

ANTIBIOTIC SUSCEPTIBILITY PATTERN OF STREPTOCOCCUS PNEUMONIAE IN ILORIN, NIGERIA

¹Akanbi II, A. A., ¹Taiwo, S. S., ¹Babatunde, S. K.,
¹Onile, B. A., ²Abdulraheem, I. S.

Departments of ¹Medical Microbiology and ²Epidemiology & Community Health,
University of Ilorin Teaching Hospital, P.M.B. 1459, Ilorin, Nigeria.

Correspondence to: Dr. A. A. Akanbi II

Antimicrobial resistance is an increasing problem, particularly among previously sensitive *Streptococcus pneumoniae*. The emergence of wide spread resistance to antimicrobial agents complicates therapy of infections caused by these organisms. Between January and December 2002, one hundred and fifty-eight isolates of *Streptococcus pneumoniae* at the microbiology laboratory of the University of Ilorin Teaching were studied; in order to determine their antimicrobial susceptibility patterns. All the isolates were recovered from clinical samples and identified by their alpha-haemolytic reaction on sheep blood agar, bile solubility and their sensitivity to optochin. Susceptibility testing was carried out using the stokes-disc diffusion method. Majority of the *Streptococcus pneumoniae* isolates (78.4%) were recovered from the cerebrospinal fluids, 18 (11.3%) from sputum, 14 (9%) from throat swab and 2 (1.3%) from eye swab. Eight three percent of the isolates were resistant to penicillin G and 12.7% were resistant to more than three antibiotics. The isolates were largely sensitive to the third generation cephalosporins and quinolones. The study has shown that penicillins are no longer useful for the treatment of infections caused by *Streptococcus pneumoniae* in this centre. The cephalosporins and quinolones however remained effective and are therefore recommended.

Key words; *Streptococcus pneumoniae*, Susceptibility, Antimicrobial

INTRODUCTION

The genus streptococcus belongs to the non-spore forming aerobic to facultatively anaerobic bacteria. They are Gram positive, occurring in pairs or in chains (1). *Streptococcus pneumoniae* can induce a diverse spectrum of diseases associated with considerable morbidity and mortality. Pneumococci are the leading cause of community- acquired pneumonia and a very frequent cause of otitis media, sinusitis and meningitis (2). In the past, most pneumococcal strains were susceptible to penicillin with minimum inhibitory concentration (MIC) less than 0.06 µg/ml (3), allowing most physicians to treat persons who had severe infection with penicillin alone and without testing for resistance. However resistance to penicillin and other antimicrobial agents has evolved and spread rapidly (4,5,6).

The problem of increasing resistance among previously sensitive bacteria species to common antimicrobial agent has become a worldwide phenomenon (7). Penicillin resistance in *Streptococcus pneumoniae* was first reported in Australia in 1967 (8), in New Guinea in 1969 (9), in South Africa in 1977 (10), and since then in many countries throughout Africa, Asia and Europe (11). Countries like Spain, Hungary and Iceland are notorious for harboring penicillin resistant pneumococci with very high MIC to β-lactam compounds. The link between penicillin resistance in pneumococci and high levels of antibiotic consumption are also very clear in these countries (5,11). Pneumococcal resistance to β-lactam antibiotic occurs due to structural alterations in the penicillin binding proteins (PBPs). Though typically, resistance to

β -lactam antibiotics by most organisms is due to the production of β -lactamase enzyme, which is able to hydrolyze penicillin compounds, resistance in *Streptococcus pneumoniae* to penicillin and other β -lactams is due to the expression of low affinity PBPs and not β -lactamase production. In these resistant isolates, there has been a reduction in the affinity of at least three of the five high molecular weight PBPs found in this organism.

The present study was carried out to determine the antimicrobial susceptibility patterns of *Streptococcus pneumoniae* in this environment, because of its increasing resistance to commonly used antibiotics.

MATERIALS AND METHODS

This study was carried out between January and December 2002 at the University of Ilorin Teaching Hospital. All *Streptococcus pneumoniae* isolates from clinical specimens such as cerebrospinal fluid, sputum and swabs were included in the study. A total of 158 isolates were characterized by standard bacteriological technique (1). First, all streptococci provisionally identified by the alpha haemolysis on blood agar were sub-cultured on to sheep blood agar. A 6-mm size filter paper disc impregnated with 5 μ g optochin was placed on the blood agar and incubated aerobically at 35°C for 18-24 hours. Growth around the disc with zone diameter inhibition greater or equal to 10mm shows that the isolate is susceptible to optochin and presumed to be *Streptococcus pneumoniae*. The viridians streptococci are resistant to optochin and grow to the edge of the optochin disc or gives zone diameter less than 10mm. All the *Streptococcus pneumoniae* isolates also had positive bile solubility test. The 158 confirmed *Streptococcus pneumoniae* isolates

were tested against the following antibiotics using the Stoke's disc diffusion method (12); Ampicillin (10 μ g), penicillin G (1unit), Erythromycin (10 μ g), Ciprofloxacin (5 μ g), Ofloxacin (5 μ g), Ceftriaxone (30 μ g) and Ceftazidime (30 μ g). *Streptococcus pneumoniae* NCTC 10319 and a viridian *Streptococcus* NCTC 10712 served as control organisms.

RESULTS

A total of 158 *Streptococcus pneumoniae* were isolated during the period of study from different clinical specimens. One hundred and twenty four isolates (78.4%) were recovered from the cerebrospinal fluids, 18 (11.3%) from sputum, 14 (9%) from throat swab and 2 (1.3%) from eye swabs (Table 1). All were associated with clinical infections.

The antibiotic susceptibility pattern is as shown in Table 2. A total of 131 (83%) isolates were resistant to penicillin G, 117 (73.8%) to ampicillin and 89 (56.6%) to erythromycin. Seventy (44.3%) of all the isolates were resistant to erythromycin and penicillin and 20 (12.7%) were resistant to more than 3 antibiotic groups i.e. resistant to erythromycin, ampicillin/penicillin, cephalosporins and quinolones. The isolates were largely susceptible to the cephalosporins; 83% to ceftazidime, 82% to cefuroxime, 72% to ceftriaxone and the quinolones; 80% susceptible to ciprofloxacin and 77.2% to ofloxacin.

TABLE 1:

Distribution of *Streptococcus pneumoniae* isolates in the different clinical specimens at UITH Haria.

Specimen type	No of isolates	Percentage
CSF	124	78.4
Sputum	18	11.3
Eye swab	2	1.3
Throat swab	14	9.0
Total	158	100

CSF = Cerebrospinal fluid

TABLE 2:

In vitro antibiotic susceptibility patterns of *Streptococcus pneumoniae* isolates at UITH Haria.

Antibiotics	No sensitive (%)	No resistant (%)
Ceftazidime	131(83)	27(17)
Cefurozime	130(82)	28(18)
Ceftriazone	114(72)	44(28)
Ciprofloxacin	126(80)	32(20)
Ofloxacin	122(77.2)	36(22.8)
Erythromycin	69(43.4)	89(56.6)
Ampicillin	41(26.2)	117(73.8)
Penicillin G	27(17)	131(83)

DISCUSSION

Antimicrobial resistance is an increasing problem particularly in *Streptococcus pneumoniae*. In the past, *Streptococcus pneumoniae* was almost uniformly susceptible to penicillin, allowing most infection to be treated with penicillin thus making the susceptibility testing of pneumococci unnecessary. Bacteria resistance has been reported to almost every antibiotic currently available. Many bacteria now exhibit simultaneous resistance to two or more antibiotics. Pneumococcus resistance may occur alone or in combination with resistance to other antimicrobial agents (11,13).

In this study, the pneumococcal isolates were largely resistance to penicillins. This correlates with the findings of other workers (14,15). No doubt penicillin are the most widely used antibiotics in the developing countries. The greater the quantity of drug used and the longer the drug have been in use, the more likely it is that strains resistant to the antibiotics will develop and spread (13).

Forty four point three percent of the isolates were also resistant to both penicillin and erythromycin, while 12.7% were resistant to more than three antibiotic groups. This shows the gradual increase in the level of resistance of the isolates in agreement with the trend worldwide (11). Contrary to other reports (11, 13, 14) however, the cephalosporin resistance rate in this study was low. This is probably as a result of the fact that these drugs are expensive and less abused in this environment. Previous studies in this centre (16, 17) have shown many pathogens to be relatively sensitive to cephalosporins.

In the first line empiric treatment of infections due to *Streptococcus pneumoniae* in our environment, penicillin will no longer be advocated. We recommend the use of second or third generation cephalosporins or the fluoroquinolones, where indicated, in the empiric treatment of serious infection due to *Streptococcus pneumoniae*. Reducing the impact of drug resistance in *Streptococcus pneumoniae* may be achieved through policy

that serves to reduce indiscriminate-antibiotic use in the community and increase understanding of other factors that contribute

to the development of resistance such as under dosage, which is a common practise in our communities.

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