



(RESEARCH ARTICLE)



Salmonella meningitis with hydrocephalus as complication in children: A case series

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Abstract

Background: Bacterial meningitis by salmonella serotype is a rare infection among neonates and young children. The treatment of salmonella meningitis requires bactericidal agents that are capable of penetrating into cerebrospinal fluid (CSF). Acute complications of bacterial meningitis mainly include hydrocephalus, subdural collection, cerebral infarction, ventriculitis, empyema, intracranial abscess and cranial nerve palsy.

Two Cases Presentation: First case, 1 months-old boy brought to the general hospital with chief complaint of fever. Patient had decreased of consciousness and bulging of anterior fontanelle. Analysis of cerebrospinal fluid (CSF) showed *Pandy test* (+4) and *None test* (+4), high protein 369 mg/dl (mononuclear 44%, polymorphonuclear 56%), liquor glucose 2 mg/dl, CSF culture and blood culture resulted salmonella. Electrolyte and blood sugar was normal, complete blood count showed leukocytes $13.96 \times 10^3/\mu\text{L}$ and mild normochromic normocytic anemia. Head CT scan revealed communicating hydrocephalus. Second case, 6 months-old boy brought to general hospital with seizure as chief complaint. Cerebrospinal fluid (CSF) analysis showed *Pandy test* (+4) and *None test* (+4), high protein 569 mg/dL, liquor glucose 26 mg/dL, CSF culture and blood culture results found salmonella sp. Head CT scan revealed subdural hygroma at frontoparietal. Patient was treated by 3rd generation of cephalosporins (ceftriaxone) for 4 weeks. Patient discharge from hospital.

Summary: Management of salmonella meningitis include administration of empiric antibiotic, supportive treatment and management of complication. High dose of antibiotic is given empirically without waiting for the results of culture.

Learning Points: Clinical manifestations and outcome of meningitis salmonella

Keyword: Salmonella meningitis; Outcomes; Children; Anemia

1. Introduction

Bacterial meningitis is an emergency in pediatric disease because it generally has poor prognosis in infants and young children. Salmonella infection as cause of bacterial meningitis is reported primarily in tropical areas but also occasionally in industrialized countries. Most cases of Salmonella meningitis involve children less than 1 year of age, primarily less than 3 months old [1,2,3]. The incidence is estimated between 0.8 and 6% of cases of bacterial meningitis, although there are differences between developed and developing countries. Currently, prevention in the form of typhoid vaccine is given it when more than 3 years old, while some cases occurred when the patient is less than 3 years old.

Salmonella serotype are facultative anaerobic gram negative bacillus, mobile, hydrogen sulphide producing bacteria belonging to the family Enterobacteriaceae. Classically three primary pathogenic serotype were distinguished:

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Salmonella typhi, *Salmonella choleraesuis* and *Salmonella enteridis*. They are classified into more than 2000 serotypes based on flagella antigens H (protein) and somatic antigens O (polysaccharide fraction of bacillary lipopolysaccharide). Additionally, *Salmonella typhi* has virulence antigen (Vi)[5]. The mechanism of transmission is ingestion of contaminated food although other rarer routes have been described as transplacental, through breast milk or by contact with reptiles carry this organism which penetrate human blood-brain barrier into brain microvascular endothelial cells [4,6].

2. Case report

During November 15th, 2021 – January 2022 there were 2 cases of salmonella meningitis in our center.

2.1. Case 1

A 1-month-old boy presented with the chief complaint of seizure and fever for two days. Seizures with body writhing and eyes glaring upwards. The child was previously alert and had been breastfeeding normally and formula milk since birth. He was born full term by caesarean section because mother had myopia and birth weight was 3,400 gram. Mother had no fever during pregnancy.

The physical examination, patient had bulging anterior fontanelle and was lethargic, heart rate 145/minute, respiratory rate 45/minute. Body weight was 3.7 kg, 50th percentile as per World Health Organization (WHO) growth charts, which is normal. Other general examination findings was normal. Systemic examination was normal. Tone was normal. There were no focal neurological deficits such as muscle weakness or paralysis.

Complete blood obtained white blood cell count of 7.650/ μ L (58.0% neutrophils, 32.9% lymphocytes), hemoglobin 11.30 g/dl, platelets 32.0 x 10³/ μ L. Cerebrospinal fluid (CSF) analysis showed sugar 2 mg/dl, protein 369 mg/dl, nucleated cells 506 (polymorphs 56% and monocytes 44%). CSF culture grew with *Salmonella* sp. CT-scan examination revealed periventricular leukomalacia, suggesting meningitis with communicating hydrocephalus and signs of ventriculitis.

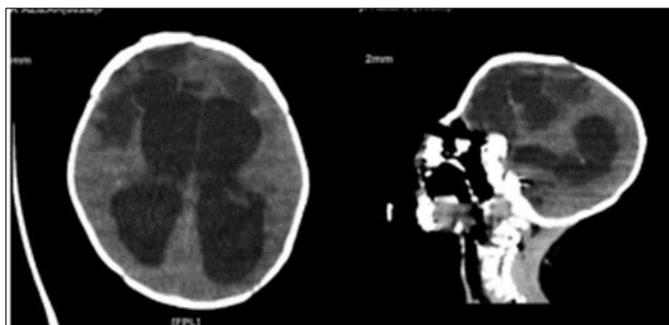


Figure 1 Head CT Scan without contrast

2.2. Case 2

A 6-month-old boy was referred from district hospital to Prof I.G.N.G Ngoerah Hospital, presented with complain decrease of consciousness.

The physical examination, patient was lethargy had bulging anterior fontanelle, heart rate 160 beats per minute, respiratory rate 45 times per minute. Body weight was 4.5 kilogram, 50th percentile as per World Health Organization (WHO) growth charts, which is normal. Other general examination finding was normal. Systemic examination was normal. Tone was normal. There were no focal neurological deficits in form of muscle weakness or paralysis.

Supporting examination of complete blood obtained white blood cell count of 8.150/ μ L (69.5% neutrophils, 20.6% lymphocytes), hemoglobin 7.20 g/dl, platelets of 136 x10³/ μ L. Cerebrospinal fluid (CSF) analysis showed sugar 25 mg/dl, protein 143.9 mg/dl, nucleated cells 1071 (polymorphs 60% and monocytes 40%). CSF culture grew with *Salmonella* sp. CT scan examination revealed decreased of cortical gray matter density and white matter density accompanied by white cerebellum sign, subdural hygroma in the right and left frontoparietal region.

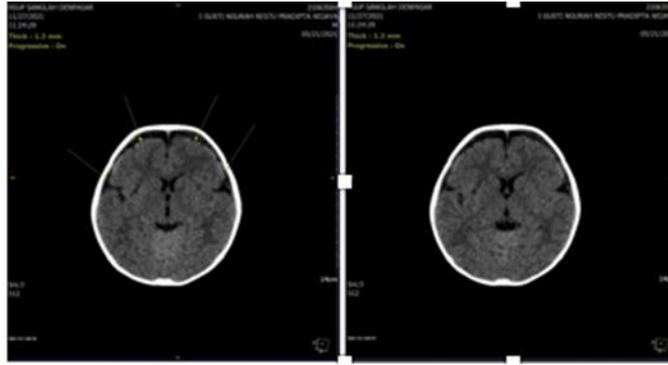


Figure 2 Head CT Scan without contrast

3. Discussion

Salmonella stereotypae are important pathogens of childhood bacterial meningitis in many developing countries, accounting for 5-13% of acute bacterial meningitis in young children in the 1980s-2000s. The most common mechanism of transmission of Salmonella is ingestion of contaminated food although other rarer routes have been described as transplacental, through breast milk or by contact with reptiles which carry this organism. The source of infection and mode of transmission in our patient is not clear. Salmonella infection is almost always by the faecal-oral route and non-typhoidal salmonella are common causes of food-borne illnesses [5,8]. Clinical manifestations of Salmonella meningitis include fever, vomiting, diarrhea, irritable, recurrent seizures, tonic-clonic seizures, sometimes high pitch cry in infants. The apparent classic sign is the bulging of anterior fontanel, while the Brudzinski and Kernig signs are difficult to evaluate.

Pathogenesis of Salmonella meningitis is similar with bacterial meningitis which suggests that bacteria entering CSF will stimulate endothelial cells and CNS macrophage cells to produce inflammatory mediators, such as interleukin-1 (IL-1) and tumor necrosis factor (TNF). Inflammatory mediators induce hyperemia of cerebral blood vessels accompanied by the migration of neutrophils into subarachnoid space, further stimulating congestion and increasing the permeability of blood vessels, facilitating the adhesion of phagocyte and polymorphonuclear cells to penetrate blood vessels through tight junctions and phagocyte the bacteria [11, 12, 16].

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Diagnosis of meningitis established with clinical signs and symptoms as well as laboratory investigations. The definitive diagnosis of meningitis through CSF examination with the finding of bacteria or viruses. The possibility of Salmonella meningitis should be considered whenever gram-negative bacteria are seen in CSF.

In first case, complete blood count showed normal leukocytes count, liquor analysis showed clear colour, *none* test ++, *pandy* test ++, cell 343 (monocyte 45%, poly 55%), erythrocyte negative, glucose 4 mg/dl, total protein 121.30 mg/dL., CSF culture showed positive result with salmonella sp and blood culture positive results with salmonella ssp. Judging from clinical manifestation such as fever, seizure and bulging fontanel, this patient was diagnosed with salmonella meningitis. This patient was administered with ampicillin and amikacin as empirical antibiotics due to infant, meanwhile the second patient was administered with ceftriaxone therapy according to result of CSF culture for 4 weeks, but after 2 weeks treatment, patient developed complication.

Second case, early laboratory values complete blood count with normal leukocytes count, liquor analysis showed clear colour, *none* test ++, *pandy* test ++, cell 343 (monocyte 40%, poly 60%), erythrocyte negative, glucose 25 mg/dl, total protein 143.90 mg/dL. CSF culture showed positive result with salmonella sp and blood culture showed positive result with salmonella ssp. Judging from clinical manifestation such as fever, seizure, this patient was diagnosed with salmonella meningitis.

Management therapy of meningitis would be through antibiotics such as, cephalosporins, gentamicin, ampicillin and fluoroquinolones. Third-generation cephalosporins are recommended for initial empiric therapy. Due to its bioavailability characteristics, third-generation cephalosporins such as cefotaxime, ceftriaxone or ceftazidime are

considered as treatment of choice, with minimum duration of 4 weeks to prevent relapses, which have been described in 60% of cases. Best treatment is determined by culture sensitivity[4,6,7].

4. Conclusion

The previous reports suggested that Salmonella meningitis was associated with high prevalence (50-90%) of morbidity, presenting variable complications and high mortality. Management of salmonella meningitis include administration of empiric antibiotic, supportive treatment and management of the complications. High dose of antibiotic is given empirically without waiting for the results of culture. We report a case of hydrocephalus caused by Salmonella serotype in infant who was initially presented with hydrocephalus, bacteremia, and meningitis. The disease manifest with slow progression and neurological complications that necessitate neurosurgical interventions and prolonged course of antibiotic treatment with final favorable outcome.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest.

Statement of ethical approval

The present research work does not contain any studies performed on animals/humans subjects by any of the authors.

Statement of informed consent

Informed consent was obtained from participant included in the report.

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