DETECTION OF NASOPHARYNGEAL CARRIAGE OF STREPTOCOCCUS PNEUMONIAE IN CHILDREN BEFORE AND AFTER THE INTRODUCTION OF VACCINATION

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Аннотация: *В данной статье представлены результаты исследования назофарингеального носительство Streptococcus pneumoniae у 76 организованных детей до 6 лет и неорганизованных детей в возрвсте от 1,5 года и до 3 лет до вакцинации и 77 неорганизованных вакцинированных детей в возрасте от 1,5 года до 2 лет г. Ташкента. Установлено, что частота назофарингеального носительства пневмококка выше у детей закрытых детских коллективов, где данный показатель колеблется 17,6%, по сравнению с частотой выделения пневмококка у домашних детей, где частота носительства составила 22,4%. У здоровых вакцинированных детей показало, что из 77 детей S. Pneumoniae выделена у 12 детей что состовило - 15,6 %.*

Ключевые слова: *дети, Streptococcus pneumoniae, носительство, вакцинопрофилактика.*

S.PNEUMONIAE NING VAKSINATSIYADAN OLDIN VA KEYIN BOLALARDA NAZOFARINGEAL TASHUVCHANLIGINI ANIQLASH

Annotatsiya: *Ushbu maqolada Toshkent shahridagi 6 yoshgacha bo'lgan 76 nafar tashkil etilgan bolalar hamda 1,5 yoshdan 3 yoshgacha bo'lgan tashkil etilmagan bolalarda vaksinatsiyadan oldingi va 1,5 yoshdan 2 yoshgacha bo'lgan 77 nafar vaksina olgan bolalarda Streptococcus pneumoniae ning nazofaringeal tashuvchanligi o'rganildi. Tadqiqot natijalari shuni ko'rsatdiki, pnevmokokk tashuvchanligi bolalar jamoalariga qatnaydigan bolalarda yuqoriroq bo'lib, ushbu ko'rsatkich 17,6% ni tashkil etdi. Uy sharoitida tarbiyalanayotgan bolalarda esa tashuvchanlik darajasi 22,4% ni tashkil qildi. Sog'lom vaksina qilingan 77 nafar boladan 12 tasida S. pneumoniae aniqlanib, bu 15,6% ni tashkil etdi. Olingan natijalar pnevmokokk infeksiyasiga qarshi vaksina profilaktikasining samaradorligini baholashda muhim аҳамиятга ega.*

Kalit so'zlar: *bolalar, Streptococcus pneumoniae, tashuvchanlik, vaksinoprofilaktika.*

DETECTION OF NASOPHARYNGEAL CARRIAGE OF S. PNEUMONIAE IN CHILDREN BEFORE AND AFTER THE INTRODUCTION OF VACCINATION

Abstract: *This article presents the results of a study on nasopharyngeal carriage of Streptococcus pneumoniae among 76 organized children under 6 years of age and non-organized children aged 1.5 to 3 years before vaccination, as well as 77 vaccinated non-organized children aged 1.5 to 2 years in Tashkent. The study demonstrated that the frequency of nasopharyngeal pneumococcal carriage was higher among children attending closed children's groups, where the carriage rate reached 17.6%, compared with children raised at home, where the carriage frequency was 22.4%. Among healthy vaccinated children, S. pneumoniae was isolated in 12 out of 77 children, accounting for 15.6%. The obtained results confirm the importance of vaccination in reducing pneumococcal carriage and support the effectiveness of pneumococcal vaccine prevention in children.*

Keywords: *children, Streptococcus pneumoniae, carriage, vaccine prevention.*

INTRODUCTION

Pneumococcal infections, despite many years of research, still remain one of the most significant problems in internal medicine and pediatrics. Streptococcus pneumoniae, the causative agent of pneumococcal infections, is responsible not only for otitis media and sinusitis (non-invasive forms), but also for pneumonia, meningitis, and bacteremia (invasive forms).

Pneumococci (Streptococcus pneumoniae) are commonly found as part of the normal microflora of the upper respiratory tract and are widespread worldwide. The level of pneumococcal carriage varies among different age groups. The highest carriage rate is observed in children under 4.5 years of age, reaching up to 90%, whereas among adults the carriage rate ranges from 5% to 10%. According to international and Russian epidemiological data, pneumococcal infection accounts for up to 76% of etiologically confirmed cases of community-acquired pneumonia in adults and up to 94% of complicated cases in children.

The aim of our study was to investigate the carriage of Streptococcus pneumoniae before and after the introduction of pneumococcal vaccination into the national immunization schedule of the Republic of Uzbekistan.

Materials and Methods. To study nasopharyngeal carriage of S. pneumoniae, a bacteriological examination of nasopharyngeal mucus was performed in 76 healthy children. Among them, 42 children were preschool attendees aged 3 to 6 years who had not received vaccination against pneumococcal infection. The remaining 34 children were non-organized children aged 1.5 to 3 years.

Three years after the introduction of pneumococcal vaccination, 77 healthy children were additionally examined. All of them had received three doses of the PCV13 vaccine (Prevenar 13) according to the recommended immunization schedule (Table 1).

Patients who received three doses of the PCV13 vaccine.

Groups of Children	Boys n (%)	Girls n (%)	Total n (%)
Non-organized unvaccinated children aged 1.5–3 years	15 (44.1%)	19 (55.9%)	34 (44.7%)
Organized unvaccinated children aged 3–6 years	18 (42.8%)	24 (57.1%)	42 (55.3%)
Non-organized vaccinated children aged 1.5–2 years	40 (51.9%)	37 (48.1%)	77 (100%)

Information about the patients' age, vaccination status, and antibiotic use during the month prior to sample collection was documented. The exclusion criteria included: the

presence of acute infectious diseases at the time of the study, exacerbation of chronic diseases during the study period, administration of antimicrobial drugs at the time of examination, and parents' refusal to participate in the study.

The bacteriological method is considered the "gold standard" for confirming the etiological role of S. pneumoniae. For the diagnosis of pneumococcal infection, the most commonly used biomaterials for culture examination include spontaneously expectorated sputum, induced sputum, tracheal aspirate, and venous blood. In our study, however, nasopharyngeal swabs were used as the primary material for investigation.

Nasopharyngeal swabs were collected using a sterile transport system (TRANSPORTSWAB snappable plastic stick + viscose head PP plain tube, sterile, Moscow), consisting of a swab applicator and a container with transport medium. Samples from the nasopharyngeal mucosa in children were obtained using a dry sterile velour nasopharyngeal swab attached to a plastic applicator. The swab was gently inserted along the outer wall of the nasal cavity to a depth of approximately 2–3 cm toward the inferior turbinate. After slightly lowering the swab downward, it was advanced into the lower nasal passage beneath the inferior nasal concha, rotated carefully, and then removed along the outer wall of the nose.

The total depth of insertion corresponded to approximately half the distance between the nostril and the external auditory canal, which was about 3–4 cm in children. After sample collection, the swab tip was placed into a sterile disposable tube containing transport medium. The flexible part of the applicator was then broken off at the designated breakpoint, and the tube was tightly sealed to ensure sterile transportation of the specimen.

The study of nasopharyngeal mucus was carried out using Gram staining and bacteriological culture methods. Microscopic examination was initially performed to obtain preliminary diagnostic information. Under microscopy, pneumococci appeared as lancet-shaped organisms or resembled a "flame of a candle." They were arranged predominantly in pairs (diplococci) and possessed a capsule in approximately 80–90% of strains. In liquid nutrient media, pneumococci were observed as chains of medium length within the microscopic field.

The results of the microflora study in 76 children before the introduction of vaccination demonstrated that S. pneumoniae was the leading etiological agent. When comparing children attending organized preschool groups with non-organized children, the frequency of S. pneumoniae carriage was significantly lower among non-organized children (17.6% compared with 22.4%).

The isolation rates of H. influenzae (8.8% and 9.5%), M. catarrhalis (11.7% and 14.3%), and S. aureus (14.7% and 19.0%) were also relatively lower in non-organized children compared with children attending preschool institutions.

The investigation of the microbial spectrum in healthy vaccinated children showed that S. pneumoniae was isolated in 12 out of 77 examined children, accounting for 15.6% of cases.

Among children who did not attend preschool institutions, normal microflora was detected in 77.9% of cases (60/77), which was almost 1.5 times more frequent than in

children attending kindergartens who had not received pneumococcal vaccination, where the rate was 57.8% (44/76).

Opportunistic pathogenic microorganisms were most frequently isolated in children who had not received pneumococcal vaccination.

Pneumococcal vaccination had not been administered in these children, and opportunistic pathogenic microorganisms accounted for 42% (32/76) of the isolated strains. The frequency of mixed microflora growth was significantly lower among non-organized children before vaccination, accounting for 6.5% (5/77), compared with examined children after vaccination, where the rate was 7.6% (10/76).

The prevalence of respiratory pathogens such as H. influenzae, S. pneumoniae, and M. catarrhalis was significantly lower in children who did not attend preschool institutions compared with organized children attending kindergartens.

The conducted study demonstrated a high frequency of nasopharyngeal carriage of opportunistic microflora among children attending preschool institutions, which may be explained by the greater number and density of contacts with peers in organized groups. In our study, the detection rate of respiratory pathogens such as S. pneumoniae, H. influenzae, and M. catarrhalis was considerably higher among children attending preschool institutions than among non-organized children who stayed at home.

S. pneumoniae was isolated from the nasopharynx in 25% of children attending kindergartens, whereas pneumococcal carriage among non-organized children was detected in only 16% of cases. The proportion of H. influenzae and M. catarrhalis was also significantly higher in the spectrum of nasopharyngeal carriage among preschool children compared with non-organized children.

The growth of potentially non-pathogenic normal flora, including staphylococci, viridans streptococci, and other representatives of normal microbiota, was observed in approximately half of non-organized children (52%) and in one-third of children attending kindergartens (29%). At the same time, the frequency of microbial associations involving respiratory pathogens was substantially higher among children from closed organized groups (60%) compared with non-organized children (8%).

The frequency of detection of respiratory pathogens such as S. pneumoniae, H. influenzae, and M. catarrhalis was significantly lower in children who did not attend preschool institutions compared with organized children.

Most studies indicate that the peak of pneumococcal carriage occurs during the first three years of life. Young children represent the main reservoir of this pathogen. Since carriage of S. pneumoniae is considered the primary prerequisite for the spread of pneumococcal diseases, continuous dynamic monitoring of both carriage frequency and circulating serotype distribution is essential.

Conclusion.Thus, the conducted study demonstrated a high frequency of nasopharyngeal carriage of opportunistic microflora among children attending organized preschool institutions compared with non-organized children. This finding may be explained by the greater number and close density of contacts with peers in organized children's groups.

Conclusions

1. The frequency of nasopharyngeal carriage of S. pneumoniae among healthy non-organized children under 5 years of age was 15%, whereas among children attending preschool institutions it reached 24%. In the spectrum of bacterial colonization of the nasopharynx, the proportion of S. pneumoniae accounted for 31% in healthy children and 47% in children with acute respiratory bacterial infections.

2. Vaccination against pneumococcal infection resulted in a reduction of pneumococcal carriage as well as a decrease in the overall incidence of respiratory infections among children.

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