Vaccine xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Meningococcal carriage prevalence in university students, 18–24 years of age in Santiago, Chile

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ARTICLE INFO

Article history:
Received 24 February 2014
Received in revised form 29 July 2014
Accepted 8 August 2014
Available online xxx

Keywords:
Meningococcal
Pharyngeal
Carriage
University
Students

ABSTRACT

Introduction: Neisseria meningitidis invasive disease is a major public health problem. Pharyngeal carriage is considered a prerequisite for invasive infection. Prevalence reaches 10% in general population and up to 30% in the 20–24 years age group. The aim of this study was to asses pharyngeal carriage prevalence in healthy subjects aged 18–24 years, and as secondary endpoints evaluate known risk factors, to identify serogroups and sequence in the isolated strains.

Methods: Cross-sectional study in 500 healthy subjects; students from Universidad de Chile aged 18–24 years, Santiago, Chile, October 2012. Each subject underwent a risk factor survey prior to throat culture sampling. Samples were processed in one central Microbiology Laboratory of Hospital Luis Calvo Mackenna and serogrouping and sequencing was performed at Instituto de Salud Pública de Chile.

Results: We obtained throat samples from 500 healthy subjects, 20 (4%) positive for *N. meningitidis*. Of positive strains 20% (Yazdankhan and Caugant, 2004) were serogroup B, 15% (3) W and the rest non groupable. The median age was 20 years, 50% were men. Of the risk factors evaluated, 24% were current smokers, 16% shared a room, 72% had kissed someone during the last month, 64% had gone to pub and 76% had consumed alcohol in the same period of time.

Discussion: Literatures meningococcal carriage prevalence reaches up to 30% in people aged 18–24 years. Prevalence in our study was 4%. Different interpretations could be given; one could be the absence of overcrowding in our students because of the lack of dorms in our scholar system and also the characteristics of our enrolled group.

Conclusions: Our results suggest the necessity to extend the study to other age groups and to other cities, to better understand the Chilean reality, as well as others regions of America, considering that these results cannot be extrapolated to another countries.

1. Introduction

Meningococcal invasive disease is unique to human beings. It is a major public health problem given its global distribution, epidemic potential and short and long-term morbidity [1–3]. It has an unexpected initiation, an unpredictable evolution and sometimes a fulminant course, mainly in healthy infants and adolescents [3]. It has an overall incidence ranging from rates below 0.5 to 1000/100,000 population per year depending on the evaluated geographical area [4,5,6]. The epidemiological situation in Chile has been classified as "low endemicity" since 2001, with an annual incidence of 0.5/100,000 inhabitants [7], mainly serogroup B. As of 2010, the country has experienced a gradual increase in serogroup W cases, with a clear predominance of this serogroup from 2012 onwards [7]. Despite important advances in diagnosis and intensive care management, case fatality rates remained stable since 1930 between 8% and 14%, and increased in 2012 up to

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http://dx.doi.org/10.1016/j.vaccine.2014.08.015
0264-410X/

25% parallel to the serogroup W ST-11 clonal complex circulation [3,10].

Neisseria meningitidis is part of common nasopharynx flora and is present in about 3–25% of the general population, which is known as pharyngeal carriage [4,5,8]. This successful, dynamic and time variable relationship between the microorganism and the host is considered an important source of infection for susceptible individuals [5,9]. The pharyngeal carriage prevalence varies by age group, from 0.7% in children under 4 years up to 32% among young people aged 20–24 years [3,4].

Several carriage risk factors have been described, such as age, male sex, overcrowding, active and passive smoking, alcohol consumption and number of kissed people, among others [4,10,11].

The relationship between carriage prevalence and invasive disease incidence is not clearly understood. However, carriage studies can provide valuable information on epidemiological basis, pathogenesis, serogroup distribution, transmission patterns and hyperinvasive strain detection. All this helps understand the potential effects of control programs, such as vaccination and antimicrobial treatment opportunity [10,12].

Latin American data shows a pharyngeal carriage prevalence of 1.9% in children and 2.9% in adolescents in Mexico [11,13] and 1.5% in schoolchildren in Venezuela [13]. Chilean information goes back to 1979, with a described prevalence of 12% in 2–15 year old subjects; no data have been published since [14].

The aim of this study was to estimate the meningococcal pharyngeal carriage prevalence in healthy university students aged 18–24 years in Santiago, Chile. Secondary endpoints were to assess the presence of known pharyngeal carriage risk factors and to identify and sequence serogroups in the isolated strains.

2. Methods

2.1. Overview

Cross sectional study, held in Santiago, Chile, during October 2012. We recruited 500 healthy individuals, all university students belonging to different faculties of Universidad de Chile, between ages 18 and 24 years old. Exclusion criteria: previous meningococcal disease, chronic diseases such as diabetes, kidney or liver disease, congenital or acquired immunodeficiencies (hemato-oncological diseases, systemic corticosteroids for longer than seven days, use of immunosuppressors), use of antibiotics at any time within the last 30 days and previous meningococcal vaccine.

The study was approved by the Scientific Ethics Committee for Human Research of the Faculty of Medicine, Universidad de Chile. After each student signed the informed consent, the following epidemiological data was collected: age, sex, residence, socioeconomic level and college career. They also completed an anonymous survey on risk factors for pharyngeal meningococcal carriage described in the literature [10,11]: dwelling place (parents house or university dorms), number of people and children in the house, shared room, active smoking, passive smoking, drinking, number of people kissed and number of nights attending pubs during the last month.

2.2. Microbiological study

After the aforementioned survey, a trained operator took a swab sample from the posterior pharynx and tonsils using a swab with Amies-Charcoal transport medium. The samples were transferred in a maximum of 5 h from collection to the Microbiology Laboratory of Hospital Luis Calvo Mackenna, where the samples were inoculated on chocolate agar and Thayer-Martin agar, incubated at 37 °C in humidified atmosphere with 5% CO_2, and evaluated after 24 and 48 h. Colonies were identified by standard methods, using Neisseria API (BioMérieux, France) [5,15–17]. Positive strains were sent to Instituto de Salud Pública de Chile. Serogrouping was performed by slide agglutination with meningococcal serogroup A, B, C, W and X antisera (Difco, Becton Dickinson, USA) and gene sequencing through multi locus sequencing type (MLST) [18].

Table 1
Demographic characteristics of 500 university students enrolled in a *Neisseria meningitidis* pharyngeal carriage study.

Characteristics	Results
Age median (pc 25–75)	20(18–24)
Male sex. N (%)	250(50)
High socioeconomic level (%)	102(20.4)
Medium socioeconomic level	174(34.8)
Low socioeconomic level	224(44.8)
No. of people per house. Median (pc 25–75)	3(0–9)
No. of adults per house. Median (pc 25–75)	2(0–9)
No. of children per house. Median (pc 25–75)	0(0–4)
Shared room. N (%)	79(15.8)
Active smoking. N (%)	18.5 (23.7)
Passive smoking. N (%)	158(31.6)
During the last month	
Kisser. N (%)	358(71.6)
No. of kisses. Median (pc 25–75)	1(1–6)
Kissed >1 person. N (%)	58(11.6)
Pub assistance. N (%)	321(64.2)
No. of night pub. Median (pc 25–75)	2(1–15)
Alcohol consumers. N (%)	382(76.4%)

2.3. Statistical analysis

The given sample size was 450, with a confidence level of 95% and an estimation error of ±5% points, for an estimated prevalence of 30%, previously described for the same age group in the literature [4,5,8]. A descriptive analysis of variables was performed. Continuous variables were described as medians and ranges and categorical variables as numbers and percentages. The risk factor analysis was made by logistic regression, obtaining Odds Ratio (OR) as a measure of association with their respective 95% confidence intervals (CI). $P < 0.05$ was considered significant. For statistical analysis we used the statistical software STATA 12 (College Station, Texas).

3. Results

3.1. Population

We enrolled 500 students from different faculties of the Universidad de Chile, during October 2012. The demographic characteristics of the study population are described in Table 1. The median age of study subjects (pc 25–75) was 20 years (18–24) and 50% were male. No students lived in dorms and 84% did not share their room. One hundred and two students (20.4%) belonged to high socioeconomic level, 174 (34.8%) to medium level and 224 (44.8%) to low level ($P = 0.4$). The educational distribution of the study group according to the university studies: 134 (26.8%) belonged to humanities, 152 (30.4%) to mathematics and 214 (42.8%) to science faculties ($P = 0.92$).

3.2. Microbiology and molecular biology

We identified a positive isolation of *N. meningitidis* in 20 of 500 subjects, reaching a carriage prevalence of 4%. Of the 20 isolated strains, four were serogroup B (20%), three serogroup W (15%) and the rest were not capsulated. Table 2 shows serogroups and MLST of the 20 *N. meningitidis* strains. It was possible to assign a clonal complex in two of the four strains of *N. meningitidis* serogroup B and in all of the three strains of *N. meningitidis* serogroup W.

Please cite this article in press as: Rodríguez P, et al. Meningococcal carriage prevalence in university students, 18–24 years of age in Santiago, Chile. Vaccine (2014), http://dx.doi.org/10.1016/j.vaccine.2014.08.015