Anemia as a Risk Factor for Lower Respiratory Tract Infections (LRTI) in Children

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ABSTRACT

Introduction: In developing countries lower respiratory tract infection is a major cause of death in children and anemia is found to be one of the commonest associated cofactors. Study was done to determine if anemia is a risk factor for lower respiratory tract infections in children.

Material and Methods: This prospective study was carried out over a one-year period in Pediatric Outpatient Department, ward and Pediatric Intensive Care Unit of a tertiary care Centre in Mumbai. The study included 110 diagnosed cases of lower respiratory tract infections as per WHO criteria. 110 age and sex matched patients who did not have respiratory complaints or chronic illness were enrolled as controls. Appropriate history was taken and detailed clinical examination was carried out in all patients followed by routine investigations like CBC, Peripheral smear, and Chest X-ray.

Results: On studying the age distribution maximum children were in the age group of 9 months to 3 years. Male preponderance was found with Male: Female ratio being 1.3:1. 67% of the cases and 36% of the controls in the study were found anemic. Anemia was found to be a significant risk factor for LRTI (p value < 0.001) with odds ratio of 3.59. Most of the anemic patients had hypochromic microcytic anemia suggestive of Iron deficiency anemia

Conclusion: Anemia was significantly found in patients with lower respiratory tract infections and these patients were found to be 3.59 times more susceptible to lower respiratory tract infections. Prevention of anemia, due to whatever etiology, early diagnosis and treatment is important to reduce the incidence of lower respiratory tract infections in children.

Keywords: Anemia, Lower Respiratory Tract Infection, Pneumonia.

INTRODUCTION

Lower respiratory tract infection (LRTI) is essentially an inflammation of the airways, pulmonary tissue, below the level of larynx. On average, children below 5 years of age suffer about 5 to 6 episodes of LRTI per year.[1] Pneumonia is the single largest cause of death in children worldwide. Every year, it kills an estimated 1.1 million children under the age of five years[2], accounting for 18% of all deaths of children under five years old worldwide. Pneumonia affects children everywhere, but is most prevalent in South East Asia and Africa. Children can be protected from pneumonia, it can be prevented with simple interventions, and treated with low-cost, low-tech medication and care. In developing countries pneumonia is said to be the biggest single cause of death in the age group of 0-5 years.[3-6] Anemia is a condition in which the number of red blood cells is insufficient to meet the body's physiologic needs. Iron deficiency is thought to be the most common cause of anemia globally. Anemia is a global public health problem affecting both developing and developed countries. Global prevalence of anemia in preschool children is around 47%.[7] It is seen in all children but more common in young children of age 0-5.[7,8] LRTI associated with anemia occurs more commonly in children than in adults. Iron deficiency anemia in children occurs most frequently between the age of 6 months and 3 years, the same period of age when repeated infections occur. Pneumonia can be prevented by preventing anemia. Study aimed to determine if anemia is a risk factor for lower respiratory tract infections in children.

MATERIAL AND METHODS

We carried out this prospective study over a period of one-year in Pediatric Outpatient Department, ward and Pediatric Intensive Care Unit of a tertiary care Centre in Mumbai. The study was initiated after obtaining permission from the institutional ethics committee. Written informed consent was taken from each patient's parents. The study included 110 children (randomly selected based on inclusion exclusion criteria) aged between 9 months and 5 years with a diagnosis of LRTI; fever, cough, tachypnea, chest retractions, and rhonchi or crackles on chest auscultation, as per WHO criteria. 110 healthy controls without any respiratory problems, age and sex matched, attending Out Patient Department were selected for the study. We excluded children with prematurity, congenital chest wall deformities, severe systemic illness (congenital heart disease, tuberculosis, etc.) chronic diseases involving the kidney, heart, lungs, liver etc. Children with PEM > Grade I, and Immunocompromised children were also excluded. Appropriate history was taken and detailed clinical examination was carried out. Routine investigations like CBC, Peripheral smear, were done for each patient. Radiological investigations like Chest X-ray were carried out as per routine standard followed, based on presentation of the patient. All the data accumulated was compiled systematically and conclusions were drawn from the same.

STATISTICAL ANALYSIS

Effect of various factors causing lower respiratory tract infection was analyzed using Pearson chi-square test with/ without Yates continuity correction and/or Fisher exact test,

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with special reference to following parameters – a) Age b) Gender c) Hemoglobin levels d) Past history of LRTI e) socioeconomic status f) breastfeeding g) Peripheral smear examination and h) immunization status. A p value of <0.05 was considered as significant for statistical purpose. Mann–Whitney test and Kruskal Wallis test was used to compare continuous data in relevant cases to compare mean values. Odds ratio was calculated for hemoglobin levels as a risk factor for LRTI. Binary Logistic Regression analysis was done for predictor variables.

RESULTS

On studying the age distribution of 110 cases and controls, maximum children that is 41.8% of the children in the study group were in the age group of 9 to 23 months, followed by 37.3% in the 24 to 35 months age group, 12.7% in the age group of 36 to 47 months and 8.2% in the age group of 48 to 60 months. Male preponderance was found with Male: Female ratio being 1.3:1. 74 (67.3%) out of 110 cases in the study group were found anemic while only 40 (36.4%) out of 110 control group were found anemic. For LRTI anemia looks like a significant risk factor with p value < 0.001 and odds ratio of 3.59 [Table 1]. Mean hemoglobin level was 9.99 mg/dl and 11.85 mg/dl in cases and controls respectively. Most of the anemic patients had hypochromic microcytic anemia. [Table 2] Past history of LRTI is a significant risk factor for recurrent LRTI with p value <0.001. [Table 3] In the study group most of the patients were falling into lower and upper lower socioeconomic strata according to modified Kuppuswamy classification i.e. 37.3% and 40.0% respectively, a collective of 77.3%. While in control group 22.7% in lower and 36.4% upper lower socioeconomic strata, a collective of 59.1%. There is significant association between socioeconomic strata and LRTI with significant p value (0.0009).

Children who were exclusively breast fed had less chances of LRTI. No significant association was found between presence of LRTI and immunization status between study and control group. The independent predictor variables for LRTI in our study included hemoglobin levels, past history of LRTI and exclusive breast feeding in descending order.

DISCUSSION

Anemia is seen in all ages but it is more prevalent in children of 1-5 years having iron deficiency.[7,14] A study conducted in India in 2014 by Mohd Ashraf et al in Srinagar India was showing maximum incidence in the age group of 3 months to 23 months.[12] Around 80% of the children were in above age group. Which is consistent with our study. In the study conducted by Malla et al they found maximum children in infantile age group.[10] As we studied the age group of 9 months to 60 months that is 5 years maximum cases were in 9 months to 3 years age group. Study conducted in India by Ramkrishnan et al which included children from 9 months to 16 years was showing maximum incidence in the children below 6 years.[9] This signifies that the incidence of LRTI decreases with age. Younger children are more susceptible to anemia and subsequently LRTI. Lower respiratory tract infection is associated with various risk factors.[13]

Anemia was significantly found in LRTI patients, and these patients were found to be 3.59 times more susceptible to LRTI. In our study population under study is mostly from urban slum of Mumbai. A recent study conducted in India in 2014 by Mohd Ashraf et al in Srinagar India found 64.5% of the cases anemic while only 28.2% of the controls were anemic.[12] While another study conducted in India by Ramkrishnan et al found 74% of the cases anemic while only 33% of the controls were anemic.[9] Study conducted in Nepal by Malla et al in 2006-07 found 68.6% of the cases having anemia while only 38.6% of the controls were having anemia.[10] Lebanese study conducted by Mourad et al found prevalence of anemia was 32% in hospitalized cases and 16% in healthy controls.[11] Mean hemoglobin level was 9.99 ± 0.62 gram per deciliter and 11.99 ± 0.92 gram per deciliter in anemic and non-anemic group respectively with a significant P-value of 0.001. Our study is showing high prevalence of Anemia as population in the study was mostly from urban slum population attending the tertiary care hospital in a metropolis. However prevalence of Anemia varies in developed and developing countries and from urban to rural population. In a developing country like India prevalence of anemia is very high in preschool children. In our study anemia was found in 67.3% of hospitalized cases and 36.4% of healthy controls. Iron deficiency can be the leading cause of anemia however further iron studies are recommended.[14] On comparing present study with other similar studies there was similarity with respect to gender and anemia. [Table 4] Prevention of anemia and early diagnosis of anemia is important to reduce the incidence of LRTI.[9-12] Exclusively breast fed children had decreased incidence of lower respiratory tract infection. Other factors such as lower socioeconomic status is also risk factor for LRTI.[15,16] However other variables also need to be studied.

We recommend screening for hemoglobin levels at the age of 9

Risk factor	Adjusted OR	95%CI		P Value
		Upper	Lower	
Anemia	3.597	6.275	2.062	<0.001
C.I: Confidence interval, OR: Odds Ratio LRTI- Lower Respiratory Tract Infection				
Table-1: Multivariate Logistic Regression Analysis Showing Anemia as a Risk factor of LRTI				

Group	Peripheral smear	Hemoglobin (gm/dl)	
		Anemia	Normal Hb
Case	Microcytic Hypochromic	78.4%	5.6%
	Normocytic Normochromic	21.6%	94.4%
Control	Microcytic Hypochromic	57.5%	2.9%
	Normocytic Normochromic	42.5%	97.1%
Table-2: Association between Peripheral smear and Hemoglobin (gm/dl) in cases and controls.			

Past history of LRTI Past h/o LRTI	Group			
	Case		Control	
Yes	31.8%		12.7%	
No	68.2%		87.3%	
Chi-Square Tests	Value	Df	p-value	Association is -
Pearson Chi-Square	11.579	1	0.0007	Significant
Continuity Correction	10.502	1	0.0012	Significant
Table-3: Association between the cases and past history of LRTI.				

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	Present study		Mohd Ashraf et al[12]		Malla et al[10]		Mourad et al[11]		Ramkrishnan et al[9]	
	Case (%)	Control (%)	Case (%)	Control (%)	Case (%)	Control (%)	Case (%)	Control (%)	Case (%)	Control (%)
Sex										
Males	62	62	57	60	71	67	51	52	63	58
Females	42	42	43	40	29	33	49	48	37	42
P-value	NS	NS	NS	NS	NS	NS				
Anemia										
Present	67.3	36.4	64.5	28.2	68.6	38.6	32	16	74	33
Absent	32.7	63.6	35.5	71.8	31.4	61.4	38	84	26	67
P-value	<0.001		0.001		<0.001		0.008		0.000	
OR	3.59		4.63		5.6		2.08		5.76	

Table-4: Comparison of present study with other studies showing association of LRTI with gender and anemia. NS: Non-significant; OR: Odds Ratio.

to 12 months for all infants and additional screening before the age of 5 years if clinically indicated. In those situations, where screening test of anemia are unavailable a therapeutic trial with oral iron may be considered when iron deficiency anemia is highly suspected based on history and physical examination.

CONCLUSION

Anemia is a significant risk factor for Lower Respiratory Tract Infection. Prevention and early diagnosis of anemia is important to reduce the incidence of LRTI.

REFERENCES

1. Christi MJ, Tebruegge M, La Vincente S, Graham SM. Pneumonia in Severely Malnourished Children in Developing Countries-mortality risk, Etiology and Validity of WHO clinical signs: A systematic review. Trop Med Int Health. 2009;14:1173–1189.
2. Bryce J, Boschi-Pinto C, Shibuya K. WHO Estimates of the Causes of Death in Children. Lancet. 2005;365:1147–1152.
3. International Institute for Population Sciences (IIPS). National Family Health Survey (MCH and Family Planning), 1992-93: India. Mumbai: IIPS; 1995.
4. International Institute for Population Sciences (IIPS) and ORC Macro. National Family Health Survey (NFHS-2), 1998-99: India. Mumbai: IIPS;2000.
5. International Institute for Population Sciences (IIPS) and Macro International. National Family Health Survey (NFHS-3), 2005-06: India. Mumbai: IIPS; 2008.
6. The Million Death Study Collaborators. Causes of neonatal and child mortality in India: a nationally representative mortality survey. Published online November13, 2010.
7. WHO. Worldwide prevalence of anaemia 1993–2005: WHO global database on anaemia. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization, 2008 (WHO/NMH/NHD/MNM/11) (http://www.who.int/vmnis/prevalence/anaemia.pdf)
8. WHO. Hemoglobin concentrations for the diagnosis of anemia and assessment of severity. Vitamin and Mineral Nutrition Information System. Geneva, World Health Organization, 2011(WHO/NMH/NHD/MNM/11.1) (http://www.who.int/vmnis/indicators/hemoglobin.pdf)
9. Ramakrishnan K, Harish PS. Hemoglobin level as a risk factor for lower respiratory tract infections. Indian J Pediatr. 2006;73:881–883.
10. Malla T, Pathak OK, Malla KK. Is Low Hemoglobin level a risk factor for acute lower respiratory tract infections? J Nepal Pediatric Soci. 2010;30:1–7.
11. Mourad S, Rajab M. Hemoglobin level as a risk factor for lower respiratory tract infections in Lebanese children. North American Journal of Medical Sciences. 2010;2:461.
12. Ashraf M, Wani J G, Ahmed J. Low Hemoglobin level a risk factor for acute lower respiratory tract infections in children. JCDR. 2014;April:8;4;PC01-PC03.
13. Savitha MR, Nandeeshwara SB, Pradeep Kumar MJ, ul-Haque F, Raju CK. Modifiable risk factors for acute lower respiratory tract infections. Indian J Pediatr. 2007;74:477–82.
14. Kotecka PV. Nutritional Anemia in Young Children with Focus on Asia and India. Indian J Community Med. 2011; 36:8–16.
15. Azab, Seham Fathy Abdel Hameed et al. Impact of the Socioeconomic Status on the Severity and Outcome of Community-Acquired Pneumonia among Egyptian Children: a Cohort Study. Infectious Diseases of Poverty. 2014;3:14-18.
16. Biswas A, Biswas R, Manna B, Dutta K. Risk factors of acute respiratory infections in underfives of urban slum community. Indian J Public Health. 1999;43:73-75.