corticosteroids and immunosuppressive therapy likely contributed to the favorable outcome [10,11].

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Conclusion

This case report highlights the diagnostic challenges and therapeutic strategies associated with CNS vasculitis, particularly when it presents with symptoms mimicking meningoencephalitis. The overlap in clinical presentation necessitates a thorough and systematic diagnostic approach, including neuroimaging, CSF analysis, and exclusion of infectious and autoimmune etiologies. Early recognition and aggressive immunosuppressive therapy are critical in managing this rare condition and preventing irreversible neurological damage. By sharing this case, we aim to increase awareness among clinicians and improve the recognition and management of CNS vasculitis, ultimately enhancing patient outcomes.

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