



Study of Risk Factors for Nasopharyngeal Carriage of Penicillin-Resistant Streptococcus Pneumonia and Antibiotic Sensitivity in Preschool Children

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Abstract: Introduction: streptococcus pneumonia is the most common cause of bacteremia, bacterial pneumonia, and otitis media and the second most common cause of meningitis in children, next to Neisseria meningitides. Resistance to penicillin and other antimicrobial agents among streptococcus pneumonia is becoming a Basic problem in worldwide and in Asia. The aim of our study was to determine prevalence of nasopharyngeal carrier of streptococcus pneumonia and their Risk factor and their antibiotic resistant pattern in children. Material and Methods: This cross-sectional study was performed from Jan 2012 to May 2013. 402 Healthy children (ages, 1 to 6 years) attending day-care center in Bandarabbas city was studied. Nasopharyngeal samples were collected by sterile swaps and then inoculated on selective agar. After 24 h incubation, microbiological tests were performed and antimicrobial sensitivity tests were done. Results: of 402 children 197(49%) were boys and 205 children (51%) were girls and the mean age was 3.4 years. streptococcus pneumonia was recovered from 63 samples(15.7%). The rate of resistance to co-trimoxazol 77.8% , Ampicillin 74.6% , erythromycin 84.1%,clindamycin 66%,oxacillin 73%,ceftriaxon 73% and Penicillin was 73%.the number of children in each day-care center was the only Risk factor for carrier status. Conclusion: in our study the rate of carriage of streptococcus pneumonia was 15.7% but this rate in other studies is different from 4.2% to 72%. Some of the difference among population may related to sampling or laboratory methodology.

Key words: Streptococcus Pneumonia, Antibiotic -Resistant, Nasopharyngeal Carriage, Risk

INTRODUCTION

Streptococcus pneumoniae (Pneumococcal pneumonia) is a very important pathogen that annually kills more than one million children worldwide. The disease caused by Pneumococcus is prevalent, and often acute, in children and has various clinical syndromes: life-threatening pneumonia, bacteremia, and meningitis. Pneumococcal antibiotic resistance is a problem for public health and 15-30% of samples all over the world have multidrug resistance. Most healthy people carry various serotypes of Streptococcus pneumoniae in their upper

respiratory tract. The highest levels of pneumococcal carriage are found in gathering places and in winter. Pneumococcus is the most common cause of bacteremia, bacterial pneumonia, otitis media, and the second cause of meningitis in children after *Neisseria meningitidis*. Boys are more susceptible to this disease compared to girls. The Pneumococcal disease is usually spread from one person to another through respiratory secretions. Prior to the routine use of Pneumococcal Polysaccharide-Protein Conjugate Vaccine (PVC), Pneumococci caused more than 80% of bacteremia cases with non-focal fever in 3-36-month-old sucklings. Prevalence of resistance to beta lactams and to classes of multi-drug resistance (MDR) has increased substantially during the past few decades. The widespread use of antibiotics has been effective in the spread of resistance strains ¹. Extensive studies in most parts of the world have shown a high level of nasopharyngeal Pneumococcal carriage in day nurseries (that act as a focus for the appearance and transfer of resistant microorganisms). Nowadays, because of indiscriminate administration of antibiotics, availability of antibiotics for purchase without a prescription, and increased morbidity and mortality rates resulting from antibiotic resistance, conducting studies on identification of asymptomatic carriers and patterns of microbial sensitivity of *Pneumococcus pneumoniae* has become a necessity ^{2,3,4,5}.

MATEREAL AND METHODS

This cross-sectional study was conducted on 1-6 year old children attending day- nurseries in Bandar Abbas from the first month of winter in 2012 until the second month of spring in 2013. Seven day- nurseries were randomly selected and 402 children from these day nurseries, who met the criteria for taking part in the research, were studied. Carrier risk factors were evaluated using a questionnaire with the following questions: age, antibiotics received during the last three months, history of ear infections during the past year, hospitalization history, number of family members, number of children attending the related day nursery, type of nutrition (breast-fed, powdered milk, both), and contact with tobacco smoke (at least one hour a day). Sterile swabs were used to take nasopharyngeal samples, and the samples were placed in a selective agar culture containing Gentamicin (5mg/l). The plates were incubated at 37°C in a CO₂ rich environment for 24 hours, and then examined with respect to the growth of alpha-hemolytic microcolonies. Optochin disks were then used. Inhibition zone diameters of ≥ 14 mm confirmed the presence of *Streptococcus pneumoniae*, while in cases where diameters of inhibition zones were less than 14 mm the bile solubility test was conducted to identify the *Streptococcus pneumoniae*. In the next stage, sensitivity of *Pneumococcus pneumoniae* to the antibiotics penicillin, oxacillin, erythromycin, ceftriaxone, clindamycin, and ampicillin was assessed using the disc diffusion method.

RESULTS

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Of the 402 children who participated in the study, 197 (49%) were boys and 205 (51%) were girls. Their average age was 3.4 years, 89% had no history of exposure to tobacco smoke, 66.7% had not received antibiotics, and 91.3% had no history of ear infections. The number of family members was studied in the two groups of fewer than and more than five persons (with most of the children, 70.8%, coming from families with fewer than 5 members) and 82% of the children had not been hospitalized. The day nurseries were also divided into the 2 groups of fewer than 50 and more than 50 children (with 74.4% having more than 50 children). Among the risk factors studied, the only correlation found was that between the number of children in the day nurseries and the number of children who were Pneumococcal carriers (P value=0). Sixty- three children were carriers (carriage frequency of *Streptococcus pneumoniae* was 15.7%).

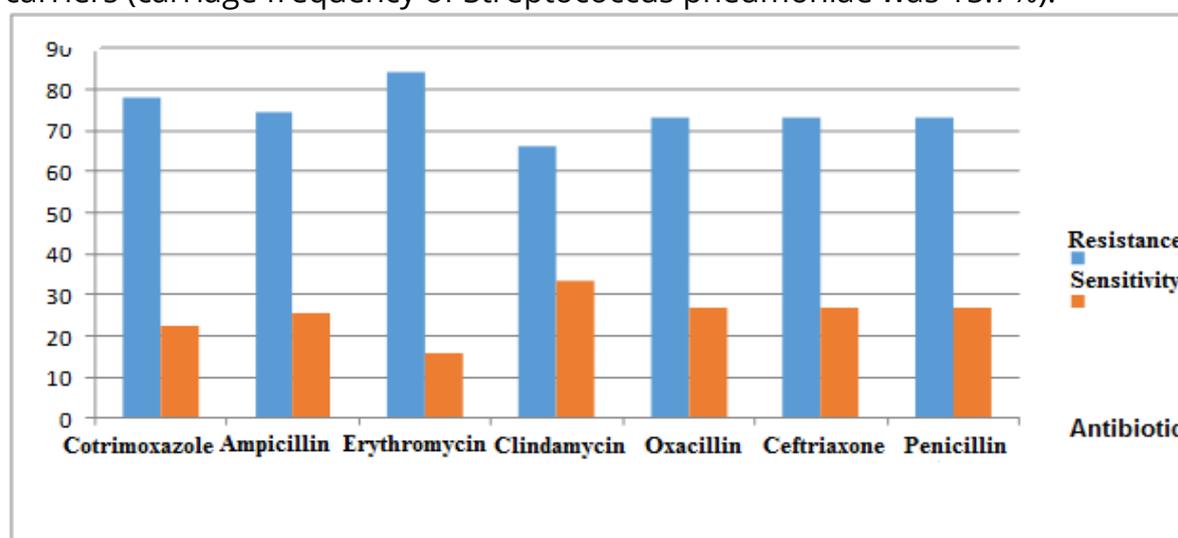


Fig1. Comparing the degrees of resistance and sensitivity to antibiotics in carriers

As shown in the diagram, the highest level of resistance was to erythromycin, and the lowest to clindamycin.

DISCUSSION

The purpose of this research was to study carriage prevalence of *Pneumococcus pneumoniae* and its risk factors in 1-6 year old children attending day centers, and to evaluate resistance of *Pneumococcus pneumoniae* to antibiotics. The carriage prevalence observed was 15.7%. Different statistics have been reported in various studies (with carriage prevalence from 4.2 to 72%). Among factors affecting this prevalence could be the number of children in the day nursery, the duration of their daily stay in the nursery, the correct technique of sampling, the laboratory methodology, and the sampling season. For example, in standard agar media few isolates are found, while selective agar media to which Gentamicin is added (the media used in this research) raises detection rates of *Streptococcus pneumoniae* in the samples. Doctor Bakhshaei in Mashhad, Felipe Piedade in Brazil, and Philip Hill in London also used this method [2,6,7,8,9,10](#).

The only significant correlation found was that between the number of children in the day nursery and Pneumococcal carriage. Paolo Marchisio in Italy studied the number of children in the day nursery and the daily duration of their stay there, and found no meaningful correlation between these factors and Streptococcal carriage³. This statistical difference may be due to differences in the durations of daily stay in the day nursery (which differs in different countries with various cultures), or probably results from better observance of hygiene principles among children.

In the study Philip Hill conducted in 21 villages around London, carriage prevalence decreased with age increase in children, and greater distances of villages from the main road led to rises in carriage prevalence (probably because of less access to health centers)¹⁰.

In most studies conducted to date, risk factors have had no correlation with carriage prevalence. In research carried out by Paolo Marchisio in Italy, the only risk factor that had a meaningful correlation with carriage was incidence of sinusitis in the past three months.

The highest levels of resistance to antibiotics were to erythromycin with 84.1% and to cotrimexazole with 77.8%, while the highest level of sensitivity was to clindamycin with 33.3%.

In several conducted studies, the highest levels of antibiotic resistance were shown to erythromycin and cotrimexazole^{6,7,11,12}. Based on this, and considering the high rates of antibiotic resistance, it is recommended that indiscriminate prescription of antibiotics and their purchase without a prescription be avoided. Moreover, future studies should be conducted on larger sample sizes, and non-nursery children should also be included to better understand the hygiene situation in the related region.

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