

## Original Article

# Characteristics associated with severe pneumonia in under-five children admitted to emergency units of two teaching hospitals in Khartoum, Sudan

Karim Eldin M. A. Salih (1), Ali Salih (2), El Fatih Z. E. El Samani (3), Kamal Eldin Hussien (4), Salah A. Ibrahim (5)

- (1) Paediatric Department, Juba University and Gaafar Ibn Oaf Children's Hospital. Khartoum, Sudan
- (2) Paediatric Department, Albanjadeed Hospital, Khartoum State, Sudan
- (3) Ahfad University for Women, Omdurman, Sudan
- (4) The National Ribat University, Khartoum, Sudan
- (5) Department of Paediatrics and Child Health, University of Khartoum, Sudan

## ABSTRACT

Pneumonia, defined as infection of lung parenchyma, is associated with severe complications especially in the very young and old patients. It is the world's leading cause of childhood mortality. The World Health Organization (WHO) classification and guidelines are commonly used in Sudan in the diagnosis and management of pneumonia patients. A group of 224 patients at Gaafar Ibn Oaf Children's Hospital and Omdurman Children's Hospital were assessed and managed for severe presentation of pneumonia. The data collected showed that most of the patients were of low socioeconomic class families. The vast majority (99%) of patients had chronic exposure to tobacco smoke at home. Female patients (52.7%) were more than males, with 42% of the presenting patients in the less than 12 months age group. Pneumonia is a dangerous childhood menace that is associated with severe presentations. Public health community outreach programs should be put in place to raise awareness. The

case fatality rate during the study period was 4%.

**Key words:** Severe pneumonia; Under-five children; Sudan

## INTRODUCTION

Pneumonia is a serious infancy and childhood disease with over 2 million deaths per year in the paediatric age group [1]. The criteria for diagnosis, classification and management of pneumonia in Sudan are taken from the World Health Organization (WHO) updates and guidelines. Pneumonia diagnosis and classification of severity depends on clinical findings [1]. The children under 5 years of age with protein energy malnutrition or immunodeficiency have the highest risk for developing morbidity and mortality from severe pneumonia [2-4]. The objectives of this study are to determine clinical characteristics, patterns, presentations and outcome of severe pneumonia in children under-five and describe their demographic and socioeconomic patterns.

### Correspondence to:

Dr. Karim Eldin M. A. Salih,  
Paediatric Department,  
Juba University, P.O. Box: 321/1, Khartoum, Sudan.  
E-mail: karimeldin\_salih@hotmail.com

### How to cite this article:

Salih K, Salih A, El Samani EZ, Hussien K, Ibrahim S. Characteristics associated with severe pneumonia in under-five children admitted to emergency units of two teaching hospitals in Khartoum, Sudan. Sudan J Paediatr 2011;11(2):25-31.

## MATERIAL AND METHODS

This is a case finding descriptive study, done at Jaafar Ibn Oaf Children's Hospital and Omdurman Children's Hospital. Over a period of 3 years, children under 5 years of age who presented to the emergency units of these hospitals with signs and symptoms of severe pneumonia, according the WHO classification, were enrolled. A questionnaire was prepared to collect information regarding the following variables: age, sex, socioeconomic status, feeding history, past history, vital signs and general examination findings, in addition to outcome of the management. All forms were filled by the same author (KEMAS) after consent from parents. Children with bronchial asthma, bronchiolitis, tuberculosis, history of foreign body, recurrent pneumonia, seriously ill as well as the patients whose parents refused to be included in the study were excluded. The study was conducted for 3

years on once a week basis. The day of recruitment is the regular weekly day when one of us (KEMAS) headed the emergency paediatric on-call.

Tabulation of the data was performed using Epi-info V6b software. The SPSS program version 16.0 was used for statistical analysis with Chi-square test and p-value < 0.05 considered to be significant.

## RESULTS

A total of 224 patients with severe pneumonia, who satisfied the inclusion criteria, were enrolled in this study (Table 1). These included 118 (52.7%) females, with most of the patients of both sexes less than 2 years of age (41% less than one year, and 34% between 1-2 years). The test of linearity for age was highly significant ( $p < 0.01$ ).

Table 1- Demographic and health characteristics of studied children

1. Age group and gender distribution			
Age Group* (months)	Gender**		Total (%)
	Female	Male	
0-11	54	40	94 (41.0%)
12 -23	34	42	76 (34.0%)
24 - 35	15	11	26 (12.0%)
36 - 59	15	13	28 (13.0%)
Total	118 (52.7%)	106 (47.3%)	224 (100.0%)

2. Duration of breastfeeding		
Duration(months)	Frequency	Percentage
< 6	47	21.0%
7-12	64	28.6%
13-18	65	29.0%
19-24	48	21.4%
Total	224	100%

\*Distribution by age is highly significant ( $p < 0.01$ ).

\*\*Distribution by gender is not significant

Table 2- Family demographic and health characteristics

1. Years of parental education		
Years of Education	Fathers (%)	Mothers (%)
Uneducated	5 (4.0%)	2 (2.0%)
1- 4	59 (50.0%)	27 (25.0%)
4-8	13 (11.0%)	63 (60.0%)
>8	41 (35.0%)	14 (13.0%)
Total	106 (100%)	106 (100%)

2. Parental occupation:		
Occupation	Parents (Frequency)	
	Fathers	Mothers
Professional	8 (7%)	0 (0%)
Employee	45 (43%)	21 (18%)
Skilled labourer	21 (19%)	7 (6%)
Unskilled labourer	13 (13%)	11 (10%)
Farmer	3 (3%)	2 (1%)
Unemployed	16 (15%)	77 (65%)
Total	106 (100%)	118 (100%)

3. Methods of cooking at home:		
Method of cooking	Frequency	Percentage
Wood	22	9.8%
Coal	50	22.3%
Gas	152	67.9%
Total	224	100%

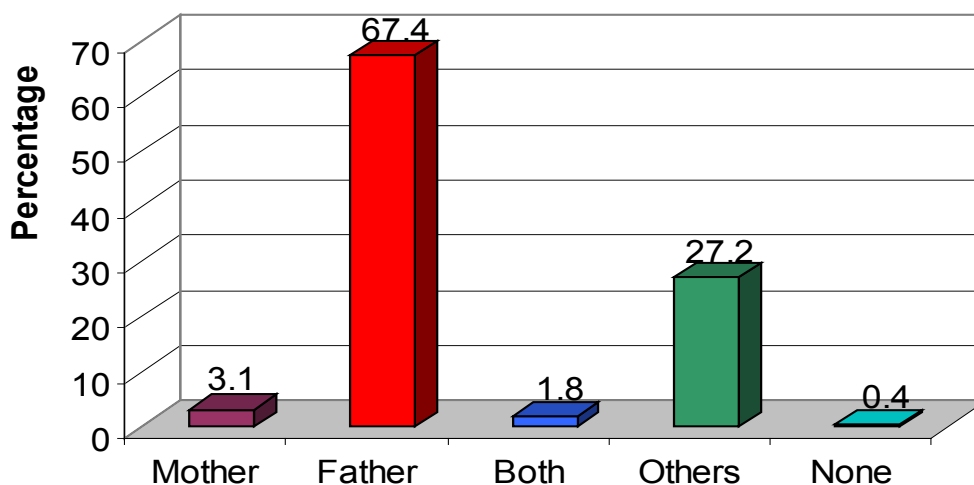
4. Number of children per family:		
Number of children	Frequency	Percentage
< 4	159	71%
> 4	65	29%
Total	224	100%

Half (50%) the children received breast feeding for more than one year and 21.0% of the cohort had breast feeding for less than 6 months. Analysis of parental education showed that 64% of the mothers and 50% of the fathers of these children had less than eight years of formal education (Table 2).

Parental occupations were diverse. While 28.6% were unemployed, only 4% were farmers and 7.4% were professional workers. Skilled labourers, unskilled

labourers and employee group were 17.2%, 20.8% and 22.2% respectively.

The most popular method of cooking was gas, followed by coal, then wood. Almost all of the study population had a direct source of chronic exposure to tobacco smoke (Figure 1), particularly paternal smokers, where fathers counted for up to 67% of the exposure. It is interesting to note that 11 of the mothers (5.0%) were smokers. The rest of the children were exposed to frequent tobacco smoke from visiting

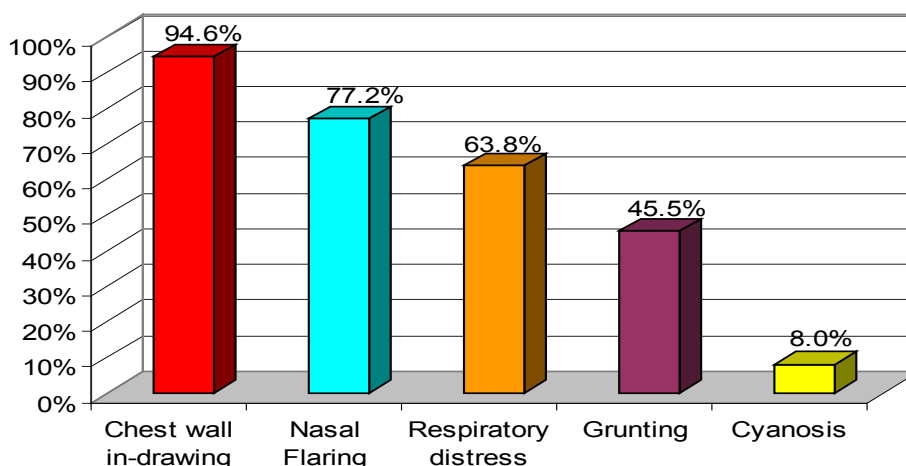


**Figure 1: Source of exposure to tobacco smoke**

relatives and friends.

The most common presenting signs (Figure 2) of patients were chest in-drawing (94%), followed

by nasal flaring (77%), respiratory distress (64%) and grunting (46%). Less common presenting signs were cyanosis (8%), refusal of feeding (2%) and

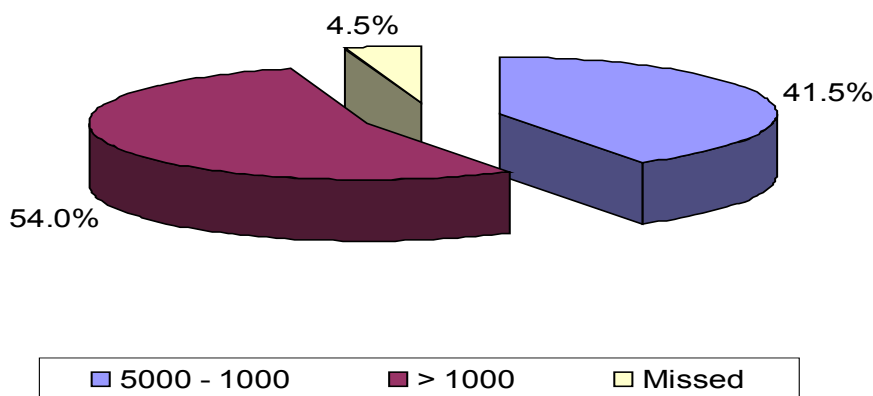


**Figure 2: Clinical findings in severe pneumonia**

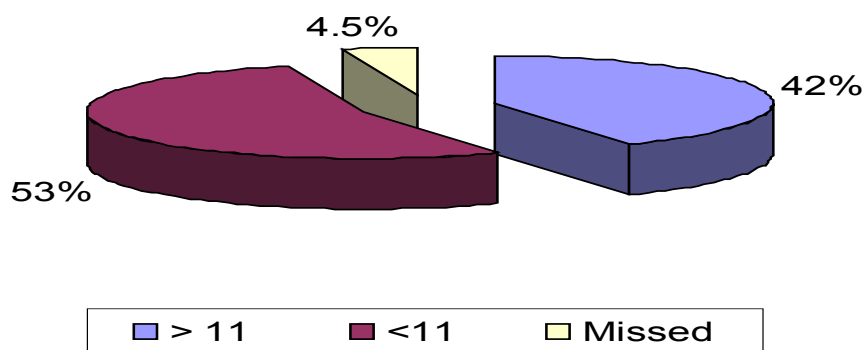
convulsions (1%). The results of ten (4.5%) of the patients' haemoglobin and total white blood counts were lost during data collection (Figure 3). About half (54%) had a total

white blood count (WBC/mm<sup>3</sup>) of 5000 – 10000, and 41.5% of the patients had white blood count >10000. Haemoglobin was > 11.0 g/dl in 42% of patients and < 11.0 g/dl in 58% (Figure 4).

**Figure 3: White blood cell count in cases of severe pneumonia (/mm<sup>3</sup>)**



**Figure 4: Haemoglobin (mg/dl) in cases of severe pneumonia**



During follow up for 3 weeks after admission, 8 patients were not available for evaluation. On discharge, most of the patients (91%) recovered completely (Table 3). Out of these 224 patients, 38 (17%) were

marasmic. Although bronchial asthma, tuberculosis and cardiac cases were among the exclusion criteria, yet we missed 11 cases who turned out to be 4 cases bronchial asthma, 4 cases pulmonary tuberculosis and 3 cardiac cases.

**Table 3- Outcome of severe pneumonia in 224 children**

Outcome	Frequency	Percentage
Full recovery	204	91%
Bronchial asthma	4	1.8%
Pulmonary tuberculosis	4	1.8%
Cardiac sequelae	3	1.3%
Death	9	4.1%
Total	224	100%

## DISCUSSION

This study was conducted at two hospitals (Gaafar Ibn Oaf and Omdurman Children's Hospitals), which are specialised paediatric hospitals in Khartoum State. The number of patients involved in the study was 224. Most of patients were less than 12 months of age, which was significant ( $p < 0.005$ ). This reflected the vulnerability of this age group for development of severe illnesses like severe pneumonia, with consequences of increasing morbidity and mortality. The case fatality was 9/224 (4.01%), which was consistent with other studies [2,4,5].

As shown in the results, almost all of the children were exposed to tobacco at home (fathers 67%), which is in agreement with other reports [6]. Nicotine has a definite anti-leucocyte action that explains this significant finding [7], which should alert people to the hazard of passive smoking and the need for concerted efforts of health education.

Analysis of family size showed that 29% had more than 4 children, while 71% of the families had less than four. Although the Sudanese family size is usually larger, this may be explained by a rather young age of the mothers of these children, with difficulty to care for them, due to limited experience. More rigorous analysis of the age of mothers and the order of the child (e.g. first child) may throw light on this phenomenon and explain such a relationship. The results showed limited years of schooling, low income and unemployment or manual occupations, reflecting low socioeconomic status. Limited knowledge and financial resources may result in late attendance to medical facilities and propagation of the disease to dangerous levels. This is consistent with other studies [4,5,7,8]. The association of severe pneumonia with low socioeconomic status, determined by low parental education and income, is also in agreement with other studies in Arab

populations [10].

The clinical findings in this study like chest in-drawing (observed in 94.6%), nasal flaring (77.2%), respiratory distress (63.8%), and grunting (45.5%) are consistent with the WHO classification of severe pneumonia [1].

Also, 17.1% of patients with severe pneumonia presented with concomitant protein energy malnutrition (marasmus). Similar results were reported among Thai population [4].

All patients included in the study were managed according to the WHO guidelines for the management of severe pneumonia. Therefore, all patients received antibiotics with the presumption that bacterial aetiology is the main cause of pneumonia in young children. Salih et al [12] and Herman et al [13] investigated the aetiology of pneumonia in Sudanese children and concluded that although bacteria constitute the main causative agent of pneumonia, other organisms namely viruses and Chlamydia contribute to the aetiology of pneumonia in this population. In the present study 204 out of the 224 (91%) patients recovered completely after emergency-care management (including antibiotics). Of the 9 children who did not survive, 6 received breast feeding for less than one year and all 9 were under two years of age. This is in agreement with other studies [9]. A recently published randomised equivalency trial [11] concluded that the outcome of patients with pneumonia management at a hospital setting and at domiciliary settings were equivalent in both morbidity and mortality, given that correct antibiotic management is used.

In conclusion, severe pneumonia is the major killer of children less than 2 years of age. The characteristic factors shared in the present study group are low socioeconomic status, presence of tobacco smoke at home and presence of protein energy malnutrition. More research needs to be conducted on this regard, for better establishment of incidence and

presentation of pneumonia in Sudan. Through this paper, it is clear that the WHO guidelines for management of pneumonia, when applied correctly, can drastically decrease morbidity and mortality of severe pneumonia. The next goal would be to improve these guidelines, so as to detect co-

morbidity with pneumonia at an earlier stage.

## REFERENCES

1. Pneumonia: The forgotten killer of children. WHO, UNICEF. September 2006.
2. Kenneth M. Community-Acquired Pneumonia in Children. *N Engl J Med* Feb 2002; 346: 429-437.
3. Severe pneumonia in children: causes, diagnosis, and treatment: are you prepared for community-acquired MRSA? *Journal of Respiratory Diseases* 2008.
4. Suwanjutha S, Ruangkanchanasetr S, Chantarojanasiri T, Hotrakitya S. Risk factors associated with morbidity and mortality of pneumonia in Thai children under 5 years. *Southeast Asian J Trop Med Public Health*. 1994 Mar; 25(1): 60-6.
5. Tiewsoh K, Lodha R, Pandey RM, Broor S, Kalaivani M, Kabra SK. Factors determining the outcome of children hospitalized with severe pneumonia. *BMC Pediatr* 2009 Feb 23; 9:15.
6. Hassan MK, Al-Sadoon I. Risk factors for severe pneumonia in children in Basrah. *Trop Doct*. 2001 Jul; 31(3):139-41.
7. Puchalski Ritchie LM, Howie SR, Arenovich T, Cheung YB, Weber M, Moore S, et al. . Long-term morbidity from severe pneumonia in early childhood in The Gambia, West Africa: a follow-up study. *Trop Doct*. 2001 ; 31(3): 139-41.
8. Stephen MG, Mike E, Tabish H, Penny E, Trevor D. Challenges to improving case management of childhood pneumonia at health facilities in resource-limited settings. *Bull World Health Organ*. 2008 ; 86(5): 349-55.
9. Forman MR, Guptill KS, Chang DN, Sarov, B, Berendes HW, Naggan L, et al. Under nutrition among Bedouin Arab infants: the Bedouin infant feeding study. *Am J Clin Nutr* 1990; 343 – 349.
10. James D, Heffe L, Gebrian B, Bordeau R, Schwartz B, Dowell SF. Evaluation of children with recurrent pneumonia diagnosed by WHO criteria. *Pediatr Infect Dis J* 2002; 21: 108 – 12.
11. Tabish H, LeAnne MF, Yasir Bin-Nisar, Matthew PF, Yusra PA, William BM, et al. Ambulatory short-course high-dose oral amoxicillin for treatment of severe pneumonia in children: a randomised equivalency trialOriginal Text. *Lancet* 2008 Jan 5; 371(9606): 49-56.
12. Salih MAM, Herrmann B, Grandien M, El Hag MM, Yousif BE, Abdelbagi M, et al. Viral pathogens and clinical manifestations associated with acute lower respiratory tract infections in children of the Sudan. *Clinical and Diagnostic Virology* 1994; 2:201-209.
13. Herrmann B, Salih MAM, Yousif BE, Abdelwahab O, Mardh PA. Chlamydial etiology of acute respiratory tract infections in children in Sudan. *Acta Paediatr* 1994; 83:169-72.