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Susceptibility Pattern of Nasopharyngeal Isolates of Streptococcus Pneumoniae among Nursery School Children in Enugu, Nigeria

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Aims: To determine the rate of nasopharyngeal colonization of Streptococcus pneumoniae among nursery school children in Enugu urban and to determine their antibiotic susceptibility pattern particularly the penicillin resistant strains.

Methods: Specimens were collected from the nasopharynx of 385 apparently healthy children aged between 12 to 36 months with cotton tipped flexible metal applicator. The swabs were immediately inoculated on to blood agar plates. The plates were incubated at 37°C for 24-48 hours under 5% carbon dioxide. Organisms were identified and confirmed as *S. pneumoniae* according to Facklam and Washington technique. Antibigram was carried out with penicillin by the oxacillin disc diffusion method and also to erythromycin chloramphenicol and cephalosporin using Mueller-Hinton agar.

Results: *S. Pneumoniae* was isolated from 64 (16.6%) children; 29% colonization rate observed in 141 malnourished children was significantly greater ($p < 0.05$) than the rate of 9.5% from the 244 children that were well nourished. Nine (14%) of the 64 isolates of *S. Pneumoniae* were resistant to penicillin and 2 of these were also found to be resistant to erythromycin, chloramphenicol and cephalosporin.

Conclusion: A good proportion of apparently healthy children in Enugu are nasopharyngeal carriers of beta-lactam drug resistant strains of *S. Pneumoniae* especially in the malnourished group and mainly in the age group 12-24 months. This observation calls for a careful re-evaluation of the management of infections due to this organism that hitherto was well managed with penicillin and related drugs. There is need for constant monitoring of the antibiotic sensitivity patterns of *S. Pneumoniae* strains from patients in this community.

Key words: Streptococcus Pneumoniae, carriage, drug resistance

INTRODUCTION

Streptococcus pneumoniae is incriminated in a host of infections of the ear nose and throat, and is the commonest bacterial pathogen in lobar and bronchopneumonia.¹ The organism causes septicaemia in a proportion of these infections, being responsible for 30 - 50 percent of episodes of otitis media.² It is responsible for a staggering number of cases of pneumonia and meningitis^{3,4} with the highest incidence among young children and the elderly.^{5,6}

The pneumococcus is carried in the nasopharynx by many healthy persons. A rate of colonization ranging from 25 - 50 percent is found in children living in institutions and sometimes in the first year of life⁷

S. Pneumoniae is highly sensitive to the penicillin but in recent years, strain resistant to B-lactam antibiotics, especially the penicillins have increasingly been noticed in many parts of the world.⁸⁻¹²

Data is however lacking in this part of the world as regards the problem of *S. Pneumoniae* drug resistance. This study aims at determining the rate of nasopharyngeal colonization among preschool (Nursery) children in Enugu urban, the rate of penicillin resistance of *S. Pneumoniae* colonizing these children and the antibiotic susceptibility pattern of these strains.

MATERIALS AND METHODS

After obtaining clearance from Nursery School authorities in Enugu urban, nasopharyngeal swabs were collected from 385 apparently healthy children aged between 12 - 36 months. The study was done between October 1997 and March 1999. Patients' inclusion criteria include; no clinical evidence of respiratory infection, not on antibiotics, and note was taken of malnourished children.

Specimens were collected from the nasopharynx using a cotton tipped flexible metal applicator and inserting the swab into each child's posterior nasopharynx, rotating slowly for a few seconds and inoculating immediately onto a blood agar plate which was then incubated at 37°C for 24 - 48 hours under 5 percent carbon dioxide. Organisms were identified and confirmed as *S. Pneumoniae* according to Facklam and Washington¹³ This involves Gram reaction, optochin test, and bile solubility test. Antibiotic sensitivity including penicillin were performed by the disk diffusion method using Mueller-Hinton agar, containing 5 percent lysed sheep blood. A one microgram oxacillin disk (break point 20mm) was used for comparative purpose.^{14,15}

RESULTS

S. Pneumoniae was isolated from 64 (16.6%) children; 141 children were malnourished and had a colonization rate of 29% that was greater than that of the 244 well nourished children with a rate of 9.5%. Chi squared test ($p < 0.05$) shows that the difference was statistically significant. Nine (14%) of the 64 isolates of *S. Pneumoniae* were resistant to penicillin by the oxacillin disk diffusion method. Two of these isolates were also found to be resistant to Erythromycin, chloramphenicol and cephalosporin.

disk diffusion method and the remaining seven were found to be susceptible to these antibiotics.

DISCUSSION

Most infections caused by *S. Pneumoniae* are treated empirically because of lack of rapid and reliable diagnostic tests. Penicillin and related drugs have been the drugs of choice. But with the emergence of drug resistant strains of *S. Pneumoniae* as shown in the current study, the management of respiratory infections caused by this pathogen is bound to change. Colonization studies of the upper respiratory tract are useful in monitoring the patterns of resistance to antimicrobial agents within communities.¹¹

The overall colonization rate of 16.6% in the present study is less than the rates in Vietnamese children of 56%, but higher than those of Chinese children in Hong Kong (11%) more than half a century ago⁷ and about the same in Pakistan, with 14% in England¹⁶. The high rate may be due to the extreme overcrowding in large family units typical in this part of the world. Also the fact that colonization rate was higher in the poorly nourished than in the well nourished may be explained by the fact that the secretory IgA and other immunological defenses in nasopharyngeal secretions and respiratory system which prevents the adherence of micro-organisms to the upper respiratory tract could be impaired both qualitatively and quantitatively in the malnourished.¹⁷ This study also confirms the early acquisition of nasopharyngeal *S. Pneumoniae*. Protease secreted by *S. Pneumoniae* may contribute to colonization and infections by this organism.¹⁸ The report by Ariansson et al¹⁹ stated that the age of acquisition of *S. Pneumoniae* in infants range from 4 days to 18 months. Of the positive culture children studied, 47 (73%) were aged between 12 to 24 months.

Nine of the 64 isolates were found to be resistant to penicillin. This may not be very surprising considering the fact that antibiotics can be used indiscriminately and without prescription in Nigeria. There is evidence that the incidence of penicillin resistant *S. Pneumoniae* is higher in children who have repeatedly received antibiotics, especially at under dosage levels.^{20,21,22} Bacteria get protection against most antibiotics by acquisition of resistance genes through plasmids, transposons and integrons.²¹ In recent times, fake drugs (under strength antibiotics) have flooded Nigerian markets and its impact on drug resistance is yet to be ascertained.

Hence a poor clinical response to penicillin must now alert clinicians to the possibility of an antibiotic resistant strain. There is need to have constant surveillance and careful evaluation of the antibiotic susceptibility of *S. Pneumoniae* isolates from patients with invasive diseases such as pneumonia and meningitis.

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