

**Current Status of Antimicrobial Sensitivity Pattern  
of *Streptococcus pneumoniae* Strains Collected  
from Clinical Sources in Dhaka, Bangladesh**\*Mohammad Shahriar<sup>1</sup>, Manasi Madak<sup>1</sup>, Anika Haque<sup>1</sup>,  
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**ABSTRACT**

A study of antimicrobial sensitivity of *Streptococcus pneumoniae* strains from clinical specimens was carried out to facilitate the preference of antimicrobial drugs in the management of *S. pneumoniae* induced infections. The duration of the study was about 12 months starting from March 2009 to March 2010. The results of the study show that tetracycline and chloramphenicol had a low sensitivity (20% and 22%, respectively) to *S. pneumoniae* while a moderate sensitivity was found for azithromycin (50%), erythromycin (54%), co-trimoxazole (58%), cefuroxime (62%), and cefaclor (62%). However, the highest sensitivity was observed for ceftriaxone (92%) followed by levofloxacin (74%) and ceftazidime (70%). This study reveals the growing antimicrobial resistance in Bangladesh and refers not to use the antimicrobial drugs that show insufficient sensitivity against *S. pneumoniae* to prevent resistance and associated treatment failure.

**Key words:** *Streptococcus pneumoniae*, antimicrobial sensitivity, clinical isolates.

**INTRODUCTION**

*Streptococcus pneumoniae* is one of the leading causes of pneumonia, bacteraemia, meningitis, and upper respiratory tract infections worldwide (Fass, 1993; Gransden et al., 1985; Kraggsbjerg et al., 1994; Block et al., 1995). Childhood pneumonia and meningitis, account for 20 to 40% annual child mortality on the estimated annual global burden of 2.7 million childhood death from pneumonia in developing countries (Mulholland, 1995; Rahman et al., 1990). In the 1940s, penicillin antibiotics became available and were used effectively to treat pneumococcal infections. During the 1960s, however, the first pneumococcal bacteria that were not susceptible ("resistant") to penicillin were discovered in humans (Gransden et al. 1985). Since then, penicillin resistant pneumococcal bacteria have been reported all over the world. Pneumococci that were resistant to other types of antibiotics in addition to penicillins were reported in the late 1970s (Kraggsbjerg et al., 1994). These "multidrug resistant" pneumococci have now been reported all over the world (Block et al., 1995). Infections caused by resistant microbes fail to respond to treatment, resulting in prolonged illness and greater risk of death. Treatment failures also lead to longer periods of infectivity, which increase the numbers of infected people moving in the community and thus expose the general population to the risk of contracting a resistant strain of infection. Much evidence supports the view that the total consumption of antimicrobials is the critical factor in selecting resistance. In this study, the susceptibility of *S. pneumoniae* strains isolated in Dhaka city, Bangladesh was investigated against different antimicrobial agents to provide supportive implications for the proper treatment of *S. pneumoniae* induced infections and related complications.

## MATERIALS AND METHODS

Patients were referred by community practitioners, clinics, and hospitals throughout Dhaka City, Bangladesh. 200 isolates of *S. pneumoniae* from these patients were chosen for this study. The sputa and blood samples were obtained according to Cheesbrough (Cheesbrough, 1984) from different diagnostic centers in Dhaka city, Bangladesh. Specimens were cultured on Blood Agar plates, after which the cultural and morphological characteristics of the isolates were studied. Identification of isolates was done by standard microbiological methods as described by Cheesbrough and Cowan (Cheesbrough, 1984; Cowan, 1993). The antimicrobial sensitivity test of each isolate was carried out by the Kirby-Bauer disc diffusion method (Bauer, 1966) as per recommendation of National Committee for Clinical Laboratory Standards (NCCLS, 1997) in Pharmaceutical Microbiology Laboratory of the University of Asia Pacific, Dhaka, Bangladesh. The duration of the study was about 12 months starting from March 2009 to March 2010. The Kirby-Bauer disc diffusion method allows rapid determination of *in vitro* efficacy of a drug by measuring the diameter of the zone of inhibition which results from diffusion of the agent into the medium surrounding the disc. Mueller-Hinton agar plates were used for the disc diffusion tests. The antibiotics used in this study to evaluate their sensitivity against *S. pneumoniae* were azithromycin, (30µg/disc), erythromycin (15µg/disc), co-trimoxazole, (25µg/disc), cefuroxime, (30µg/disc), cefaclor, (30µg/disc), ceftazidime (30µg/disc), levofloxacin (5µg/disc), ceftriaxone (30µg/disc), tetracycline (30µg/disc), chloramphenicol (30µg/disc).

## RESULTS AND DISCUSSION

In this study, 200 isolates of *S. pneumoniae* were subjected to antimicrobial sensitivity test against azithromycin, erythromycin, co-trimoxazole, cefuroxime, cefaclor, ceftazidime, levofloxacin, ceftriaxone, tetracycline and chloramphenicol and the results were expressed as overall percent (%) sensitivity of *S. pneumoniae* to each antimicrobial drug. Table 1 shows the results of current sensitivity pattern of *S. pneumoniae* to different antimicrobial drugs.

**Table 1: Antimicrobial sensitivity pattern of clinical isolates of *S. pneumoniae*.**

Antimicrobial Drugs	Frequency of sensitive isolates of <i>S. pneumoniae</i> (N=200)	Overall Sensitivity of <i>S. pneumoniae</i>
Erythromycin	108	54%
Azithromycin	100	50%
Ceftazidime	140	70%
Ceftriaxone	184	92%
Cefuroxime	124	62%
Cefaclor	124	62%
Co-trimoxazole	116	58%
Levofloxacin	148	74%
Tetracycline	40	20%
Chloramphenicol	44	22%

With the sensitivity of (92%), ceftriaxone was the most susceptible antimicrobial followed by levofloxacin (74%) and ceftazidime (70%). On the other hand, a low sensitivity to chloramphenicol (22%) & tetracycline (20%) and a moderate sensitivity to azithromycin (50%), erythromycin (54%), co-trimoxazole (58%), cefuroxime (62%), and cefaclor (62%) were observed during the study.

Literature review reveals that most *S. pneumoniae* isolates (83%) were resistant to tetracycline (Chang-Phone Fung et al. 2000) and this figure is close to that found in Hong Kong (78.9%) and far higher than the rate (7.5%) recorded in the USA (Kam et al. 1995; Doern et al. 1996). The resistance rate to erythromycin (74%) was higher than in Japan (56.7%), South Korea (52%) or Hong Kong (39.2%) and considerably higher than in the USA (10%) (Konno et al., 1994; Lee et al., 1995; Kam et al., 1995; Doern et al., 1996). It is worth noting that 78% of *S. pneumoniae* isolates were also resistant to azithromycin, a drug only recently made available in Taiwan.

Clearly macrolides can no longer be used as first-line drugs to treat pneumococcal infections in Taiwan (Doern et al., 1996). Resistance to clindamycin (54%) was as frequent as in Japan (58.1%) (Konno et al., 1994); but data for other Asian countries were not available. The resistance rate to chloramphenicol (23%) was higher than in the USA (4.3%), but lower than in South Korea (65%) and Hong Kong (37%) (Lee et al., 1995; Kam et al., 1995; Doern et al., 1996). However, the most sensitive antimicrobial drug in this study was Ceftriaxone (92%) while the lowest sensitivity was found for tetracycline (20%). A low sensitivity of *S. pneumoniae* to chloramphenicol (22%) and moderate sensitivity to azithromycin (50%), erythromycin (54%), co-trimoxazole (58%) found in this study shows almost similar results studied before (Chang-Phone Fung et al., 2000; Konno et al., 1994; Lee et al., 1995; Kam et al., 1995; Doern et al., 1996). The variation found in the sensitivity pattern to these commonly used antimicrobial drugs in present study could be attributed to the prevailing usage and abuse of the drugs in the area under study. The lower sensitivity to the commonly used drugs indicates the dependence of the prescribers on these drugs in contrast to ceftriaxone and levofloxacin which are less commonly used. This further suggests the relation between antibiotic usage and the level of drug resistance encountered.

## CONCLUSION

The judicious use of antibiotics by the health professional and efforts to control procurement and use of antibiotics officially in the locality will probably help to limit the increasing rate of drug resistance in the pathogens. In Bangladesh, empirical therapy is the rule rather than the exception (Bennish, 1987) and in this context of changing the dynamics of resistance to antibiotics, it is imperative for optimal patient care that constant evaluation of antibiotic sensitivity pattern of pathogens for commonly used antimicrobial agents in a particular environment should be carried out.

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