CLINICAL AND EPIDEMIOLOGICAL FINDINGS DURING A MEASLES OUTBREAK OCCURRING IN A POPULATION WITH A HIGH VACCINATION COVERAGE

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From March 1991 to April 1992, 250 measles suspected cases were studied in the Municipality of Niterói, State of Rio de Janeiro. The median age found was 11 years and 76.0% of the cases were in school age children. Exposure histories were present in 149 patients and schools were the most frequent sites of transmission (45.0%). Vaccination status was known for 127 studied cases and 76.4% of them had received measles vaccine before their first birthday. One or more complications were reported for 68 cases and in 8.9% of the studied cases hospitalization was required. Frequency of complications varied according to each age group studied and were more commonly encountered among children < 1 year of age (55.6%). The history of previous vaccination did not diminish the number of complications of the cases studied. The results of this work show changes in age distribution of measles leading to sizeable outbreaks among teenagers and young adults.

Key-words: Measles epidemiology. Vaccine failure. Measles complications.

In countries where measles vaccination has reached high levels some changes in disease epidemiology have been observed, and among them, a progressive upward shift in the age distribution of measles incidence towards older children. This increase in the mean age of occurrence of measles cases is related to population vaccination coverage levels. Recently, many authors have reported measles outbreaks in teenagers and adults, and in some cases including people previously vaccinated.

Despite the differences found in the vaccination coverage levels among the States of Brazil, the number of measles notified cases in recent epidemics did not reach the same levels observed in the 70's. This fact is due to the progressive increase in the vaccination coverage levels in the last years and the impact of vaccination campaigns on the incidence of the disease.

Until 1984 the epidemiology of measles in the Municipality of Niterói, State of Rio de Janeiro, was characterized by high morbidity and mortality rates, mainly reported in children under five. Since 1985, following the introduction of national immunization campaigns mainly directed to children 9 - 23 months of age, measles incidence and mortality have declined rapidly. However, it has been observed that the mean age of reported cases increased each year.

Measles incidence in Niterói began to increase during the 90’s, but at this time most of the cases were observed in children from 10 to 14 years of age, followed by those from 5 to 9 years of age. Although the age group at the highest risk continues to be children of less than one year of age, an increase in the proportion of measles cases has occurred in older children. A similar picture has been described by other authors, mainly in countries that have achieved and sustained high coverage rates.

This paper reports the investigation of an outbreak of measles in a population with a high vaccination coverage.
MATERIAL AND METHODS

Study design. The study was conducted in Niterói, State of Rio de Janeiro, Brazil. From March 1991 to April 1992 an intensive surveillance system was instituted by the Division of Epidemiology of Niterói Department of Health. Physicians were required to report suspected measles cases immediately, based on the criteria established by the Centers for Diseases Control as a clinical case: an illness characterized by fever ≥ 38.3°C, generalized maculopapular rash of a 3 days-duration and, at least one of the following: cough, coryza or conjunctivitis. Each case reported to the Department of Health was followed up by a review of the case record and investigated by epidemiologists or nurses of the Department of Health especially trained to confirm clinical diagnosis. In order to find additional cases all health workers were instructed to ask patients about the presence of rash-like illness occurring in their neighbourhood as well as among school colleagues.

A questionnaire containing the personal data, signs and symptoms of measles, vaccination history, setting of transmission, and complications was designed for the study. Only persons with a well-documented history of prior immunization were assumed to be vaccinated. All of them had received a live, attenuated measles vaccine.

Exposure histories. A history of exposure to measles was present in 149 (59.6%) patients. The most frequently reported sites of transmission were: school: 67 (45.0%) cases; home: 47 (31.5%) cases; neighbourhood: 24 (16.1%) cases and others: 11 (7.4%) cases. Setting of transmission varied according to age. The most frequently reported contacts for children < 5 years of age were the home and neighbourhood, and among patients from 5 to 19 years of age, school and home. The relation school/home increased according to age.

Vaccination status. Vaccination status was known for 127 (50.8%) studied cases and 97 (76.4%) of them had been vaccinated before their first birthday. The other 30 (23.6%) patients had received measles vaccine on or after one year of age (14 cases received one dose and 16 cases received two or more doses). All the children < 1 year of age were unvaccinated. The remaining 123 patients were unvaccinated or had a poor documented history of prior vaccination.

Complications of measles. One or more complications were reported for 68 (27.2%) cases, including pneumonia in 37 (54.4%), otitis media in 22 (32.4%), diarrhea in 12 (17.7%), and others (sinusitis, laryngitis, tonsillitis) in 8 (11.8%). No case of encephalitis was seen. Frequency of complications varied according to each age group studied (Table 2). They were more commonly encountered among children < 1 year of age and those of the age group from 15 to 19 years old. A total of 22 (8.9%) hospitalizations were required by measles complications.
Frequency of complications also varied according to previous vaccination status (Table 3). They were seen more frequently in unvaccinated cases (33.3%) than in those vaccinated (21.3%). This result was statistically significant ($\chi^2: 4.60 - P < 0.05$). The relation between complications and history of previous vaccination were also analysed without including children < 1 year of age (Table 4). Although they continued to be seen more frequently in unvaccinated cases (29.5%) than in those vaccinated (21.3%), this result was not statistically significant anymore ($\chi^2: 2.09 - P > 0.05$).

**DISCUSSION**

In the USA, from 1984 to 1988, 58% of reported cases affected children ≥10 years of age, compared with 10% during the period 1960 to 1964. This progressive upward shift in the age distribution of measles incidence towards older children has been reported by foreign authors and also in our country. This fact was confirmed in this work, where the median age for the period studied was 11 years. The proportion of cases among children from 10 to 14 years of age exceeded the one among children from 1 to 4 and from 5 to 9 years old together (32.8%). Furthermore, the proportion of cases among people from 15 to 19 years old (16.8%) was higher than the proportion found in children from 1 to 4 years old (12.0%), the age group of highest incidence before the beginning of vaccination campaigns.

The changes in the age distribution of measles incidence can be related to some factors: a) Because of the mass campaign vaccination, the number of susceptible children under the age of 5 decreased and the measles cases that occur in adolescents and adults came to represent a great percentage of all reported cases. b) The decrease of measles transmission in the community caused by vaccination also protected indirectly unvaccinated people (herd immunity). So, many of them became older without having contact with the measles virus, either natural or by vaccination. Another factor that can be responsible for the changes of measles epidemiology is that vaccine induced immunity can wane with time. Krugman believes that waning immunity may be insignificant from the epidemiologic point of view and that adequate immunization is sufficient to protect more than 95% of the vaccinated children over a long period.

However, the increase of measles cases in previously vaccinated children has been described by different authors. The reasons of vaccine failure can be related to: neutralization of vaccine virus by maternal antibodies or those artificially administered (gamma globulin); improper storage or handling vaccine leading to inactivation of live virus; "primary vaccine failure", which occurs in about 5% of vaccines. In Brazil, because of the high incidence of measles at a young age, routine measles vaccine has been recommended for children 9 months of age or older since 1982. As 13–15% of the children remain susceptible with this strategy, a few States decided to administer a second dose of the vaccine after 15 months of age. Nevertheless, this policy was not adopted for the country as a whole, leading to insufficient levels of vaccine coverage to attain disease control.
birthday. The other 30 (23.6%) patients had received measles vaccine at or after one year of age. The high percentages of people vaccinated with only one dose before their first birthday could explain vaccine failure. Moreover, alterations in measles vaccine quality could also have contributed to the results related above. Oliveira et al., in 1986 and in 1990, carried out an investigation to evaluate the basic procedures involved in the storage of measles vaccine in public health units of the Municipality studied. The first research showed that all vaccine sample titers were well below the minimal recommended potency by the manufacturers. Four years later, despite the improvement of the cold chain when compared to the former evaluation, 55.2% of the vaccine samples were still under the minimal recommended potency.

Transmission in schools accounted for 67 (45.0%) of 149 cases with a history of measles, followed by homes (47 cases 31.5%) or neighbourhood (24 cases 16.1%). Moreover, transmission in schools was more frequent for people from 5 - 19 years of age. The highest proportion in these settings can be explained because students transmit infection more efficiently than younger children. They frequently visit other classrooms and attend social events outside the school, which bring large groups together. It was particularly interesting to observe that transmission in medical settings (hospitals, emergency rooms, and physicians' offices), found in only one case in this study, had not so much importance as the one observed by Manson et al. and Atkinson et al. in the USA, 44.3% and 26.4% of their cases, respectively. The less severe measles cases observed are probably due to the change in the age distribution and the increasing median age of reported cases. The history of previous vaccination did not diminish the number of complications of the cases studied.

The results of this study show changes in the epidemiology of measles in the Municipality of Niterói, mainly in the last three years. All the facts here discussed, as vaccination strategies adopted and causes of vaccine failures, may have contributed to these results. Therefore, to attain measles control it is important to continue the efforts to increase vaccination coverage, and to expand active surveillance of the disease.

RESUMO

No período de março de 1991 a abril de 1992, 250 casos de um total de 293 notificados como sarampo em Niterói, RJ foram estudados. Em 75,9% dos casos o sarampo ocorreu em pessoas de idade escolar (mediana: 11). História de exposição estava presente em 149 pacientes. O local de transmissão variou de acordo com a idade sendo a escola o mais frequentemente encontrado (45%). Em 127 casos o estado vacinal era conhecido e 76,4% deles tinham sido vacinados antes do primeiro aniversário. Em 68 casos uma ou mais complicações estavam presentes e em 8,9% deles a hospitalização foi necessária. Complicações foram mais frequentes em menores de um ano de idade (55,6%). História de vacinação prévia não diminuiu o número de complicações dos casos estudados. Os resultados deste trabalho mostram mudanças na epidemiologia do sarampo, com alterações na distribuição etária dos casos da doença, levando à ocorrência de importantes surtos da virose entre adolescentes e adultos jovens.


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REFERENCES


