April 2006

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Original Article

Incidence of acute respiratory infections in children 2 months to 5 years of age in periurban communities in Karachi, Pakistan

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Abstract

Objective: To measure the incidence of acute respiratory infections and burden of respiratory pathogens in children aged two months to five years.

Methods: Four periurban communities in Karachi were selected for the study. The children, identified with fever and cough during community surveillance at regular intervals, were referred to especially established study clinics. These children were diagnosed to have "no pneumonia", "pneumonia" and "severe pneumonia" as per IMCI guidelines. To identify the causative organisms, children with pneumonia and severe pneumonia were investigated with oropharyngeal swabs and blood culture.

Results: Acute respiratory infection was seen in 5884 children during 1st February 2002 to 31st January 2003. Of these, 1097 children had pneumonia and severe pneumonia, with an incidence 440.3/1000 children per year for Acute Respiratory Infections and 82.1/1000 children per year for pneumonias. Haemophilus influenzae, Streptococcus pneumoniae and Klebsiella pneumoniae were isolated from 10.9%, 3.7% and 8.5% of oropharyngeal swabs respectively. Extrapolating from the results of this study, the total number of cases of pneumonias in children aged less than five years in Pakistan is estimated to be 213,116 per year due to H. influenzae, and 71,864 per year due to S. pneumoniae.

Conclusion: Incidence of acute respiratory infections in children varies in different communities and is a common cause of morbidity (JPMA 56:163;2006).

Introduction

Pneumonia is a common cause of morbidity and mortality in children. It is estimated that 1.9 million children die each year due to acute respiratory infections (ARIs), mainly due to pneumonia.[1] Annual numbers of pneumonia cases in developing countries were estimated as 174 million[2] with a global standardized pneumonia incidence as 0.3 episodes per child per year. Besides such a high mortality, respiratory infections are responsible for highest morbidity. According to WHO report[3], about 3.9 million deaths and loss of 94.6 million disability adjusted life years (DALYs) occur due to respiratory infections alone throughout the world. The incidence of ARIs and pneumonia varies from country to country and within the country. The incidence of ARI varies from 1.1 episodes per child per year reported from Malawi[4] to 2.6 episodes and 6.42 episodes per child per year reported from India.[5,6] Seventy to ninety percent of these episodes were mild with cough and cold only and no pneumonia. The incidence is also higher in children of younger age and in those suffering from malnutrition. In a study from India, the incidence varied from 2.26 episodes per child per year in mildly malnourished children to 3.27 episodes per child per year in moderate to severely malnourished children.[7]

Data about incidence of ARIs in Pakistan are limited. It has been reported that about one third of the hospital beds in Pakistan are occupied by children with pneumonia and acute respiratory infections. The incidence of lower respiratory infections (LRTI) in some earlier studies has been reported as ranging from 0.2 - 4 episodes per child per year.[8-10] Similarly a study from Aga Khan University showed population based ARI proportionate mortality of 9-11%.[11] Acute respiratory infections also account for the major workload in the outpatient of the hospitals as well as in the clinics of private practitioners. Nizami et al.[12] looking at the prescribing behavior of the practicing physicians in Karachi found 40% of visits of children in less than five years of age to the general practitioners and pediatricians due to cough and cold.

The important bacteria responsible for pneumonia in children include Haemophilus influenzae (Hib), Streptococcus pneumoniae and Klebsiella pneumoniae. Peltola H. in his review of the Hib and pneumococcal disease in Africa[13] and Asia[14] showed that in Africa, pneumococci were the leading causative agents of non-epidemic meningitis and other bacteraemic diseases, followed by Hib. Mortality rates associated with pneumococcal and Hib diseases were 549 (45%) of 1211 patients and 389 (29%) of 1352 patients and sequelae occurred in 50% and 40% of cases respectively. At 0-4 years of age, the estimated incidences of Hib meningitis and all classic Hib diseases were 70 and 100 cases per 100,000 population per year, accounting for approximately 90,000 and 120,000 cases per year, respectively. Though the data from Pakistan is lacking but in reviewing the burden of Hib in Pakistan, Bhutta et al.[15] estimated 85000 childhood deaths and handicaps in infancy occurring due to Hib and pneumococcal diseases. Since the introduction of conjugate Hib and pneumococcal vaccines in routine immunization of infants and children, the incidence and mortality of invasive Hib and pneumococcal diseases has been significantly reduced in the developed world. However, situation in developing countries is different where either due to non-availability or high cost, these vaccines are still not included into public health system, resulting in continuation of high morbidity and mortality due to pneumonia. In order to introduce a vaccine in public health system particularly in developing countries where finances are a big issue, it is also important to know the burden of diseases and causative organism in a given community or country. Since the data about incidence of ARIs especially pneumonia in children and burden of respiratory pathogens in communities in Pakistan is scanty, we did a community study to look at the incidence of ARIs and burden of Hib and pneumococcal disease in communities from Karachi, Pakistan.

The objectives of the study were to measure the incidence of acute respiratory infections in peri-urban communities in Karachi, Pakistan and the burden of common bacterial respiratory pathogens in peri-urban communities in Karachi, Pakistan

Methods

Four peri-urban sites i.e. Sultanabad, Hijrat Colony, Sher Pao Colony and Rehri Goth were selected for the study. A house to house census was conducted in all four communities before starting the study. One study clinic was established in each area, manned by a medical officer, who was trained in management of ARI as per IMCI guidelines. Children two months to five years of age with fever and cough were encouraged to visit these clinics for diagnosis and treatment. In addition community workers were hired to visit each household in the communities every two weeks to detect and refer the patients to the study clinic if they had fever and cough.

Children reporting at these study clinics were registered for the study. A detailed history was taken and the examination was done by research medical officers. These children were classified into "No pneumonia", "Pneumonia" and "Severe pneumonia" according IMCI guidelines. Children with pneumonia and severe pneumonia were investigated after obtaining informed consent from their parents / guardian. Blood was drawn for complete blood count and blood culture. Nasopharyngeal swabs were planned to be taken to identify the causative organisms. Due to non-availability of nasopharyngeal swabs, throat (oro-pharyngeal) swabs were obtained for culture and sensitivity. Efforts were made to get as much material from posterior pharyngeal walls as possible. These samples were transported to the Aga Khan University laboratory for analysis. Though the oropharyngeal swabs are processed to detect ß-hemolytic streptococci only but these swabs were specially processed to identify other respiratory pathogens as follows.

Oropharyngeal swabs were set up on sheep blood and MacConkey agar at 37°C atmospheric and chocolate agar at 37°C, 5%CO2. The organisms were identified using methodologies; beta haemolysis and serotyping for BHS group A, optochin sensitivity and bile solubility for S. pneumoniae, production of coagulase, deoxyribo-nuclease, phosphatase and acid from mannitol for S. aureus, X,V factor requirements for Haemophilus influenzae and parainfluenzae and API 20E for oxidase negative gram negative rods. Sensitivities were tested in accordance wit NCCLS guidelines.

Results

A census of all the four study sites was conducted

Table 1. Incidence of acute respiratory infections /1000 children /year in two age groups in the four communities studied.

Study sites	Sher Pao			Sultanabad			Rehri Goth			Hijrat Colony			Total
Ages in months	2-12	13-60	2-60	2-12	13-60	2-60	2-12	13-60	2-60	2-12	13-60	2-60	2-60
Ages in months	2-12	13-60	2-60	2-12	13-60	2-60	2-12	13-60	2-60	2-12	13-60	2-60	2 -60
Number of children in community as per census	607	2113	2720	1086	3276	4362	323	1120	1443	1066	3773	4839	13364
No pneumonia	672.2	373.9	440.4	291.9	247.6	258.6	1411.8	600	781.7	323.6	261.9	275.5	358.2
Pneumonia	65.9	56.3	58.5	79.2	104.1	97.9	312.7	83.9	135.1	58.2	30.7	36.8	71.8
Severe pneumonia	39.5	7.6	14.7	4.6	6.1	5.7	71.2	22.2	33.3	8.4	4.0	5.0	10.3
Total	777.6	437.8	513.6	375.7	357.7	362.2	1795.7	707.1	950.8	390.2	296.6	317.2	440.3

and 13364 children aged two months to five years were enumerated. During the study period i.e., 1st February 2002 to 31st January 2003, 5884 children with ARI were registered at the study clinics giving an incidence of 440.3/1000 children per year (Table 1 and 2). It varied from site to site with lowest incidence in Hijrat Colony (317.2/1000 children per year) to highest from Rehri Goth (950.8/1000 children per year). The children less than 12 months of age presenting with ARI were 32%. Pneumonia or severe pneumonia was diagnosed only in 18.6% of children.

The incidence of ARI and pneumonia was significantly higher in children aged two months to twelve months than in older children (Table 1). It was significantly less during summer than in winter months (Figure). The dispersion of cases of ARI in the community is shown in figure 2, plotted on GIS map of the areas under study.

Table 2. Burden of organisms causing pneumonias as per results of oropharyngeal swab culture with and without adjusting of refusal for test per 1000 children 2-60 months of age per year in four study areas.

Organisms isolated	Number (%)	Number / 1000 children/yr (unadjusted)	Number / 1000 children / yr (adjusted)	Total # of cases/year (Estimated for Pakistan)
Haemophilus influenzae	86 (10.9%)	6.4	8.9	213,116
Haemophilus parainfluenzae	52 (6.6%)	3.9	5.4	128,860
Strep. pneumoniae	29 (3.7%)	2.2	3.0	71,864
Klebsiella pneumoniae	67 (8.5%)	5.0	6.9	166,032
Miscellaneous	13 (1.6%)	1.0	1. 3	32,215
Total positive cultures	**247 (31.2%)**			
Negative	**544 (68.8%)**			
Total	791			

Total cases of pneumonias 1097; Childhood population 13364
# of children < 5 years in Pakistan 23,879,450

Table. 3. Sensitivities of organisms isolated from oropharyngeal swab against commonly used antibiotic

Antibiotics	Sensitivities in % for organisms isolated from oropharyngeal swab.		
	Hemophilus influenzae	Streptococcus pneumoniae	Klebsiella pneumoniae
Pennicillin	-	92	-
Ampicillin	93	-	3
Co-amoxiclav			87
Amikacin	-	-	100
Gentamicin	-	-	93
Chloramphenicol	92	96	-
Co-rtrimoxazole	8	58	58
Ceftriaxone	100	-	92.5
Ofloxacin	100	100	100
Cefixime	-	-	91

Out of 791 oro-pharyngeal swab cultures, 247 (31.2%) were positive. Commonest organisms that were isolated from oropharyngeal swabs included Haemophilus influenzae and Klebsiella pneumoniae in 86 (10.9%) and 67 (8.5%) children respectively. Streptococcus pneumoniae was isolated in 29 (3.7%) and Haemophilus parainfluenzae in 52 (6.6%) children. After adjusting for the refusal of oro-pharyngeal swab, the burden of Haemophilus influenzae and Streptococcus pneumoniae in these communities was estimated as 8.9/1000 children / year and 3.0/1000 children respectively (Table 2). Both organisms were resistant to Co-trimoxazole (Table 3).

Though blood culture was positive in 158 (26.6%) out of 594 blood samples but clinically significant

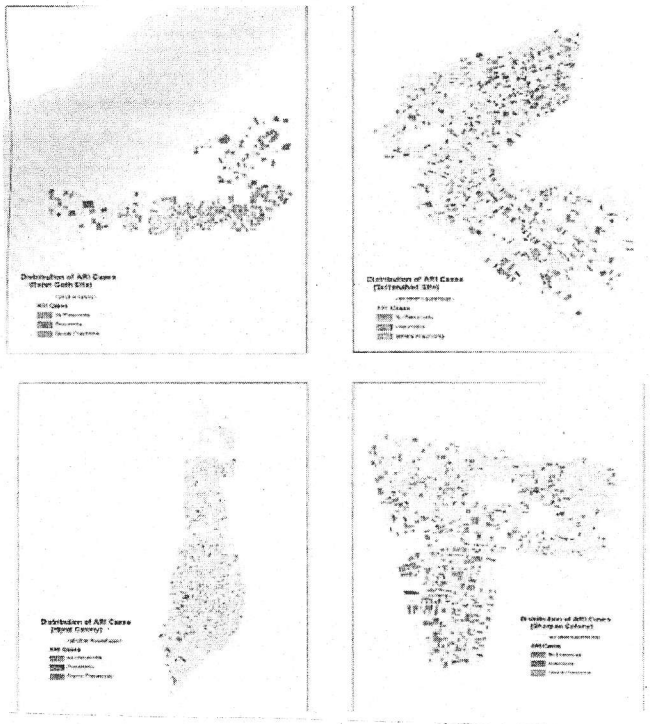

Figure. Distribution of cases of acute respiratory infections in children 2 months to 5 years of age on GIS map of the study areas.

respiratory pathogenic organisms were isolated from few cases only.

Discussion

The overall incidence of ARI and pneumonia both seem to be low in our study as compared to standardized global pneumonia incidence rate of 300/1000 children / year. This is due to the nature of the study. The population under study was heterogeneous in term of locality, economic status and availability of alternate medical services. In Rehri Goth, where the incidence of both ARIs and pneumonia was highest, the population was poor, uneducated and short of health care facilities. In Sultanabad and Hijrat Colony, though the housing facilities were poor but economic status of population was better along with higher number of available health care facilities. About 30 qualified private medical practitioners are providing medical care to the residents of these areas. During domiciliary surveillance, community health workers visited each household to identify children with fever and cough. The children suffering from fever and cough were encouraged to visit the study clinic to get free investigations and treatment, but all such patients did not avail this facility. It was estimated that only about 20-25 % of the sick patients identified during domiciliary surveillance in Sultanbad and Hijrat colony and about 50% of the patients in Rehri Goth and Sher Pao Colony availed this facility. Thus the actual burden of diseases in general community may be two to four times higher than measured in this study. In spite of this limitation, extrapolating from the results of this study, it is estimated that 10.5 million children less than five years of age get acute respiratory infections each year in Pakistan. Of these 1.96 million children get pneumonia and severe pneumonia. This is based on the population of children less than five years of age (23,879,450) calculated at 15% of total estimated population of Pakistan in 1994. This is a conservative figure and actual number of pneumonia cases may however be much higher. Since Haemophilus influenzae type b and Streptococcus pneumoniae are the two common causative organisms, accounting up to 15 % of the pneumonias in this study, and both being preventable by immunization, at least 0.3 million children might be saved by immunizing children against these organisms.

Isolation of causative organisms especially of Streptococcus pneumoniae was also extremely low in this study. However, comparing this incidence with earlier studies from Pakistan[8,9], the incidence of H. influenzae & Klebsiella pneumoniae is almost similar. The reasons for this low yield are difficult to explain. Inadequate collection of material for culture on the swab in a crying child may be one but there may be several other factors such as transportation time to the laboratory which might be responsible for death of S. pneumoniae. In spite of this low yield of positive cultures, isolation of Haemophilus influenzae from 10.9% and Streptococcus pneumoniae from 3.7% of pneumonia cases indicate a burden of 213116 cases of H. influenzae per year and 71864 cases of Streptococcus pneumoniae per year in children less than five years of age. Considering the limitations of the study, the actual burden of these organisms may be several times higher. As we have not estimated the cost of illness and given the high cost of HiB and polyvalent pneumococcal conjugate vaccines, it is difficult to determine cost effectiveness of mass immunization program at this stage. Immunization doesn't prevent only respiratory infections but also meningitis and other invasive diseases, burden of which may be at least one fifth of the respiratory illnesses. Their morbidity, mortality and cost of management are also several times higher than those of respiratory illnesses. Considering these facts, immunization seems to be beneficial. However cost of illness studies are needed to demonstrate these facts.

Acknowledgement

The financial support for the study was provided by grant received from the Aga Khan University Research Council Karachi Pakistan. We are grateful to our field staff including medical officers and field workers for their long hours of field work. We also acknowledge the contribution of our data management staff and data manager Mr. Shahid Rasool for computerization of the data and helping in its analysis.

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Original Article

Role of ICT Malaria Immunochromatographic Test for Rapid diagnosis of Malaria

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Abstract

Objective: To evaluate the sensitivity and specificity of immunochromatographic test (ICT) malaria p.f/p.v using microscopy as the gold standard diagnosis.

Methods: Five hundred and sixty patients of both sexes and all age groups with clinical suspicion of malaria were studied. Venous blood was collected for microscopy and ICT. Thick and thin films prepared and stained with Leishman's stain were examined. ICT malaria test was performed and interpreted according to manufacturer's instructions. Data was analyzed using Epi-6.

Results: A total of 560 cases were studied, 339 males and 221 females with age ranges between 2 to 73 years. Seventy two (12.85%) cases had parasitaemia (with or without sexual forms). On microscopy 65 (11.6%) cases had asexual-stage parasitaemia and 7 (1.25%) cases had P. falciparum gametocytes only. Thirty two cases were infected with P. falciparum, 29 with P. vivax and 4 had mixed infection. For P. falciparum the ICT was 97.0% sensitive, 98.3% specific, with positive predictive value (PPV) of 78.0% and a negative predictive value (NPV) of 99.8%. For P. vivax the sensitivity was only 89.7%, specificity 97.9%, PPV was 70.3% and NPV 99.4%.

Conclusion: Our results are in concordance with previous studies. Rapid tests though expensive are simple to perform and effective diagnostic tools of malaria. They can be used selectively, though microscopy remains the gold standard diagnosis, economical and accurate if performed by skilled technologists (JPMA 56:167;2006).

Introduction

Malaria is one of the most common parasitic diseases and a major health problem world wide infecting 200 million and killing about 2 million people each year.[1] Rapid diagnosis and early treatment of clinical cases is central to the reduction of malarial morbidity and mortality.[2] The two diagnostic approaches currently used are clinical and microscopic examination. Clinical diagnosis of malaria alone is unreliable and should be confirmed by laboratory tests.[3] Microscopic examination of stained thick and thin blood film is currently the standard method of malaria diagnosis.[3,4] This technique remains cost effective however; correct interpretation of the blood films requires considerable expertise and adequate quality control. Secondly, its reliability is questionable particularly