

A STUDY OF RISK FACTORS FOR ACUTE LOWER RESPIRATORY TRACT INFECTION AND THEIR EFFECT ON OUTCOME IN CHILDREN AGED 1 MONTH TO 5 YEARS

Maddi Prakash Kumar¹, Chinnatambi Narayanan Mohan Chandran², Duggirala Manikyamba³, Amujuri Krishna Prasad⁴, G. Raja Sekhar Reddy⁵

¹Assistant Professor, Department of Paediatrics, Rangaraya Medical College, Kakinada.

²Associate Professor, Department of Paediatrics, Rangaraya Medical College, Kakinada.

³Professor & HOD, Department of Paediatrics, Rangaraya Medical College, Kakinada.

⁴Associate Professor, Department of Paediatrics, Rangaraya Medical College, Kakinada.

⁵Junior Resident, Department of Paediatrics, Rangaraya Medical College, Kakinada.

ABSTRACT

BACKGROUND

Acute Lower Respiratory Infection (ALRI) is a leading cause of morbidity and mortality in under five children in developing countries. There is a need to explore the association between easily modifiable risk factors and occurrence of ALRI in developing countries to bring down the incidence of ALRI. This study is taken up to identify the various risk factors for acute lower respiratory tract infection and their effect on severity and outcome in under five children.

METHODS

A total of 275 children of age group 1 month to 5 years were studied for various risk factors. Severity of pneumonia and duration of hospital stay were noted in each case.

RESULTS

The significant risk factors for children with pneumonia for very severe pneumonia and prolonged hospital stay were age <12 months, overcrowding, low socioeconomic status, use of cow dung/mud flooring, biomass fuel usage, passive smoking, LBW, partial breast feeding and no breast feeding, partial immunization, PEM and anaemia.

CONCLUSION

The present study identified many modifiable risk factors for ALRI, which had significant effect on outcome. These risk factors can be tackled through effective health education of the community and appropriate initiatives taken by the government.

KEYWORDS

ALRI, Risk Factors, Pneumonia, PEM, Anaemia.

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INTRODUCTION

Acute respiratory infections account for 20% to 40% of the children attending outpatient clinics and 12% to 35% of admissions of children into hospitals. India with 20.3% of under five deaths caused by pneumonia, i.e. 0.371 million deaths, tops the list and contributes 23.5% of all pneumonia deaths in the world.¹ There is a need to explore the association between easily modifiable risk factors and occurrence of ALRI in developing countries to bring down the incidence of ALRI. Existing studies focused on association between these risk factors and ALRI and these are not focused on risk factors and severity of pneumonia. Therefore, we undertook this study to identify the various risk factors for acute lower respiratory tract infection and their effect on severity and outcome in under five children.

METHODOLOGY

The present study is a hospital-based prospective observational study, which was conducted from May 2014 to Oct 2015 at Government General Hospital attached to Rangaraya Medical College, Kakinada. All children in the age group of 1 month to 5 years admitted in paediatric wards and ICU with acute lower respiratory tract infection during study period were enrolled in the study. The WHO definition of ALRI was used and all cases are graded into severe and very severe pneumonia. Children with clinical diagnosis of bronchial asthma, tuberculosis and any underlying chronic illnesses were excluded from the study.

A predesigned proforma was used to record the details of enrolled children. A detailed history was taken and physical examination was done to elicit various potential risk factors. Age of the child was recorded in completed months. A detailed history of relevant symptoms like fever, cough, rapid breathing, chest retraction, refusal of feeds, lethargy, wheezing, etc. was taken. History of upper respiratory infection in mother and siblings and family history of respiratory tract infection were also obtained. History of breastfeeding was recorded. History of smoking by various family members and details of cooking fuel used was recorded. Details of the housing conditions were also obtained.

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Corresponding Author:

Dr. G. Raja Sekhar Reddy,

Junior Resident,

Department of Paediatrics,

Rangaraya Medical College,

Kakinada.

E-mail: rajasekhar.gogireddy@gmail.com

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Overcrowding is noted if following are present (>6 people in house/>4 children (<15 years)/>2 people sharing bed room/>2 people per room). Socioeconomic status grading was done according to modified Kuppuswamy's classification.

A detailed examination of each child was done. Respiratory rate and heart rate were recorded for one minute, when the child was quiet. A detailed anthropometry was taken and malnutrition was graded according to Indian Academy of Paediatrics classification. Severity of respiratory distress was assessed in each child. Anaemia and signs of vitamin deficiencies were recorded. Haemoglobin estimation and CXR were done in all cases and other investigations were done as per requirement of individual cases. Treatment was given, clinical recovery and duration of hospital stay were noted in each case. Hospitalization for more than seven days was considered as prolonged hospital stay.

Data was recorded on a predesigned proforma and managed on Excel spread sheet. Chi square test and Fisher's exact test were used to study the association between the risk factors and outcome (Severity of pneumonia and prolonged hospital stay). 'P' value <0.05 was taken as significant.

RESULTS

Only children with severe and very severe pneumonia were included in the study, as only these children were admitted in hospital. A total of 275 children were enrolled in this study, of which 194 (70.5%) were admitted with severe pneumonia and 81 (29.5%) with very severe pneumonia. In the study population, 170 (61.8%) children with pneumonia were 1-12 months and 105 (38.2%) were 13-60 months of age. ALRI was more common among infants [Table 1].

Risk Factor		Admitted with ALRI n	Severe Pneumonia n (%)	Very Severe Pneumonia n (%)	>7 Days of Hospital Stay n (%)	Mean Duration of Hospital Stay
AGE	1-12 m	170	110 (64.7%)	60 (35.3%)	92 (54.1%)	9.8 days
	13-36 m	88	71 (80.7%)	17 (19.3%)	48 (54.5%)	9.2 days
	37-60 m	17	13 (76.5%)	4 (23.5%)	7 (41.2%)	10.2 days
	P Value		P=0.024		P=0.57	
GENDER	Male	171	120 (70.2%)	51 (29.8%)	92 (53.8%)	9.64 days
	Female	104	74 (71.2%)	30 (28.8%)	55 (52.9%)	9.63 days
	P Value		P=0.89		P=0.88	
Total		275	194 (70.5%)	81 (29.5%)	147 (53.4%)	9.64 days

Table 1: Demographic Profile of Children with Pneumonia

Among socioeconomic variables, 216 (78.5%) children with pneumonia were living in overcrowded houses; 32.5% and 57.9% of children with overcrowding in their houses had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant [Table 2].

Risk Factor		Admitted with ALRI n	Severe Pneumonia n (%)	Very Severe Pneumonia n (%)	>7 Days of Hospital Stay n (%)	Mean Duration of Hospital Stay
Mother's literacy	Illiterate	77	55 (71.4%)	22 (28.6%)	46 (59.3%)	10.3 days
	Literate	179	127 (70.9%)	52 (29.1%)	89 (49.7%)	9.25 days
	P Value			P=0.54	P=0.34	
Overcrowding	Present	216	146 (67.5%)	70 (32.5%)	125 (57.9%)	9.78 days
	Absent	59	48 (81.3%)	11 (18.7%)	22 (37.3%)	9.07 days
	P value			P=0.039	P=0.004	
Socioeconomic class	Lower middle	61	44 (72.1%)	17 (27.9%)	25 (40.9%)	9.5 days
	Upper lower	142	119 (83.8%)	23 (16.2%)	71 (50%)	9.66 days
	Lower	72	31 (43.1%)	41 (56.9%)	52 (72.2%)	10 days
	P value			P=0.00001	P=0.0006	

Table 2: Socioeconomic Variables in Children with Pneumonia

Among environmental variables, 55.3% and 68.5% of children with mud/cow dung flooring in their house had very severe pneumonia and prolonged hospital stay, which was statistically significant; 172 (62.5%) children with pneumonia lived in households using cooking fuel other than LPG; 33.7% and 62.2% of children lived in households using cooking fuel other than LPG had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant; 154 (56%) of children with pneumonia had smokers in the household; 34.4% and 59.1% children with smokers in the household had significant risk for very severe pneumonia and prolonged hospital stay respectively, which was statistically significant [Table 3].

Risk Factor		Admitted with ALRI n	Severe Pneumonia n (%)	Very Severe Pneumonia n (%)	>7 Days of Hospital Stay n (%)	Mean Duration of Hospital Stay
Type of floor	Mud/Cow dung	38	17 (44.7%)	21 (55.3%)	26 (68.5%)	10.8 days
	Cement/Tiles	237	178 (75.1%)	59 (24.9%)	121 (51.1%)	9.57 days
	P value			P =0.001	P =0.03	
Type of fuel used	Firewood	172	114 (66.3%)	58 (33.7%)	107 (62.2%)	10.3 days
	LPG	159	122 (76.7%)	37 (23.3%)	59 (37.1%)	8 days
	P value			P =0.039	P=0.0004	
Family H/o smoking	Smokers in house	154	101 (65.6%)	53 (34.4%)	91 (59.1%)	9.6 days
	Not present	121	93 (76.9%)	28 (23.1%)	56 (46.3%)	8.9 days
	P value			P =0.04	P =0.03	

Table 3: Environmental Variables in Children with Pneumonia

Among nutritional variables 87.5% and 87.5% of children who were not breastfed had very severe pneumonia and prolonged hospital stay respectively which was statistically significant; 59.3% and 81.5% of children with LBW had very severe pneumonia and prolonged hospital stay respectively which was statistically significant; 46.4% and 75.6% of children with incomplete immunization status had very severe pneumonia and prolonged hospital stay respectively which was statistically significant; 60.8% and 76.5% of Grade III and Grade IV PEM children with pneumonia had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant; 51.5% and 90.9% of anaemic children with pneumonia had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant [Table 4].

Risk Factor		Admitted with ALRI n	Severe Pneumonia n (%)	Very Severe Pneumonia n (%)	>7 Days of Hospital Stay n (%)	Mean Duration of Hospital Stay
Birth weight	NBW	248	183 (73.8%)	65 (26.2%)	125 (50.4%)	9.13 days
	LBW	27	11 (40.7%)	16 (59.3%)	22 (81.5%)	11.05 days
	P value			P =0.0003	P =0.002	
Breast feeding	EBF	192	163 (84.9%)	29 (15.1%)	86 (44.8%)	8.5 days
	Partial	67	29 (43.3%)	38 (56.7%)	47 (70.1%)	9.7 days
	Never	16	2 (12.5%)	14 (87.5%)	14 (87.5%)	12.1 days
	P Value			P=0.000001	P =0.00003	
Immunization	Complete	234	172 (73.5%)	62 (26.5%)	116 (49.6%)	9.18 days
	Incomplete	41	22 (53.6%)	19 (46.4%)	31 (75.6%)	10.15 days
	P value		P =0.01	P =0.002		
PEM	Absent	103	89 (86.4%)	14 (13.6%)	41 (39.8%)	8.74 days
	Grade I + II	121	85 (70.2%)	36 (29.8%)	67 (55.4%)	9.27 days
	Grade III + IV	51	20 (39.2%)	31 (60.8%)	39 (76.5%)	11.54 days
	P value			P =0.00001	P =0.00008	
Anaemia (WHO Grading)	Mild (10-11)	68	56 (82.4%)	12 (17.6%)	32 (47.1%)	8.4 days
	Moderate (7-10)	165	113 (68.5%)	52 (31.5%)	82 (49.7%)	9.5 days
	Severe(<7)	33	16 (48.5%)	17 (51.5%)	30 (90.9%)	12.31 days
	P Value			P =0.0009	P =0.006	

Table 4: Nutritional Variables in Children with Pneumonia

DISCUSSION

In the present study, ALRI was more common among infants (61.8%). Severity of Pneumonia was found to be decreasing with increasing age. Sehgal V et al.² N Deivanayagam et al. and Anil Kumar et al.³ also documented an inverse relationship between ALRI mortality and age. A large number of studies have shown that the incidence of viral respiratory illness peaks in infancy and steadily reduces with age. Hence, children below 1 year of age have high risk for severe ALRI and this group is to be targeted for early referral and intervention. This increased risk in infants is probably due to degradation of maternal antibodies, immaturity of adaptive immune system and cessation of breastfeeding. There is no statistically significant difference in incidence of very severe pneumonia or duration of hospital stay in males and females. Similar results were found by Anil Kumar et al.³

There was no statistically significant difference in the incidence of very severe pneumonia or duration of hospital stay in children of illiterate or literate mothers. But mean duration of hospital stay was more in children of illiterate mothers (10.32 days). Victoria et al. also reported that strong association between lack of parental education and risk of death from ALRI.⁴

In the present study, 32.5% and 57.9% of children with overcrowding in their houses had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Ibrahim et al.⁵ and Mirji et al.⁶ observed that LRTI risk were found to be 1.47 and 4 fold increased when the number of people who live in the same room was >3.

So improvement in household ventilation might decrease incidence and severity of ALRI.

In the present study, 56.9% and 72.2% of children with pneumonia belonging to lower socioeconomic class had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Similar results were found by Tupasi et al. Lower social status is associated with crowded living conditions, higher smoking rates, potential for nutritional deficit and exposure to environmental pollutants. These factors may contribute to increase susceptibility to respiratory infections in these groups.

In the present study, 55.3% and 68.5% of children with mud/cow dung flooring in their house had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Similar results were found by MR Savitha et al.⁷ Cracks and crevices which are common in these types of floors lead to breeding of insects and harbourage of dust.

In this study, 33.7% and 62.2% of children lived in households using cooking fuel other than LPG had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. The use of biomass fuels as the primary cooking fuel has been found by several studies to be associated with the risk of ALRI with odds ratios ranging from 2 to 4 (Murray et al.⁸ Broor et al.⁹ Smith et al.¹⁰ and Shah N et al.¹¹). Johnson AW and Aderele WI found that children with ALRI who came from homes that burnt wood were 12.2 times ($p < 0.0005$) more likely to die than those coming from homes using kerosene or gas. In the present study, wood was used as a cooking fuel in almost all houses. These fuels are typically burnt in simple stoves with incomplete combustion and generate a lot of toxic products that adversely affect specific and nonspecific local defences of the respiratory tract.¹⁰

In this study, 34.4% and 59.1% children with smokers in the household had significant risk for very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Similar results were found by Dharmage et al.¹² and Shah N et al.¹¹ Environmental Tobacco Smoke (ETS) is another indoor pollutant that reduces local defense mechanisms and predisposes children to respiratory illness.¹⁰

59.3% and 81.5% of children with LBW had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Dharmage et al.¹² and Victoria CG et al.⁴ reported an association between LBW and severe ALRI.

87.5% and 87.5% of children who were not breastfed had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. So measures to improve exclusive breastfeeding rate for the first six months is required. Victoria CG et al.⁴ study on ALRI specific mortality reported that relative to breastfed infants, those who also received artificial milk had 1.6 times and non-breastfed infants had 3.6 times risk of death due to ALRI. Breast milk in addition to passive protection seems to affect the infant's systemic immune response via multiple ways (Maturational, antiinflammatory, immune modulatory and antimicrobial).¹³

46.4% and 75.6% of children with incomplete immunization status had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Ibrahim et al.⁵ found that 1.69 fold increased risk of LRTI in patients with incomplete vaccination.

This is probably because mothers utilizing immunization services are better aware of health care facilities.

In this study, 60.8% and 76.5% of Grade III and Grade IV PEM children with pneumonia had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Arpitha G et al.¹⁴ showed that severity of pneumonia increased with increasing severity of malnutrition being 40% in not significant malnutrition to 63% in significant malnutrition. It is well known that malnourished children have defective cell mediated immunity.

In this study, 51.5% and 90.9% of anaemic children with pneumonia had very severe pneumonia and prolonged hospital stay respectively, which was statistically significant. Karalanglin et al.¹⁵ and Anil Kumar et al.³ had identified anaemia as a significant risk factor increasing mortality from pneumonia by 10.88 times and 5.4 times respectively. So, prevention of anaemia will reduce the incidence and severity of pneumonia.

CONCLUSIONS

The present study identified many modifiable risk factors for ALRI, which had significant effect on outcome. The significant risk factors for children with pneumonia for very severe pneumonia and prolonged hospital stay were age <12 months, maternal illiteracy, overcrowding, low socioeconomic status, use of mud/cow dung flooring, biomass fuel usage, passive smoking, LBW, partial breast feeding and no breast feeding, partial immunization, PEM and anaemia. These risk factors can be tackled through effective health education of the community and appropriate initiatives taken by the government leading to healthy community and a healthy nation as a whole. The results of this study contribute favourably to the primary prevention and promotion of health aimed at acting more efficiently on the risk factors related to the health-disease process.

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