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Fulminant Meningitis: A Rare Case of HSV-2 and Cryptococcal Co-Infection in a Patient With AIDS

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Abstract

Cryptococcal meningitis (CM) is a severe and often fatal infection of the central nervous system that is caused by *Cryptococcus* spp. Cryptococcal meningitis mainly affects immunocompromised individuals such as those with AIDS, organ transplantation recipients, and those with conditions requiring prolonged immunosuppressive therapy. Infection typically begins with the inhalation of cryptococcal spores, often from bird droppings, which can remain dormant in the lungs and lymph nodes before disseminating to the central nervous system. Signs and symptoms include headache, nausea, and cognitive impairment, which can progress to severe neurological complications if not promptly treated. Even in the era of antifungal and antiretroviral therapies, CM remains a public health challenge with substantial morbidity and mortality. Although rare, sporadic cases of *cryptococcal neoformans/gattii* coinfection with *Mycobacterium tuberculosis, Streptococcus pneumoniae*, and *Treponema pallidum* have been reported in the literature. Herein, we describe an extremely rare case of fulminant meningitis due to herpes simplex virus (HSV)-2 and *Cryptococcal neoformans* coinfection. Our patient also had cryptococcemia, which is known to increase acute mortality rates in patients with CM.

Keywords

cryptococcal meningitis, cryptococcal meningoencephalitis, cryptococcal neoformans/gattii, herpes simplex virus 2

Introduction

Cryptococcal meningitis (CM) is the inflammation of the meninges surrounding the brain and/or spinal cord due to *Cryptococcus* species (spp).[1] Cryptococcal meningitis is an opportunistic infection and an AIDS-defining illness, with an estimated global incidence of 220 000 cases per year.[1,2] A higher burden has been reported in resource-limited countries in Africa and Asia where HIV/AIDS is more prevalent.[1,3,4] An analysis of the global HIV/AIDS data from 2014 showed that CM was responsible for 181 100 deaths and 15% of AIDS-related deaths.[1,5,6] The high mortality rate is attributed to delays in diagnosis and inadequate treatment in resource-limited countries.[2,4]

Cryptococcal meningitis has a high mortality rate, even with antifungal therapy, and coinfection with another pathogen is associated with a grave prognosis. Although infrequent, cases of *cryptococcal neoformans/gattii* coinfection with *M tuberculosis, S pneumoniae*, and *T pallidum* have been reported in the literature.[7-9] To our knowledge, this is the second reported case of fulminant meningitis due to herpes simplex virus-2 (HSV-2) and *cryptococcal neoformans/gattii* coinfection.[10] Our patient had a history of HIV/AIDS but was not compliant with antiretroviral therapy (ART). Other interesting aspects of our case include the detection of *Cryptococcus* antigen in the patient's blood and determination of the optimal timing for initiation of ART. The patient was successfully treated with acyclovir, liposomal amphotericin B, flucytosine, and fluconazole. The patient is currently receiving maintenance therapy with fluconazole and antiretroviral agents.

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Table 1. Admission Laboratory Values Compared to Normal Ranges.

Laboratory test	Result	Reference range
Hemoglobin	18.8	11.1-15.9 g/dL
Hematocrit	57.0	41.0%-53.0%
White blood cell count	13.1 × 10^3/mm^3	3.4-10.8 × 10^3/mm^3
Sodium	142	134-144 mEq/L
Potassium	3.7	3.5-5.2 mEq/L
Blood glucose	161	70-100 mg/dL
Creatinine	1.33	0.60-1.30 mg/dL
Blood urea nitrogen	64	7-23 mg/dL
Creatine kinase	493	30-223 unit/L
Lactic acid	2.5	0.5-2.2 mmol/L

Table 2. CSF Analysis After the First (Index) Lumbar Puncture Compared to Reference Ranges.

Parameters of CSF	Test result	Reference range
Specific gravity	1.020	1.020
Color	Colorless	Colorless
Appearance	Clear	Clear
Red blood cells	900	≤0 mm^3
Crenated RBCs	0	≤0%
White blood cells	21	0-5 mm^3
Supernatant	Non-xanthochrom	Non-xanthochrom
Segmentations	9	0%-6%
Lymphocytes	61	40%-80%
Monocytes	25	15%-45%
Eosinophils		
Other cells	0	0%
Glucose	<10	50-75 mg/dL
Protein	271	15-45 mg/dL
Opening pressure	48	6-25 cmH_2O
Closing pressure	12	

Case Report

A 39-year-old male with a medical history of HIV/AIDS (not on ART; last CD4 from 3 weeks prior was 48 cells/mm^3), untreated hepatitis C, and intravenous drug use disorder was brought to the emergency department (ED) for evaluation of altered mental status. The patient was found unresponsive by his roommate, who then called an ambulance due to concern for a drug overdose. Intake history was limited due to the patient's mentation and clinical status. Notably, the patient was seen in our ED 3 weeks prior for a headache, and a computed tomography (CT) scan of the head was negative for acute pathology. A magnetic resonance imaging (MRI) of the brain and spine were suggested to rule out opportunistic infections, epidural abscess, and osteomyelitis but the patient declined. The patient also refused a lumbar puncture and eventually left against medical advice. He was requested to follow-up with the infectious disease clinic to resume ART.

In the ED, the patient appeared lethargic and cachectic, but not in distress. The vital signs were significant for elevated blood pressure (155/122 mm Hg) and tachycardia (140 beats per min). The patient was afebrile, saturated 99% on room air, and protected his airway. On further examination, the patient was responsive to noxious stimuli, but did not follow any verbal commands. The patient had bilateral upper extremity tremors, concerning for seizure-like activity. There were no signs of head trauma or tongue laceration, but yellowish plaques were observed in his mouth, extending to the oropharynx, consistent with oral candidiasis. The pupils were equal, round, and reactive to light. The rest of the examination was unremarkable. A CT scan of the head was negative for acute bleeding, fracture, mass effect, or midline shift. Triage blood test results revealed elevated creatine kinase, creatinine and blood urea nitrogen, lactic acidosis, polycythemia, and leukocytosis (Table 1). Urinalysis, a urine drug screening test, and serum acetaminophen, alcohol, and aspirin levels were negative. Chest x-ray was negative for acute pathology, and electrocardiogram (EKG) was significant for ectopic atrial tachycardia without an acute ischemic pattern.

After resuscitation with intravenous fluids, the patient's mental status improved and he was able to answer basic questions. Given his HIV status, there was a high index of suspicion for meningoencephalitis and his family was contacted for consent. Lumbar puncture was performed in the ED, and cerebrospinal fluid (CSF) analysis showed low glucose and elevated protein levels (Table 2). The opening pressure was 48 cmH_2O and closing pressure 12 cmH_2O. The patient was empirically treated for infectious meningitis with cefepime, vancomycin, ampicillin, acyclovir, and dexamethasone. He was also loaded with levetiracetam and administered a dose of midazolam for possible seizures. Later, in the evening, a microbiologist reported that the CSF Biofire Filmarray meningitis/encephalitis (ME) polymerase chain reaction panel was positive for HSV-2 and *cryptococcal neoformans.* The gram staining of the CSF also revealed clusters of encapsulated yeast consistent with *Cryptococcus*. The serum cryptococcal antigen was also positive, with a titer of 1:1280. Antimicrobial therapy was tailored to acyclovir 800 mg, IV, Q8H, liposomal amphotericin B 240 mg, IV, Q24H, Flucytosine 2000 mg, Q6H, for fulminant meningitis. With negative AFB blood cultures, the patient was started on atovaquone and azithromycin as prophylactic therapy against opportunistic infections. ART was initially deferred to avoid immune reconstitution inflammatory syndrome (IRIS). On the night of admission, the patient's mentation worsened, prompting endotracheal intubation to protect the airway.

The blood cultures were positive for *C neoformans*. Biofire multiplex polymerase chain reaction bacterial pneumonia panel and sputum culture grew *Klebsiella pneumoniae*

which was treated with ceftriaxone. Cerebro spinal fluid fungal culture grew *Cryptococcus neoformans*. The respiratory viral panel, urine culture, and AFB sputum cultures yielded negative results. An electroencephalogram revealed mild diffuse encephalopathy, with no evidence of active seizures or epileptogenic potential. Brain MRI revealed changes consistent with meningoencephalitis and multiple periventricular brain infarcts. Magnetic resonance imaging of the entire spine showed diffuse muscle signal abnormality involving the paraspinal muscles of the lumbar spine, which may have been caused by myositis or muscle strain. No drainable collections were noted. In the intensive care unit (ICU), the patient underwent a total of 11 lumbar punctures to control intracranial pressure (ICP) and to avoid brain herniation. The final lumbar puncture revealed an opening pressure of 23 cmH_2O (normal range 6-25) and a closing pressure of 10 cm H_2O. The patient's ICU stay was complicated by oropharyngeal dysphagia and ventilator dependence. He also developed bilateral pulmonary emboli, which were treated with heparin infusion. Given his grim prognosis, a palliative care team was consulted for goals of care discussion. The patient's family elected percutaneous tracheostomy and endoscopic gastrostomy (PEG) placement and continued curative therapy.

The patient spent an additional 2 months on the medical floor for the management of both acute and long-term conditions. He completed the induction (liposomal amphotericin B 240 mg, IV, Q24H, ×5 weeks, flucytosine 2000 mg, Q6H, ×5 weeks, fluconazole 1200 mg, Q24H, ×1 week, fluconazole 800 mg, Q24H, ×2 weeks) and consolidation phases (fluconazole 800 mg, Q24H, ×8 weeks) of the CM treatment and is currently receiving maintenance therapy with fluconazole (200 mg for at least 12 months). Lumbar puncture prior to the initiation of consolidation therapy showed a normal ICP (18 mm H_2O), improved cryptococcal antigen titer (1:80 from 1:1280), and negative CSF culture results. Given the HSV-2 coinfection, the patient completed a 21-day course of intravenous acyclovir (600 mg, Q8H) during the induction phase of CM therapy. A fixed-dose combination pill of bictegravir/emtricitabine/tenofovir alafenamide was started after the first month in the medical floor without complications. Absolute CD4 count at the time was 33 cells/mm^3. The tracheostomy was gradually decannulated, and the patient's ventilation status remained stable. After 3 months of hospitalization, the patient was discharged to a rehabilitation facility for medical optimization. At the time of discharge, the patient followed basic commands and was able to nod to show agreement or disagreement. The patient tolerated oral fluids and a full liquid diet in addition to the tube feeding.

Discussion

Herein, we describe an extremely rare case of fulminant meningitis due to HSV-2 and cryptococcal coinfection. To our knowledge, this is the second case of dual infection reported in the English literature.[10] Interestingly, our patient also had cryptococcemia, which is known to increase acute mortality rates in patients with CM. Although cryptococcemia is estimated in 10% to 30% of CM cases, current evidence is retrospective in the form of case reports.[11] In a retrospective study of 52 patients with cryptococcemia, Jean et al[11] found that patients with concurrent CM and cryptococcemia experienced higher rates of morbidity and mortality.

The timing for starting or resuming ART is a contentious issue, especially in CM, as current studies show mixed results. The Cryptococcal Optimal ART Timing (COAT) trial showed increased mortality rates with early ART and recommended waiting at least 5 weeks before starting therapy to improve patient outcomes.[12,13] The study findings, however, had poor external validity as the trial was conducted in Africa, where CM is endemic and there is limited access to adequate treatment.[12] To overcome this limitation, Ingle et al[14] used data from observational studies to mimic a randomized controlled trial to establish how the timing of ART affected patient outcomes in developed countries. Ingle et al[14] found little to no evidence that early therapy increases mortality rates among ART-naive patients. As this study was based on observational data, there is inherent risk of bias and confounding, which limits the generalizability of these findings. Both the COAT and Ingle's simulated trials involved ART-naive patients; therefore, further research is needed to establish the optimal timing for resuming ART in patients with CM.

Patients with CM usually present with subacute or long-term symptoms including headache, fever, and malaise over a period of 1 to 2 weeks.[3,15] Other common symptoms include neck stiffness, photophobia, confusion, visual disturbances, and hearing loss.[3,9] The classic meningismus findings only occur in less than 20% of cases.[16] Cryptococcal meningitis causes an increased ICP, which causes intractable headaches, vomiting, neurological deficits, blindness, seizures, and altered sensorium.[1,3] Roughly 50% of patients suffering with CM have intracranial hypertension with an ICP greater than 200 mm H_20.[9] Further complications can emerge because of adverse reactions to antifungal and antiretroviral drugs required for treatment.[3]

A battery of laboratory tests and imaging studies can aid in prompt diagnosis of CM. Lumbar puncture is used for CSF analysis and ICP management.[3,9] A preprocedure CT scan of the brain is essential to rule out other brain pathologies and to prevent brain herniation.[9] India ink microscopy remains the primary diagnostic tool for identifying *Cryptococcus* in CSF as it is readily available and cost effective.[4] It should not be the sole diagnostic tool though as its sensitivity depends on the fungal burden in the CSF sample.[2,4] Cerebro spinal fluid fungal culture is the gold standard for the diagnosis of CM as a positive culture implies active cryptococcal disease, but it also can produce false-negative results when the fungal burden is low.[4] In asymptomatic patients, the detection of cryptococcal antigens (CrAg) in

serum or CSF media can be diagnostic.[2,4] These antigen tests are sensitive, specific, and readily available from commercial sources.[4] Owing to cost, need for storage infrastructure, and skilled personnel, these test kits remain largely unavailable in resource-limited regions.[4-6] CrAg lateral flow assay (LFA) has revolutionized the diagnosis of CM in poor countries as they are inexpensive and provide rapid results when performed on CSF, blood, serum, or even urine.[3,4] LFAs have enabled early diagnosis of CM where lumbar puncture or blood sampling is not practical.[4]

Brain imaging is not particularly helpful in the diagnosis of CM, as 47% of CT scans and 8% of MRI scans are typically normal.[9,17] However, abnormal brain imaging has been identified as a poor prognostic factor for patients with CM. Computed tomography scans of the brain typically show nonspecific features, such as brain atrophy, diffuse edema, and rarely hydrocephalus.[9,17] Brain MRIs in patients with CM often show dilated perivascular spaces, leptomeningeal enhancement, pseudocysts, cryptococcomas, and hydrocephalus.[1,3,9,15,17] In our case, a head CT scan did not show any acute pathologies, but the MRI of the brain showed changes consistent with meningoencephalitis along with multiple periventricular brain infarcts.

Treatment of CM is divided into the induction, consolidation, and maintenance phases.[1-3,5,6,9,15] Depending on the institutional policy, CM cases can be managed as per the Infectious Disease Society of America (IDSA) 2010 guidelines or the World Health Organization (WHO) 2022 guidelines.[3,4,18] Our patient was managed as per the WHO guidelines; for induction, a single dose of liposomal amphotericin at 10 mg/kg plus 14 days of flucytosine 100 mg/kg per day, divided into 4 doses per day, as well as 14 days of fluconazole 1200 mg daily, is recommended.[3,4,18] Following the 2-week course of induction therapy, consolidation therapy includes fluconazole 800 mg daily for 8 weeks.[18] There may be cases in which the induction and consolidation phase can be extended beyond the documented 2-week course for up to 1 to 6 weeks, such as in cases of patients that remain comatose, clinical deterioration, persistent elevated ICP, and CSF cultures that remain positive following the 2-week induction therapy.[1] Our patient had a delayed response to treatment prompting us to prolong the induction phase by 3 weeks. The initial lack of response may have been due to immunodeficiency, higher fungal burden, or coinfection with HSV-2. Neurosurgery was consulted for possible intrathecal administration of the antifungal; however, this option was deferred when the patient started to show signs of improvement.

Typically, maintenance therapy follows the consolidation phase and requires negative CSF cultures. Both the IDSA and WHO guidelines recommend treatment with fluconazole 200 mg per day for over 1 year.[1,18,19] An alternative to fluconazole during the maintenance period is itraconazole 200 mg per day orally for over 1 year; however, large prospective studies have shown fluconazole as the most effective therapy.[1,20] The length of maintenance therapy is determined by several factors to mitigate relapse; risk of relapse is low in patients who have completed primary therapy, free of symptoms, and those who have been receiving ART with a CD4 cell count of >100 cells/mL and an undetectable viral load.[1] Elevated ICP is a known complication of CM and is due to the obstruction of reabsorption of CSF at the arachnoid villi by the yeast.[1,4] During the induction phase of treatment, it is recommended to decrease ICP by drainage of CSF with a reduction of opening pressure by 50%, or to normal pressure <20 cm of CSF.[1] Drainage options include serial lumbar punctures, temporary lumbar drainage catheter, or ventriculostomy.[1,3,4,7] Cerebrospinal fluid drainage often leads to immediate relief of severe headaches.

Herpes simplex virus-2 encephalitis, which can be a consequence of a primary infection or reactivation of latent HSV, is treated with acyclovir 10 mg/kg IV every 8 hours for 14 to 21 days in immunocompetent individuals.[21-25] However, immunocompromised patients may require higher doses and for an extended period of time.[15,24] The use of corticosteroids is typically reserved for patients with extensive edema and mass effect, as immunosuppression can further aid in viral replication.[24] In addition, it is important to keep in mind crystal-induced nephropathy that can be induced as an adverse effect of acyclovir and will require appropriate hydration in mitigating that risk.[21,24,25]

Conclusion

Cryptococcal meningitis is a severe infection of the central nervous system caused by *Cryptococcus* spp., primarily affecting immunocompromised individuals such as those with AIDS. Symptoms include headaches, nausea, and cognitive decline, potentially leading to severe neurological complications if untreated. Despite modern therapies, CM remains a significant health challenge, with high morbidity and mortality rates. Very rarely, coinfections with bacteria or viruses may occur, complicating the treatment and prognosis. Prompt diagnosis and appropriate treatment with antifungals and ART are crucial for managing CM and improving patient outcomes. Here, we describe a unique case of HSV-2 and cryptococcal coinfection in a patient with AIDS. Although the patient had a grim prognosis during his hospitalization, his clinical status improved significantly after a prolonged induction phase and initiation of ART.

Author Contributions

LB and MM conceptualized the idea of this case report and contributed equally to its writing. LB and MM share first authorship as designated by the asterixis. CK, TR, RB, and UE helped with data curation, collection of pertinent patient data, and writing. SP and SU edited, fact-checked, and proofread the final version of the manuscript.

Data Availability Statement

Further inquiries can be directed to the corresponding author

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Ethics Approval

Our institution does not require ethical approval/waiver for case reports.

Informed Consent

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References

1. Mourad A, Perfect JR. Present and future therapy of Cryptococcus infections. *J Fungi*. 2018;4(79):1-10. doi:10.3390/jof4030079
2. Poley M, Koubek R, Walsh L, et al. Cryptococcal meningitis in an apparent immunocompetent patient. *J Investig Med High Impact Case Rep*. 2019;7:1-5. doi:10.1177/2324709619834578
3. Ngan NTT, Flower B, Day JN. Treatment of cryptococcal meningitis: how have we got here and where are we going? *Drugs*. 2022;82(12):1237-1249. doi:10.1007/s40265-022-01757-5
4. Zhao Y, Ye L, Zhao F, et al. Cryptococcus neoformans, a global threat to human health. *Infect Dis Poverty*. 2023;12(20):1-18. doi:10.1186/s40249-023-01073-4
5. Rajasingham R, Wake RM, Beyene T, et al. Cryptococcal meningitis diagnostics and screening in the era. *J Clin Microbiol*. 2019;57(1):1-8.
6. Rajasingham R, Smith RM, Park BJ, et al. Global burden of disease of HIV-associated cryptococcal meningitis: an updated analysis. *Lancet Infect Dis*. 2017;17(8):873-881. doi:10.1016/S1473-3099(17)30243-8
7. Saleem F, Fasih N, Zafar A. Cryptococcus neoformans and *Streptococcus pneumoniae* co-infection in post-traumatic meningitis in a patient with unknown HIV status. *J Pakistan Med Assoc*. 2015;65(10):1122-1124. http://ecommons.aku.edu/
8. Gonzales Zamora JA, Espinoza LA, Nwanyanwu RN. Neurosyphilis with concomitant cryptococcal and tuberculous meningitis in a patient with AIDS: report of a unique case. *Case Rep Infect Dis*. 2017;2017:1-5. doi:10.1155/2017/4103858
9. Wirantara H, Rusli M, Arfijanto MV, et al. Cryptococcal meningoencephalitis in HIV/AIDS patient coinfected with tuberculosis. *Case Report. Gac Med Caracas*. 2023;131(2):387-396. doi:10.47307/GMC.2023.131.2.15
10. Payal P, Sekar U, Sujatha S, et al. Meningitis caused by Cryptococcus neoformans and Herpes simplex virus: dual infection in an immunocompetent patient. *J Acad Clin Microbiol*. 2016;18(2):114-116. doi:10.4103/0972-1282.194942
11. Jean S-S, Fang C-T, Shau W-Y, et al. Cryptococcaemia: clinical features and prognostic factors. *QJ Med*. 2002;95:511-518. https://academic.oup.com/qjmed/article/95/8/511/1698433
12. Boulware DR, Jarvis JN. Timing of antiretroviral therapy in cryptococcal meningitis: what we can (and cannot) learn from observational data. *Clin Infect Dis*. 2023;77(1):74-76. doi:10.1093/cid/ciad123
13. Boulware DR, Meya DB, Muzoora C, et al. Timing of antiretroviral therapy after diagnosis of cryptococcal meningitis. *N Engl J Med*. 2014;370(26):2487-2498. doi:10.1056/nejmoa1312884
14. Ingle SM, Miro JM, May MT, et al. Early antiretroviral therapy not associated with higher cryptococcal meningitis mortality in people with human immunodeficiency virus in high-income countries: an International Collaborative Cohort Study. *Clin Infect Dis*. 2023;77(1):64-73. doi:10.1093/cid/ciad122
15. Zhou W, Lai J, Huang T, et al. Clinical interventions in aging dovepress cryptococcal meningitis mimicking cerebral infarction: a case report. *Clin Interv Aging*. 2018;13:1999-2002. doi:10.2147/CIA.S181774
16. Correa K, Craver S, Sandhu A. An uncommon presentation of cryptococcal meningitis in an immunocompetent patient: a case report. *Clin Pract Cases Emerg Med*. 2021;5(4):450-454. doi:10.5811/CPCEM.2021.8.53368
17. Mohamed SH, Nyazika TK, Ssebambulidde K, et al. Fungal CNS infections in Africa: the neuroimmunology of cryptococcal meningitis. *Front Immunol*. 2022;13:1-13. doi:10.3389/fimmu.2022.804674
18. World Health Organization. *Guidelines for Diagnosing, Preventing and Managing Cryptococcal Disease Among Adults, Adolescents and Children Living with HIV*. World Health Organization; 2022.
19. Pappas PG. Cryptococcal infections in non-HIV-infected patients. *Trans Am Clin Climatol Assoc*. 2013;124:61-79.
20. Petrakis V, Angelopoulou CG, Psatha E, et al. Recurrent cryptococcal meningitis in a late presenter of HIV: a rare case report and review of literature. *Am J Case Rep*. 2023;24:e941714. doi:10.12659/AJCR.941714
21. Silwal S, Hassan E, Jain S, et al. A case of herpes simplex virus meningitis in an immunocompromised individual: avoiding common diagnostic pitfalls. *Cureus*. 2023;15(7):1-6. doi:10.7759/cureus.42242
22. Bodilsen J, Tattevin P, Tong SYC, et al. Treatment of herpes simplex virus type 2 meningitis: a survey among infectious diseases specialists in France. *Open Forum Infect Dis*. 2022;9(12):1-6. doi:10.1093/ofid/ofac644
23. Sherchan R, Shrestha J, Omotosho YB, et al. Herpes simplex virus-2 meningitis masquerading as pseudotumor cerebri. *Cureus*. 2021;13(6):e15764. doi:10.7759/cureus.15764
24. Trakolis L, Naros G, Vougioukas V, et al. Herpes simplex meningitis after vestibular schwannoma surgery: illustrative case. *J Neurosurg Case Lessons*. 2021;1(6):6-9. doi:10.3171/CASE20146
25. Patil S, Beck P, Nelson TB, et al. Herpes simplex virus-2 meningoencephalitis with abducens nerve palsy with literature review. *Cureus*. 2021;13(6):e15523. doi:10.7759/cureus.15523