

# Bacterial Meningitis- *Serratia marcescens*-Case Report

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## ABSTRACT

Meningitis is a medical condition characterized by irritation of the meninges which are the protective membranes surrounding the brain and the spinal cord. The cause can be bacterial, viral, tuberculous or fungal. Common symptoms of meningitis in children under five years of age include headache, fever, neck stiffness, seizures, and difficulty in feeding. The purpose of this case report is to highlight the rare isolation of *Serratia* from CSF fluid sample in a 9 months old child. *Serratia* is not commonly associated with meningitis and is often found as a nosocomial pathogen. Therefore, the isolation of *Serratia* from the CSF sample in this particular case is noteworthy.

**Keywords:** Child, CSF analysis, Hydrocephalus, Seizure, Meningeal Irritation, Enterobacteria

## INTRODUCTION

Meningitis is defined as inflammation of the meninges, in almost all cases identified by an abnormal number of white blood cells in the cerebrospinal fluid and specific clinical signs/symptoms. Onset may be acute or chronic, and clinical symptoms of acute disease develop over hours to days [1]. Despite breakthroughs in diagnostics, treatment regimens and vaccinations; in 2015, there were 8.7 million reported cases of meningitis worldwide, with 379,000 subsequent deaths [2]. Meningitis is a life-threatening disorder that is most often caused by bacteria or viruses. Before the era of antibiotics, the condition was universally fatal. Nevertheless, even with great innovations in healthcare, the condition still carries a mortality rate of close to 25% [2].

*Serratia marcescens* belongs to the family Enterobacteriaceae, which is commonly found in water, soil, animals, insects, plants. Although *S. marcescens* displays relatively low virulence, it causes nosocomial infections and outbreaks in severely

immunocompromised or critically ill patients, particularly in settings such as intensive care units (ICUs), especially neonatal units (NICUs). This microorganism gives rise to a wide range of clinical manifestations in newborns: from asymptomatic colonization to keratitis, conjunctivitis, urinary tract infections, pneumonia, surgical wound infections, sepsis, bloodstream infection and meningitis. The most frequent site of infection is the bloodstream, followed by the respiratory apparatus and the gastrointestinal tract [3].

At the nosocomial setting *S. marcescens* infections are more frequently reported in neonatology and ICU, where this microorganism has been isolated from catheters, oxygenation devices, prefilled syringes, needles, parenteral solutions, milk-drawers, sinks, nails, and hands of health care workers [4]. Strains of *S. marcescens* involved in epidemic events have frequently proved to be multi-resistant. Indeed, this species displays intrinsic resistance to several classes of antibiotics, including some  $\beta$ -lactams and tetracyclines [3]. The early identification of colonized or infected patients and the prompt implementation of infection control measures, particularly rigorous hand hygiene and contact precautions, are essential in order to curb the spread of infection [3].

#### CASE PRESENTATION

A fully immunized 9-month-old boy weighing 6 kilograms, was brought to emergency with a 10-day history of fever and generalized tonic clonic fits for one day.

On general physical examination the child was drowsy having continuous generalized tonic clonic seizure accompanied by an arching posture. His vitals were, BP: 90/55 mmHg, pulse: 140 beats per minute, temperature: 101 Fahrenheit, O<sub>2</sub> saturation: 99% at room air. CNS examination revealed drowsy child with GCS (Glasgow Coma Scale) of 10/15, increased muscle tone, reduced muscle power, brisk reflexes and positive Babinski. Upon auscultation of the chest harsh vesicular breathing sounds were detected. Examination of the abdomen and cardiovascular system (CVS) did not reveal any abnormalities.

Clinical laboratory investigation showed a normocytic normochromic RBC morphology with a normal platelet count ( $326 \times 10^9/L$ ). The neutrophil count was elevated accounting for 85% of the total white blood cell count. C-reactive protein levels were elevated measuring 195.8 mg/L.

Based on the clinical presentation, the differential diagnoses of meningitis and encephalitis were considered. Management including neuroprotective measures and empirical treatment of ceftriaxone, vancomycin, dexamethasone along with phenytoin was started. Further investigations, including cerebrospinal fluid (CSF) analysis with culture and sensitivity, as well as an MRI, were planned to rule out a specific diagnosis.

The investigation (tables 01&02) of CSF analysis with culture and sensitivity showed bacterial meningitis with the *Serratia marcescens* organism.

**Table 1**

Colour	Light yellow
Appearance	Clear
Coagulum	absent
protein	155mg/dl
Sugar(glucose)	11mg/dl
RBC	740/cumm
WBC	260/cumm
Neutrophils	75%
Lymphocytes	22%
Monocytes	03%

**Table 2**

Gram-negative rods	few
Pus cells	02/HPF
Isolated organism	<i>Serratia marcescens</i>
Antibiotics sensitivity and intermediate	Fosfomycin (s), Tigecycline (s), Meropenem (I)

MRI scan revealed communicating hydrocephalus, debris in the ventricle and meningeal enhancement.

Following the detection of *Serratia marcescens* bacterial species, the medication regimen was adjusted to Vancomycin and Tigecycline along with ongoing symptomatic treatment. However, despite these changes, the patient's condition did not improve and continued to deteriorate. The patient

experienced persistent fever spikes and arching of the body. In order to check the response of the patient CSF analysis with culture and sensitivity (tables 03 & 04) was repeated. Unfortunately, the results once again indicated bacterial meningitis caused by *Serratia marcescens*. This suggests that the infection was not effectively controlled by the initial medication regimen, and a more targeted approach may be required

**Table 3**

Colour	Light yellow
Appearance	clear
Coagulum	Present
Protein	682mg/dl
Glucose	2mg/dl
RBC	1000/cumm
WBC	564/cumm

**Table 4**

Gram-negative rods	Few
Pus cells	01/HPF
Isolated organism	<i>Serratia marcescens</i>
Antibiotic sensitivity	Fosfomycin (s), Tigecycline (s)

This case required multidisciplinary approach to manage the patient's condition. The infectious control team recommended implementing an external ventricular drain, discontinuing vancomycin and administering intravenous Meropenem at the maximum dose. Additionally, intrathecal Fosfomycin was prescribed to target the infection directly. However, the combination of Fosfomycin and Meropenem did not show any improvement in the patient's condition. The neurosurgery

team suggested that it would be more appropriate to resolve the infection before considering the placement of an external ventricular drain. Their recommendation was to focus on treating the infection effectively before proceeding with any invasive procedures.

Despite the management plan involving the multidisciplinary team to affectively treat *Serratia* infection, the patient's condition continued to deteriorate.

The parents decided to discontinue medical treatment against the advice of medical team. (LAMA: Leave Against Medical Advice). Considering the parent's condition it is crucial to counsel the child's parents about the potential risks and consequences of leaving against medical advice. It is important to emphasize the importance of consistent medical management for the child's well-being and to prevent further complications.

After a few days, we reached out to patients to become acquainted with their conditions. The child was receiving the same management, but after five days of LAMA, the child passed away.

## DISCUSSION

*S. marcescens* operates as an opportunistic pathogen mainly affecting patients with prior antibiotic treatment or hosts with a weakened immune system [4]. Meningitis caused by *Serratia* spp, a rare pathogen of central nervous system, was first reported in the year 1952 by two different researchers [5]. Although cases reported in pediatric age group in our country are extremely rare and are not found in the available literature. However, in the international literature, CNS infection cases caused by *Serratia* spp. have been reported in newborn and children. The largest study on *S. marcescens* meningitis in the English literature pertains to one by Wu et al. In this study, cases occurred sporadically over a period of 10 years and all registered patients were detected in different wards or ICUs. Recent epidemiological data have shown an increased frequency of antimicrobial resistance among *S. marcescens* isolates. In the study, all *S. marcescens* isolates from the first positive CSF sampling, 31 of who developed meningitis after neurosurgery, were found to be susceptible to ceftriaxone, ceftazidime, imipenem, amikacin and gentamicin [5].

*Serratia* meningitis or cerebral abscesses may develop in premature children and newborns with previous sepsis. Patients with a history of head trauma, cranial operation, lumbar puncture, or even epidural injection, brain tumor, mastoiditis, or chronic sinusitis are at risk of developing CNS infection (meningitis or cerebral abscess) due to *Serratia* spp. Compared with other Gram-negative meningitis, *S. marcescens* meningitis is more common in post-neurosurgical patients [4]. Fever, vomiting, headache, drowsiness, seizures, signs of meningeal irritation and coma are the presenting symptoms. In our case the patient initially presented with fever and fits, headache could not be clearly evaluated due to his age. However, relevant examinations and investigations

were conducted leading to a confirmed diagnosis of isolated *S. marcescens* through CSF analysis. Treatment was started with Ticozid and Vancomycin considering the altered CSF parameters including decrease CSF glucose concentration, increased protein concentration, presence of coagulum with neutrophil predominance and positive culture. CSF analysis was repeated for ongoing management, and the Creactive protein level was found to be high, along with thrombocytosis. Clinical management of *S. marcescens* infections is challenging due to its intrinsic resistance to different classes of antibiotics such as ampicillin, first and second generation cephalosporins, macrolides, and cationic antimicrobial peptides [4]. In this case, the patient demonstrated resistance to the standard drugs used for *Serratia* management, necessitating an antimicrobial susceptibility test. The test revealed sensitivity to Tigecycline, leading to the initiation of appropriate antibiotic therapy with Ticozid and Meropenem while awaiting the results of the subsequent CSF culture. *Serratia* is reported to have lower mortality rates, but due to its rarity and antimicrobial resistance pose challenges in finding the appropriate drug therapy for treatment success. In our presented case the condition of the patient was not improving, and after significant efforts, the patient's parents decided to discontinue treatment and asked for LAMA (Leave Against Medical Advice) despite adequate counselling. After few days we reached out to the parents of the child, centering on being acquainted with the patient's condition, but after five days of LAMA the child passed away. The healthcare team should make every effort to educate and support the child's parents, explaining the potential consequences of leaving the hospital without completing the recommended treatment.

## CONCLUSION

*S. marcescens* still remains a rare gram-negative bacillus which can manifest as meningitis. Due to its increased antimicrobial resistance, the treatment options become selective and narrows drug therapy. The prognosis of *Serratia marcescens* meningitis can vary depending on several factors, including the timeliness of presentation and diagnosis. If the infection is detected early and prompt diagnosis is made, the prognosis can be favorable. Early detection allows for timely initiation of appropriate treatment and implementation of infection control measures, which can significantly impact the outcome. However, in cases where the patient presents late, the prognosis tends to be more guarded. Delayed presentation can result in a more advanced stage of the disease potentially leading to complications and poorer treatment response.

It is important to emphasize the significance of early detection, prompt medical attention, and adherence to infection control measures to improve the prognosis of *Serratia marcescens* meningitis.

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