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Original Article

Risk Factors of Community-Acquired Pneumonia Among Under-Five Children in a Tertiary Level Hospital in Rajshahi

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Abstract

Introduction: Community-acquired pneumonia (CAP) top the list of causes of under-five children mortality worldwide. Therefore, properly assessing and controlling these risk factors may help decrease the morbidity and mortality in under-five children suffering from CAP in Bangladesh and thereby help improve the quality of life of our future generation.

Objective: To assess the risk factors of CAP among under-five children (2-59 months) in a tertiary-level hospital in Rajshahi.

Materials and methods: This case-control study was carried out in the Department of Pediatrics and EPI Center of Rajshahi Medical College Hospital, RMCH, from January 2017 to December 2018 to determine the risk factors of CAP among children under five. For this study, 246 children aged two months to 59 months were selected by purposive sampling. One hundred twenty-three were cases that were taken indoors, and 123 were healthy controls taken from the outpatient department & EPI center. After taking written consent from guardians, history was taken, and a physical examination was done. All information was recorded in a predesigned data sheet. The chi-square test and odds ratio were used to demonstrate significance.

Results: Among 246 children, more patients of both groups were male and came from rural areas. Cases were predominantly under 12 months and came from lower socioeconomic status. A statistically significant association was found between social class and CAP (<0.001); the father's literacy was inversely related to CAP (p-value <0.001). Types of housing, living room ventilation, overcrowding, fuel and cookers used for cooking, parental smoking, malnutrition, history of diarrhea and presence of anemia, prematurity, and low birth weight were significantly associated with CAP (p-value <0.05).

Conclusion: Proper assessment of these risk factors and controlling them may help decrease the morbidity and mortality in under-five children suffering from CAP in Bangladesh and thereby help improve the quality of life of our future generation.

Key Words: Under five, Community-acquired pneumonia (CAP) Risk factors.

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Introduction

Worldwide under-five child mortality has decreased, and Bangladesh has made significant progress in decreasing childhood mortality between 1993 and 2017. According to the BDHS, the under-five mortality rate was 46/1000 live births in 2014 and 45/1000 live births in 2017.[1]

CAP has remained at the top of the causes of under-five child mortality.[2] World's 44% of the children under five years live in Bangladesh. The highest incidence rate of CAP for children under -

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five is reported at 0.51 episodes/ child-year in Bangladesh.[3]

Community-acquired pneumonia (CAP) is a lower respiratory tract infection in a child who has not resided in a hospital or health care facility in the preceding 14 days.[4]

A recent meta-analytic systemic review[5] found that low birth weight, undernutrition, household air pollution, human immunodeficiency virus (HIV) infection, non-exclusive breastfeeding, household crowding, and incomplete immunization are significantly associated with respiratory infections.[6]

Hemophilus influenzae type B (Hib) and Streptococcus pneumoniae (SPN) are the two major bacterial causes of childhood CAP. The Bangladesh EPI introduced 10-valent PCV (PCV10) on a 6, 10, and 18-week schedule in March 2015,[7] and the Hib vaccine was introduced in 2009 with significant reductions of both pneumonia and meningitis.[8]

Low birth weight is a risk factor for pneumonia, and death can be preventable during the prenatal period.

Parents' educational level, particularly maternal education, is inversely related to morbidity and mortality from pneumonia in childhood.[9] Educated mothers are presumably more capable of taking care of their children.

There is evidence of a causal relationship between poor socioeconomic conditions and pneumonia, a greater frequency of CAP episodes in children from less privileged backgrounds. Exposure to cigarette smoke due to parental smoking in the first year of life doubles the risk for the infant of an attack of respiratory infections.[10]

Exclusively breastfed child had four times less chance of death from pneumonia than a child who was bottle fed.[11]

So, this study was undertaken to find the risk factors of Community-acquired pneumonia among under-five children (2-59 months children) at Rajshahi Medical College Hospital, Rajshahi. Proper assessment of these risk factors and controlling them may help decrease the morbidity and mortality in under-five children suffering from CAP in Bangladesh and thereby help in improving the quality of life of our future generation.

Materials and Methods

To find out the risk factors associated with CAP, a case-control study was conducted between January 2017 to December 2018 among under-five children (2-59 months) in the Department of Pediatrics and EPI Center of Rajshahi Medical College Hospital, RMCH. A purposive sampling was done on 123 cases and 123 controls. Children suffering from CAP were selected from the inpatient department of Paediatrics of RMCH as cases, while 2-59 months children (not suffering from CAP) were selected from the Paediatrics Out Patient Department & EPI center of RMCH as control. All information, including history, examination findings, and investigation reports, was recorded in a predesigned clinical format. In addition, CBC and chest X-ray were done. Ultimately, data were processed and analyzed by computer using SPSS 16 software.

Results

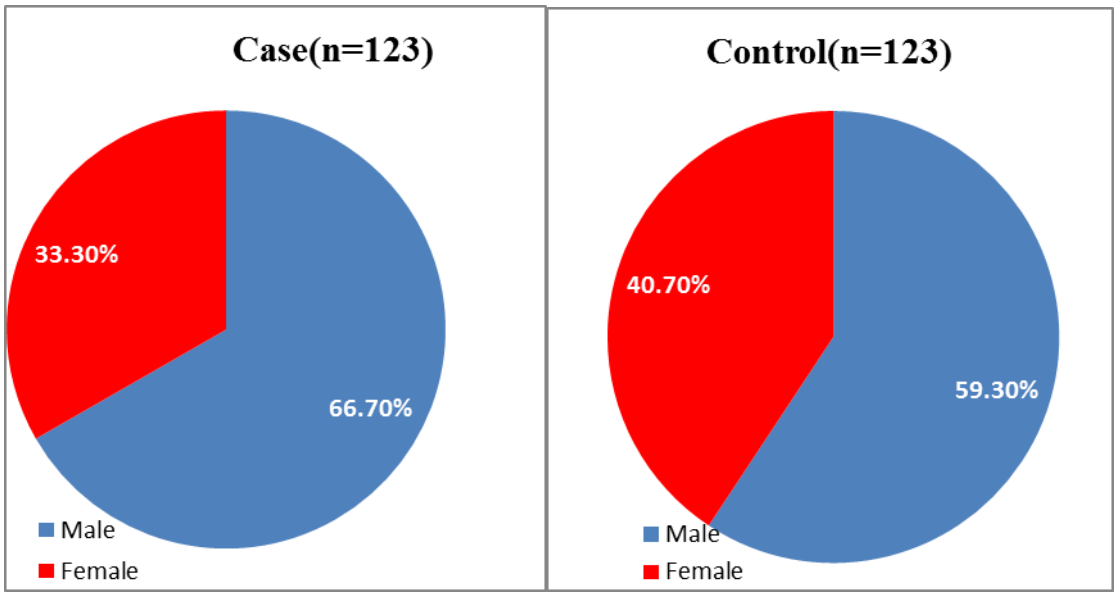

Figure I: Gender distribution of the children (n=123 in each group)

This figure shows that a greater number of patients in both groups were male.

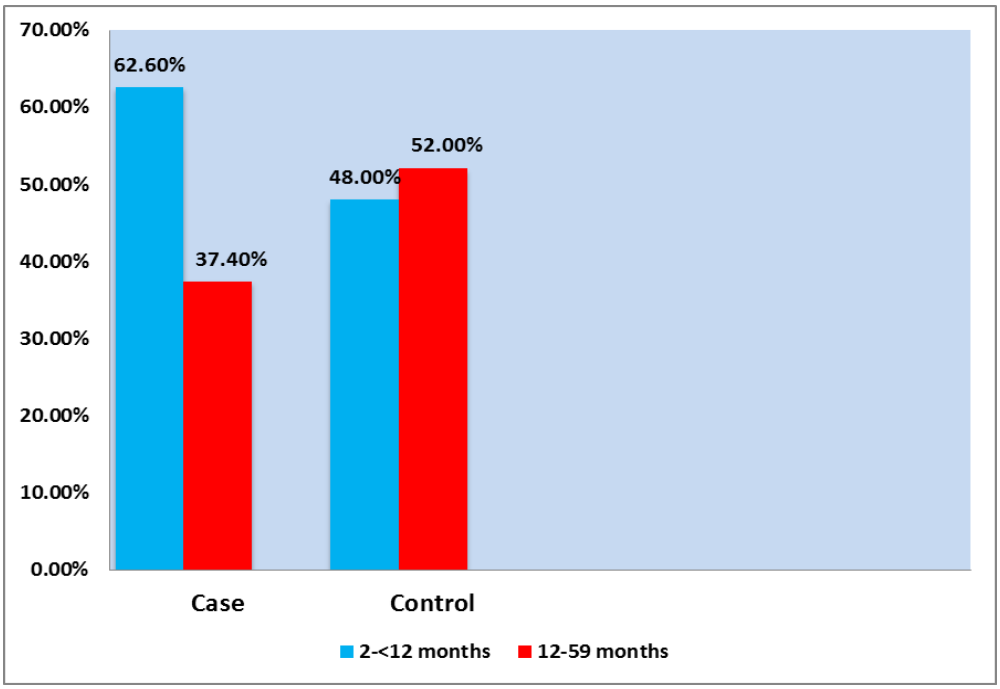

Figure II: Distribution of cases and controls according to age groups (n=123 in each group)

The figure shows that cases were predominant between 2-<12 months of age (62.60%), whereas controls were predominant between 12-59 (52%) months of age.

Table I: Socio-demographic factors of the study population (n=123 in each group)

Variable	Case(n=123)	Control(n=123)	Total	*p*-value
Residence:				
Rural	93(75.60%)	85(69.10%)	178	
Urban	30(24.40%)	38(30.90%)	68	
Socioeconomic status:				x^2 =20.4
Poor	100(81.30%)	67(54.47%)	167(67.89%)	p <0.001,
Lower middle class	17(13.82%)	46(37.40%)	63(25.60%)	
Upper middle class	6(4.88%)	10(8.13%)	16(6.50%)	
Mother's literacy:				x^2=2.87,
Illiterate	55(44.7%)	42(34.1%)	97(39.4%)	*p*>0.05
Literate	68(55.3%)	81(65.9%)	149(60.6%)	(0.09)
Father's literacy				
Illiterate	64(52%)	38(30.9%)	102(41.5%)	x^2=11.322,
Literate	59(48%)	85(69.1%)	144(58.5%)	*p* <0.001
				OR =2.42

The table showed that more patients from both groups came from rural areas. Most cases and controls belonged to the poor class, and the lowest number belonged to the upper middle class. A statistically significant association was found between social class and CAP (<0.001).

Mother's literacy was not significantly associated with CAP (p-value>0.05). However, the father's literacy was inversely related to CAP (p-value <0.001).

Table II: Housing condition of the cases and controls

Variable	Case(n=123)	Control(n=123)	Total(n=246)	p-value
Type of housing:				
Kuchha	59 (47.97%)	87(70.73%)	187(76.02%)	
Semi pucca	53(43.09%)	27(21.95%)	80(32.52%)	x^2= 14.02
Pucca	11(8.94%)	9(7.32%)	20(8.13%)	p <0.01
Ventilation of living room:				
Bad	50(40.7%)	32(26%)	82(33.3%)	x^2 = 5.9
Good	73(59.3%)	91(74%)	164(66.7%)	p <0.05
Overcrowding:				
Yes	82 (66.7%)	62 (50.4%)	144 (58.5%)	x^2 = 6.69
No	41 (33.3%)	61 (49.6%)	102 (41.5%)	p <0.05

Condition of cooker:				
Smoke	100 (81.3%)	80 (65%)	18 0(73.2%)	x^2 = 8.28
Smokeless	23 (18.7%)	43(35%)	66(26.8%)	p <0.01

Types of housing, ventilation of the living room and overcrowding, and types of fuel and cookers used for cooking all had significant associations with CAP.

Table III: Distribution of smoking habits of parents among case and control groups (n=123 in each group)

Parenteral smoking (Only father)	Case(n=123)	Control(n=123)	Total(n=246)	OR	OR
Yes	65(52.8%)	31(25.2%)	96(39%)	x^2=19.748, *p*=<0.001 (0.000)	3.32
No	58(47.2%)	92(74.8%)	150(61%)		

Parental smoking was significantly associated with CAP (p-value <0.001).

Table IV: Nutritional risk factors of the study population (n=123 in each group)

Variable	Case (%)	Control (%)	Total (%)	OR	*p*-value
Malnutrition:					
Yes	98(79.7%)	61(49.6%)	159(64.6%)		x^2=24.346, *p*=<0.001 (0.000)
No	25(20.3%)	62(50.4%)	87(35.4%)	3.9	
Exclusive breastfeeding(EBF):					
No	47(38.2%)	30(24.4%)	77(31.3%)	1.91	x^2=5.463, *p*=<0.05 (0.019)
Yes	76(61.8 %)	93(75.6 %)	169(68.7%)		
Signs of Vitamin A deficiency:					
Yes	01(0.8%)	00(0%)	01(0.4%)		x^2=1, *p*>0.05 (0.31)
No	122(99.2%)	123(100%)	245(99.6%)		
History of diarrhea:					
Yes	26(21.1%)	10(8.1%)	36(14.6%)	3.02	x^2=8.330, p=<0.001 (0.004)
No	97(78.9%)	113(91.9%)	85.4%		

History of Measles:					
Yes	00	00	00		
No	123	123	246		
Anemia:					
Yes	01(0.8%)	00(0%)	01(0.4%)	**1.87**	x^2=5.578,
No	122(99.2%)	123(100%)	245(99.6%)		p<0.05
					(0.018)

Most of the cases were malnourished. In contrast, the majority of controls had normal nutritional status. Malnutrition was significantly associated with CAP (p-value <0.001).

EBF was inversely associated with CAP (p-value <0.05). Only one case (0.8%) had signs of vitamin A deficiency. Vitamin A deficiency was not significantly associated with CAP. History of diarrhea and anemia were significantly associated with CAP (p-value <0.05).

Table V: Distribution of cases and controls according to Gestational Age & Birth Weight

Risk factors		Case(n=123)	Control(n=123)	Total(n=246)	OR
Prematurity	Yes	71(57.7%)	52(42.3%)	123(50%)	1.86
	No	52(42.3%)	71(57.7%)	123(50%)	
Birth Weight of	LBW	72(58.5%)	53(43.1%)	125(50.8%)	1.86
Child	Normal	51(41.5%)	70(56.9%)	121(49.2%)	

Chi-Square =5.87, df = 1, p-value <0.05(0.015)

This table showed that prematurity and low birth weight were significantly associated with CAP

(p value<0.05).

Discussion

An attempt was made to find associations between the occurrence of CAP and its risk factors, particularly in the context of Bangladesh. In this study, poor socioeconomic status and the literacy status of the fathers were found to be highly correlated, although the literacy status of mothers was not found to be related. Tobacco smoking by parents, overcrowding, exposure to cold and humidity, and indoor air pollution were found to be positively related to the occurrence of CAP. Poor nutritional status was found to play an important role, the most significant being the presence of malnutrition, anemia, lack of exclusive breastfeeding, prematurity, and low birth weight. History of diarrhea also was positively associated with the presence of CAP.

In this study,62.60% of children in the case group and 48% in the control group were under 12 months of age. Under 12 months of age was a significant risk for CAP. Studies by Srivastava et al.[12] also found the same association. Amorium et al.[13] found no relationship between age and complicated pneumonia.

In our study, more male (66.7%) children were affected with CAP. This study had similarities with other studies by Chatterjee[14] and Srivastava et al.[12] Amorium et al.[13] found no such association.

In our study, residency in rural areas had no significant role in CAP (p-value>0.05). However,

a study by Rudan et al.[15] found that residency in rural areas was a significant risk factor for complicated pneumonia in childhood.

The study showed that low socioeconomic status was significantly associated (p-value <0.05, OR = 1.95) with CAP. Children from low socioeconomic status with a poor house can also be directly linked to pneumonia because of dampness, lack of ventilation, and large fluctuations of day and night temperature, all of which predispose a child to acute respiratory infections. Socioeconomic status is also an important factor for treatment seeking from qualified doctors. This is also supported by other studies by Foneseca et al.[6] and Azab et al.[16]

Our study did not show any relationship between the education of the mother (p-value>0.05) on the occurrence of CAP in children. While these findings are similar to the study by Fonseca et al.[6]

However, there was a significant association (p-value <0.001, OR = 2.42) between the level of the father's education and the occurrence of CAP in children. This study is co-related with a case-control study by Victoria et al.[17]

In our study, the association between parents' cigarette smoking and CAP was statistically significant (p-value <0.001, OR =3.33). Likewise, Azab et al.[16] showed that parents' smoking habits were significantly associated with the risk of severe CAP.

Overcrowding contributes to the transmission of infection through respiratory droplets. The study found a statistically significant association between overcrowding with CAP (p-value <0.05, OR =1.96). This was in agreement with a study by Cardoso et al.[18]

In our study, ventilation of the house was significantly associated (p-value <0.05, OR=1.95) with CAP in children. This study is co-related with the study by Xiaohong et al.[19] In this study use of biomass for cooking was found to be a significant risk factor for CAP (p-value < 0.001, OR =2.33). Biomass fuels (wood, crop residues, charcoal) and others like kerosene are important contributors to indoor air pollution. A study by Bruce et al.[20] has shown that indoor air pollution by biomass fuels increases the risk of pneumonia.

In this study, out of the total 246 children, only 35.4% had normal nutritional status. The number was more in controls as compared to cases. This study found a highly significant (p-value < 0.001, OR =3.98) association between CAP and malnutrition. Rudan et al.[15] and Srivastava et al.[12] found a similar association. No such association was found in the study conducted in industrialized nations by Jackson et al.[5]

There was a statistically significant difference (p <0.05, OR =1.92) between breastfed and partially breastfed children in developing CAP. Partially breastfed were found to be more prone to developed CAP than those who were breastfed. A study by Shams Arifeen et al.[21] observed the same association.

In this study, Vitamin A deficiency was not significantly associated (p-value>0.05) with CAP under five children. This could be attributed to the high proportion of subjects with complete vitamin A supplementation (99.6%); there were no differences between cases (99.2%) and controls (100 %). A similar finding was found by Srivastava et al.[12] But a study by Fitch & Neville[22] showed that Vitamin A deficiency with acute respiratory infections have a close relationship.

In this study, H/O diarrhea in the past three months is significantly associated (p-value < 0.001, OR = 3.02) with CAP in children. This finding is supported by a study by Rudan et al.[15]. But a study by Lassi et al.[23] found that children whose mothers reported having diarrhea in the past three months were less likely to present with pneumonia.

Past history of measles was not a risk factor for CAP in this study. Measles vaccination is a preventive measure against pneumonia and diarrhea only if both diseases are measles complications. In our study, there was a statistically significant association between anemia and risk of CAP (p-value <0.05, OR = 1.87), which was similar to another study by Allwyne.[24]

This study showed a significant association between CAP with LBW and prematurity.(p value <0.05, OR =1.86). This result is in agreement with Park.[25] In our study, 100% of cases and controls were fully immunized according to age.

Conclusion

CAP is a concern in children under five. Some risk factors for CAP are modifiable and preventable; family members and trained specialists can play significant roles in reducing CAP. Proper assessment of these risk factors and controlling them may help decrease the morbidity and mortality in under-five children suffering from CAP in Bangladesh, thereby improving our future generation's quality of life. The incidence of CAP could be reduced by improving the nutritional status and promoting the knowledge and practice of mothers about proper care of their children. In addition, reduced exposure to smoke must be promoted by introducing more efficient and less polluting stoves, keeping children away from smoky environments, and discouraging parental smoking.

Conflict of interest: None declared

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