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A Case of Coccidioidal Meningitis With Biofilm Obstructing VP Shunt Due to *Cutibacterium acnes*

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Abstract

Herein described is a case of biofilm obstructing ventriculoperitoneal shunt due to *Cutibacterium acnes* infection in a patient with coccidioidal meningitis. *Cutibacterium acnes* infects and obstructs cerebral shunts by the production of biofilm; however, diagnosis is usually missed by routine aerobic cultures. Obtaining anaerobic cultures routinely in patients with foreign body implants leading to central nervous system infections could prevent a missed diagnosis of this pathogen. Penicillin G is the first-line treatment.

Keywords

Cutibacterium, *Propionibacterium*, coccidioidal meningitis complications, CNS shunt infections

Introduction

Cutibacterium acnes (*C acnes*) is a biofilm-forming bacteria and infects and obstructs cerebral shunts by its ability to form biofilms leading to an increase of antibiotic tolerance.¹ *C acnes* does not induce a clear inflammatory response as it is able to escape the immune system.¹ Only a slight increase in the inflammatory markers (erythrocyte sedimentation rate, procalcitonin, c-reactive protein) is seen in these infections.¹

Coccidioidomycosis, a fungal infection, is typically a mild to moderate respiratory illness. Approximately 1% of the patients develop disseminated disease.² Roughly half of these disseminated cases results in meningitis. Between 15% and 40% of those cases develop hydrocephalus either early or late in the course of their disease requiring a ventriculoperitoneal (VP) shunt.² One of the major problems with VP shunts is superimposed bacterial infection.³ The most commonly recognized infecting organisms are *Staphylococcus epidermidis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella*, *Proteus*, and *Pseudomonas*.^{4,5}

In recent years, an increasing prevalence of *C acnes* has been found in cerebrospinal fluid (CSF) shunt infections.⁶ The Valley Fever Institute cared for a patient with a VP shunt infection caused by *C acnes*. The diagnosis was delayed secondary to failure to utilize anaerobic culturing of cerebrospinal fluid of VP shunt for anaerobic bacteria.

Methods

Institutional Review Board of Kern Medical approved this study. A retrospective review of the patient's record was performed. Literature search was conducted on PubMed and Google Scholar using the search terms *Cutibacterium*, *Propionibacterium*, coccidioidal meningitis complications, and central nervous system (CNS) shunt infections.

Case Presentation

A 32-year-old woman with coccidioidal meningitis onset 10 years prior subsequently required bilateral VP shunts for non-communicating hydrocephalus. She had multiple VP shunt revisions: 4 years prior, 3 years prior, 2 revisions within

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1 year prior. All aerobic cultures from the VP shunt revisions were negative for any growth. Anaerobic cultures were not performed.

A year after her last shunt revision, she developed recrudescence headaches and was diagnosed to have bilateral VP shunt failure requiring another complete shunt replacement. During distal externalization, a biofilm material within the shunt lumen was noticed. CSF cultures remained negative. Subsequently, a decision was made to collect anaerobic cultures from the ventricular catheters before completion of the revision, and she was discharged in stable condition. Twenty days after discharge, intraoperative anaerobic cultures grew *C acnes*. One month postoperatively, the patient again presented with worsening headaches, blurred vision, and vomiting due to VP shunts failure and subsequently underwent removal of shunts and extra ventricular drainage was isolated. She was treated in the hospital with ceftriaxone 2 g every 12 hours for 2 weeks. Extra ventricular fluid grew *C acnes* from the intraoperative anaerobic cultures. Following revision and hospital discharge, patient has not had any further recurrence of shunt failures for 24 months. Her meningitis has remained stable.

Discussion

C acnes is a gram-positive anaerobic rod. It is found on normal skin flora, oral cavity, conjunctiva, and the external ear.⁷ *C acnes* is well known to cause prosthetic shoulder, hip, and knee infections. More recently, the role of *C acnes* in neurosurgical device infections involving internal CSF shunts and external ventricular drains (EVD) has been recognized.⁷ In neurosurgical device infections, the most common organisms are listed above. Historically, less than 10% of shunt malfunctions are identified to be secondary to shunt infections.⁷ The authors point out that shunt failure, especially repetitive shunt failure without inflammatory symptoms or significant CSF pleocytosis and negative cultures may very well be infection with *C acnes*.⁷⁻⁹ The causative pathogen, mechanism of infection, and the type of shunt all contribute to the clinical features of CSF shunt infections.

Patients who develop *C acnes* particularly post neurosurgery typically present with subtle clinical symptoms making it hard to recognize. New headache, lethargy, nausea, change in mental status, erythema, and tenderness are strongly suggestive of CSF shunt infection.⁸ In various studies by Schlecht et al and Rozgonyi et al, the duration of symptom onset to diagnosis has been shown to vary between 1 and 3 months. Culturing for this organism under both aerobic and anaerobic conditions is suggested given *C acnes* is aero-tolerant.⁹ *C acnes* infects and obstructs cerebral shunts by producing biofilm; therefore, when obtaining sample to culture, it is recommended to obtain the sample directly from the implant.¹⁰⁻¹² Prolonged incubations may be required for slow growing pathogens such as *C acnes*. In 1 study, 15 cases were identified only because the incubation period was

greater than 7 days.¹ The Infectious Diseases Society of America recommends (IDSA) recommends cultures be held for at least 10 days.⁸

In treating *C acnes*, IDSA recommends penicillin G 20 million units every 24 hours for 12 weeks as first line treatment along with shunt removal and replacement.⁸ Penicillin G is a good first-line treatment based on susceptibility and penetration into the biofilm formed by *C acnes*.¹³ The goals of shunt removal surgery in acute infections are to decrease the bacterial burden and remove the foreign material.¹³ This is because the biofilm is still immature in acute infections less than 4 weeks, making eradication easier. In delayed infections, those greater than 4 weeks, the aim is for shunt removal and replacement as the biofilm is mature causing the eradication difficult.⁷ In a retrospective study by Conen et al., it was found that majority of patients with *C acnes*-related infections who were treated with antibiotics and shunt removal had a better outcome compared with the antibiotics only group.¹⁴

C acnes infects and obstructs cerebral shunts by the production of biofilm; however, diagnosis is usually missed by routine aerobic cultures. Obtaining anaerobic cultures and prolonged incubation could have prevented delayed diagnosis of this pathogen. As far as we were able to discern, this is the first reported case of *C acnes* VP shunt infection in a coccidioid meningitis patient. We believe that this occurs more frequently, but is unrecognized due to the subtle signs and symptoms and delays in the growth of *Cutibacterium*. Efforts should be tailored to routinely obtaining anaerobic cultures in patients with potential CSF infection secondary to foreign body implant.

Acknowledgments

This case was presented with poster at the Coccidioidomycosis Study Group 66th Annual Meeting in Bakersfield, California in April 2022.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Ethics Approval


Kern Medical Center Institutional Board Review approved this study as minimal risk (Study # 21121).

Informed Consent

Informed consent from the patient for this publication was obtained.

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