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Radiological Findings in Severe Pneumonia in Children 1-59 Months in a Children's Hospital, Khartoum, Sudan

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Abstract

Objective: This prospective hospital base study was conducted to examine the role of chest radiography in diagnosis of pneumonia in children and correlate the severity of the disease with radiological findings.

Methods: A total of 156 cases aged 1-59 months admitted through the Emergency Room with severe pneumonia were enrolled over 24 hours/day admissions, once every two weeks

Results: The enrolled groups were 61.5% female, 38.5% were male. The chest X-ray showed pneumonia in 83 (53.2%) cases with alveolar pneumonia accounting for 47 (30.12%), and non alveolar pneumonia for 36 (23.10%) cases. Factors that were found to have significant association with severe pneumonia included smoking associated diarrheal diseases, endemic diseases, malnutrition anaemia and breastfeeding < 18 months. (P. value < 0.04; < 0.001, < 0.001, < 0.001, < 0.01 and < 0.48, respectively).

In conclusion chest X-ray is an important tool in diagnosing severe pneumonia, particularly in situations where other means of investigations are meager.

Keywords: Severe pneumonia; Chest XR; Alveolar pneumonia; Sudan

Introduction

The estimation of annual death due to pneumonia, worldwide in children less than 5 years is more than 10 million, and most of these deaths occur among children in developing countries [1,2]. Also respiratory tract, mainly pneumonia caused by bacterial infection may account to 2 millions [3,4]. The Burden of pneumonia is poorly estimate, due to poor documented, which reflect difficulties for health planner to plan for prevention and selection of suitable treatment i.e. antibiotics [5].

Death due to pneumonia (bacteria) are more than that due to meningitis, however, surveillance for pneumonia is too difficult issue to be performed [6].

In order to make a definite diagnosis of clinical pneumonia you might need invasive procedure, which make more difficulties in identifying the causative organisms [7]. Blood culture is not acceptable way to identify bacterial pneumonia [8-10] and specimens from interstitial tissue is technically difficult and need experience personnel and it is risky procedure [9,11]. Therefore, chest X-ray can give useful information about the presence of pneumonia [12]. Due to the burden of pneumonia WHO established standard categorization for radiological pneumonia [13].

Patients and Methods

This is a prospective hospital-based which was done over study on a period of 2 years (from March 2009 to March 2011). The catchments area is approximately 5 million populations with more than 450 patients visiting the Emergency Room (ER) daily having different paediatrics problems. Children included were aged 1 – 59 months with the diagnosis of severe pneumonia according the WHO criteria for severe pneumonia [14,15]. They were admitted via ER to the tertiary hospital (Gaffar Ibn Aouf Children's Hospital) in Khartoum. The sample of 156 patients was collected over whole 24 hours period on the unit causality duty day (which is every other Wednesday). A questionnaire

was designed to include personal data, medical, nutritional and past history as well as clinical examination Investigations done included chest X-ray, TWCC, blood film for malaria and Widal test for typhoid fever. Routine management was timely initiated.

The chest X-rays were interpreted by a senior radiologist, one senior paediatrics chest physician and a general pediatrician. Informed verbal consent was obtained from parents or care providers.

Chest radiograph Interpretation was according to WHO classification:

- 1) Alveolar pneumonia: i.e. end point consolidation, which may be fluffy of part for whole lobe or enter lung often containing air bronchogram and or with plural effusion [16].
- 2) Non alveolar (i.e. other consolidation or infiltrate) [16].

The presence of other infiltrates as defined above in the absence of plural effusion as well as other non end point (i. e. linear, interstitial, pre-bronchial thickening, multiple areas of atelectases [16].

When more than one radiological signs were present condition is designed as severe radiological pneumonia.

Results

One hundred and fifty six children aged 1-59 months with severe pneumonia (Based on WHO definition) were enrolled in this study.

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Table 1 shows gender and age distribution, 60 (38.5%) cases were males and 96 (61.5%) were females. Those children of history of diarrhea, smoking at home and receiving breastfeeding less than 18 months showed significant association with severe pneumonia ($P < 0.0001$; $P < 0.04$ and $P < 0.048$) respectively (Table 2). All children with severe pneumonia presented with fever (100%), followed by shortness of breath (88.5%), cough (81.4%) and running nose (78.2%), while grunting in two third of the cases (Table 3). X-ray finding of pneumonia were present in 83 (53.2%) children with alveolar pneumonia accounting for 47 (30.12%), and non alveolar pneumonia for 36 (23.10%) cases, while X-ray showed normal findings in 46.8% (Table 4). It was observed that 29 (34.9%) chest X-ray showed severe radiological pneumonia. The severity of the disease has significant association with many factors e.g. hospital stay more than 4 days ($P <$

Characteristic	Number of children	Percentage
Gender:		
Male	60	38.5
Female	96	61.5
Age (in months)		
< 12	27	17.3
12 – 24	46	29.5
25 – 36	47	30.1
> 36	36	23.1
Total	156	100%

Table 1: Gender and age distribution of children in the study (n=156).

Risk factors	N (%)	Chi-square (X^2)	P. value
Age (in month):			
< 36	36 (43.4)	4.2	0.240
=> 36	47 (56.6)		
Gender:			
- Female	47 (56.6)	1.3	0.246
- Male	36 (43.4)		
Father's education:			
- Post primary	73 (88.0)	3.8	0.143
- Illiterate	10 (12.0)		
Mother's education:			
- Post primary	45 (54.2)	2.2	0.318
- Illiterate	38 (45.8)		
Father's occupation:			
- Skilled and professional	61 (73.5)	1.4	0.49
- Unskilled	22 (26.5)		
Mother's occupation:			
- Skilled and professional	45 (54.2)	3.2	0.201
- Unskilled	38 (45.8)		
Number of sibling:			
< 4	62 (74.7)	0.014	0.704
> 4	21 (25.3)		
Smoking:			
- Yes	67 (80.7)	3.9	0.04
- No	16 (19.3)		
History of diarrhea:			
- Yes	52 (62.7)	19	0.0001
- No	31 (37.3)		
Method of cooking:			
- Gas.	66 (79.5)	0.17	0.679
- Wood and Coal	17 (20.5)		
Vaccination:			
- Yes	71 (85.5)	0.031	0.57
- No	12 (14.5)		
Breastfeeding:			
< 18 months	59 (71.1)	6.07	0.048
18 -24	18 (19.9)		

Table 2: Possible risk factors contributing to pneumonia (n = 83).

Symptoms	Number of cases	Percentage
Fever	156	100
Cough	127	81.4
Running nose	122	78.2
Shortness of breath	138	88.5
Grunting	101	64.7

Table 3: Presenting symptoms of pneumonia (n= 156).

Finding	Number of cases	Percentage
Alveolar	47	30.1
Non alveolar	36	23.1
Normal	73	46.8

Table 4: Radiological findings (n= 156).

Factors for severity	N (%)	Chi-square (X^2)	P. value
Oxygen therapy more than 24 hours	29 (100)	5.7	0.22
Hospital stay more than 4 days	29 (100)	20	0.0001
More than one antibiotic:			
- Yes	20 (69.0)	3.9	0.142
- No	7 (24.1)		
- Missed	2 (6.9)		
Association with other diseases:			
- Yes	20 (69.0)	3.5	0.01
- No	9 (31.0)		
Association with anemia:			
- Yes	15 (51.8)	4.26	0.039
- No	14 (48.2)		
Association with malnutrition:			
- Yes	12 (41.4)	20.1	0.0001
- No	17 (58.6)		

Table 5: Factors associated with X-ray severity of the disease (n = 29).

0.001), presence of severe malnutrition ($P < 0.001$), presence of other illnesses like typhoid and malaria ($P < 0.01$) and anemia (Hb less than 10 grams based on WHO definition) (Table 5).

Discussion

Chest X-ray is a useful investigation in diagnosing severe pneumonia whereby reducing the burden of severe pneumonia. In this study the chest radiology showed signs of alveolar and non alveolar pneumonia (based on WHO criteria) in 83 (53.2%) cases which is less than that seen in Northern Territory endogenous children in Australia [14]. The high rate of positive X-ray findings in that population is higher than in our study because they include all hospitalized children, moreover, due to good facilities, easy transportation many patients they report to hospital, this differ from our situation, where some patients receiving antibiotics at home, were reluctant to report to hospital. The lack of expert facilities made our rate of positive X-ray findings less than that in Australia. However, our findings are more or less similar to the Spanish study where chest X-ray proved pneumonia in 62.1% of cases [17]. But our findings in X-ray are more than that in Fiji where pneumonia was proved in 34% of the children [18].

Diarrheal disease and gastroenteritis and severe malnutrition had strong association with the severity of the disease in this research, which

in concordance with other studies done in Middle-east [14,19,20]. The diarrhoeal disease will lead to deficiency of vitamin A and zinc with subsequent deficiency in mucosal defense against organisms as a result of this immunodeficiency infection will develop [21-24]. Therefore, diarrhoeal disease and malnutrition with trace elements and anaemia will predispose to severe infection of pneumonia. Those children with hospital stay more than 4 days associated with severe disease in this study and this in agreement with other studies [25]. Smoking and incomplete breastfeeding which is significant in this study agreed with other studies [26,27]. The symptomatology in severe pneumonia is also in agreement with previous study in Sudanese children [28].

Conclusion

Achievement of goal number four of the UN Millennium Development as far as acute lower respiratory tract infection should be obtained [29]. Chest X-ray is an important tool in diagnosing severe pneumonia. It also helps in deciding the severity of the disease. It is highly recommended for diagnosis of pneumonia particularly in low-income countries where other tools of investigations are meager.

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