


CASE REPORT

Atypical presentation of meningococcal meningitis in an infant caused by meningococemia and complicated by ventriculitis with bilateral extra-axial septated collection

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ABSTRACT

Background: The diagnosis of meningitis in the infancy period is challenging. Clinical evaluation and high index of suspicion with early empirical treatment guidelines continue to evolve and support physician efforts to decrease the morbidity and mortality associated with pediatric meningitis.

Case Report: We report a case of a previously healthy 2-month-old male who presented with excessive crying, preceded by subjective fever and watery diarrhea, for 1 day without any other symptoms. His parents gave him multiple antipyretic doses at home for irritability which might mask his fever. The patient was tachycardic with an unremarkable physical exam. A full septic work-up was done after the stabilization of the patient and empirical antibiotics started. His blood culture grew *Neisseria meningitidis* which caused meningococcal meningitis and ventriculitis with bilateral extra-axial collection, the patient was in septic shock with multiple organ dysfunction.

Conclusion: Meningococcal meningitis in the neonatal and infancy periods remains a serious health threat with high morbidity and mortality. This case report urges the physician to keep a high index of suspicion by taking a detailed history and frequent assessment of each suspected case as the clinical presentations, signs, and symptoms in the infancy period are not specific nor classic to guide the physician.

Keywords: Meningitis, infants, meningococcal meningitis.

Introduction

Bacterial meningitis is a serious infection of the brain and spinal cord, associated with high mortality and morbidity around the world [1]. Bacterial meningitis is the cause of death for approximately 318,000 deaths every year worldwide [2]. One of the most serious pathogens causing meningitis is *N. meningitidis*, which has a higher incidence in Saudi Arabia [3]. Recently incidence of meningococcal meningitis in Saudi Arabia has decreased due to the vaccination program that has been implemented by the Saudi Ministry of Health [4].

Neisseria meningitidis is a Gram-negative diplococcus that is transmitted via droplets or direct contact with the patient and can invade the bloodstream,

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causing meningococemia, or cross the blood-brain barrier causing meningitis. Most of the patients with meningococcal meningitis will present with various symptoms, depending on the age and immune status of the patient. The symptoms include fever, petechial or purpuric rash, headache, neck stiffness, nausea, vomiting, photophobia, seizures, and decreased consciousness [5].

The diagnosis will be made based on the combination of the clinical presentation and laboratory tests. The confirmation of the infection will be through blood and cerebral spinal fluid (CSF) cultures [6]. Polymerase chain reaction (PCR) can be used to confirm the presence of *N. meningitides*, along with the lumbar puncture fluid analysis which will show signs of bacterial meningitis [6]. The CSF analysis will contain several valuable findings which are gram stain, cell count, glucose, and protein levels. CSF leukocyte count $\geq 20/\text{mm}^3$ is suggestive of bacterial meningitis in the infant. Low glucose and high protein in the CSF are suggestive of bacterial meningitis, moreover, the CSF culture is gold-standard for the diagnosis [7].

The cornerstone of the management is the early detection of the disease and starting the antibiotic as soon as the diagnosis is suspected, which will decrease the mortality and prevent further complications. The treatment of choice is intravenous (IV) broad-spectrum antibiotics based on the age of the patient, along with initiation of supportive care, such as IV fluid and symptomatic treatment. Vaccination against *N. meningitides* is recommended as a preventive measure. Close contact with the patient should receive a prophylactic antibiotic as recommended [5-7]. This case report represents an atypical, complicated case of meningitis in an infant.

Case Presentation

A 2-month-old male, full term, medically and surgically free, received a birth vaccine with appropriate developmental stages for his age and presented to the pediatric emergency department with a history of excessive crying that interrupted his sleep and feed for 1 day. There was subjective fever and watery diarrhea 2 days before his presentation.

Physical examination revealed a conscious awake infant with significant irritability and crying. Vitals included a heart rate of 195 beats/minute, rectal temperature of 37.8°C, normal blood pressure, and respiratory rate for his age with oxygen saturation of 98% on room temperature and air. Abdominal, chest, cardiovascular, and central nervous system examinations were normal with an open flat anterior fontanelle and normal skin color without any rashes.

Full septic work-up was done with prophylactic antibiotics, Ceftriaxone, and Vancomycin, started for the clinical sepsis situation of the patient in the emergency room. His initial laboratory results showed a white blood cell (WBC) count of $5.37 \times 10^9/\text{l}$, hemoglobin 11.2 mg/dl, platelets $74 \times 10^9/\text{l}$, creatinine 61 $\mu\text{mol/l}$, blood urea nitrogen 11.6 mmol/l, alanine transaminase 58 U/l, and aspartate aminotransferase 94 U/l. High inflammatory markers including a c-reactive protein 271 mg/l and

procalcitonin 82 ng/ml, venous blood gas showed metabolic alkalosis (pH 7.26, pCO_2 28 mmHg HCO_3 46 mmHg) without electrolyte disturbance.

Based on the patient's presentation and his age, he worked up for nonaccidental trauma causes to be ruled out in such cases despite the negative history taken from the parents, initial brain computed tomography (CT) showed no acute traumatic brain injury, unremarkable skeletal survey, and unremarkable abdominal ultrasound (US).

The patient was admitted to the pediatric intensive care unit (PICU) where he deteriorated and intubated with multiple team services involved as a case of fluid-responsive septic shock with multiple organ dysfunction, disseminated intravascular coagulation (DIC), acute kidney injury, and transaminitis. The patient started to have right eye ptosis with sparing pupils with two episodes of seizures in the form of jerky movement of the limb with vital instability that lasted for minutes and was controlled by Levetiracetam loading and maintenance doses.

One day later, blood culture grew *N. meningitides*, (PCR was positive for *N. meningitides*, CSF analysis showed white WBC $300 \times 10^6/\text{l}$, protein 1.8 g/l, glucose 3.8 mmol/l, and negative (CSF) culture.

A brain magnetic resonance imaging (MRI) was reported with findings suggestive of meningoencephalitis and ventriculitis (Figure 1A and B).

The external ventricular drain was inserted by the neurosurgery team for evacuation of the subdural collection. Repeated brain CT showed an interval mild increase in the extra-axial collection, causing a minimal midline shift to the left side (Figure 2).

The patient developed a bluish discoloration on his toes with an intact pulse; venous Doppler US of the lower extremities showed patent bilateral lower extremity vasculature without occlusion of thrombosis (Figure 3A and B).

During his admission, he started to improve in his condition, both laboratory and clinically; the patient was extubated and transferred to the general pediatric ward after 4 4-day stay in the PICU. Repeated blood and CSF cultures were negative; the patient was admitted to the hospital around 2 months later for further management of hematological complications and investigation of immunodeficiency diseases which came negative unremarkable investigations and discharged home in stable condition with regular follow-up in the clinic. Chemoprophylaxis therapy was provided to family members and healthcare providers.

Discussion

In spite of the significant advances in antimicrobial therapy and modern vaccination strategies, acute bacterial meningitis remains one of the global threats with a high rate of morbidity and mortality [8]. The incidence of bacterial meningitis ranges approximately from 0.9 to 80 per 100,000 individuals per year depending upon income, socioeconomic status, and geographical area [8]. The

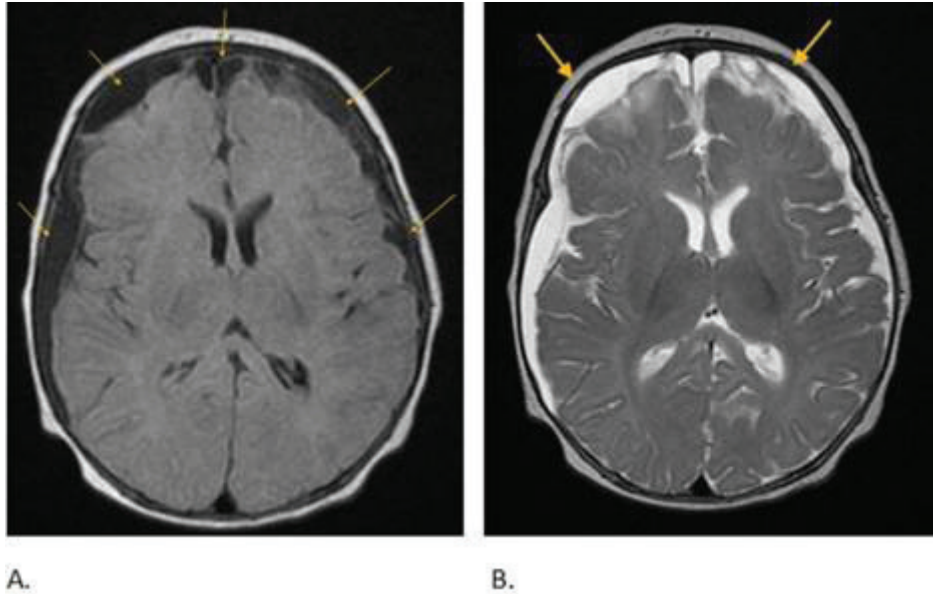


Figure 1. (A) Axial view brain MRI and (B) Axial view brain MRI post contrast: the images show extensive extra-axial collection with subarachnoid debris with diffuse leptomeningeal enhancement evident on flair post-contrast sequences more evident in the bifrontal regions with associated high T2 signal intensity of the underlying brain parenchyma.

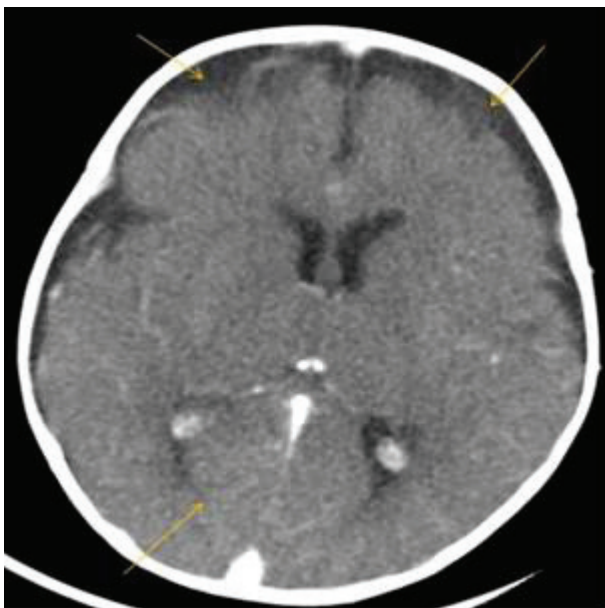


Figure 2. Axial view brain CT: The image shows bifrontal extra axial collection causing minimal midline shift to the left side.

annual incidence of bacterial meningitis in infants aged less than 90 days was 0.38 per 1,000 live births, overall, Group B *streptococcus* counts for 50% and *Escherichia coli* 14%, both were responsible for approximately two-thirds of isolated bacteria, *Streptococcus pneumoniae* 9%, *N. meningitidis* 8%, and *Listeria monocytogenes* 4% as reported by Okike et al. [8].

In our case report, we present a 2-month-old male infant who had an atypical presentation of neonatal sepsis and meningitis caused by *Neisseria meningitides*, a Gram-negative proteobacterium that belongs to the bacterial family Neisseriaceae. There are 13 *N. meningitides* serogroups based on different capsular polysaccharide structures, but



Figure 3. (A) Right foot and (B) Right hand: the images show a bluish discoloration on the foot and hand of the patient.

only six (A, B, C, W-135, X, and Y) can cause the majority of life-threatening diseases with serogroups (A) and (N) being the most common cause [9]. Meningococcal disease has an annual incidence that varies depending on the geographic area ranging between one thousand cases per 100,000 people [9]. The usual clinical presentation of neonates with meningitis is often subtle, nonspecific, and overlaps with the presentation of neonatal sepsis, symptoms usually present with fever, lethargy, listlessness, high-pitched crying, irritability, feeding difficulties, vomiting, diarrhea, respiratory distress, bulging fontanelle, and seizures. Skin hemorrhage lesions are present in 28%-77% of patients with invasive meningococcal disease on admission followed by high-grade fever and hypotension in 30% of the patients [10]. Unlike our patient, the only presentation he had was excessive crying that interrupted his feeding and sleep for 1-day duration.

Despite the fact that high pleocytosis in CSF analysis aids in the diagnosis and management of bacterial meningitis, a positive CSF culture remains the gold standard for confirming the diagnosis. A study conducted in multiple pediatric tertiary care hospitals across Canada showed only 2.7% with culture-proven meningitis did not have CSF pleocytosis, and 76% of the patients who underwent at least one imaging study had abnormal results including infarction, hydrocephalus, and brain abscess and they were associated with alterations in CSF as reported by Stephens et al. [10].

The primary goal of treating children with septicemia, particularly those with septic shock and a high susceptibility to meningitis, should be to begin antibiotic treatment as soon as possible. They require vigorous IV fluid to prevent and treat shock while also maintaining extracellular volume. Early antimicrobial therapy kills meningococcal disease in CSF within 3-4 hours after IV treatment with adequate dose, and endotoxin concentrations in plasma fall by 50% within 2 hours [10].

Many children survive meningococcal disease, however, despite aggressive and proper management, the fatality rate of bacterial meningitis varies between 10% and 58% depending on the country's income, and around 7.2% of cases with *N. meningitidis* have the risk of neurological sequelae such as deafness and major and minor neurodevelopmental impairments [8-10]. The bacterial load in the bloodstream increases rapidly to very high levels, releasing parts of their outer membranes and causing an inflammatory cascade to be activated, resulting in DIC, which manifests as a shock with cool peripheries, poor capillary refill, tachycardia, oliguria, and hypotension [9,10].

Conclusion

Meningococcal meningitis in the neonatal and infancy periods remains a serious health threat with high morbidity and mortality even with the widespread availability of antimicrobial therapy and advances in prevention and critical care medicine. The clinical presentation of our patient led to other differential diagnoses besides sepsis/ meningitis, especially since the patient was initially not febrile and not septic looking upon arrival, our aim of this case report is to urge and emphasize the physician to keep a high index of suspicion by taking detailed history and frequent assessment in each suspected cases as the clinical presentations, signs and symptoms in the infancy period are not specific nor classic to guide the physician to suspect any case of meningitis.

Persistent crying and irritability during the infancy period are an alarming sign that should not be taken lightly and can be a sign of serious sepsis or central nervous system infection. Aggressive and early management in the emergency room with the initiation of prophylactic antibiotics and IV fluids is of the utmost importance to prevent significant morbidity and mortality.

List of Abbreviations

AKI	Acute kidney injury
ALT	Alanine transaminase
AST	Aspartate aminotransferase

CRP	C-reactive protein
CSF	Cerebral spinal fluid
CT	Computed tomography
DIC	Disseminated intravascular coagulation
EVD	External ventricular drain
GBS	Group B streptococcus
IV	Intravenous
MRI	Magnetic resonance imaging
PCR	Polymerase chain reaction
PICU	Pediatric intensive care unit
US	Ultrasound
WBC	White blood cell

Conflict of interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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Consent for publication

Due permission was obtained from the /parents/guardians of the patient to publish the case and the accompanying images.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

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