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Pneumococcal Infection in Children Attending Yangon Children's Hospital

Mo Mo Win[1], Mar Mar Nyein[2], Mi Mi Htwe[2], Than Mya[3], Thin Thin Shwe[3], Aye Maung Han[4] & Khin Htwe[5]

[1]Biological Toxicology Research Division
[2]Bacteriology Research Division
[3]Virology Research Division
Department of Medical Research (Lower Myanmar)
[4]University of Medicine 1 (Yangon)
[5]Department of Child Health, Yangon Children's Hospital

Blood samples were collected from 150 children (73 males and 77 females) with pneumonias (110 cases), septicaemia (22 cases) and meningitis (18 cases) attending Yangon Children's Hospital from July 2006 to April 2007; ages ranging from 2 months to 12 years. Seventy (46.6%) out of 150 samples yielded bacterial pathogens by blood culture method. Among them, *Streptococcus pneumoniae* (Pneumococci) was isolated from 12 cases (17.14%). They were isolated from 7 cases of pneumonia, 3 cases of meningitis and 2 cases of septicaemia. Gentamicin blood agar plate was used for isolation of *Streptococcus pneumoniae* and for identification, colony recognition and optochin sensitivity test were done. Antibiotic susceptibility test was done by Kirby-Bauer disc agar diffusion method. They were resistant to penicillin (41.6%), gentamicin (41.6%), cotrimoxazole (33.3%), ciprofloxacin, ampicillin and ceftriaxone (16.6%, each) and amikacin (8.3%). The other pathogens isolated were *Haemophilus influenzae* (22 isolates), *Pseudomonas aeruginosa* (12 isolates), *Staphylococcus aureus* (12 isolates), *E. coli* (6 isolates), *Klebsiella pneumoniae* (4 isolates), and *Neisseria meningitidis* (2 isolates). This study highlighted the prevalence of *Streptococcus pneumoniae* and other bacteria pathogens concerning major childhood illnesses.

INTRODUCTION

The pneumococci (*Streptococcus pneumoniae*) are gram-positive diplococci, often lancet-shaped or arranged in chains. They are normal inhabitants of the oral flora and colonize the nasopharynx, particularly in young children from birth and the level of colonization gradually declines with age.[1] Although their isolation from the nasopharynx of the children with respiratory illness does not necessarily represent pneumococcal disease, nasopharyngeal colonization is often the first step in the development of pneumococcal co-infection or secondary bacteria infection may result from organisms that had colonized the nasopharynx. Invasive diseases with meningitis and bacteraemia remain "tip of the ice berg" presentation for pneumococcal disease but *Strept pneumoniae* is infrequently cultured from CSF and blood especially when antibiotics have been given.[2] An important factor is that pneumococcal diseases will not occur without preceding nasopharyngeal colonization with the homologous strains.

Strept pneumoniae is a common cause of invasive diseases and respiratory tract infections in more and less developed countries. Risk groups for diseases caused by pneumococci, such as meningitis, sepsis and pneumonia include young children, elderly people and patients with immunodeficiences.

Each year, one million children younger than five-year old died from pneumonia and invasive diseases. Community acquired pneumococcal meningitis also has a very high case fatality rate (20% and 50% in more and less developed countries, respectively). Depending on age, 30-60% of survivors developed long-term sequelae including hearing loss, neurological deficits and neuropsychological impairments.[1]

Moreover, a high incidence of penicillin-resistant and multidrug-resistant strains of *Strept pneumoniae* among clinical isolates has subsequently been reported. Since the first penicillin-resistant *Strept pneumoniae* was reported in Australia in 1967, the frequency has been increasing around the world. The prevalence of resistance makes choosing an antibiotic for invasive pneumococcal infection difficult.[3, 4]

The present study was undertaken to assess the baseline prevalence of pneumococcal infection in Yangon Children's Hospital.

MATERIALS AND METHODS

Collection of specimens

A total of 150 blood samples were taken from children (age: from 2 months to 12 years, male: 73, female: 77) suffering from pneumonia (110 cases), septicaemia (22 cases) and meningitis (18 cases) admitted to Yangon Children's Hospital from July 2006 to April 2007. After taking informed consent, history taking and physical examination, 2 ml of blood were collected into blood culture bottle containing Tryptic Soy Broth and then transported to laboratory.

Isolation and identification

All isolates were recognized by their colonial morphology and alpha haemolysis displayed on gentamicin blood agar plates after incubation at 37ºC (with 5% CO_2) for 24-48 hours. The isolates were further identified by their gram stain characteristics and sensitivity to optochin (5 µg) and then those isolates were serotyped by the capsular swelling method using comercially available antisera (Statens Serum Institute, Copenhagen, Denmark).

Antibiotics susceptibility testing

It was done by Kirby-Bauer disc agar diffusion method. The following antibiotics and concentrations (in bracket) were used: penicillin G (10 unit), ampicillin (10 µg), cotrimoxazole (1.25, 23.75 µg), ceftriaxone (30 µg), gentamicin (10 µg), ciprofloxacin (5 µg) and amikacin (30 µg).

Ethical consideration

This study was approved by Institutional Ethical Review Committee, Department of Medical Research (Lower Myanmar) on 15 March, 2006.

RESULTS

Distribution of Strept pneumoniae in children

Out of 150 blood samples cultured, 70 cases yielded different pathogens. Among them, 12(17.14%) were identified as *Streptococcus pneumoniae* (Fig. 1 a & b).

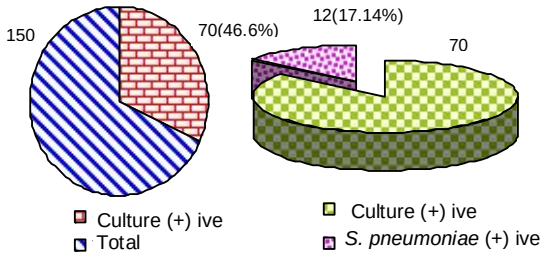


Fig. 1 a & b. Distribution of *S. pneumoniae* in children

Isolation of Strept pneumoniae from invasive infections

Strept pneumoniae were isolated from 7 cases of pneumonia, 3 cases of meningitis and 2 cases of septicaemia (Fig. 2).

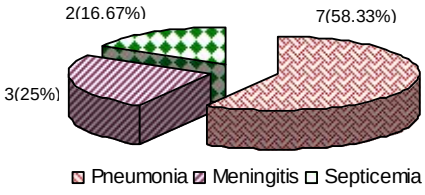


Fig. 2. Isolation of *S. pneumoniae* in invasive pneumococcal infections

Age distribution of children with Strept pneumoniae infections

Five pneumococcal isolates were found in age group 0-1 year, 5 isolates in 1-2 years age group, 1 isolate each in 3-4 years and 7-8 years age groups (Fig. 3).

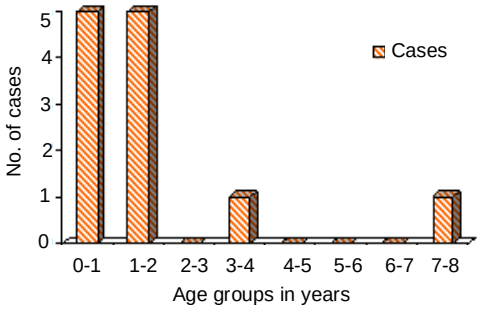


Fig. 3. Age distribution of children with *Strept pneumoniae* infections

Outcome of children with pneumococcal infection

Regarding outcome of 12 cases with pneumococcal infections, all the pneumonia cases (7 cases) and septicaemia (2 cases) had no sequelae and they had complete recovery. In the three meningitis cases, one patient had neurological deficit and one patient died (Table 1).

Table 1. Outcome of children with pneumococcal infections

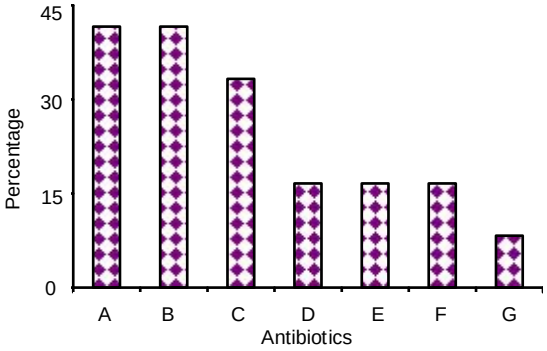
Outcome	Pneumonia	Septicaemia	Meningitis	Total
No sequelae	7	2	1	10
Sequelae	0	0	1	1
Death	0	0	1	1

Antibiotics resistance pattern of Strept pneumoniae isolated

They were resistant to penicillin (41.6%), gentamicin (41.6%), cotrimoxazole (33.3%), ciprofloxacin, ampicillin and ceftriaxone (16.6%, each) and amikacin (8.3%) (Fig. 4).

Seasonal variation of pneumococcal infection

Pneumococcal infections were more common in winter (1 case in July, 9 cases from October to January and 2 cases in March were isolated) (Fig. 5).



A =Penicillin D=Ciprofloxacin G=Amikacin
B =Gentamicin E =Ampicillin
C =Cotrimoxazole F =Ceftriaxone

Fig. 4. Antibiotic resistance pattern of *Strept pneumoniae* isolated

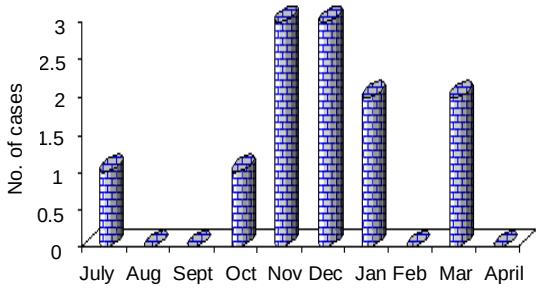


Fig . 5. Seasonal variation of pneumococcal infections

The other pathogens isolated were *Haemophilus influenzae* 22 isolates, *Pseudomonas aeruginosa* 12 isolates, *Staphylococcus aureus* 12 isolates, *Escherichia coli* 6 isolates, *Klebsiella pneumoniae* 4 isolates and *Neisseria meningitidis* 2 isolates.

DISCUSSION

Pneumococcal infections are the most common cause of invasive bacteria infection in children and major invasive pneumococcal infections are meningitis, septicaemia, pneumonia, otitis media and septic arthritis. Pneumococcal colonization is also an important factor. It may colonize the respiratory tract and spread via aerosolization. Viral respiratory tract infection, malnutrition and local damage to the mucosa may also predispose to pneunococcal infection. In the United States, pneumococcal infection was estimated to cause

200 deaths, 700 cases of meningitis, 1,700 cases of bacteremia annually in children under 5 years of age.[5] According to reports from Invasive Bacteria Infection Surveillance group (1999), case fatality rate of meningitis was 34%, pneumonia 19% and septicaemia 21%.[6]

This study was aimed to evaluate invasive pneumococcal infection causing major childhood illnesses from July 2006 to April 2007. One hundred and fifty blood samples were obtained from children with pneumonia, septicaemia and meningitis. *Strept pneumoniae* was isolated from 12 cases out of 70 culture positive cases. It was mainly isolated from children with pneumonia.

In a study regarding age distribution, the incidence of pneumococcal infection is high in neonates, infants and toddlers, low in adolescents, young adults and then increases again in the elderly.[2] In our study, the majority of cases were found in under 2 years of age group and there was not much sex differences.

The study of the outcome of patients with pneumococcal infection revealed that all pneumonia and septicaemia cases had no sequelae and they recovered completely, whereas one patient with meningitis undergone neurological sequelae and one patient died.

Meningitis is the most severe type of pneumococcal infection. About 5% of children under 5 years of age who contract pneomococcal meningitis will die of the infection and others can have long-term problem such as hearing loss. Many children with pneumococcal pneumonia or bacteraemia will need to be hospitalized.[2]

Antibiotic resistance pattern of pneumococcal isolates from this study revealed 41.6% each resistant to penicillin and gentamicin, 33.3% to cotrimoxazole, 16.6% each to ciprofloxacin, ampicillin, ceftriaxone and 8.3% to amikacin. In a report from Taiwan, 82% and 87% of 200 pneumococci were resistant to penicillin and cotrimoxazole, respectively.[6, 7]

Similarly, one study in Memphis reported that pneumococci shown to be resistant to penicillin, also exhibited resistance to cotrimoxazole (95%).[8] Moreover, there were several reports on penicillin-resistant *Strept pneumoniae* in Asia. For example, 69.1% in Hong Kong (1999), 59.3% in Japan (1995) and 68.7% in Korea (1995).[5, 9, 10]

In Taiwan, the first two cases of penicillin-resistant pneumococcal meningitis and extremely high prevalence (71%) of nasopharyngeal carriage of penicillin-resistant *Strept pneumoniae* among children and a high incidence of multidrug-resistant strains among clinical isolates have been reported.[6]

The study from Thailand in 2003 revealed that 43% of pneumococci were fully resistant to penicillin G.[11] The emergence of penicillin and other antibiotics resistance might be due to the ease of obtaining the drugs from many drug stores, the indiscriminate use of antibiotics and prescribing antibiotics in viral infections, thus, resulted in uncontrolled usage of medication.

In this study, most of the pneumococcal infections were found in winter months which may be due to predisposing viral respiratory tract infection.

Conclusion

Streptococcus pneumoniae is a notorious bacteria pathogen for infant, children and elderly. Even in the developed countries, despite the availability of excellent antimicrobial therapy and adequate health care systems, respiratory diseases and invasive infections caused by pneumococci still comprise a major health problem. Worldwide emerging resistance to penicillin and other commonly used antibiotics underscores the importance of the development of novel vaccine strategies to combat pneumococcal diseases.

This study emphasized the need for continuous surveillance of *Streptococcus pneumoniae* infection as well as its colonization and changing trends of antibiotic susceptibility.

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