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TRENDS AND EPIDEMIOLOGICAL ASPECTS OF BACTERIAL MENINGITIS IN CHILDREN

TENDÊNCIA E ASPECTOS EPIDEMIOLÓGICOS DAS MENINGITES BACTERIANAS EM CRIANÇAS

TENDENCIA Y ASPECTOS EPIDEMIOLÓGICOS DE MENINGITIS BACTERIANA EN NIÑOS

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ABSTRACT

Objective: to describe the epidemiological profile of bacterial meningitis in children aged zero to 14 years living in the state of Pernambuco, 2001-2010. **Method**: this was a descriptive study on a population composed of all confirmed cases of bacterial meningitis in the notifiable diseases information system (Sinan). The EpiInfo 7 software was used to analyze the data. ***Results*****:** 4379 cases were confirmed, with a mean coefficient of detection of 1.69/10,000 inhabitants. Concentrations of cases were observed among males (n = 2504; 57.26%) and among infants less than one year old (n= 1605; 36.70%). Among the 1357 cases with specified etiology, 446 consisted of meningococcal meningitis with meningococcemia. It was observed that 3629 (85.32%) recovered from the disease and 603 (14.18%) died, with a lethality rate of 13.77%. ***Conclusion*****:** Bacterial meningitis continues to present significant morbidity and mortality. Epidemiological information is important for enabling public health measures and ensuring adequate care provision.*Descriptors*: Meningitis, Bacterial; Child; Information Systems; Epidemiology.

RESUMO

Objetivo: descrever o perfil epidemiológico da meningite bacteriana em crianças de zero a 14 anos de idade residentes no estado de Pernambuco, 2001-2010. ***Método***: estudo descritivo, cuja população foi composta por todos os casos de meningite bacteriana confirmados no Sistema de Informação de Agravos de Notificação (Sinan). Utilizou-se o programa EpiInfo 7 para a análise dos dados. ***Resultados*****:** foram confirmados 4.379 casos, com coeficiente de detecção médio de 1,69/10.000 habitantes. Observou-se concentração dos casos no sexo masculino 2.504 (57,26%) e na faixa etária dos menores de um ano (n=1.605, 36,70%). Entre os 1.357 casos com etiologia especificada, 446 eram de meningite meningocócica com meningococemia. Verificou-se que 3.629 (85,32%) evoluíram para alta e 603 (14,18%) para óbito, com coeficiente de letalidade 13,77%. ***Conclusão*****:** a meningite bacteriana continua apresentando uma significativa morbidade e letalidade. Informações epidemiológicas são importantes para iniciar medidas de saúde pública e assegurar uma assistência adequada. ***Descritores*****:** Meningites Bacterianas; Criança; Sistemas de Informação; Epidemiologia.

RESUMEN

Objetivo: describir el perfil epidemiológico de la meningitis bacteriana en niños de cero a catorce años de edad residentes en el Estado de Pernambuco, 2001-2010. ***Método***: estudio descriptivo, cuyo universo está compuesto por todos los casos de meningitis bacteriana confirmados en el Sistema de Información de Notificaciones de Atención (Sinan). Se empleó el programa Epilnfo 7 para el análisis de datos. ***Resultados***: se confirmaron 4.379 casos con coeficiente de detección medio de 1,69/10.000 habitantes. Se apreció concentración de casos en el sexo masculino 2.504 (57,26%) y entre los menores de un año (n=1.605, 36,70%). Entre los 1.357 casos con etiología especificada, 446 eran de meningitis meningocócica, con meningococemia. Se verificó que 3.629 (85,32%) evolucionaron hacia el alta y 603 (14,18%) al óbito, con coeficiente de mortandad de 13,77%. ***Conclusión***: la meningitis bacteriana continúa presentando una significativa morbilidad y mortandad. Informaciones epidemiológicas son necesarias para iniciar medidas de sanidad pública y asegurar una asistencia adecuada. ***Descriptores*****:** Meningitis Bacterianas; Niño; Sistemas de Información; Epidemiología.

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INTRODUCTION

The term meningitis refers to a group of infectious diseases of great social relevance, due to its high rate of morbidity and mortality, besides the sequelae.[1] It consists of the inflammation of the meninges, membranes which cover the brain and the spinal cord, caused most frequently by (bacterial, viral or fungal) infection. This disease is included among the 10 main causes of death by infectious diseases in the whole world, especially in developing countries.[2]

Therefore, the bacterial meningitis is a medical emergency characterized by the inflammation of the meninges, caused by a bacterial infection and when it is not treated, the mortality approaches 100%.[3] Excluding the cases that result from outbreaks, one million of cases are estimated in the world, among them 170 thousand per year are fatal.[2]

The symptoms vary according to the age, however they mainly consist of fever, headache, photophobia, vomiting, change in the level of consciousness, convulsions, purpuric rash and petechiae. The stiff neck may be present in children who are older than two years old. Consciousness changes and prolonged convulsions generally compromise the protection of the airways.[4]

The incidence and lethality of the meningitis vary according to the age group and the etiologic agent involved. Despite of the increase in the availability of powerful antimicrobials and intensive therapy units, the bacterial meningitis still remains as an important cause of morbidity and mortality among children.[5]

In the last years, the epidemiology of the bacterial meningitis in childhood has changed significantly, mainly because of the national programs of conjugate immunization against the *Haemophilus influenzae* b (Hib). Thus, the meningitis by Hib has drastically decreased, and *Streptococcus pneumoniae* and *Neisseria meningitidis* became the most common agents of bacterial meningitis in childhood.[2,6] The vaccine was introduced in Brazil in September 1999 for children who are younger than two years old.[7]

In Brazil, the meningitis is a disease of compulsory notification according to the ordinance number 104/2011 of the Health Ministry. Thus, all the suspected cases are investigated by the epidemiological surveillance system of meningitis. This system was implemented in 1975, aiming to monitor the epidemiological situation of meningitis in the country, guiding the preventing and control measures, besides producing and disseminating information. It is for the Notifiable Diseases Information System (Sinan) to collect, process and diffuse the information about the notification diseases, thus enabling the monitoring of the epidemiological situation of these diseases.[7]

Considering the significant morbidity and mortality of bacterial meningitis, precise information about the etiologic agents and populations at risk is important in order to enable measures of public health and ensure a proper assistance.[8] Thus, the knowledge of the epidemiological characteristics of bacterial meningitis is important for the planning of control measures. In this sense, the objective of this study is to describe the epidemiological profile of bacterial meningitis in children from zero to 14 years old in the state of Pernambuco in the period from 2001 to 2010.

METOD

This is a descriptive epidemiological study, carried out in the state of Pernambuco, which is located in the Northeast of Brazil, with the territorial extension of 98.136,315 Km^2. According to the data of the Brazilian Institute of Geography and Statistics (IBGE), the population of the state is 8.796.448 inhabitants distributed in the 185 cities.[9]

All the cases of bacterial meningitis notified and confirmed by the Notifiable Diseases Information System (Sinan) in the 0-14 age group from Pernambuco were studied; these cases happened from 2001 to 2010. For the epidemiological surveillance the criteria recognized by the Health Ministry were adopted as a definition of case.[7]

The data source was constituted by the data of Sinan offered by the Department of Computers of the Unified Health System of the Health Ministry (Datasus), being analyzed the following variables: gender, age group, etiology, confirmation criterion and case evolution. The coefficient of detection and lethality were calculated. For the studied variables the descriptive statistics with distribution of frequencies and measure of central tendency (mean) were applied. The data analysis was made on the software EpiInfo version 7.0.

The study used public data provided by the site of the Datasus, not being necessary the submission of the project to the Research Ethics Committee.

RESULTS

During the period of study, 4.379 cases of bacterial meningitis in the 0-14 age group

were confirmed in Pernambuco, representing an average Coefficient of Detection of 1.69 per 10.000 inhabitants. The highest concentration of cases was identified in 2002 (Figure 1).

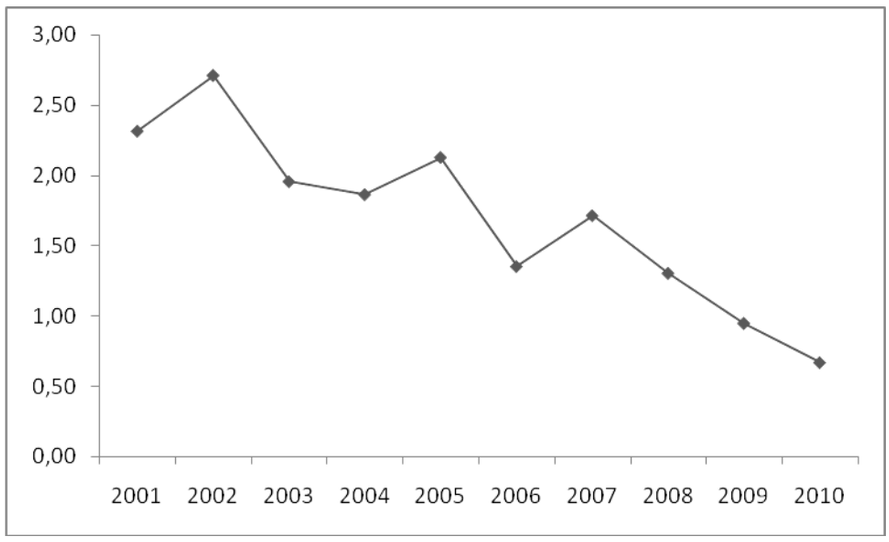

Figure 1. Coefficient of Detection of the confirmed cases of Meningitis, Pernambuco, 2001-2010.

There was the predominance of cases in males 2.504 (57.26%), which coefficient of detection (CD) was 2.97/10.000 inhabitants. In relation to the age group there was an accentuated concentration in individuals younger than one year old corresponding to 1.605 (36.70%) cases, with CD 2.10/10.000 inhabitants. However, the greater risk of sickening is found among the adolescents from 10 to 14 years old with a frequency of 663 cases (15.16%) and a CD 8.64/10.000 inhabitants (Table 1).

Regarding etiology of cases of meningitis, most of them was classified like meningitis resulting from other bacteria (n=2.891, 68.05%) with CD of 3.99/10.000 inhabitants. Among the 1.357 cases with specified etiology, 446 were of meningococcal meningitis with meningococcemia, 407 were cases of meningococcal meningitis, 214 were of meningitis by Pneumococcus and 57 by Haemophilus (Table 1).

The criteria of diagnosis that were used for the etiologic confirmation of meningitis were: the chemo-cytological method (n=1.959, 46.45%), followed by the culture method with 1.258 (29.83%) cases. Regarding the criteria of confirmation by epidemiological link and epidemiological clinic, both obtained the same frequency, 23 cases (0.55%). The viral isolation was the least used method with three cases (0.07%) (Table 1).

In regards to the evolution of cases, it was found that 3.629 (85.32%) evolved to severe and 603 (14.18%) death (Table 1). The Coefficient of Lethality was 13.77% (603/4.379).

Table 1- Social characteristics, etiology, criteria of confirmation and evolution of cases of Meningitis in patients younger than 15 years old. Pernambuco, 2001 to 2010.

Variables	n	%	CD*
Sex [n=4.373[(a)]]			
Male	2.504	57.26	2.97
Female	1.869	42.74	2.43
Age group [n=4.373[(b)]]			
< 1 year	1.605	36.7	2.1
01 to 04	1.077	24.63	1.41
05 to 09	1.028	23.51	1.34
10 to 14	663	15.16	8.64
Specified etiology [n=4.248[(c)]]			
Meningococcemia	233	5.48	3.05
Meningococcal Meningitis	407	9.6	5.33
Meningococcal Meningitis with Meningococcemia	446	10.5	5.85
Meningitis by other bacteria	2.891	68.05	3.99
Meningitis by Haemophilus	57	1.34	0.74
Meningitis by Pneumococcus	214	5.03	2.8
Confirmation criteria [n=4.217[(d)]]			
Culture	1258	29.83	
CIE	54	1.28	-
Ag. Latex	33	0.78	-
Clinic	328	7.78	-
Bacterioscopy	297	7.04	-
Necropsy	18	0.43	-
Epidemiological Link	23	0.55	-
Chemo-cytological	1.959	46.45	-
Epidemiological clinic	23	0.55	-
Viral isolation	3	0.07	-
Death Certificate	16	0.38	-
CPR	25	0.59	-
Others	180	4.27	-
Evolution [n=4.253[(e)]]			
Discharge	3.629	85.32	-
Death by Meningitis	603	14.18	-
Death for another reason	21	0.5	-

Number/percentage of ignored or in blank: [(a)]6/0, 13%; [(b)]6/0, 13%; [(c)]131/2, 99%; [(d)]162/3, 69%; [(e)]126/2, 87%

*Average Coefficient of Detection of the 10-years-study for 10.000 inhabitants.

DISCUSSÃO

The results of the study demonstrated a reduction of the incidence of the bacterial meningitis in Pernambuco. Studies that were carried out in Brazil and other countries also proved the tendency of decrease.[1,10-14] Such fact may be credited to the reduction of incidence of the forms of the disease caused by *H. influenza* due to the introduction of the vaccination program.[15]

Males were the most affected, coinciding with the data found in the literature.[10,14,16,17] A study that analyzed the etiologic profile of the meningitis in children identified a concentration in males who are four years old.[18] The literature proves that there is a variation of age and the peak of occurrence in the dependence of the agent involved and the local epidemiological conditions.[18]

The age group of the individuals younger than one year old was the most affected. A recent revision about the bacterial meningitis in the pediatric population considers that this is a medical emergency which requires a high index of clinical suspicion and early diagnosis. Advances in clinical techniques and investigations are helping the diagnosis of bacterial meningitis.[3]

A study carried out with the objective of estimating the incidence of bacterial meningitis in the city of Lazio, Italy, also identified a higher frequency of cases in this age group.[16] In the United States, the analysis of the cases of bacterial meningitis notified in eight areas indicated that children younger than two months compose the group of higher risk.[13] In this age group, the important causal organism is the *Haemophilus influenzae* b (Hib). In Brazil, a research that described the epidemiological characteristics of the population affected with meningitis by Hib also observed a higher incidence during the first month of life.[19]

In this study the age group of greater risk was from 10 to 14 years old. In this age group the etiologic agent is the *Neisseria meningitidis*. With the introduction of the vaccine against the meningococcus C will possibly occur a reduction in the risk, which cannot be corroborated here, for the vaccine was only introduced in the basic calendar in

2010. A research about the vaccination coverage in Salvador (BA) proved a reduction in meningitis in this age group.[20]

The undetermined bacterial meningitis was the one of highest occurrence. Among the types of meningitis with the specified etiology the meningococcal meningitis with meningococcemia was highlighted. Similarly, data from the epidemiological surveillance of São Paulo city (SP) identified that the meningococcal disease responds for approximately 40% of all the cases of meningitis.[12]

The meningococcal meningitis is a potentially fatal disease and most of the cases are considered avoidable when there is vaccination. Therefore, the vaccination constitutes of an important way of prevention.[21] Nowadays, the most important cause of bacterial meningitis in Brazil is the meningococcus, resulting, approximately, in three thousand cases per year. Children who are under five years old constitute of the group of the highest risk, with the highest incidence among the individuals who are under one year old. With the introduction of the vaccine against the meningococcus of the group C in the calendar of vaccination of children, a reduction of 29% was verified in the number of cases among the individuals under two years old.[22]

Admittedly, the meningococcal meningitis occurs with a higher frequency in populations with poor life conditions. A research developed with the objective of verifying the association among the spatial variation of bacterial meningitis and life conditions of the population identified that the areas with the worst life conditions presented a higher lethality of the meningococcal disease. This fact reflects the difficulties in the immediate access and bad quality of the medical care faced by these populations.[1]

The reduced number of meningitis by Haemophilus found in this study is pointed out. The introduction of the vaccine Hib in Brazil and in several countries of the world was determinant for the important change in the epidemiology of the bacterial meningitis.[23] Thus, the necessity to develop effective conjugate vaccines against the other common pathogens of meningitis .[8]

Still, the benefit caused by the introduction of the vaccine Hib may also open opportunities for other conditions to cause diseases. A research carried out in the city of Salvador (BA), before and after the introduction of the vaccination, identified a reduction of 69% in the incidence one year after the beginning of the vaccination Hib, on the other hand the incidence of *H. influenza* type A increased eight times. Thus, it is recommended the continuous surveillance for the *H. Influenza* and to monitor the potential increase due to another serotype.[24]

For the conclusive diagnosis of the bacterial meningitis it is necessary the isolation of the bacterium in the cerebrospinal fluid (LCR) and it must be done before the treatment with antibiotics, the patient must present a stable clinical condition and proper asepsis. The identification of the causative agent of meningitis is very important, although not possible in many cases, due to the indiscriminate use of antibiotics, techniques of collection and inappropriate storage.[1,7] The cases of undetermined meningitis are due to factors that hinder the diagnosis like: early use of antibiotics, rapid autolysis of meningococcus after collection and low microbial concetration.[25]

In this study, the most frequent method of detection was the chemo-cytological. A study about the incidence of the meningitis in Rio de Janeiro identified that in most of the cases the lumbar puncture and cytochemical were done.[10] The chemo-cytological method is one of the main examinations proposed by the Ministry of Health, for the diagnosis of the suspected case of meningitis.[7] The culture was the second method used, being considered gold standard for the epidemiological surveillance, for it enables the characterization of the infectious agent.[26,27]

Most of the cases of bacterial meningitis in this study evolved to discharge. Possibly, this is due to early diagnosis, proper treatment and vaccination in the early years in life. In the pediatric age group a great part of the cases has an unspecified presentation, what hinders the diagnosis. The delay in the identification of the pathology represents commitment in the treatment and may lead to severe consequences.[28]

Death was the result in 14.18% of the cases. Historical cohort of the confirmed cases of meningitis in a city of Santa Catarina also revealed 15% of the cases evolved to death.[29] A study of systematic revision carried out with the objective of estimating the global morbidity of acute bacterial meningitis in children, identified an average lethality rate of 14.4% (5.3 -26.2 %).[30] In Rio de Janeiro this rate was 20.5%.[10] Although, a reduction of 11% has occurred in the last ten years in this city, there is difficulty in the early diagnosis, due to the non specificity of the signs and symptoms in the acute phase. The extension

of measures of prevention and development of rapid diagnosis methods and less invasive is essential.[1]

Advances in clinical techniques and investigation are helping the diagnosis of bacterial meningitis. A combination of techniques is useful in order to confirm or exclude the diagnosis. Although the antibiotics and therapy of support remain the base of treatment, more researches need to be carried out.[3]

FINAL REMARKS

There was a reduction in the incidence of bacterial meningitis in children. The epidemiological profile of the cases is characterized by the predominance in males, in the age group of younger than one year old; however, the higher incidence is in children in the 10-14 age group. Among the cases with specified etiology, the meningococcal meningitis with meningococcemia and the meningococcal meningitis are highlighted. The most used diagnosis criteria for the etiological confirmation of meningitis were: the chemo-cytological method and the culture. Most of the cases evolved to cure without sequelae. The bacterial meningitis continues to present a significant morbidity and lethality. Epidemiological information is important to enable measures of public health and ensure an adequate assistance.

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