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Case Study

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ESCHERICHIA COLI MENINGITIS IN AN IMMUNOCOMPROMISED ADULT PATIENT: A CASE REPORT

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INTRODUCTION

Bacterial meningitis remains one of the most severe central nervous system (CNS) infections, carrying significant morbidity and mortality, particularly in immunocompromised patients. In immunocompetent adults, the most common bacteria causing meningitis are *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Neisseria meningitides*.[1] In immunocompromised patients, there may be an increased incidence of pathogens such as *Listeria monocytogenes*, tuberculosis and gram-negative bacilli.[2] Immunocompromised states, such as those caused by malignancies and their treatments, including chemotherapy, radiation, and stem cell transplants, increase the risk of opportunistic and invasive infections.[3] *Escherichia coli* (*E. coli*), a common pathogen in urinary tract infections, gastrointestinal infections, and nosocomial infections, is less frequently implicated as a cause of bacterial meningitis, especially in adults. While *E. coli* is estimated to cause approximately 20% of neonatal meningitis cases, its occurrence in immunocompetent adults is exceedingly rare, with an estimated incidence of less than 0.1 cases per 100,000 individuals.[4] However, that risk increases in patients with compromised immune systems where *E. coli* can cause meningitis, bacteremia and end organ damage.[5,6,7]

This case report details the clinical course of a 57-year-old female patient with advanced stage diffuse large B-cell lymphoma, who presented with bacterial meningitis caused by *E. coli*. The patient's medical history includes

ongoing radiation therapy at the time of presentation. Despite recent treatment for upper respiratory tract infection symptoms and left ear pain, her condition rapidly deteriorated, leading to a diagnosis of bacterial meningitis. The infectious source was ultimately traced to bacterial sinusitis and otitis media, confirmed by positive cultures for *E.coli* from the ear fluid, blood, and cerebrospinal fluid.

This case underscores the complexity of managing bacterial meningitis in the context of an immunocompromised patient. It highlights the importance of considering unusual pathogens, such as *E. coli*, and the need for a comprehensive approach to diagnosis, including imaging, lumbar puncture, and microbiological testing. Additionally, the management of this patient involved not only antimicrobial therapy but also source control measures, such as myringotomy tube insertion. This case serves as an important reminder of the challenges and considerations in treating meningitis in immunocompromised individuals and the critical need for early, aggressive intervention to prevent further complications and improve patient outcomes.

Case presentation

A 57-year-old female with a medical history of advanced-stage diffuse large B-cell lymphoma was admitted to the hospital on January 27, 2025, with symptoms of bacterial meningitis. The patient had undergone an autologous stem cell transplant in August 2024 and completed chemotherapy in March 2024. She was currently undergoing radiation therapy for her lymphoma and was on multiple home medications, including amiloride, vitamin D3, multivitamins with iron and folic acid, perindopril, pantoprazole, and sulfamethoxazole/trimethoprim for pneumocystis prophylaxis and acyclovir for herpes simplex virus prophylaxis.

The patient’s illness began on the evening prior to their admission, when she started to feel unwell, but the symptoms worsened the following morning. Her family found her on the bathroom floor, confused, agitated, and unable to speak full sentences. It was unclear if there had been any falls or seizures. She was then brought to a nearby emergency department for evaluation.

Two days prior to her admission, the patient had presented to a local community hospital with symptoms of an upper respiratory tract infection, including a cough, sore throat, fever, and left ear pain. She was prescribed amoxicillin-clavulanate 875 mg twice daily for ten days and ciprofloxacin/dexamethasone ear drops. Despite this treatment, her condition deteriorated, and she developed sepsis and a change in mental status.

Upon presentation at the ED on the day of admission, she was febrile, with an altered mental status consistent with encephalopathy. Initial investigations revealed elevated inflammatory markers and signs of sepsis. A lumbar puncture was performed, which revealed a white blood cell count of 11,000/µL, low glucose, and a positive culture for Escherichia coli in the cerebrospinal fluid. Blood cultures were also positive for *E. coli*, confirming the diagnosis of bacterial meningitis. A head CT scan was performed, which showed no immediate complications such as mass effect or hemorrhage.

Investigations

Upon admission, several important laboratory tests were conducted to assess the patient's condition and guide treatment. The initial complete blood count revealed a white blood cell (WBC) count of 16.6 x 10^9/L with a neutrophil count of 14.98 x 10^9/L with a hemoglobin level of 101 g/L. Additional laboratory results showed an elevated haptoglobin level of 4.97 g/L and a lactate level of 3.4 mmol/L.

A lumbar puncture was performed on admission, with CSF findings that further supported the diagnosis of bacterial meningitis. The CSF revealed a WBC count of 10,900 x 10^6/L, with 15,111 x 10^6/L RBC. The glucose level were < 0.1 mmol/L, and total protein was significantly elevated at > 6 g/L. Cultures from CSF, peripheral blood, and left ear drainage all grew *E. coli*, confirming the causative pathogen. Notably, the *E. coli* isolate was resistant to ampicillin and trimethoprim/sulfamethoxazole, with intermediate resistance to cefazolin. These findings guided appropriate antimicrobial therapy.

In addition to the laboratory tests, a head CT was performed on admission, which showed no evidence of space-occupying lesions or hemorrhage. There was also no evidence of infarction. The CT also revealed extensive mucoperiosteal thickening within the maxillary, sphenoid, and ethmoid air cells, along with air-fluid levels in the maxillary sinuses, which were consistent with acute sinusitis in the appropriate clinical setting.

Treatment

Upon admission (admission day 1), the patient was initiated on ceftriaxone, vancomycin, ampicillin, and a loading dose of tobramycin to provide broad-spectrum antimicrobial coverage. However, on Admission Day 2, after identification of gram-negative bacilli in blood, cerebrospinal fluid, and ear drainage cultures, an infectious disease consultation was conducted. In light of the gram-negative bacilli identified in both the blood and CSF, the recommendation was to switch to the ceftriaxone to ceftazidime 2g IV every 8 hours for broader coverage pending sensitivities and final speciation. As a result, vancomycin and ampicillin were discontinued. On Day 3 of admission, following confirmation of *E. coli* growth in both CSF and blood cultures, ceftriaxone therapy was resumed at a dose of 2 grams intravenously every 12 hours.

In addition to antimicrobial therapy, an Ear, Nose, and

Throat (ENT) consultation was performed upon admission. Given the presence of acute bacterial rhinosinusitis, the ENT specialist recommended the use of intranasal corticosteroid spray (mometasone 50 mcg) 2 sprays twice daily and xylometazoline nasal spray twice daily for symptom management. On Admission Day 2, the ENT specialist performed a left myringotomy tube insertion to address the source of the infection. Additionally, ciprofloxacin/dexamethasone ear drops were prescribed for twice-daily use for 7 days to manage otitis media and inflammation.

Due to the patient's decreased level of consciousness and the need to facilitate the myringotomy tube insertion, the patient was intubated on Admission Day 2 to secure the airway and ensure adequate ventilation. Given the anticipated prolonged antibiotic therapy, a peripherally inserted central catheter line was also placed to facilitate long-term intravenous access. The patient was extubated 48 hours later (admission day 4), as her level of consciousness improved and her clinical status stabilized.

By admission day 5, the patient's clinical condition had significantly improved, prompting infectious disease consultation to recommend a 21-day course of ceftriaxone 2g IV q12h. On admission day 7, she exhibited ongoing meningismus, likely due to a high burden of infection, along with a fever that warranted additional blood and urine cultures. Despite these findings, her overall clinical status showed reassuring improvement. On admission day 9, metronidazole 500mg PO BID was added by the Infectious Disease team to provide anaerobic coverage. The patient's progress was closely monitored, with adjustments to the treatment plan made as needed based on her clinical response and microbiological findings.

DISCUSSION

This case highlights the diagnostic and management challenges of *E. coli* meningitis, especially in an immunocompromised patient with underlying malignancy. While *E. coli* meningitis is most frequently observed in neonates, it also affects other vulnerable populations, including the elderly, those with malignancies, individuals with urinary tract infections, and patients with nosocomial acquisition.[3] Gram-negative bacilli cause approximately 9% of bacterial meningitis, with *E. coli* comprising about 1% of adult cases in otherwise healthy individuals.[3] However, despite the recognized increased risk, the precise incidence of *E. coli* meningitis in immunocompromised patients remains unknown.[8] This patient's advanced diffuse large B-cell lymphoma and recent radiotherapy likely increased her susceptibility to this rare, invasive infection.

The pathophysiology of *E. coli* meningitis involves the hematogenous spread of the pathogen from a distant focus of infection, often from the gastrointestinal or urogenital tract, or, as in this case, from a localized infection such as otitis media and rhinosinusitis.[10] The bacteria enter the bloodstream, and from there, they can cross the blood-brain barrier, leading to inflammation of the meninges. In this case, the source of the *E. coli* infection was identified as acute bacterial rhinosinusitis and otitis media, which was supported by positive cultures from the blood, cerebrospinal fluid, and ear drainage. The extensive mucoperiosteal thickening and air-fluid levels seen on imaging also indicated acute sinusitis, a known risk factor for *E. coli* bacteremia and meningitis.[10]

Immunocompromised patients, such as those undergoing chemotherapy or with hematologic malignancies, have an increased susceptibility to *E. coli* infections.[3] This is due to a compromised immune response and the disruption of normal host defenses. Additionally, patients undergoing chemotherapy are at risk of mucositis, which can further facilitate the translocation of bacteria from the gastrointestinal tract into the bloodstream.[9] The management of *E. coli* meningitis requires prompt identification of the pathogen and timely initiation of appropriate antimicrobial therapy. In this case, initial empirical therapy was started with ceftriaxone, vancomycin, ampicillin, and tobramycin, which covers a broad range of potential pathogens. Importantly, agents with bactericidal activity were selected given the poor outcomes associated with bacteriostatic agents.[2] Once gram-negative bacilli were identified as the initial pathogen, antimicrobial therapy was adjusted to include ceftazidime, which is effective against a broader range gram-negative bacilli.[2,10] Final culture and speciation allowed for appropriate antibiotic de-escalation to ceftriaxone which was continued for a total of 21 days.[2]

Additionally, corticosteroids, such as dexamethasone, were administered to reduce inflammation and prevent neurological sequelae, aligning with current guidelines for the management of bacterial meningitis. While initial studies primarily demonstrated benefit in *Streptococcus pneumoniae* meningitis, subsequent observational studies have suggested improved clinical outcomes in non-pneumococcal and non-*Haemophilus influenzae* cases as well.[11] However, The use of adjunctive dexamethasone in Listeria monocytogenes meningitis remains controversial. One study associated it with reduced survival, while another suggested a potential mortality benefit.[12,13] In a Cochrane review on adjunctive corticosteroid use in meningitis, the authors found similar results with a significant reduction in mortality for pneumococcal meningitis in subgroup analysis but no such benefit for meningococcal or *Haemophilus influenzae* meningitis.[14] In *H. influenzae* meningitis, corticosteroids significantly lowered the risk of severe hearing whereas no reduction was observed in cases of *non-Haemophilus* species meningitis. Therefore, there is a lack of evidence demonstrating clinical benefits of corticosteroid use in gram-negative bacilli meningitis; however, the potential benefits may still outweigh the risks in preventing neurological sequelae.

In addition to antimicrobial treatment and adjunctive therapy with corticosteroids, source control through surgical intervention is essential, especially in cases where the source of infection is a localized focus such as otitis media or sinusitis. In this case, consultation with the Ear, Nose, and Throat (ENT) specialist was critical. The ENT team performed a myringotomy to drain the infected ear fluid and control the infection source. They also prescribed nasal corticosteroids and nasal decongestants to manage the sinus infection, which helped in reducing the bacterial load. The importance of multidisciplinary consultation in optimizing both antibiotic therapy and source control cannot be overstated.

Despite clinical improvement, the patient continued to exhibit meningismus on admission day 7. This ongoing inflammation within the cerebrospinal fluid, likely due to a high bacterial burden, is consistent with the established relationship between bacteremia and *E. coli* meningitis. Research suggests that a high degree of bacteremia is often a prerequisite for *E. coli* to penetrate the blood-brain barrier and cause meningitis, with some studies specifying a threshold of circulating bacteria potentially exceeding 10^6 CFUs/ml for meningeal invasion.[15] Therefore, while the patient's overall condition was improving, the persistent meningismus suggests that a significant bacterial burden likely remained, contributing to her ongoing symptoms.

This case report has inherent limitations. Primarily, the retrospective design may have influenced the thoroughness of identification, reporting, and documentation within the patient's medical chart. Furthermore, this report describes a single patient's experience, which inherently limits its generalizability to other patients with *E. coli* meningitis, particularly given the patient's immunocompromised status and complex clinical course. Variations in host factors, the specific *E. coli* strain, and the details of treatment could influence the clinical presentation and response to therapy. Finally, while this case highlights important diagnostic and management considerations, it cannot provide definitive conclusions about the benefits of corticosteroid use in non-*Haemophilus* species meningitis.

Ultimately, this case serves as a reminder of the importance of early recognition of unusual pathogens, timely interventions, and multidisciplinary management in improving patient outcomes in complicated infections like *E. coli* meningitis.

CONCLUSION

This case report illustrates the complexities of managing *E. coli* meningitis, particularly in an immunocompromised patient. It underscores the importance of prompt diagnosis, broad-spectrum empiric antibiotics followed by targeted therapy, and aggressive source control. The patient's ongoing meningismus despite initial improvement highlights the challenges of potentially high bacterial burden and is consistent with some evidence linking bacteremia levels to meningeal invasion.

This case also raises the question of adjunctive corticosteroid use in non-*Haemophilus* meningitis given the limited evidence of benefit. While this case details the clinical course and management of a rare *E. coli* meningitis presentation in an immunocompromised adult, further research, especially larger, prospective studies, is needed to optimize treatment strategies, including the role of adjunctive therapies, and improve outcomes for this vulnerable population.

Appendix

Table 1: Cerebral spinal fluid culture.

Parameter	Result	Reference Range	Interpretation
White Blood Cell Count	10,900 × 10^6/L	< 5 × 10^6/L	Markedly elevated (pleocytosis)
Red Blood Cell Count	15,111 × 10^6/L	< 10 × 10^6/L	Likely traumatic tap or hemorrhagic
Glucose	< 0.1 mmol/L	2.2–3.9 mmol/L	Critically low
Protein	> 6 g/L	0.15–0.45 g/L	Significantly elevated
Gram Stain	Gram-negative bacilli seen	—	Suggestive of E. coli infection
Culture	Positive for *E. coli*	—	Confirms diagnosis

Table 2: Microbiologic findings.

Specimen	Culture Result	Organism Identified	Gram Stain	Comments
CSF	Positive	*Escherichia coli*	Gram-negative bacilli	Confirmed central nervous system infection
Blood (×2)	Positive	*Escherichia coli*	Gram-negative bacilli	Confirms bacteremia
Ear drainage	Positive	*Escherichia coli*	Gram-negative bacilli	Suggests sinusitis/otitis media source

Table 3: *Escherichia coli* antibiotic sensitivity.

Antibiotic	Result	Interpretation
Ampicillin	Resistant	Not recommended
Trimethoprim/Sulfamethoxazole	Resistant	Not recommended
Cefazolin	Intermediate	Use with caution
Ceftriaxone	Susceptible	Agent of choice
Ceftazidime	Susceptible	Alternative if needed
Gentamicin	Susceptible	Used as initial coverage

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