Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Primary Central nervous system vasculitis mimicking Tuberculous Meningitis: A case report

Yanbin Liu
Wuhan Pulmonary Hospital
Junhui Liu
Wuhan Pulmonary Hospital
Teng Luo
Wuhan Pulmonary Hospital
Lin Wang
Wuhan Pulmonary Hospital
Qi Zhu
617718660@qq.com

Wuhan Pulmonary Hospital

Case Report

Keywords: Primary central nervous system vasculitis, tuberculous meningitis, cerebrospinal fluid, autoimmune disease

Posted Date: November 1st, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11277325/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Abstract

Background

Primary central nervous system vasculitis (PCNSV) is a rare disease characterized by inflammatory infiltration of blood vessels in the central nervous system (CNS). Owing to the lack of specificity in its clinical features and imaging examinations, it is highly prone to being missed or misdiagnosed.

Case presentation

A 58-year-old female from South China was admitted with headache in March 2025. Brain MRI suggested possible intracranial inflammation, and cerebrospinal fluid (CSF) examination revealed increased cell counts, decreased glucose and chloride levels, and elevated protein levels. CNS viral infection was considered, and empirical antiviral and anti-inflammatory effects with penciclovir and dexamethasone yielded no improvement. Then, diagnostic anti-tuberculosis (TB) treatment was given, there was no improvement in symptoms. Weeks later, the patient's condition worsened, with persistent headache accompanied by nausea, vomiting, cognitive dysfunction and memory decline. Even after intensified steroid therapy, the response was still poor. A subsequent craniotomy biopsy confirmed central nervous system vasculitis.

Conclusion

This case illustrates that PCNSV can present with symptoms such as headaches and abnormal cerebrospinal fluid indicators, which closely resemble CNS infections. For patients with poor response to empirical antibiotic therapy, early biopsy can help improve diagnostic accuracy and prognosis.

Background

Primary central nervous system vasculitis (PCNSV) is a rare inflammatory disease of the central nervous system (CNS) blood vessels, affecting both small and large vessels of the brain parenchyma, spinal cord, and leptomeninges. The incidence rate is approximately 2.4 per million cases[1], accounting for about 1% of all central nervous system vasculitis[2], making it extremely rare in clinical practice. Owing to the absence of any reliable diagnostic clinical features, the presence of almost innumerable neurological mimics, and the continuing lack of any diagnostic investigations short of brain biopsy. Making it a major challenge in clinical practice, with a high rate of mortality ranging from 8–23%, and approximately 25% of patients experience severe disability[3].

Here, we report a case of PCNSV admitted to our hospital on March 2025, which was misdiagnosed as tuberculous meningitis (TBM). Analyzing its clinical manifestations, imaging features, and treatment course to improve clinicians' recognition of the disease and reduce misdiagnosis and missed diagnosis.

Case presentation

On March 15, 2025, a 58-year-old woman was admitted to Wuhan Union Hospital due to intermittent headache, accompanied by poor appetite and fatigue, without nausea, vomiting, fever, dizziness, or eye swelling. There was no known history of pulmonary tuberculosis in the patient, and there was no family history of tuberculosis reported by the patient. After admission, a cranial computerized tomography (CT) was performed, which revealed possible deep bilateral parietal lobe infarction. Enhanced cranial magnetic resonance imaging (MRI) showed subcortical hyperintensities in the bilateral parietal lobes, which was concerning for an infectious, inflammatory. On March 19, 2025, a lumbar puncture was performed, with an opening pressure of 250 mmH_2O (the normal range is 80 ~ 180 mmH_2O). The CSF test results were shown in Table 1. CSF acid-fast staining and cryptococcal smear were negative. A diagnosis of viral meningitis was made, and empirical antiviral and anti-inflammation agents with penciclovir and dexamethasone were administered for 10 days, her headache was still not well controlled. Later, the blood tuberculosis interferon-gamma release assay (T-SPOT. TB) was confirmed to be positive, raising suspicion of tuberculous meningitis.

On March 26, she was admitted to our hospital. She was alert and oriented, the physical examination showed normal muscle strength and tone, with no pathological neurological signs. Laboratory examinations showed: complete blood count, urinalysis, stool routine, coagulation panel (5 items), liver and kidney function, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), hepatitis B surface antigen, hepatitis C antibody, syphilis antibody, and HIV antibody were all normal. Chest CT scan indicated bilateral pneumonia with fibrous proliferative foci. On March 27th, a lumbar puncture was performed again, and the CSF pressure was measured at 245 mmH2O. The results of routine CSF analysis were shown in Table 1. CSF tests, including India ink staining, Gram staining, acid-fast staining, TB polymerase chain reaction (PCR), Cryptococcus neoformans capsular antigen assay, bacterial cultures, mycobacterial cultures, fungal cultures, viral panel were all negative.

Table 1
CSF test results

CSF characteristic/date	19, march	27, march	7, April	16, April	23, April	1, May
Pressure (mmH_2O)	250	245	290	510	480	440
WBC cell count (×10^6/L)	105	32	14	20	6	10
mononuclear cells (%)	98	94	94	94	96	96
polymorphonuclear cells (%)	2	6	6	6	4	4
Protein(g/L)	2.72	1.27	1.98	3.27	3.39	3.71
Adenosine deaminase(U/L)	2	3.4	3.6	4.7	5.9	4.4
Lactic dehydrogenase(U/L)	30	22	19	27	30	39
Chloride(mmol/L)	123.3	121.6	117.1	116.2	112.0	118.6
Glucose (mmol/L)	2.55	2.44	3.15	2.68	3.35	3.56

Based on the CFS results, pulmonary and cranial imaging findings, as well as a positive blood T-SPOT, tuberculous meningitis cannot be completely ruled out. On March 28, diagnostic treatment with anti-tuberculosis medications (isoniazid, rifampicin, pyrazinamide, levofloxacin, and amikacin) began. Accompanied with hormone dosage (dexamethasone, 5mg/d), she was initially experienced clinical improvement.

However, weeks later, the patient’s headache worsened, accompanied by nausea, vomiting, cognitive dysfunction and memory decline. A lumbar puncture was performed, the CSF pressure has risen to 510 mmH2O, the CSF results were shown in Table 1, CSF protein levels

further increased compared to before. Repeat enhanced MRI revealed short T1 signals were observed in the left occipital lobe. Ring enhancement was seen on contrast-enhanced MRI, and the cerebral sulci became narrower (Fig. 1), suggesting subacute cerebral hemorrhage, tuberculoma? Metastatic tumor? Differential diagnoses included autoimmune encephalopathy, cerebral involvement of rheumatic diseases and tumor, were considered. However, autoimmune encephalitis antibodies in both blood and CSF yielded negative results. Blood tests were negative for antinuclear antibody, anti-SSA, and anti-SSB antibodies. After excluding contraindications, the dexamethasone dosage was increased to 10 mg/d.

The patient's condition has not improved, on May 13, Follow-up contrast-enhanced MRI revealed newly developed hemorrhagic lesion (Fig. 2). Then, the patient was transferred to Wuhan Union Hospital for hospitalization. On June 20, a right occipital lobe brain tissue biopsy was performed. Pathology examinations showed diffuse perivascular inflammatory cell infiltration and granulomatous response, partial transmural vascular damage, and focal hematoma formation (Fig. 3). Special stains: acid-fast staining (-), Grocott's methenamine silver stain (-), Periodic Acid-Schiff stain (-). The final diagnosis: granulomatous vasculitis. The patient was treated with methylprednisolone and immunosuppressive

agents, granulomatous vasculitis. The patient was treated with methylprednisolone and immunosuppressive agents, symptoms gradually improved.

Discussion

PCNSV is a rare disease characterized by inflammatory infiltration of the central nervous system vessels. The etiology, pathogenesis and immune mechanism of PACNS have not yet been completely elucidated. It is currently believed that it is primarily related to immune abnormalities and infections. The deposition of immune complexes and cell-mediated autoimmunity lead to immune inflammation and necrosis of the wall from the vessels. As a result, vascular damage causes ischemia and infarction or intracranial hemorrhage[4].

Most patients have a slow onset, while a few cases progress rapidly and may present with a fulminant or even fatal course[5]. The clinical manifestations of PCNSV are generally complex and nonspecific, with the most common clinical symptoms being chronic or insidious headache, which can occur in 50%–60% of PACNS patients[4], followed by cognitive decline. It can also manifest as epileptic seizures and stroke-like

episodes. 76% of PACNS patients show changes indicative of local

cerebral ischemia on their first MRI after admission. Other focal signs are related to the location, nature, and severity of the lesions and may include dizziness, psychiatric symptoms, personality changes, memory decline, or dementia[6]. Approximately 5% of cases involve the spinal cord, and systemic symptoms such as fever, night sweats, fatigue, weight loss, and myalgia are not common in PCNSV patients.

Serological markers of inflammation such as CRP and ESR are normal in most patients[7], which often serves as an important basis for differentiating it from infectious diseases, but specific biomarkers are lacking. The CSF pressure in patients with PCNSV is generally normal. However, 80%-90% of patients present with abnormal CSF findings[4]. Common abnormalities include mild to moderate increases in lymphocytes and/or elevated protein levels, with normal blood sugar levels. If the CSF analysis is normal (cell count < 5 cells per milliliter or protein levels < 45 mg/dL), other diseases should be considered. CSF tests are typically used to rule out varicella-zoster virus (VZV)-related central nervous system vasculitis, other infectious causes, and malignancies[8]. Unlike infectious meningitis, where there is no consumption of glucose by pathogenic microorganisms, PCNSV, like other central nervous system immune diseases, usually does not show decreased CSF glucose and chloride. However, in our case, the CSF analysis revealed an increase in cell count and protein, as well as a decrease in glucose and chloride, accompanied by refractory intracranial hypertension. It is precisely this CSF manifestation, which closely mimics tuberculous meningitis, that has added considerable difficulty to our diagnosis. The cause of increased intracranial pressure was considered to be related to diffuse cerebral edema in the acute phase and the location of the lesion.

MRI has high sensitivity but low specificity, with over 90% of patients with PCNSV showing positive MRI findings. The manifestations are exceptionally diverse, with ischemic and semorrhagic being the most common pattern, and frequently include multiple lesions, which are usually bilateral, asymmetrical, and predominantly in the supratentorial compartment involving both the white and gray matter, particularly the subcortical and deep white matter[9]. 57% of patients experience hemorrhagic transformations of ischemic lesions [10]. However, cerebral hemorrhage and infarction are also very common complications of TBM, furthermore, annular enhancement was observed on the enhanced MRI scan performed on April 18, which can also be seen in the MRI presentation of tuberculomas. These imaging findings further misled our diagnosis. In our case, the initial manifestation was deep cerebral infarction foci, which, as the disease progressed, predominantly presented as hemorrhagic foci. And the lesions changed, with new lesions appearing in some regions, while the previously observed lesions showed some resolution (Fig. 2). This manifestation was consistent with the findings of Seby Robert[11].

Digital subtraction angiography (DSA) demonstrates high sensitivity in detecting vasculitis, with 98% of cases showing positive results. Some studies have suggested that performing DSA on suspected cases on the basis of MRI findings can improve the diagnostic rate of PCNSV. However, DSA is only meaningful only for vasculitis involving predominantly large to medium vessels and cannot detect all small vessel vasculitis[5] .

Owing to the lack of specific clinical, imaging, and laboratory features, there is often a delay in diagnosis, with the median time from onset to diagnosis of PCNSV being 15 weeks[12], whereas cases confirmed by biopsy require even longer. In our case, the time from onset to definitive diagnosis was approximately 12 weeks, which was shorter than the median time. However, because our hospital cannot perform brain tissue biopsy, this time for the patient was also prolonged.

Brain tissue biopsy is the gold standard for diagnosing PCNSV. On the basis of histopathological biopsy results, PCNSV can be classified into three subtypes: granulomatous vasculitis, lymphocytic vasculitis, and necrotizing vasculitis. Among them, the granulomatous type is the most common, followed by the lymphocytic type[3]. These usually remain stable over time in an individual patient, but at times may overlap. The typical pathological features include transmural inflammatory damage to blood vessels, with infiltration of lymphocytes and macrophages. In some cases, granuloma formation or necrotizing vasculitis can be observed. In our case, the pathology showed diffuse perivascular inflammatory cell infiltration and granulomatous reaction, partial transmural vascular damage, which was consistent with the pathological features of PCNSV.

PCNSV treatment is primarily divided into induction and maintenance phases. The primary induction treatment regimens include glucocorticoids and/or cyclophosphamide[4]. Some studies suggest that, for most patients with mild disease, characterized by isolated headaches and minimal neurological deficits and imaging, empiric treatment is high-dose glucocorticoid monotherapy or in combination with cyclophosphamide. For patients with moderate to severe disease, which defined by encephalopathy, stroke, seizures, rapidly progressive deficits, or angiographic evidence of large-vessel involvement,

intravenous high-dose glucocorticoid pulse therapy is required, IV cyclophosphamide is added to glucocorticoid therapy to achieve disease control and reduce the risk of relapse [3]. In our case, the patient received combination glucocorticoid therapy at the initial stage of the disease, but her symptoms did not improve. Despite increasing the glucocorticoid dosage in subsequent treatment, the patient's condition still progressed. This reminds us of the importance of immunosuppressants in PACNS patients. In the absence of contraindications, early combination therapy should be initiated to help control the disease as soon as possible and improve patient outcomes.

Conclusion

In conclusion, the clinical manifestations of PCNSV lack specificity, CSF and imaging Findings are difficult to distinguish from intracranial infectious diseases. Brain tissue biopsy is the gold standard for diagnosis. For patients with symptoms of headaches, and abnormal CSF findings, Imaging suggests meningitis, intracranial inflammatory diseases should be considered, not only intracranial infectious diseases, but also but also non-infectious ones. Especially when empirical antibiotic treatment yields poor outcomes, in such cases, rare diseases should be conscious of. If conditions permit, early brain biopsy needs to be performed to confirm the diagnosis, which can lead to better treatment outcomes and improve patient prognosis. Additionally, as clinicians, we should enhance our understanding of rare and uncommon diseases to reduce the rates of missed diagnosis and misdiagnosis.

Abbreviations

PCNSV	Primary central nervous system vasculitis
CNS	central nervous system
CSF	cerebrospinal fluid
TBM	tuberculous meningitis
CT	computerized tomography
MRI	magnetic resonance imaging
T-SPOT.TB	Tuberculosis interferon-gamma release assay
ESR	erythrocyte sedimentation rate
CRP	C-reactive protein
PCR	TB polymerase chain reaction
DSA	Digital subtraction angiography

Declarations

Acknowledgements

Not applicable.

Authors' contributions

Yanbin Liu and Teng Luo and are responsible for collecting and sorting paper materials, producing pictures, writing the paper, and retrieving documents. Junhui Liu and Lin Wang contributed to organizing paper materials, proofreading data, and retrieving literature. Qi Zhu is responsible for the design and review of the paper.

Funding

National Key Research and Development Program of China (2021YFC2600200).

Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

All data in this paper have been reviewed and recorded by our hospital's Medical Ethics Committee, which has agreed to publication.

Consent for publication

Written informed consent was obtained from the patient and her family members for publication of this case report and all accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests

The authors declare no competing interests

References

1. Patel SD, Oliver FO, Elmashad A, Patel N, Mehta T, Hinman J, et al. Outcomes among patients with primary angiitis of the CNS: a nationwide united states analysis. J stroke cerebrovasc dis : off j Natl Stroke Assoc. 2022;31:106747. doi:10.1016/j.jstrokecerebrovasdis.2022.106747 PubMed PMID: 36162376.
2. Salvarani C, Brown RD, Hunder GG. Adult primary central nervous system vasculitis. Lancet. 2012;380:767–77. doi:10.1016/S0140-6736(12)60069-5 PubMed PMID: 22575778.

3. Phu A, Agrawal DK. Overview of primary angiitis of the central nervous system: current insights. Arch intern med res. 2026;9:40–52. doi:10.26502/aimr.0236 PubMed PMID: 41947889; PubMed Central PMCID: PMC13052826.
4. Mitrović J, Golob M, Lazibat I. Primary angiitis of the central nervous system - a diagnostic challenge. Acta Clin Croat. 2023;62:355–61. doi:10.20471/acc.2023.62.02.14 PubMed PMID: 38549589; PubMed Central PMCID: PMC10969649.
5. Agarwal A, Sharma J, Srivastava MVP, Sharma MC, Bhatia R, Dash D, et al. Primary CNS vasculitis (PCNSV): a cohort study. Sci Rep. 2022;12:13494. doi:10.1038/s41598-022-17869-7 PubMed PMID: 35931755; PubMed Central PMCID: PMC9355950.
6. de Boysson H, Parienti JJ, Mawet J, Arquizan C, Boulouis G, Burcin C, et al. Primary angiitis of the CNS and reversible cerebral vasoconstriction syndrome: a comparative study. Neurology. 2018;91:e1468–78. doi:
10.
1212/WNL.0000000000006367 PubMed PMID: 30232250.
7. Beuker C, Strunk D, Rawal R, Schmidt-Pogoda A, Werring N, Milles L, et al. Primary angiitis of the CNS: a systematic review and meta-analysis. Neurol(r) Neuroimmunol Neuroinflammation. 2021;8. doi:10.1212/NXI.0000000000001093 PubMed PMID: 34663675; PubMed Central PMCID: PMC10578363.
8. Sarti C, Picchioni A, Telese R, Pasi M, Failli Y, Pracucci G, et al. “when should primary angiitis of the central nervous system (PACNS) be suspected?”: literature review and proposal of a preliminary screening algorithm. Neurol Sci : Off J Ital Neurol Soc Ital Soc Clin Neurophysiol. 2020;41:3135–48. doi:10.1007/s10072-020-04583-3 PubMed PMID: 32776287; PubMed Central PMCID: PMC7567723.
9. Agarwal S, Sebastian LJD, Gaikwad S, Srivastava MVP, Sharma MC, Singh M, et al. The role of susceptibility-weighted imaging & contrast-enhanced MRI in the diagnosis of primary CNS vasculitis: a large case series. Sci Rep. 2024;14:4718. doi:10.1038/s41598-024-55222-2 PubMed PMID: 38413676; PubMed Central PMCID: PMC10899183.
10. Boulouis G, de Boysson H, Zuber M, Guillevin L, Meary E, Costalat V, et al. Primary angiitis of the central nervous system: magnetic resonance imaging spectrum of parenchymal, meningeal, and vascular lesions at baseline. Stroke. 2017;48:1248–55. doi:10.1161/STROKEAHA.116.016194 PubMed PMID: 28330942.
11. Robert S, Deepica R, Arpitha K, Wilson C. Primary angiitis of the central nervous system: a medical mystery. Rom J Intern Med. 2026. doi:10.2478/rjim-2026-0017
12. Kraemer M, Berlit P. Primary central nervous system vasculitis - an update on diagnosis, differential diagnosis and treatment. J Neurol Sci. 2021;424:117422. doi:10.1016/j.jns.2021.117422 PubMed PMID: 33832773.

Figures

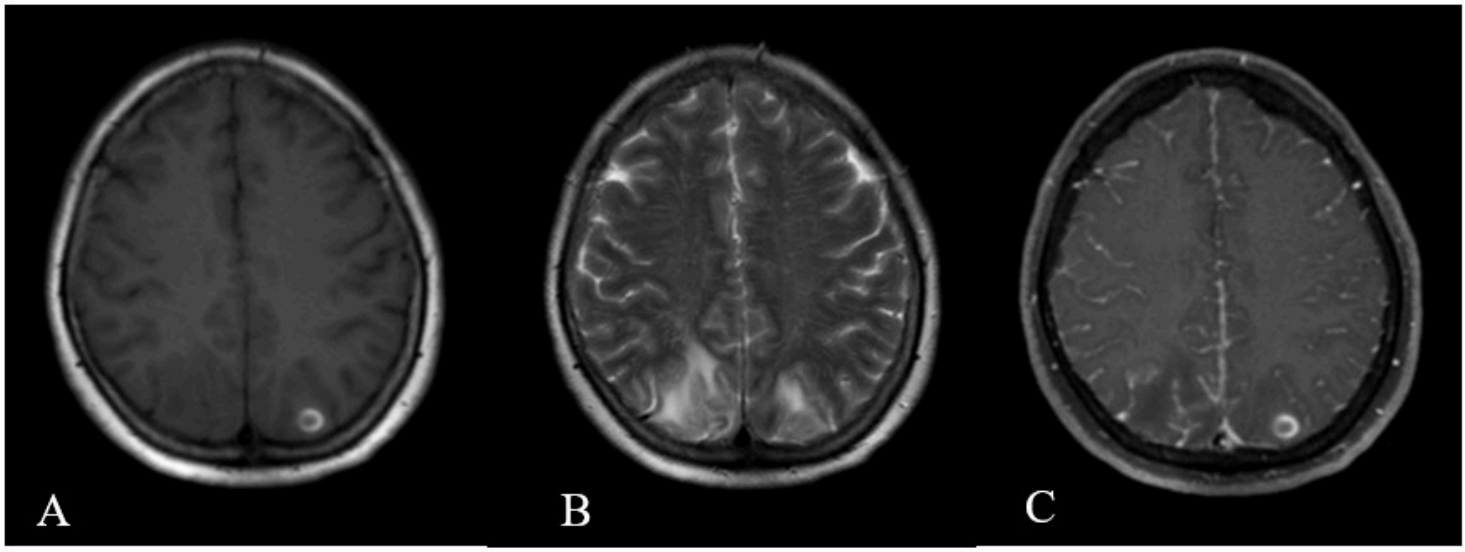


Figure 1

short T1 signals were observed in the left occipital lobe(A), T2-FLAIR shows high signal(B). Ring enhancement was seen on contrast-enhanced MRI, and the cerebral sulci became narrower(C).

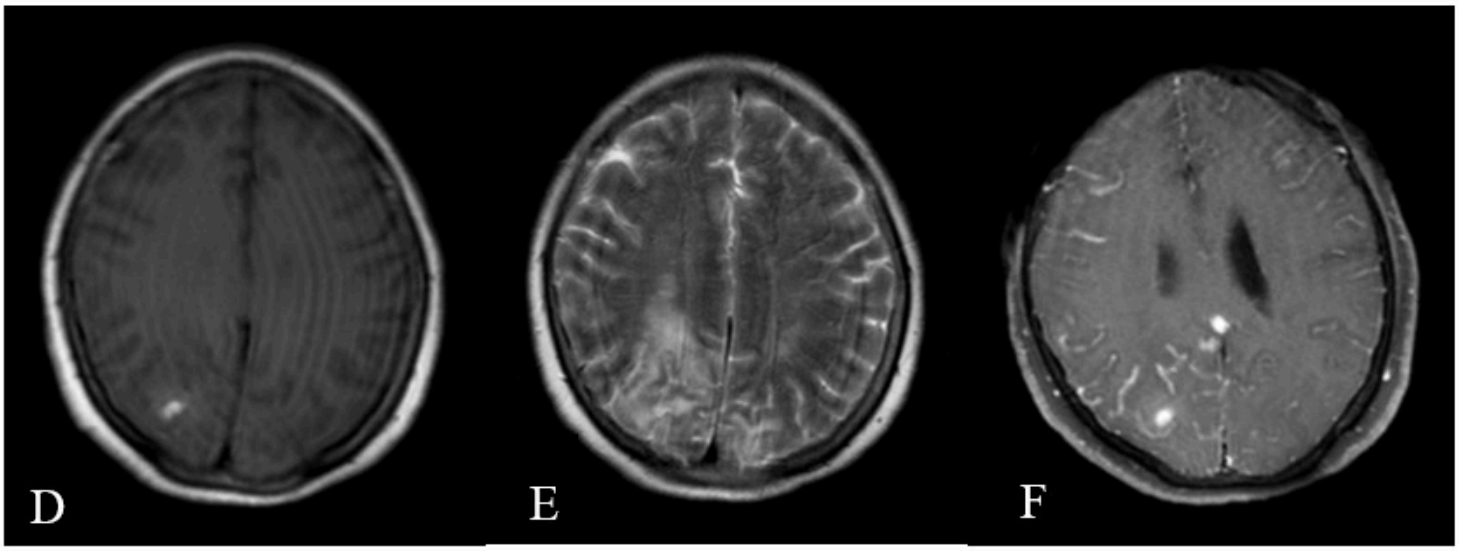


Figure 2

newly developed hemorrhagic lesion in the right occipital lobe, appearing as short T1 signal(D), and hyperintense on T2-FLAIR(E). After enhancement, band-like patterns and cast-like high signals were seen in most of the pia mater(F).

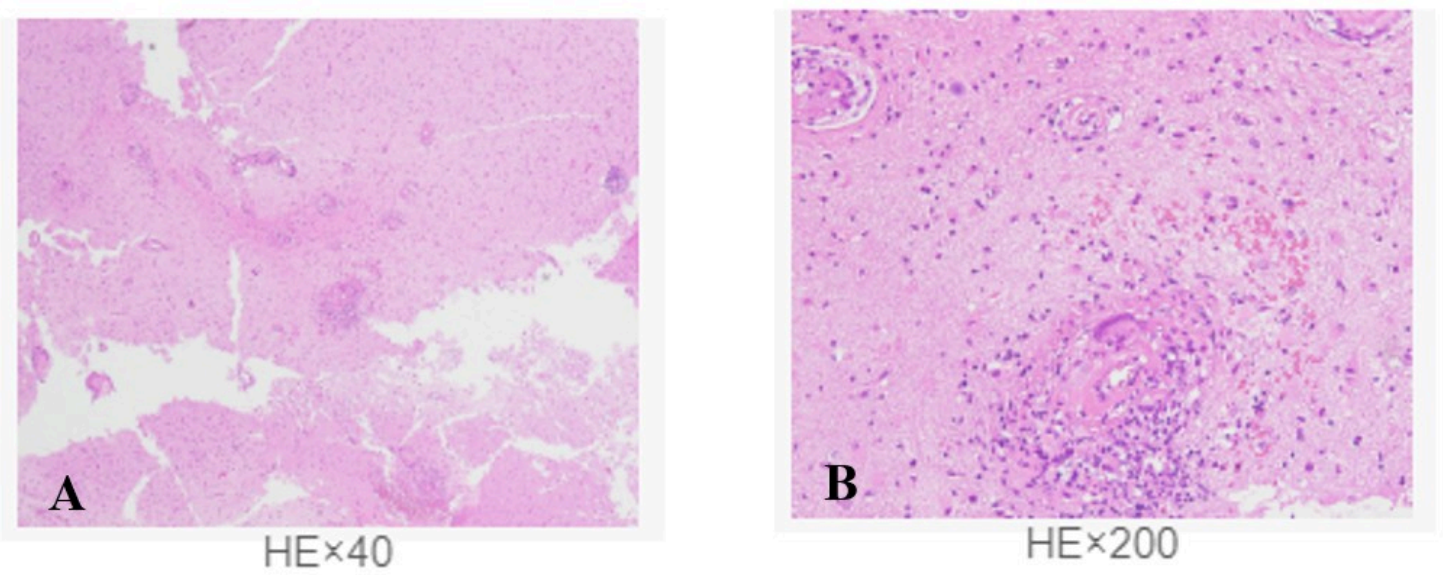


Figure 3

Photomicrographs showing diffuse perivascular inflammatory cell infiltration and granulomatous reaction on Hematoxylin and Eosin stain at 40 × (**A**) and 200 × (**B**) respectively.