

Enteroviral meningitis at a pediatric hospital in Dakar (Senegal)

Abstract

Introduction: Enteroviral meningitis is the main cause of meningitis for all causes combined. They are frequent and most often benign, but underdiagnosed due to the limited technical platforms of laboratories. This is why we deemed it important to carry out this study aimed at determination of the role of these viruses in aseptic meningitis at the pediatric hospital of Diamniadio in Dakar.

Materials and methods: This was a prospective study covering the period from the 1st of January to the 31st of August 2017 involving 30 patients from the children's hospital of Diamniadio. The cytochemical tests and the assessments of soluble antigens in the CSFs were carried out at the laboratory of the hospital of Diamniadio. The virological tests were carried out at the Pasteur Institute of Dakar.

Results: All up, 30 aseptic CSFs were received by the laboratory during the study period. The patients were aged from 0 to 15 years. The analysis of the CSFs found an average protein concentration level of 1.15g/L and an average glucose level of 0.52g/L. No microbial organisms were detected by conventional bacteriological analyses. The virological analyses, on the other hand, allowed 9 *Enteroviruses* and 1 cytomegalovirus (CMV) to be found in the CSFs.

Conclusion: *Enteroviruses* constitute a significant part of the etiologies of viral meningitis in Senegal. Larger scale studies are needed, however, to obtain a more accurate indication of the viral causes of meningitis in Senegal.

Keywords: meningitis, cerebrospinal fluid, enterovirus, senegal

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Dr Mouhamadou Lamine Dia,¹ Soumbounou M,² Ndiaye SF,² Fall A,³ Kébé O,³ Ndiaye Kader³

¹Laboratory of Bacteriology-Virology, UHC of FANN, Senegal

²Laboratory of Biology, Children's Hospital of Diamniadio, Senegal

³Pasteur Institute of Dakar, Department of Virology, Senegal

Correspondence: Dr Mouhamadou Lamine Dia, BP 16222 Fann, Dakar, Senegal, Tel 00 (221) 77 657 56 34, Email laminedi2004@yahoo.fr

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Introduction

Enteroviral meningitis is the main cause of meningitis for all causes combined.¹ While bacterial meningitis is potentially serious, if not deadly, hence justifying immediate and intensive treatment, viral meningitis is more frequent and more often benign.¹ It is also frequent in Senegal, particularly in children.² Unfortunately, it is underdiagnosed due to the limited technical platforms of laboratories. Viral meningitis results in aseptic meningitis, with a clear cerebrospinal fluid. The latter can also be caused by other microorganisms such as mycobacteria and fungi. The main aim of this study was to determine the role of viruses in aseptic meningitis at the pediatric hospital of Diamniadio in Dakar.

Materials and methods

This was a prospective study covering the period from the 1st of January to the 31st of August 2017. All of the clear CSFs obtained from the patients with a strong suspicion of clinical meningitis were included in this study. The purulent CSFs were not retained in this study. The following data were collected for each patient: age, gender, place of origin, and the clinical diagnosis. To eliminate a bacterial infection, Gram staining was carried out on all of the samples. The CSFs were also inoculated in normal Mueller-Hinton (MH) medium and in MH supplemented with sheep blood (MHSB) and vitamins (Polyvitex bioMérieux). The incubation of these media was carried in CO₂ at 37°C for 48h with daily monitoring. The assessment of soluble

antigens was carried on all of the samples with a Pastorex meningitis kit (Bio-Rad).

The virological part of the analysis of the CSFs was carried out at the virology unit of the Pasteur Institute of Dakar (PID). The detection and the molecular characterization of the viral agents was carried out by RT-PCR followed by sequencing. The data were processed using Epi-Info version 3.5.4 software.

Results

All up, 30 aseptic CSFs were received by the laboratory during the study period. The patients were aged from 0 to 15 years. The sex ratio (M/F) was 1.5. Most of the patients were being treated for simple convulsions (6 patients, or 20%) or for febrile seizures (3 patients, or 10%). Fever was present in 13 children, with a minimal temperature of 36.3°C and a maximal temperature of 40°C. The analysis of the CSF was revealed an average protein concentration of 1.15 g/L, with extremes of 0.15g/L and 5 g/L. The average glucose level was 0.52 g/L, with extremes of 0.27 g/L and 0.88 g/L. The average level of polynuclear neutrophils was 8352/mm³, with extremes of 1350/mm³ and 23940/mm³. The average level of lymphocytes was 7690/mm³, with extremes of 989/mm³ and 75400/mm³. The conventional bacteriological analysis did not find any microorganisms. The virological analysis, on the other hand, allowed 9 *enteroviruses* and 1 cytomegalovirus (CMV) to be found in the CSFs. The genotypes of the *enteroviruses* could be determined and are represented in Table 1.

Table 1 The genotypes of the enteroviruses isolated from the CSFs

Genotypes of the enteroviruses	Frequency	Percentage
CV-B1	5	55.55%
CV-B2	2	22.22%
Echo-6	2	22.22%
Total	9	100.00%

Discussion

We identified 30 aseptic CSFs during the study period. The viruses isolated in our study were mainly non-polio myelitic *enteroviruses*, particularly Coxsackie B-1 (CV-B1), Coxsackie B-2 (CV-B2), and *Echovirus-6* (Echo-6) virus. *Enteroviruses* are common infectious agents divided into four species (human *enteroviruses* species A through D) that currently comprise 108 serotypes.³ They are non-enveloped positive-sense single-stranded RNA viruses, belonging to the family of *Picornaviridae*, that are very resistant to the external environment and that are transmitted mainly by the fecal-oral route as well as by air.³ These *enteroviruses* are frequent agents of meningitis in children. Indeed, in Taiwan, *Coxsackie B-1* (CV-B1) virus has already been isolated from the CSF of a child of less than 2 years of age.⁴ Similarly, in Brazil, *Coxsackie B-2* (CV-B2) virus caused a fatal meningoencephalitis in a child of 8 years of age.⁵ There is little data available regarding *enteroviruses* in Senegal. To our knowledge, our study is one of the first to report the isolation of *enteroviruses* in CSFs in Senegal. Their presence had previously been detected in nasopharyngeal secretions and stools² in Senegal. Coxsackie B viruses are a more virulent type of cytolitic viruses in neonates and immunosuppressed individuals. They can cause illnesses without any discernible signs, as well as upper respiratory tract, heart, and nervous systems diseases.^{6,7} The non-specific syndromes comprise meningitis, fever, diarrhea, and upper respiratory tract infections.⁷ There are 6 Coxsackie B viruses, while there are 23 Coxsackie A viruses.⁷

Echoviruses also belong to the *Enterovirus* genus and to the family of *Picornaviridae*. Most infections by echovirus are asymptomatic.⁸ The most common symptom of an infection is non-specific acute febrile illness, with or without a rash.⁸ Echoviruses are often associated with aseptic meningitis. The symptoms comprise the sudden appearance of fever, headaches, photophobia, nausea, and vomiting. A case of meningitis involving human *Parechovirus* (HPeV3) complicated by septic shock in a neonate of 10 days was reported in Senegal in 2018.⁹ Our data confirm that *Enteroviruses* are one of the agents responsible for meningitis in Senegal. Meningitis by *enteroviruses* is often underdiagnosed due to a lack of testing for them. Testing by

Polymerase Chain Reaction (RT-PCR) for *enteroviruses* in the CSF is recommended, however, in cases of meningitis that do not appear to have a bacterial origin.¹

Conclusion

Enteroviruses definitely account for a significant part of the etiologies of viral meningitis. Meningitis involving enterovirus generally progress in a favorable manner without treatment, thus permitting a short treatment.¹ larger scale studies are needed in Senegal to obtain a more accurate picture of the viral causes of meningitis. The results of such studies will depend largely on the technical platforms of the laboratories.

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Conflicts of interest

The authors declare there are no conflicts of interest.

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