CLINICAL AND EPIDEMIOLOGICAL PROFILE OF CASES AND DEATHS DUE TO ACCIDENTAL TETANUS IN THE STATE OF MINAS GERAIS, BRAZIL

PERFIL CLÍNICO E EPIDEMIOLÓGICO DOS CASOS DE ÓBITOS POR TÉTANO ACIDENTAL NO ESTADO DE MINAS GERAIS, BRASIL

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ABSTRACT

Introduction: Tetanus is an acute infectious, non-contagious disease resulting from the binomial solution of skin/mucosal continuity and contamination by the bacillus Clostridium tetani. It is a vaccine-preventable disease and highly lethal. Objective: To evaluate the clinical and epidemiologic profile of confirmed cases and deaths from accidental tetanus recorded in the State of Minas Gerais, Brazil, between January 2007 and December 2022. Methodology: The methodological strategy involved the analysis of epidemiological bulletins provided by the Sistema de Informação de Agravos de Notificação (Sinan) and the Sistema de Informações sobre Mortalidade (SIM) from 2007 to 2022. There were 395 reported cases and 27% of deaths due to complications of this infection. Belo Horizonte, Ipatinga, Montes Claros and Juiz de Fora were the cities with the highest prevalence of the disease. Results: It was found that males, brown people, aged between 40 and 59 years, with a low level of education and urban dwellers were the most affected. There were 12 cases of infection in pregnant women. The profile of individuals who died was male, 50 years or older, white race, married, with less education and with an occupation related to the production of industrial goods and services. Conclusion: Despite the availability of effective vaccines, accidental tetanus is still a major public health problem in Minas Gerais. Epidemiologic surveillance of tetanus is essential to identify risk factors and take appropriate preventive measures, involving

INTRODUCTION

Tetanus is a vaccine-preventable, non-contagious, acute infectious disease caused by the action of exotoxins, such as tetanospasmin, produced by Clostridium tetani bacteria. C. tetani is a gram-positive sporulated bacillus, anaerobic, able to survive in the environment for years, and widespread in urban areas. The major reservoirs described for the bacteria are the soil, dust, intestinal tract and animal feces, on the surface of rusty objects such as nails, screws nails, screws, barbed wire, etc.

The infection is characterized by persistent muscular hypertonia, deep hyperreflexia, and paroxysmal spasms or contractures triggered by tactile, auditory, or visual stimulation of

the patient. The evolution of accidental tetanus is directly related to the severity of the clinical form of the disease, the patient's age, preexisting comorbidities, the type of bacillary entry wound, the duration of the incubation period (14 days on average, but can range from 3 to 21 days), the level of complexity of the patient's treatment, and the quality-of-care provided\textsuperscript{1,3-4}.

In 2015, a total of 6,750 cases of accidental tetanus were reported through the WHO/UNICEF Joint Reporting Form, considering the low sensitivity of tetanus case reporting and uncertainty about the true incidence of the disease on the planet\textsuperscript{5}. In developed countries, the incidence of infection has decreased significantly over the years since 1940 due to national vaccination campaigns\textsuperscript{6}. In Brazil, in the last decade, the state of Minas Gerais had the highest number of tetanus notifications representing 10.42% of the total\textsuperscript{7}.

Knowing that the data provided by the Epidemiological Surveillance Directorate of the Brazilian Ministry of Health indicate that the State of Minas Gerais has an incidence above the national average\textsuperscript{7}, the objective of this study was to evaluate the clinical and epidemiologic profile of confirmed cases and deaths from accidental tetanus recorded in the State of Minas Gerais, Brazil, between January 2007 and December 2022.

**METHODOLOGY**

This is a cross-sectional, ecological, descriptive and quantitative epidemiologic study. Its subject is the notification of accidental tetanus cases and deaths in the State of Minas Gerais individuals during the period 2007 to 2022.

The methodological strategy involved the analysis of epidemiological bulletins provided by the Sistema de Informação de Agravos de Notificação (Sinan)\textsuperscript{8} and the Sistema de Informações sobre Mortalidade (SIM)\textsuperscript{9}. Research with this profile, involving only publicly available data that does not identify research participants, does not require approval by human research ethics committees associated with the Comissão Nacional de Ética em Pesquisa from Brazil.
Data collection occurred in April 2023. The secondary data are presented in descriptive tables, and a map of its spatial distribution. The elements studied were stratified according to the information available in the notification forms, such as the distribution of notifications and their annual prevalence, such as sex (male and female), race (white, black, yellow, mixed race, and indigenous), education level (illiterate, 1st to 4th grade incomplete elementary school, 4th complete grade of elementary school, 5th to 8th grade incomplete elementary school, complete elementary school, incomplete high school, complete high school, complete higher education, and incomplete higher education), age group (< 1, 1-4, 5-9, 10-14, 15-19, 20-39, 40-59, 60-64, 65-69, 70-79, and ≥ 80 years old), and area of residence (urban, rural, and peri-urban).

The reports in pregnant women were studied according to the gestational period (1st, 2nd, and 3rd trimester). The evolution of the cases was stratified according to clinical cure and death from accidental tetanus.

The variables were transferred and analyzed using Excel® and GraphPad Prism 6®. The map of the spatial distribution of cases was generated using TabWin 4.15®.

To calculate the annual prevalence rate, the number of notifications in each year was used as the numerator and the Brazilian population by year, according to the Brazilian Demographic Census projection, as the denominator. The result of the division was multiplied by hundred thousand inhabitants, adapted from Oliveira & collaborators.

Statistical analysis was performed using GraphPad Prism 6®. The normality of the number of reports in the study period was assessed by the Kolmogorov-Smirnov test, which found a non-parametric distribution of the data. Data were subjected to Kruskal-Wallis’s test and Dunn's multiple comparison test for comparison between groups. P-values <0.05 were considered significant.

RESULTS

According to the data collected in the Sinan database, between 2007 and 2022, 395 cases of accidental tetanus were identified in the State of Minas Gerais.
The number of notifications per year and their annual prevalence rate are shown in Figure 1. The bar graph represents the number of cases and should be analyzed with the Y-axis on the left. The line graph with circular symbols refers to the annual prevalence rate in the period studied and should be analyzed with the Y-axis on the right of the figure.

**Figure 1** - Accidental tetanus cases and annual prevalence in Minas Gerais (2007-2022).

Source: Author's preparation with data from the Sinan.

The statistical analysis did not identify significant differences between the notifications in the period studied.

Figure 2 shows the spatial distribution of reported cases according to the municipality of residence of the infected persons. Note that the cities with a high prevalence of notification in Minas Gerais are Belo Horizonte at 13.5%, Ipatinga at 5.4%, Montes Claros at 4.4%, and Juiz de Fora at 3.1%.

Figure 2 - Geographic distribution of accidental tetanus cases Minas Gerais (2007-2022).

Source: Author's preparation with data from the Sinan.

Table 1 shows the socio-demographic profile of individuals who contracted accidental tetanus. It was possible to determine that males, people brown, aged between 40 and 59 years, with a low level of education, and urban residents are the most affected by the infection.
Table 1 - Social and demographic profile of accidental tetanus in Minas Gerais (2007-2022).

<table>
<thead>
<tr>
<th>Feature</th>
<th>n</th>
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<tbody>
<tr>
<td><strong>Sex</strong></td>
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<td>Male</td>
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</tr>
<tr>
<td>Female</td>
<td>66</td>
</tr>
<tr>
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<td>Brown</td>
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<td>Complete elementary school</td>
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</tr>
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<td>Incomplete high school</td>
<td>15</td>
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<tr>
<td>Complete high school</td>
<td>19</td>
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<td>Complete higher education</td>
<td>2</td>
</tr>
<tr>
<td>Incomplete higher education</td>
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<td><strong>Age group</strong></td>
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<td>10-14 years old</td>
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<tr>
<td>Ignored/white</td>
<td>102</td>
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</tbody>
</table>

Caption: “n” is the raw number of notifications related to the described feature. Source: Author’s preparation with data from the Sinan.

A number of 12 cases were reported in pregnant women and three of them were in the 1st, one in the 2nd, and five in 3rd trimester. In addition, there were 3 reports in which the gestational age was ignored by reporting.
As for the evolution of the cases, 53.4% of the cases evolved to cure, 27% died from the reported ailment and 2.8% died from another cause.

The sociodemographic profile of the deceased\(^9\) was 72% male, 68% 50 years or older, 47.7% white race, 46.7% married, 21.5% with less education (up to 3 years completed), and 13.1% with an occupation related to the production of industrial goods and services. 95.3% of deaths occurred in a hospital\(^9\).

**DISCUSSION**

The prevalence of tetanus in Minas Gerais in the years studied seems to be in a declining trend, like that observed in Brazil\(^12,13\). Despite being immunopreventable, accidental tetanus is still an important public health problem in Minas Gerais\(^14\).

In the epidemiologic study conducted by Vieira and Santos\(^14\) in Minas Gerais between 2001 and 2006, 225 cases of infection were reported. The data described by the authors are consistent with the present study since they found a prevalence of the disease in men over 65 years of age\(^14\). On the other hand, differing from the data found in this study, the area of residence of the patients was in rural areas, other studies show a predominance of the cases related to rural residents\(^14,15\).

Sarmento et al.\(^15\), in a study conducted between 2009 and 2011, found 935 cases of accidental tetanus, 187 of which were among rural residents, with an average of 62.3 cases per year and an average lethality of 32.6%.

The male gender is the group most affected by tetanus\(^14,16\), due to the failure of vaccination campaigns directed at these individuals. In the country, the vaccination strategy is aimed at the prevention of neonatal tetanus during pregnancy and, consequently, in pregnant women\(^14\). Thus, the male population is at higher risk of contracting the infection. In addition, the focus of vaccination campaigns also explains the lower prevalence of tetanus in women under 50 years of age\(^14\).

The high number of cases in individuals over 40 years of age can be explained by the fact that aging causes a reduction in reflexes, visual and auditory acuity, and motor skills\(^17\), putting these individuals at risk.

In this regard, Silva\textsuperscript{18} states that the elderly population is exposed to greater risk factors than the young population due to misconceptions about the disease, including the lack of adequate active immunization measures, as well as the natural decline of immunogenic protection against infection in this age group.

Concerning age, among those who died from the infection, there was a greater preponderance of workers in the production of industrial goods and services sectors, highlighting the impact of occupation on the risk factors for acquiring the disease and predisposing those infected to death.

This fact is explained by the occupational risk process, which is higher among agricultural and construction workers, as well as the low educational level of the population described. Considering these aspects, the impact on the health-disease process related to the low level of education of the community represents a social determinant of health risk for accidental tetanus\textsuperscript{13}.

Among the data described are notifications of accidental tetanus in pregnant women. Tetanus in pregnant women can cause muscle stiffness and spasms, especially in the muscles of the jaw and neck. This can make it difficult for the woman to eat and breathe. In severe cases, tetanus can lead to respiratory failure and death\textsuperscript{19}.

In addition, \textit{C. tetani} infection can affect the developing fetus, increase the risk of miscarriage and stillbirth, cause premature labor and delivery, and cause low birth weight, which can increase the risk of other health problems for the newborn\textsuperscript{19}. Therefore, if the pregnant woman has no history of vaccination, she should receive 3 doses of the dual adult vaccine in cases of probable exposure to the bacteria\textsuperscript{20}.

The lethality found in different studies ranges from 16.3\% to 52.3\%, being higher at the extremes of age\textsuperscript{16,21}. Therefore, the data from this study are in line with the global lethality rate, since the data showed that cases that progressed to death represented 27\% of the notifications.

The Sistema de Informação de Agravos de Notificação (Sinan) is a fundamental tool for monitoring public health in Brazil\textsuperscript{22}. However, one of the main challenges facing Sinan
is the presence of ignored and blank variables in the notifications. This can lead to underreporting of cases and, consequently, underestimation of the magnitude of certain diseases. To reduce underreporting, health authorities should provide regular training, encourage the standardization of records, and ensure the availability of resources and technology for data collection and analysis\textsuperscript{22,23}.

CONCLUSION

Despite the availability of effective vaccines, accidental tetanus remains a significant public health problem in the state of Minas Gerais. This potentially fatal disease can lead to prolonged hospitalization and long-term disability, so its prevention and early diagnosis are crucial. Epidemiologic surveillance of tetanus is essential to identify risk factors and implement appropriate preventive measures.

Healthcare professionals must remain vigilant in their efforts to educate the public about the importance of tetanus vaccination and wound care. It is also necessary to strengthen case reporting and investigation to ensure timely response and effective management of the disease. A comprehensive approach involving collaboration between public health authorities, health care providers and the community is essential to reduce the burden of accidental tetanus in Minas Gerais.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interests to disclose.

REFERENCES


