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Original Research Paper

EVALUATING THE RISK FACTORS FOR ACUTE LOWER RESPIRATORY TRACT INFECTION IN CHILDREN OF 0-5 YEARS OF AGE

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ABSTRACT

Background: ALRTI (acute lower respiratory tract infection) is the major cause of mortality in children 0-5 years of age. The burden of ALRTI can be markedly reduced by identifying the modifiable risk factors for severe ALRTI.

Aim: The present study aimed to assess the risk factors for acute lower respiratory tract infection in children 0-5 years of age.

Methods: The present study utilized the case definition of ALRTI given by WHO (World Health Organization). The study included subjects with ALRTI and subjects visiting the Outpatient Department of Pediatrics for immunization served as controls. A preformed structured proforma was used to record the potential risk factors in cases and controls.

Results: The present study assessed 256 children with 101 cases and 155 control subjects. It was seen that family history of ALRTI, inappropriate immunization age, cooking on other mediums than LPG, severe malnutrition, upper respiratory tract infection in siblings, and lack of breastfeeding were significant risk factors for ALRTI with OR of 5.13, 2.83, 2.3, 1.83, 24.93, and 6.51 respectively. Non-significant risk factors for ALRTI are housing type, inadequate caloric intake, anemia, number of children at home, education of the parents, age of the parents, and gender of the child.

Conclusions: The present study concludes that family history of ALRTI, inappropriate immunization age, cooking on other mediums than LPG, severe malnutrition, upper respiratory tract infection in siblings, and lack of breastfeeding were significant risk factors for ALRTI and should be monitored.

Keywords: Breastfeeding, malnutrition, passive smoking, pneumonia, respiratory tract infection.

INTRODUCTION

ALRTI or acute lower respiratory tract infection is the major cause of mortality in children under five years of age. It has been considered the lead cause of death globally with a higher incidence being reported in subjects from developing nations including in India.[1] In a literature review for assessment of the epidemiology of acute lower respiratory tract infection in developing nations, the risk factors identified for acute lower respiratory tract infection included passive smoking, lack of breastfeeding, vitamin A deficiency, malnutrition, and low birth weight that was further confirmed by other literature studies.[2]

The existing and recent literature data further added other risk factors to the list of already included risk factors such as non-allopathic management in the initial stage of acute lower respiratory tract infection, air pollution, young age, crowding, advanced birth order, family history of bronchitis, large family size, and poor socioeconomic status.[3,4]

Other recent literature studies have put forward the strong role of indoor air pollution as one of the leading risk factors affecting children with acute lower respiratory tract infections. Various risk factors being mentioned are modifiable and can be corrected. Modification of these factors can further help in decreasing the alarming and very high burden of acute lower respiratory tract infections affecting children globally.[5,6] Hence, the present study was done to assess the risk factors for acute lower respiratory tract infection in children under five years of age.

MATERIALS AND METHODS

The present prospective clinical study was aimed to assess the risk factors for acute lower respiratory tract infection in children 0-5 years of age. The study was done at Department of Pediatrics, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh. The study subjects were from the Department of Pediatrics of the Institute. Verbal and written informed consent was taken from the parents of all the participants before study participation.

The study included children admitted to the Institute with severe ALRTI (acute lower respiratory tract infection) with no underlying chronic disease where acute respiratory tract infection was defined as the presence of cough with or without fever for less than two weeks. Severe ALRTI was defined as lower chest in-drawing presence with a respiratory rate of >60 per minute, >50 per minute, and >40 per minute in infants less than 2 months, 3-12 months, and 13-60 months of age. The study also included controls that were healthy children of <5 years of age who attended the Outpatient Department of Pediatrics for immunization.

In both control and case subjects, clinical review was done including the comprehensive history taking and physical examination done to assess different potential risk factors that were noted in a preformed structured proforma. The age of the children was noted in completed months, whereas, the age of the parents was noted in years completed. Father's and mother's education was noted as years of education. The parents were noted as illiterate if they were not able to read or write. For assessment, the age of the parents and children were categorized as <25 or >25 years for the mother, <30 or >30 for the father, and <1 or >1 year for the child. Immunization

history and schedule were noted to check if the child was completely immunized when they received all vaccination doses following the National Immunization Schedule for his/her age.[7]

The details of the cooking fuel being used and the smoking history of the family members were noted and recorded. Also, the history of upper respiratory tract infection in the father, mother, grandparents, and siblings in the past two weeks along with the family history of bronchitis or pneumonia in the study subjects was assessed and noted. The information concerning the housing type as cemented or thatched was also noted by the parents of all the study subjects.

Age for the introduction of the supplementary feeding and breastfeeding history was also recorded for all the subjects. To assess the caloric intake in the child, food items given to the child regularly were recorded before the current illness by recall of the parents. Also, the children were assessed for the presence of pallor that was graded as suffering from severe anemia when the color of the creases in the palm was similar to the remaining palm color.[8]

The infantometer was used for assessment of the length of the child to the nearest millimeter till two years of age and after two years, the height was assessed after making the child stand on the stadiometer. To assess the weight of the child, a beam type of weighing scale was used, and the weight was noted to the nearest 100 grams. To assess the malnutrition severity, age-independent criteria were used in the form of weight ratio in kilograms multiplied by 100, and height or length in cm2 was assessed. The ratio of >0.14 was taken as normal or mild malnutrition, whereas, a ratio of <or =0.14 was taken as severe malnutrition.[9]

The data gathered were analyzed statistically using the SPSS software version 21.0 (IBM Corp., Armonk, NY, USA) and the chi-square test. The data were expressed as mean and standard deviation and frequency and percentage. Statistical significance was kept at a p-value of <0.05.

RESULTS

The present prospective clinical study was aimed to assess the risk factors for acute lower respiratory tract infection in children under five years of age. The study included children admitted to the Institute with severe ALRTI (acute lower respiratory tract infection) with no underlying chronic disease. There were 101 children with ALRTI and 155 controls. There were higher numbers of males compared to females in study subjects as well as controls with statistically significant differences with p=0.02. The age between the two groups was comparable with p=0.25 Concerning the father's and mother's education, the difference in the two groups was statistically significant with p=0.000. The age of the father was comparable (p=0.13), whereas, mothers of age <=25 were significantly higher in the ALRTI group compared to >25 years in controls with p=0.01. Subjects with ALRTI had significantly higher children at home that were >=2 compared to controls (p=0.002). Significantly higher positive LRTI family history was seen in subjects with ALRTI with p=0.000. The history of ALRTI in grandparents was statistically non-significant with p=0.103, whereas, a positive history in siblings showed a significant correlation to ALRTI with p=0.000. URTI in the father had no significant correlation, whereas, URTI in the mother showed a significant correlation to ALRTI with p=0.005. Also, a statistically

significant correlation was seen in ALRTI and subjects where immunization was not completed by age with p=0.000 (Table 1).

On assessing the correlation of nutritional factors and ALRTI in study subjects, it was seen that ALRTI was higher in subjects with inadequate caloric intake compared to subjects with adequate caloric intake with p=0.01. Also, ALRTI was significantly higher in subjects with severe malnutrition with p=0.000. ALRTI was significantly higher in subjects who had no breastfeeding with 0.000. Subjects with severe pallor had a higher incidence of ALRTI compared to controls that had fewer subjects with pallor with p=0.000 as shown in Table 2.

The study results showed that for the correlation of environmental factors and ALRTI in study subjects, it was seen that the smoking of grandparents had no significant effect on ALRTI in study subjects with p=0.07. Similar results were seen for the smoking of the father and mother which had no significant effect on the ALRTI incidence with p=0.25 and 0.31 respectively. Housing type, thatched had a significantly higher number of subjects with ALRTI compared to controls, where cemented housing type was higher in the control group with p=0.001. A significantly higher incidence of ALRTI was seen in subjects that used cooking fuel other than LPG with p=0.007 as summarized in Table 3.

Concerning the risk factors for ALRTI in study subjects, it was seen that the risk factors found associated with ALRTI were family history of LRTI, inappropriate immunization, severe malnutrition, no breastfeeding or for <4 months, URTI in siblings, mothers with history of URTI, and use of cooking fuel other than LPG with adjusted odd's ratio of 5.13, 2.83, 1.83, 1.62, 24.05, 6.51, and 2.49 respectively. 95% CI (confidence interval) was 2.98-8.80, 1.57-4.98, 1.12-2.98, 1.21-2.15, 7.6-74.2, 2.71-15.59, and 1.49-4.14 respectively. The respective p-values were 0.000,0.000, 0.01, 0.001, 0.000, 0.000, and 0.000 respectively (Table 4).

DISCUSSION

The study included children admitted to the Institute with severe ALRTI (acute lower respiratory tract infection) with no underlying chronic disease. There were 101 children with ALRTI and 155 controls. There were higher numbers of males compared to females in study subjects as well as controls with a statistically significant difference with p=0.02. The age between the two groups was comparable with p=0.25 Concerning the father's and mother's education, the difference in the two groups was statistically significant with p=0.000. The age of the father was comparable (p=0.13), whereas, mothers of age <=25 were significantly higher in the ALRTI group compared to >25 years in controls with p=0.01. Subjects with ALRTI had significantly higher children at home that were >=2 compared to controls (p=0.002). Significantly higher positive LRTI family history was seen in subjects with ALRTI with p=0.000. The history of ALRTI in grandparents was statistically non-significant with p=0.103, whereas, a positive history in siblings showed a significant correlation to ALRTI with p=0.000. URTI in the father had no significant correlation, whereas, URTI in the mother showed a significant correlation to ALRTI with p=0.005. Also, a statistically significant correlation was seen in ALRTI and subjects where immunization was not completed by age with p=0.000. These data were similar to the studies of Jackson S et al[10] in

2013 and Arun A et al[11] in 2014 where authors assessed subjects with demographic data comparable to the present study in their respective studies.

It was seen that on assessing the correlation of nutritional factors and ALRTI in study subjects, it was seen that ALRTI was higher in subjects with inadequate caloric intake compared to subjects with adequate caloric intake with p=0.01. Also, ALRTI was significantly higher in subjects with severe malnutrition with p=0.000. ALRTI was significantly higher in subjects who had no breastfeeding with 0.000. Subjects with severe pallor had a higher incidence of ALRTI compared to controls that had fewer subjects with pallor with p=0.000. These results were consistent with the studies of Schlaudekar EP et al[12] in 2011 and Tazinya AA et al[13] in 2018 where authors reported a similar correlation between nutritional factors and ALRTI in their study subjects as seen in the present study.

For the correlation of environmental factors and ALRTI in study subjects, it was seen that the smoking of grandparents had no significant effect on ALRTI in study subjects with p=0.07. Similar results were seen for the smoking of the father and mother which had no significant effect on the ALRTI incidence with p=0.25 and 0.31 respectively. Housing type, thatched had a significantly higher number of subjects with ALRTI compared to controls, where cemented housing type was higher in the control group with p=0.001. A significantly higher incidence of ALRTI was seen in subjects that used cooking fuel other than LPG with p=0.007. These results were in agreement with the findings of Zou S et al[14] in 2021 and Banda B et al[15] in 2016 where a comparable correlation is being reported by the authors for ALRTI and environmental factors as reported in the results of this study.

The study results showed that concerning the risk factors for ALRTI in study subjects, it was seen that the risk factors found associated with ALRTI were family history of LRTI, inappropriate immunization, severe malnutrition, no breastfeeding or for <4 months, URTI in siblings, mothers with a history of URTI, and use of cooking fuel other than LPG with adjusted odd's ratio of 5.13, 2.83, 1.83, 1.62, 24.05, 6.51, and 2.49 respectively. 95% CI (confidence interval) was 2.98-8.80, 1.57-4.98, 1.12-2.98, 1.21-2.15, 7.6-74.2, 2.71-15.59, and 1.49-4.14 respectively. The respective p-values were 0.000,0.000, 0.01, 0.001, 0.000, 0.000, and 0.000 respectively. These findings were in line with the results of Cardoso AM et al[16] in 2013 and Kerai S et al[17] in 2019 where risk factors similar to the present study findings were reported by the authors in their studies concerning ALRTI in children aged <5 years.

CONCLUSIONS

Within its limitations, the present study concludes that family history of ALRTI, inappropriate immunization age, cooking on other mediums than LPG, severe malnutrition, upper respiratory tract infection in siblings, and lack of breastfeeding were significant risk factors for ALRTI and should be monitored. However, further longitudinal studies in the future are warranted with a larger sample size and longer monitoring period.

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TABLES

Variables	**ALRTI**				**OR**	**95% CI**	**p-value**
	Yes (n=101)	**%**	**No (n=155)**	**%**			
Gender							
Females	27	26.73	56	36.12	0.8	1.00-2.22	**0.02**
Males	74	73.26	99	63.87	1.49		
Age (months)							
<=12	63	62.37	104	67.09	0.79	0.54-1.15	0.25
>12	38	37.62	51	32.90	0.8		
Father's education							
Illiterate	18	17.82	9	5.80	3.53	1.92-6.51	**0.000**
=10 years	32	31.68	48	30.96	1.28	0.85-1.91	
>10 years	51	50.49	98	63.22	63.1		
Mother's education							
Illiterate	35	34.65	31	20	2.80	1.79-4.36	**0.000**
=10 years	31	30.69	38	24.51	1.90	1.22-2.94	
>10 years	35	34.65	86	55.48	0.8		
Father's age (years)							
<=30	68	67.32	96	61.93	1.29	0.88-1.89	0.13
>30	33	32.67	59	38.06	0.8		
Mother's age							
<=25	61	60.39	71	45.80	1.75	1.21-2.52	**0.01**
>25	40	39.60	84	54.19	0.8		
Children number							
<2	39	38.61	16	10.32	1.76	1.19-2.59	**0.002**
>=2	61	60.39	139	89.67	0.8		
LRTI family history							
Positive	19	18.81	33	21.29	2.75	1.86-4.07	**0.000**
Negative	82	81.18	122	78.70	0.8		

Grandparents							
Yes	2	1.98	1	0.64	6.27	0.67-56.70	0.103
No	99	98.01	152	98.06	0.8		
Siblings							
Yes	20	19.80	2	1.29	18.45	6.46-52.59	**0.000**
No	81	80.19	153	98.70	0.8		
Father URTI							
Yes	1	0.99	2	1.29	3.16	0.92-16.68	0.07
No	100	99	153	98.70	0.8		
Mother URTI							
Yes	18	17.82	4	2.58	7.30	3.42-15.55	**0.005**
No	83	82.17	151	97.41	0.8		
Immunization							
Completed by age	30	29.70	79	50.96	0.39	0.26-0.57	**0.000**
Incomplete by age	71	70.29	76	49.03	0.8		

Table 1: Relationship between demographic data and ALRTI in study subjects

Variables	**ALRTI**				**p-value**
	Yes (n=101)	**Yes (%)**	**No (n=155)**	**No (%)**	
Caloric intake					
Inadequate	36	35.64	42	27.09	**0.01**
Adequate	75	74.25	113	72.90	
Malnutrition					
Severe	58	57.42	62	40	**0.000**
None/mild	47	46.53	93	60	
Breastfeeding					
None	28	27.72	21	13.54	**0.000**
<4 months	50	49.50	97	62.58	
>4 months	23	22.77	37	23.87	
Pallor					
Severe	15	14.85	5	3.22	0.16
Mild/None	86	85.14	150	96.77	

Table 2: Correlation of nutritional factors and ALRTI in study subjects

Variables	**ALRTI**				**p-value**
	Yes (n=101)	**Yes (%)**	**No (n=155)**	**No (%)**	
Smoking (grandparents)					
Yes	1	0.99	4	2.58	0.07
No	100	99	151	97.41	
Smoking (Father)					
Yes	32	31.68	42	27.09	0.25
No	69	68.31	113	72.90	
Smoking (Mother)					
Yes	1	0.99	0	0	0.31
No	100	99	155	100	

Housing type					
Thatched	13	12.87	7	4.51	**0.001**
Cemented	88	87.12	148	95.48	
Fuel for cooking					
LPG	64	63.36	123	79.35	**0.007**
Other	37	36.63	32	20.64	

Table 3: Correlation of environmental factors and ALRTI in study subjects

Risk factors	OR (Odds ratio)	95% CI	p-value
Family LRTI history	5.13	2.98-8.80	**0.000**
Inappropriate immunization	2.83	1.57-4.98	**0.000**
Severe malnutrition	1.83	1.12-2.98	**0.01**
No/<4 months breastfeeding	1.62	1.21-2.15	**0.001**
URTI in siblings	24.05	7.6-74.2	**0.000**
Mother with URTI	6.51	2.71-15.59	**0.000**
Cooking fuel other than LPG	2.49	1.49-4.14	**0.000**

Table 4: Risk factors for ALRTI in study subjects