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ORIGINAL ARTICLE

A prospective study of risk factors for neurological complications in childhood bacterial meningitis☆

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KEYWORDS
Bacterial meningitis;
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Abstract

Objective: To prospectively analyze the prognostic factors for neurological complications of childhood bacterial meningitis.

Methods: This prospective study enrolled 77 children from 1 month until 16 years of age, treated for bacterial meningitis during the period of January 1, 2009 through December 31, 2010. 16 relevant predictors were chosen to analyze their association with the incidence of neurological complications. p-values < 0.05 were considered statistically significant.

Results: Of the 77 children treated for bacterial meningitis, 33 patients developed neurological complications (43%), and two children died (2.6%). The etiology of bacterial meningitis cases was proven in 57/77 (74%) cases: 32 meningococci, eight pneumococci, six Gram-negative bacilli, five *H. influenzae*, *five* staphylococci, and *one S. viridans* isolates were found. Factors found to be associated with increased risk of development of neurological complications were age < 12 months, altered mental status, seizures prior to admission, initial therapy with two antibiotics, dexamethasone use, presence of focal neurological deficit on admission and increased proteins in cerebrospinal fluid (CSF) ($p < 0.05$). Initial pleocytosis > 5,000 cells/mm^3, pleocytosis > 5,000 cells/mm^3 after 48 hours, CSF/blood glucose ratio < 0.20, female gender, previous treatment with antibiotics, community-acquired infection, duration of illness > 48 hours, presence of comorbidity, and primary focus of infection were not associated with increased risk for the development of neurological complications.

Conclusion: Age < 12 months and severity of clinical presentation at admission were identified as the strongest predictors of neurological complications and may be of value in selecting patients for more intensive care and treatment.

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PALAVRAS-CHAVE
Meningite bacteriana;
Complicações neurológicas;
Crianças;
Resultados

Estudo prospectivo dos fatores de risco para complicações neurológicas na meningite bacteriana infantil

Resumo

Objetivo: Análise prospectiva de fatores de prognóstico para complicações neurológicas da meningite bacteriana infantil.

Métodos: Este estudo prospectivo recrutou 77 crianças de um mês a 16 anos de idade tratadas de meningite bacteriana durante o período de 1/1/2009 a 31/12/2010. Foram escolhidos 16 preditores relevantes para analisar sua associação com a incidência de complicações neurológicas. Valores de p abaixo de 0,05 foram considerados estatisticamente significativos.

Resultados: Das 77 crianças tratadas para meningite bacteriana, desenvolveram-se complicações neurológicas em 33 pacientes (43%), e duas crianças morreram (2,6%). A etiologia dos casos de meningite bacteriana foi comprovada em 57/77 (74%) dos casos: foram encontrados 32 isolados de meningococos; 8 de pneumococos; 6 de bacilos gram-negativos; 5 de *H. influenzae*; 5 de estafilococos e 1 de *S. viridans*. Os fatores que se mostraram associados a aumento do risco de desenvolvimento de complicações neurológicas foram idade < 12 meses, alteração do estado mental, crises convulsivas antes da admissão, terapia inicial com dois antibióticos, uso de dexametasona, presença de déficit neurológico focal na admissão e aumento das proteínas do líquido cerebrospinal (LCS) ($p < 0,05$). Pleiocitose inicial > 5.000 células/mm^3, pleiocitose > 5.000 células/mm^3 depois de 48 horas, baixa relação da glicose no LCS/sangue < 0,20, gênero feminino, tratamento prévio com antibióticos, infecção adquirida na comunidade, duração da doença > 48 horas, presença de comorbidade e foco primário de infecção não se associaram a aumento do risco para o desenvolvimento de complicações neurológicas.

Conclusão: Idade inferior a 12 meses e gravidade da apresentação clínica na admissão foram identificadas como os preditores mais fortes de complicações neurológicas e podem ter valor para selecionar pacientes para tratamento mais intensivo.

Introduction

Despite the development of antibiotics that are more effective in treating bacterial meningitis, the mortality rates continue to be high, ranging between 5% and 30%, while as many as 50% of survivors experience neurological sequelae, such as hearing impairment, seizure disorders, and learning and behavioral problems.[1–12] The neurological complications resulting from bacterial meningitis include subdural effusions or empyemas, cerebral abscesses, focal neurological deficits (e.g., hearing loss, cranial nerve palsies, hemiparesis, or quadriparesis), hydrocephalus, cerebrovascular abnormalities, altered mental status, and seizures. Acute bacterial meningitis is more common in resource-poor than resource-rich settings.[3] The occurrence of negative consequences of bacterial meningitis in developed countries is strongly reduced by vaccination strategies, antibiotic treatment, and good care facilities.[1,4,5] The speed of diagnosis, the identification of the causative pathogen, and the initial antimicrobial therapy represent important factors for the prognosis of bacterial meningitis in children. Developing countries such as Kosovo are still facing cases of bacterial meningitis in children due to non-implementation of vaccination programs against meningeal pathogens. Furthermore, the shortage of antibiotics in hospitals makes it difficult to follow guidelines for the initial empirical therapy of children with bacterial meningitis. Late and insufficient results of cerebrospinal fluid (CSF) cultures and Gram-staining make treatment more difficult, particularly in cases with neurological complications.

From previous reports in Kosovo, the mortality rate of children with bacterial meningitis was 5.4%, while neurological complications were reported in 22% of cases.[10] During the years of the present study, the annual incidence of bacterial meningitis was 3.0 cases per 100,000. Of the total bacterial meningitis cases (n = 126), 77 (63%) were children up to 16 years of age, while 74% of pediatric bacterial meningitis cases occurred in children under 6 years of age.

The aim of this study was to perform a prospective multivariate analysis of statistically significant predictors for neurological complications of childhood bacterial meningitis.

Material and methods

Children aged between 1 month and 16 years, treated for bacterial meningitis at the Infectious Diseases Clinic in Prishtina (University Clinical Center of Kosovo) during the period from January 1, 2009 to December 31, 2010 were prospectively enrolled in the study. The furthest distance from Prishtina is estimated to be < 100 km or 1.5 hour driving. 57 children had a confirmed bacterial etiology. 20 patients were treated for probable bacterial meningitis, based on World Health Organization (WHO) criteria: clinical signs and symptoms of meningitis, changes in CSF, and lack of an identifiable bacterial pathogen. Children