

## Streptococcus pyogenes Meningitis in a Pediatric Patient: Case Report

### Meningite por Streptococcus pyogenes num Paciente Pediátrico: Relato de Caso

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#### ABSTRACT

*Streptococcus pyogenes* causes a wide spectrum of diseases in children. However, meningitis due to this pathogen is highly uncommon. Although rare, it is associated with a high case fatality rate and can result in severe neurological sequelae. We report a case of *Streptococcus pyogenes* meningitis in a previously healthy 3-year-old boy. The purpose of this case report is to emphasize that this agent should be considered a cause of meningitis in previously healthy infants because of its frequent association with complications, sequelae, and high mortality rates.

**Keywords:** Child; Meningitis, Bacterial; Streptococcal Infections; Streptococcus pyogenes

#### RESUMO

O *Streptococcus pyogenes* está associado a um amplo espectro de doenças em crianças. No entanto, a meningite por esse agente é altamente incomum. Embora rara, está associada a uma elevada taxa de mortalidade e pode resultar em sequelas neurológicas graves. Relatamos um caso de meningite por *Streptococcus pyogenes* numa criança de três anos, previamente saudável. O objetivo deste caso é enfatizar que este agente deve ser considerado como causa de meningite em crianças previamente saudáveis, dado estar frequentemente associado a complicações graves, sequelas e elevadas taxas de mortalidade.

**Palavras-chave:** Criança; Infecções Estreptocócicas; Meningite Bacteriana; Streptococcus pyogenes

#### INTRODUCTION

*Streptococcus pyogenes* (Group A streptococcus, GAS), causes a wide spectrum of diseases in children, namely impetigo, pharyngitis, and scarlet fever. Less commonly, it can cause severe invasive infections, including necrotizing fasciitis, pneumonia, sepsis, and streptococcal toxic shock syndrome (STSS).<sup>1,2</sup>

GAS meningitis due to *S. pyogenes* is highly uncommon, representing one of the most infrequently reported focal infections due to this pathogen.<sup>2</sup> Although rare, GAS meningitis is associated with a high case fatality rate and can result in severe neurological sequelae.<sup>1-3</sup>

In this article, we describe a case of GAS meningitis in an immunocompetent child.

#### CASE REPORT

An immunocompetent 3-year-old boy, with no relevant prior medical history, presented to a pediatric emergency department with a four-day history of fever up to 40°C, vomiting, and frontal headache. There were no signs of a viral upper respiratory infection, such as cough or rhinorrhea. His immunizations were up to date. A week prior to the child's admission, the mother suffered from an episode of tonsillitis that was treated with amoxicillin.

On admission, the child was alert and responsive, but appeared unwell. He was febrile, with a temperature of 39°C and was pale with cold extremities. Meningeal signs were positive. He showed no neurological signs of focal disorders or intracranial hypertension. He had tonsillar exudates. The remainder of his physical examination was unremarkable.

A positive rapid antigen detection test (RADT) using a pharyngeal swab confirmed GAS tonsillitis. Laboratory tests showed an increase in white blood cells (WBC) count to  $14.79 \times 10^9/L$  (86% neutrophils), a platelet count of  $532 \times 10^9/L$  and a C-reactive protein of 6.80 mg/dL. Coagulation tests were normal. A computed tomography (CT) scan of the head showed opacification of the right mastoid and all paranasal sinuses. There were no signs of deep venous sinus thrombosis or abscess. A lumbar puncture was performed with the extraction of turbid cerebrospinal fluid (CSF). Empirical intravenous antibiotic therapy with ceftriaxone and vancomycin was initiated for presumed bacterial meningitis. Examination of the CSF later revealed pleocytosis with  $4828/mm^3$  leucocytes, 69% neutrophils and no red blood cells, CSF glucose was 25 mg/dL (serum level 76 mg/dL) and the protein concentration was 234.9 mg/dL (normal 15 mg/dL to 40 mg/dL). The CSF Gram stain showed Gram-positive cocci in chains, and subsequently grew beta-hemolytic GAS (sensitive to penicillin, vancomycin and erythromycin). Blood cultures were negative. His antibiotics were de-escalated to intravenous ceftriaxone for 10

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days. He did not receive corticosteroids during his hospitalization.

The patient responded well to treatment, with remission of the fever and other symptoms within 24 hours of the start of antibiotic therapy. He did not develop any neurological sequelae and the audiological test was normal four months after discharge.

## DISCUSSION

Over 1.2 million cases of bacterial meningitis are estimated to occur worldwide each year, with the majority caused by *Neisseria meningitidis*, *Streptococcus pneumoniae*, and *Haemophilus influenzae*.<sup>4,5</sup> The prevalence rate of meningitis cases caused by *Streptococcus pyogenes* remains extremely low, accounting for fewer than 1% of all cases of bacterial meningitis.<sup>1,4-6</sup>

The exact pathogenesis of GAS meningitis has not been entirely explained. Generally, it occurs secondary to bacteremia or arises from a recognizable focus of infection, mainly in the upper respiratory tract (such as otitis, mastoiditis, sinusitis and tonsillitis).<sup>2,4,5</sup> However, despite the fact that GAS infection or colonization of the upper respiratory tract is very common during infancy, GAS central nervous system infections remain extremely uncommon, suggesting that direct meningeal invasion is not the likely mechanism of infection.<sup>3,4,7</sup> Therefore, the exact route of spread of the organism to the CSF in these patients remains unclear.<sup>8</sup>

Some risk factors for GAS infections of the central nervous system have been identified, including the neonatal period, neurosurgery, skull fractures, CSF leaks, the presence of a ventriculo-peritoneal shunt, and immunocompromising conditions.<sup>2,6</sup> Nevertheless, cases have been reported in previously healthy individuals that did not have predisposing conditions.<sup>4,6</sup>

This article describes a rare case of GAS meningitis with a favorable outcome in a pediatric patient. Our patient did not require intensive care and responded quickly to treatment, both in terms of clinical and laboratory responses. There was no recognizable underlying risk factor for GAS meningitis in the case we have described. However, the GAS tonsillitis confirmed by a positive RADT in a pharyngeal swab suggests that this may have been the primary source of infection.

Both the clinical presentation and the CSF analysis of GAS meningitis are indistinguishable from meningitis caused by other pyogenic bacteria s.<sup>4,8</sup> *Streptococcus pyogenes* is universally susceptible to all beta-lactam antibiotics, with no published reports of resistance to this date.<sup>3,4</sup> Therefore, the majority of individuals are treated with high-dose intravenous penicillin as a single agent.<sup>1,3</sup> However, third-generation cephalosporins are increasingly used as alternative agents in the empirical treatment of bacterial meningitis because of the penicillin resistance of some prevalent meningeal pathogens.<sup>9</sup> In our case, despite not having investigated sensitivity to ceftriaxone, the patient promptly responded to antimicrobial therapy with ceftriaxone, and therefore it was decided not to replace this antibiotic with penicillin.

The use of corticosteroids prior to antibiotics in children with bacterial meningitis has been associated with a lower rate of hearing loss, particularly in meningitis secondary to *Haemophilus influenzae*. However, due to its low prevalence, the role of corticosteroids in GAS meningitis has yet to be established.<sup>9</sup>

Recent case reports suggested that GAS meningitis is associated with high mortality and morbidity rates.<sup>1,2,4,5</sup> Rates of sequelae of GAS meningitis appear greater when compared with other forms of bacterial meningitis.<sup>7,8</sup> The most frequent complications are neurological, including hearing loss, hydrocephalus, developmental delays, and motor deficits, and appear to be more frequent in children than in adults.<sup>6-8</sup>

In conclusion, GAS meningitis remains an unusual form of invasive GAS disease in children, frequently occurring in association with other focal infections. Despite being a rare cause of bacterial meningitis, GAS should be considered in all cases of childhood meningitis, because of its frequent association with complications, *sequelae*, and death. Early recognition and prompt treatment are essential to ensure good outcomes.

## AUTHOR CONTRIBUTIONS

LT: Conception and design of the work; data acquisition, analysis and interpretation; drafting of the work; final approval of the version to be published.

AMR, CF: Conception and design of the work; data acquisition, analysis and interpretation; final approval of the version to be published.

SS, PC: Conception and design of the work; critical revision; final approval of the version to be published.

## PROTECTION OF HUMANS AND ANIMALS

The authors declare that the procedures were followed according to the regulations established by the Clinical

Research and Ethics Committee and to the Helsinki Declaration of the World Medical Association updated in 2013.

#### DATA CONFIDENTIALITY

The authors declare having followed the protocols in use at their working center regarding patients' data publication.

#### PATIENT CONSENT

Obtained.

#### COMPETING INTERESTS

The authors have declared that no competing interests exist.

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