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**CASE REPORT** **OPEN ACCESS**

# ESCHERICHIA COLI MENINGITIS IN AN IMMUNOCOMPROMISED ONCOLOGY PATIENT - CASE REPORT

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## ABSTRACT

This is a case report that highlights the diagnostic and treatment complexities of an oncology patient (rectal neoplasia) with Escherichia coli meningitis. The study focuses on laboratory findings and imaging results leading to the definitive diagnosis, addressing signs and symptoms, blood culture history, treatment administered, and clinical outcome. The aim is to contribute to the medical literature by providing relevant information on the treatment of Escherichia coli meningitis in an adult immunocompromised patient due to neoplasia, to stimulate future research and diagnostic reasoning, and to raise awareness among healthcare professionals about the rarity of the case and the careful use of antibiotic therapy to improve the quality of care.



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# INTRODUCTION

Bacterial meningitis is a global health issue with various etiological agents that vary by age and geographic area. It is defined as an infection and inflammation of the meninges, resulting in significant morbidity and global mortality (WHO, 2023). It can be fatal in 50% of cases if untreated, and 8-15% of patients may die even when diagnosed early and treated appropriately. Additionally, 10-20% of survivors may have permanent sequelae such as hearing loss, learning difficulties, and various brain damage (WHO, 2023). The etiological agents responsible for bacterial meningitis vary by age group. Among neonates, most cases are caused by Group B Streptococcus, Escherichia coli, and Listeria monocytogenes. In contrast, the majority of cases in children and adults are caused by Streptococcus pneumoniae and Neisseria meningitidis (BROUWER, 2010; CENTERS FOR DISEASE CONTROL AND PREVENTION, 2017). Haemophilus influenzae is implicated in bacterial meningitis across all age groups, being more prevalent in children under 5 years of age (WHO, 2013; HAMBROSKY AND WOLF, 2015). A meta-analysis involving 72 studies identified that Neisseria meningitidis was the most prevalent pathogen in children aged 1-5 years, while Streptococcus pneumoniae was more relevant in the group of children aged 6-18 years. Among neonates, Escherichia coli and Streptococcus pneumoniae were the most common. There were a few studies available on pathogens in different age groups, such as Group B Streptococcus, Listeria monocytogenes, Escherichia coli, and Staphylococcus aureus (ANOUK, 2018)). Aerobic gram-negative bacteria are an uncommon cause of community-acquired meningitis but may be found in immunocompromised patients (e.g., those with HIV), neonates, and the elderly, as well as after head trauma and neurosurgical procedures (BROUWER, 2010). The most common symptoms in adult patients include neck stiffness, high fever, confusion or altered mental status, headache, nausea, and vomiting. Less frequently, symptoms may include seizures, neurological deficits (such as loss of vision or hearing, cognitive impairment, and limb weakness). Bacterial meningitis can also cause other symptoms due to septicemia, such as purpura, rash, diarrhea, tachypnea, myalgia, and arthralgia (WHO, 2023). Diagnosis is based on the clinical presentation followed by lumbar puncture, confirmed with bacterial growth documented in cerebrospinal fluid or blood cultures (WHO, 2023). A case report published by the Neurology Department of the Paulista School of Medicine highlights that E. coli meningitis is not common, being extremely rare in adults (ALEXANDER, 1946). The case involved a 76-year-old patient with an acute gastrointestinal infection presenting with fever, vomiting, abdominal cramps, dysentery, and malaise. On the fourth day, with the gastrointestinal symptoms in remission, the patient developed headache and restlessness, progressing over the following days to agitation and confusion. On clinical examination, the patient had neck stiffness and signs of Kernig and Brudzinski. Cerebrospinal fluid analysis revealed purulent meningitis caused by Escherichia species. The patient's condition worsened over the next 12 hours, resulting in deep

drowsiness and progression to coma. Treatment with chloramphenicol succinate was initiated via intrathecal administration, and the patient progressively improved, being cured by the 15th day of therapy (DINIZ, 1959). Additionally, another analytical and retrospective study with 25 cases of adults diagnosed with meningitis with positive cultures for Escherichia coli, conducted over a 29-year period (January 1989 to December 2017) in Taiwan and published in 2021 by the Neurology Department of Kaohsiung Chang Gung Memorial Hospital and Chang Gung University of Medicine, was found. It concluded that out of the 25 patients, 13 had a post-neurosurgery state as an underlying condition for the infection. Among the neurological clinical manifestations, 19 patients had altered consciousness, 10 cases had hydrocephalus, 7 patients had seizures, 5 had acute/subacute cerebral infarction, 2 had cerebral abscesses, and 1 had a subdural empyema. Overall, 21 patients had fever, 8 developed septic shock, 6 had bacteremia, and 3 had hyponatremia. With the treatment administered, the mortality rate was > 44% (11 patients died), with the presence of septic shock being a significant factor (HSIAO, 2021). Regarding antibiotic therapy in the aforementioned study, third or fourth-generation cephalosporins (ceftriaxone, ceftazidime, and cefepime) combined with vancomycin were initially administered as empirical treatment, and were later adjusted according to susceptibility results found in antibiograms. Ampicillin, ciprofloxacin, cefepime, ceftriaxone, ceftazidime, and meropenem had sensitivities of 25% (4/16), > 50% (8/16), > 68.75% (11/16), 75% (12/16), 87.5% (14/16), and 100% (16/16), respectively (HSIAO, 2021).

# MATERIAL AND METHODS

This study is an observational research with a descriptive and qualitative data approach. A literature search was conducted in electronic databases: SciELO, Portal CAPES, (Lilacs), and Medline/PubMed, covering the period from 1926 to 2023, in both Portuguese and English languages, with the majority of selected articles being in English. By cross-referencing Health Sciences Descriptors (DeCS), the following were selected: Meningitis, Escherichia coli, diagnostic examination, signs and symptoms, case report. The information in this work was obtained through a review of the medical record, documentation of diagnostic methods to which the patient was subjected, and literature review. This article complies with Circular Letter 166/2018 from the National Commission of Ethics in Research (CONEP), directly linked to the National Health Council, approved under Opinion No. 065165/2024 of the Research Ethics Committee of Hospital Porto Dias in Belém do Pará.

# CASE REPORTS

This study involves a 45-year-old female patient, married, with a prior diagnosis of colorectal neoplasia and scheduled to restart chemotherapy (having been off chemotherapy since 2017), who was admitted with fever, chills, myalgia, and dyspnea on exertion, requiring hospitalization. Her blood culture during this admission grew multidrug-sensitive Escherichia coli, and antibiotic therapy with ceftriaxone was initiated for 7 days with improvement in initial symptoms, leading to her discharge. However, one day later, she developed high fever, severe headache in the neck, abdominal pain, and had not had a bowel movement for 7 days, but denied vomiting. On physical examination, neck stiffness was the most notable finding. Initial evaluation showed leukocytosis of 17,000. She was readmitted with a diagnostic hypothesis of meningitis, and treatment with ceftriaxone, vancomycin, and ampicillin was started. Admission CT scans yielded the following relevant results:

***Head computed tomography (CT) scan:*** No evidence of intracranial expansive processes or extra-axial fluid collections above or below the tentorium. Sulci and fissures were unremarkable, the ventricular system had normal morphology and dimensions. No midline shifts were noted. The white and gray matter had normal attenuation coefficients. Visible portions of the paranasal sinuses showed no abnormalities. There was atheromatosis of the carotid and vertebral arteries.

***Chest computed tomography (CT) scan:*** A non-calcified pulmonary nodule in the posterior segment of the left upper lobe, approximately 1.3 cm in size, suggesting secondary neoplastic involvement; other thoracic structures were unremarkable.

***Abdominal computed tomography (CT) scan:*** Signs of surgical manipulation in the colon and transverse rectum. The liver had normal morphology, topography, and dimensions, but a heterogeneous nodular formation, predominantly hypodense with a hyperdense central portion, with partially defined limits and irregular contours, was noted in the left hepatic lobe, measuring about 4.8 cm, of indeterminate nature. Perirretal fat densification was observed, with a rounded hypodense image in the presacral area extending cranially and retrouterinely, with a gas focus, measuring up to 5.4 cm, indeterminate in this non-contrast study, possibly corresponding to an abscess.

Following hospitalization, the patient progressed with decreased level of consciousness and mental confusion, requiring admission to the Intensive Care Unit. Her cerebrospinal fluid (CSF) analysis showed a turbid and purulent appearance, with significant leukocytosis (54,000) consisting of 90% polymorphonuclear cells, consumed glucose (2 mg/dl), and significant protein levels (202). VDRL, Cryptococcus, and BARR tests were negative. CSF microscopy revealed gram-negative bacilli, guiding a change in the antibiotic regimen to meropenem (for central nervous system) and vancomycin. The CSF culture was positive for ESBL-positive Escherichia coli. The patient's condition worsened with decreased consciousness, respiratory failure, and tachypnea, requiring mechanical ventilation and vasopressor support for ongoing septic shock. MRI of the brain showed the following abnormalities: purulent collection within the lateral ventricles, primarily the posterior horn of the left lateral ventricle, indicating ventriculitis. Subdural empyema surrounding the posterior aspect of the right cerebellar hemisphere, measuring 1.5 cm, as well as in the left ponto-cerebellar angle cistern, adjacent to the sigmoid sinus, measuring 1.7 cm. There was abnormal enhancement of the leptomeninges within the internal auditory canals. Associated thickening of the third cranial nerve was noted.

The patient was evaluated by neurosurgery, which, considering the risks and benefits of possible drainage, did not recommend surgical intervention due to the risk of contamination of the subarachnoid space and potential damage to the sigmoid sinus, making the procedure contraindicated. Along with the infectious disease evaluation—considering the possibility of disseminated Escherichia coli infection—it was decided to administer intrathecal polymyxin via an epidural catheter in the subarachnoid space. Fifteen days after admission, the patient developed significant abdominal distension and bilious output via a nasoenteric tube, prompting a new abdominal CT scan showing considerable enlargement of the pelvic collection compared to the admission CT, leading to interventional radiology-guided drainage, with purulent, foul-smelling content, approximately 300 ml. The patient continued to be refractory to the instituted measures, remaining tachycardic, with tachycardia, dyspnea, high fever, and the need for increasing doses of mechanical ventilation and vasopressors, progressing to death due to septic shock. Ultimately, with progressive clinical deterioration, the patient experienced cardiopulmonary arrest with no response to resuscitation efforts, leading to death.

# DISCUSSION

Meningitis is known to be a global health problem, potentially fatal in 50% of cases if not treated adequately (WHO, 2023). Furthermore, it is also known that Escherichia coli is an uncommon etiological agent in adults without risk factors such as head trauma or neurosurgery (BROUWER, 2010). Therefore, it is crucial for clinicians to have the ability to recognize the condition and initiate appropriate antibiotic

therapy in a timely manner. Two aspects make the publication of this E. coli meningoencephalitis case particularly noteworthy: first, the fact that it involves a relatively young patient, and second, the progressive resistance to antimicrobials observed in the cultures. It is believed that the patient's immunocompromised state due to colorectal neoplasia and possible hepatic and pulmonary metastases significantly contributed to the severity of the infection and the unusual etiological agent. In the late 1980s, there was an increase in the incidence of ESBL-producing Gram-negative bacteria, especially in developing countries, possibly related to the increased use of third- and fourth-generation cephalosporins (BRADFORD, 2001; KIM, 2002). The most reported beta-lactamase-producing bacteria in the literature are Klebsiella pneumoniae and Escherichia coli (KIM, 2002). Extended-Spectrum Beta-Lactamases (ESBLs) are non-inducible enzymes mediated by plasmid genes that can hydrolyze the oxime-beta-lactam ring present in the chemical structure of antibiotics. Therefore, their action spectrum extends to broad-spectrum beta-lactams, such as first, second, and third-generation cephalosporins, as well as monobactams and penicillins (CORDOVA, 2006). The incidence of ESBL-producing Gram-negative bacteria varies across different regions studied. To date, more than 430 ESBLs have been characterized, with many described in Brazil (LINCOPAN, 2012). In recent years, irrational use of antibiotics has also been a major factor in the emergence of bacterial resistance (PICOLI, 2011). The lack of short- and medium-term therapeutic options for bacterial infections and the increasing incidence of multidrug resistance highlight the importance and need for preventive measures against their spread. The rate of resistance development in various Gram-positive and Gram-negative pathogens is a constant challenge worldwide (KIM, 2002). Inappropriate use of antibiotics may be related to various factors, such as subtherapeutic doses, lack of activity of the chosen antibiotic, short treatment regimens, low penetration at infection sites, age, and patient immunity status (LINCOPAN, 2012). Although the diagnosis of ESBL-positive E. coli meningitis is uncommon, rational antibiotic therapy, especially in immunocompromised patients as outlined in this case report, is essential for ensuring appropriate treatment, preventing progression to severe forms, and avoiding death.

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