Nasopharyngeal bacterial carriage and antimicrobial resistance in underfive children with community acquired pneumonia

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Abstract

Pathogens in nasopharynx is a significant risk factor for pneumonia. According to WHO, isolates to be tested for antimicrobial resistance in the community should be obtained from nasopharyngeal (NP) swabs. The aim of this study is to know the bacterial patterns of the nasoparynx and cotrimoxazole resistance in under five-year old children with community acquired pneumonia. The study was carried out in 4 primary health clinic (Puskesmas) in Majalaya sub-district, Bandung, West Java, Indonesia. All underfive children with cough and/or difficult breathing and classified as having non-severe pneumonia (WHO guidelines) were included in the study. Nasopharyngeal swabs (CDC/WHO manual) were collected by the field doctor. The swabs were placed in Amies transport medium and stored in a sterile jar, before taken to the laboratory for further examination, in the same day. During this nine month study, 698 children with clinical signs of non-severe pneumonia were enrolled. About 25.4% (177/698) of the nasopharyngeal specimens yielded bacterial isolates; i.e. 120 (67.8%) were positive for S pneumoniae, 21 for S epidermidis and alpha streptococcus, 6 for Hafnia alvei, 5 for S aureus, 2 for B catarrhalis, and 1(0.6%) for H influenzae and Klebsiella, respectively. The antimicrobial resistance test to cotrimoxazole showed that 48.2% of S pneumoniae strain had full resistance and 32.7% showed intermediate resistance to cotrimoxazole. This result is almost similar to the other studies from Asian countries. It seems that H influenzae is not a problem in the study area, however, a further study is needed. ***(Med J Indones 2002; 11: 164-8)***

Abstrak

Adanya kuman patogen di daerah nasofaring merupakan faktor risiko untuk pnemonia. Menurut badan kesehatan sedunia (WHO), di komunitas, untuk melakukan uji resistensi terhadap berbagai antimikroba, sebaiknya spesimen diambil dengan apus nasofaring. Tujuan penelitian ini adalah untuk mengetahui pola bakteri yang ada di nasofaring balita penderita pnemonia dan resistensi kuman terhadap kotrimoksasol. Penelitian ini dilaksanakan di 4 Puskesmas di Kecamatan Majalaya, Kabupaten Bandung, Jawa Barat, Indonesia. Semua anak dengan batuk dan /atau kesulitan bernafas dan diklasifikasikan sebagai pnemonia tidak berat menurut pedoman WHO, diikut sertakan pada penelitian. Apus nasofaring (sesuai pedoman CDC/WHO manual) dilakukan oleh dokter yang terlatih dan spesimen ditempatkan ke dalam media Amies transport, dan disimpan dalam termos, sebelum kemudian dibawa ke laboratorium untuk pemeriksaan selanjutnya, pada hari yang sama. Selama 9 bulan terdapat 698 anak dengan gejala klinis pnemonia tidak berat, yang diikut sertakan dalam penelitian. Sebanyak 25,4% (177/698) spesimen menunjukkan hasil isolat positif, 120 (67,8%) positif untuk S pneumoniae, masing-masing 21 untuk S epidermidis dan alpha streptococcus, 6 untuk Hafnia alvei, 5 untuk S aureus, 2 (1,13%) untuk B catarrhalis dan masing-masing 1 (0,6%) untuk H influenzae dan Klebsiella. Hasil uji resistensi S pneumonia terhadap kotrimoksasol menunjukkan 48,2% resisten penuh dan 32,7% resisten intermediate. Hasil ini hampir sama dengan penelitian lain di Asia. Tampaknya H influenzae tidak merupakan masalah, akan tetapi penelitian lebih lanjut perlu dilakukan. ***(Med J Indones 2002; 11: 164-8)***

Keywords: *nasopharyngeal swab, S pneumoniae, cotrimoxazole*

Pneumonia can be caused by a variety of agents, and each requires a different treatment approach. The majority of lower respiratory infections during infancy and childhood are of viral etiology. It was estimated that bacteria caused only 10% - 30% of all cases of acute pneumonia.[1] Rarely the cause of pneumonia in children can be identified, therefore, antibiotic therapy must be empirical, using a drug that will be effective against the most common causes of the illness.[2]

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A study using lung aspiration technique suggested that S pneumoniae and H influenzae were the most frequent cause of bacterial pneumonia in all age groups.[3] According to Shann et al. S pneumoniae and H influenzae caused the most fatal pneumonia in children.[4] The best way to obtain specimen to know the etiology of pneumonia is using lung puncture. Lung puncture yields the highest rate of positive cultures. However, this procedure is an invasive method that exposes the child to serious risks. In addition, there have been strong ethical objections to use it in clinical research, especially for a study in the community. According to WHO, isolates to be tested for antimicrobial resistance in the community should be obtained from nasopharyngeal (NP) swabs. Previous studies support the use of NP isolates to determine antimicrobial resistance patterns of isolates from children with pneumonia.[3]

Several antibiotics are effective in treating S pneumoniae and H influenzae infections, including penicillin, ampicillin, amoxycillin, cotrimoxazole and chloramphenicol. However, several studies reported that some strains had developed resistance to one or more of these antimicrobial agents.[2]

The aim of this study is to know the nasopharyngeal bacterial pattern and the cotrimoxazole resistance in children with community-acquired pneumonia.

METHODS

This study is a part of a study on the management of pneumonia in infants and children in the community, in Bandung, West Java, Indonesia, from September 1999 to June 2000. The approval to conduct the study was obtained from the Research Unit Committee. The study took place in Majalaya. Majalaya is a periurban sub-district, about 30 kilometers south from the city of Bandung, and composed of 6 villages. Each village has one health center (Puskesmas). Four health centers were selected for the study, i.e. Majalaya Baru, Cikaro, Solokan Jeruk, and Padamukti.

Subjects

All children with cough and or difficult breathing who came to the health centers were examined by a physician from this study group. All underfive children with pneumonia according to the WHO classification, were selected for the study, if their parents agreed to their participation. Further, a written informed consent was obtained and the child was enrolled in the study.

Procedures

The field doctor collected a nasopharyngeal swab from each subject in the Puskesmas. Calsium alginate swabs on flexible aluminium wire shafts were used for this purpose. All children received cotrimoxazole for 5 days.

Nasopharyngeal swab

With the child's head tipped backwards and immobilized, a sterile swab was inserted into a nostril and passed to the nasopharynx. To make sure that the swab had reached the nasopharynx, the shaft should have passed half of the distance between the nose and the ear. The swab was directly placed in a screw capped tube containing Amies transport medium. The entire fiber portion of the swab should be covered by the medium. Thereafter, all the tubes were put into an anaerobic jar, and kept in room temperature before they were transported to the laboratory in the Medical Research Unit, in Bandung, in the same day, for further examination.

Culture and sensitivity test

In the laboratory, the specimens were inoculated on media plates. Sheep blood agar, and chocolate agar (CA) containing bacitracin was used to isolate S pneumoniae and H influenzae, respectively. Plates were placed in a candle jar, and incubated in an incubator at 37^0 C for 48 hours. S pneumoniae was identified by colony characteristics on blood agar plates, Gram staining, and optochin disc susceptibility. Thereafter S pneumoniae was tested for its sensitivity to cotrimozaxole on Muller-Hinten agar containing 5% sheep blood. H influenzae was identified by colony characteristics on chocolate agar plates containing bacitracin, Gram staining, and X-V factor test.

RESULTS

Characteristics of respondents

During this 9-month study, there were 698 cases of non-severe pneumonia, consisting of 350 boys and 348 girls, with age between 2 to 59 months. Around 40% of the subjects were infant aged 2 to 11 months, and more than three quarters were less than 3 years old (Table 1).

Table 1. Characteristics of respondents

Characteristics	N	%
1. Sex		
Boy	350	50.1
Girls	348	49.9
2. Age (months)		
2 – 11	284	40.7
12 – 23	256	36.7
24 – 35	105	15.0
36 – 47	38	5.4
48 – 59	15	2.1

Culture

Table 2 shows the naso-pharyngeal swab (NPS) culture results. More than 25% (177/698) of the nasopharyngeal specimens yielded bacterial isolates. From those isolates, 120 were positive for S pneumoniae. Furthermore, each of S epidermidis and alpha streptoccoccus was found on 21 isolates respectivelly.

Table 2. Naso-pharyngeal swab (NPS) culture result

Bacteria	N	%
Streptococcus pneumoniae	120	67.80
Staphylococcus epidermidis	21	11.86
Alpha streptococcus	21	11.86
Hafnia alvei	6	3.39
Staphylococcus aureus	5	2.82
Brahmanella catarrahalis	2	1.13
Haemophylus influenzae	1	0.56
Klebsiella pneumoniae	1	0.56

Cotrimoxazole resistance

Around 48% of S pneumoniae isolates showed resistance to cotrimoxazole, 32.7% showed intermediate resistance, and only 19.1% were sensitive (Table 3).

Table 3. Cotrimoxazole resistant streptococcus pneumoniae

Resistant to cotrimoxazole	N	%
Resistant	53	48.2
Intermediate resistant	36	32.7
Sensitive	21	19.1
Total	120	100

DISCUSSION

Many factors have to be taken into account to provide optimal management for children with pneumonia, because the etiology is difficult to determine. The majority of lower respiratory infections in children are of viral etiology; and it was estimated that bacteria was the cause of 10 to 30% of all cases of pneumonia.[4] A clinician should make several decisions to provide optimal management for children with pneumonia. Usually initial therapy is based on the frequency of pathogens in various age groups, local antibiotic resistance patterns of the organisms, clinical presentation, and epidemiological data.[3] If pneumonia is diagnosed, it must be determined whether the child will benefit from antimicrobial therapy and which drug is the most appropriate. Several studies showed that S pneumoniae and H influenzae were the most common bacteria that caused pneumonia in children after newborn period.[3,5,6] Together they accounted for approximately 80% of the isolates.[7] In 1988, the Center for Disease Control (CDC) Atlanta and WHO developed a manual on the national surveillance of antimicrobial resistance of S pneumoniae and H influenzae. The manual was field tested in Egypt, Pakistan, Thailand and Vietnam.[8] The total positive isolates were 74.0%, 73.5%, 55.0%, and 54.0%, respectively. Our study found a lower result than those studies, i.e. only 16.6% of the bacterial isolates were positive (Table 4). Furthermore, they found H influenzae in 14.0%, 9.1%, 21%, and 19.6% of the isolates respectively, while our study found only one H influenzae (0.56%). A population-based survey of

Table 4. Result of nasopharyngeal cultures (percentage of positive results)

	Egypt	Pakistan	Thailand	Vietnam
	n = 1093	n = 601	n = 1783	n = 403
Strepto. Pneumoniae	19.0	36.9	17.0	29.5
Haemoph. Influenzae	14.0	9.1	21.0	19.6
Both Bacteria	41.0	27.5	18.0	4.5
Total	74.0	73.5	55.0	54.0

Data from WHO, 1995[8]
n = number of children

H influenzae type B, in healthy children aged 0 - < 25 months, conducted in Lombok Island, Indonesia, found that 32% (155/484 samples) of NP isolates yielded organisms that were presumptively H influenzae.[9] The big difference results need further study, due to many factors influencing the prevalence of bacterial carriage in the throat.

Several antibiotics such as penicillin, ampicillin, amoxycillin, cotrimoxazole and chloramphenicol are generally effective in treating S pneumoniae and H influenzae infections. It is important to know the resistance rate of microorganisms to antibiotics for the decision which antibiotics will be used for children with pneumonia. The World Health Organization – Acute Respiratory Infections (WHO ARI) program recommends cotrimoxazole for the management of non-severe pneumonia,[10] and it is also recommended in Indonesia.

Two community studies conducted in Pakistan showed that in vivo efficacy of cotrimoxazole was 92% and 91% in children with non-severe pneumonia. Another study revealed that 78.3% - 79.9% of S pneumonia isolates showed in vitro resistance to cotrimoxazole.[11] Nevertheless, cotrimoxazole is still recommended in Pakistan. Our study showed a lower percentage of resistancy to cotrimoxazole compared to Egypt and Pakistan (urban), but higher than Thailand and rural area in Pakistan. It is almost similar with the results from Vietnam (Table 5). Although many studies revealed high percentage of resistancy of S pneumoniae to cotrimoxazole, in vivo response was still good.

Table 5. Cotrimoxazole resistant streptococcus pneumoniae isolated from nasopharyngeal cultures

Country	Laboratory	Number of positive cultures	Resistance (%)
Egypt*	CDC, Atlanta	304	80.2
Pakistan*	CDC, Atlanta		
Urban		276	77.5
Rural		132	40.2
Thailand*	Bangkok	543	25.4
Vietnam*	Hanoi	114	52.6
Indonesia**	Bandung	120	48.2

* Data from WHO, 1995[8]
** Our study

CONCLUSIONS

This study showed that the percentage of nasopharyngeal specimens that yielded positive bacterial isolates was low compared to other studies. The percentage of cotrimoxazole resistant S pneumoniae was lower compared to the result in Egypt, and Pakistan, similar with that in Vietnam, but higher than in Thailand. It seems that H influenzae is not an important cause of pneumonia in those areas. Nevertheless, further study is needed to know the role of the bacteria as the cause of community acquired pneumonia.

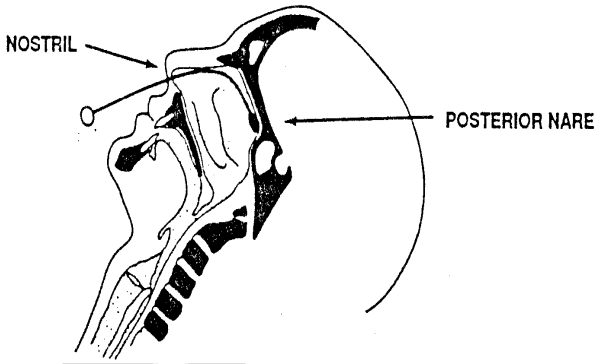

Figure 1. Method of obtaining nasopharyngeal secretions for culture

Figure 2. Method of immobilizing child while nasopharyngeal swab is taken

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