Building the epidemiological profile of pediatric patients with bacterial meningitis in Brazil between 2017 and 2022

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1 INTRODUCTION

Meningitis is an inflammatory process of the membranes lining the structures of the Central Nervous System (CNS), manifesting itself acutely or chronically. In a diagnostic context - in addition to other clinical, laboratory and epidemiological findings - it can be characterized as the inflammation of the leptomeninges with an abnormal quantity of leukocytes in the Cerebrospinal Fluid. It is a condition that has varied etiologies, namely bacterial, viral, fungal, parasitic, autoimmune and non-autoimmune (SOURCES et al, 2019; FRASSON et al, 2021).

Bacteria stand out among the aforementioned infectious etiologic agents, being the second most frequent cause, with greater recurrence of the following pathogens: *Neisseria meningitidis, Streptococcus pneumoniae, Haemophilus influenzae, and Streptococcus agalactiae* (group B streptococcus). Bacterial meningitis has a high complexity, a rigid clinical picture, and an absence of a specific pattern. Thus, the disease is regarded as a public health problem worldwide. Furthermore, late diagnosis of bacterial meningitis has the capacity to generate serious sequelae in affected individuals (AGUIAR et al, 2022; GUIMARÃES et al, 2022;).

The most affected population group corresponds to children, especially those under one year of age and up to 9 years and 11 months. Despite the advances achieved in prevention with vaccination offered by the Brazilian Unified Health System (SUS), the disease is still prevalent in Brazil. Infectious

meningitis, due to its endemicity in the Brazilian territory and significant lethality, is part of the category of compulsorily notifiable diseases. Therefore, the related data must be compulsorily recorded in the Sistema de Informação de Agravos de Notificação (SINAN) (MENDES, 2022; SILVA, MEZAROBBA, 2018).

In this sense, the present study is relevant for the evaluation of the current epidemiological situation of bacterial meningitis in the pediatric population in Brazil, relating variables of importance for the analysis. By gathering and discussing evidence, we seek to contribute to the implementation and strengthening of preventive measures, early diagnosis and adequate treatment of the disease in order to mitigate its consequences.

2 OBJECTIVE

To study the epidemiological profile patterns of occurrence of bacterial meningitis and related factors, in Brazil, in the period from 2017 to 2022.

3 METHODOLOGY

This is an ecological epidemiological study with a quantitative approach, developed based on data from the SUS Department of Informatics (DATASUS) from 2017 to 2022. Data from the pediatric population aged 14 years or less were included, being divided into the following categories: age less than 1 year, 1 to 4 years, 5 to 9 years, and 10 to 14 years. The variables analyzed were: evolution, etiology, confirmation criteria, serogroup, sex and race.

For the operationalization of data collection, we used tables elaborated in EXCEL from data available in TABNET from DATASUS and the results expressed through descriptive statistical analysis.

The present work, because it uses secondary information from public access and domain databases, does not need Research Ethics Committee (REC) appreciation and approval, according to Resolutions No. 466/12 and 510/2016 of the National Health Council (GUERRIERO, MINAYO, 2019).

4 DEVELOPMENT

During the period from 2017 to 2022, a total of 9,305 cases of bacterial meningitis were reported in individuals up to fourteen years of age in Brazil. These are: 2,149 (23.1%) in 2017; 2,106 (22.6%) in 2018; 1,937 (20.9%), in 2019; 846 (9%) in 2020; 798 (8.6%) in 2021; and 1,469 (15.8%) in 2022.

Regarding the biological sex, it was identified a greater involvement of males, which registered 5,323 (57.2%) of cases in the period in question. This finding is compatible with that found in the

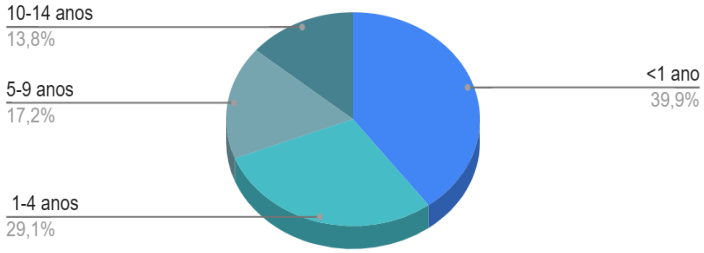
literature, however, the authors do not point out an explanation capable of justifying the predominance in boys (SANTOS et al., 2021; LIMA; PATRIOTA 2021; MAGALHÃES; SANTOS, 2018).

Considering the sample, only 7,962 (85.5%) reported race. Among those who had bacterial meningitis, the white race (58.5%) of individuals up to 9 years old. In contrast, in the 10-14 age group, a predominance of the brown race was observed, representing 52% of cases.

The predominance of white ethnicity was also found in other studies in the literature by Shimaburkuro and collaborators (SILVA; MEZAROBBA, 2018; SHIMABURKURO et al., 2019). However, we emphasize that one of the limitations of this study, is self-reporting, which often may not reflect the real ethnicity of the patient, as well as the possibility of underreporting.

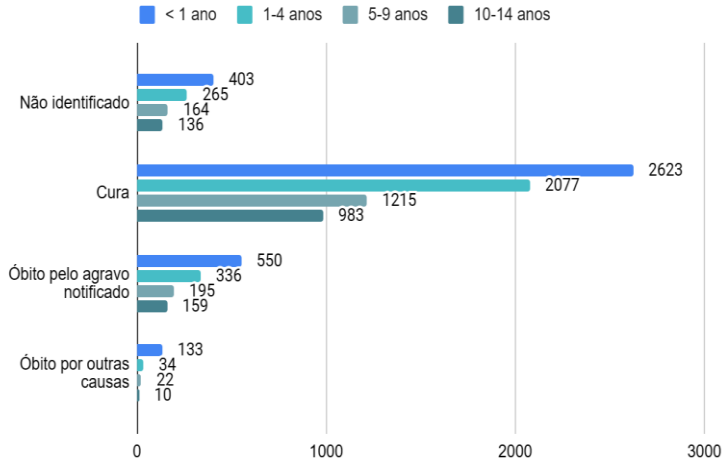
Regarding age (distribution shown in Chart 1) and its relation with the outcome of the disease (Chart 2), it is possible to observe that 6,898 cases (74.1%) evolved with cure and, when the death by the reported grievance is related to age, it is identified that individuals <1 year old present a higher percentage of such evolution (14.82%) compared to other age groups, which obtained the approximate value of 12% each. This higher lethality found is in accordance with what is found in the literature and can be explained by the immaturity of the immune system of infants during this period (FREITAS et al., 2022; PIRES et al., 2022; SANTOS et al., 2021).

Graph 1: Number of cases versus age



Source: Authors, 2023

Graph 2: Age group and disease progression



Source: Authors, 2023

Among the most commonly used criteria for confirming the diagnosis, chemocytology is the most recurrent, having been performed in 3,158 cases (33.9%), followed by culture with 2,818 cases (30.2%). In the study by Silva and Mezarobba (2018), the most used test was also chemocytological in all regions of Brazil.

The etiologic agent was ignored in 65 cases and 5,355 cases (57.54%) were identified only as bacterial meningitis. In those who had it specified, there was a predominance of *Streptococcus pneumoniae* in all age groups, totaling 1,301 cases (13.9%) and, as the second most prevalent etiology, meningococcal meningitis was observed, accounting for 785 cases (8.4%). However, when comparing the number of cases of meningococcal meningitis in the age group between 10 and 14 years, it is possible to observe that there was a significant reduction in the number of notifications over the years analyzed.

Such data show that in the period from 2017 to 2019 the number of notifications ranged between 45 and 53 cases (representing 16.44% of cases in the period from 2017 to 2019 and in the 10-14 age group), while in the interval from 2020 to 2022 the values were between 6 and 14 cases (representing 6.85% of cases in the period from 2020 to 2022 and in the 10-14 age group). The aforementioned reduction in the number of cases of meningococcal meningitis may be a repercussion of the introduction of the MenACWY vaccine (conjugate) in the National Immunization Program (PNI) for adolescents (between 11-12 years) in 2020 (CONITEC, 2020).

Regarding the determination of the serotype of meningococcal meningitis, 8,464 cases (90.9%) were not identified, and among the remaining 814 cases (9.1%), there was a predominance of serotype B (50.6%) in individuals up to 9 years old, while in the 10-14 age group, there was a greater number of cases caused by serotype C (104 cases of 154 with determined serotype). Although the literature points to the importance of identifying the serogroups to plan control measures, the vast majority of records did not do so (CONITEC, 2020).

Furthermore, the number of C serotype cases in the 10-14 age group in recent years (2020-2022) showed a 92% reduction in the number of cases when compared to the first three studied (2017-2019). In 2017 there were 40 cases, while in 2021 and 2022 there were 2 and 5 cases respectively. This reduction may reflect the introduction of the aforementioned vaccine in the NIP (CONITEC, 2020).

Although serotype C is the most prevalent in those over 9 years of age, when comparing the number of cases in this age group, there has been a significant reduction. In 2017 there were 40 cases, while in 2021 and 2022 there were 2 and 5 cases, respectively. This reduction may reflect the introduction of the aforementioned vaccine in the PNI (CONITEC, 2020).

5 CONCLUDING REMARKS

The group of infants under 1 year of age presents the highest number of notifications (39.9%), being also the public with the worst outcome, evolving to death. The analysis shows that males (57.2%), and in general, whites (42.89%) followed by browns (26.7%) are the most frequent. As for the most used diagnostic methods, chemocytology is the most used (33.94%), followed by culture (30.28%), and the most identified etiologic agent is *Streptococcus pneumoniae.* In general, among the serotypes identified, the presence of serotype B prevailed, followed by C.

This study points to the importance of vaccination in reducing cases of bacterial meningitis and its potential lethality and risk of sequelae. There is a reduction in the number of notifications in the age group contemplated by the introduction of MenACWY in 2020, thus pointing to the need to expand the age group served by the vaccine. Furthermore, given the increased proportion of infection caused by serogroup B, it is important to introduce a vaccine that includes it in the PNI. Finally, further updated studies are needed to help public health managers.

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