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PharmaInterScience Publishers

Research article

Int J Pharm Biomed Sci 2012, 3(4), 177-180
ISSN No: 0976-5263

Disease pattern and bacteriology of childhood pneumonia in Western India

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This study was planned to assess the disease pattern and bacteriological profile of childhood pneumonia in western India. One hundred hospitalized children between the age group of 2 months-12 years with clinically suspected pneumonia were included in the study. Pneumonia was diagnosed by radiological investigations. Biochemical analysis of blood samples was performed. Microbiological analyses of blood samples and pleural fluid samples were performed to assess the bacteriological profile. The disease pattern and outcome were assessed and recorded. Maximum number of subjects of pneumonia was in 1-5 years of age group. The most common pathogen identified was Methicillin Sensitive *Staphylococcus aureus*. The other pathogens identified were *Streptococcus pneumoniae*, Methicillin Resistant *Staphylococcus aureus*, Klebsiella species and Pseudomonas species. Ninety-seven subjects recovered without sequelae, this includes twenty-five cases, which had serious complications. Out of hundred cases, twenty-eight subjects had complications such as bacteraemia, respiratory failure, septic shock, empyema and multi-organ dysfunction. Out of the twenty-eight cases in which complications were observed twenty five survived and mortality was observed in three subjects. Severe pneumonia is a cause of mortality in children less than 5 years of age.

Key words: Bacteriology, Disease pattern, MSSA, Pleural effusion, Pneumonia

Received: 03 Nov 2012 / Revised: 07 Nov 2012 / Accepted: 08 Nov 2012 / Online publication: 13 Nov 2012

1. INTRODUCTION

There are reports from India that each year 4, 00,000 children under 5 years of age die due to pneumonia [1]. The current incidence of pneumonia in developed countries is estimated to be 0.026 episodes per child year as compared to 0.280 episodes per child year in developing countries [2]. Pneumonia is the prime concern of childhood mortality in India and developing countries [3]. It is important to identify etiology of pneumonia for clinical management of the disease. This would also help to achieve millennium development goal number-4, of decreasing childhood mortality by two third by the year 2015 as promoted by United Nations [3] and Department of Health, Government of India.

There are reports from south and north India about etiology and disease pattern of pneumonia in children [1,4,5]. In this study, it was planned to study disease pattern and significance of bacterial pneumonia in children from western India.

2. MATERIALS AND METHODS

This was a prospective study, conducted at a teaching hospital. The study included 100 children in the age group of 2 months to 12 years, hospitalized for pneumonia, from September 2008 to September 2010. Approval from the Institutional Ethics committee was obtained prior to the conduct of the study.

Cases were identified as suspected case of pneumonia if the subject had clinical symptoms such as fever, cough, fast breathing and clinical signs like nasal flaring, lower chest indrawing, grunting, decreased oral intake, cyanosis and lethargy [6]. The cases were then enrolled after obtaining a written informed consent. A detailed clinical examination was performed. The subjects were clinically managed with intravenous antibiotics, inotropic support, ventilator support along with supportive treatment, as per standard guidelines. The cases were assessed and antibiotics were graded up in the absence of clinical improvement after 72 hours of start of standard treatment. The cases were reviewed for complications and appropriate treatment was instituted.

2.1. Investigations

In all subjects baseline investigations, chest X-ray and ultra sonography of thorax were carried out. Blood and pleural fluid analysis including microscopic analysis, biochemical analysis and culture on appropriate growth media were performed. In patients with pneumonia of suspected tubercular origin, tuberculin skin test was performed and gastric aspirate was checked for acid-fast bacilli [7].

The disease pattern was assessed clinically, confirmed by radiological, biochemical and microbiological methods. Outcome was recorded and data was analyzed.

3. RESULTS AND DISCUSSION

Most of the new cases of pneumonia are concentrated in six countries- India, China, Pakistan, Bangladesh, Indonesia and Nigeria [6]. Pneumonia is the leading cause of childhood mortality. The disease pattern and bacteriology associated with pneumonia were investigated in this study.

Total 100 hospitalized subjects that were clinically suspected as per WHO case defining criteria for pneumonia, were evaluated for this study. Most of the subjects (n=71) with pneumonia were in the age group of 1-5 years with a male to female ratio of 3:2 showing a male preponderance (Table 1). Similar results were observed in a study carried out by MS Tullu, CT Deshmukh in which the male to female ratio was 2.4:1 [8].

Table 1
Distribution of cases as per age and sex

Age (Year)	Sex		Total
	Male	Female	
< 1	2	2	4
1 – 5	41	30	71
>5	17	8	25
Total	60	40	100

Table 2
Blood culture and pleural culture analysis

Age (Year)	Blood culture and Pleural culture					Total
	Klebsiella	MRSA	MSSA	Pseudo	Strepto	
< 1	0	0	0	0	0	0
1 – 5	3	0	8	0	4	15
>5	0	3	0	2	2	7
Total	3	3	8	2	6	22

MRSA: Methicillin Resistant *Staphylococcus aureus*, MSSA: Methicillin Sensitive *Staphylococcus aureus*, PSEUDO: *Pseudomonas* spp. STREPTO: *Streptococcus pneumoniae*

Out of one hundred subjects, fifty seven cases had bilateral pneumonia and forty three had unilateral disease. Twenty-three subjects were radiologically and ultrasonographically confirmed cases of pneumonia with pleural effusion. Out of these twenty-three subjects, nine had

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minimal non-tappable fluid. Pleural fluid tapping was performed in fourteen subjects and blood culture was sent in all subjects. In cases of pneumonia, blood culture is a modality for identifying pathogen spectrum; especially when it is suspected to be associated with bacteraemia [9].

Total twenty-two samples were culture positive either in blood culture or in pleural fluid culture. Blood culture was reported positive in seventeen cases, while pleural fluid culture was positive in five cases. In a study done by Falade AG et al, blood culture was positive in 18% cases and lung aspiration or pleural fluid aspiration was positive in 52% cases [10]. Agarwal A reported blood culture positivity in 21.9% cases and Kabra S.K et al in their study reported blood culture positivity of 5-15% [1,4] which is similar to the findings in the present study.

The pathogen spectrum identified on culture, in the age group 1-5 years was maximum number of Methicillin Sensitive *Staph. aureus* followed *Streptococcus pneumoniae* & *Klebsiella* spp. In age group >5 years, Methicillin Resistant *Staph. aureus* was the most common microorganism found followed by *Streptococci pneumoniae* and *Pseudomonas* species. No microorganisms were cultured in age group less than 1 year (Table 2). In the Severe Pneumonia Evaluation Antimicrobial Research (SPEAR) study performed in Bangladesh, Ecuador, India, Mexico, Pakistan Yemen and Zambia, bacterial isolates obtained from blood and lung aspirates in 110 children between the age group of 2-59 months, the most common organism isolated was *Staph. aureus* (n=47) and *Streptococcus pneumoniae* (n=22) [11]. In the present study, *Streptococcus pneumoniae* and Methicillin Sensitive *Staph. aureus* were isolated in pleural fluid culture. In one subject of pneumonia with pleural effusion, the blood culture showed Methicillin Resistant *Staph. aureus* whereas the pleural fluid culture did not demonstrate any growth on culture media. Community associated Methicillin Resistant *Staph. aureus* (CA-MRSA) is an important cause of community acquired pneumonia complicated with empyema [12]. In the present study none of the cultures were found to be positive for *Haemophilus influenzae* type B, probably because of fastidious growth requirements of the organism.

Gastric aspirate examination was performed in four tuberculin skin test positive cases. Out of these four cases, three had a positive history of contact with an open case of tuberculosis. One case demonstrated acid fast bacilli microscopically by Ziehl Neelsen staining. Sputum culture for tuberculosis could not be analyzed in the above cases due to difficulty of sample collection. A significant number of pneumonia cases in children may be due to *Mycobacterium tuberculosis*, which are difficult to identify [10].

Out of hundred cases, ninety-seven cases recovered completely without any sequelae with standard line of treatment, including twenty-five cases, who had serious complications. Four cases were diagnosed to have tubercular pneumonia, which recovered in due course of time with appropriate treatment.

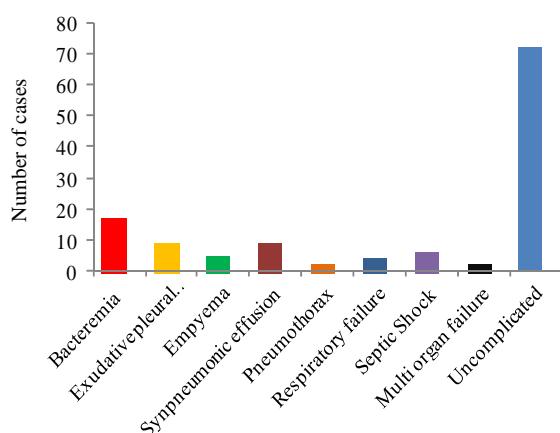


Fig.1. Disease pattern in severe pneumonia cases

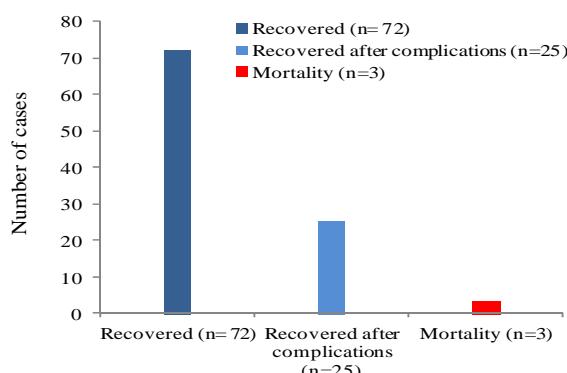


Fig.2. Clinical outcome of hospitalized pneumonia cases

Twenty-eight cases had one or more of the complications such as bacteremia (17 cases), exudative pleural effusion (9 cases), empyema (5 cases), minimal synpneumonic effusion (9 cases), pneumothorax (2 cases), respiratory failure (4 cases), septic-shock (6 cases) and multi organ dysfunction (2 cases). Serious complications like respiratory failure, septic-shock and multi-organ dysfunction requiring inotropic medications and ventilatory support were observed in patients who were culture positive subjects (Fig.1). The health seeking behavior of caretakers, delayed referral for hospitalization, delay in initiation of appropriate treatment could have attributed to development of severe disease with complications.

Mortality was observed in three cases, all under 3 years of age with bilateral pneumonia due to respiratory failure, septic shock and multi-organ dysfunction (Fig.2). Out of these three cases, Methicillin Sensitive *Staphylococcus aureus* was isolated in two cases and *Klebsiella* spp in one in blood culture. The mortality due to severe pneumonia amongst all hospitalized children was reported to be 1.35 %, 3.32% &

0.89% in a multi centric study carried out at Chandigarh, Kolkatta and Vellore while in the Million Death Study, amongst all the causes of childhood mortality, 27.6% deaths were attributed to pneumonia [13].

The limitation of the present study was that only hospitalized patients with severe and very severe pneumonia were included. Patients treated on outpatient department were not included. Nevertheless, the present study found that severe pneumonia affected children between 1-5 years of age and MSSA and *Strep. pneumoniae* were the most common pathogen identified from culture, in children of Western Indian region. Children in poor and developing countries that have a large burden of pneumonia cases do not have free availability to *Haemophilus influenzae* and *Pneumococcal* vaccines in routine immunization programmes [14]. Preventive measures like immunization against *Haemophilus influenzae*, *Streptococcus pneumoniae* can help decrease mortality due to pneumonia in developing countries especially with the increasing emergence of antibiotic resistant strains.

4. CONCLUSIONS

More cases of severe pneumonia in children were observed in the age group of less than 5 years with a male preponderance. The commonest bacterial pathogen isolated in the present study on blood/pleural fluid culture was Methicillin Sensitive *Staphylococcus aureus* and *Streptococcus pneumoniae* and other pathogens were Methicillin Resistant *Staph. aureus*, *Klebsiella* species and *Pseudomonas*. The mortality due to severe pneumonia was observed in three cases, all less than 3 years of age and the bacterial pathogens isolated in these cases were Methicillin Sensitive *Staph. aureus* and *Klebsiella* species.

ACKNOWLEDGEMENTS

Authors thank Dean, for facilitating the study, department of Radiology for radio-diagnosis of subjects under study, department of Biochemistry, and department of Microbiology, Dr. D.Y. Patil Medical College, Hospital and Research center, Pune for analyzing samples for the study. Authors acknowledge Dr. Rajendra Karambelkar for his valuable inputs. Authors also acknowledge Dr. Anubhav Gupta for his time and efforts in collecting the data.

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